MAINTENANCE MANUAL

COPE® 1030

CONVERSATIONAL TERMINAL

Manual No. 220003

April 1974

HARRIS

COMMUNICATION AND
INFORMATION PROCESSING

HARRIS CORPORATION Data Communications Division

MAINTENANCE MANUAL

COPE® 1030

CONVERSATIONAL TERMINAL

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PARAGRAPH INDEX 1030

INTRODUCTION

PURPOSE OF THIS MANUAL

This manual provides service and maintenance instructions for the 1030 Conversational and Data Capturing Remote Terminal. This terminal provides program preparation, inquiry/response, text-editing, computer assisted instruction, and terminal-to-terminal network communications.

USE OF THIS MANUAL

A table of contents is provided which indicates the section, subsection, paragraph number, and title with page number to facilitate the location of information and/or supporting illustrations. The illustrations have been located closely with their related subject matter to provide a more informative and useful publication. The section numbers on the upper outside corners of each page provides quick reference throughout the manual. Abbreviations, phrases, and words which are on a decal, placard, or engraving are capitalized in the text exactly as they appear on the decal, placard, or engraving.

RELATED PUBLICATIONS

Publications pertinent to the maintenance and care of the terminal are as follows:

*241-5157-1	IBM MT/ST I/O Parts Catalog
*241-5158-5	IBM MT/ST I/O Parts Catalog Part No./Price List
241-5159-3	IBM Customer Engineering, Manual of Instruction
241-5182	IBM "Selectric"® I/O Reference Manual (Complete Manual)
*241-5307-3	IBM Pictorial Reference/ Adjustment Manual "Selectric" Typewriter
241-5529-1	IBM MT/ST I/O Adjustment Manual
241-5615-0	IBM "Selectric" Typewriter Service Manual

*Vendor manuals pertaining to keyboard main frame. These manuals are mandatory requirements for maintenance and parts requisitioning.

DEFINITION OF PERTINENT TERMS

The following abbreviations, words, and phrases, as noted with their definitions will appear without definitions hereinafter in this publication.

Acoustic Coupler — A device which provides the facility to transmit and receive intelligence using the standard telephone handset as the coupling to the line.

Asynchronously — A type of transmission where there is no fixed time interval between characters or between the bits of which the characters are composed.

Band — The frequency range between two defined limits.

Baud — Unit of speed for telegraphic signaling equal to one bit or space per second; baud rate is synonymous to bits per second.

Binary Number — A number, representing a sum in which the individual quantity represented by each figure is based on a radix of two.

Bit — An abbreviation of binary digit, and is a single element of a character in a binary number.

Bit Rate — The rate at which binary digits, or pulses representing them, pass a given point.

Carrier Frequency — The basic frequency or pulse rate of a communication channel, which bears no intelligence until modulated by another signal which does bear intelligence.

Character Duration — The time required for all of the pulses which are associated with a specific character to pass a given point on a communication channel.

Check Bit — A binary check digit, often a parity bit.

Common Carrier — A company authorized and regulated by the United States Federal Communications Commission appropriate state agency as having a vested interest in furnishing a communications service to the public.

Communication Channel — Path for electrical transmission between two or more stations; also called circuit.

Correspondence Code — Selectric typewriter code.

Data Phone — Generic term to describe a family of devices available to facilitate data communication.

Dedicated Line — Communication channel devoted to one user, that is, it is not part of a switched network.

Demodulation — The conversion of audio frequency signals from a communication channel to digital signals which can be used and interpreted by a business machine.

Duplex — A channel providing simultaneous transmission in both directions.

EBCD Code — Extended Binary Coded Decimal code.

EOA — End of address also ⓒ code.

EOT — End of transmission also ⓓ code.

Full Duplex — A communication channel or device capable of receiving and transmitting simultaneously.

Half-Duplex — A circuit which permits transmission in either direction, but in only one direction at a time.

Hard Copy — A machine printed document.

I/O — Abbreviation for input/output.

Information Retrieval — The recovering of desired information or data from a collection of documents or files.

Interface — A common boundary between data processing systems, or the components of a single system.

Interlock — To arrange the control of machines or devices so that their operation is interdependent in order to assure proper coordination.

Manual Data Access Arrangement — The name associated with the A T & T switched network protective device which provides for the connection of modems other than those supplied by A T & T.

Marking Condition — One of two conditions that a communication circuit can assume. Marking is normally the condition where no intelligence is being transmitted. The opposite of "spacing".

Millisecond — One thousandth of a second.

Modem — Contraction of modulation/demodulation.

Modulation — The conversion of digital signals from a business machine to audio frequency signals for transmission over communication channels.

Multiplexing — The transmission of a number of different messages over a single circuit.

Non-Graphic — The operations of functions which may be performed on a printing device which do not register a unique character on the printed copy.

Null — An absence of information as contrasted with zero or blank for the presence of no information.

Off-Line — Descriptive of a condition in which the operation of the peripheral equipment of a system is not under control of the central processing unit.

On-Line — Descriptive of a condition in which the operation of the peripheral equipment of a system is under control of the central processing unit.

Parity Bit — A bit which is used to indicate whether the total number of binary "I" digits in a character or word is odd or even.

Processor — A shorter term for automatic data processor, synonymous with central processing unit.

Pulse — A significant and sudden change of short duration in the level of some electric variable, usually voltage.

Serial Printer — A device capable of printing characters one at a time across a page.

Serial Transmission — To move data over a communication channel, in sequence one character at a time, each bit in a predetermined order.

Solid State — The electronic components that convey or control electrons within solid materials; e.g., transistors, diodes, etc.

Spacing Condition — One of two conditions that a communication channel can assume. Spacing is usually the indication that intelligence is being transmitted.

Sub Set — A subscriber apparatus in a communications network.

Switched Network — The name associated with the common carrier provided telephone service.

Synchronous — Name used to describe a method of transmission in which each character requires an equal amount of time and the interval between characters is constant.

Terminal — A machine capable of generating and receiving signals to be transmitted or received from a communication channel.

Text-Editing — A method of correcting or altering a file such that is only necessary to indicate corrections as opposed to reconstructing the entire file.

Time Sharing — The use of a device or system for two or more purposes during the same overall time interval.

Turn Around Time — The time required to reverse the direction of transmission in a communication channel.

Vertical Parity — The term used to describe the method of error checking which utilizes a check or parity bit with each character.

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL DESCRIPTION.

The terminal (figure 1-1) is contained in a typewriter housing equipped with a keyboard/printer based on the heavy duty IBM Selectric ® typewriter I/O printer.

As a communications terminal, it achieves high reliability through the use of integrated circuits, solid state components, and magnetically actuated switches.

As an automatic typewriter, it provides quality printed material in a compact unit which does not require a special desk or console mounting.

1-2. LEADING PARTICULARS.

The terminal contains an integral modem of the COPE 9000 series with either acoustic or hard-coupled interface lines to the telephone network, or optionally provides RS-232-B interface signals to a WE 103A data set (or equivalent). The terminal transmits and receives digital data serially, asynchronous by character and synchronous by bit, at a maximum average character rate of about 14.9 cps; either IBM BCD or Correspondence codes are standard. The terminal generates and checks parity and is capable of reverse channel signaling and response via the interrupt and reverse break functions.

The terminal unit contains the TEN-10 Printer (modified IBM Selectric), power supply, logic PC board assembly, integral modem, cooling fan, and a control switch and indicator assembly.

The printer unit power supply consists of a power transformer, regulator PC board, and filter capacitors. This supply provides the following outputs:

a. +5 VDC to logic and electronic switches.

b. +24 VDC to Model 10 solenoids.

c. +12 VDC and −12 VDC to oscillator circuit and integral modem.

The fan circulates air at the rate of 43 cfm.

The TEN-10 Keyboard Printer is a modified IBM Selectric mechanism which contains the necessary solenoids and sensors to enable the machine to operate as a communications terminal. The printer may be commanded, either from the keyboard or the terminal logic to execute print, shift, operation, and keyboard lock-out functions.

Figure 1-1. Cope 1030 Terminal

Transmitting and receiving signals are coded either in EBCD code or Correspondence code. Each character consists of six information bits: one start bit, one stop bit, and one check bit. The unit transmits and receives codes serially, asynchronously by character and synchronously by bit in the format shown in figure 1-2.

Nominal timing characteristics of the COPE 1030 during operation over a communications channel are shown in figure 1-3.

Normal communications takes place in half-duplex, however, the ATTENTION and REVERSE BREAK functions take advantage of the full duplex capability of the communications facility.

A listing of general specifications and options is carried in figure 1-4.

The COPE 1030 communicates with a remote computer or with another COPE terminal. Each terminal requires a separate communications channel. The terminal may be linked to the commercial dial network, or to leased lines. See figure 1-5 for optional connections.

Bit	START / I / 2 / 3 / 4 / 5 / 6 / CHECK / STOP
Value	B A 8 4 2 I C

Notes:

1. START - The beginning of a character is indicated by a transition from "mark" to "space".
2. CHECK - The check bit provides odd vertical parity.
3. STOP - One bit time (minimum) of "mark" before the next START transition.
4. B,A,8,4,2,I - Provide the necessary information bits.

Figure 1-2. Code Format

DATA TRANSMISSION		DATA RECEIVING	
Max Speed	14.9 characters per second	Max Speed	14.9 characters per second
Character Duration	66.87 milliseconds ±1.25%	Ideal Character Duration	66.87 milliseconds
Bit Duration	7.43 milliseconds	Allowable Distortion	40% peak distortion (jitter) from START to STOP for each character.

Figure 1-3. Communication Timing

NOMENCLATURE	DESCRIPTION	NOMENCLATURE	DESCRIPTION
PARTICULARS:			
SIZE:			
Keyboard Printer	8" H x 22" W x 22" D		
WEIGHT:		F07 APL Keyboard/Type sphere	Standard IBM key-top and type-sphere combinations are offered for APL and 360 Basic programming applications.
Keyboard Printer	58 lbs.		
POWER:	115/230 VAC, 60/50 Hz		
ENVIRONMENT:	+50° F to +110° F (10% to 80% relative humidity)		
SPEED:		F21 360-Basic Key-board Typesphere	Same as F07.
Keyboard Printer	15 CPS	F380 230 VAC Operation	The terminal will operate on 230 volt/50Hz AC power.
PARTICULARS:			
Keyboard Printer	Heavy duty IBM SELECTRIC I/O printer		
OPTIONS:		F450 Typamatic	The terminal will execute the re-peat function on certain characters when an overload spring under spe-cific keylevers are overridden. The characters are space, backspace and hyphen.
F020 Carbon Ribbon	A non-reusable car-bon-film ribbon provides more lucid print quality.		
F040 Pin-Feed Platen	Paper advance and alignment is con-trolled by sprocket pins in the platen.		

Figure 1-4. General Specifications and Options

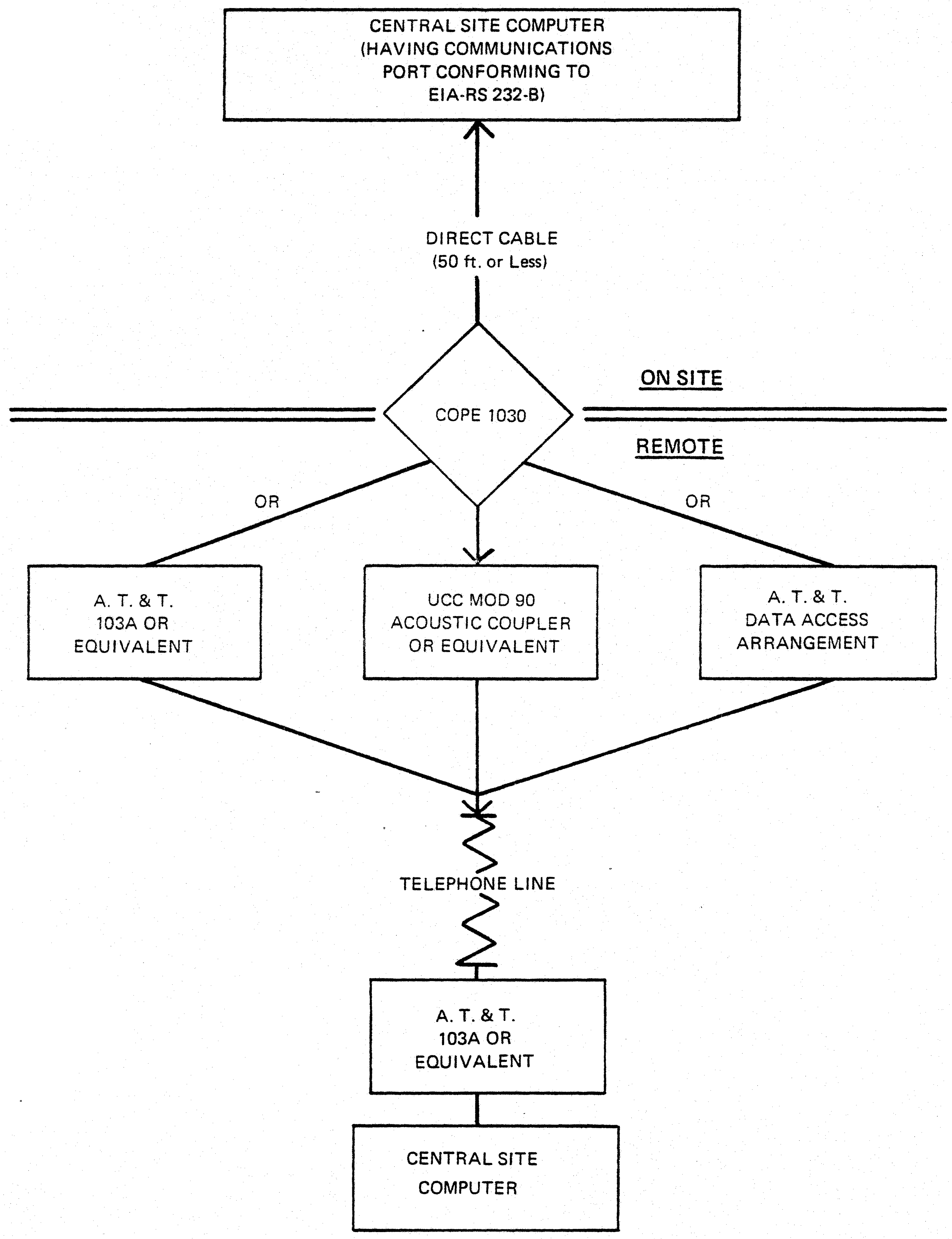


Figure 1-5. COPE 1030 Connections

SECTION II

TEST EQUIPMENT AND TOOLS

2-1. TEST EQUIPMENT.

Test equipment required for maintenance and testing of the COPE 1030 Terminal; Tektronix 422 oscilloscope or equivalent.

2-2. TOOLS.

Tools required for maintenance and testing of the COPE 1030 Terminal are listed in figure 2-1.

PART NO.	NOMENCLATURE	PART NO.	NOMENCLATURE
N/A	F. E. Tool Kit	9900210	Spring hook, special
M8800111	Extender, Cable	9900112	Hooverometer
1012444	Fulcrum rod, small	9900427	Hand cycle tool
1000502	Fulcrum rod, large	9900375	Half cycle tool
9900034	Oiler	9900373	Keybutton puller
158645	Grease gun	9900419	Keywrench kit
450813	Tip for gun	M800112	Turn around button
990059	Spring hook, large	M800113	Back to back cable
9000105	Spring hook, small	M800115	I/O power cord

Figure 2-1.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. UNPACKING AND SET UP.

Removing terminal and acoustic coupler from respective inner container. Remove plastic bags and other protective coverings from units. Remove four shipping screws in base of terminal. Place units on selected operator's site (desk, typing table, etc.).

3-2. FINAL ASSEMBLY.

Certain items required for operation of the terminal are not pre-installed. These items are packaged in a bag and located in the terminal shipping container. The following paragraphs give installation instructions for those items in order of installation.

Piror to first installation, open top cover and move the paper release lever and paper bail toward the front (keyboard portion) of the terminal. Gain access to card area and reseat logic boards for voltage protection.

Feed Rolls. There are four feed rolls, two large and two small. The large feed rolls mount to the rear of the terminal. The small feed rolls mount to the front. To install, insert end of feed roll shaft into round opening of cradle, and slide the shaft down into opposite slot end.

Paper Deflector. Care should be taken so as not to bend deflector or the tines at either end of it. Install the paper deflector by holding toothed edge of deflector toward front of terminal. Lower it into the unit, to rest between the large and small feed rolls, until the tines on either end straddle the two grooved studs on the outside of the feed roller assembly.

Platen. Position platen with the ratchet teeth to the right. Center the end plate in the groove in the right end of the platen shaft. Push it gently until it clicks into place.

The carrier is secured to the print shaft with fiber glass re-enforced tape. Before moving the carrier, or plugging the machine in, remove the tape and wipe off any glue residue remaining on the print shaft.

3-3. TEST PROCEDURE.

The following paragraphs outline a performance test of the system to insure maximum operating efficiency and reliability at installation.

While performing these procedures, do not do any adjusting. Record what you see throughout the procedure. At completion of test procedure, make any required adjustments. If necessary, perform test procedure again.

a. Install one sheet of paper in the terminal.

b. Position LOCAL/REMOTE switch to LOCAL and ON/OFF switch to ON.

c. Line Lock

   1. Type or roll characters at an average speed.
      (a) The keyboard should lock within plus or minus two spaces from where the margin is set.

   2. Turn the power off and move the carrier away from the right hand margin. Check to see that the keyboard is locked.

d. Escapement (Covers Removed)

   1. Observe the space between the escapement trigger and the lug on the torque bar. There should be at least 0.007" clearance. See that the clearance is maintained from right to left across the machine.

e. Back Space

   1. Type approximately nine characters starting from the left hand margin and then backspace the same number. Type the same characters over the first. The second set of characters should fit perfectly.

   2. Do the same thing at the center of the carrier and at the right end.

f. Paper Feed

1. Type a line of characters. Roll the platen in both directions and then go back to the same line. Type the same characters over the first printed line. The two sets of printed characters should fit perfectly.

g. Carbon Ribbon

1. Type a line of characters at very high speed.

   (a) Check the line for carbon trails by a dirty or maladjusted card holder.

2. Look at the used ribbon and see that no characters overlap or print partially off the ribbon.

h. Carrier Return and Motor

1. With the carrier at the right hand margin, depress the carrier return keybutton and restrict the carrier from moving. Depress the shift key a few times and listen for the drive belt jumping cogs.

2. At the left hand margin, space out 4 spaces, carriage return and hold carrier. As you slowly release the carrier, the return mechanism should operate positively.

3. The motor should also sound quiet. No sounds of vibration should be heard noticeably.

i. Print Quality

1. Type 5 slashes at the left, center, and right areas of the typewriter.

   (a) Make sure the copy control lever is all the way forward, one sheet of paper is in the typewriter, and the impression control lever is at 3.

   (b) Look to see whether or not the slash looks like the impression is even from top to bottom. This should be observed on the back side of the paper. The paper shoulc show even embossment.

   (c) Type a line of any combination of characters and look to see that each character is completely uniform. This should be observed on the back side of the paper. The paper should show even embossment.

j. Lock Up

1. Quickly run you fingers LIGHTLY across the keyboard a number of times. Make sure all keys are hit in this manner. The keyboard should not lock at any time except when the carrier reaches the right hand margin.

k. Set and Clear Tabs

1. Set a number of tabs at different places across the typewriter. Note where you set the tabs.

2. Print and tab 5 lines. The characters printed should all be under each other and also where you had set tab stops.

3. With the carrier at the right margin, depress the tab clear and carrier return buttons. This should clear all previously set tab stops.

l. Index

1. At the left hand margin, type a few characters, index and backspace into the left margin. Do this 5 times. Move the left margin to the center and then toward the right end of the typewriter and do the same test.

   (a) The lines of type should be placed evenly one or two units of line feed depending on where the index control lever is set.

2. Pull the detent roller out of the platen. Hand cycle an index and allow the detent roller to reset the platen. The platen should not move in either direction.

m. Spacebar

1. Depress the spacebar and observe the tripping point. There should be very little downward movement before the mechanism trips, roughly 1/8 of full travel. Check the side to side movement of the spacebar and see that the movement does not allow any rubbing of the spacebar on the top cover.

n. Print to Space Interlock

1. Make sure the cycle shaft is latched at rest.

2. Depress a character and hand cycle the operational shaft to 30° from rest.

3. Depress the spacebar.

4. Slowly continue hand cycling the machine. The character should print and escape. Continue hand cycling. The machine should space.

o. Shift to Print and Print to Shift Interlocks (Covers Removed)

1. Hold the shift clutch ratchet and release the shift. Allow the ratchet to rotate so the shift release arm is flush with the trailing edge of the inner lug on the shift clutch ratchet. Now hold the ratchet stationary. Depress a character and then release the clutch ratchet. The machine should shift and then print.

2. Release the shift ratchet and cycle the shift until the detent roller is out of the cam. There should be 0.20" to 0.30" clearance between the interlock arm and the cycle clutch sleeve.

p. Perform the above test on line to insure satisfactory performance.

3-4. PREPARATION FOR MOVING/ SHIPMENT.

It is recommended that the terminal be placed on a typing stand or work station equipped with casters if it is to be moved frequently. To move, unplug the terminal from the power receptacle, roll the stand with the terminal on it to the new location, and plug the power cord into an electrical outlet.

When the terminal is not mounted on a mobile stand, the keyboard printer, and acoustic coupler should be disconnected and carried to the new location as two separate items.

If the terminal is to be shipped long distances or by a commercial carrier, procure a shipping container and pack in reverse of unpacking instructions at the beginning of this section.

SECTION IV

THEORY OF OPERATION

4-1. SELECTRIC I/O KEYBOARD PRINTER.

A detailed theory of operation for the IBM Selectric I/O Keyboard Printer is contained in the following paragraphs.

4-2. OPERATING CONTROLS

The operating controls explained below are illustrated in figure 4-1.

1. **Copy Control Lever** – To compensate for the thickness of multiple forms, the copy control lever is provided. As the copy control lever is moved to the rear, the platen will move farther away from the typehead.
2. **Index Selection Lever** – You may control the indexing (line space movement) of the platen by setting the index selection lever forward for single space and back for double space.
3. **Paper Release Lever** – Move the paper release lever forward to position or remove paper.
4. **Paper Bail Lever** – Holds the paper against the platen to prevent buckling. Should be moved forward when inserting paper.
5. **Margin Set Lever** – Provides the operator with a means of changing the margin settings.
6. **Index Key** – Provides vertical indexing of the paper without changing the position of the carrier assembly.
7. **On-Off Switch** – Turns the printer on and off.
8. **Tab Set/Clear** – Used to set or clear tab stops.
9. **Margin Release Key** – Provides a means of operating the printer beyond the margin settings without changing the settings.

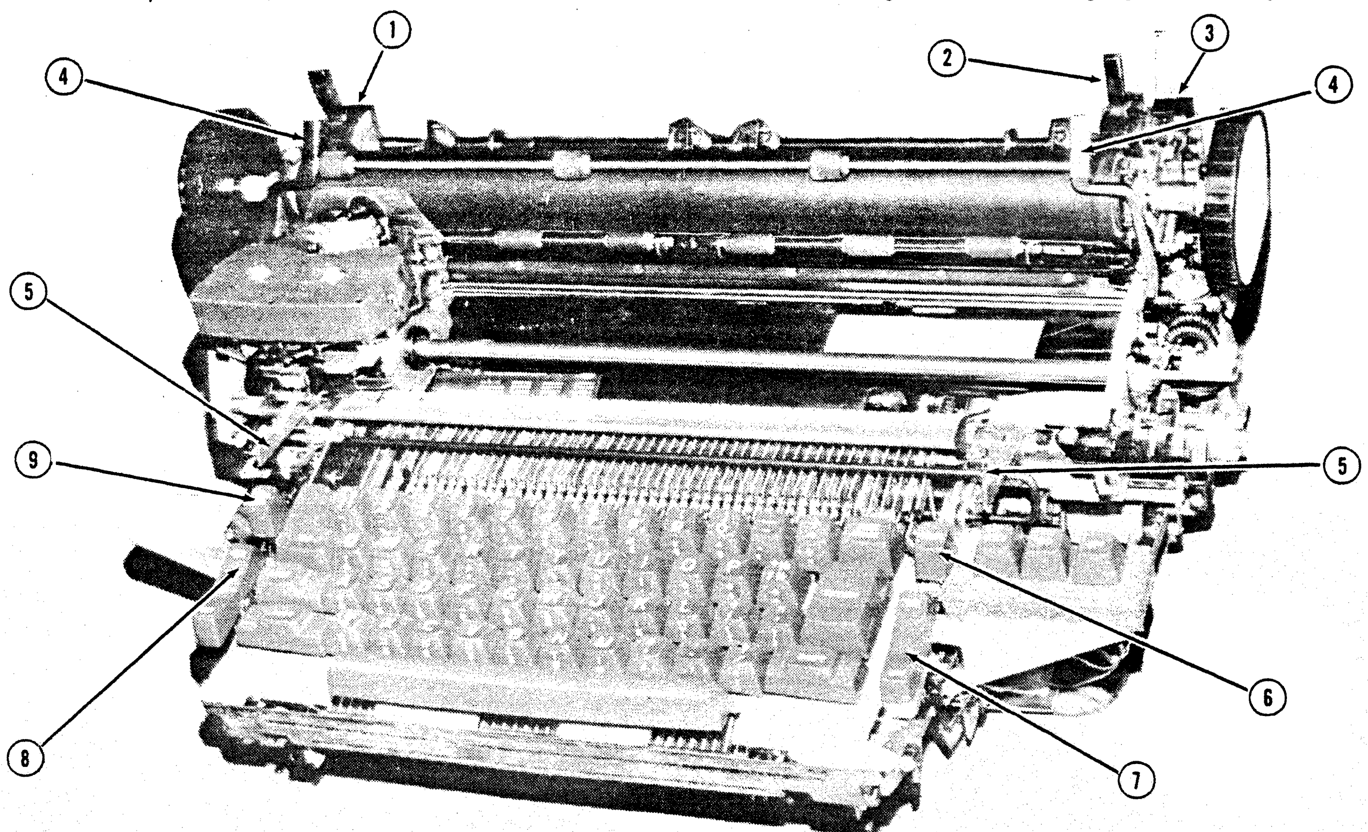


Figure 4-1.

4-3. MOTOR AND DRIVE

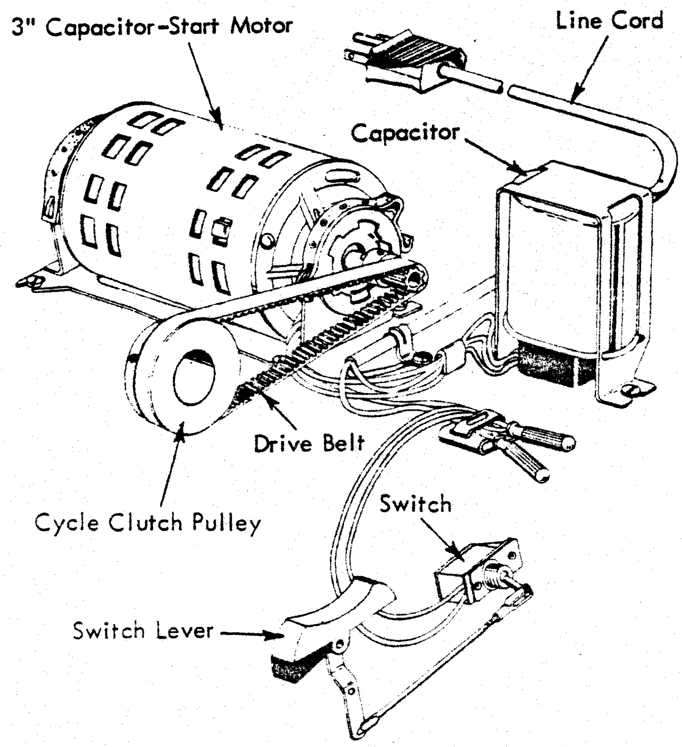


Figure 4-2.

The capacitor start three wire grounded system (Figure 4-2) has in addition to the three wire line cord and jumper wire a grounded capacitor mounting bracket. This is done by using metal mounting screws (Figure 4-3).

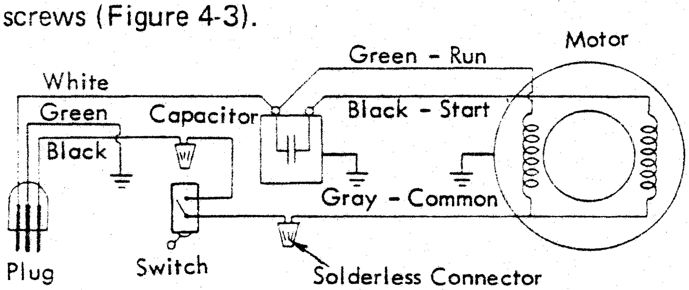


Figure 4-3.

The switch and switch lever are mounted on the right side of the keyboard. The switch lever operates the electrical switch by means of a short link extending to the rear. It is operated by pressing down on the rear of the lever to turn the machine ON and the front to turn the machine OFF. The switch lever is labeled ON and OFF. When the switch lever is in the ON position, a contrasting color at the front of the switch lever shows just above the case. This calls attention to the fact that the machine is ON to minimize chances of the machine being left running when not in use.

In addition to operating the typewriter switch, the switch lever also controls the keyboard lockout mechanism. This mechanism is discussed in the keyboard section.

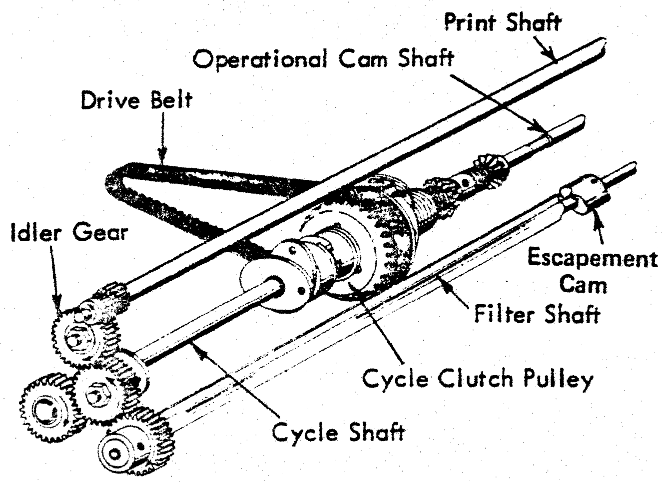


Figure 4-4.

Through a series of idler gears at the left, two other shafts are driven by the cycle shaft each time it operates (Figure 4-4). They are the filter shaft and the print shaft. The filter shaft operates the character selection mechanisms, the print escapement, the shift interlock, and a spacebar lockout device. The print shaft operates the print mechanism, type aligning mechanism, and ribbon feed and lift mechanisms.

The shaft to the right of the cycle clutch pulley hub is the operational cam shaft. All powered functional operations are driven by its rotation. The functions involved are spacebar, backspace, tabulation, carrier return, indexing, and shift. The shaft also controls the speed of the carrier during a tab operation. Each of the functions is discussed in detail in its own section.

The operational cam shaft is driven by the cycle clutch pulley hub and is in continuous rotation whenever the motor is running. The right end of the shaft operates in a self-aligning porous bronze bearing. The left end extends into the cycle clutch pulley hub where it is supported by a vinyl sleeve (Figure 4-5). The sleeve provides a snug fit for the shaft in the hub to prevent any noise due to vibra-

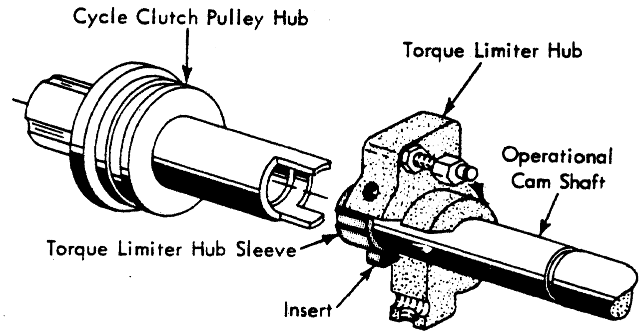


Figure 4-5.

tion. The driving connection between the cycle clutch pulley hub and the operational shaft is made by two extensions of the hub that fit into cut-outs in the left side of the torque limiter hub. The torque limiter hub is held in position at the extreme left end of the shaft by two set screws. Two nylon inserts fit into the cut-outs of the torque limiter hub (around the extensions of the cycle clutch pulley hub). The inserts provide a noiseless driving connection between the two hubs.

Just to the right of the torque limiter hub are three spring clutches and two small pinion gears. The components are part of the carrier return and tab mechanisms and are discussed in their particular sections.

a. Cycle Clutch

The shaft to the left of the cycle clutch pulley hub is the cycle shaft. The cycle shaft is driven by means of a spring clutch and only turns whenever a letter keylever is depressed. Its rotation is restricted to 180 deg. for each character cycle. After 180 deg. rotation, the spring clutch is disengaged allowing the shaft to remain stationary. (Figure 4-6)

The control for starting and stopping the cycle shaft is the cycle clutch which uses a "helical spring" type of drive.

If the turned up ear on the right end of the spring (Figure 4-7) were held stationary, and the left end turned in the direction shown by the arrow, the spring would tend to unwind and the inside diameter would become larger. If the left end of the spring was held in this position and the right end turned loose, the spring would wind up under its own tension and the inside diameter would become smaller.

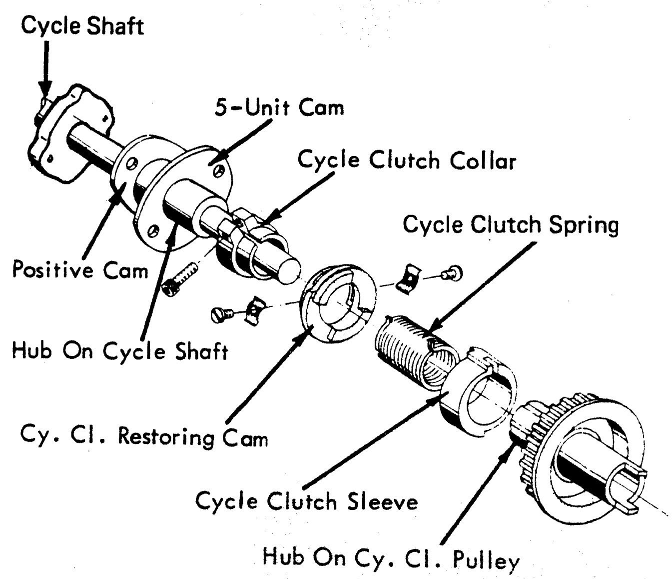


Figure 4-6.

The clutch arbor surface of the cycle clutch pulley hub is slightly larger than the inside diameter of the spring when the spring is in its relaxed state. With the spring held in its unwound position, its inside diameter is large enough so the driving arbor will fit inside and have clearance. If the right end of the spring were released, the spring would wind up on the driving arbor and be turned further in a winding direction, in turn driving anything attached to the left end of the spring. If the right end of the spring were stopped and the left end continued to turn, the diameter of the spring would increase and would no longer be driven by the driving arbor.

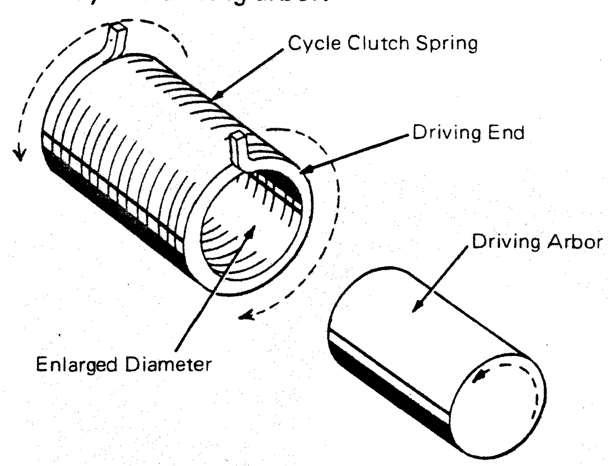


Figure 4-7.

The right end of the cycle clutch spring fits through a cycle clutch sleeve. The turned up ear fits into a notch on the right side of the cycle clutch sleeve. If the cycle clutch sleeve is stopped, the right end of the spring is stopped. The left end of the cycle clutch spring fits over the cycle shaft and is clamped securely to the cycle shaft by an adjustable clamp. (Figure 4-8)

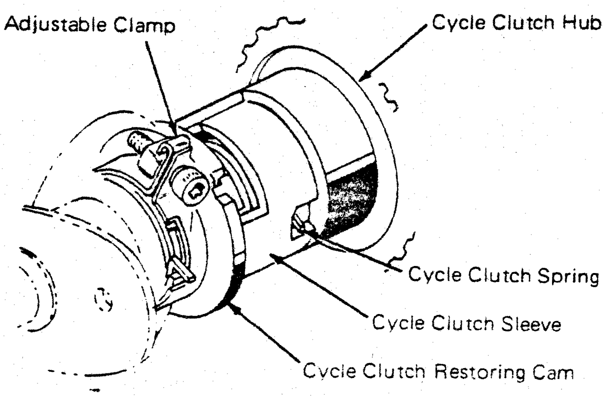


Figure 4-8.

Starting and stopping the cycle shaft is dependent upon controlling the expansion and contraction of the spring. As the shaft and clutch turn, top to front, one of the latch surfaces on the cycle clutch sleeve and right end of the cycle clutch spring completing 180 deg. of rotation. (Figure 4-9)

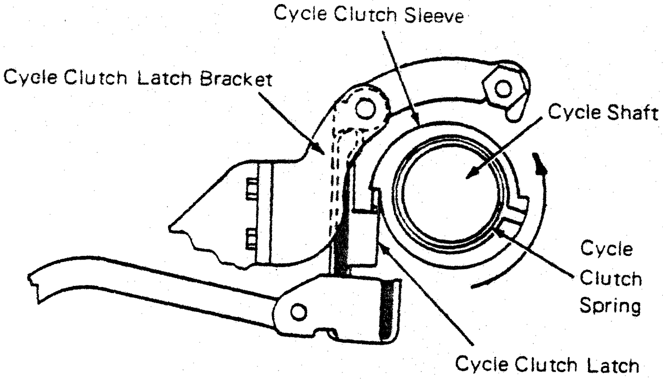


Figure 4-9.

The cycle shaft has inertia and tends to keep turning even though the sleeve has stopped. The result is the spring unwinds and is expanded to a point where the hub is no longer driving the spring. A cycle clutch check pawl is mounted at the extreme left end of the cycle shaft on the inside of the left casting. The inertia of the shaft expands the cycle clutch spring and at the same time allows the check pawl to drop into its latch surface. The left end of the spring is now fixed so the cycle shaft cannot turn backwards and allow the spring to engage on the hub. (Figure 4-10)

When another cycle is desired, all that is needed is to pull the cycle clutch latch free of the sleeve. This will allow the right end of the cycle clutch spring to wind up, grab the hub and go through another cycle. When the step on the opposite side of the sleeve engages the cycle clutch latch, the right end of the spring will be stopped and the cycle shaft will overthrow and the check pawl will drop in. The cycle shaft is now in a latched position.

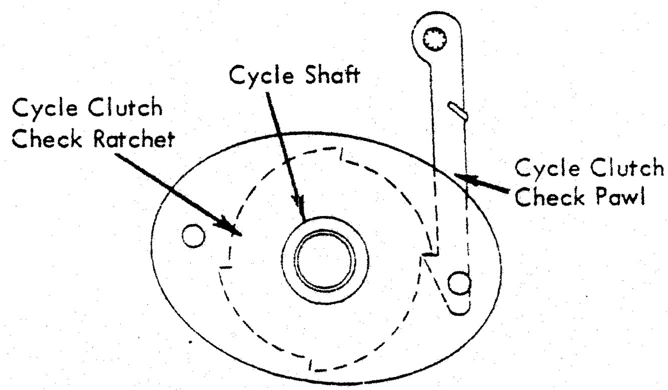


Figure 4-10.

NOTE:

An easy method to obtain this adjustment with "power on" is as follows:

a. Leave the right hand dust shield in place while performing this "power on" adjustment. This will eliminate the danger of the bristo wrench being thrown out of the machine due to the possibility of it contacting the torque limiter hub. Rotation of the cycle clutch pulley and drive belt does not constitute a hazard as there are no exposed projections which could propel the bristo wrench out of the machine.

b. Insert the "L" shaped foot of the Hoovero-meter into the cycle clutch latch link to prevent accidental cycling of the machine while performing the "power on" adjustment of the cycle clutch. (Figure 4-11)

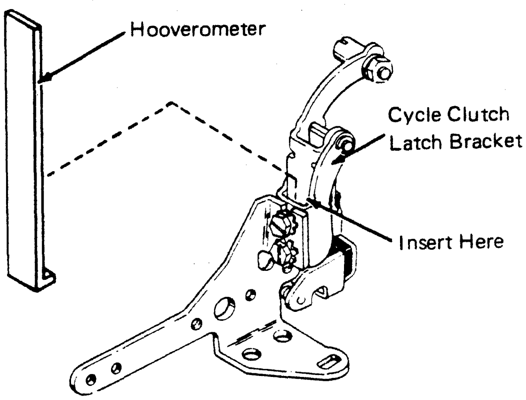


Figure 4-11.

c. Turn machine on, position the cycle clutch collar screw up, then position the carrier into the RH margin to prevent cycling of the cycle shaft.

d. Loosen the cycle clutch clamp screw and overthrow stop screws then advance print shaft (top to rear). Caution: Do not trip the cycle clutch with the bristo wrench in the clamp screw.

e. At this time check the lateral position of the cycle clutch spring. Expand the cycle clutch spring by pushing the LH side of the spring with a spring hook. The lateral position of the spring can be changed by pushing left or right for proper adjustment with the cycle pulley.

f. Rotate the print shaft a complete cycle (top to rear) until the cycle shaft check pawl drops in. Back the cycle shaft up against the check pawl.

g. Position the overthrow stop for .007" - .015" clearance and tighten the clamp screw. This will give approximately 1/2 tooth of motion to "unwrap" the spring in its rest position. Observe this motion at the print shaft gear by hand cycling a zero tilt, negative-five character with the power off.

4-4. KEYBOARD

The keyboard is compact and is detachable as a unit from the rest of the machine. In this section, we will discuss how the keyboard controls the selection latches to determine the specific character that will print, and the tripping of the cycle clutch.

The keylevers pivot on a fulcrum rod at the rear. A guide comb limits the travel of the keylevers in the front. (Figure 4-12)

Keylever tension is supplied by flat leaf spring fingers under the front of the keylevers. The forward end of each spring finger is cupped so that the spring will maintain its position under the keylever. Different spring tension is supplied to the four rows of letter keylevers by auxiliary leaf springs under the keylever springs. The auxiliary spring fingers vary in length to offset leverage difference between the four rows of keylevers. This variation in spring tension permits a uniform operating force requirement for all keylevers.

Attached to each keylever by a shoulder rivet, is a keylever pawl. This pawl is spring loaded and is in a position to strike the top of an interposer.

Each character keylever has an interposer located just below it. The interposer is used to select the amount of tilt and rotate needed to bring the desired character to the printing point. The interposer pivots about a large fulcrum rod at the front and is spring loaded up at the rear. The front and rear of the interposer is positioned laterally by a guide comb. The interposers are allowed to move vertically in the rear guide comb as well as front to rear.

The interposers have several lugs extending from them. There are positions for eight lugs on the bottom. Several of these lugs are used for selection. The absence or presence of these lugs will determine which of the selector bails will be operated. No two interposers are alike. The rear most lug is used for special applications of the machine. The wide lug in the middle is common to all interposers. Its purpose is to release the cycle clutch whenever a keylever is depressed. Mounted directly below this lug is a cycle bail that pivots vertically. Downward movement of the interposer forces the cycle bail to release the cycle clutch latch pawl. (Figure 4-13)

To assure the interposer will remain depressed long enough to operate the character selection mechanism, a spring latch is employed. The interposer latch is a flat leaf spring mounted to the rear keylever guide comb in a position to snap forward trapping the interposer down when it is depressed. (Figure 4-14)

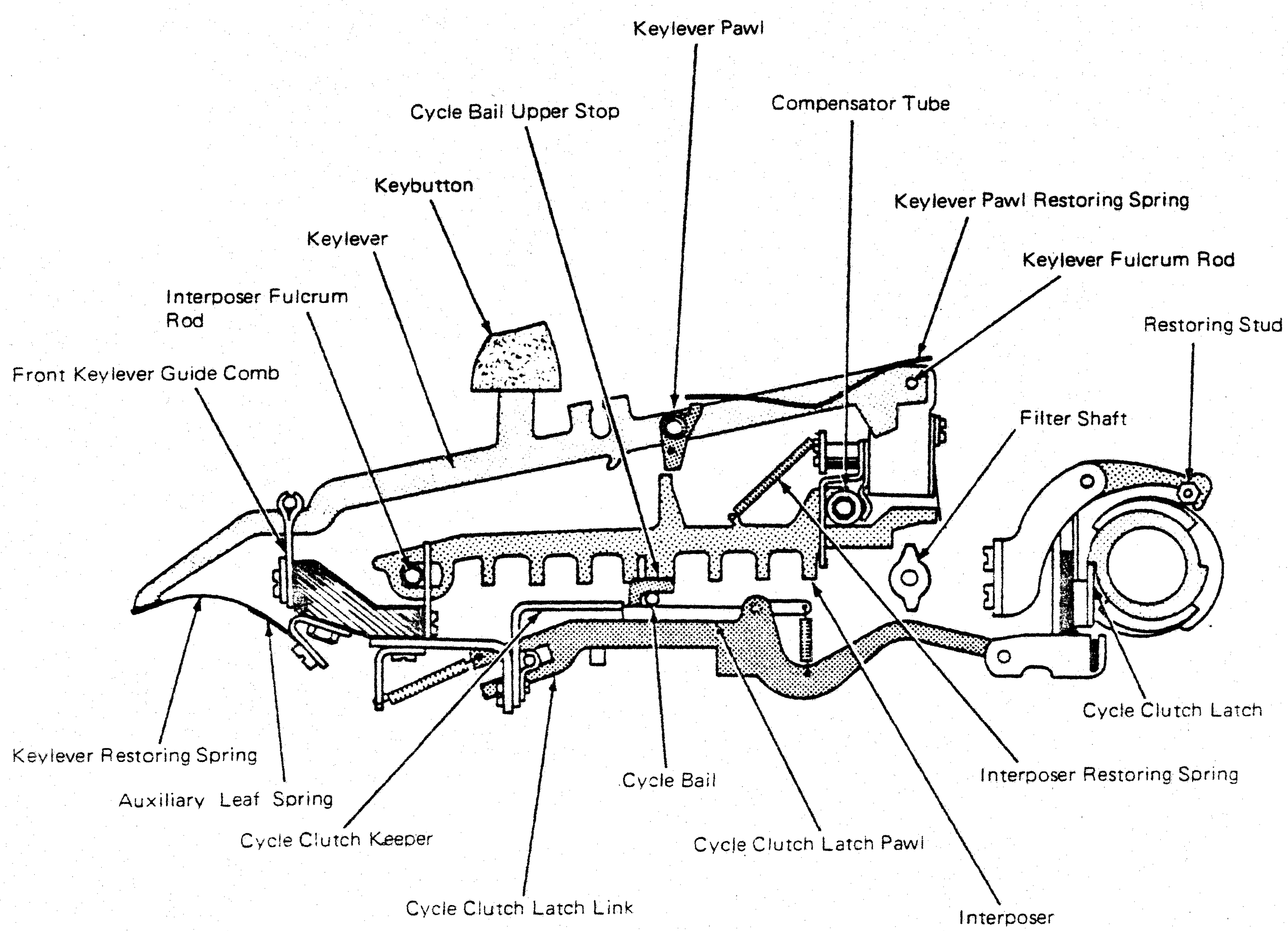


Figure 4-12.

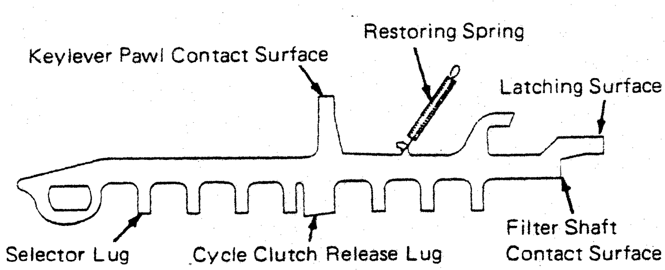


Figure 4-13.

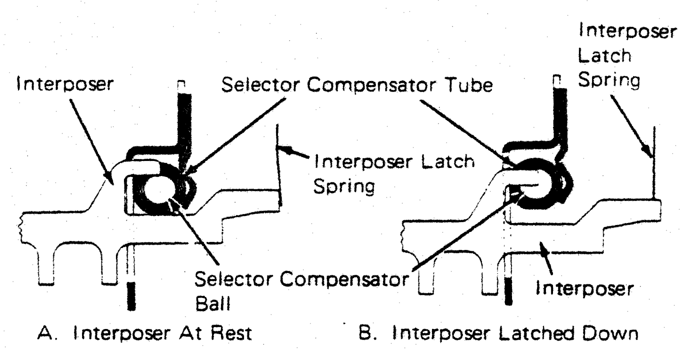


Figure 4-14.

A compensator tube is used to prevent the latching of more than one interposer down at a time. Each interposer has a lug at the top of the interposer that intersects the compensator tube. The compensator tube contains closely spaced steel balls. When an interposer is down, the steel balls shift in the compensator tube to block the downward movement of any other interposer. (Figure 4-15)

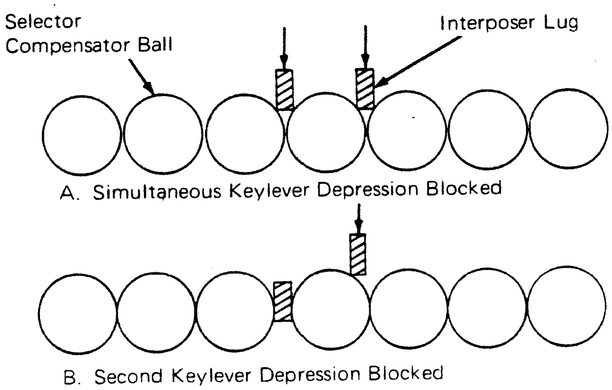


Figure 4-15.

An adjustable stop, located at each end of the compensator tube, keeps the steel balls centered between the interposers. The balls are thus prevented from shifting too far to the left or right. If the balls were allowed to move too far under the interposer lugs, they would partially block the depression of an interposer and result in a stiff keyboard. (Figure 4-16)

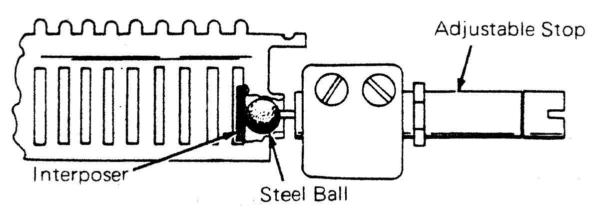


Figure 4-16.

Located at the left end of the selector bails are six latch interposers. Each latch interposer has a lug that extends up directly in front of the selector bail. As the selector bail is driven forward, the latch interposer is carried with it. An extension spring at the bottom of each latch interposer loads the interposer and its selector bail to the rear. (Figure 4-17)

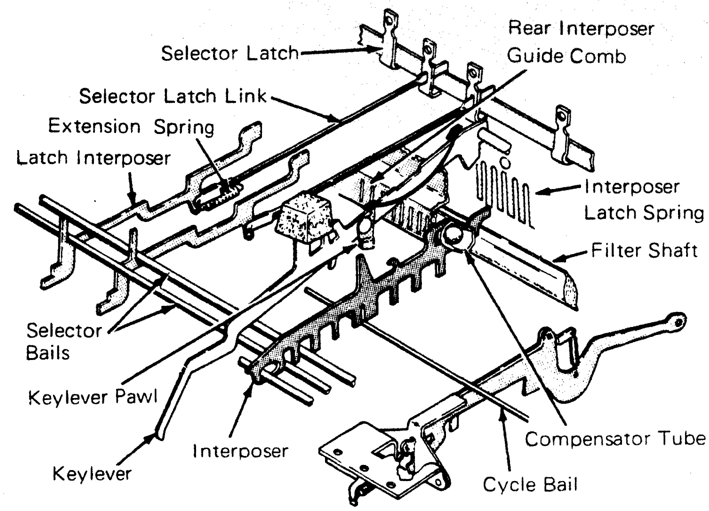


Figure 4-17.

An adjustable link connects each latch interposer to one of the selector latches of the selection mechanism. When a latch interposer is moved forward, the selector latch connected to that interposer is also pulled forward to prevent it from being operated downward by the latch bail.

A filter shaft is mounted just to the rear of the interposers. Once the interposer is in the latched interposer forward. The interposer lugs will then operate its corresponding selector bail. The interposer from beneath the interposer latch spring. This allows the interposer spring to restore the interposer to its rest position. (Figure 4-18)

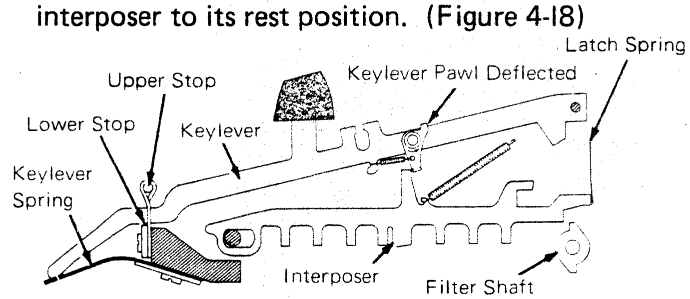


Figure 4-18.

Although not a part of the keyboard section, the cycle clutch latch is directly related to the keyboard mechanism. Depression of a keylever will allow the cycle clutch to operate. (Figure 4-19)

The cycle clutch latch pivots from the top of a bracket that mounts at the front of the power frame. The latch is held in a position to engage the cycle clutch sleeve by a cycle clutch latch pawl and link assembly that extends forward from the cycle clutch latch. The cycle clutch latch pawl pivots on the cycle clutch latch link. The cycle clutch latch pawl engages the cycle clutch keeper to prevent the cycle clutch latch from being pulled forward.

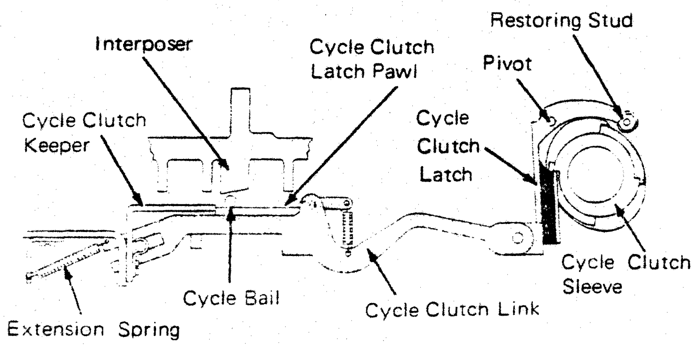


Figure 4-19.

When the keylever is depressed, the interposer beneath the keylever forces the cycle bail to pivot downward. The cycle bail moves the cycle clutch latch pawl downward disengaging it from the keeper. An extension spring at the front of the link is allowed to snap the link and cycle clutch latch forward disengaging the latch from the cycle clutch sleeve. This allows the cycle clutch spring to tighten and begin a cycle operation.

A nylon cam attached to the cycle clutch clamp restores the cycle clutch latch beneath the sleeve. A horizontal extension at the top of the cycle clutch has a small adjustable stud mounted on it which rides the cam during a restoring operation. When the machine is at rest, the low point of the restoring cam is directly below the stud. When the cycle clutch latch swings forward, the stud on the extension drops down onto the restoring cam. The cam rotates toward its high point and forces the stud on the extension up, swinging the cycle clutch latch to the rear into the path of the cycle clutch sleeve. The latch is restored far enough to the rear to permit the cycle clutch latch pawl to reset on its keeper. (Figure 4-20)

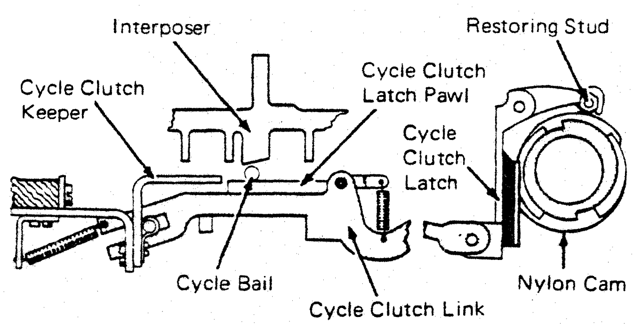


Figure 4-20.

A small lever, called the cycle bail damper, pivots at each side of the keyboard just above the cycle bail. The purpose of the dampers is to lightly retard the upward movement of the cycle bail so as to prevent the bail from bouncing as it reaches the upward limit. Without the dampers, the bail could have a tendency to bounce. (Figure 4-21)

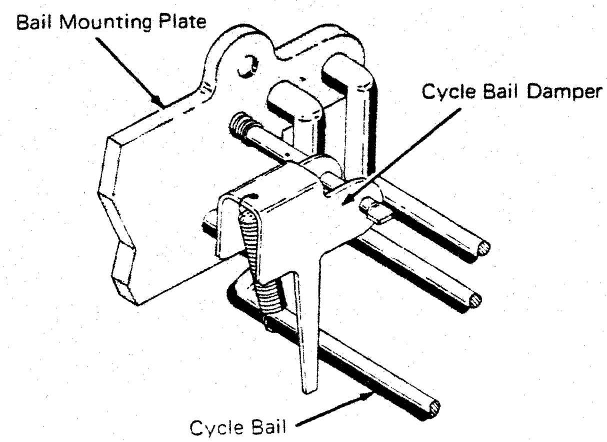


Figure 4-21.

When the switch is in the off position, the keyboard must be locked to prevent the motor from having to start under a load and to prevent an unwanted operation the next time the switch is turned on. The switch lever operates the lockout bail into a position below an extension of the cycle clutch latch pawl when the switch lever is in the off position. To further assure against an interposer from latching down, a special bellcrank at the left side of the keyboard is rotated into the selector compensator tube by the lockout bail. This forces the steel balls to shift in the tube and block the downward movement of all interposers. When the switch is in the on position, the keyboard lock bellcrank is spring loaded out of the selector compensator tube. (Figure 4-22)

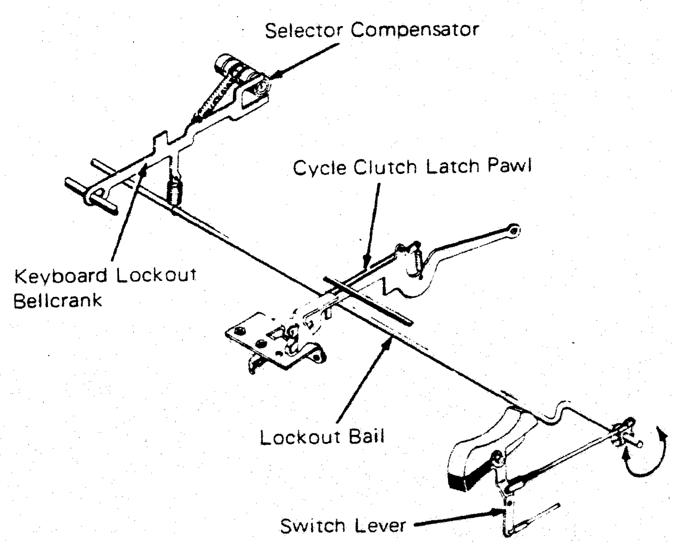


Figure 4-22.

4-5. SHIFT

The purpose of the shift mechanism is to rotate the typehead 180 deg. in the counter clockwise direction. This action places the upper case hemisphere of the typehead near the platen for typing capital letters. Each upper case character is in the same tilt band as its lower case counterpart but 180 deg. from it.

The shift mechanism consists of a shift arm, shift cam, spring clutch, clutch control mechanism and interlocks. The power to operate the shift mechanism is taken from the right hand end of the operational shaft. (Figure 4-23)

Two keybuttons, one at each front corner of the keyboard, can be used to actuate the shift mechanism. A bail is used to tie the two keylevers together. The left hand keylever has a lock mechanism attached to it to enable the operator to lock the keybutton down in the upper case position. The shift lock may be released by depressing and releasing either shift keybutton.

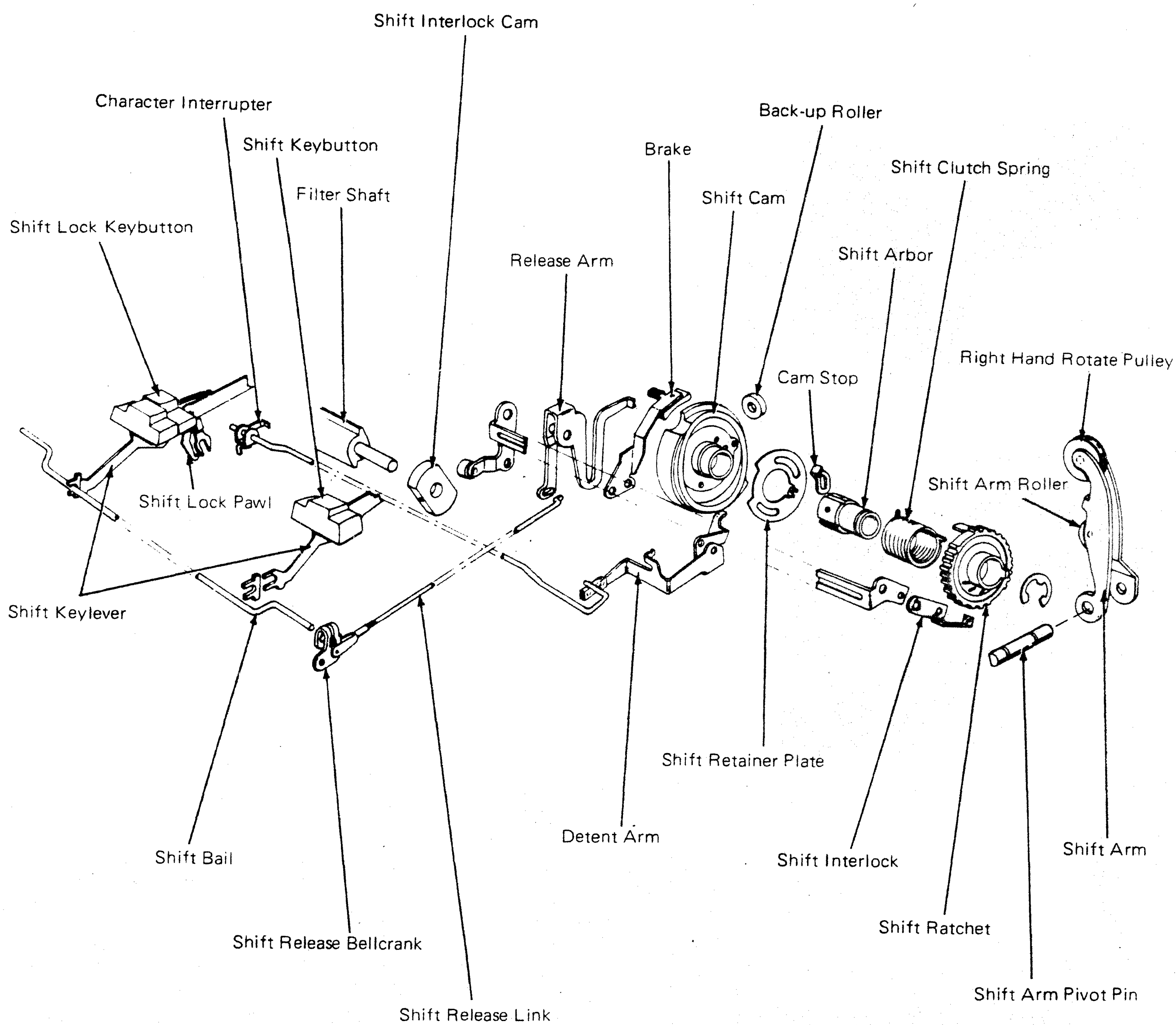
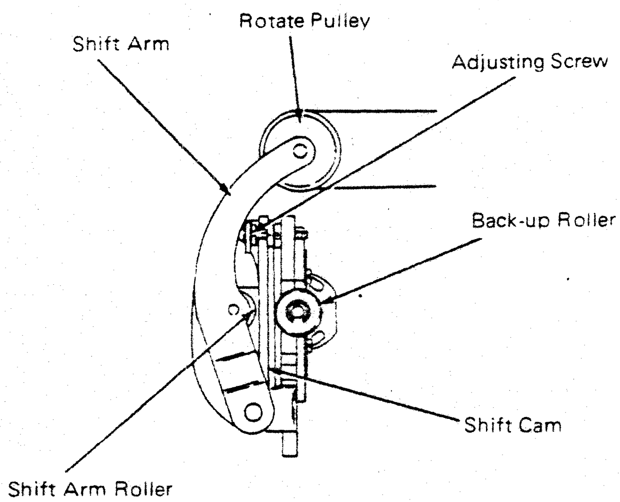


Figure 4-23.

The right hand rotate pulley is fastened to the top of the shift arm. The shift arm pivots left to right about a pin at the bottom. Mid point on the shift arm is a roller that rides the surface of the shift cam. In the lower case position, the shift arm rests against the head of an adjustable screw on the side of the power frame. (Figure 4-24)

The shift cam is a disc shaped cam that has the lobe on the right hand side of the cam rather than on the perimeter. A roller is mounted in a fixed position to the left of the shift cam, directly opposite the roller on the shift arm, and serves as a backup roller for the cam. When the cam is operated 180 deg., the high point is encountered and forces the shift arm to the right into the upper case position.



(Rear View)

Figure 4-24.

The shift cam rotates only during shift operation and is controlled by a spring clutch. One end of the spring clutch is anchored to the shift cam by an adjustable retainer plate. The other end of the shift clutch spring is mounted to the shift ratchet. (Figure 4-25)

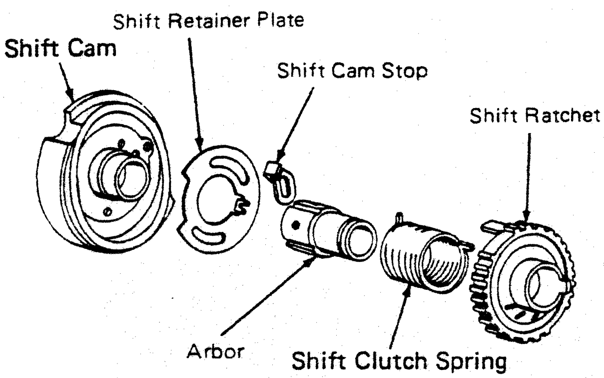


Figure 4-25.

The shift ratchet has two lugs protruding to the left side 180 deg. apart. One lug is nearer the center of the ratchet than the other lug. The shift clutch release arm, pivoted just in front of the cam, blocks the lugs to stop the rotation of the ratchet. The position of the shift release arm determines which lug will be stopped. The shift release arm is positioned by a link connected between the shift clutch release arm and a bellcrank attached to the shift bail. When the keylevers are at rest, the release arm is in a position to contact the inner lug of the shift ratchet. Depression of the keylever causes the clutch release arm to rise out of the path of the inner lug into the path of the outer lug. This allows the spring clutch to tighten around the shift arbor and drive the shift cam until the outer lug of the shift ratchet is encountered. (Figure 4-26)

The overthrow of the shift cam is controlled by an adjustable stop attached to the cam and operates against the inner lug of the shift ratchet. Since the relationship between the inner lug and the shift cam stop remains constant for both upper and lower case, overthrow can be controlled whenever the ratchet is stopped by either lug on the shift ratchet.

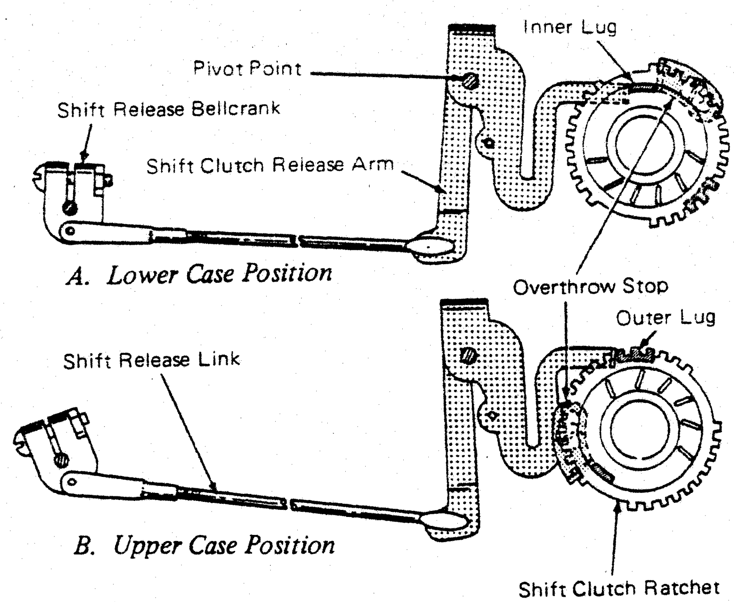


Figure 4-26.

Shift cam overthrow is a greater problem in returning the machine to lower case than in shifting to upper case. This is due to the acceleration received from the pressure of the shift arm roller against the receding surface of the shift cam. To prevent excessive noise and possible parts breakage, a raised braking surface on the shift cam contacts a nylon shoe mounted to a heavy spring when returning to lower case and prevents acceleration of the shift cam. (Figure 4-27)

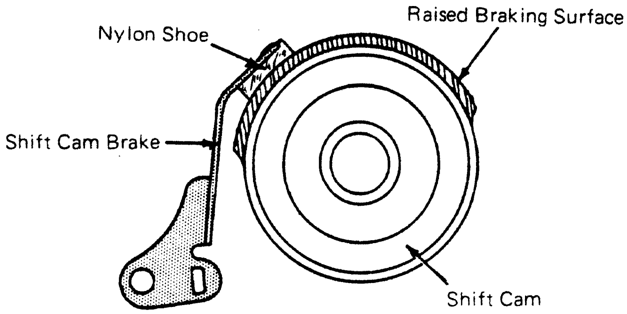


Figure 4-27.

a. Shift Interlock

Operating the shift mechanism when the typehead is in the process of printing would result in parts damage. The rotate detent would be engaged in a notch of the typehead and the typehead could be against the platen. At this time no rotation of the typehead can be allowed; therefore the shift must be prevented from operating once the typehead has started toward the platen.

We have seen that the shift spring clutch remains disengaged as long as the shift clutch ratchet is prevented from rotating. An interlock arm is operated by a cam on the right end of the filter shaft (Figure 4-28). The interlock engages the teeth of the shift clutch ratchet and prevents rotation of the ratchet. When the cycle mechanism is at rest, a roller on the interlock rests near the low point of the interlock cam allowing free operation of the shift mechanism (Figure 4-28A). As soon as a cycle operation begins, the filter shaft rotates causing the interlock cam to actuate the interlock into the teeth of the shift clutch ratchet (Figure 4-28B). This interrupts the shift operation until the cycle operation is completed.

If an operator should operate the shift immediately after striking a character, the shift cam could begin to rotate before the filter shaft had sufficient time to actuate the shift interlock. This could cause an erroneous character to print because the shift arm had already begun to move. This is known as "beating the shift". This condition occurs mostly in shifting from upper to lower case. Shifting from lower to upper case is no problem because the shift arm does not rest against the cam in lower case. The cam must rotate somewhat before it begins to move the shift arm, thereby allowing the filter shaft sufficient time to actuate the shift interlock.

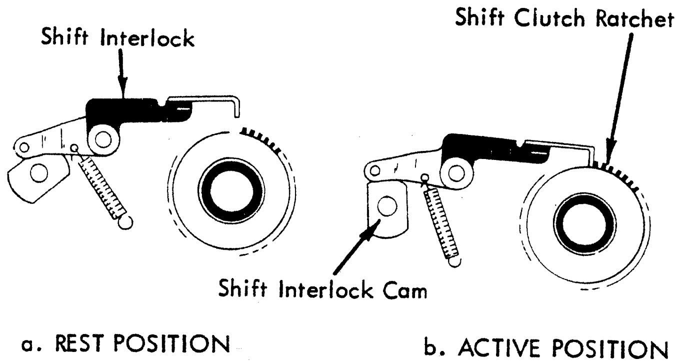


Figure 4-28.

b. Shift To Print Interlock

The shift to print interlock provides a means for delaying a print operation until the shift motion is complete. It mounts on the cycle clutch trip mounting bracket.

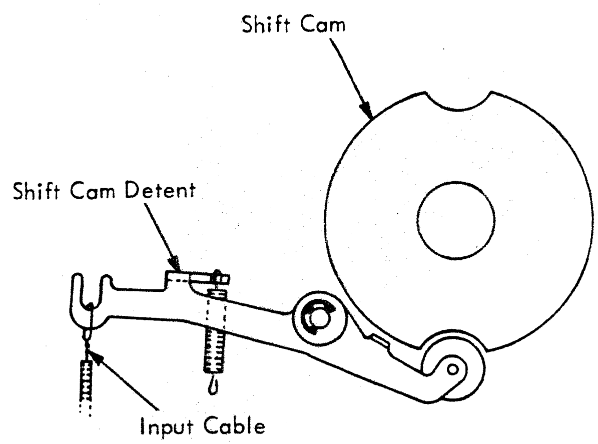


Figure 4-29.

When the shift cam starts to rotate, the shift cam detent roller rides up onto the high surface of the shift cam (Figure 4-29). This rotation of the shift cam detent pulls on the input cable which transfers motion to the input interlock arm. As the input interlock arm moves to the rear the shift interlock arm rotates forward over the rear step on the cycle clutch sleeve (Figure 4-30).

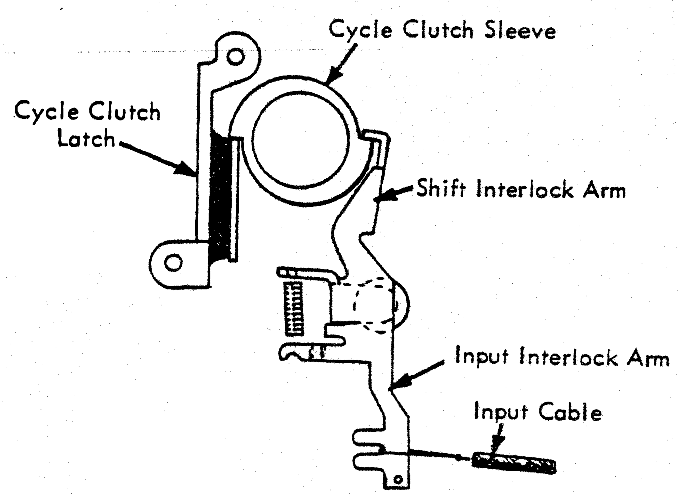


Figure 4-30.

The shift interlock arm will remain engaged until the shift cam detent roller enters the detent of the shift cam. This insures that the cycle clutch sleeve will not be released until a shift operation is complete.

4-6. FINE ALIGNMENT

Fine alignment is defined as locking and supporting the typehead in place so that the desired character will print clearly. In this section we will discuss how the typehead is detented and locked into position for printing. The desired character is brought to the approximate print position in front of the platen by the selection mechanism. Just prior to printing, the typehead must be detented in position both horizontally and vertically. After the print operation occurs, the tilt and rotate detents are withdrawn, allowing the selection mechanism to return the typehead to reset. (Figure 4-3l)

The carrier assembly is supported in front by the print shaft. The print sleeve is keyed to the print shaft causing it to turn when the print shaft rotates. The print sleeve turns within two bearings in the carrier casting. (Figure 4-32)

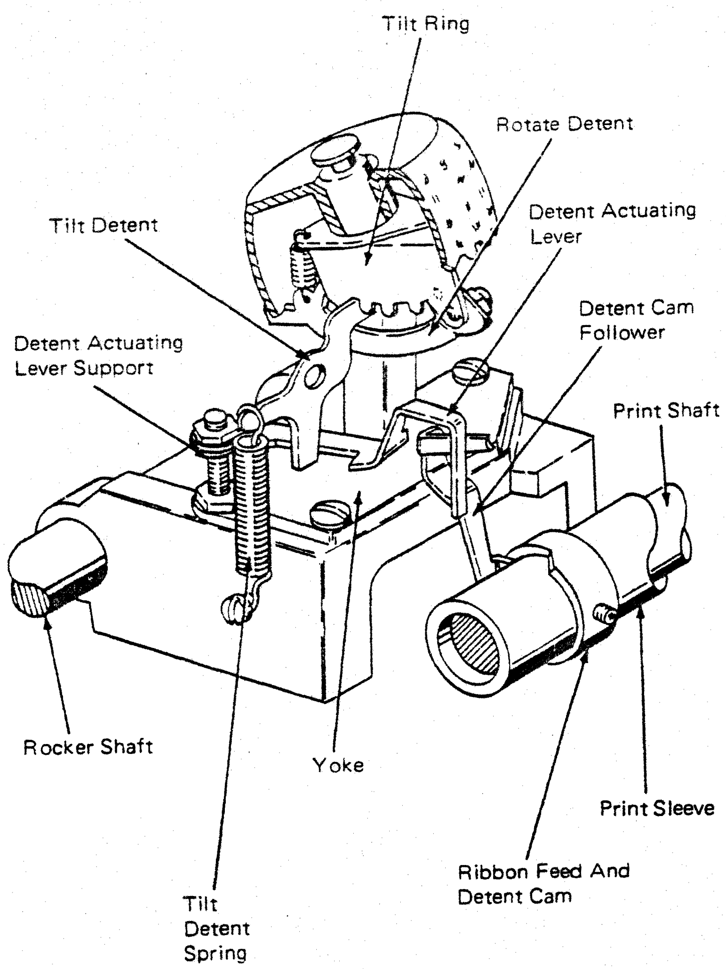


Figure 4-31.

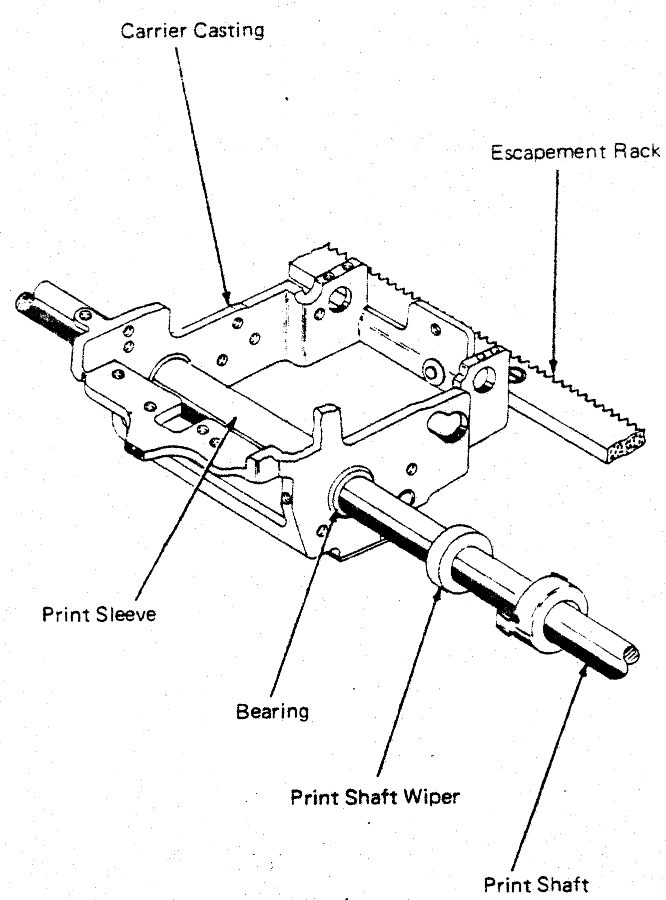


Figure 4-32.

The rear of the carrier is supported by the front edge of the escapement rack. The carrier has two shoes, an upper carrier shoe and a lower carrier shoe. The lower shoe is a small block fastened to a plate and mounted on the carrier. The upper carrier shoe is mounted by an eccentric stud. (Figure 4-33)

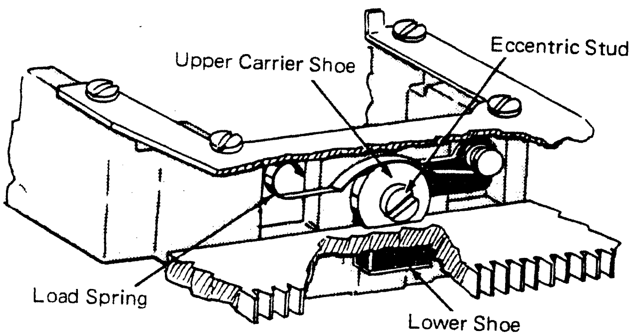


Figure 4-33.

A load spring is used on the new style support and maintains a constant pressure on the upper carrier shoe and removed the play between the lower shoe and the bottom of the escapement rack. This eliminates any vertical play at the rear of the carrier during a print operation. (Figure 4-34)

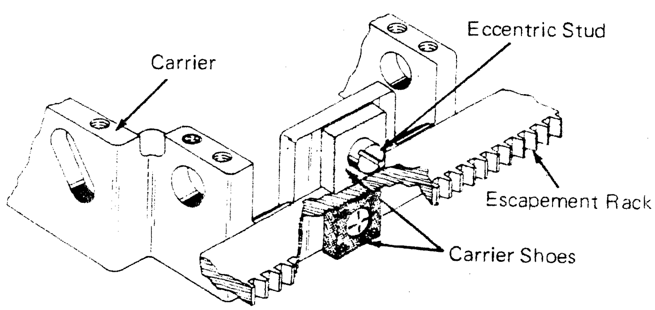


Figure 4-34.

The rocker assembly pivots about the rocker shaft at the rear of the carrier. At the proper time in the cycle, the print cam, also located on the print sleeve, drives the rocker about its pivot point, causing the type head to strike the paper. (Figure 4-35)

The fine alignment mechanism is located within the carrier assembly. There is a separate detent for both tilt and rotate. The tilt detent directly controls the rotate detent. If the tilt detent fails to seat in the detent notch, the rotate detent cannot seat in its notch. Both detents are spring loaded into engagement. When detenting occurs, the tilt detent will be spring loaded into a notch in the tilt ring. When the tilt detent enters a tilt ring notch, the rotate detent will be allowed to enter a notch in the skirt of the typehead. These detents are power driven out of engagement. (Figure 4-36)

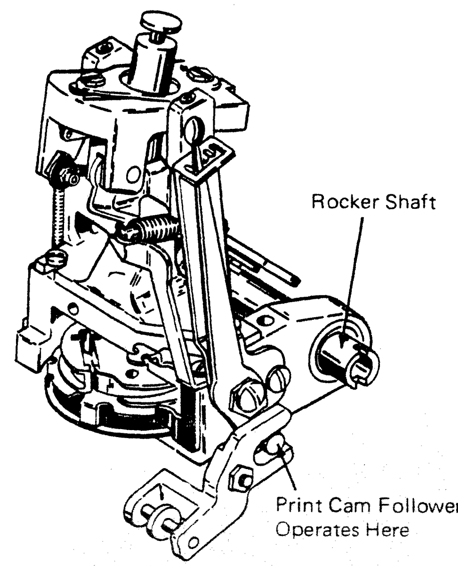


Figure 4-35.

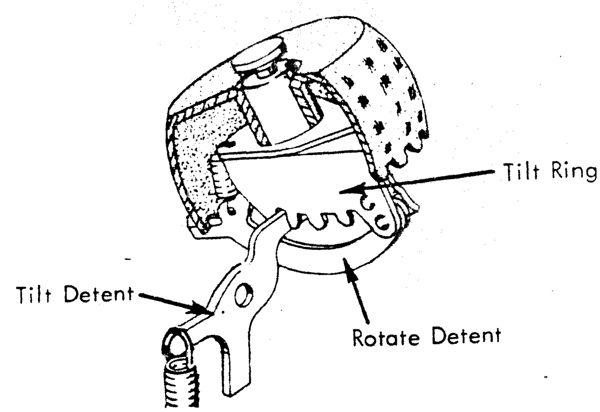


Figure 4-36.

The detents are controlled by the detent cam through the detent cam follower and detent actuating lever. The spring load of the detents causes the detent cam follower to ride the surface of the detent cam. As the detent cam follower enters the low dwell of the detent cam, the detent actuating lever will allow the tilt detent to enter a notch in the tilt ring and the rotate detent to enter a notch in the typehead. As the print sleeve continues to rotate, the high dwell of the detent cam is encountered. The cam follower and the detent actuating lever will be driven to the left to remove the detents from the notches. This permits the selection mechanism to return the typehead to rest. (Figure 4-37)

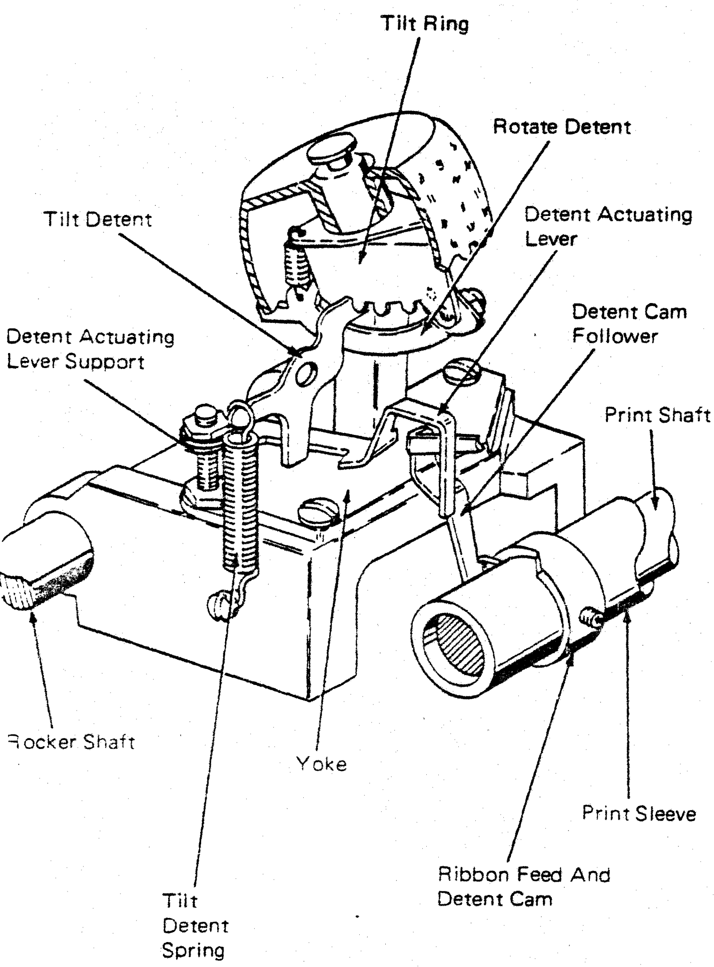


Figure 4-37.

NOTE:

Vertical and horizontal alignment must be properly defined before any adjustments are attempted.

VERTICAL alignment problems exist when the letters are out of position this way.

An example follows:

anbncndnenfngnhninjnknlnmnnnonpnqnrnsntn unvnwnxnynzn

ANBNCNDNFNGNINJNKNLNMNNNONPNQN RNSNTNUNVNWNXNYNZN

HORIZONTAL alignment problems exist when the letters are out of position this way.

An example follows:

anb nc ndnenf ngnh inj nk nln mn nnopnq nrnsn tnunv n wnxny nz

ANB NCND NENF NGNHN INJNK NLNMNONP N ONPN QRN SNTN UNV N WNXY NZ

4-7. CHARACTER SELECTION

a. Tilt

The purpose of the tilt mechanism is to select the desired horizontal character band so that a character in that band may be brought to the printing point. The typehead clips to the upper ball socket. The upper ball socket mounts in a platform-like part called the tilt ring. The tilt ring pivots on two pivot pins between the yoke arms, inside the hollow part of the typehead. The yoke assembly is fastened to the rocker assembly. (Figure 4-38)

The tilt ring is located in about the center of the typehead and causes the typehead to tilt as the tilt ring pivots about its pivot pins. The typehead rests with the upper band of characters in the print position and all tilt positions are upward from the rest position.

The tilt pulley is mounted on an angle on the rocker and is connected to the tilt ring by a link. A pull on the tape causes the tilt pulley to rotate about its mounting stud and transfers motion to the tilt ring. When the pull on the tape is relaxed, the tilt pulley is restored to rest by an extension spring. The tilt pulley link is fastened to the tilt pulley by a ball shouldered rivet to allow the link to pivot in all directions.

The left hand tilt pulley is mounted to the tilt arm on a ball shouldered pivot screw. This allows the pulley to remain horizontal regardless of the position of the tilt arm. It must remain horizontal to prevent the tape from coming off the pulley.

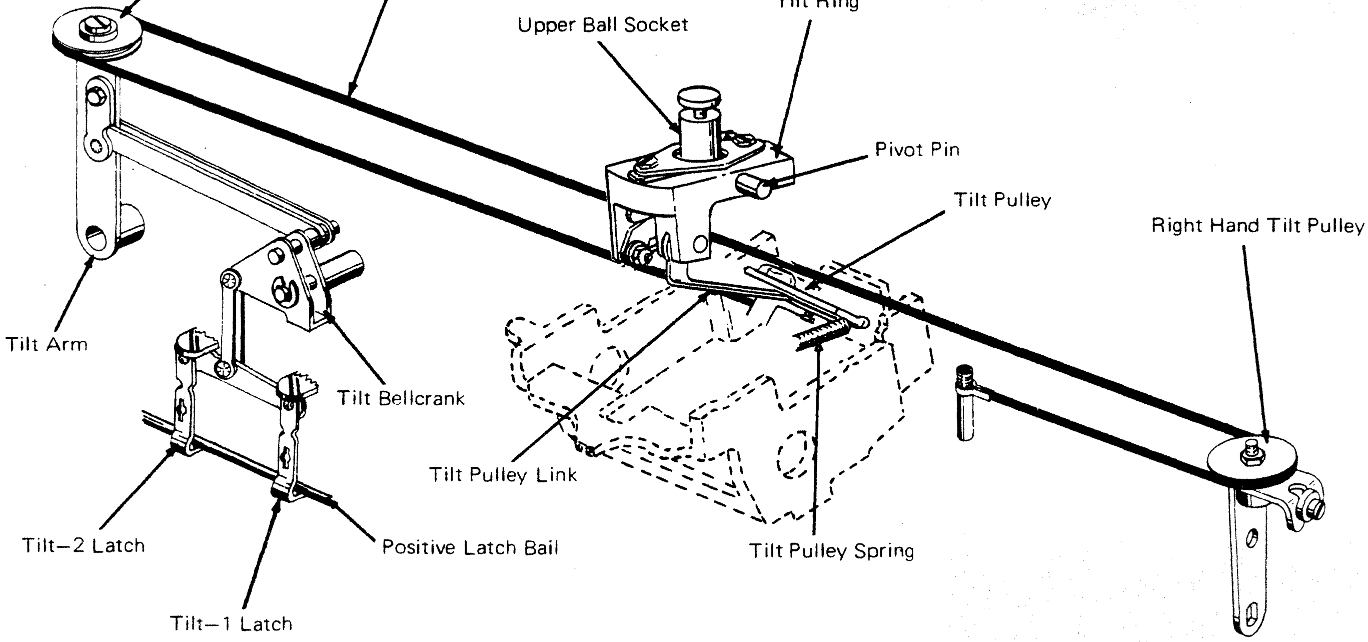


Figure 4-38.

The typehead is positioned throughout four tilt band positions by two latches. (Figure 4-39) Tilt band 0 does not use either latch. Tilt band 1 requires the T1 latch to remain under the bail and causes the tilt arm to move one band of movement. (Figure 4-40) To select the tilt 2 band, the T2 latch remains under the bail and the T1 latch is removed, thus causing the tilt arm to move two bands of movement. The fourth band of the typehead or the tilt 3 position, requires both tilt latches remain under the bail to give three bands of motion to the tilt arm.

If you have a vertical alignment failure, first remove the typehead from your machine. Check the detenting on the "Z" and "J". Make sure the tilt ring is detenting properly when the play is removed in the negative direction. Also, make sure you check the detenting by removing the play in the positive direction. This will tell you if the 'tilt ring play' is correct and, more

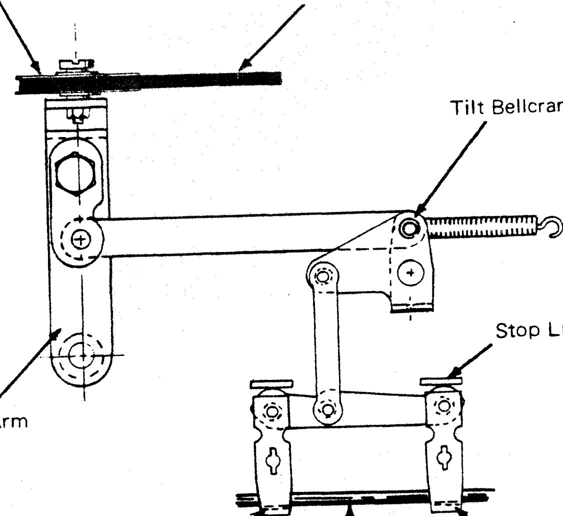


Figure 4-39.

important, if the detent is catching on the tip of the notch. If the detent catches on the tip of the notch, the tilt detent will fail to seat and it will restrict the rotate detent from seating in the typehead tooth. This will look like a "fine alignment" problem. (Figure 4-41)

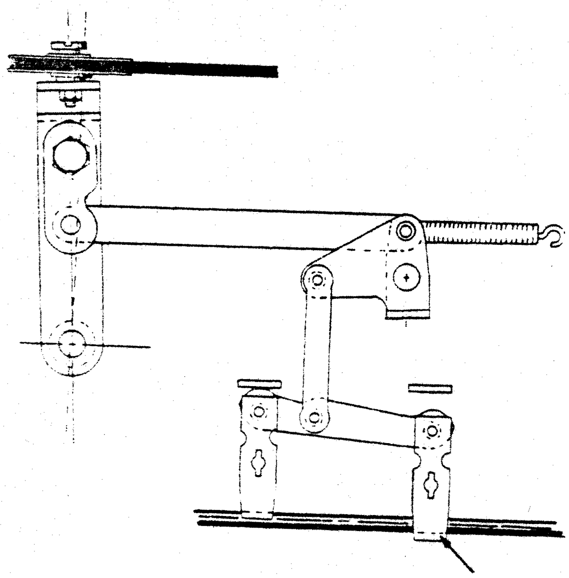
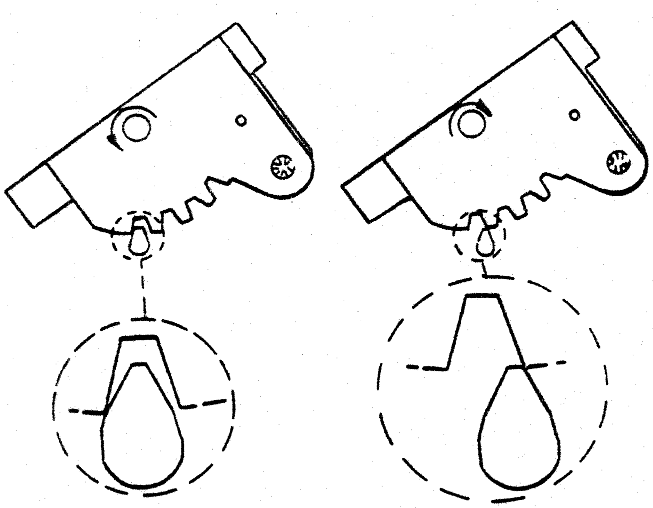


Figure 4-40.



Play Removed In The Negative Direction

Play Removed In The Positive Direction

Figure 4-41.

b. Rotate

The purpose of the rotate mechanism is to position the typehead rotationally to any of the eleven rotational positions. The rotate mechanism is similar to the tilt mechanism, however, it is more complex. Coarse alignment will position the typehead to the correct approximate position. The built-in headplay allows the rotate detent to refine the coarse aligned position. Headplay results from backlash between the slots of the dog bone and the pins in the upper and lower ball sockets. In this section, we will be concerned only with coarse alignment of the typehead. (Figure 4-42)

Once the rotate mechanism has positioned the typehead so the rotate detent is seated within the V-shaped notch in the skirt of the typehead, any horizontal misalignment problems cannot be attributed to coarse alignment adjustments. The problem lies in the carrier and rocker area and is usually caused by one or more of the following: side play in the rotate detent, improper detent timing, vertical or horizontal play in in the upper ball socket, excessive side play of the rocker, or anything that will restrict carrier movement. Rotate selection is accomplished by four latches. There are three positive and one negative latch. Various combinations of these latches position the typehead to one of the eleven rotational positions. The latches have rotational incremental values assigned to them. They are from left to right, R2A, R1, R2 and negative 5. Latch R2A is never used by itself and is only used for rotational positions 4 and 5. Latches R1, R2, and R2A provide l,2,3,4, and 5 increments of counterclockwise or positive rotation, depending on the combination operated. Those latches not needed are removed from beneath the bail by links connected to the latch interposers in the keyboard. The -5 rotate latch rotates the typehead five units in the clockwise or negative direction. Lesser increments of negative rotation are selected by including one or more positive increments (latches) with the negative 5. The negative 5 latch, however, must be activated to be effective.

The motion obtained from the selection latches is transmitted through a bellcrank, link and rotate arm. The position of the rotate arm controls the effective length of the rotate tape. When a latch is pulled down, the opposite end of the lever tries

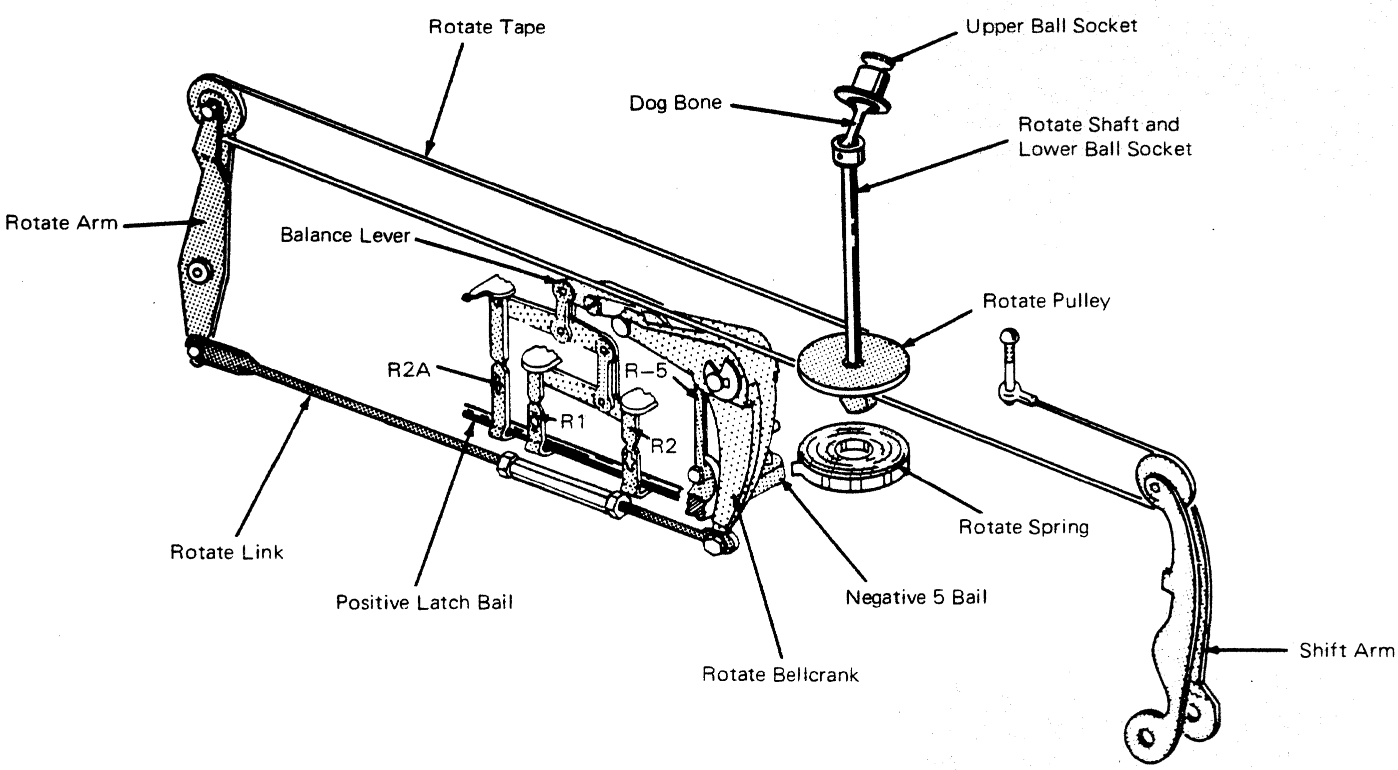


Figure 4-42.

to move up, but is held by a stationary stop pad. Motion is then transferred to linkage and to the rotate bellcrank. To equalize the amount of motion received from the positive latches and the negative bail, a balance lever is located between the negative 5 bail and the positive latches. This lever is adjusted so the positive motion from the positive latches and negative motion from the negative latch are cancelled and no movement of the typehead is observed. (Figure 4-43)

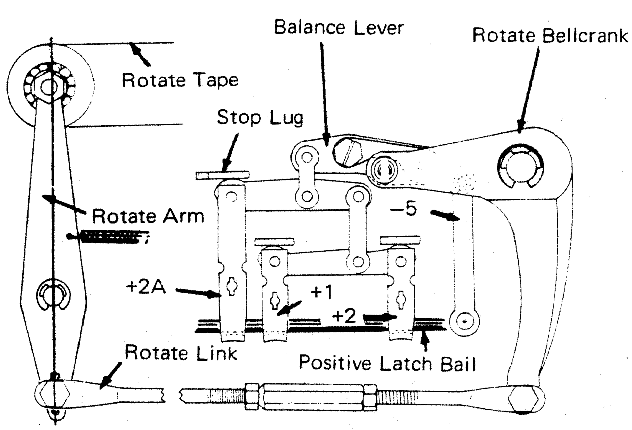


Figure 4-43.

In Figure 4-44 the +1 and +2 latches are under the positive latch bail to give a positive 3 rotation.

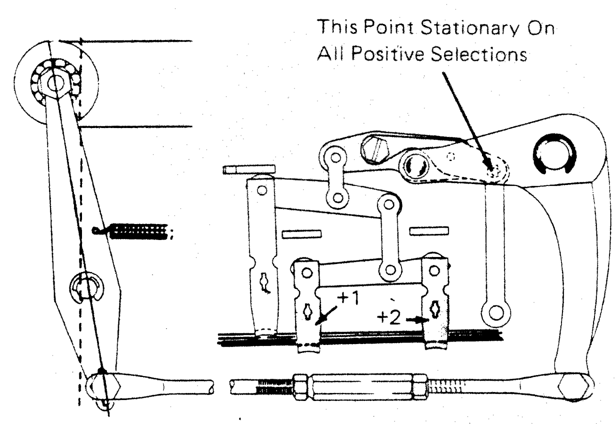


Figure 4-44.

In Figure 4-45, the negative five bail is allowed to operate. This provides a negative 5 rotation.

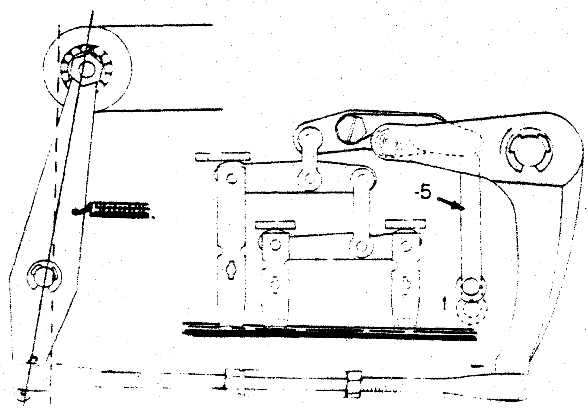


Figure 4-45.

In Figure 4-46, the +2 latch and the negative 5 bail "add" together to provide a negative 3 rotation.

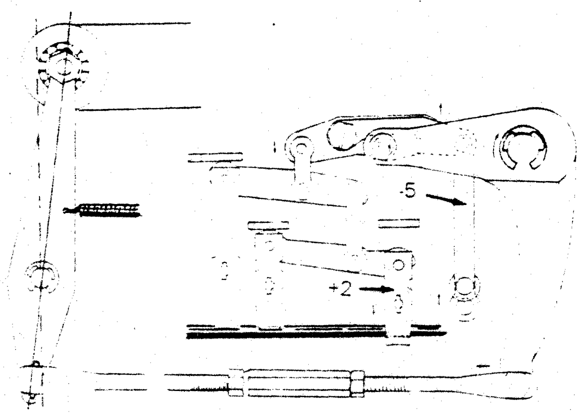


Figure 4-46.

Any wear in the system will cause the typehead to drift in the negative direction. This is because of the rotate spring applying a constant pressure to the rotate system in a negative direction. Because of this drift, coarse alignment or homing adjustments should be checked each time the machine is visited. (Figure 4-47)

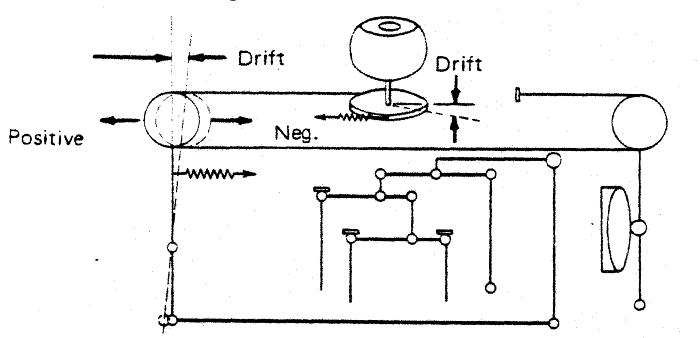


Figure 4-47.

Wear potential in the rotate mechanism is defined as the ability of the rotate mechanism to properly align the typehead after a measurable amount of uncompensated wear is felt in the mechanism. A portion of the typehead play provides the rotate system with a substantial amount of wear potential. To explain how this is accomplished let's look at the relationship between headplay, homing and bandwidth. (Figure 4-48)

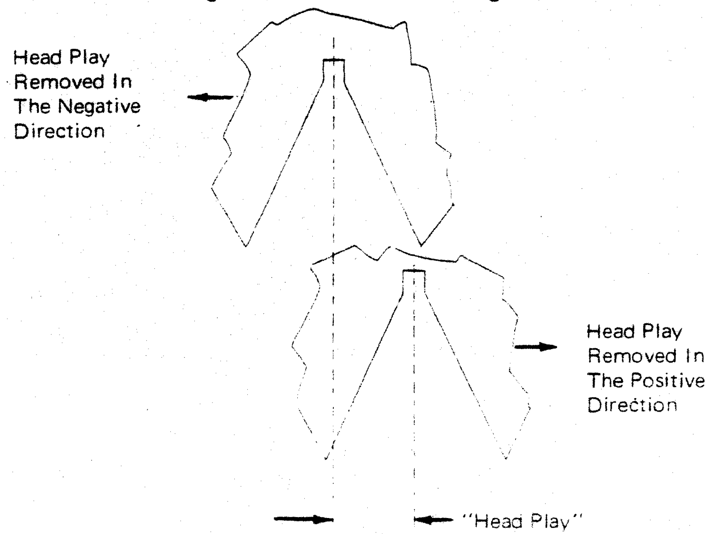


Figure 4-48.

Typehead play is .050" to .060" measured at the typehead skirt or slightly less than half the distance between teeth. The headplay is split between the positive and negative slopes of the typehead notch. The element is homed so that the rotate detent contacts the notch slope, with the headplay removed in the negative direction, approximately .015" down the negative side of the notch. (Figure 4-49)

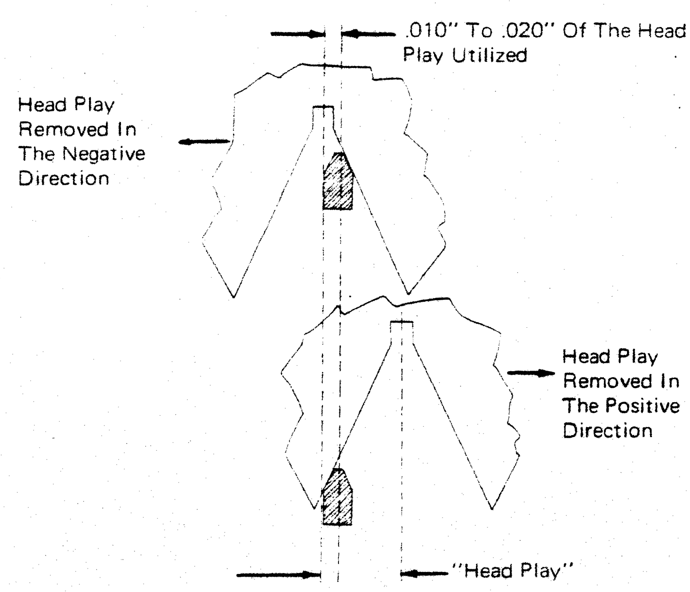


Figure 4-49.

The purpose of this adjustment is to provide maximum wear potential to the system. Also, this adjustment tends to allow more time to withdraw the detent before the typehead restores in the positive direction. Breakage in the system would occur if the detent did not withdraw prior to typehead movement.

Next, let's consider bandwidth. With the headplay removed in the negative direction, the greatest variation between detenting of one typehead position (Figure 4-50A) and another typehead position (Figure 4-50B) is called bandwidth. It is caused by unequal adjustment of the rotate latch stop pads. You will note that we have now used up almost 3/4 of the negative slope of the typehead notch. The remaining distance of the slope is considered the wear potential. The typehead can drift without causing problems until the most negative detented position falls near the end of the negative slope.

When wear occurs in the system, the typehead drifts in the negative direction with respect to the detent. This causes the headplay and bandwidth to drift in the negative direction with respect to the detent. As long as this drift does not exceed the wear potential portion of headplay, the detent will continue to fine align the typehead. Once the wear potential is exceeded, the rotate selection that coarse aligns the most negative, with respect to the detent, will fail to seat in the detent notch. The detent will then fail to seat causing that character to print out of alignment. From the preceding, one can see that for optimum performance, reliability and wear potential, bandwidth must be controlled to be as small as possible. (Figure 4-51)

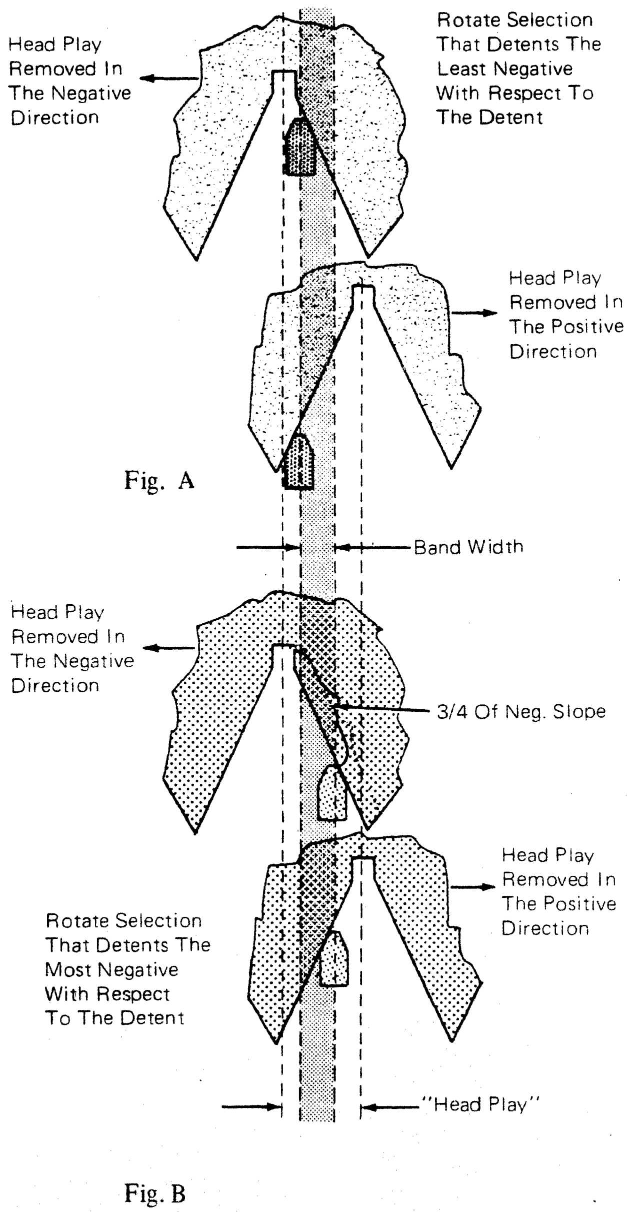


Figure 4-50

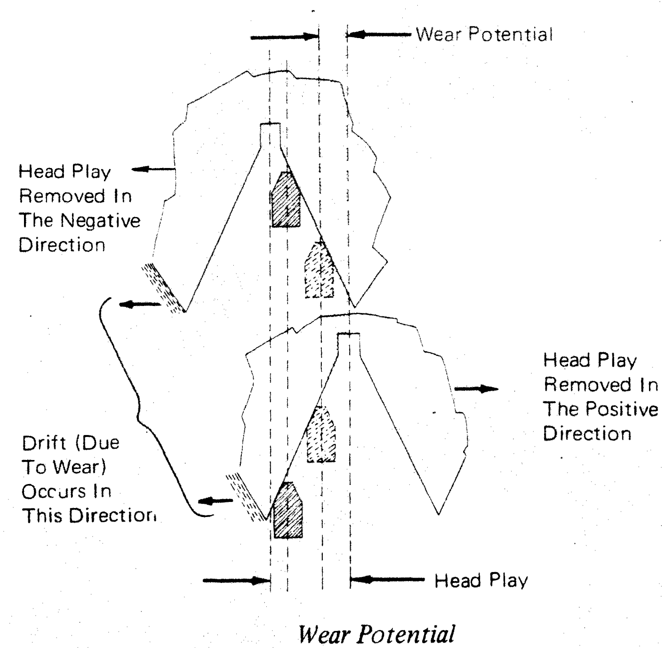


Figure 4-51.

4-8. PRINT MECHANISM

The print mechanism moves the typehead toward the platen and returns it to rest. There are two basic conditions necessary for correct print operation. They are: Correct velocity of the typehead as it strikes the paper, and proper platen position.

The print mechanism contains an impression control lever which may be positioned to one of five settings to permit operator to change the overall impression of the typehead. An automatic velocity selection mechanism is also employed to provide a lighter impression for the periods, commas, colon, semi-colon, quotation mark, apostrophe, hyphen, and underscore; regardless of where the impression control lever may be set. (Figure 4-52)

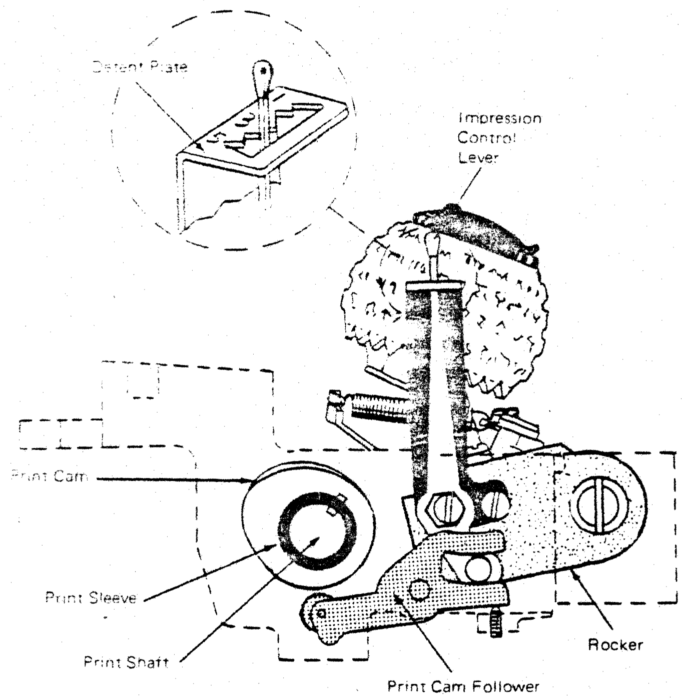


Figure 4-52.

This is accomplished by using a print cam that has two different camming surfaces. The low and high points of both camming surfaces are identical. The contour of one camming surface provides the typehead with a lower impact velocity than the other. The difference in typehead velocities produced by the two camming surfaces remains proportional between all settings of the impression control lever. (Figure 4-53)

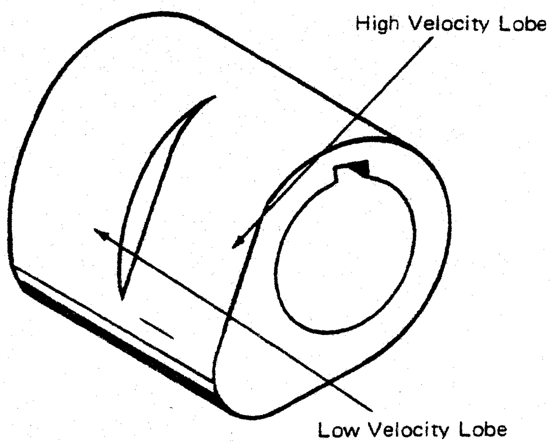


Figure 4-53.

The print cam follower has a roller mounted on a pin and is free to slide left to right to select the desired velocity lobe. The camming surface or lobe on the print cam that produces the greatest impact velocity is called the high velocity lobe. This is the right hand lobe on the print cam. The left hand lobe, producing less impact velocity, is called the low velocity lobe. (Figure 4-54)

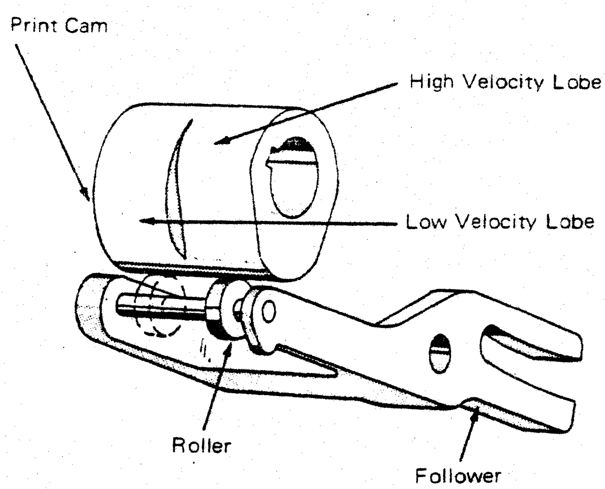


Figure 4-54.

The roller is positioned left to right under the desired cam lobe by a roller yoke that straddles the roller. A lever, called the yoke actuating lever, controls the lateral position of the yoke and roller. It mounts on the tab cord anchor bracket by a shouldered rivet. The yoke actuating lever is spring loaded at the rear and maintains the rest position of the roller directly beneath the high velocity lobe of the print cam. (Figure 4-55)

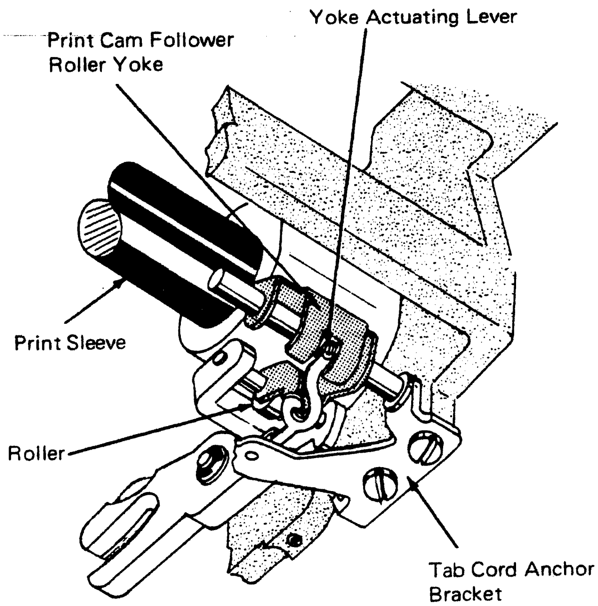


Figure 4-55.

A sheathed cable called the velocity control cable fastens to the yoke actuating lever. Whenever a pull is produced on the velocity control cable, the yoke actuating lever and roller yoke will shift the print cam follower roller from the high velecity lobe to the low velocity lobe of the print cam. When the pull on the velocity control cable is relaxed, the yoke actuating lever spring shifts the roller back to its position beneath the high velocity lobe of the print cam. (Figure 4-56)

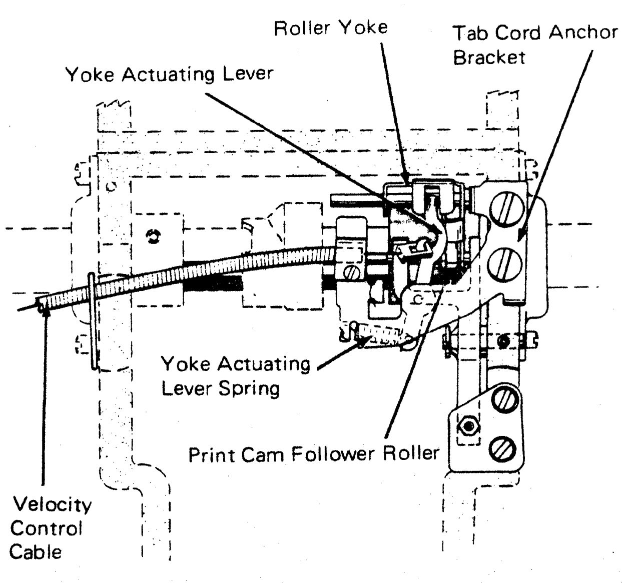


Figure 4-56.

To prevent the print cam from interfering with the print cam follower roller as it shifts from one lobe to the other, the print cam follower and roller are held disengaged from the print cam by an adjustable stop screw until the roller has shifted. The stop screw contacts the rear of the print cam follower. The shifting of the roller occurs at the print cam follower. The shifting of the roller occurs at the beginning and at the end of a low velocity print cycle which is just as the print cam is leaving or approaching its rest position. (Figure 4-57)

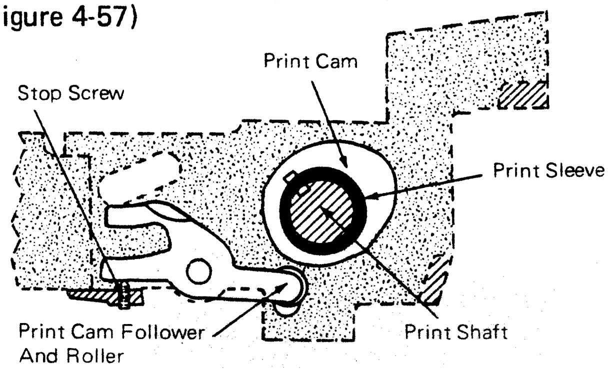


Figure 4-57.

The impression made by the typehead is determined by the velocity of the typehead upon impact with the paper. By increasing or decreasing the velocity of the typehead with the impression control lever, the impression for all characters can be changed equally regardless of automatic velocity selection. The impression control lever may be positioned by the operator to one of five different impression settings. Changing the position of the impression control lever causes a pin in the lower part of the lever to move front to rear in the forked slot of the print cam follower. The front to rear position of the pin determines the amount of powered travel that the typehead receives from the print cam follower. This plus the amount of free flight or typehead movement from the high point of the print cam to the platen determines the velocity of the typehead upon impact with the paper. (Figure 4-58)

When the impression control lever is pulled forward, the pin on the lower extension moves toward the rear in the forked slot of the cam follower and increases the amount of powered travel that the typehead will receive. This is accomplished by changing the rest position of the typehead and not as a change in the amount of free flight.

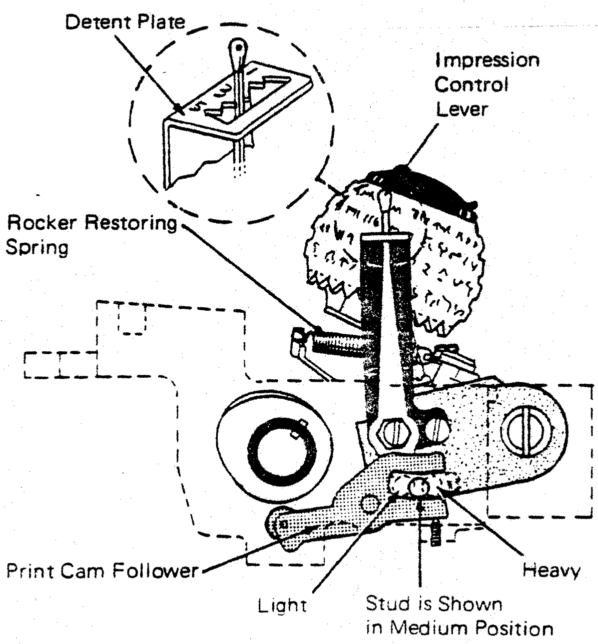


Figure 4-58.

To prevent smearing and alignment problems, long carriage machines are equipped with a carrier support to prevent flexing of the print shaft. The support is mounted to the power frame just below the front of the carrier. The bottom of the carrier pad serves as a buffer. (Figure 4-59)

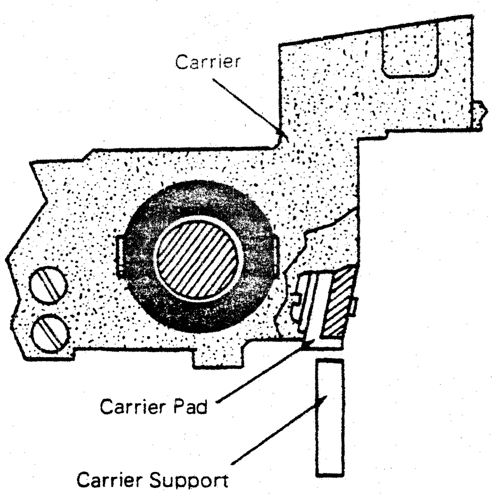


Figure 4-59

The quality of typed impression is determined to a large extent by the condition of the platen. Platen rubber may be adversely affected by numerous factors such as light, heat, chemicals, etc. An old or worn platen may be considerably harder than a new platen and may also vary slightly in diameter. The machine is equipped with a platen with a hardness density comparable to the number 2 platen used with the standard IBM Electric Typewriter. (Figure 4-60)

The platen is held in position in the machine by a latch pivoted at the front of each carriage end plate. The platen may be removed by pressing the rear of the latches down and lifting the platen out. It may be re-installed by snapping it into position without depressing the latches, however, care must be taken to prevent bending the platen shaft. Also, releasing feed roll tension will aid in re-installation of the platen.

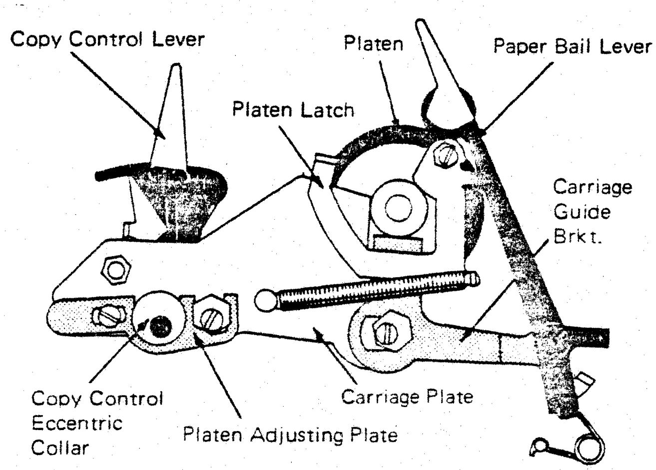


Figure 4-60.

The copy control mechanism positions the platen front to rear for different thicknesses of typing material. The copy control mechanism is operated by a lever located at the left end of the carriage. The lever is attached to a shaft that extends through the sides of the powerframe. An eccentric collar attached to each end of the shaft operates between adjusting plates attached to the carriage end plate. As the lever is moved to the rear, the shaft rotates causing the eccentric collars to force the carriage plates to the rear. The platen and entire paper feed mechanism move with the carriage plates. When the copy control lever is pulled forward, the eccentric collars contact the platen adjusting plates and force the carriage forward into the normal position. The copy control lever can be set in five different positions. A spring detent attached to the power frame acts against a knob on the copy control lever to hold it in place. (Figure 4-60)

4-9. PAPER FEED

In this section we will discuss how the paper is held firmly against the platen, both vertically and horizontally, and how the paper is indexed vertically. First, let's look at the paper feed mechanism.

The paper feed operated by pressing the paper tightly against the platen so that it must move as the platen rotates. The paper is held against the platen by the front and rear feed roll assemblies located beneath the platen. Each feed roll assembly contains three or four rubber rollers equally spaced along the feed roll shaft and molded to the shaft. (Figure 4-61)

The feed rolls mount in the front and rear feed roll arm assemblies. The front feed roll arms pivot on the feed roll actuating shaft. Also pivoting on the feed roll actuating shaft is a feed roll arm. There are several holes in the upper extension of the feed roll arm. Heavy extension springs are connected between the carriage tie rod and one of the holes to provide a means of adjusting the feed roll pressure.

The paper deflector guides the paper around the platen. It is supported beneath the platen by lugs on the front and rear feed roll arms. A lug at each end of the deflector fits over a stud on the paper feed mounting arm to maintain the correct position of the deflector. (Figure 4-62)

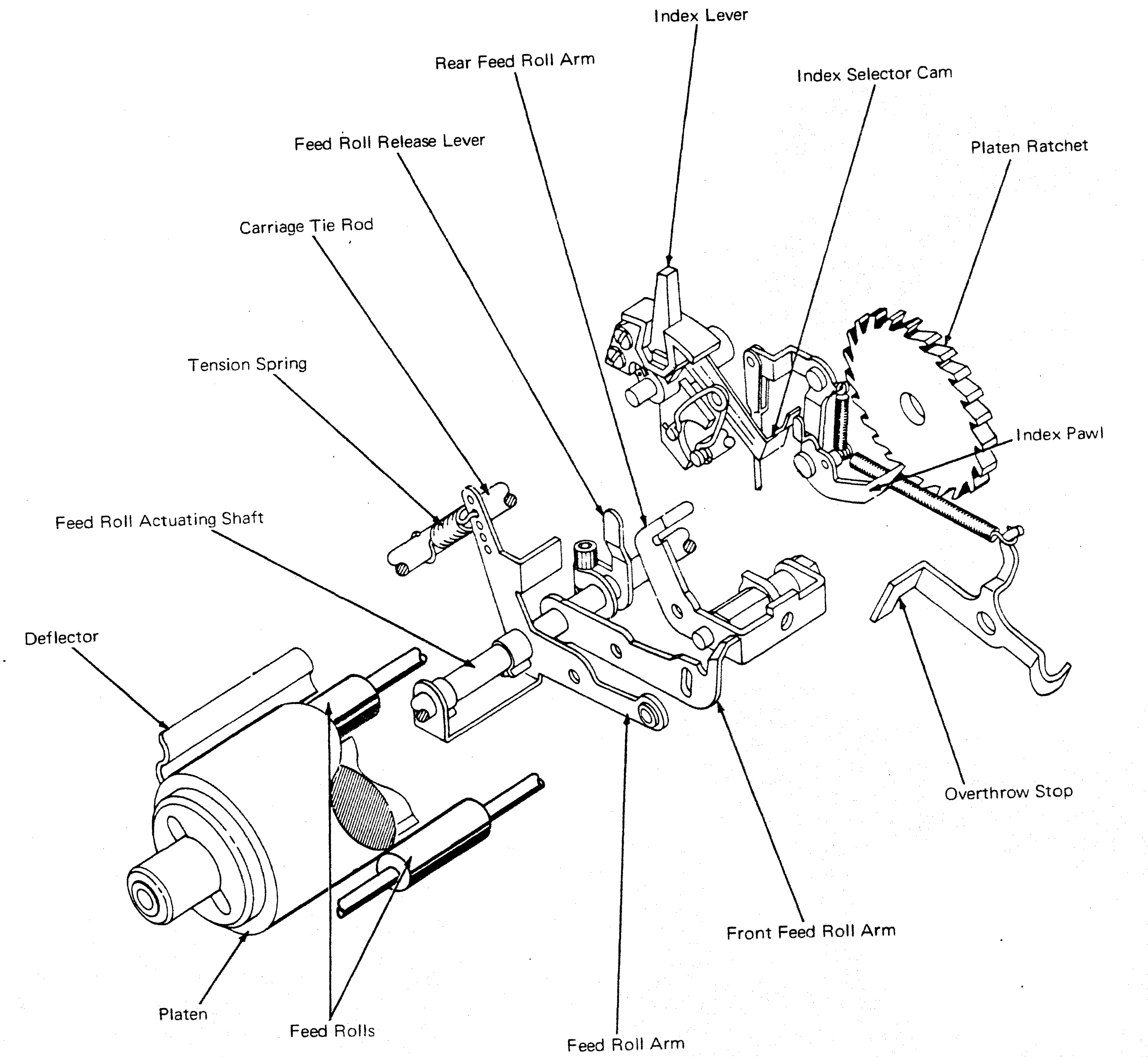


Figure 4-61.

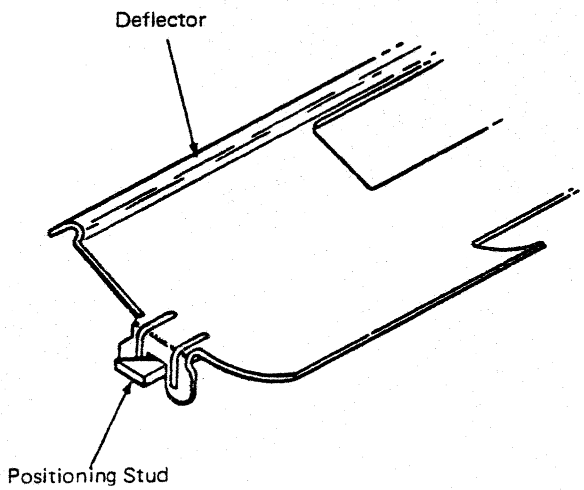


Figure 4-62.

As the paper is inserted into the machine, an adjustable guide, mounted on the case at the rear of the platen, serves to position the paper for its left margin positon. The paper deflector guides the paper between the rear feed roll and the platen. As the platen is turned, the paper is forced to move with the platen. The deflector guides the paper around the platen into positon between the front feed roll and the platen. As the paper is fed farther, the end of the paper is guided upward by the cardholder attached to the rear of the carrier. (Figure 4-63)

The cardholder assists in holding the typing material against the platen in the printing area. A scale on each side of the cardholder aids the typist in re-inserting material into the machine to a specific printing point. The vertical marks on the scale indicate the middle of the character space and horizontal line indicates the bottom of the writing line. A single mark, located at the top of the cardholder, indicates the middle of the next character to be typed.

Above the writing line, the paper is engaged by two rubber rollers mounted on the paper bail. These rollers hold the paper against the platen above the writing line to reduce the possibility of over printing on the paper. The rollers are also used to feed the paper vertically after the bottom of the paper has left the front feed rolls.

The paper bail is supported by a lever at each end and pivots front-to-rear. A hair pin spring attached to each bail lever, serves as a toggle to hold the bail rolls either to the rear against the platen or forward in the release position.

The pressure of the feed rolls is released from the platen to allow the operator to position the paper more accurately and to allow easier insertion and removal of the paper. Paper release is accomplished by pulling forward on the paper release lever located at the right end of the machine. The feed roll release levers are clamped to the feed roll actuating shaft and rest behind a lug of each front feed roll arm. As the shaft rotates, the feed roll release levers rotate the front feed roll arms down, away from the platen. Due to the inter-connection between the front feed roll arm and the rear feed roll arm, the rear feed roll arms are forced away from the platen. When the paper release lever has been pulled all the way forward, the end of the feed roll release arm detents to hold the feed roll release lever in the released position. (Figure 4-64)

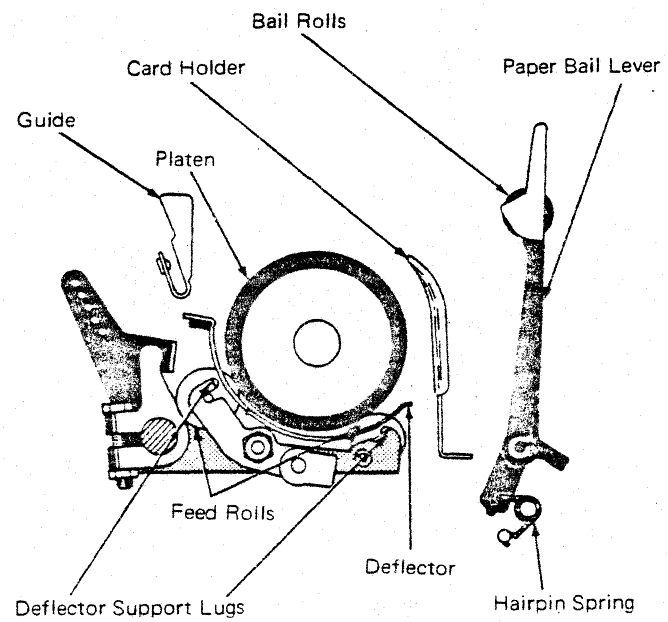


Figure 4-63.

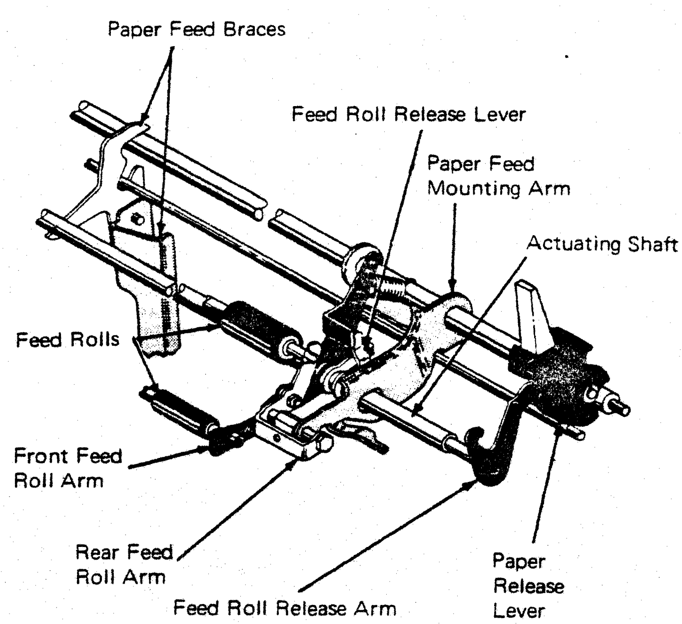


Figure 4-64.

4-10. ESCAPEMENT

Escapement is the controlled single space movement of the carrier to the right that occurs every time a character is printed. The carrier is under a constant spring tension to the right. The escapement mechanism allows or prevents the carrier's movement to the right under this spring tension.

At rest, a pawl which is mounted to the carrier engages a fixed escapement rack and prevents the spring tension exerted by the mainspring from pulling the carrier to the right. During an escapement operation, the pawl is temporarily removed from the rack. (Figure 4-65)

There are two pawls mounted to the carrier, an escapement pawl and a backspace pawl. There are also two racks, an escapement rack and a backspace rack.

An escapement operation is obtained by forcing the escapement pawl to the rear out of engagement with the rack teeth. Due to the slotted mounting hole, as soon as the pawl clears the escapement rack tooth it is snapped to the right by the pawl spring. The escapement pawl is allowed to move to the front into engagement with the next tooth. The carrier then moves to the right until it comes to rest against the escapement pawl.

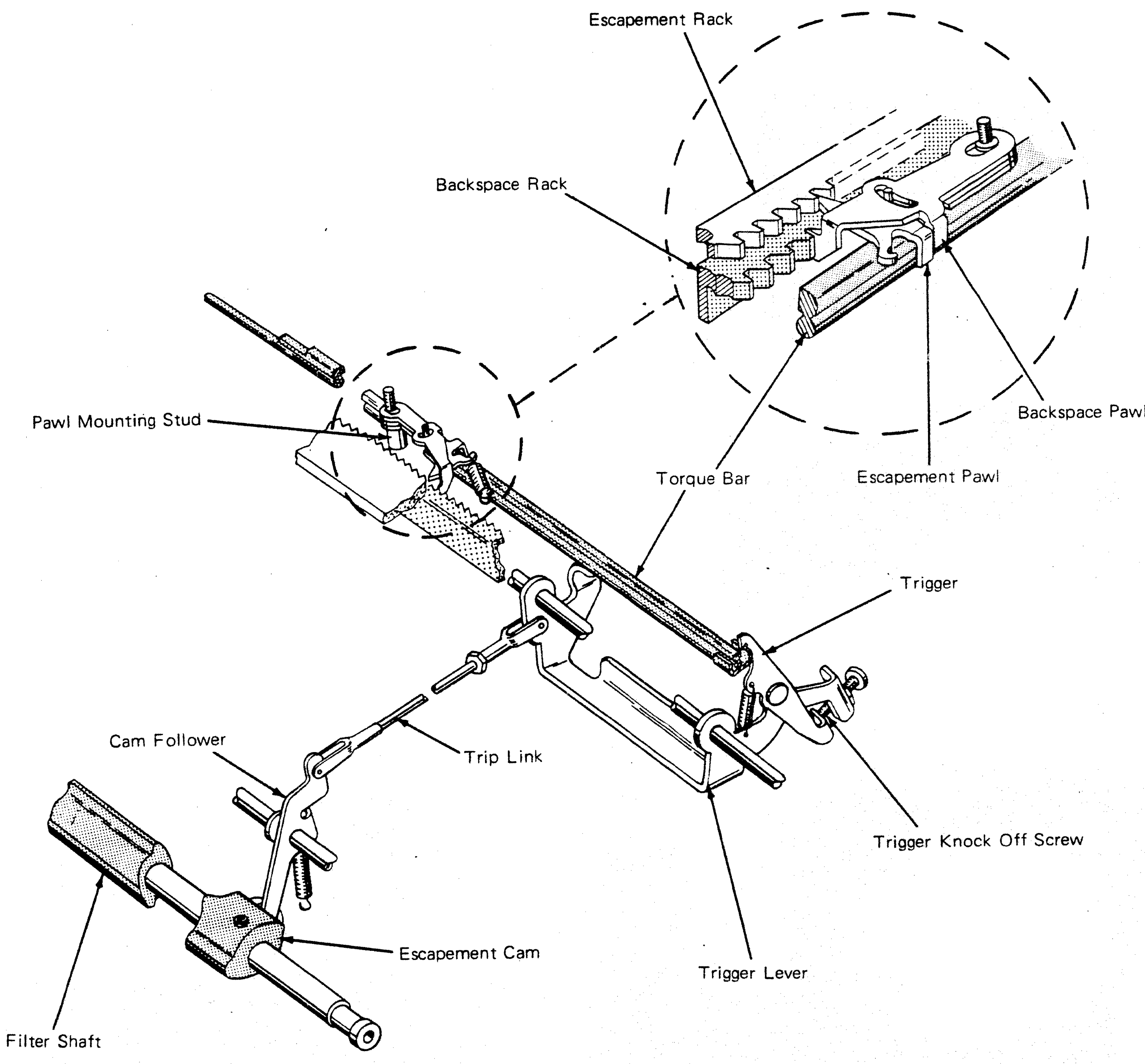
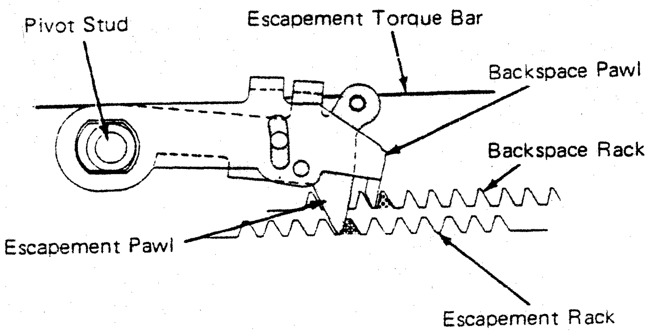


Figure 4-65.

Operating Sequence

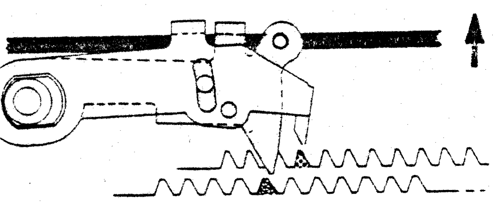
1. This picture shows the escapement and backspace pawls and their associated racks. The pivot point or stud is attached to the bracket mounted on the carrier.

   The carrier is always being pulled to the right, and the pivot has moved to the right until it hits the right edge of the elongated slot in the pawls.



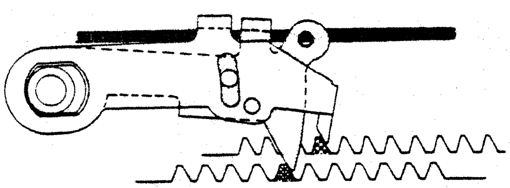
1

2. This picture shows the torque bar operated, the pawls have been pulled free of their racks and the spring tension has pulled the pawls to the right before the carrier has started to move.



2

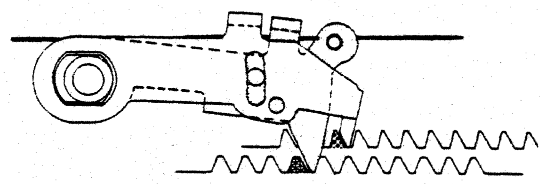
3. Here, the torque bar is returning to its rest position and the pawls are dropping into the next tooth on their racks.



3

4. Now the carrier has moved to the right and the pawls have stopped the stud, and again the carrier is at rest after spacing once.

There is a timing consideration in this type of escapement. The torque bar must return to rest before the carrier has moved enough to skip a tooth on the racks.



4

The carrier and escapement pawl must be moved to the left for a backspace operation. Because the backspace pawl is mounted to the escapement bracket, movement of the backspace pawl to the left forces the carrier and escapement pawl to the left. The backspace pawl is mounted just above the escapement pawl, but its tooth extends below the escapement pawl and is held engaged with the backspace rack by a small extension spring.

The backspace rack is mounted to the rear of the power frame by shouldered screws through elongated holes in the rack. This mounting arrangement allows lateral movement of the rack. Movement of the rack towards the left forces the backspace pawl to the left to cause a backspace operation.

The backspace operation is pointed out here due to its close association with the escapement mechanism. The backspace pawl is engaged with the rack when in the rest position. This means that both the backspace and escapement pawls must be removed from their racks in order for the carrier to move to the right.

A flat torque bar pivots between the sides of the power frame just to the rear of the backspace and escapement racks. Its purpose is to trip the backspace and escapement pawls out of their respective racks. (Figure 4-66)

The pivot point of the torque bar is near its bottom edge. The escapement pawl and the back-space pawl each have a lug that extends down just behind the torque bar. As the top of the torque bar pivots to the rear, it will force the lugs of the pawls to the rear causing the tips of the pawls to clear their respective racks.

Rotation of the escapement torque bar is instantaneous and supplies just enough motion to remove the pawls from their racks. The torque bar is immediately rotated back to the rest position by an extension spring located at the right hand end. This allows the pawls to re-enter their racks to limit the carrier movement to one space.

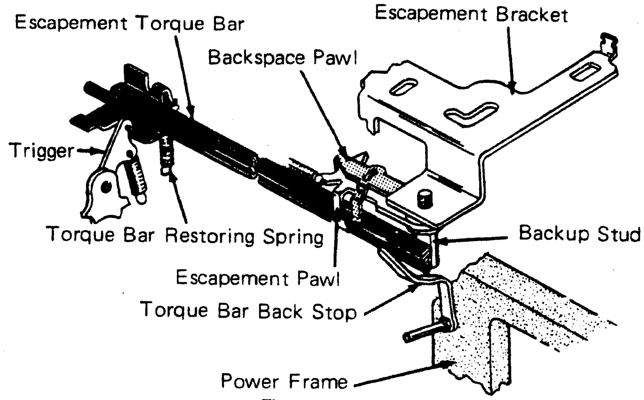


Figure 4-66.

Because of the force required to trip the pawls out of their racks, the torque bar tends to bow toward the front instead of pushing the pawls to the rear. This is eliminated by a large head on the pawl pivot stud extending down from the escapement bracket directly in front of the torque bar. On long carriage machines, an additional support is given to the escapement torque bar to prevent it from bowing to the rear. A backstop mounted to a stud in the machine power frame provides the backing.

The escapement trigger is used to operate the torque bar to obtain an escapement operation. A lug on the right rear end of the torque bar is used to pivot the torque bar. Downward movement of the trigger causes the torque bar to rotate. (Figure 4-67)

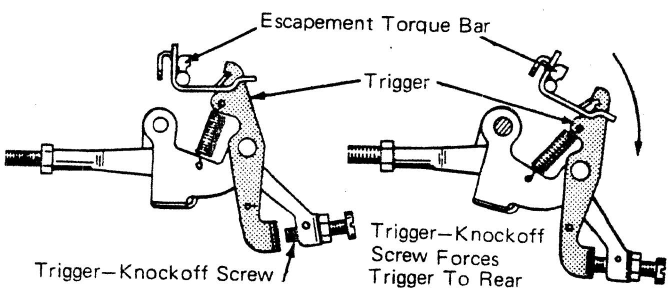


Figure 4-67.

The trigger lever is cam operated, therefore, it can only restore as fast as the cam can rotate from the high point to the low point. To prevent the escapement pawl from skipping, the torque bar must be allowed to restore more quickly. An adjustable knockoff screw causes the trigger to cam off of the torque bar lug just after the pawls have been removed from the rack. The torque bar can then restore without waiting for restoration of the trigger and the trigger lever.

Power to operate the escapement trigger is taken from a double lobed cam mounted on the filter shaft just inside the right hand power frame. Each time a cycle operation occurs, the filter shaft operates the cam 180 deg. Anytime the escapement and backspace pawls are removed from their racks, the carrier is pulled toward the right by the mainspring tension. (Figure 4-68)

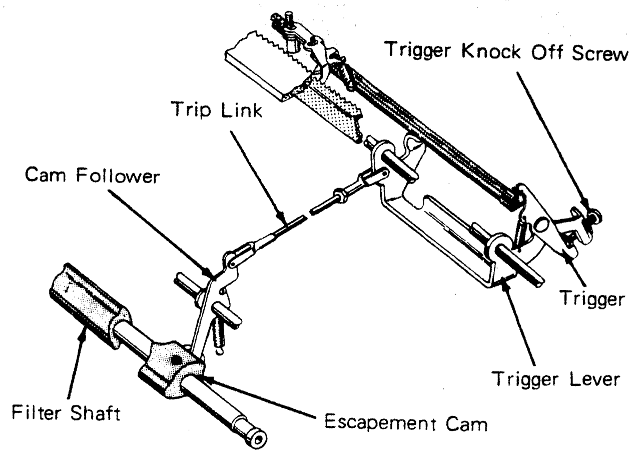


Figure 4-68.

The escapement shaft extends forward through a backplate and the power frame. Located on this shaft are two drums. Attached to each drum is a small nylon cord. The escapement/tab cord is wound several turns around the front drum, then to the right over a guide roller just prior to passing through the right side of the machine. The cord passes around a cord tension arm and back through the power frame and connects to the right hand side of the carrier. (Figure 4-69)

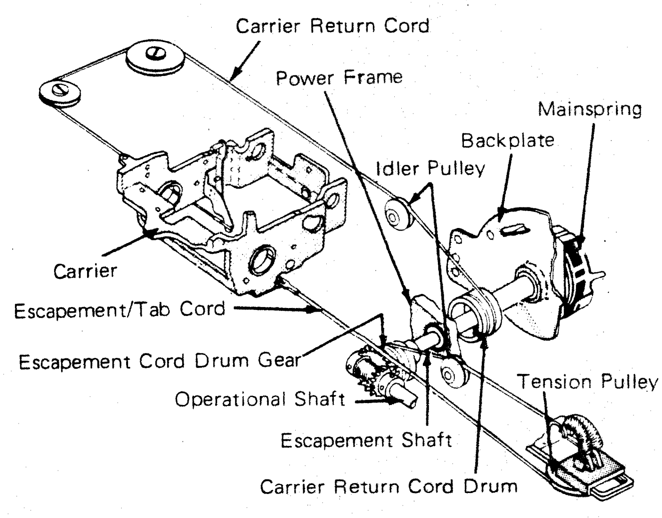


Figure 4-69.

Another cord is wound around the drum between the power frame and the backplate. Through a guide and pulleys, the cord is attached to the left hand side of the carrier. This cord is used for carrier return. The carrier return cord must pay out cord in order for the carrier to move to the right. Likewise the escapement tab cord must be payed out from its drum in order for the carrier to return to the left. To accomplish this, the cords are wound in opposite directions.

4-11. OPERATIONAL CONTROL AND SPACE BAR

Because of the interrelated functions of the spacebar and operational control mechanisms they will be covered together in this section.

The space bar is mounted at the front of the keyboard on a pivot shaft. Depression of the spacebar causes the pivot shaft to rotate, and in turn the spacebar keylever. As the spacebar keylever is depressed, a lower lug on the keylever pawl contacts the interposer, forcing it down to release the interposer latch from the latching surface of the interposer latch plate. As soon as the interposer latch has cleared the latch plate, the interposer is pulled to the rear by its spring. (Figure 4-70)

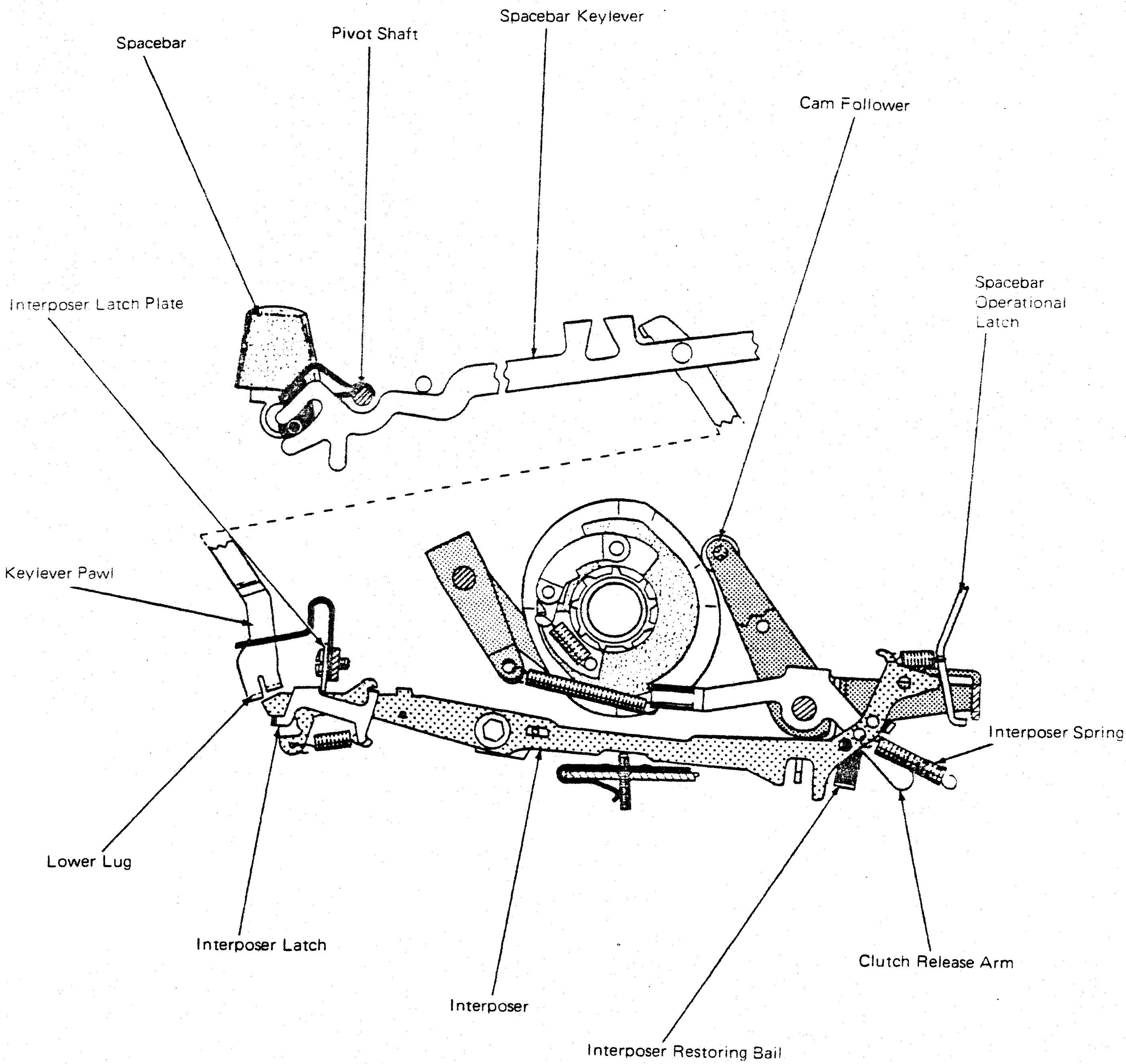


Figure 4-70.

A lug on the interposer contacts the clutch release arm, rotating it down at the front allowing the cam wheel to be released. This allows the spring-loaded cam pawl to move into a position to be contacted by the rotating operational clutch ratchet which is setscrewed to the operational shaft. At the same time, the interposer forces the spacebar latch to the rear, pushing it under the cam follower. (Figure 4-71)

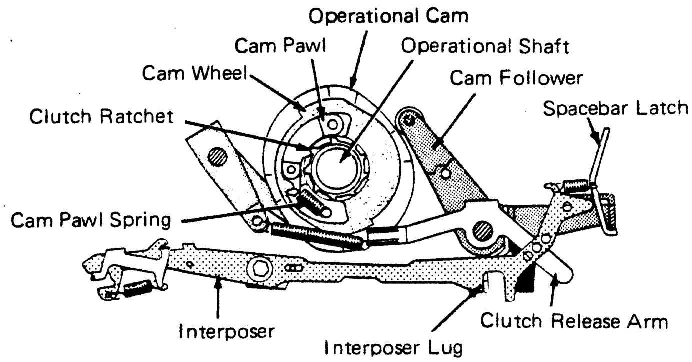


Figure 4-71.

As the cam is driven by the clutch ratchet, the cam follower moves from the low dwell to the high point of the cam. Movement of the cam follower pulls the spacebar operational latch down which causes the spacebar latch lever to pivot. An adjusting screw on the latch lever contacts the trigger lever, causing the trigger on the trigger lever to rotate the escapement torque bar and allow the carrier to complete an escapement operation in the same manner as a character print escapement. (Figure 4-72)

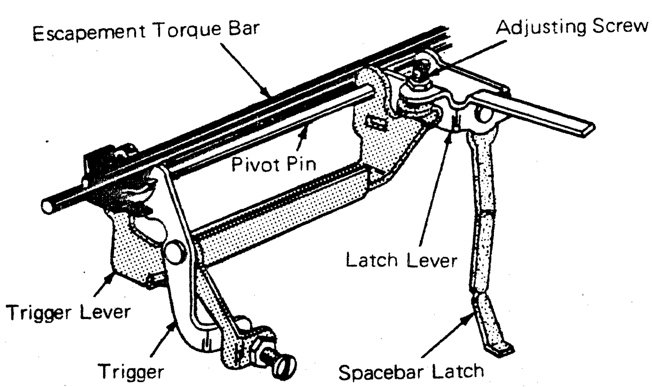


Figure 4-72.

As the cam follower is pulling down on the spacebar latch, it also actuates the interposer restoring lever to restore the interposer forward. The clutch release arm restores into the path of the clutch wheel ready to disengage the cam clutch. (Figure 4-73)

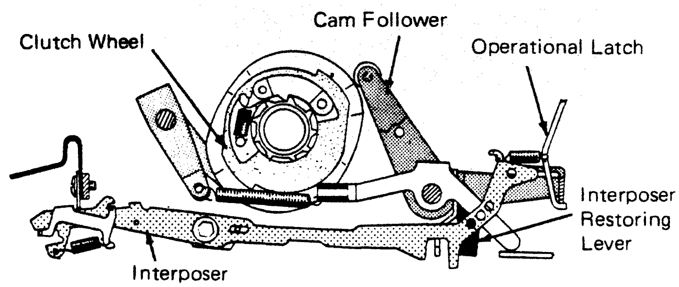


Figure 4-73.

The rotational movement of the cam wheel is stopped when its tooth contacts the clutch release arm. (Figure 4-74) Continued movement of the operational cam while the cam wheel is held stationary causes a pin on the cam pawl to slide up the beveled hole in the clutch wheel and disengage the pawl from the ratchet. To hold the cam in the disengaged position, a check pawl is provided. The check pawl engages a notch in the cam check ring. (Figure 4-75)

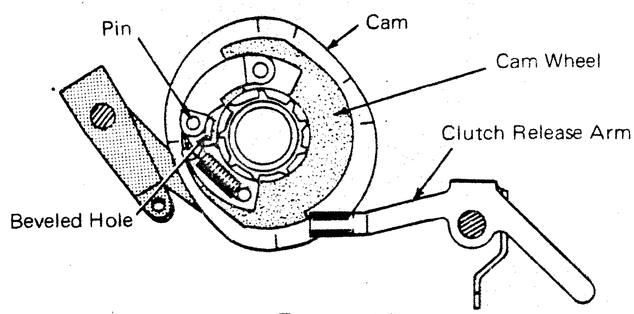


Figure 4-74.

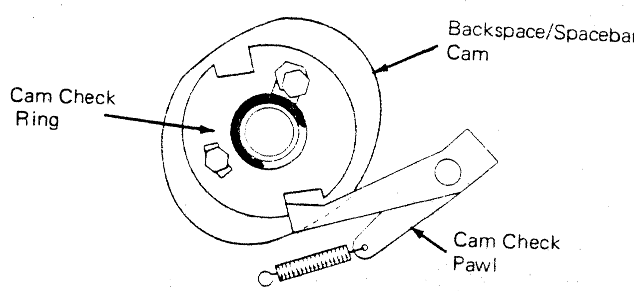


Figure 4-75.

Repeat operation of an operational mechanism can be accomplished by preventing the interposer from relatching against the interposer latch plate. (Figure 4-76) A second lug, called the repeat lug, on the keylever pawl is used to prevent the relatching of the interposer when a keylever is depressed in the repeat zone. In the case of Carrier Return the repeat lug on the keylever pawl, is formed to the right above the index interposer. Depression of the carrier return keylever into the repeat zone causes the index interposer to be released, resulting in additional linespacing.

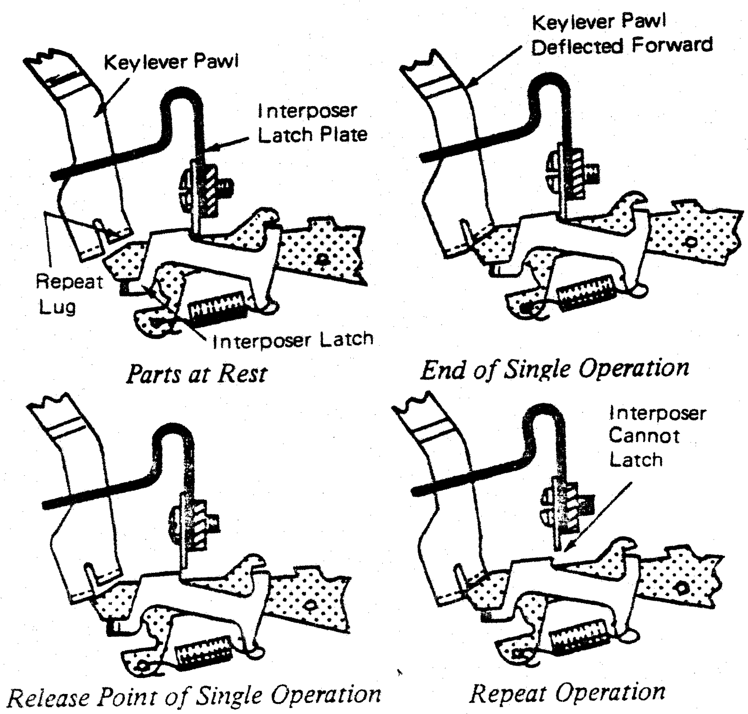


Figure 4-76.

As previously mentioned, both spacebar escapement and print escapement operate by actuating the escapement trigger lever to cause an escapement operation. Because of the interrelationship of these two mechanisms operating both of them rapidly or together causes only one space of escapement to occur. This could happen when an operator strikes the spacebar too soon after a character print operation.

To ensure the spacebar will actuate an escapement operation following a print cycle, it is necessary to place the spacebar mechanism into storage until the print cycle is completed. (Figure 4-77)

Spacebar storage is accomplished by blocking the movement of the spacebar interposer to the rear. As the filter shaft rotates during a print operation, the interlock interposer follows the contour of the spacebar interlock cam by pivoting the top to the front. As the interlock interposer drops off of the high point of the cam, its rear extension moves up and blocks the movement of the interposer to the rear. This stops the spacebar operation and holds the interposer in "storage" until the print cycle is completed.

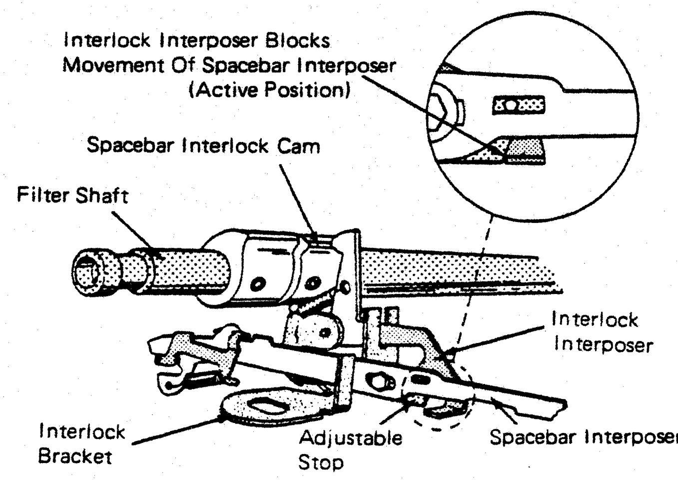


Figure 4-77.

Two cams provide the necessary motion to operate these mechanisms. The left hand operational cam is a double lobed cam and provides the motion to drive the spacebar and backspace mechanisms. The right hand cam is single lobed and powers the carrier return and index mechanisms. (Figure 4-78)

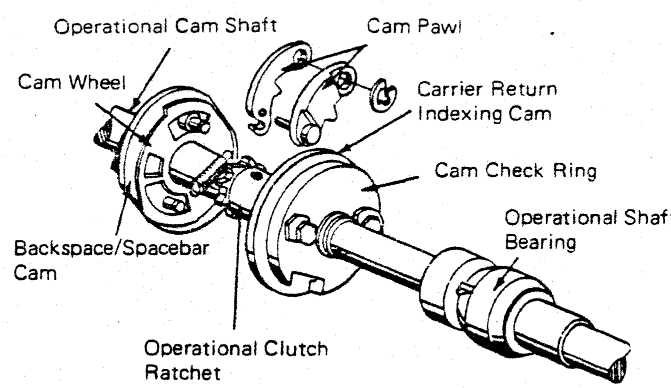


Figure 4-78.

There is an interposer in the operational control mechanism for each of the four functions (Spacebar, Backspace, Carrier Return and Index) driven by that mechanism.

The principles of operation for both operational cams and the entire operational control mechanism is the same. The backspace, carrier return and index mechanism theory is very similar to the spacebar mechanism, although the parts design may differ slightly.

4-12. BACKSPACE

The purpose of the backspace mechanism is to move the carrier to the left one space at a time. The backspace mechanism also has a "typamatic" option that causes a repeat operation when the keybutton is held fully depressed.

Since operational control was covered with the spacebar mechanism, this section will be concerned only with the backspace mechanism after the latch begins to operate.

The backspace latch assembly is mounted on a pivot stud permanently affixed to the backplate in the right rear of the machine. The latch assembly receives its motion from the cam follower lever. This motion is transferred by the intermediate backspace lever to the backspace rack. (Figure 4-79)

The backspace rack is mounted on shouldered studs to the power frame. As the backspace rack moves to the left, the backspace pawl is engaged.

The backspace pawl is mounted directly above the escapement pawl to the escapement bracket. Movement of the backspace pawl to the left also moves the carrier and the escapement pawl to the left. (Figure 4-80)

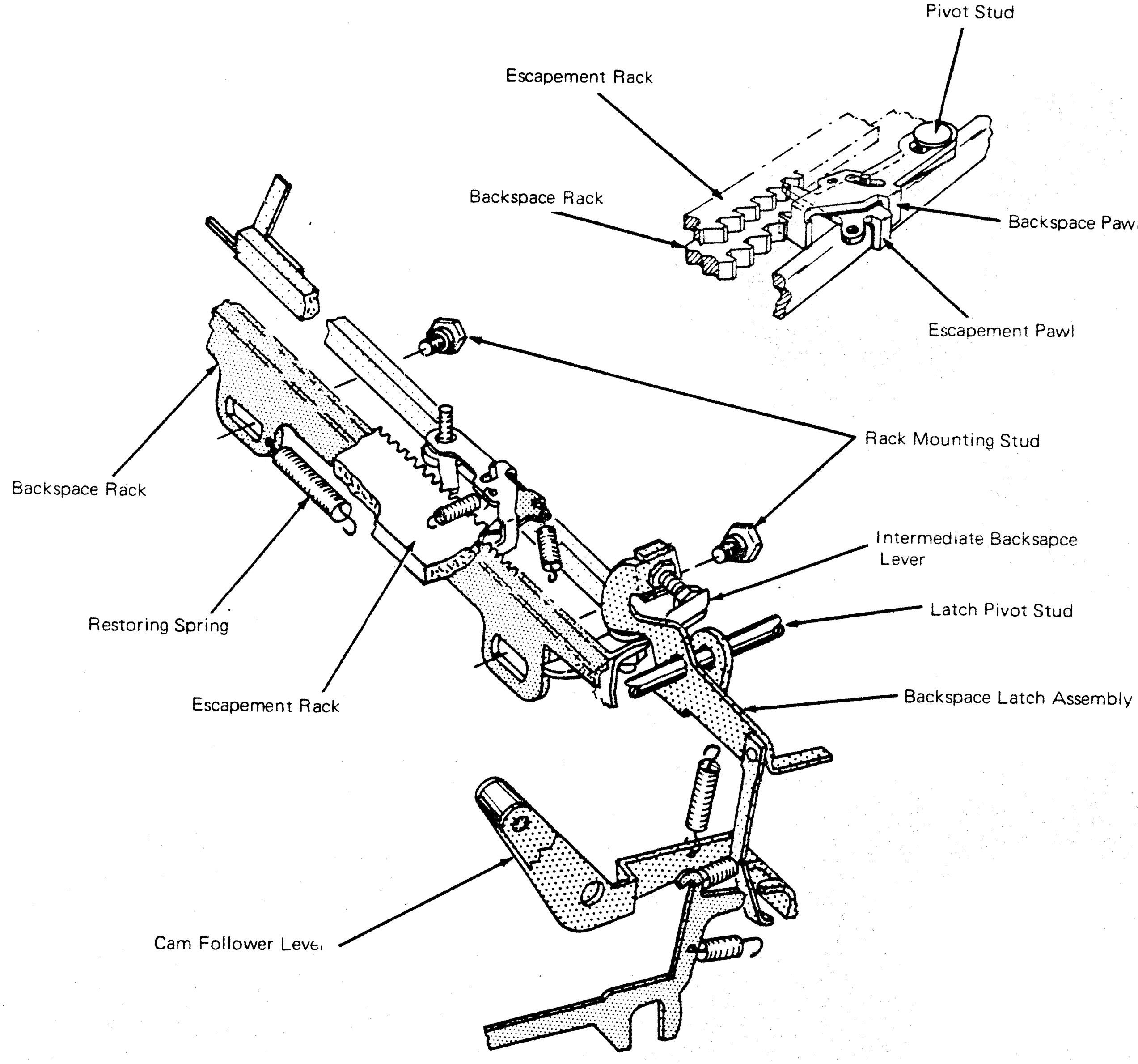


Figure 4-79.

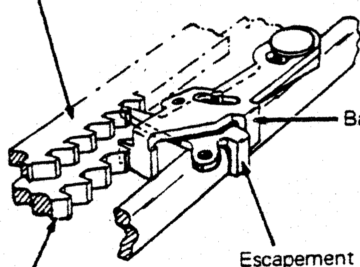


Figure 4-80.

The escapement pawl and backspace pawl move front to rear independently. The escapement pawl has a small upright stud on its upper surface which extends through an elongated slot in the backspace pawl. This allows the escapement pawl to cam to the rear and fall into the previous tooth of the escapement rack as the backspace rack moves the carrier to the left. (Figure 4-81)

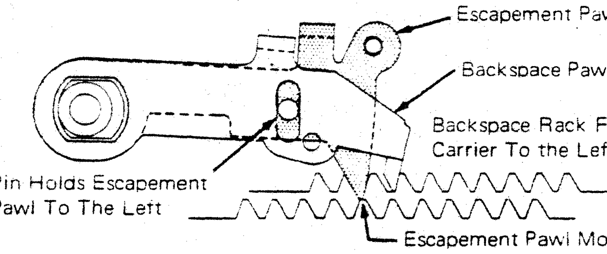


Figure 4-81.

The backspace rack is spring loaded to the right. As a backspace operation is completed, the backspace rack returns to its rest position. The carrier is held by the escapement pawl and the backspace pawl drops into the next tooth of the backspace rack as the rack restores. (Figure 4-82)

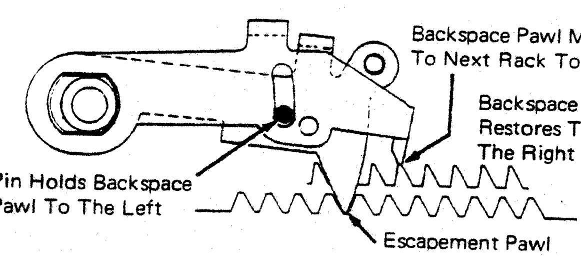


Figure 4-82.

4-13. TABULATOR

The tab mechanism provides the operator with rapid carrier movement to the right to a predetermined position on the writing line. The tab mechanism may be used for "tabulating" columns of figures, indenting paragraphs or any other application that requires positioning the carrier to a specific point.

To accomplish this, several things take place in a very short period of time. To better understand a tab operation, the information will be presented in time sequence.

a. Tab Set And Clear

The tab rack, located parallel to and just to the rear of the escapement rack, allows the operator to select the positions where the carrier will stop during a tab operation. The tab stops operate in slots in the rack with one stop for each escapement position. The tab set and clear button may be rocked forward or backward to set or clear a tab stop. (Figure 4-83)

When the front, or set position of the keybutton, is depressed, an extension on the bottom of the keybutton pushes, through a connecting link, the tab set and clear arm. The tab set and clear arm pivots the tab set and clear bellcrank, which rotates the tab rack. As the tab rack rotates, a tab stop corresponding to the carrier position contacts a projection on the escapement bracket. As the tab rack continues to rotate, the tab stop is forced to turn within the tab rack. When the tab set button is released, the tab rack restores to its rest position. The working surface of the tab stop will be lower than the other tab stops, or in the "set" position. The tab stop is then in a position to stop the latched out tab lever during a tab operation. (Figure 4-84)

A set tab stop may be cleared by depressing the rear of the tab set and clear button. This rotates the tab rack in the opposite direction. The set tab stop contacts the gang clear finger. (Figure 4-85)

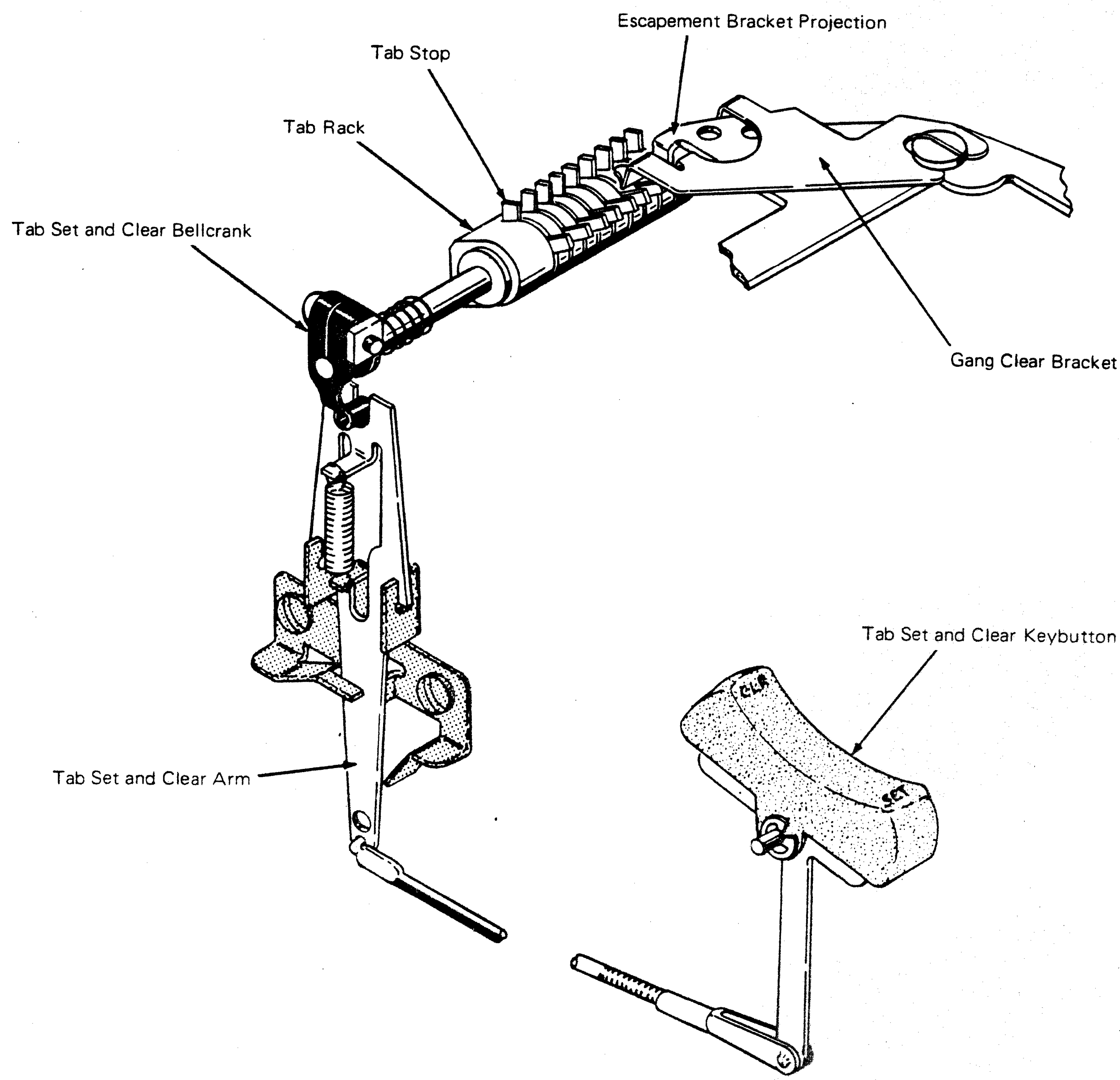


Figure 4-83.

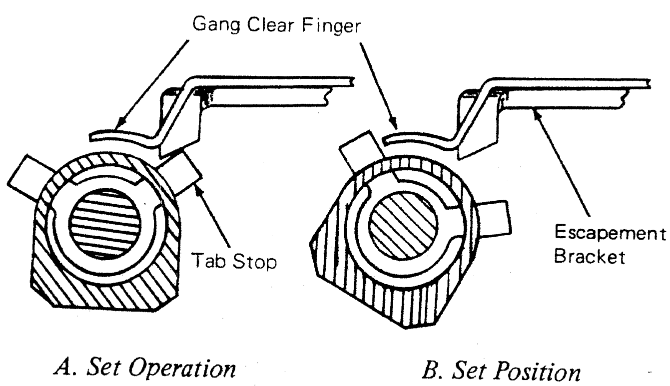
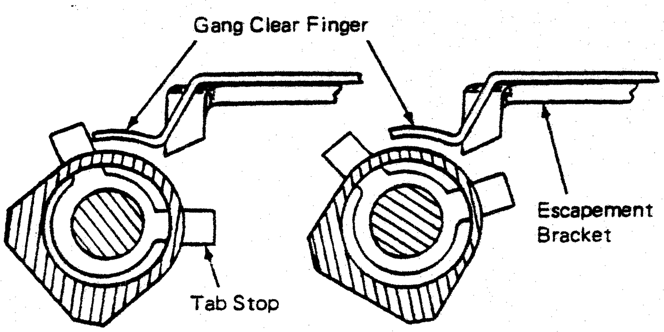


Figure 4-84.

As the rack continues to rotate, the tab stop turns within the tab rack to its "cleared" position. As the keybutton is released, the rack restores to its rest position and the previously set tab stop is in line with the other tab stops.

If the carrier is at the right margin and the carrier return mechanism is operated while the tab clear button is held depressed, all set tab stops will be cleared as the carrier moves to the left. This is accomplished by the gang clear bracket which is mounted to the escapement bracket.



C. Clear Operation *D. Clear Position*

Figure 4-85.

b. Keylever Assembly

The tab keylever operates a bail that extends from left to right above the shift bail (Figure 4-86). The bail operates a keylever on the right side of the keyboard. This keylever does not have a stem for a keybutton and is used only to trip the tab interposer.

c. Pawl Release

The tab interposer engages the backspace/spacebar cam and pushes the tab operational latch under the backspace/spacebar cam follower.

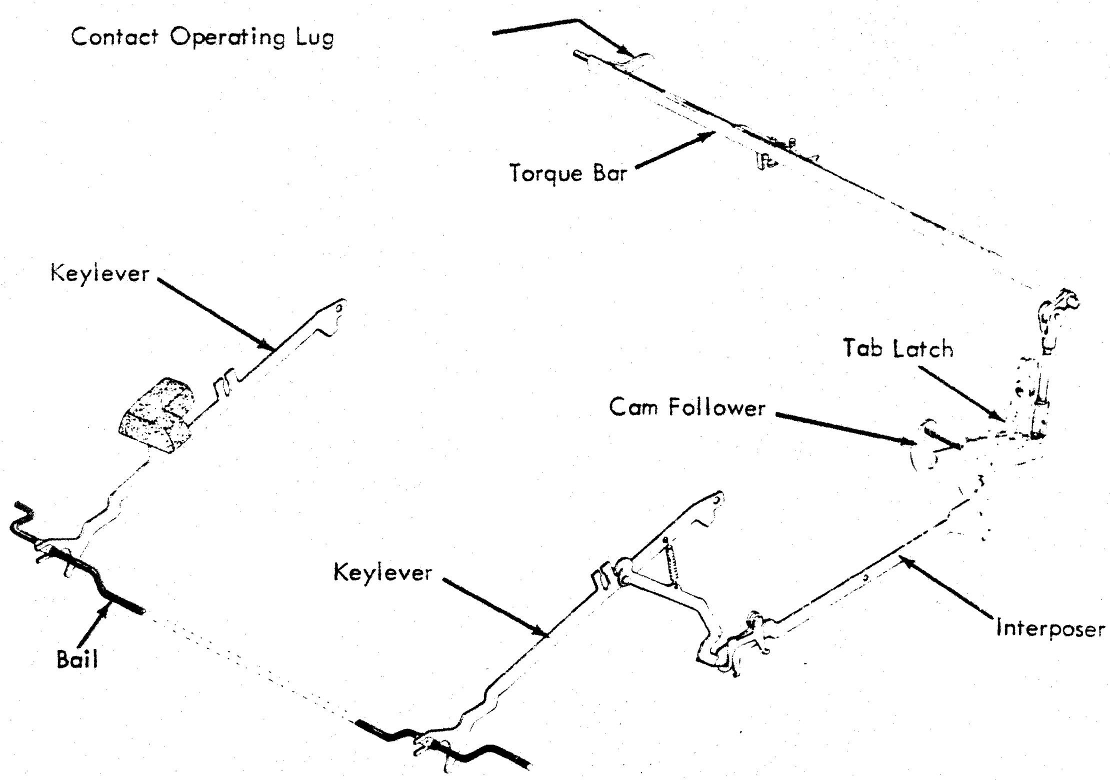
The tab operational latch is connected to the latch bellcrank and, as the latch is carried down by the backspace/spacebar cam-follower lever, the bellcrank rotates clockwise.

A link connects the tab torque bar to the latch bellcrank. Rotating the bellcrank, raises the link. The link rotates the bottom of the torque bar to the rear.

The tab torque bar is mounted the same as the escapement torque bar. The pivot point is near the top of the torque bar so that the bar swings to the rear. (Figure 4-87)

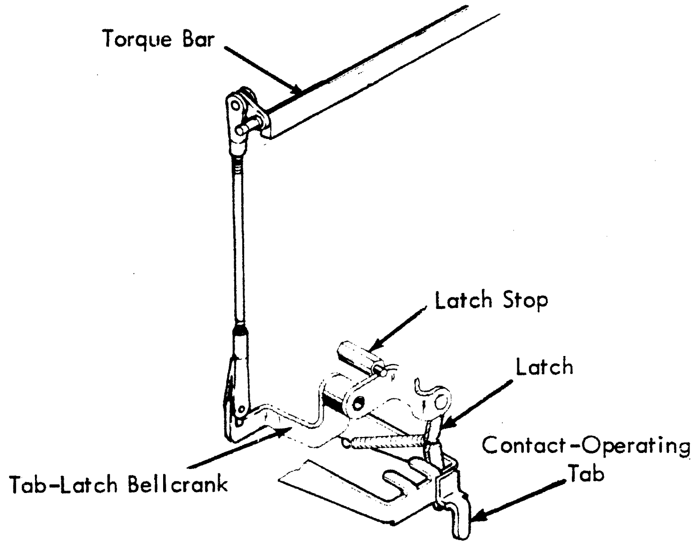
The tab lever is operated to the rear by the tab torque bar.

The tab lever is a small lever pivoted on the top of the escapement bracket at the rear. The tab lever releases both the escapement and backspace pawls from their racks and holds them in the released position. As the tab lever pivots toward the rear, a lug at



Power Tab Mechanism

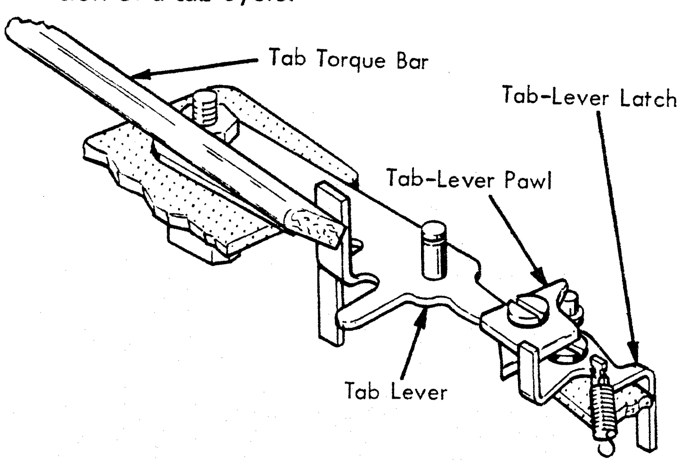
Figure 4-86.



Power-Tab Latch

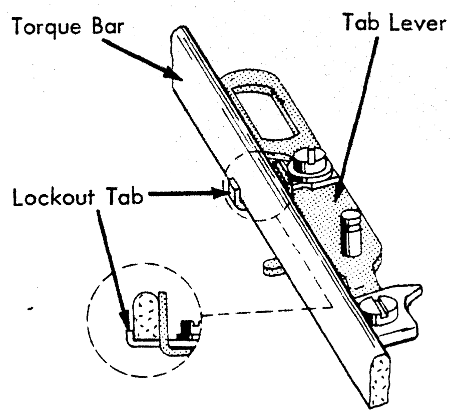
Figure 4-87.

the front of the tab lever contacts the escapement and backspace pawls and forces them to the rear out of mesh with their racks. A small latch pivots on the escapement bracket at the right end of the tab lever. When the tab lever has moved far enough to the rear to release the pawls, the tab latch swings into a notch in the tab-lever assembly to hold it to the rear, thus latching the pawls out of their racks (Figure 4-88). A torque bar lockout tab on the tab lever holds the torque bar to the rear as long as the tab lever is latched out (Figure 4-89). This is necessary to keep the tab Interlock contact operating for the duration of a tab cycle.



Tab-Latch Operation

Figure 4-88.



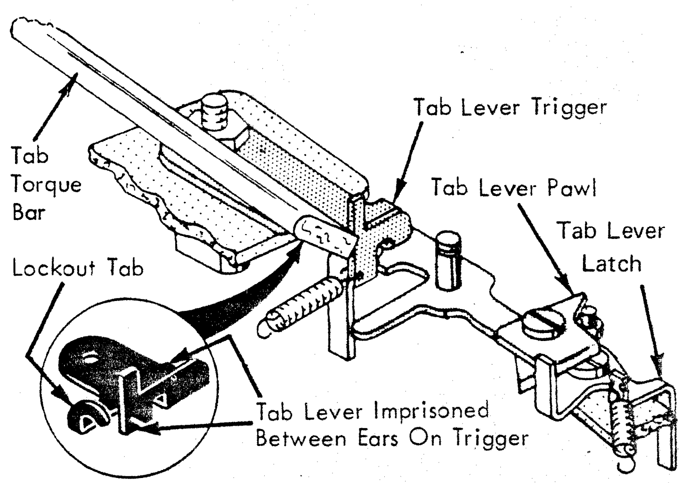
Torque-Bar Lockout Tab

Figure 4-89.

d. Old Level

The old tab mechanism operates very similar to the current. Instead of the torque bar contacting the tab lever lug it contacts a trigger which, in turn, moves the tab lever to the rear (Figure 4-90)

The trigger also has an upright lug toward the front (Figure 4-90), which takes the place of the lockout tab (Figure 4-89). The rest of the tab operation is the same on both old and new mechanism.



Tab Lever Trigger

Figure 4-90.

e. Tab Lever Overthrow Stop (Old Level)

An overthrow stop is mounted on the escapement bracket. It extends to the rear and down behind the trigger (Figure 4-91). The stop prevents the tab lever from being thrown into the tab rack.

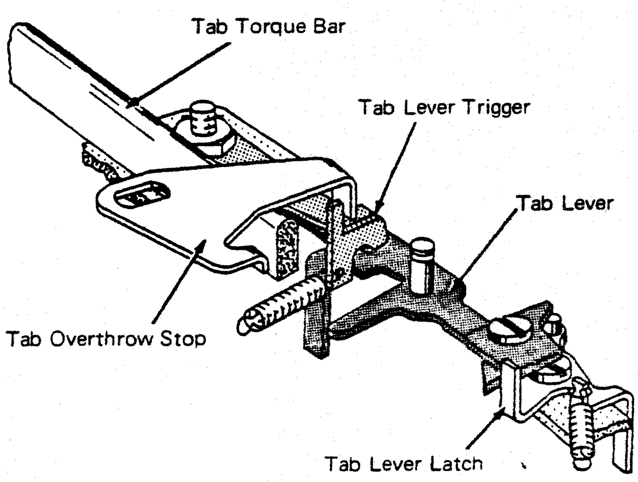


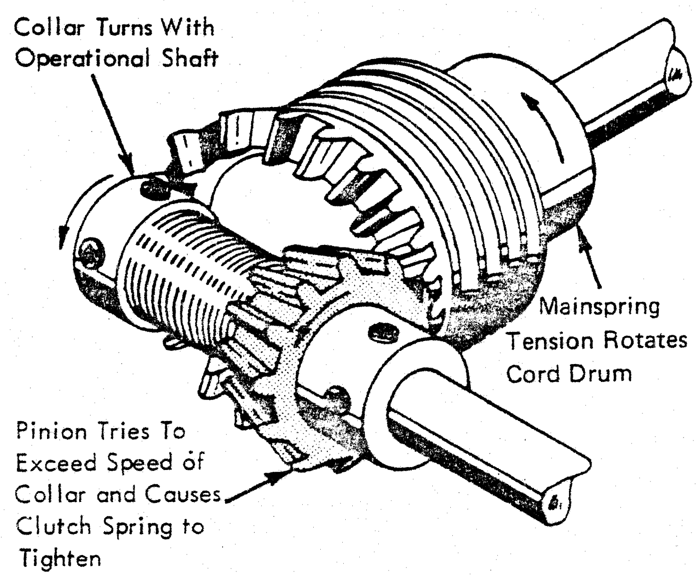
Figure 4-91.

f. Tab Governor (Both Levels)

The carrier speed during a tab operation must be controlled to insure an accurate tab, reduce the noise, and prevent excessive wear and shock on the components. During a tab operation, the carrier is pulled to the right by the tension of the mainspring as during an escapement operation. The tab governor operates by limiting the speed with which the escapement cord drum winds up the cord.

The beveled gear on the escapement cord drum meshes with the tab governor pinion located on the operational shaft to the right of the cord drum (Figure 4-92). The pinion gear operates between two collars. The left collar and the pinion gear have hubs enclosed by a clutch spring. The left collar is setscrewed to the shaft and the pinion gear pivots freely on the shaft. The spring is wound so that it slips when the pinion is held stationary and the operational shaft is turning.

If the pinion gear is turned in the same direction as the operational shaft but at a faster rate of speed, the friction of the clutch spring causes it to tighten around the two hubs locking them together. During a tab operation, the cord drum drives the pinion gear in the same direction as the operational shaft. The mainspring tension causes the pinion to speed up and tighten the clutch spring. The mainspring then tries to accelerate the operational shaft. The mainspring does not have sufficient tension to drive the operational shaft, because of the drag present in the system. The shaft must be driven by the motor; therefore the speed of the tab governor pinion can be no faster than the normal speed of the operational shaft. The escapement cord drum can wind up the cord only as fast as the pinion will let it. The gear ratio between the pinion gear and the escapement cord drum allows the carrier to be moved at the proper speed during a tab operation. No governing action is obtained during approximately the first inch of carrier travel, because a short distance is required to tighten the tab governor clutch spring.



Tab Governor Mechanism

Figure 4-92.

The tab governor pinion is the same size as the carrier return pinion gear. This makes the speed of the carrier the same for both tab and carrier return.

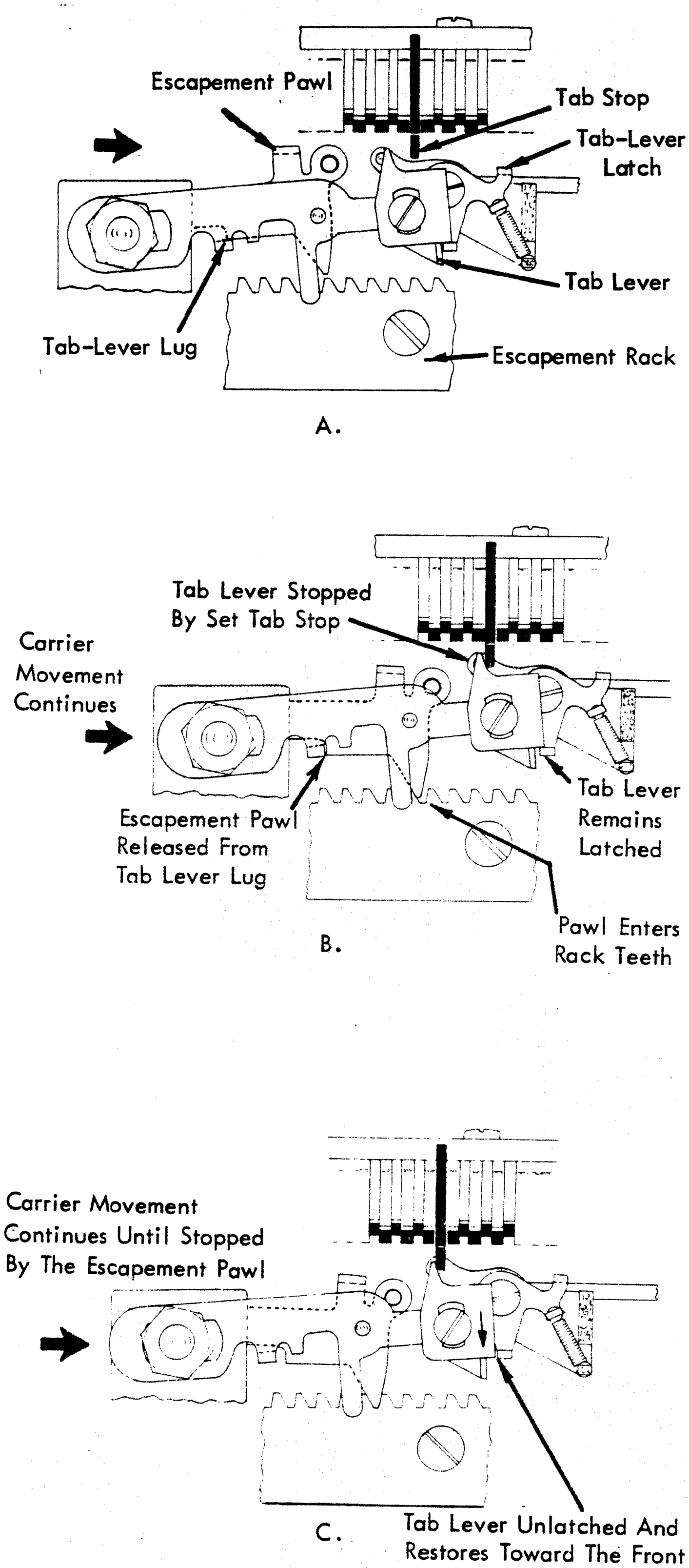
g. Tab Unlatching

When the carrier reaches the desired stopping point, the escapement pawl must be allowed to re-enter the escapement rack and stop the movement of the carrier. The tab lever is mounted in an elongated hole at its pivot point. An extension spring holds the tab lever to the right. As the carrier moves toward the right, the tip of the tab lever contacts the set tab stop and is prevented from moving further (Figure 4-93A). The carrier continues to the right carrying the pawls and the tab latch with it. Movement is allowed by the elongated hole at the tab lever pivot. As the escapement pawl moves to the right in relation to the tab lever, a notch in the pawl allows it to drop off the lug of the tab lever and restore to the escapement rack (Figure 4-93B). Further movement of the carrier moves the tab latch to the right out of the notch of the tab lever (Figure 4-93C) The tab lever then restores and allows the backspace pawl to re-enter its rack.

It should be noted that the escapement pawl is allowed to enter the rack before the backspace pawl. The escapement pawl must be allowed to enter early to insure that it will enter the correct tooth of the escapement rack. If the backspace pawl were allowed to enter at the same time, the adjustment of the backspace rack could allow the backspace pawl to enter its rack stopping the carrier slightly to the left of the desired point. Delaying the entry of the backspace pawl prevents this possibility.

The trigger moves to the right with the carrier during the unlatching travel of the carrier. At about the same time the tab lever is released by the tab latch, the tab lever trigger moves in front of a notch in the tab lever (Figure 4-94). The tab lever is then allowed to move forward into the rest position. The tab lever is restored by the action of the springs on the tab lever and the backspace pawl.

When the tab lever trigger restores, the tab lever is allowed to reset for the next operation. As the trigger moves out of the notch in the tab lever, the tab lever is snapped to the right by its spring into position to be operated by the trigger. At the same time, the tab lever lug resets to the right in front of the escapement pawl ready for pawl release on the next operation. A forward extension of the tab lever rests against the escapement bracket. A lug at the rear of the tab lever trigger rests against the tab lever to prevent the trigger from resting against the tab torque bar. Improper rest position of the tab lever can cause backspace problems if the backspace pawl is not allowed to mesh deeply enough into its rack. The tab lever will also fail to reset to the right in front of the es-



Tab-Unlatching Operation

Figure 4-93.

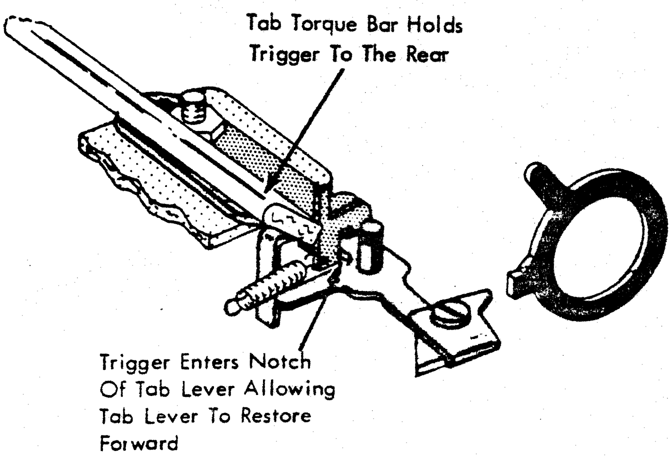


Figure 4-94.

capement pawl, if the tab lever rests too far to the rear. The tab mechanism would then be inoperative, because no pawl release could be obtained.

h. Tab Interlock

The tab interlock prevents the tab lever from being latched to the rear during a carrier return operation. If the tab lever were allowed to latch, the tab lever pawl could strike the right side of a set tab stop during a carrier return operation and lock the carrier. To prevent this from happening, the tab lever latch has a lower lug extending behind the escapement torque bar. When the escapement torque bar is pivoted, the tab lever latch will be rotated out of its latching position, thus preventing the tab lever from being latched out. The escapement torque bar pivots during a carrier return operation, spacebar operation, or print escapement operation. (Figure 4-95)

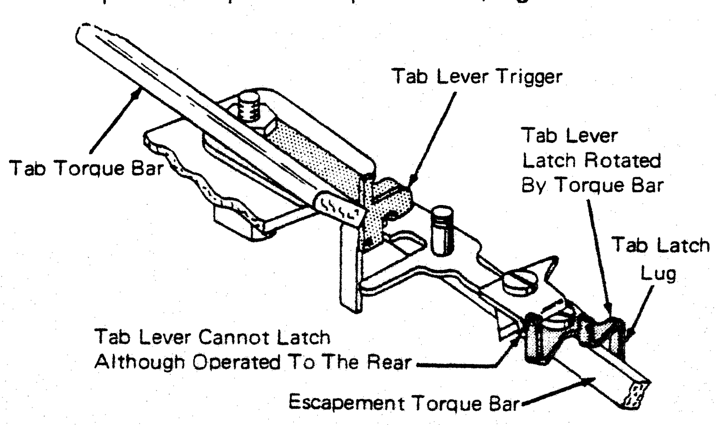


Figure 4-95.

4-14. CARRIER RETURN AND INDEX

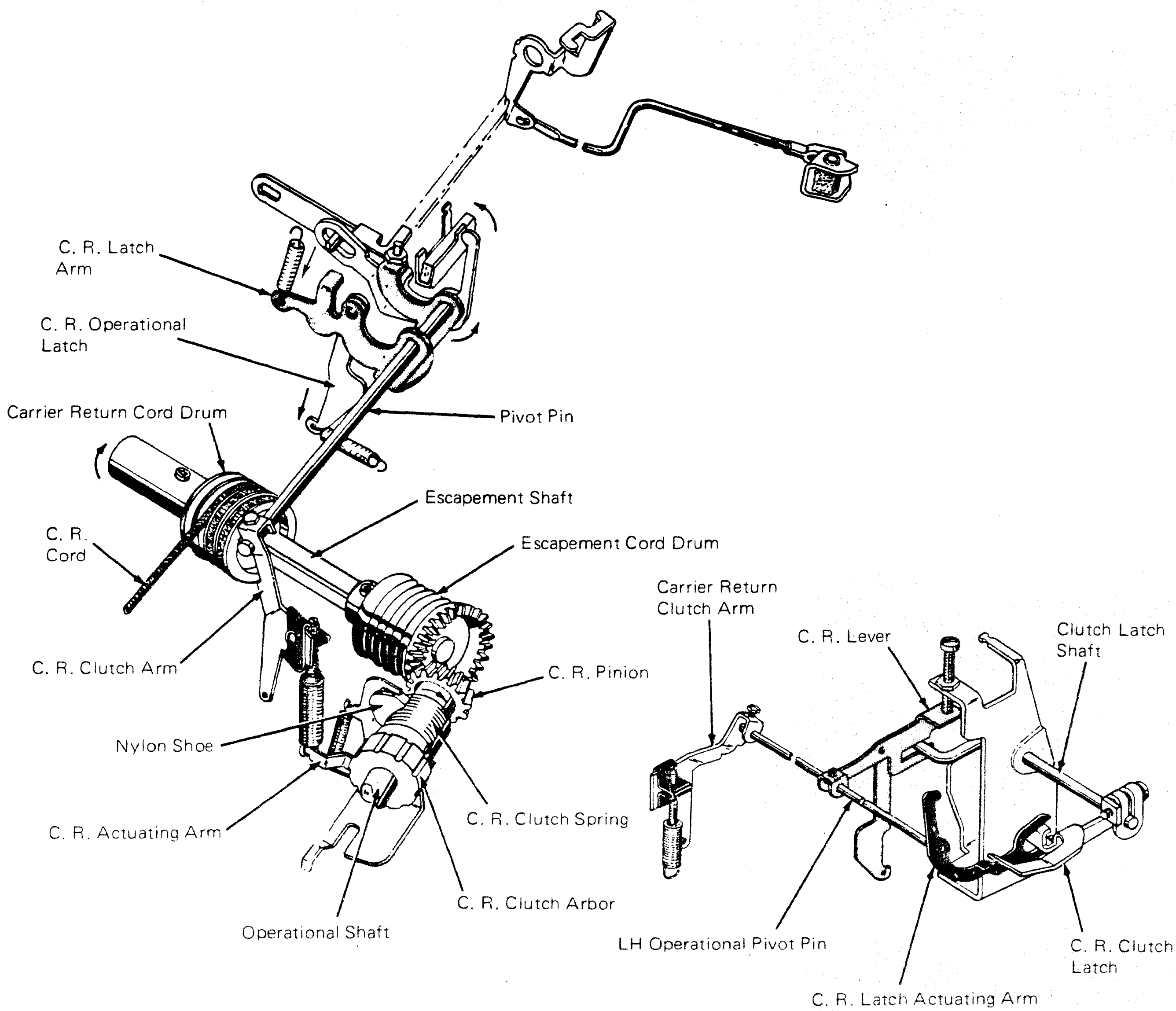
The carrier return mechanism returns the carrier to the left hand margin and automatically line spaces the paper whenever the carrier return keylever is depressed. Further depression of the carrier return keylever causes additional index operations.

The carrier is moved to the left hand margin by winding the carrier return cord onto a drum mounted on the rear of the escapement shaft in front of the mainspring. As the escapement shaft rotates, the carrier return cord drum will wind up the cord and move the carrier to the left. The carrier return cord passes to the left over a roller guide and around two pulleys on the left hand side of the machine. It is then hooked to the bottom of the carrier. (Figure 4-96)

The power to turn the escapement shaft is taken directly from the operational shaft. The escapement cord drum has a beveled gear molded on its front which meshes with a carrier return pinion gear that turns freely on the operational shaft. A spring clutch is employed to cause the carrier return pinion gear to rotate with the operational shaft. The pinion gear drives the escapement cord drum in a clockwise direction causing the carrier return cord to be wound onto its drum. (Figure 4-97)

The left hand end of the carrier return pinion forms the arbor for the carrier return spring clutch. A second hub, the carrier return clutch arbor, is just to the left of the carrier return pinion. This hub is in constant rotation with the operational shaft and the carrier return clutch spring is anchored to this hub by a spring clip. The operational shaft turns in the tightening direction of the spring, however, no drive occurs because the pinion hub is smaller than the inside diameter of the spring clutch. When the loose end of the carrier return clutch spring is pressed against the pinion hub, the spring clutch will tighten around the hub and drive the pinion. The tension of the spring clutch resists any change in size and will snap back to its normal size when the external pressure is released.

The external pressure required to cause the carrier return spring clutch to drive is applied by a nylon shoe. The power to operate the nylon shoe against the clutch spring is taken from a single lobed operational cam. (Figure 4-98)



Left Front View *Right Front View*

Figure 4-96.

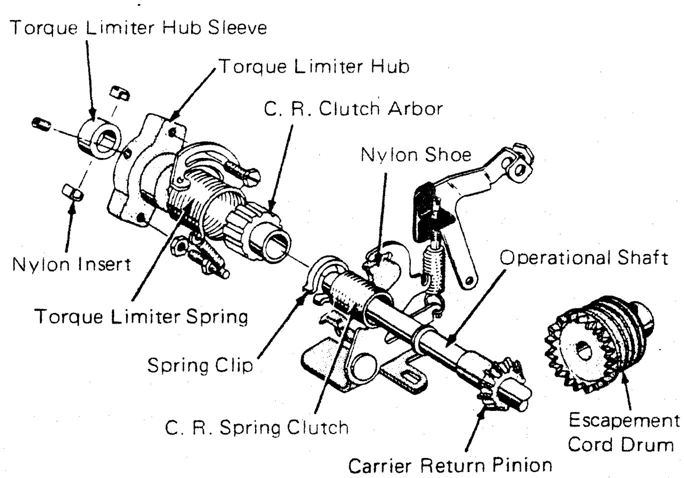


Figure 4-97.

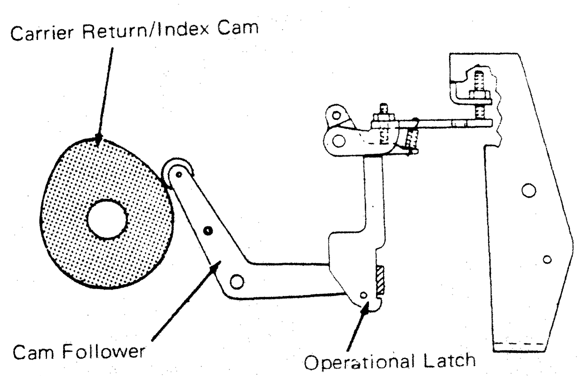


Figure 4-98.

When the carrier return operational latch is pulled down by the cam follower, the latch pulls the carrier return lever down. As the carrier return lever moves down, it pivots the clutch latch shaft. Attached to the right hand end of the clutch latch shaft is the carrier return clutch latch. As the carrier return clutch latch moves downward, it rotates the latch actuating arm which will pivot the escapement torque bar and remove the escapement torque bar and remove the escapement pawl from the escapement rack. The clutch latch actuating arm are latched in their operated position. (Figure 4-99)

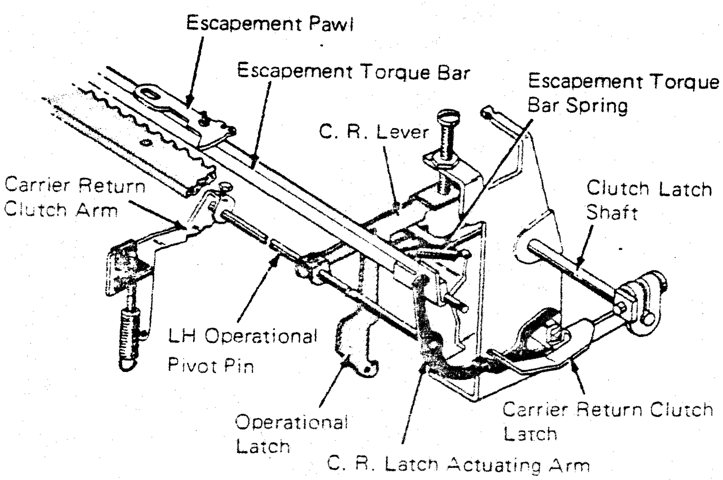


Figure 4-99.

The left hand operational pivot pin is set screwed to the carrier return lever and pivots about its mounting hole as the carrier return lever moves downward. Located on the left end of the left hand operational pivot pin is the carrier return clutch arm. As the carrier return clutch arm moves upward, the carrier return shoe actuating arm pivots and forces the carrier return shoe into the spring clutch. The carrier return clutch causes the carrier return mechanism to be latched in this active position until the carrier reaches the left hand margin. At that time, the clutch is unlatched and the escapement pawl is allowed to restore into the rack. (Figure 4-100)

When the carrier reaches the left hand margin, the carrier return mechanism must be restored to rest. The clutch is unlatched and the escapement pawl is restored to the escapement rack, ready for an escapement operation. The margin rack is mounted between the side frames and in front of the carrier. The margin rack has a small amount of lateral movement. When the carrier is away from

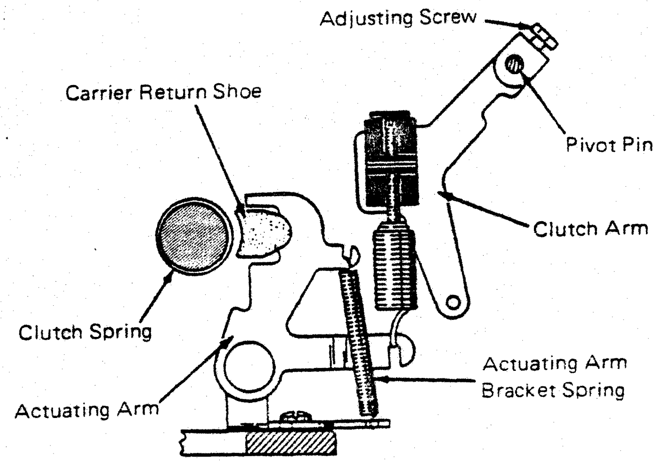


Figure 4-100.

the left hand margin, a spring, located at the left end of the margin rack, loads the margin rack to the right. The carrier strikes the left hand margin stop and forces the margin rack to the left. An extension on the overbank guide located on the right hand end of the margin rack will pivot the carrier return unlatching bellcrank. Operating the bellcrank, pulls the connecting link between the carrier return unlatching bellcrank and the carrier

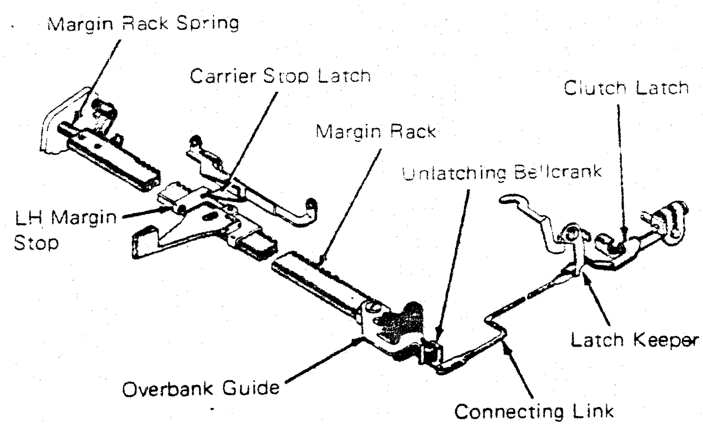


Figure 4-101.

return latch keeper, pulling the keeper forward and releasing the clutch latch. The latch is restored to the rest position by the actuating arm bracket spring and the escapement torque bar spring. (Figure 4-101)

If the carrier is already resting at the left hand margin when a carrier return operation is initiated, the clutch is prevented from latching. The cam is not prevented from operating so a carrier return operation must occur. The carrier cannot be pulled farther to the left, because it is already against the left margin. The pull continues on the carrier return cord until the cam follower passes the high point of the cam. During the time the cord is being pulled without moving the carrier, the carrier return mechanism must be allowed to slip in order to reduce the strain and prevent parts breakage. (Figure 4-102)

The carrier return clutch arbor is indirectly driven by the operational shaft. A large shoulder on the arbor fits into a heavy clutch spring at the left called the torque limiter spring. The left hand end of the torque limiter spring is anchored, by an adjustable clamp, to the torque limiter hub. The torque limiter hub is set screwed to the operational shaft.

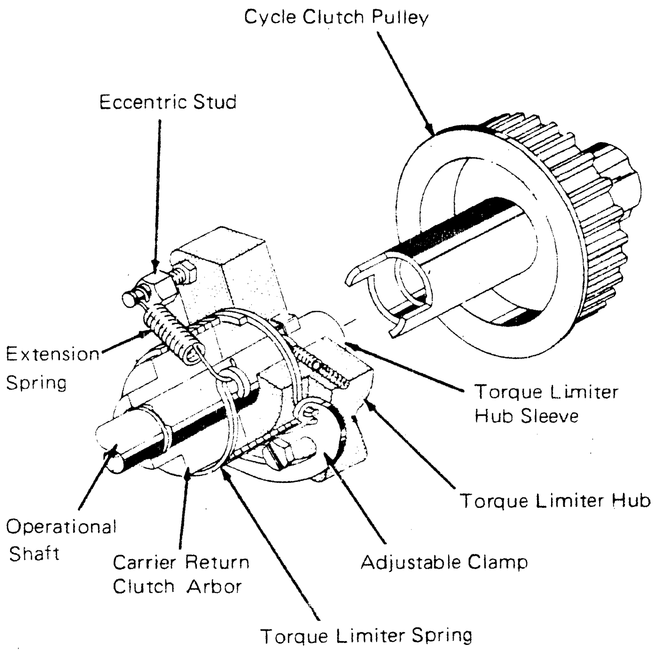


Figure 4-102.

The operational shaft turns in the unwinding direction of the torque limiter spring. This tends to expand it and allow it to slip. The spring, however, is heavy and considerably smaller in diameter than the carrier return clutch arbor, over which it fits. The friction present between the arbor and the spring, tends to drive the arbor even though it is in the unwinding direction of the spring, but insufficient driving force is obtained from this arrangement. The right end of the torque limiter spring has a loop formed to accept an extension spring. The extension spring is connected between this loop and an eccentric stud on the torque limiter hub. The extension spring increases the force required to unwind the torque limiter spring so that no slippage occurs during normal carrier return. The torque limiter spring slips when the carrier cannot move to the left. It also slips at the beginning of a carrier return operation to allow smooth acceleration and prevent a jerky start.

The index mechanism indexes the paper vertically. An index operation can be obtained by depressing either the carrier return keylever or the index keylever. Depressing the carrier return keylever also causes the carrier to move the left margin, whereas depressing the index keylever causes only an index operation.

The index mechanism is operated from the cam follower by means of a multiplying lever and the index link. The rear of the multiplying lever is always in contact with the multiplying lever stop attached solidly to the power frame. The index pawl carrier link always received the same amount of motion each time the cam operates regardless of the position of the index lever. (Figure 4-103)

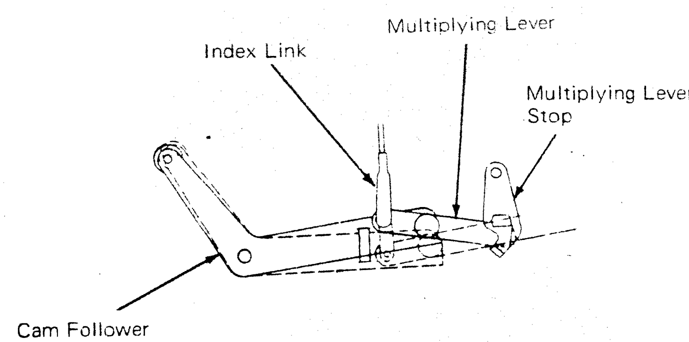


Figure 4-103.

The index selection lever is held in the single or double space position by a toggle hair pin spring. The index selection lever movement is restricted by two extensions at the bottom of the lever, that contact the hairpin spring mounting stud. (Figure 4-104)

During the double space position, the index pawl is allowed to enter the platen ratchet immediately. The index pawl then forces the ratchet forward two spaces until the pawl contacts the platen overthrow stop. The platen overthrow stop wedges the pawl into the ratchet teeth to lock the platen in position.

If only a single space operation is desired, the index pawl must be prevented from entering the ratchet until it has passed one tooth of the ratchet. The remaining travel after the index

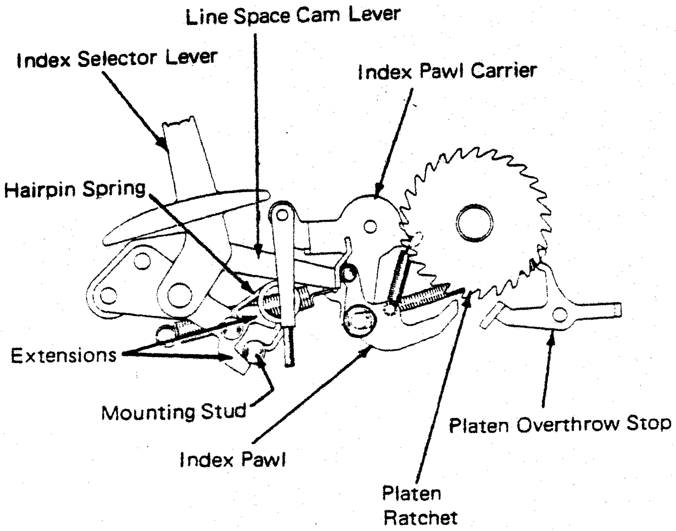


Figure 4-104.

pawl enters the ratchet is only sufficient to cause one tooth of rotation to the platen. The index pawl contacts the platen overthrow stop at the end of this stroke as on the double space operation. (Figure 4-105)

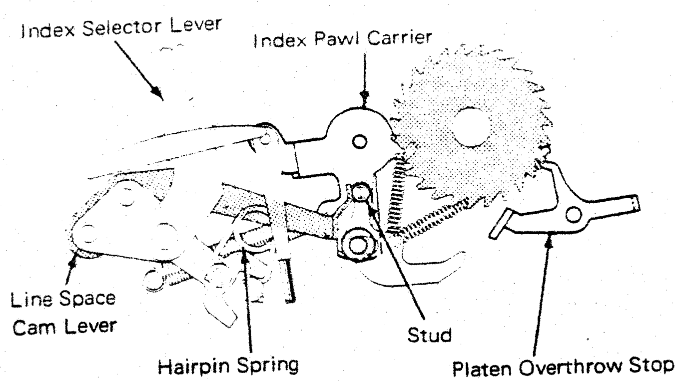


Figure 4-105.

The index pawl entry into the platen ratchet is controlled by the line space cam lever located on the index lever. The line space cam lever has two steps at the forward end, in a position to contact a stud on the side of the index pawl. The index pawl is spring loaded toward the platen. With the index lever in the double space position, the index pawl rests near the platen ratchet. In the single space position, the index pawl stud maintains contact with the line space cam lever longer and delays the entry of the pawl into the platen ratchet.

The index pawl is designed with an elongated pivot hole so that it "floats" forward during a portion of the index stroke. As the index mechanism operates, the pawl engages the ratchet tooth. There is a slight delay until the pawl carrier reaches the end of the elongated slot in the index pawl. Because the pawl carrier is operated so sharply the platen is caused to move ahead of the index stroke. Without the elongated hole in the index pawl, the platen ratchet would reach the final position ahead of the index pawl. This is prevented by the pawl moving with it and reaching the overthrow stop at the same time the platen reaches the final position. The pawl is then able to wedge into the ratchet and block any further rotation caused by the momentum of the platen. (Figure 4-106)

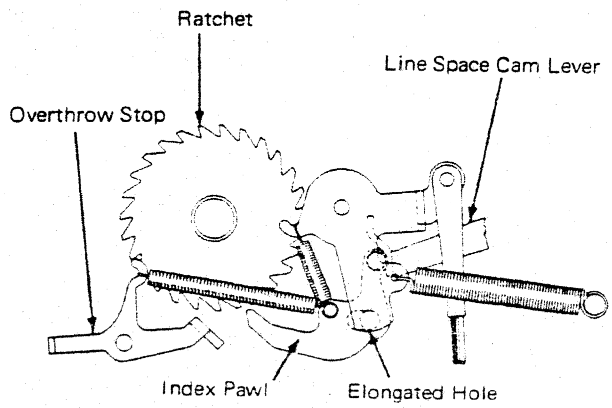
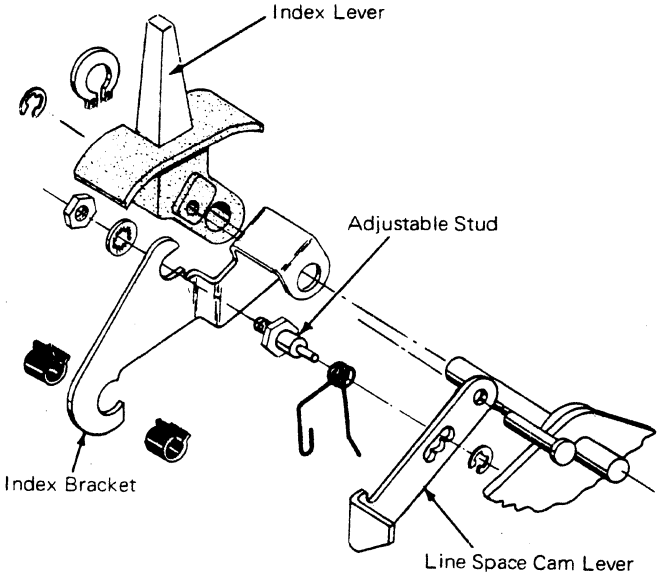


Figure 4-106.

The 54 tooth index mechanism operates basically the same as the mechanism just described. However, there are three positions for the index lever. The line space cam lever has an elongated hole with three detent positions on the lower side. An adjustable stud, mounted on the index bracket, detents the line space cam lever to control index pawl entry into the platen ratchet. This permits feeding two, three or four ratchet teeth to index the platen a space, space and half and two spaces. (Figure 4-107)

The platen variable mechanism provides the operator with a means of rotating the platen to a position other than the normal writing line. The platen variable is used for typing permanently above or below the writing line or locating the writing line after reinserting the paper. The platen ratchet must remain stationary when selecting a new writing line so that the detent roller will be seated between the two teeth of the ratchet at the new position. A clutch mechanism connects the ratchet to the platen so that it can be engaged for line spacing and disengaged for variable operation. The clutch can be disengaged by pushing the left hand platen knob toward the right, and as long as the platen knob is held to the right, the



54 Tooth Index Mechanism

Figure 4-107.

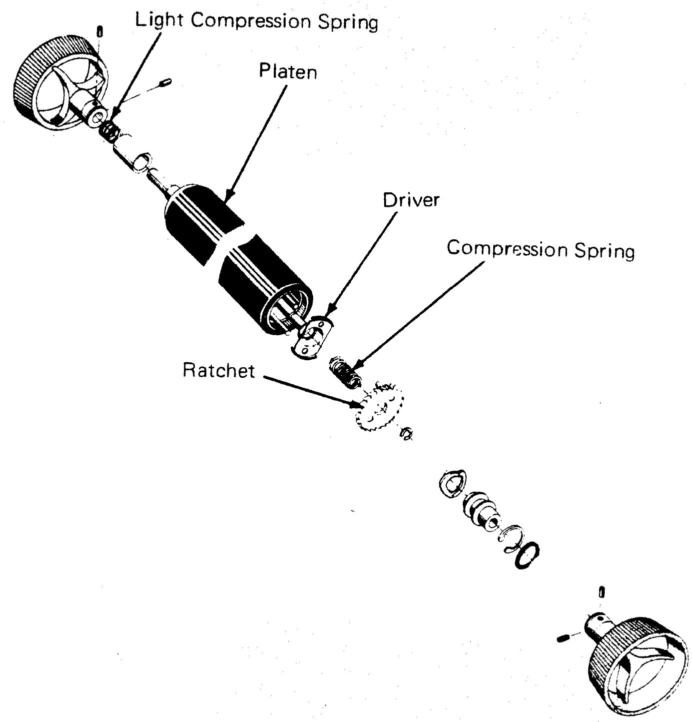
platen can be rotated freely while the ratchet remains stationary. When the knob is released, the clutch is automatically re-engaged by spring tension. (Figure 4-108)

When the driver is disengaged from the platen end plug, the platen can be turned to the desired position. The driver can then engage different serrations and lock the platen in the new postion. The left hand platen knob is mounted to a shaft that slides left-to-right inside the platen. A light compression spring holds the shaft toward the right to prevent free play. The shaft pushes against the platen driver. Movement of the platen knob toward the right is transferred to the driver to disengage it from the platen end plug.

The left side of the platen ratchet contains two pins that fit into a slot on the platen driver. The platen driver operates left-to-right and always turns with the ratchet. A compression spring between the ratchet and the driver loads the driver to the left so the serrations on the outer surface of the driver mesh with matching serrations inside the platen end plug. The meshing of the serrations cause the platen, the driver, and the ratchet to be locked together and turn as a unit. (Figure 4-108)

a. Pin Feed Platen

The purpose of the pin feed platen is to feed continuous forms. This is accomplished by two pin wheel assemblies, one on each end of



Platen Assembly

Figure 4-108.

the platen core. Platen cores come in lengths to accomodate most standard width forms.

The pin wheel body is setscrewed to a hexagonal shaft called the platen shaft. The platen core is keyed to the right hand pin wheel body. The platen ratchet is attached to the right end of the poaten shaft. (Figure 4-109)

Each pin wheel body has 9 holes, symmettrically spaced around its surface. In each hole is a pin (.140" diameter). A cam attached to the pin wheel body causes the pins to slide in and out of their holes. Screwed to the cam is a control plate which is anchored to the cam anchor rod. The cam is held stationary by the control plate while the pin wheel body rotates with the platen when indexed. This means that the pins will exit and enter the pin wheel body at an exact radial position thrus providing the motion necessary to feed forms through the typewriter. (Figure 4-110)

Level 1 pin feed platens have a threaded shaft and .125" diameter pins. Level 1 and Level 2 parts are not interchangeable. Both levels are exactly the same functionally.

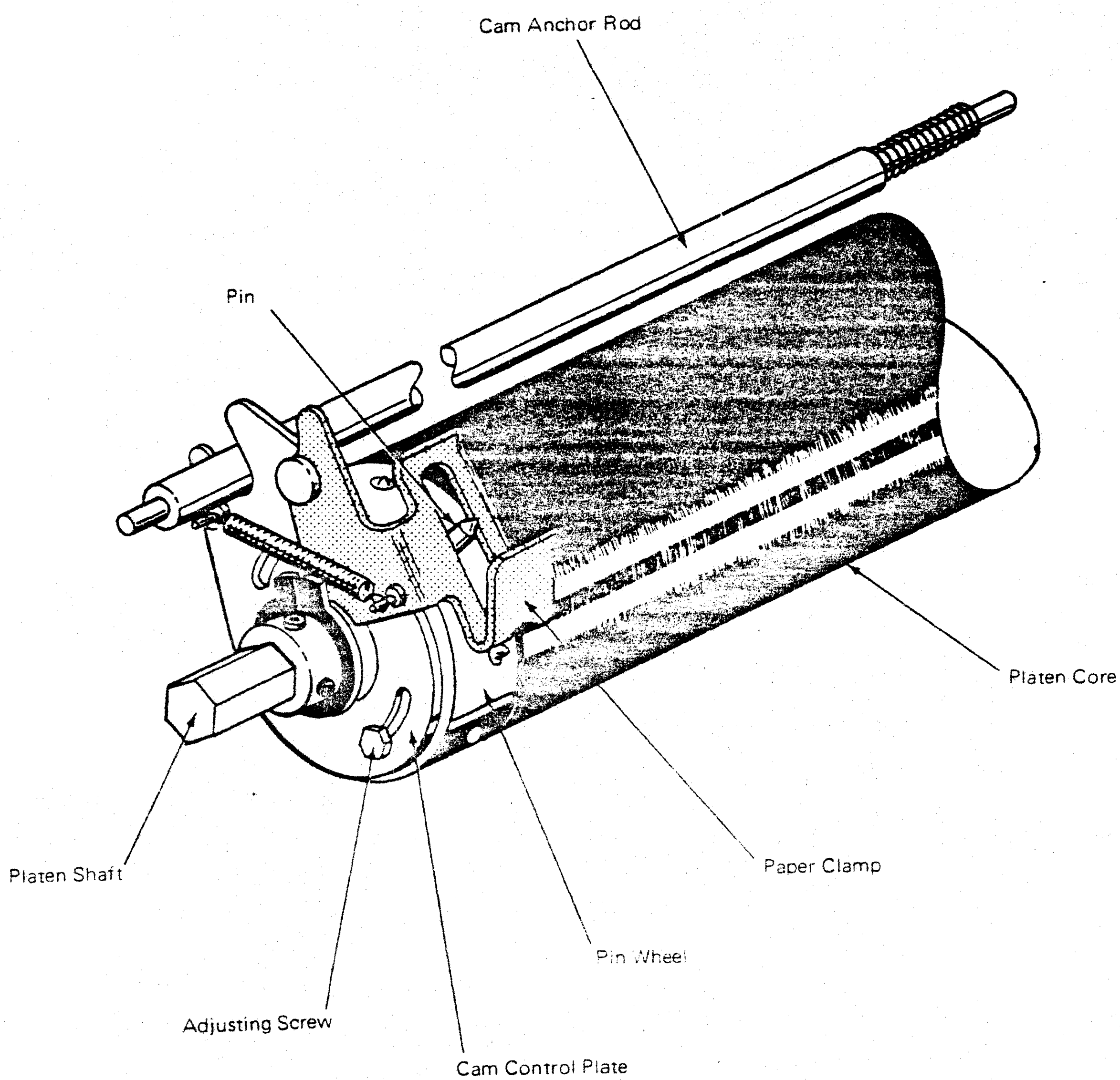


Figure 4-109.

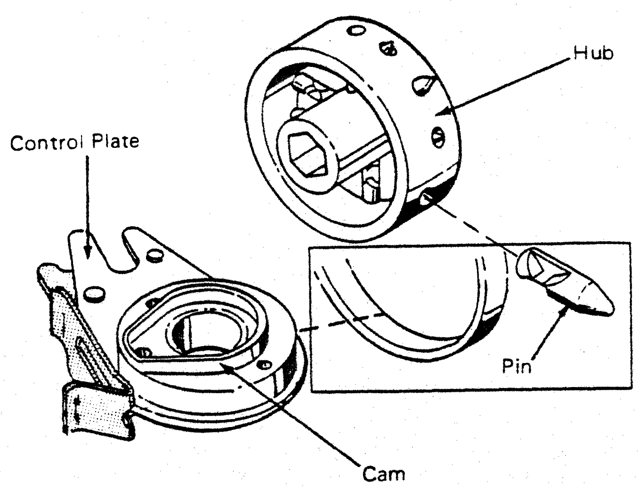


Figure 4-110.

4-15. MARGIN

The term "margin" is defined as the distance between the edge of the paper and the typewritten material. The purpose of the margin mechanism is to allow the operator to vary the length of the writing line. The left and right hand margins are determined by the position of the margin stops on the margin rack. The carrier travel is restricted by the position of the margin stops. (Figure 4-111)

The margin rack is a flat rack containing teeth along its rear edge. The number of teeth per inch in the margin rack corresponds to the pitch of the machine.

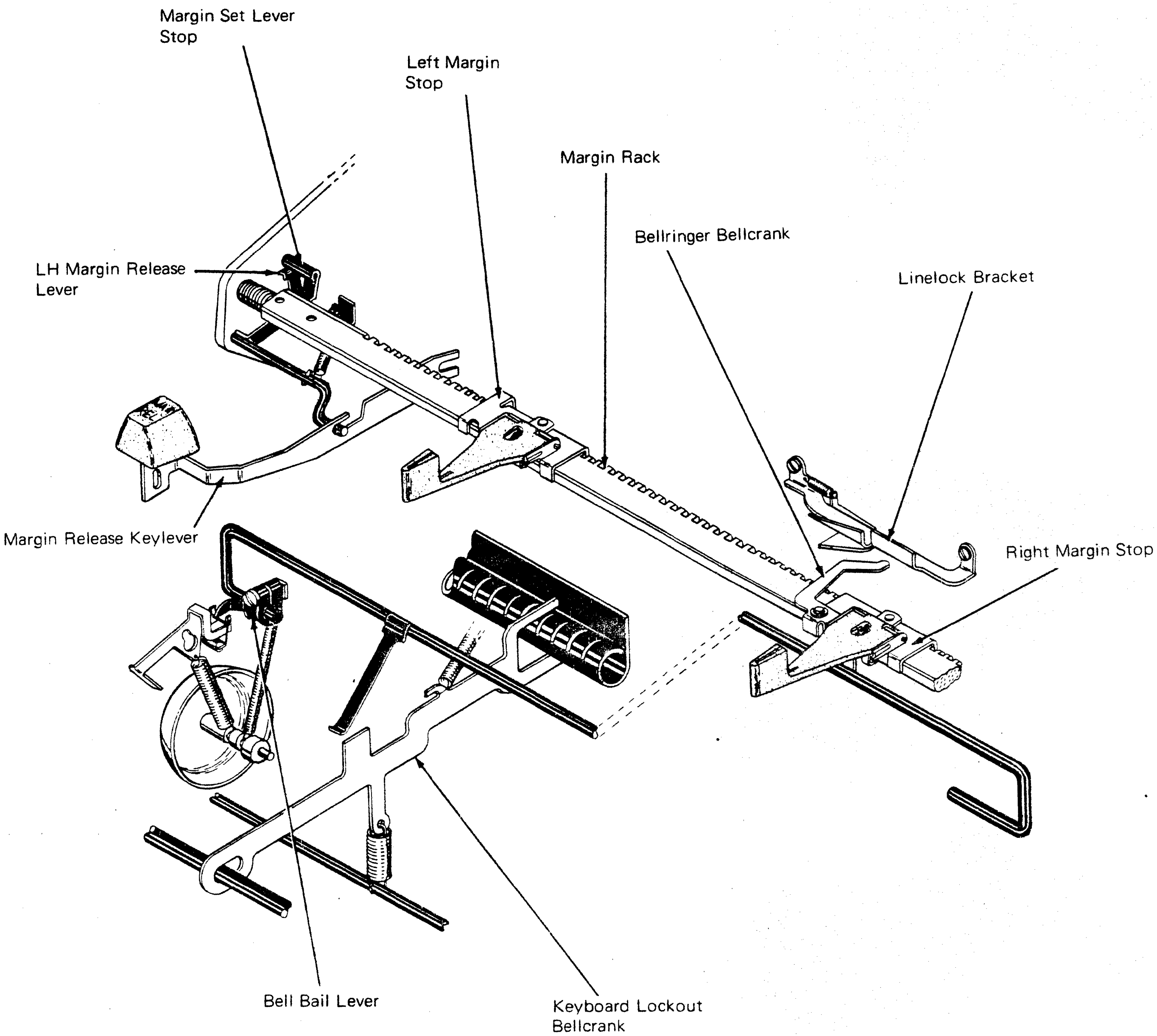


Figure 4-111.

Each margin stop has a pin and slider assembly that meshes with the teeth at the rear of the margin rack. Each margin stop has a margin set lever attached to the pin and slider assembly. The margin set levers extend through a slot in the front case of the machine to make them accessible to the operator. Either margin stop may be repositioned by pushing the margin set lever to the rear to disengage the pin from the rack, then, by sliding the margin stop along the rack to the desired location. A line on each margin set lever serves as a pointer to indicate the position of the margin stop in relation to the scale on the front of the case. A pointer, located on the front of the carrier, indicates the position of the carrier. (Figure 4-112)

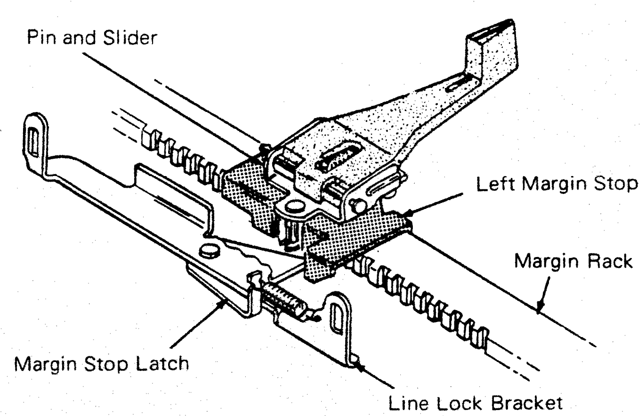


Figure 4-112.

The left hand margin stop controls the left margin. When the carrier is returned by the carrier return mechanism, an extension of the left hand margin stop is struck by the margin stop latch pivoted on the linelock bracket attached to the carrier. This action forces the margin rack to the left to unlatch the carrier return mechanism and leaves the car.ier resting at the left margin position.

The right hand margin stop operates the line-lock mechanism which in turn locks the keyboard when the carrier has reached the right hand margin. With the keyboard locked, the operator cannot continue typing at that position. However, the right hand margin linelock mechanism only locks the keyboard. The spacebar, backspace, tab and carrier return are not affected. (Figure 4-113)

In addition to operating the linelock, the right hand margin stop also rings a bell several spaces before the linelock action occurs. The bell warns the typist that the carrier is near the margin stop and in most cases allows sufficient space to complete a word or phrase before the line lock occurs.

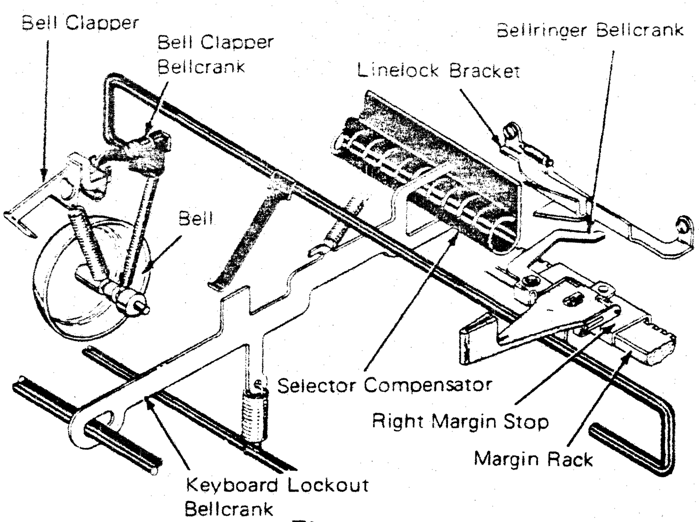


Figure 4-113.

If the typist continues typing after the bell rings, the keyboard is locked after several spaces to prevent typing in the margin. The keyboard is locked by forcing a special bellcrank into the selector compensator tube to prevent the depression of any other interposer. (Figure 4-114)

As the carrier approaches the right hand margin, the bellringer bellcrank slides over two upright tabs on the linelock bracket. This causes the bell-

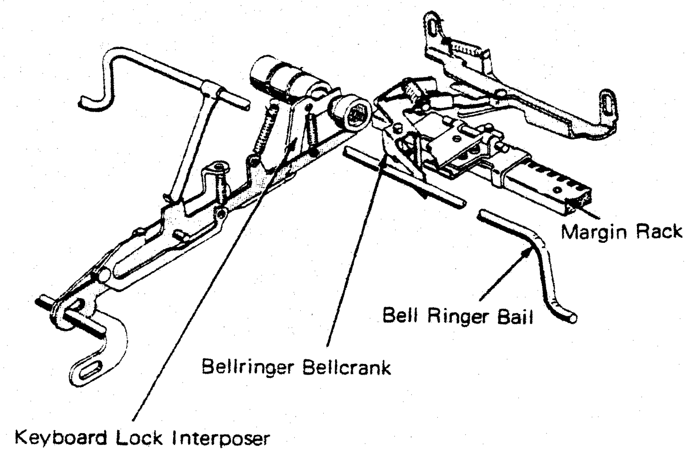


Figure 4-114.

ringer bail to the front of the machine. An extension of the bellringer bail forces the keyboard lock-out bellcrank into the selector compensator tube.

As the bellringer bail is cammed to the front of the machine, the bell clapper bellcrank pivots the bell clapper away from the bell. (Figure 4-115-4-116) Further rotation of the bail causes the bell clapper bellcrank to slip off the bell clapper allowing the bell clapper to restore to rest. (Figure 4-117)

The pull of the bell clapper spring and the momentum of the bell clapper returning to rest causes it to

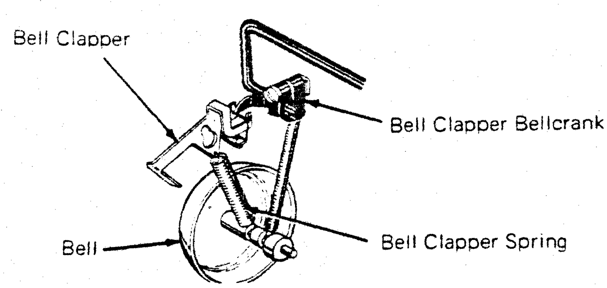


Figure 4-115.

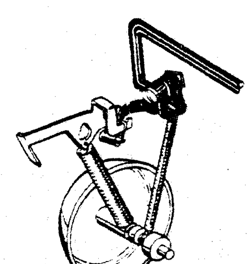


Figure 4-116.

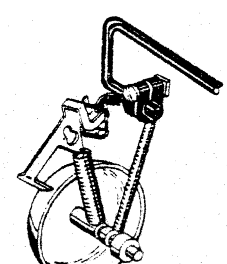


Figure 4-117.

overthrow its rest position and strike the bell. When the bellringer bail is allowed to restore, the bell clapper bellcrank resets above the bell clapper ready for the next operation.

The margin release mechanism allows an operator to type beyond the left and right margins without changing the position of the margin stops. The margin release operates by rotating the margin rack so the margin stops move upward out of the path of the linelock bracket on the carrier. (Figure 4-118)

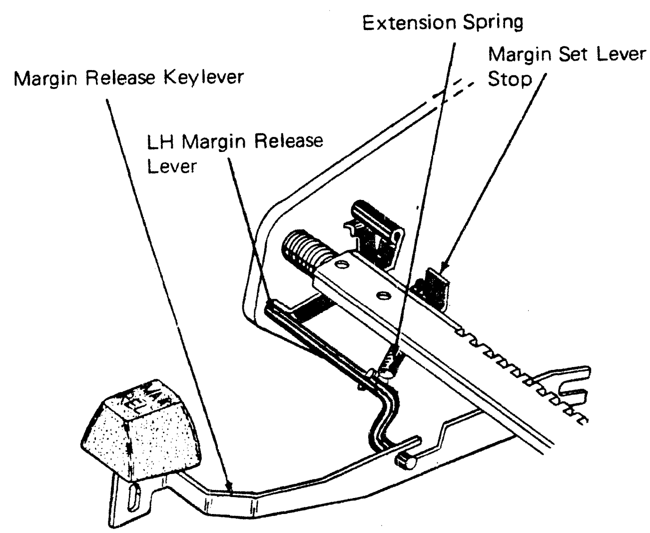


Figure 4-118.

The margin release keylever pivots at the left side of the keyboard. Depression of the margin release keylever causes the rear of the margin rack to rise. A lug on the left end of the margin rack remains in the path of the carrier to unlatch the carrier return if it is operated with the margin release keylever depressed. An extension spring restores the mechanism and holds it in the rest position.

The margin stop latch mounted on the linelock bracket, has an elongated mounting hole. It is spring loaded to the left so when the margin release is depressed the stop latch will snap to the left, under the margin stop. This eliminates the need for the operator to hold the margin release depressed while backspacing or carrier returning into the left margin. (Figure 4-119)

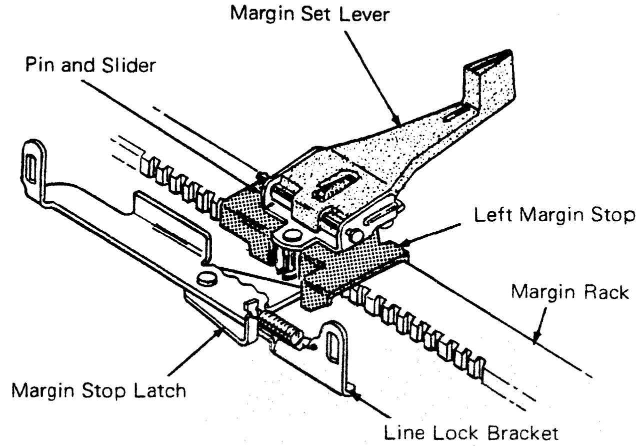


Figure 4-119.

The old level linelock mechanism locked the keyboard in the same manner as the present mechanism. However, the keyboard lock interposer was composed of several parts. The bellringer bail operated the keyboard lock interposer which through an extension spring pulled the keyboard lock bellcrank into the compensator tube. (Figure 4-120)

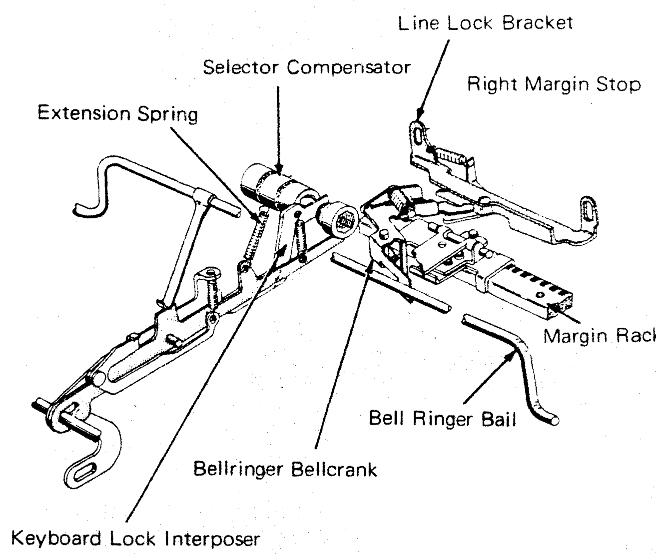


Figure 4-120.

4-16. FABRIC RIBBON

The fabric ribbon mechanism can be divided into two separate distinct mechanisms. They are the ribbon lift mechanism and the ribbon feed mechanism. The ribbon lift raises the ribbon to the printing position before the typehead prints and then restores the ribbon to allow a visible writing line. The ribbon feed moves the ribbon laterally past the printing point to provide an unused portion for the next typing operation. Included in the ribbon feed mechanism is the ribbon reversing mechanism which changes the feeding direciton when either end of the ribbon is reached.

The ribbon is 9/16" fabric ribbon enclosed in a disposable cartridge unit for clean handling. The cartridge unit contains two spools on which the ribbon is wound. The ribbon is constantly fed from one spool to the other and back again. Once the ink supply has been depleted, the cartridge is simply snapped off, discarded and a new cartridge is installed. (Figure 4-121)

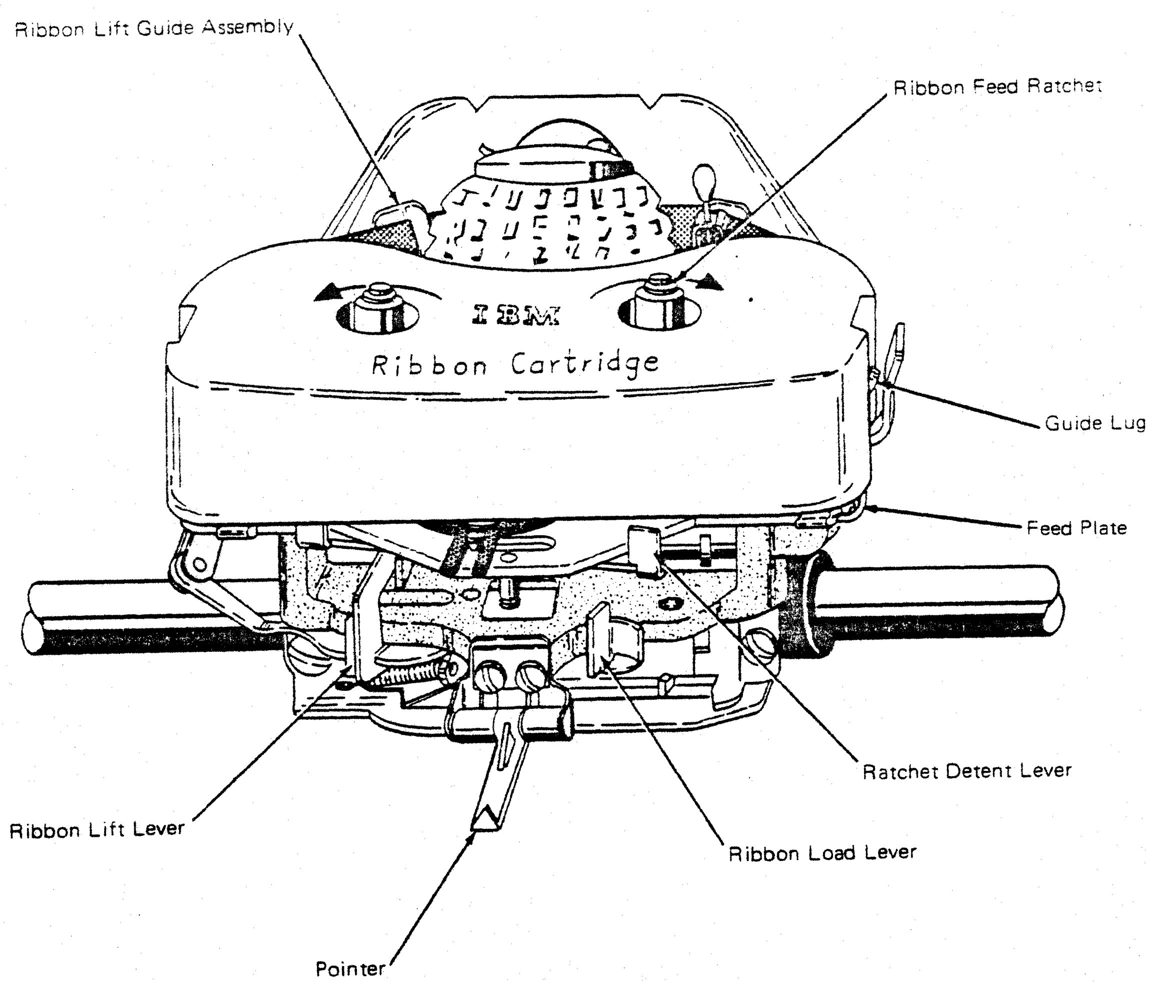


Figure 4-121.

Located to the right of the pointer on the carrier assembly is the ribbon load lever. When this lever is pushed to the right, it forces the ribbon lift guide into an extreme lift position for convenience of changing the ribbon. This load lever is detented to hold the ribbon lift in the high lift position. The cartridge is then removed from the ribbon feed plate and the ribbon can be easily removed from the guide without touching the ribbon.

A new ribbon can be installed by reversing the above procedure. Tapered lugs on the sides of the ribbon feed ratchet cores automatically guide the ribbon spools into the correct position. Guide lugs at each side of the feed plate maintain the lateral position of the cartridge. Retainer springs attached to the guide lugs hold the cartridge down to prevent vibration. After the ribbon is installed, the load lever is moved back to the left to allow the ribbon to restore to its normal position for a typing operation. (Figure 4-122)

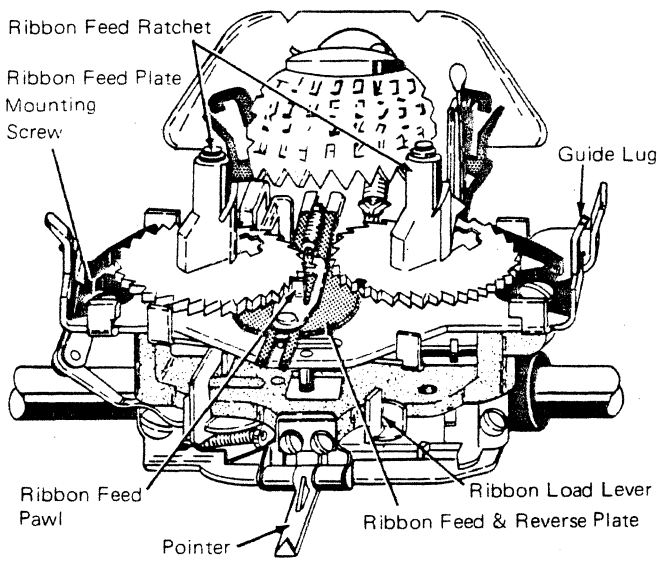


Figure 4-122.

The ribbon lift mechanism consists of a lift cam, a cam follower, a control mechanism, and the ribbon lift guide assembly. The lift mechanism is mounted to the carrier and moves with it. The ribbon lift cam is a single lobe cam that is setscrewed to the left side of the print sleeve. Each time a print cycle occurs the cam makes one complete revolution. (Figure 4-123)

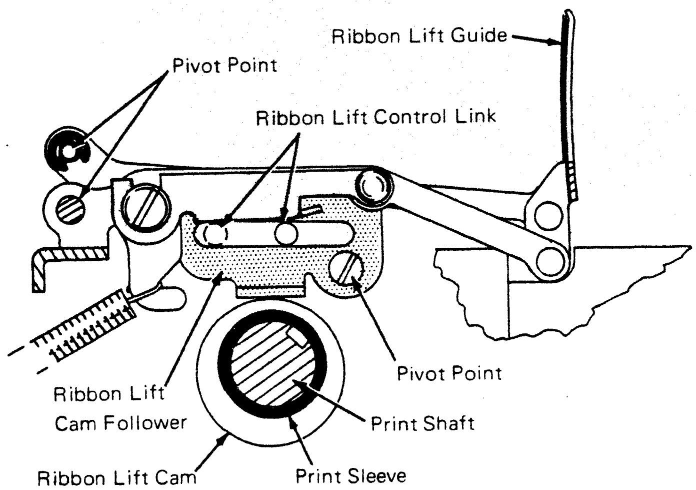


Figure 4-123.

The ribbon lift cam follower pivots on the carrier assembly above and to the rear of the cam. Each revolution of the cam raises the cam follower. The end of the ribbon lift control link fits into an elongated slot in the cam follower. The ribbon lift guide rests on the control link and pivots at the front of the carrier casting. As the cam follower is raised, the control link forces the ribbon lift guide assembly to pivot at the front and raise the rear of the assembly. A flat link from each side of the ribbon lift guide attaches to two pins at the front of the carrier to maintain the ribbon lift guide in a vertical position. (Figure 4-124)

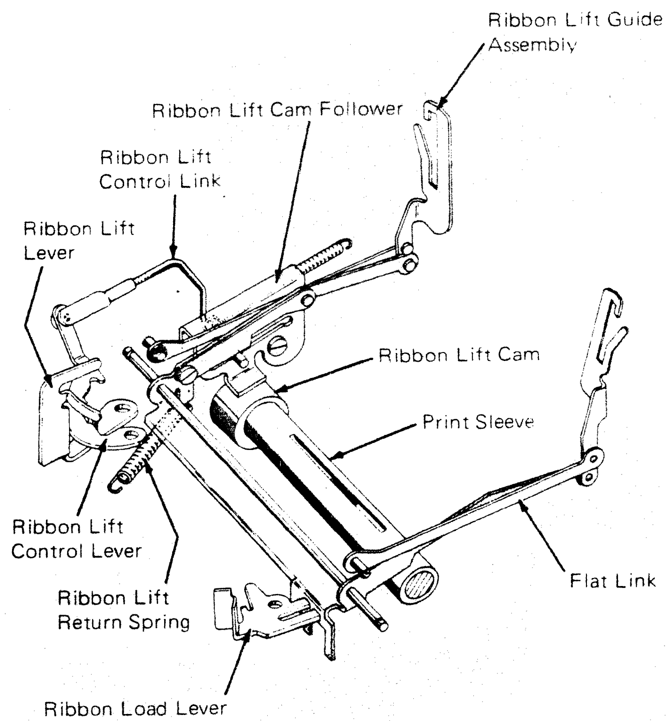


Figure 4-124.

The fabric ribbon mechanism has four lift positions. A lift position is selected by manually positioning the ribbon lift lever for stencil, low, medium, or high lift position. The height to which the ribbon will be raised is determined by the position of the ribbon lift control link in the elongated slot of the cam follower. When the control link is to the rear of the slot, no motion is transferred to the lift guide assembly. When the control link is to the front of the slot, maximum motion is imparted to the lift guide assembly.

The ribbon lift guide assembly is spring loaded into the rest position to ensure that it will restore rapidly and to prevent overthrow of the ribbon due to the momentum of the lift mechanism.

The ribbon feed and reverse mechanism is mounted at the top of the carrier just in front of the typehead. The mechanism is detachable as a unit for repair or replacement purposes.

The ribbon feed plate is made up of the following items: Two ribbon feed ratchets, the ribbon feed lever, the ratchet detent lever, the ribbon feed and reverse plate, and a bracket that is used to attach the ribbon feed lever. The feed and reverse plate has the ribbon feed pawl mounted to it with a shouldered stud so that it can pivot freely. The ribbon feed lever protrudes through an elongated slot in the feed and reverse plate so it can transfer the rotary motion of the feed cam to a front to rear motion of the feed pawl. The front to rear motion of the feed pawl is used to move a ribbon feed ratchet two teeth to the rear on each feed stroke. The ratchet to be fed is determined by the position of the ratchet detent lever. (Figure 4-125)

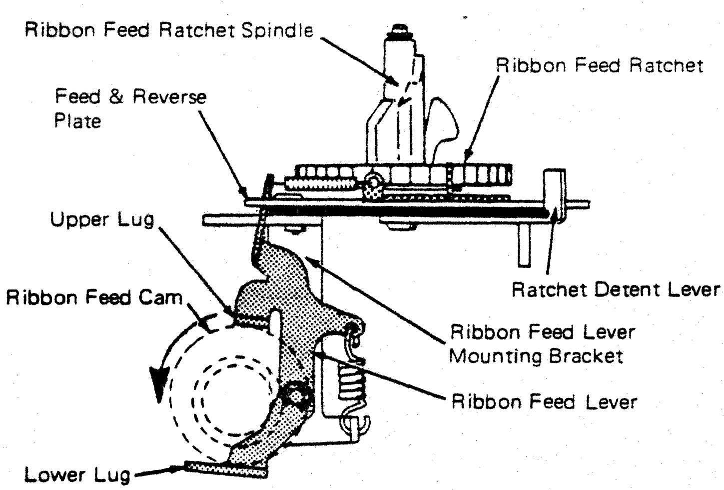


Figure 4-125.

The ribbon feed ratchet assemblies rotate freely around their respective feed ratchet spindles. The ribbon feed ratchet is designed to center the ribbon supply hub within the ribbon cartridge and lock it in place radially so that when the ribbon feed pawl moves a ratchet, the supply spool will also move. Two flat retainer springs are mounted on the ribbon feed plate at the rear so that they rest against the ribbon feed ratchets. The slight drag applied by the springs prevents the jerk of the ribbon feed operation from spinning the supply spool and spilling off excessive ribbon. (Figure 4-126)

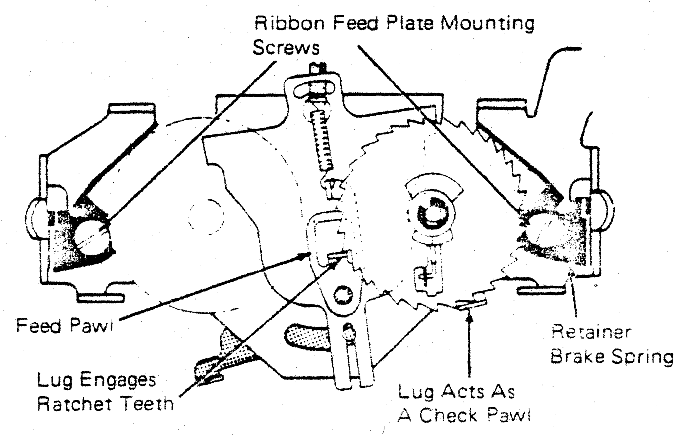


Figure 4-126.

Each feed ratchet contains a small bellcrank called the ribbon reverse trigger. This trigger is spring loaded down by a small flat reverse trigger spring. The reverse trigger is held within the ribbon feed ratchet in the inactive position as long as ribbon is around the spool. During the last revolution of the supply spool, the reverse trigger is released into the active position. This causes the lower extension of the reverse trigger to drop into the path of a notch in the feed and reverse plate. (Figure 4-127)

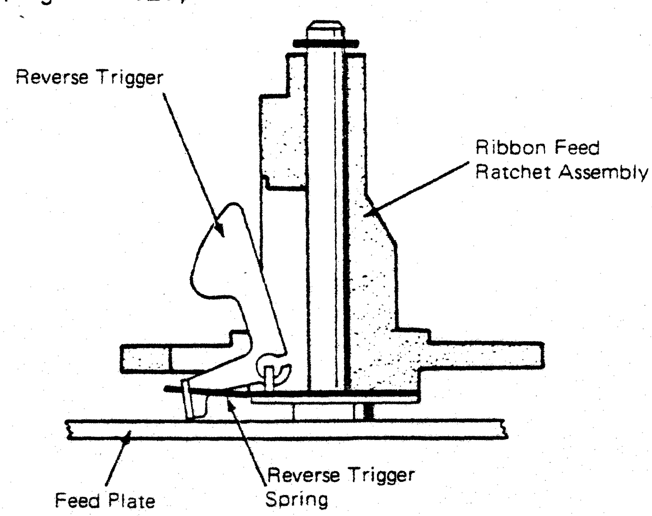


Figure 4-127.

On the forward or restoring stroke of the plate, the reverse trigger restricts one side of the plate from sliding forward. The other side continues to slide forward, thereby, causing a pivoting action to the entire plate about the point of restriction. This makes the front of the plate pivot toward the opposite side, positioning the feed pawl in line with the ratchet teeth of the ribbon feed ratchet containing the empty ribbon spool. On the next feed stroke, the feed pawl will engage the ratchet teeth of the empty spool, causing it to begin to take on ribbon (Figure 4-128).

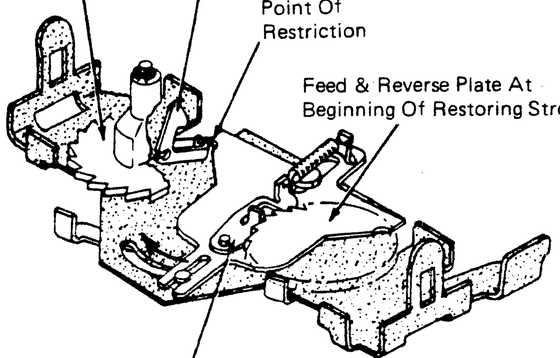
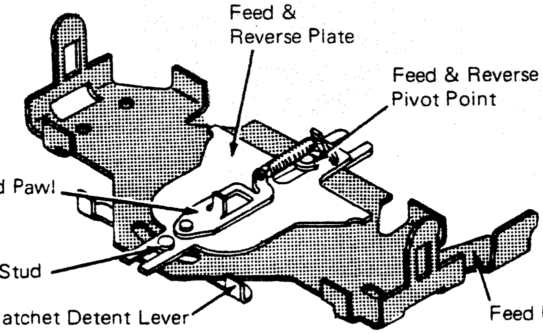


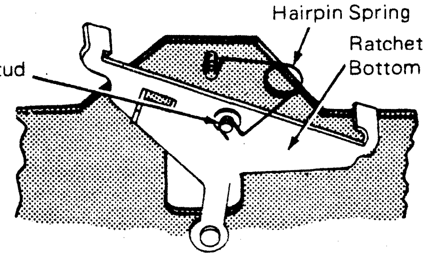
Figure 4-128.

Since the reversing action makes the "full" take-up spool become the supply spool and the "empty" supply spool become the take-up spool, it is necessary to disengage the ratchet detent lever from one feed ratchet and engage it with the other. This is done in step with the reversing operation. (Figure 4-129A) As the front of the feed and reverse plate swings, causing the feed pawl to engage with the opposite feed ratchet, it pivots the ratchet detent lever to the opposite spool. A stud riveted to the lever protrudes up through a slot in the feed and reversing plate linking the two together. A hairpin spring fastened to this stud and anchored to the feed plate provides a toggling action to both the feed and reverse plate and the ratchet detent lever. (Figure 4-129B) In addition, the hairpin spring keeps the ratchet detent lever constantly spring loaded against the teeth of the feeding ratchet.

Ribbon feed is interrupted during the stencil mode of operation. This is accomplished by centering the feed pawl between the ratchet spools so it can move freely front to rear without engaging a ratchet tooth. The feed pawl is caused to operate in this manner by the ribbon lift lever when it is in the no lift or stencil position. (Figure 4-130)



A. Reversing Operation



B. Ratchet Detent Lever

Figure 4-129.

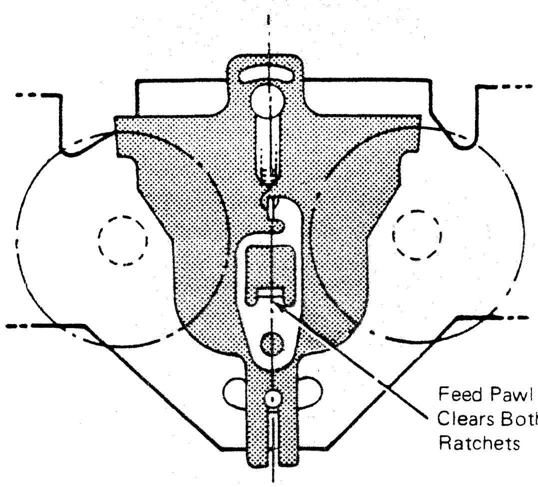


Figure 4-130.

Two lugs on the ribbon lift lever form a "V" which traps a lug on the ratchet detent lever. As the ribbon lift lever is placed in the stencil position, one or the other of the lugs, depending upon which spool is being driven, will contact the lug on the ratchet detent lever and cam it to the center of the "V". At this point, the ribbon lift lever will be in a detented position and the ratchet detent lever will be centered. With the ratchet detent lever in this position, the feed pawl will be guided between the ratchet spools. (Figure 4-131)

The old-level ribbon mechanism contains a few more parts than the current mechanism,

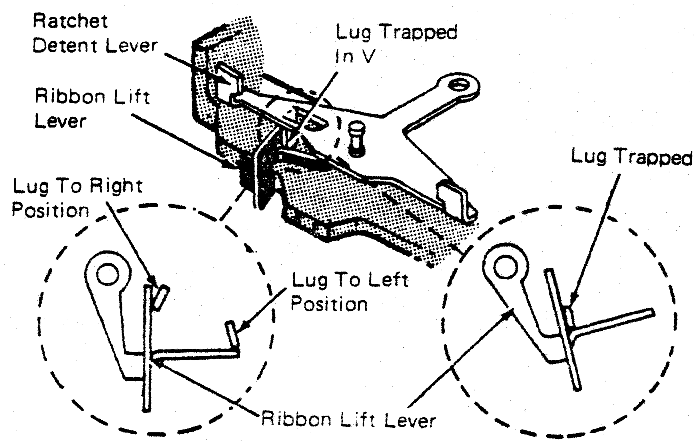


Figure 4-131.

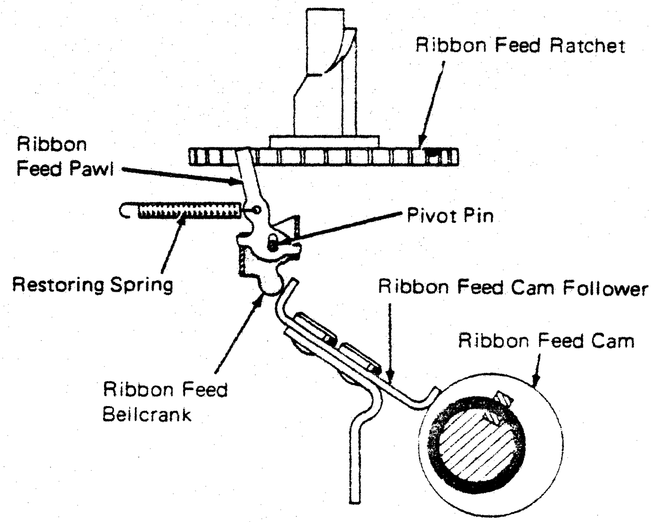


Figure 4-132.

however, the operation is similar. The position of the feed pawl determines which ratchet is fed as the pawl moves to the rear. The feed pawl pivots on a pin beneath the ribbon feed plate and extends up through a hole in the plate. Mounting of the pawl permits left to right as well as front to rear movement. An extension spring attached to the pawl restores the pawl to the rest position each time it operates. The spring also holds the pawl left to right into engagement with the correct ribbon feed ratchet depending upon the direction of the pull of the spring. The forward end of the spring is attached to a lever called the ribbon feed detent lever. The detent lever pivots on the ribbon feed plate. When the lever is moved to the right, the feed pawl is pivoted into engagement with the right hand feed ratchet. When the detent lever is moved to the left, the feed pawl engages to feed the left hand ratchet. (Figure 4-132)

The ribbon feed pawl is powered to the rear by the action of the ribbon feed cam. A sliding cam follower transfers the motion of the cam to the ribbon feed bellcrank which pivots and actuates the feed pawl to the rear. Sufficient motion is available from the cam to cause a two teeth feed of the ratchet. As the feed pawl restores to the front, it slides along the teeth of the ratchet into the rest position. The drag of the pawl along the teeth tends to rotate the ratchet backwards and unwind the ribbon. To prevent any backward rotation, a detent pawl is spring loaded into the teeth of the ratchet to allow feed in one direction only.

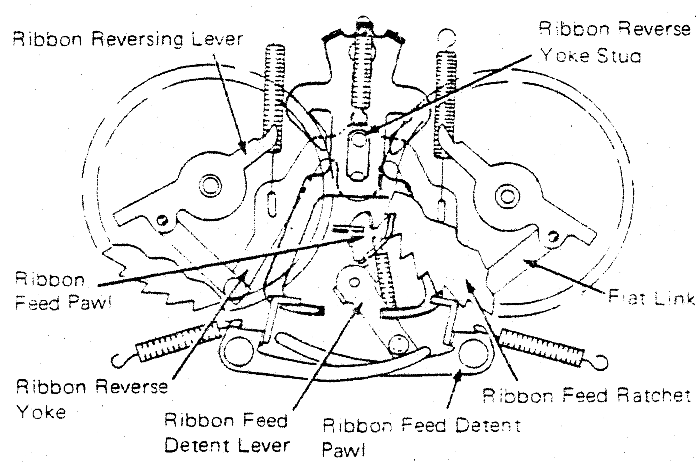


Figure 4-133.

To reverse the ribbon, a portion of the reverse trigger pivots down through a hole in the ratchet into position below the ratchet as it does in the current mechanism. The empty spool rotates slightly farther causing the reverse trigger to contact and actuate the reverse lever which pivots just below the ratchet. The reverse lever is connected, by means of flat link, to an arm of the reverse yoke beneath the ribbon feed plate. The yoke is pivoted by operation of the reverse lever. A stud on the yoke at the rear of the pivot point extends up through the feed plate into a slot in the reverse interposer. Movement of the yoke positions the front of the reverse interposer left or right depending upon which ribbon spool is being emptied. (Figure 4-134)

Two things occur when the reverse interposer is positioned. A hook at the front of the interposer

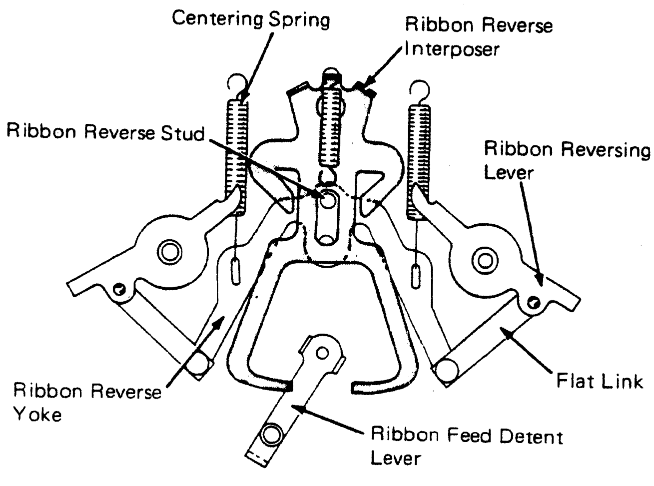


Figure 4-134.

hooks around a lug on the ribbon feed detent lever. The interposer lever, mounted on the interposer, is positioned into the path of the ribbon feed pawl. The next operation of the ribbon feed cam causes the feed pawl to drive the reverse interposer to the rear. The hook at the front of the interposer pulls the lug of the detent lever to the rear causing the detent lever to pivot to the opposite position. Movement of the detent lever disengages the detent pawl at the full spool and allows the pawl to engage the ratchet at the empty spool. As the feed pawl restores, its spring pivots it over into engagement with the opposite ratchet. (Figure 4-135)

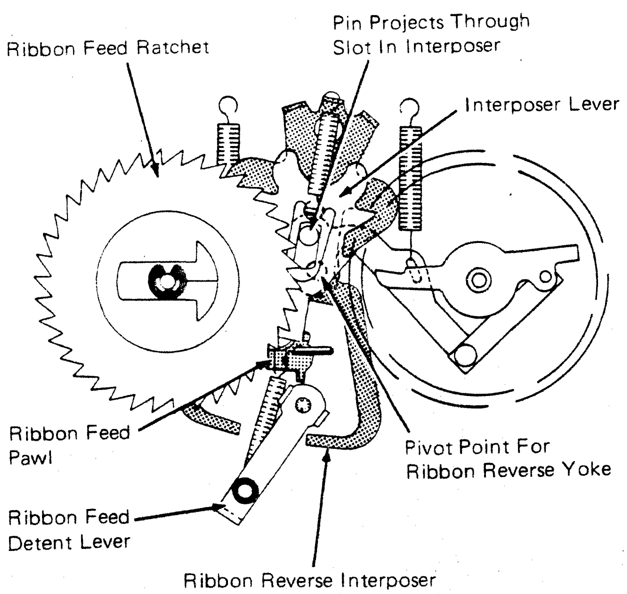


Figure 4-135.

4-17. FILM RIBBON

The film ribbon mechanism mounts on and moves with the carrier assembly. The supply spool of ribbon mounts on a permanent supply spool on the left side of the carrier. Due to the inner-connection between the plastic core of the supply spool, both spools rotate as a unit during a ribbon feed operation. As the ribbon comes from the supply spool, it threads around the ribbon circuit to the take-up spool. The take-up spool is a disposable, transparent spool mounted on the right side of the carrier. Once the ribbon has been used and fed to the take-up spool, both the take-up spool and the plastic core from the supply side are removed and discarded. The new ribbon to be installed comes equipped with its own take-up spool fastened to the end of a clean leader. (Figure 4-136)

Just prior to winding up the take-up spool, the ribbon passes around a feed roller. This roller determines how fast the ribbon will feed through the machine. The ribbon feed and lift wheel is connected to the bottom of the feed roller by a left hand threaded screw. (Figure 4-137)

The ribbon feed and lift wheel contains sixteen feed windows laid out in a circular pattern. A feed pawl operates in these windows and feeds one window each time the feed pawl is powered forward. (Figure 4-138)

The ribbon feed cam, located on the print sleeve, supplies the motion to the feed pawl. The motion from the cam is transmitted through an adjustable stud, to the cam follower which, in turn, drives the feed pawl. The cam follower mounts on a bracket that is fastened to the front carrier casting by two hex-headed screws. An extension spring, anchored to one of these screws, loads the cam follower against the cam. The feed pawl mounts at the top of the cam follower by a shouldered rivet and is spring loaded into engagement with the ribbon feed and lift wheel. (Figure 4-139)

Once the ribbon leaves the feed roller, the used ribbon is wound onto the transparent take-up spool. The take-up spool receives its motion from the feed mechanism by a friction type spring drive system. (Figure 4-140)

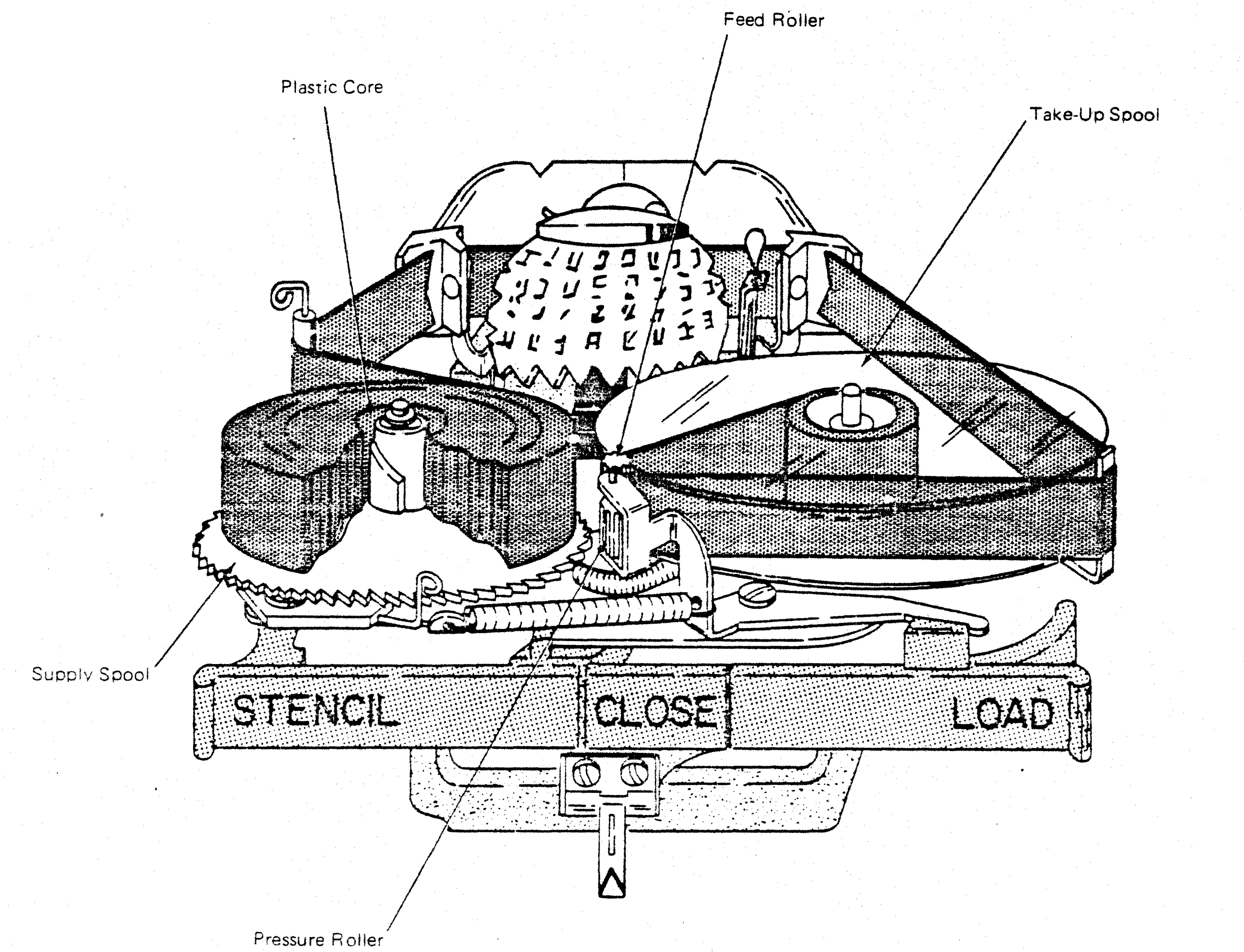


Figure 4-136.

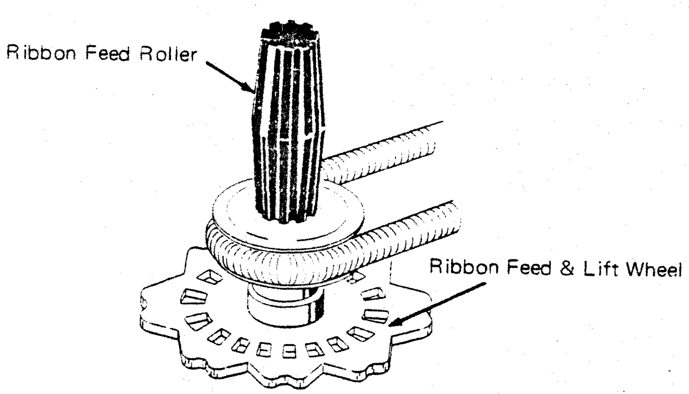


Figure 4-137.

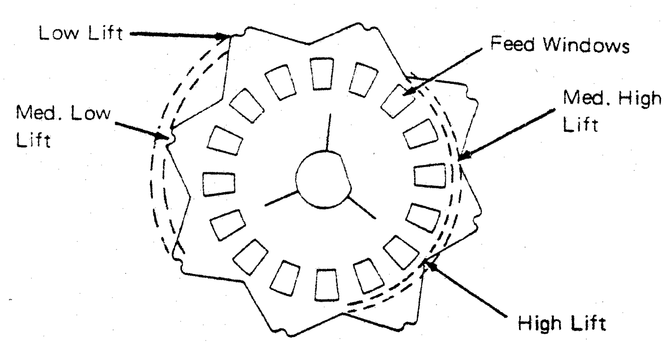


Figure 4-138.

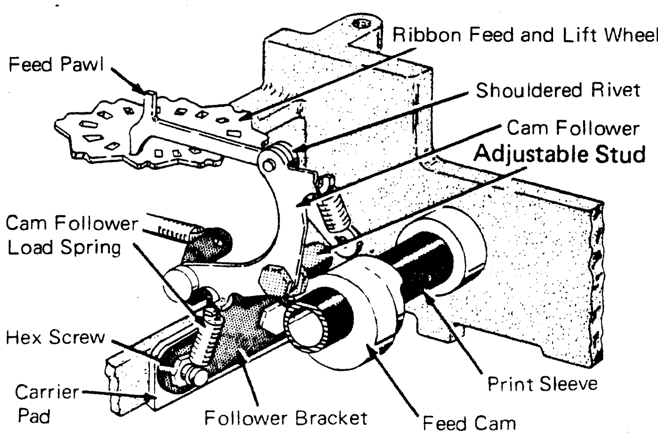


Figure 4-139.

A drive pulley located directly below the feed roller rotates with the feed roller during a ribbon feed operation. This drive pulley supplies the motion to the take-up pulley through a drive spring. The take-up pulley, driven by the drive spring, rotates about the take-up spool pivot stud and is held in place by a "C" clip. The shape of the belt groove in the take-up pulley is designed slightly different from that of the drive pulley. This is to permit all of the necessary slippage of the drive spring to occur at the take-up pulley and not at the drive pulley. This slippage is necessary to ensure the take-up spool will wind all of the ribbon. Two hooked lugs on the top face of the take-up pulley project into corresponding slots in the bottom of the transparent take-up spool. These lugs provide a locking connection between the take-up pulley and the disposable take-up spool.

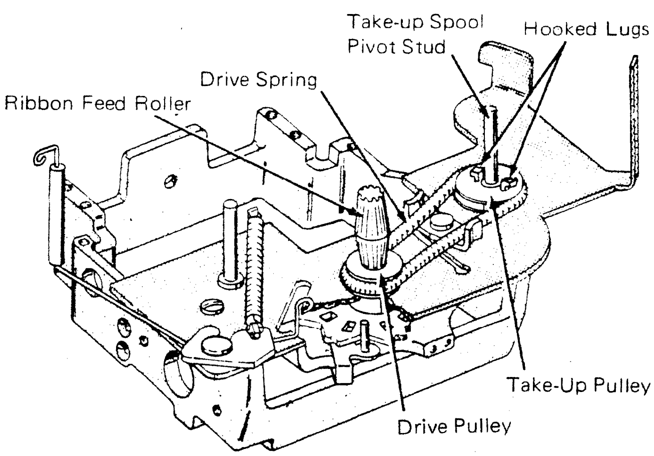


Figure 4-140.

To maintain a stable ribbon tracking characteristic from the supply spool to the feed and pressure rollers, the ribbon must be kept slightly taut throughout the ribbon path. Any slack in the system will affect the tracking of the ribbon. The ribbon is kept taut by means of a shock spring and detent. As the ribbon is pulled through by the feed roller, the supply spool detent, located on the front of the shock spring, releases the supply spool to allow the ribbon to feed. (Figure 4-141)

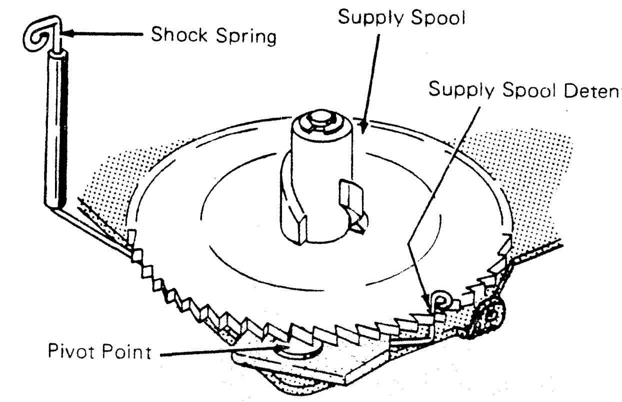


Figure 4-141.

To obtain the desired number of characters per spool of ribbon, a 9/16" wide ribbon is used. By varying the ribbon lift position for each character, a greater number of characters can be typed on a given length of ribbon.

The ribbon lift mechanism consists of a ribbon lift cam, a cam follower, a control mechanism, and the ribbon lift guide assembly. The lift mechanism is mounted to the carrier and moves with it. The ribbon lift cam is a single lobe cam that is setscrewed to the left hand side of the print sleeve. Each time a print cycle occurs the cam makes one complete revolution. (Figure 4-142)

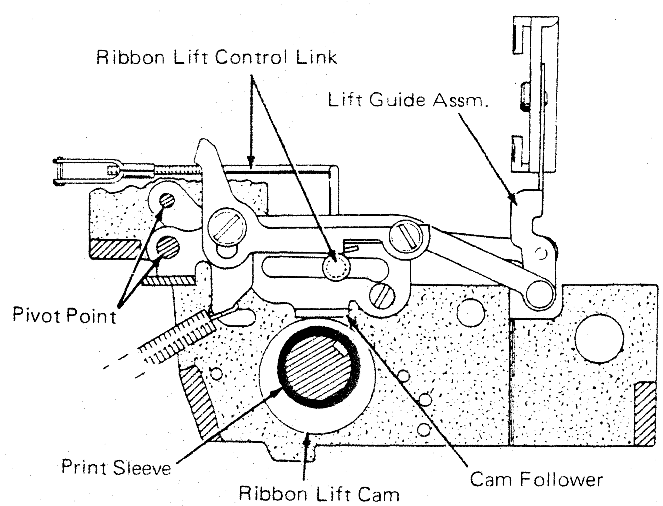


Figure 4-142.

The ribbon lift cam follower pivots on the carrier assembly above and to the rear of the cam. Each revolution of the cam raises the cam follower. The end of the ribbon lift control link fits into an elongated slot in the cam follower. The ribbon lift guide rests on the control link and pivots at the front of the carrier casting. As the cam follower is raised, the control link forces the ribbon lift guide assembly to pivot at the front and raise the rear of the assembly. A flat link from each side of the ribbon lift guide attaches to two pins at the front of the carrier to maintain the ribbon lift guide in a vertical position. (Figure 4-143)

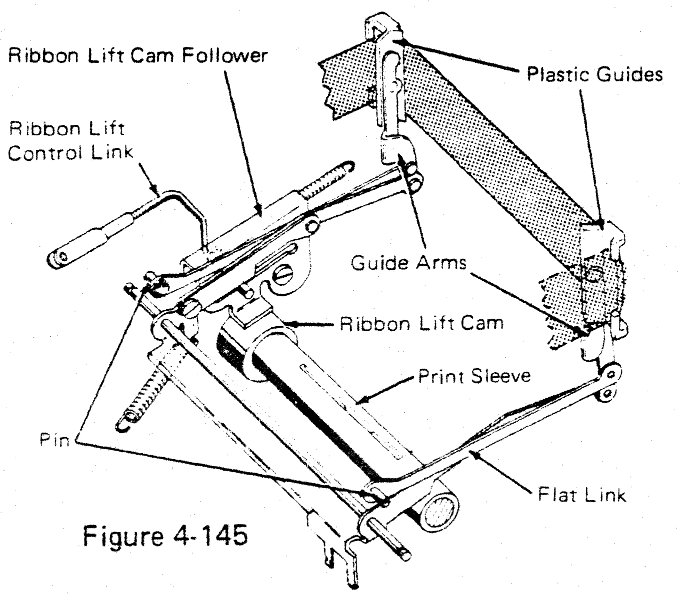


Figure 4-143.

The film ribbon lift mecahnism automatically changes the lift position to one of four different lift positions during each print cycle. This is achieved by changing the location of the lift control link in the slot of the cam follower. The four lift positions obtained by moving the control link are designated by "A", "B", "C", and "D". (Figure 4-144)

Positions "A" and "C" are low lift positions while "B" and "D" are high lift positions. These four lift positions occur in a definite order during a typing operation. It takes four print operations to complete a lift cycle which is from "A" to "B" to "C" to "D". On the fifth print operation, the lift cycle begins all over again with lift positon "A". Changing the location of the lift control link in the slot of the cam follower produces these lift positions.

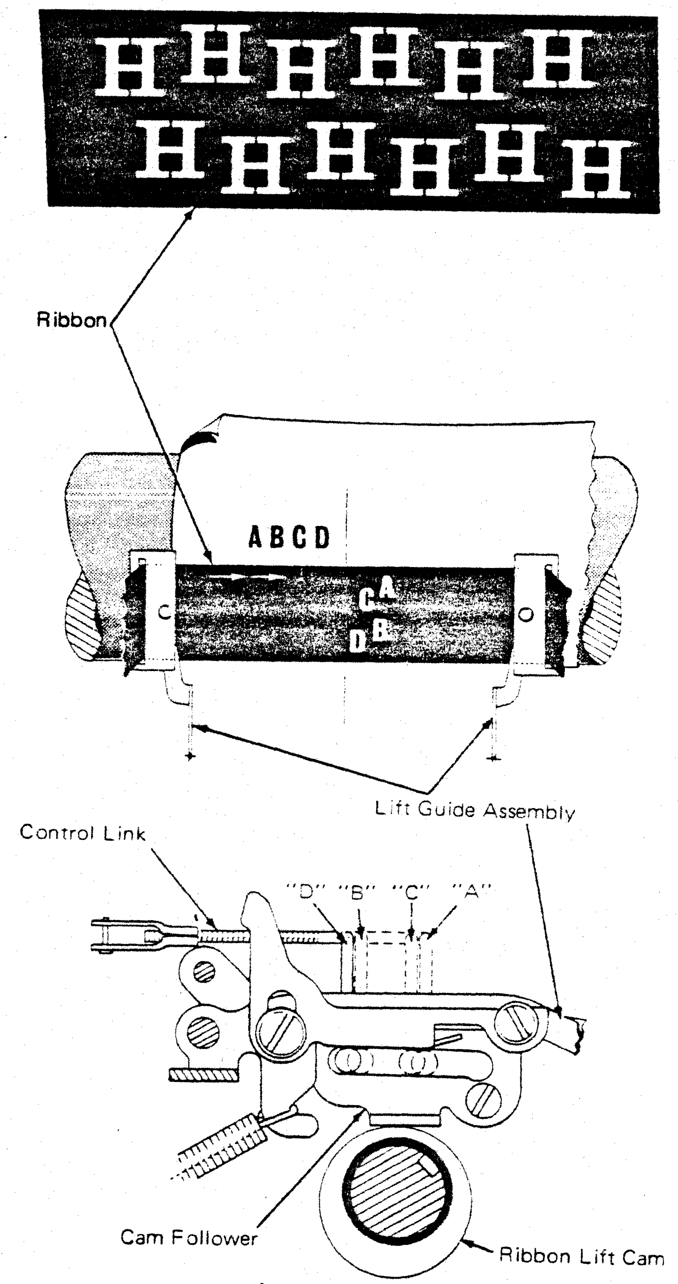


Figure 4-144.

The different lift positions are determined by the ribbon feed and lift wheel. The camming lobes on the perimeter of the wheel govern the position of the lift control link during each ribbon feed operation. These lobes which correspond to each feed window produce the four lift positions in a consecutive order as the wheel rotates 1/16 of a turn for each ribbon feed operation. (Figure 4-138 and 4-145)

The motion produced by the camming lobes on the ribbon feed and lift wheel is transmitted to the lift control link by the ribbon lift control lever. The lift control lever is mounted to the front of the carrier by a shouldered screw and is spring loaded against the camming lobes of the feed and lift wheel. During the early portion of a print cycle, the feed and lift wheel tends to rotate backwards with the feed pawl. This happens because the feed pawl is cammed out of the feed window as it travels toward the rear of the machine. To prevent the feed and lift wheel from rotating backwards, the ribbon lift control lever serves to detent the feed and lift wheel. This is accomplished by a detent notch cut on the high lobes of the ribbon feed and lift wheel. (Figure 4-145)

The selected ribbon lift position for each print operation is always established by the ribbon feed operation from the previous print cycle. This is because the rotation of the feed and lift wheel does not occur until after the typehead has printed.

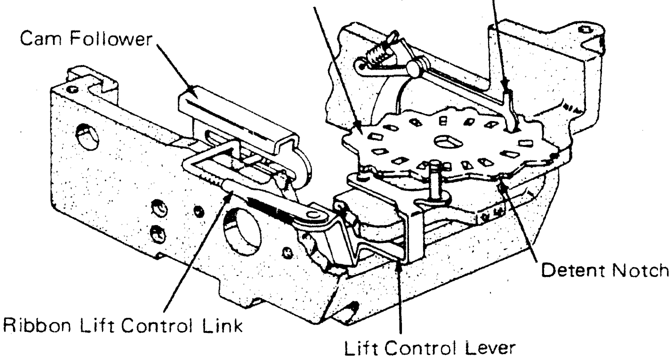


Figure 4-145.

Whenever the machine is used for typing stencils, the ribbon feed and lift operation must be locked out. This is accomplished by pushing the stencil lever, located on the front of the carrier to the rear. (Figure 4-146)

The lockout of the feed mechanism is achieved through a lug on the stencil lever. In the stencil position, the lug pivots to the right into the path of the upright lug of the feed pawl. Ribbon feed is interrupted because the feed pawl is not allowed to move to the rear and drop into the next feed window.

Lockout of the lift operation is achieved by a camming surface on the left end of the stencil lever. As the lever is pushed into the stencil position, the lift control lever is cammed away from the feed and lift wheel. This causes the control link to move to the rear of the slot in the cam follower where no lift motion will be produced to the ribbon lift guide assembly.

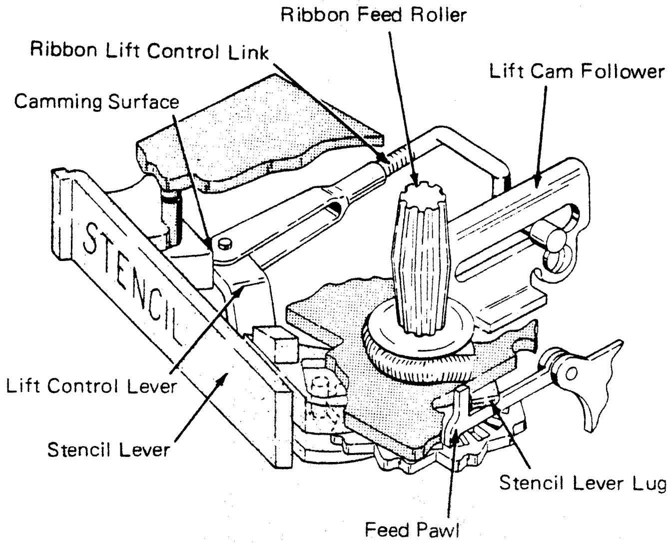


Figure 4-146.

When the operator desires to change the ribbon, she begins by pushing the load lever to the rear into its load position. This causes the ribbon lift guide assembly to rise above the element so the ribbon may be easily threaded through the guides. Latching the load lever in its load position caused the lower extension of the load lever to contact an extension on the lift guide assembly and cam it upward. At the same time, an extension on the pressure roller lever is contacted by the upper portion of the load lever and pivots the pressure roller away from the feed roller. The operator may now install a ribbon with no obstructions. (Figure 4-147)

The early level film ribbon mechanism differs slightly from the mechanism just described. A supply drag lever is in contact with the ribbon on the supply spool. (Figure 4-148)

A separate supply spool brake is used to stabilize the ribbon during the vibrations caused by repeat spacebar, backspace or underscore. During a feed operation, the supply spool brake is mechanically disengaged by the ribbon lift mechanism. The upper extension of the lift guide plate contacts the brake actuating lever when the lift guide is in the raised position. As the brake actuating lever pivots about its pivot point, it cams the supply spool brake out of engagement with the supply spool. (Figure 4-149)

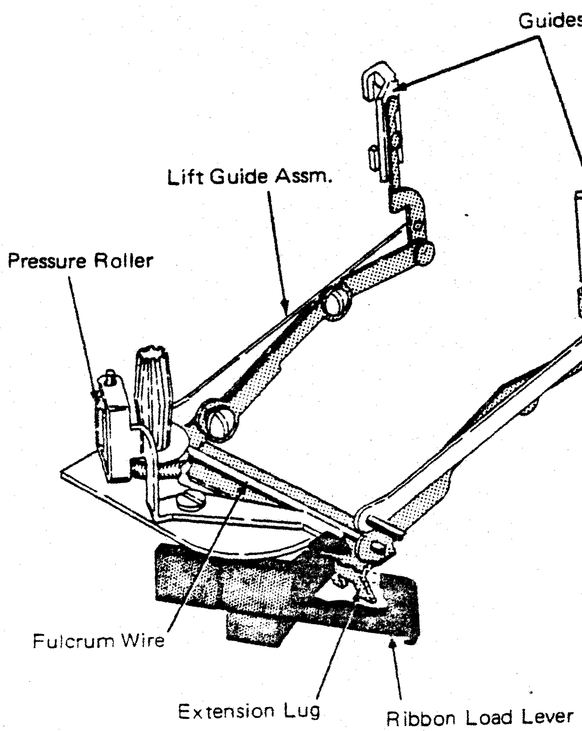


Figure 4-147.

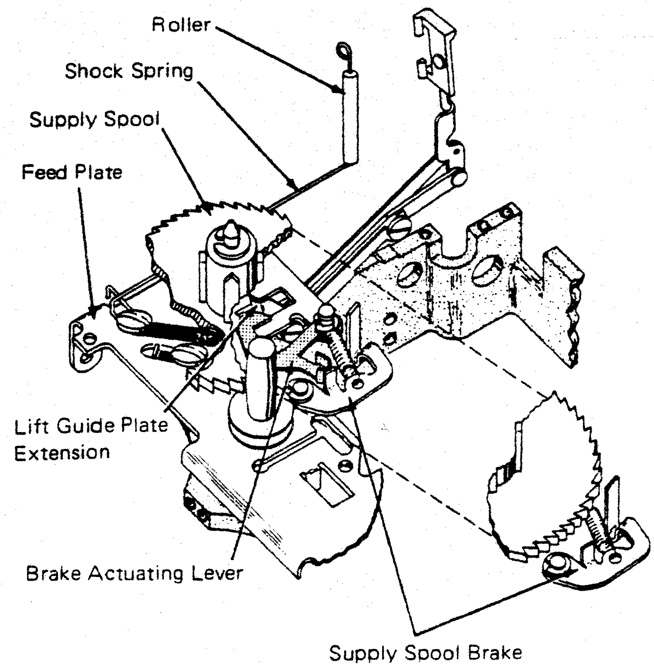


Figure 4-149.

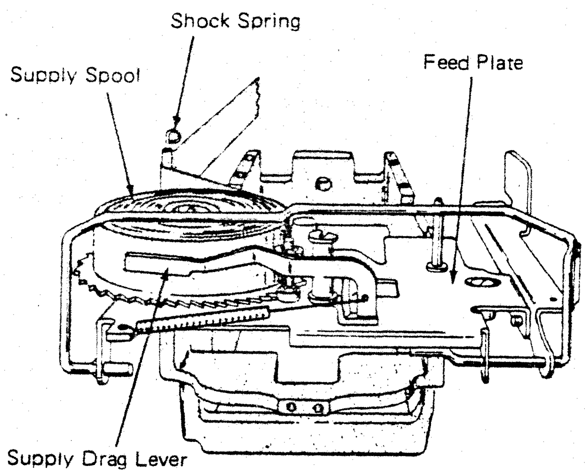


Figure 4-148.

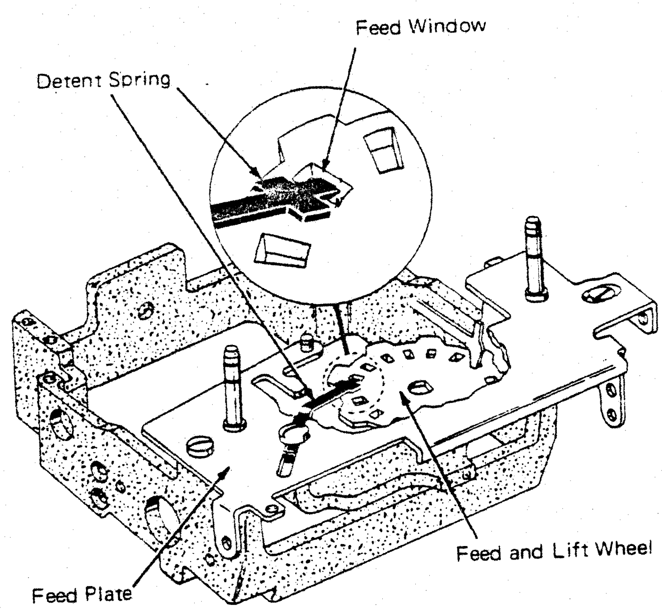


Figure 4-150.

To prevent the ribbon feed and lift wheel from rotating backward during a feed operation, a detent spring rides in the feed windows of the ribbon feed and lift wheel. (Figure 4-150)

In the stencil position, a shield is rotated beneath the feed pawl to prevent the feed pawl from operating in the feed windows. Lockout of the lift mechanism is achieved in the same manner as the present mechanism. However, the parts design is slightly different. (Figure 4-151)

The ribbon load operation is initiated by a ribbon load bail. A link is connected between the ribbon load bail and the load lever. The load lever raises the lift guide assembly in the same manner as the current load lever. (Figure 4-152)

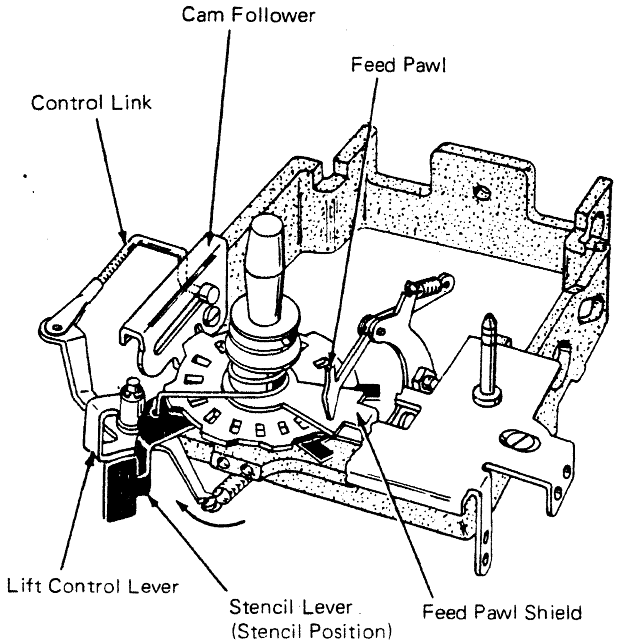


Figure 4-151.

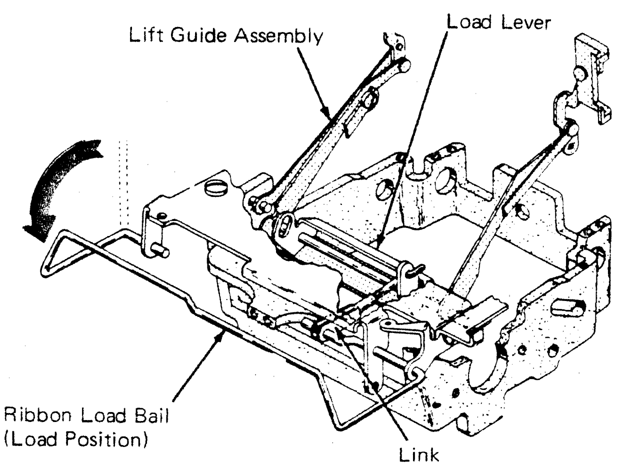


Figure 4-152.

An adjustable pressure roller release arm is attached to the load lever to release the pressure roller in the load position. The pressure roller release arm pushes against the pressure roller lever. As the pressure roller lever pivots away from the feed roller, it also cams the supply drag lever away from the supply spool. Thus, all obstructions are removed to permit the operator to install a new ribbon. (Figure 4-153)

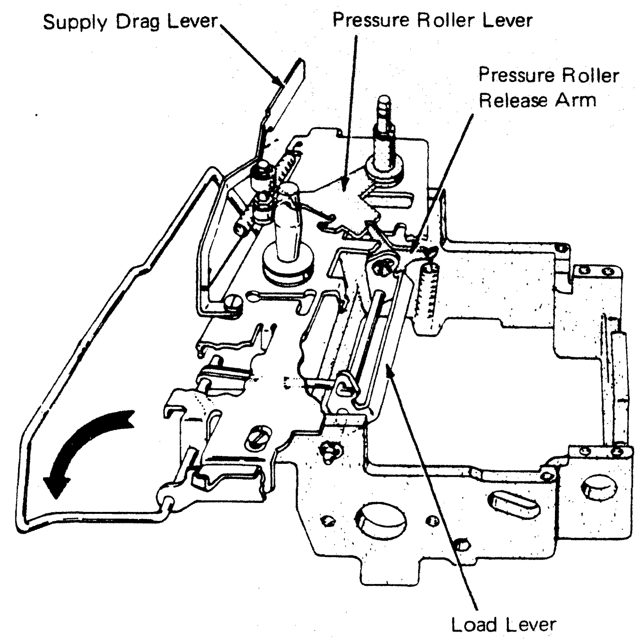


Figure 4-153.

4-18. I/O INTERFACE.

The interface is made up of 14 solenoids and 14 switches which command the printer to function or inform the logic of the state of the printer, depending on the mode of the terminal.

4-19. SOLENOIDS

KEYBOARD LOCK SOLENOID – This solenoid when energized locks the keyboard keys.

BAIL SOLENOID – Upon receipt of coded information from logic, the appropriate solenoid(s) are energized which in turn activate the selector latches R1, R2, R2A, R-5, T1, and T2. There are 6 bail input solenoids.

CYCLE CLUTCH SOLENOID – Upon command from logic, the solenoid is energized which trips the cycle clutch latch mechanism for print cycle operation.

SHIFT SOLENOID – Upon command from logic, the solenoid is energized which activates the shift mechanism for upper case shift.

OPERATIONAL SOLENOID – Upon command from logic, the desired solenoid (tab, space, backspace, carrier return, and index) is energized and the appropriate operation is initiated.

4-20. SWITCHES

BAIL SWITCHES – Six Reed switches which are actuated by the latch interposers (R1, R2, R2A, R-5, T1, and T2) for encoding to the logic.

OPERATIONAL SWITCHES – The tab, space, backspace, carrier return, and index switches encode the information sent to the logic to indicate the operation being performed.

FILTER SHUTTER – A reed switch and bow tie shaped vane are operated by the rotation of the filler shaft. A pulse is generated by the switch and sent to the logic as a strobe (LE) and a busy signal (TE) to control cycle time.

SHIFT SWITCH – A micro switch sends a signal to the logic to indicate a case change to upper case.

SHIFT INTERLOCK SWITCH – A reed switch operated by a vane which follows the shift cam indicates when the shift cycle is complete.

4-21. TRANSMIT

The switches are used when the terminal is in a transmit mode. A switch changing state indicates two things to the logic.

a. Tells the logic that we are beginning to transmit a character.

b. Tells the logic what character to transmit.

When we transmit an operation one switch does both a and b above, but when we transmit a keyboard character we rely on two switches. Filter shutter performs function a alone, while we use the bail switches to perform function b.

Filter shutter also tells the logic when to look at the bail switches. Its timing with regard to the bail switches is very critical. This timing relationship will be covered in Section V.

4-22. RECEIVE

The receive section of the interface consists of mag drivers and solenoids. One mag driver circuit for each solenoid. When the logic receives and decodes a character low going pulses are sent to the interface (in parallel) to turn on the mag driver(s) needed for that character.

The low going signal is input to base of the PNP transistor of the mag driver circuit (2N 4125). That transistor "turns on". When it "turns on" the level at the base of the NPN transistor (2N3569) goes more positive and causes that transistor to "turn on". As long as we hold the input to the mag driver circuit low both transistors will be "turned on". This "turn on" will apply a ground potential to one side of the related solenoid. The other side of the solenoid is connected to +24 volts. When the ground potential is applied we complete (or close) the circuit and current will flow through the coil, causing the armature to be attracted to the solenoid. As the armature moves it will operate a mechanical device in the I/O printer and initiate a mechanical cycle.

4-23. LOGIC.

The logic is located on a single interchangeable board and consists of Transistor to Transistor Logic (TTL integrated circuits) and some discrete components. The Logic board must be supplied voltage from an external supply. Its requirements are +.5 volts and ±12 volts. The TTL integrated circuits have an operating voltage of +5 volts which may be found on pin 8, ground may be found on pin 1 of every 600 series IC. All other IC's have +5 volts on pin 14 and ground on pin 7. Signal levels on the logic board are +5 volts = HIGH and 0 volts = LOW. The +12 volts operate discrete components on the board.

4-24. INTEGRATED CIRCUITS (Signetics Spec. Sheet)

a. NAND Gates

1. The SP680A is a Quad 2 input NAND Gate. It can be used in the Collector Logic configurations.
2. The SP670A is a Triple 3 input NAND Gate. It can be used in the Collector Logic configuration.
3. The SP616A is a Dual 4 input NAND Gate with an expander node. It can be used in the Collector Logic configuration. A capacitor may be connected to the node pin to increase the turn on time. The Fan-In Expander SP631A is connected to the node pin when additional diode inputs are needed.

b. Expander Gate

1. The SP631A is a Quad 2 input Gate Expander used with the SP616A or SP659A to expand their input capabilities.

c. Buffer Driven Element

1. The SP659A is a Dual 4 input Buffer Driven NAND Gate with an expander node. It is capable of driving a heavy load.

d. J-K Binary Element

1. The SP620A is a DC-Triggered master-slave, J-K Flip Flop. The circuit may be set or reset synchronously with the S_D and R_D inputs with the clock line low. The circuit may also be switched synchronously using the J and K inputs with a clock pulse.

e. D-Flip Flop

1. The S8828A is a Dual Delay Binary Element which responds on the positive going edge of the clock pulse. The logic level at the D input prior to the clock pulse will be transferred to the Q output with the rising clock pulse. The S_D and R_D are activated by "O" level. A "O" at S_D causes Q output to go to "1" A "O" at R_D causes Q output to go to "1".

f. Single Shot

1. The S8162A is a Nonstable Multivibrator which can provide delays from 80 nanoseconds to 2 seconds by using the appropriate external components. Pin 9 must be low when pin 10 goes low to get an output on pin 4.

g. Truth Tables

A Truth Table is an orderly array of all possible combinations of inputs, together with the truth value of the resulting output. The Truth Table is shown in figure 4-154.

4-25. BASIC LOGIC FLOW

a. Transmit

1. Bail Switch or Operational Switch actuated
2. Control Logic starts functioning
3. Load into Print Register
4. Load into Line Encoder
5. Load into Serial Data Register
6. Parity Generation
7. Output Buffers

INPUTS		OUTPUTS OF THE IC NAMED					
A	B	AND	NAND	OR	NOR	EXCLUSIVE OR	EXCLUSIVE NOR
0	0	0	1	0	1	0	1
0	1	0	1	1	0	1	0
1	0	0	1	1	0	1	0
1	1	1	0	1	0	0	1

Figure 4-154. Truth Table

b. Receive

1. Input Buffers
2. Control Logic starts functioning
3. Loaded into Serial Data Register
4. Parity Detection
5. Line Decoder
6. Loaded into Print Register
7. Loaded into Mag Driver Decoder
8. Loaded into Mag Driver
9. Performs proper mechanical operation

4-26. SERIAL DATA REGISTER

a. Transmit

The Serial Data Register is made up of four S8828A Dual Delay Binary Elements. S. R. Reset is fed into the set input of each flip flop. This drives the Q output high. The information is loaded into each flip flop at the reset input in parallel. If a one (1) is to be loaded into the register the reset input will remain high. For all bits that are not to be loaded into the register the reset input for that flip flop will go low and the Q output will go low. When the register has been set and reset according to the proper code the SHIFT pulse comes into the clock input of each flip flop and shifts the information out serially.

b. Receive

In the receive mode the leading edge of the start bit is what starts the logic in motion. As Serial Data Receive goes high these signals are set: Start Time, Cycle, Oscillator Gate, F. D. Reset, S. R. Reset, Clock, and Shift. Serial Data Receive is fed into the D input of the register and K2-2 goes low. At the same time S.R. Reset goes low for 10 microseconds and is fed into the set input of each gate. This sets all Q outputs high. 3.71 milliseconds after the leading edge of the start bit, we receive the first shift pulse and then one every 7.43 milliseconds for a total of 8 pulses. When the start bit reaches the start gate the information is taken out in parallel as soon as $\overline{Q}$ of the start gate goes high.

4-27. SERIAL DATA REGISTER – SHIFT CONTROL

a. Transmit

In transmit we must have 4 signals at the same time to get a shift pulse. Cycle, Transmit, and S. R. Empty go high and will stay high for 67 milliseconds. The clock pulse goes high for 116 milliseconds once every 7.43 milliseconds for a total of 9 clock pulses. These 4 signals are ANDED together in gate J2. It is inverted in the same gate. When all 4 inputs are high at the same time we then get a low out. This will fall at a clock rate. The output of J2 is collector ORED with H2. H2 will always be high while J2 is operating. J2 output is then fed into J1 and inverted. The output of J1 is Shift. We then feed J1 into L5 and invert it again. This is the SHIFT line that is fed into the Serial Data Register Clock input. An SP659A is used here because of the heavy load.

b. Receive

In receive we must have 3 signals at the same time to get a shift pulse. RCV and START go high. Start remains high for 55.72 milliseconds. RCV remains high for 67.43 milliseconds. Clock goes high 3.71 milliseconds after RCV goes high and stays high for 116 microseconds once every 7.43 milliseconds thereafter for a total of 8 times. These 3 signals are ANDED together in gate H2. It is inverted in the same gate. When all 3 inputs are high at the same time we get a low out. This will fall at a clock rate. The output of H2 is collector ORED with J2. J2 will always be high while H2 is operating. H2 output is then fed into J1 and inverted. The output of J1 is Shift. We then feed J1 into L5 and invert it again. This is the Shift line that is fed into the Serial Data Register Clock input.

4-28. SERIAL DATA REGISTER – CYCLE CONTROL

a. Transmit

1. Cycle

The cycle latch is made up of 2 gates, J3 (SP680A) and H2 (SP670A). Before a cycle starts the inputs should be set at these levels: J3-3 high, J3-4 high, H2-3 high, H2-4 low, and H2-5 high. J3-3 is high because of the proper input levels to H2. J3-4 is high because F2 (SP620A) Start Time flip-flop is in the reset condition. H2-4 is low because J3-3 and J3-4 are at the proper levels. H2-5 is high because Link Ready is high. H2-3 is high because H1-2, H1-6, and F1-14 are high. Gate H1 (pins 2, 3, 4, & 5) is used to generate Stop Time in the transmit mode. Gate H1 (pins 6, 7, 9, & 10) is used to generate Stop Time in the receive mode. Gate F1 is used to generate Stop Time in case of a false start in the receive mode. The outputs of these 3 gates are collector ORED together and are fed into H2-3.

Start Time must go low in order to start the timing of a cycle. Start Time is generated in Gate F2. F2-4 and F2-11 inputs are used in receive and will remain low in transmit. S. R. Load comes in on F2-5 and sets Start Time. This causes Start Time to go low. Start Time comes in on J3-4 of the cycle latch causing J3-2, the true side of Cycle, to go high. The high on J3-2 is fed in on H2-4 causing H2-2 to go low. When H2-2 goes low it is fed into J3-3 and holds J3-2 high after Start Time goes high.

To turn the Cycle off after 66.87 milliseconds the Stop Time signal, which is fed in on H2-3, must go low. Gate H1 (pins 2, 3, 4, &5) will do this in transmit. H1-3 will go high at the beginning of the cycle and remain high for 66.87 milliseconds. H1-4 will go high when the check bit reaches the start gate. H1-5 is the Clock line. When these 3 inputs are high at the same time, and only then, we will get a Stop Time pulse to turn the Cycle off.

Start Time, Transmit and Cycle are fed into J4 and NANDED together to ensure that the Data input to the Serial Data Register will remain low during the transmit cycle.

2. S. R. Load

S. R. Load is used mainly to load the Serial Data Register during transmit. S. R. Load is generated by NANDING 2 signals and inverting it again. Gate E1 (pins 9, 10, & 11) is used for this. Cycle comes in on E1-9. Cycle is high because a cycle has not been started yet. KEYBOARD READY comes in on E1-10 and goes high. When E1-9 and E1-10 are both high at the same time output E1-11 will go low. E1-11 is S. R. Load. E1-11 is then fed into E1-12, the output E1-14 is inverted. E1-14 is S. R. Load.

3. S. R. Reset

S. R. Reset is used to set the Serial Data Register flip-flops and reset the Parity flip-flop. E1-11 come in on E1-7. This input will normally be setting high. E1-6 comes from E2-2 and is normally set high. E1-6 and E1-7 go low only for a few microseconds at the beginning of each cycle. When these 2 inputs are high at the same time output E1-5 goes low. E1-5 is fed 2 places, straight into E2-12 and into a 10 microsecond delay network. The delay network is made up of a SP616A with a capacitor connected to the node pin. The output of the delay network F1-2 is fed into E2-13. With this delay network operating properly we will get a 10 microsecond pulse out on E2-14. E2-14 is S. R. Reset. Once again we use an SP659A because of the heavy load it is required to drive.

4. Parity Bit Injection and Interrupt Injection

The Parity Bit is injected into the character after it has been shifted from the Serial Data Register. Start, Transmit, and Cycle are NANDED together. Parity Bit is collector ORED to this output. This is the first time we have a complete character. This output is NANDED with Interrupt which is normally setting high. The output is then fed into the Output Buffer. Interrupt will remain high unless we are sending an interrupt. Then it will override the characters being sent.

b. Receive

1. Start Time Generation

Serial Data Receive comes into the Input Buffer. The output then goes into an inverter H3 (pins 9 & 11). Serial Data Receive is then NANDED with RCV and Cycle. The output of H3 is inverted and fed into F2-4. This is the enabling pulse for the Start Time flip-flop.

2. S. R. Reset Generation

S. R. Reset in receive is generated by F. D. Reset. E1-7 will remain high at all times during receive. F1 and E2 generate the 10 microseconds S. R. Reset pulse in receive the same way they generated the pulse in Transmit.

3. SDR

SDR is a controlled Serial Data Receive which is fed into the D input of the Serial Data Register. This signal is made by NANDING SDR with RCV in gate H3 (pins 12, 13, & 14).

4. Cycle

In the receive mode we use the Set and Clock inputs of the Start Time flip-flop. H3-2 is fed into the set input and causes Q to go high. The Q output will stay high until the clock input rises and falls. F2-12 Start Time comes into the Cycle flip-flop on J3-4 and starts the cycle the same as in Transmit. H2-3 must go low to turn the cycle off. Gate H1 (pins 6, 7, 9, & 10) will perform the function if it is a complete character. If the cycle started on false levels gate F1 will generate Stop Time. Assuming a normal character operation H1-9 will go high at the beginning of the cycle and remain high for 63.16 milliseconds. When the Start Bit reaches the Start gate Start will go high. Start comes in on H1-10. Clock comes in on H1-7. When all 3 signals are high at the same time we get a Stop Time pulse to turn off the cycle.

5. False Start

Now we will consider a false start. F1-10 will go high because we started a cycle. F1-13 will be high for 7.43 milliseconds. F1-12 will go high because we started the Clock running. F1-11 will be high because we do not have a complete Start Bit. This will give us a Stop Time pulse and turn the cycle off. The only time we can consider a false start is during the Start Bit time. This takes care of any cycles that are started by noise.

4-29. SERIAL DATA REGISTER – TRANSMIT AND RECEIVE CONTROL

a. Transmit

Link Rdy NANDS with Rcv Cycle gate J5. Both of these signals will be high constantly while we are in the Transmit mode. J5-2 feeds in on H5-11 to ensure that H5 operates during Transmit only. J5-2 is inverted in J5 (pins 6 & 5) to make a high Clock input for H5. Output Clock comes into H5-5 to set the KEYBOARD READY flip-flop. The Clock input is always high during Transmit. F2-12 comes into H5-10 to reset KEYBOARD READY. H5-12 comes into E4-12 where it is NANDED with D3-14 to give a reset pulse for the Transmit flip-flop. E5-12 will set low accept during the actual Transmit of a character. E5-11 will be high as long as Link Rdy is high. E5-13 will be low before a character transmission because it is connected to E4-11. With these levels present E5-14 will be high. E5-14 feeds into E4-9. H5-12 comes into E4-10 to set the Transmit flip-flop. At the end of a cycle D3-14 will go high causing E4-14 to go low. E4-14 feeds into E5-12 causing the Transmit flip-flop to reset.

b. Receive

The Logic sets in the receive mode all of the time except during actual transmission of a character. H5-12 is high and feeds into F4-6. E5-14 feeds into F4-7. The output F4-5 is then inverted to make the RCV level.

c. Off Line

The 1030 is designed to work as an office typewriter off line. When it is off line the Clear to Send level will be low. The output of the Input Buffer will be high. L5-14 will be low. With these levels present the Transmit and Receive gate will be gated off.

4-30. FREQUENCY DIVIDER AND SHIFT CLOCK

a. Transmit

1. Frequency Divider

In the 1030 we have a need for a very stable Clock rate. This stability is required for dependability in its response to codes. The clock rate is quite slow and a slow running Oscillator is not very stable. To gain stability we use a much higher frequency Oscillator and divide it down to the Clock rate. The Oscillator runs at a frequency of 17.227 KHz. This gives us a 58 microseconds square wave out of the Oscillator. The output of the Oscillator is fed into E1-3 where it is NANDED with Oscillator Gate. E1-2 output is then fed into the clock input of the first Frequency Divider flip-flop. When Oscillator Gate goes high $\overline{\text{F. D. Reset}}$ goes low for 10 microseconds and Sets each gate in the Frequency Divider to the True State (Q=1). Each Set and Reset of an N8828A that is not used must be tied high. Oscillator Gate goes high. $\overline{\text{F. D. Reset}}$ sets the Frequency Divider. D1-6 (Q) is low. Q is connected to the Data input of the flip-flop. The Clock input will go high and low at the Oscillator Frequency. D1-3 goes high. The low at D1-2 is transferred to D1-5. D1-5 goes low and D1-6 goes high. D1-6 is connected to D1-11. D1-11 goes high. As D1-11 goes high it transfers the high at D1-12 to D1-9. D1-9 goes high causing D1-8 to go low. The reason the flip-flops do not continue to transfer is because N8828A responds to the positive going edge of the clock pulse only. The Data inputs are locked out once the clock is high, thus preventing more than one transition of the binary per clock pulse. D1-3 clock input goes high again. The high that is now at D1-2 transfers to D1-5. D1-5 goes low, D1-6 goes high. Now D1-9 will change states because its clock input is high. This procedure takes place throughout the Frequency Divider causing D5 to toggle at a 7.43 millisecond rate.

2. Shift Clock

The purpose of the Shift Clock network is to provide a 116 microsecond Clock pulse every 7.43 milliseconds. D5-6 is NANDED with E4-11. E4-11 is Transmit Control Level. E4-2 is NANDED with D4-9, D4-5, D2-9, D2-5 and D1-9. The output of D3 is $\overline{\text{Clock}}$. $\overline{\text{Clock}}$ is inverted in H3 to get Clock.

b. Receive

In Receive the Clock pulse must fall in the center of the bit of information. To do this the true side of D5 is NANDED with the Receive Control Level. The output of E4 then follows the same path as in transmit.

4-31. FREQUENCY DIVIDER CONTROL

a. Transmit

The Frequency Divider Control is used to turn the Clock on and off. F3-5 will go low and cause F3-2 (Oscillator Gate) to go high. Oscillator Gate must be held high for 67 milliseconds. F3-4 will go low for 7.43 milliseconds. F3-6 will go low for 66.87 milliseconds. $\overline{\text{F3-3}}$ will go low for each Clock pulse. $\overline{\text{Clock}}$ holds the output high between F3-5 going high and F3-4 going low. F3-2 is Oscillator Gate. It is fed into E2-3. E2-3 is ANDED with the Oscillator Gate which has been delayed 10 microseconds. E2-2 is $\overline{\text{F. D. Reset}}$. E2 is an SP659A because of the heavy load it must drive.

b. Receive

The Frequency Divider works the same in receive as in transmit except for 1 signal level. F3-5 stays high all the time in receive. F3-4 will go low and turn Oscillator Gate on. F3-3 and F3-6 will keep it on for 66.87

milliseconds. Oscillator Gate and F. D. Reset operate the same as in transmit.

4-32. PARITY GENERATION AND DETECTION

a. Transmit

Parity Generation is accomplished with a control gate, flip-flop and an extended NAND Gate. The control gate NANDS Shift and Transmit Control Level with Start from the Serial Data Register. E5-6 will be used as a Clock input for the Bit Counter. A "1" is loaded into the Serial Data Register. E5-7 will go high for 66.87 milliseconds because of actual transmission of a character. E5-10 will go high with the Shift pulses. E5-9 will be low. Therefore, when the Shift pulse comes in on E5-10 the output of E5 will remain high. D5 was put in the reset condition by S. R. Reset and will remain in that condition until the Clock input goes low and back high. E5-9 will stay low until after receipt of the 6th Shift pulse. The 6th Shift pulse comes in to E5. The output does not change because E5-9 is still low. D5 has no change. As the Shift pulse returns to its low state E5-9 goes high. As the 7th Shift pulse comes into E5-10 the output E5-6 will go low for the time of the shift pulse, then back to its high state. This causes D5 to change states making D5-9 high. D5-9 is then fed into an extended NAND Gate. The NAND Gate and its extenders are: L4 (pins 10, 11, 12, 13 and 14) an SP616A, L3 (pins 9, 10, & 11) an SP631A, L3 (pins 12, 13, & 14) an SP631A and E3 (pins 2, 3, & 4) an SP631A. All 10 inputs must be high at the same time for L4-14 to go low. The inputs are: E3-4 Transmit Control Level, E3-3 Parity Flip-flop, L3-12C, L3-13 1, Le-10 4, L3-11 2, L4-10 Start, L4-11 B, L4-12 A and L4-13 8. When all 10 inputs are high, L4-14 will be low. An "F" is to be loaded into the Serial Data Register. S. R. Reset comes into D5-13 and resets D5. E5-7 goes high for 66.87 milliseconds. E5-9 goes low with S. R. Load as the Serial Data Register is loaded for the letter "F". 7.43 milliseconds later E5-10 goes high for 116 microseconds. E5-6 does not change because E5-9 is low. The Shift pulse on E5-10 goes low. E5-9 goes high. 7.43 milliseconds later E5-10 goes high. E5-6 goes low for 116 microseconds then back to its high state. As E5-6 goes high D5 changes states. D5-9 is now high. The 3rd Shift pulse comes in on E5-10. E5-6 goes low for 116 microseconds then back to its high state. As E5-6 goes high D5 changes states. D5-9 is now low. E5-9 now goes low. The 4th Shift pulse comes in on E5-10. E5-6 does not change because E5-9 is low. D5-9 stays low. E5-10 goes low. E5-9 goes high. The 5th Shift pulse comes in on E5-10. E5-6 goes high. D5 changes states. D5-9 is now high. The 6th Shift pulse comes in on E5-10. E5-6 goes low because E5-9 is high. D5 changes states. D5-9 is now low. E5-6 goes high. E5-10 goes low. E5-9 goes low. The 7th Shift pulse comes in on E5-10. E5-6 stays high because E5-9 is low. D5 does not change. D5-9 is low. The Check bit is added to the character at this time. L4-14 will determine if we have a Check bit or not. The 10 inputs that control L4-14 are setting at these levels now: E3-3 low, E3-4 high, L3-12 high, L3-13 high, L3-10 high, L3-11 high, L4-10 high, L4-11 high, L4-12 high, L4-13 high. One input is low, therefore, L4-14 is high and a Check bit will be added.

b. Receive

Parity Detection is accomplished with a control gate and a bit counter. Receive Control Level is NANDED with Serial Data Receive to the Serial Data Register and Shift. Receive Control Level on E5-3 will go high and stay high 66.87 milliseconds. Serial Data Receive on E5-5 will go high and low with the character signals received. Shift on E5-4 will go high for 116 microseconds once every 7.43 milliseconds for 8 times. S. R. Reset comes in on D5-13 resetting D5. D5-9 is now low. Each time Serial Data Receive and Shift are high at the same time, E5-2 will go low. E5-2 goes low for 116 microseconds then back high. Each time E5-2 goes high D5 will change states. D5-8 is the Parity signal.

4-33. SERIAL DATA REGISTER EMPTY

a. Transmit

1. Serial Data Register Empty

Serial Data Register Empty is the signal used to tell the Serial Data Register Cycle Control that the Serial Data

Register is completely empty. One input from each flip-flop of the Serial Data Register comes into the Serial Data Register Empty extended NAND gate and its expanders. Following the 8th Shift pulse the Serial Data Register Flip-flops will all have their Q side high except for Start, it will have $\overline{Q}$ high. When this condition is present $\overline{\text{Serial Data Register Empty}}$ will go low indicating that the register is empty. L4-2 is then inverted in J1 to make Serial Data Register Empty.

4-34. LINE DECODER

a. Receive

1. Line Decoder

The Line Decoder converts Line Code into Latch Code. The information is loaded into the Line Decoder in parallel. The information is then NANDED with P. R. Load. J5 (pins 9, 10, & 11) converts B into $\overline{T_2 \text{ Load}}$. J5 (pins 12, 13, & 14) converts A into $\overline{T_1 \text{ Load}}$. J3 (pins 5, 6, & 7) converts 8 into $\overline{R_{2A} \text{ Load}}$. J3 (pins 9, 10, & 11) converts 2 into $\overline{R_1 \text{ Load}}$. J4 (pins 6, 7, 9, & 10) converts 8 and 4 into $\overline{R_2 \text{ Load}}$. J4 (pins 11, 12, 13, & 14) converts 8 and 4 into $\overline{R_2 \text{ Load}}$. The proper inputs to either gate will give us $\overline{R_2 \text{ Load}}$. M4 (pins 6, 7, 9, & 10) converts 1 and 8 into $\overline{R\text{-}5 \text{ Load}}$. M4 (pins 2, 3, 4, & 5) converts 8 and 1 into $\overline{R\text{-}5 \text{ Load}}$. The proper inputs to either gate will give us $\overline{R\text{-}5 \text{ Load}}$. The output must go low for that information to be loaded into the Print Register.

4-35. LINE ENCODER

a. Transmit

1. Line Encoder

The Line Encoder is used to convert latch code into Line Code. The Print Register outputs are NANDED with S. R. Load to give us Line Code to be loaded into the Serial Data Register. N2 (pins 5, 6, & 7) convert R_{2A} into 8. N4 (pins 2, 3, & 4), M3 (pins 2, 3, & 4) and J3 (pins 12, 13, & 14) convert $\overline{R\text{-}5}$ and $\overline{R_{2A}}$ or R-5 and R_{2A} into 1. N3 (pins 2, 3, & 4) converts R1 into 2. N2 (pins 9, 10, & 11), N2 (pins 12, 13, & 14) and N2 (pins 2, 3, & 4) convert $\overline{R_2}$ and R_{2A} or R_2 and $\overline{R_{2A}}$ into 4. P3 (pins 2, 3, & 4) convert T_1 into A. R4 (pins 2, 3, & 4) convert T_2 into B. The outputs go low when we don't load those bits into the Serial Data Register.

4-36. SWITCH ENCODER AND PRINT REGISTER

a. Transmit

1. Switch Encoder

The Switch Encoder converts Bail Switches, Operational Switches and Control Modes into Latch Code for the Print Register. All Switch Encoder inputs will set normally high and go low. The output will be normally low. There are 6 groups of Switch Encoder Gates, one representing each of the bails in the printer. When a character is selected from the keyboard and T_2 Bail Switch closes R5-14 output will go high. R5-14 is NANDED with Keyboard. R4-5 output feeds into R4-13, the T_2 Print Register latch. When an operation is performed its switch termination is fed into the proper gates to give us the code we need. The code for Space is T_2, T_1, R_1, R_2, and R_{2A}. Space Switches termination is fed into T_2 Switch Encoder, T_1 Switch Encoder, R_1 Switch Encoder, R_2 Switch Encoder and R_{2A} Switch Encoder. R_2 Switch Encoder Gate has all of the operational switches coming into it so its output is called Switches and is used to set Switch Pulse Pulse Delay.

2. Print Register

The Print Register is basically a storage and buffer unit. The Print Register is the only place in the logic that Code is held until the next character comes in. The outputs from the Switch Encoder are fed into the true side of each bail latch. $\overline{\text{Register Reset}}$ is fed into the false side of each Print Register latch. Each Print Register latch is made up from 2 SP680A gates. The latch is set by feeding a low into the true side from Switch Encoder outputs. The outputs of the true sides are then fed into one of the inputs of the false side. The latch is reset by feeding Register Reset into the other inputs on the false side of the latch. The outputs of the false sides are then fed into the inputs of the true side of the latch.

b. Receive

1. Switch Encoder

The Switch Encoder is used only to generate a Switches output in receive which is used in generating an interlock for operations.

2. Print Register

The Print Register is loaded from the Line Decoder in the receive mode and operates the same as in transmit.

4-37. MAGNET DRIVER DECODER

a. Receive

1. Bail Magnet Drivers

The Bail Magnet Drivers are each made up from one SP680A Gate. One input from the Print Register and one input from U3-11. Both inputs to a Bail Magnet Driver must be high to get the output to go low. When the output goes low that magnet is energized. S5 (pins 5, 6, & 7) is the T_2 Bail Magnet Driver Gate. Its inputs come from U3-11 and Print Register T_2 (R4-14). S5 (pins 2, 3, & 4) is the T_1 Bail Magnet Driver Gate. Its inputs come from U3-11 and Print Register T_1 (P3-14). S5 (pins 12, 13, & 14) is the R_{2A} Bail Magnet Driver Gate. Its inputs come from U3-11 and Print Register R_{2A} (P4-2). S5 (pins 9, 10, & 11) is the R_1 Bail Magnet Driver Gate. Its inputs come from U3-11 and Print Register R_1 (N3-14). T5 (pins 5, 6, & 7) is the R_2 Bail Magnet Driver Gate. Its inputs come from U3-11 and Print Register R_2 (N4-14). T5 (pins 2, 3, & 4) is the R-5 Bail Magnet Gate. Its inputs come from U3-11 and Print Register R-5 (M3-14).

2. Cycle Clutch Magnet Driver

The Cycle Clutch Magnet must be energized each time we print a character. S4 (pins 11, 12, 13, & 14) is the Cycle Clutch Magnet Driver Gate. S4-11 is connected to T2-11 which will go high as soon as the Print Register is loaded with the new character. S4-12 will go high with Output Clock. S4-13 will be high because we did not receive the code for a Space. S4-14 output will go low for the duration of Output Clock and Cycle Clutch Magnet will be energized.

3. Space Magnet Driver Gates

The Space Magnet Driver network is made up from four gates: T3 (pins 2, 3, 4, 5, 6, & 7), an SP616A; E3 (pins 9, 10, & 11), an SP631A; T5 (pins 13 & 14) and T5 (pins 9, 10, & 11), an SP680A. T3 and E3 are used to detect the Space Code. T5 (pins 13 & 14) is an inverter. T5 (pins 9, 10, & 11) is actually the space Magnet Driver Gate. The space level is NANDED with a signal that is made up from Text and Output Clock. T5-11 goes low and the Space Magnet will be energized.

4. Operational Magnet Drivers

The Operational Magnet Driver Gates NAND the proper Print Register outputs with Operation and Control. S3 (pins 11, 12, & 13) is the Index Magnet Driver Gate. The code for Index is R_1, R_2, and T_2. R_2 is not fed into the gate because R_2 and $\overline{R_{2A}}$ indicate an operation or control code. R_1 and T_2 are NANDED with Operation and Control. S3-14 will then go low and the Index Magnet will be energized. Each of the Operational Magnet Driver Gates operate in the same manner.

4-38. PRINTER MAGNET CONTROL

a. Receive

1. Print and Space Control

The Print and Space Control tells the logic that a print or space operation is taking place. U4-13 will be high because we are in the receive mode and ready to receive information. U4-12 will go high each time we get an Output Clock. U4-14 output is fed into U4 (pins 2 & 4) and inverted, because Cycle Trip is now high; U4-2 output is then fed into Print and Space gate, Space Magnet Driver Gate and Cycle Clutch Magnet Driver Gate. U4-2 will normally be low and go high for 12 milliseconds, then it will go back low. U4-7, the other input to Print and Space gate, comes from T4 (pins 2, 3, & 4) which defines an operation or control code. U4-5 will go low during a print or space for the same amount of time as Output Clock is high.

2. Bail Flip-flop

The Bail Flip-flop controls the length of the pulse sent to the Bail Magnets. T2 (pins 9, 10, & 11) of the Bail Flip-flop is set by the Print and Space gate when it goes low. In a print operation the bail pulse should be 18 to 22 milliseconds long. T3-11 will be high because of Link Rdy. T3-12 will be high because the Filter Shutter has not closed yet. T3-13 will be high because we did not receive the code for a Space. T3-10 will go high when Print and Space set the Bail Flip-flop. This will cause output T3-14 to go low and hold the flip-flop in the set condition even after Print and Space has gone back to normally high state. T2-11 output is NANDED with Print and Space. When Print and Space goes back high U3-5 output goes low. U3-5 is fed into U3-10 and is inverted. The output of the inverter U3-11 is NANDED with each of the true outputs from the Print Register. If T2 from the Print Register is high when U3-11 goes high, the Bail T_2 Magnet Driver output will go low and the Bail T_2 Magnet will be energized. Approximately 30 to 34 milliseconds after the Bail Flip-flop sets, the Filter Shutter closes and resets it. When the Bail Flip-flop resets it causes U3-11 to go low. When U3-11 goes low the Bail Magnet Driver gate turns off and the Bail Magnet will de-energize.

3. Operation and Control

Operation and Control is the level that turns the Operations and Controls off and on. U4 (pins 12, 13, & 14) NANDS Output Clock and Text together to give us a 12 millisecond operational magnet pulse. The output of U4 is then fed into T4-10 and inverted, because Cycle Trip is high. The Operation and Control level comes from 5 gates that are collector ORED together. All 5 gates must be high at the same time to get an operation and control function. U4 (pins 12, 13, & 14) and T4 (pins 10 & 11) determine the length of the Operation and Control pulse. T4 (pins 2, 3, & 4) and T4 (pins 12 & 14) determine if the code received is an Operation or Control Code. S3 (pins 6, 7, 9, & 10), S3 (pins 2, 3, 4, & 5) and T4 (pins 5, 6, & 7) are code inhibiting gates. There are 6 operational codes that are not used in the 1030. These gates will cause the logic to ignore those codes. U4 (pins 12, 13, & 14) NANDS Output Clock and Text together to give us a 12 millisecond operational magnet pulse. The output of U3 is then fed into T4-10 and inverted.

4-39. SWITCH PULSE PULSE DELAY

a. Transmit

1. Switch Pulse Pulse Delay

The Switch Pulse Pulse Delay network filters out switch bounce and holds Switch Pulse Pulse Delay high for 2 milliseconds after the switch has opened back up. The Switch Pulse Pulse Delay network can be set by either of 2 ways, with Switches input on W5-12 or with the Filter Shutter Switch. A character is printed from the keyboard and the Filter Shutter Switch closes pulling U2-11 and U2-5 low. U2 (pins 11, 12, 13, & 14) filters out switch bounce. U2 (pins 2, 3, 4, 5, & 6) is the true side of the Switch Pulse Pulse Delay latch. U2-5 goes low causing U2-2 to go high. U2-2 feeds into U1-9 to hold U2-2 latched high. 25 to 30 milliseconds later the Filter Shutter Switch opens. U2-11 and U2-5 go high. U2-2 will remain high for 2 milliseconds because of the time delay in gate U2 (pins 11, 12, 13, & 14). 2 milliseconds after the Filter Shutter Switch opens U2-14 goes low. U1-10 will then reset the Switch Pulse Pulse Delay latch. For an operation, the input that sets the latch is Switches on W5-12. W5 (pins 12 & 14) is an inverter which feeds U2-12 and U2-4. The rest of the Switch Pulse Pulse Delay network functions the same as for a print character. An automatic EOA does not close a switch and the code does not have R_2 in it. Therefore EOA must also be fed into the true side of the Switch Pulse Pulse Delay latch so that it can generate a Switch Pulse Pulse Delay signal.

b. Receive

1. Switch Pulse Pulse Delay

The Switch Pulse Pulse Delay network functions the same in receive as in transmit.

4-40. RECEIVE OUTPUT CLOCK CONTROL

a. Receive

1. Receive Output Clock Control

Output Clock must be started as soon as the complete character has been received. J2 is used to set the Receive Ready Flip-flop. J2-12 will be high because Receive is normally high. J2-11 will be high because Start Time is low for the first 3.71 milliseconds of each character. J2-10 will be high because Cycle goes high at the beginning of each character and remains high for 63.15 milliseconds. J2-13 will go high when the Start Bit reaches the Start Flip-flop. J2-14 will go low setting H4. H4-7 will be high because we have a carrier established. H4-7 must be high in order to set and reset the Flip-flop with the J & K inputs. H4-3 Receive Ready is NANDED with Bail Flip-flop and Receive Cycle to get Clock Start. Clock Start is the trigger pulse for Output Clock in the receive mode. P1-13 is high because H4 has just been set. P1-12 is high because Receive Cycle Flip-flop has not set yet. P1-11 is high because we are not in the print portion of the cycle yet. P1-14 Clock Start goes low and is inverted in F4 to make our Print Register Load Pulse. F4-14 is fed into F3 to give us a 50 microsecond time delay. The low pulse out of F3 is used to reset H4. When H4 resets P1-14 goes back to its high state. When H4 is reset F5 Receive Cycle Flip-flop is set. F5-3 Receive Cycle will stay high until the end of Output Clock.

2. Check Gate

The Check Gate triggers the Check Flip-flop in case of a parity error detection. L1 NANDS Receive Ready, Text and Parity to get the Check Flip-flop trigger pulse.

3. Ready Lamp

The Ready Lamp tells us that we have established a carrier. The lamp driver input is connected to CTS LCL which goes low when a carrier is established turning on the Ready Lamp.

4-41. OUTPUT CLOCK

a. Transmit

1. Register Reset

The Register Reset pulse resets the Print Register and is the trigger pulse for Output Clock in the transmit mode. Switch Pulse Pulse Delay is NANDED with Keyboard. W1-2 output is NANDED with Clock Start. W1-14 will normally be low and go high with Switch Pulse Pulse Delay in transmit. W1-14 is fed into W1-10 and V1-13. V1-14 will stay high for 10 microseconds after its input goes high. Output V1-14 is fed into W1-9. This will give us a 10 microsecond pulse out on W1-11. W1-11 is Register Reset.

2. Output Clock

Output Clock gives us a reference from which to start our cycle. V3 (pins 2, 5, & 6) and W1 (pins 5, 6, & 7) hold the Output Clock input latch reset. W2-5 will normally be setting low. When W1-2 goes low to generate Register Reset, W2-5 goes high and W2-4 goes low. This holds W2-2 high and holds W2-14 high. As Register Reset is fed into W2-12 the output W2-14 will go high. W2-14 goes back low the Output Clock Single Shot is triggered. V2, an N8162A, must have its output pulse set for 12 to 13 milliseconds. This is done by adjusting R37, a 5K potentiometer. If W1 (pins 5, 6, & 7) or V3 (pins 2, 5, & 6) do not have a low output we will not trigger another Output Clock until they go low.

b. Receive

1. Register Reset

Register Reset pulse is generated the same as in transmit except for the originating signal. W1-2 will remain high at all times during the receive mode because Keyboard on W1-4 will be low. Clock Start comes into W1-12 to start out Register Reset gates to functioning.

2. Output Clock

The Output Clock pulse is generated the same as in transmit except for the originating signal. The Clock Start pulse comes in on W2-11 and goes low for 50 microseconds. W2-14 goes high. At the same time Register Reset goes low, but it has no effect because W2-11 is already low. W2-14 will be high for 50 microseconds per character in receive.

4-42. INTERLOCK

a. Transmit

1. Interlock

The Interlock latch is held in the reset condition all the time during the transmit mode. W2-6 will remain high.

b. Receive

1. Interlock

The Interlock was designed to tell the logic when the proper operation for a given code is completed. S4 (pins 2, 3, 4, & 5), U5 (pins 5, 6, & 7) and U5 (pins 2, 3, & 4) are used to set the Interlock latch for control functions. V3-11 (Print & Space) set the Interlock latch for print and space functions. Operations are Interlocked with Switch Pulse Pulse Delay in gate W1 (pins 5, 6, & 7). In a print function V3-11 goes low causing V3-14 to go high. When the Filter Shutter Switch closes Switch Pulse Pulse Delay goes low. This will reset the Interlock latch. When the machine is first turned on Link Rdy resets the Interlock latch.

4-43. CASE SHIFT CONTROL

a. Transmit

1. Power on Reset

The Power On Reset is used to insure that the machine will always come up in lower case when it is first turned on. U1-4 is connected to Power-On Reset. U1-3 is fed from EOT which is normally high. U1-3 will go low when an EOT is transmitted and automatically put the machine in Lower Case each time. When U1-3 are both high U1-2 goes low allowing V5, the Up Shift Flip-flop, to be set and reset with the J & K inputs. U1-2 is inverted in U1 (pins 13 & 14). The high out on U1-14 is fed into W3-7 via a diode to set the shift control JK (W-3).

2. Shift Magnet Driver

W3-3 will be high initially because of POR. W4-13 will be high because W3-3 is high. W4-11 will be high or low depending on the state of the Shift

Switch. W4-11 is tied to the normally closed contacts of the Shift Switch (the machine in Lower Case). W4-14 will be high and the magnet will be de-energized. The machine will be in Lower Case. To shift to Upper Case we depress the Shift Key which changes the state of the Shift Switch. W4-11 will go high. This will make all 3 inputs, W3-11, 12, and 13, high. W4-14 will go low causing the Shift Magnet to be energized. As the Shift Key is released, W3-5 goes back high. W3-3 stays the same because the clock input stayed low. W4-11 goes low and the output will go high de-energizing the shift Magnet.

3. Generating a Shift Code

There are two signals used to generate a Shift Code, UpShift and Shift Interlock Switch. Both signals are generated in the logic. The Shift Interlock Switch opens and closes as the machine is going to Upper Case. V1 (pins 2 & 3) filter out bounce and invert it. Shift Interlock Switch is fed into the R-5 and R_2 Switch Encoding Gates. R_2 Switch Encoding Gates give us Switches output which is used to generate Switch Pulse Pulse Delay as well as loading the Print Register. Shift Interlock Switch is also fed into set side of the Shift Interlock latch gates W5 (pins 2, 3, & 4) and W4 (pins 2, 3, 4, & 5). W4-5 is used to reset the latch in transmit. W4-4 will stay high at all times during transmit. The Shift Interlock Switch will be open for 7 to 15 milliseconds causing V1-2 to go low setting the Shift Interlock Switch latch. The latch will be held set until Switch Pulse Pulse Delay on W4-5 goes low. While W5-2 is high it's NANDED with the Up Shift Flip-flop false side. W5-5 is the Up Shift signal which is fed into the Switch Encoder Gates T_1 and T_2.

4. Case Shift Restore

If an EOT is transmitted the machine will automatically go to lower case. The EOT transmitted will cause KYBD to go high, making W3-3 go low, de-energizing the Shift Magnet.

b. Receive

1. Decoding Shift Codes

The Print Register outputs are fed into Upper and Lower Case control gates. When an Upper Case Code is received V4-2 will go low. V4-4 is high because we have been in lower case. V4-6 will go high because the Upper Case Code has T_2 in it. V4-3 will go high because the Upper Case Code has R-5 in it. V4-5 will go high because we are performing an operational function. V4-2 will be low and V4-14 will be high. The Shift Interlock Switch latch will be held with the reset side high by W3-3 of the Shift Flip-flop. U5-12 and U5-10 will be held high all the time in the receive mode. With V4-2 low U5-14 will be high. With V4-14 high U5-11 will be low. With U5-14 high and U5-11 low the Up Shift Flip-flop will be set. Going from Upper Case to Lower Case V4-14 will be low and V4-2 will be high. U5-11 will be high and U5-14 will be low. With U5-11 high and U5-14 low the Up Shift Flip-flop will reset.

2. Shift Magnet Driver

With the machine setting in the receive mode and in lower case W5-9 will be high and W5-10 will be high. W5-11 will be low holding the Shift Magnet Driver de-energized. Going to Upper Case W5-9 and W5-10 will go low causing W5-11 to go high. W4-9 will be high because W5-11 is high. W4-7 will be high because we did not receive a Lower Case Code. W4-10 will be high because we are in receive. This will cause W4-6 to go low and the Shift Magnet will energize. Going to Lower Case W5-9 and W5-10 will go high. W4-9 and W4-7 will be low. W4-10 will remain high because we are still in the receive mode. W4-6 will be high and the Shift Magnet Driver will be held de-energized.

3. Case Shift Restore

If an EOT is received the machine will automatically go to Lower Case. U1-3 goes low causing U1-2 to go high. V5-11 goes high resetting the Up Shift Flip-flop causing V5-12 to go high. W5-9 goes high because of V5-12 going high. W5-10 will be high because the last code received was not an Upper Case Code. This causes W5-11 to go low. W4-9 will go low causing W4-6 to go high. W4-6 goes high and the Shift Magnet will de-energize.

c. Off Line

1. Shift Magnet Driver

The 1030 is equipped with an all electric shift. W3, the Shift Flip-flop, is held in the set condition by Link Ready. W4-14 will then go high and low as the Shift Switch is closed and opened. When the switch is closed the Shift Magnet is energized. When the Switch is open the Shift Magnet will be de-energized.

4-44. CHECK AND CORRECT DATA

a. Transmit

1. Generating Correct Data Code

The Correct Data Switch has effect only during transmit. When the Correct Data Switch is pressed T2-12 goes high. We are in transmit so T2-13 will be high. T2-14 will go low resetting the Check Flip-flop and turning out the Check Lamp. T2-14 also feeds the Switch Encoding gates which feed the Print Register. T2-2 goes low causing U1-5 to go high and the Keyboard will unlock.

b. Receive

1. Check

When a parity error is detected by the Check gate the Check lamp comes on. T2-4 goes low and sets the Check Flip-flop causing T2-2 to go high. T1-6 will go low and the Check lamp Driver will turn on the Check lamp.

4-45. EOA

a. Transmit

1. EOA

The EOA can be transmitted 2 ways; automatically upon receipt of an EOT, or by depression of the "#" key on a BCD Unit ("9" key on a CORR Unit). To get the machine in sync. going terminal to terminal the above key must be depressed. The EOA code is the same as the code for a "#" on the BCD Unit. The first time the code is received after the machine has gone into the receive mode it is acknowledged as an EOA and the machine will not print. Upon receipt of an EOT the EOT memory latch is set. 12 milliseconds after P2-2 goes low it will go back high because Operation and Control Level is a 12 millisecond pulse. S1-2 will be low because S1-4 Switch Pulse Pulse Delay is high. S1-5 will be high because Interlock is high. S1-3 will be high because EOT is high. S1-2 is low causing R1-14 to be high. R1-5 will go high because R1-14 goes high. R1-14 goes high because R1-12 goes low. R1-12 goes low because S1-2 goes low. S1-2 goes low because P2-2 went back high. R1-3 will be high because we have just set the EOT memory latch. R1-4 goes high when P2-2, EOT, goes back to its high state. When R1-12 goes low it will set the EOA latch. This will then cause EOA, R1-2, to go low, R1-2 is then fed into the Switch Encoding gates which loads an EOA Code into the Print Register. The low on R1-2 is also fed into R1-13 to hold the EOA latch set. Keyboard Ready then goes low and resets the EOT memory latch causing M1-14 to go low. R1-3 will then go low and R1-2 will then go high. The EOA latch is then reset.

b. Receive

1. EOA

The EOA code is used to put the machine into Text after it is already in the receive mode. The EOA code is T_1 and T_2. T_2, T_1, $\overline{R\text{-}5}$, $\overline{R_2}$, $\overline{R_{2A}}$ and $\overline{R_1}$ are NANDED together to give us our EOA Level in receive, P2-14, the EOA output, is inverted and fed into the J input of the Text Flip-flop. When Receive Cycle, which is fed into the clock input, goes high, the Text Flip-flop is set. The Text Flip-flop will stay set until the keyboard latch is set. The true side of the Keyboard latch is fed into the Direct Reset input of the Text Flip-flop.

4-46. EOT

a. Transmit

1. EOT

The EOT code can be sent 2 ways; automatically, following a carrier return, or by depression of the Interrupt Key when in the transmit mode. The CR/LF Switch closes causing L2-14 and M2-3 to go high. M2-4 will go high because as the CR/LF Switch closes Switch Pulse Pulse Delay Latch is set. M2-5 will be high because the Keyboard latch is set. M2-2 and L2-12 will go low holding the CR/LF latch set. The low on M2-2 is fed into L2-6 of the CR/LF Memory latch and sets it. M2-9, the other side of the memory latch, is high because Keyboard Ready is high. M2-10 will be high because we have a carrier established. L2-5 is fed into M2-7 which holds the CR/LF Memory latch set. The CR/LF Switch opens back up. Switch Pulse Pulse Delay goes low and the CR/LF latch is reset. R1-10 of the EOT latch will be high because the CR/LF Memory latch is set. R1-9 will be high because we just reset the CR/LF latch. R1-7 will go high because Switch Pulse Pulse Delay, which is fed into S1-4, just high. S1-2 and R1-12 go low causing R1-14 to go high, which sets the EOT latch. R1-6 will be low and it is fed into R1-11 which holds the EOT latch set. R1-6 is fed into the Switch Encoding gates which load the Print Register. As the EOT is transmitted M2-9 of the CR/LF Memory latch goes low and resets the CR/LF Memory latch. L2-5 and R1-10 will go low resetting the EOT latch. The CR/LF Memory latch can also be set by L2-11 going low. With the machine in transmit L2-10 will be high because the Keyboard latch is set. L2-9 will go high when Interrupt Switch is depressed. This causes L2-11 to go low setting the CR/LF Memory latch.

b. Receive

1. EOT Code Detection

The EOT code in receive is used to generate the EOA code. The EOT code is NANDED with Operation and Control to give us an EOT level with which to set the EOT Memory latch. P2-2 goes low upon receipt of the EOT code.

4-47. KEYBOARD

a. Transmit

1. Keyboard

The Keyboard is locked in the receive mode and when we transmit an EOA we unlock the Keyboard, take the machine out of Text, and turn on the Proceed Lamp. In transmit the Keyboard Latch is set and M2-14 will be high. M2-11 will be high because we have a carrier established and Link Ready is high. M2-13 will be high because the Keyboard Latch is still reset. M2-12 is high because we have not yet generated an EOA. M1-12 goes low as we generate an EOA causing M1-14 to go high. M1-14 is fed into M1-9 to hold the Keyboard Latch set. M1-11 (Keyboard) is low. Keyboard is NANDED with EOT and Automatic Terminal Check to get Keyboard level.

2. Keyboard Lock Magnet Driver

The Keyboard Lock Magnet Driver takes the Keyboard signal and inverts it. When the Keyboard latch is set M1-11 is low and the output of the Keyboard Lock Magnet Driver will be high. The Keyboard Lock Magnet will be de-energized.

3. Proceed Lamp

The Proceed Lamp will be on whenever we are in the transmit mode. M2-14, the true side of the keyboard latch, will be high and is NANDED with proceed enable. The output, M1-2, is inverted in the Lamp Driver and the Proceed Lamp will turn on.

b. Receive

1. Keyboard

The Keyboard has been unlocked in the transmit mode and as we go to receive we must lock the Keyboard and cause the Keyboard level to go low. To lock the Keyboard an EOT must be generated which will reset the Keyboard latch. M1-11 goes high and M1-5, the output of the Keyboard Lock Magnet Driver, goes low energizing the magnet. In receive, T1-14 Keyboard must be low. T1-11 will normally be low because we are not sending an Automatic Terminal Check Code. T1-12 will be high because the Keyboard latch is reset. T1-13 will be high because we are not sending an EOT Code. Therefore, T1-14 will be low.

2. Proceed Lamp

The Proceed Lamp must go out when we are in the receive mode. M1-3 will still be high because we still have proceed enable. M1-4 will be low because the Keyboard latch is reset and M2-14 is low. M1-2 will be high cutting off the Proceed Lamp Driver and the Proceed Lamp will go out.

4-48. INTERRUPT

a. Transmit

1. Interrupt

Whenever an Interrupt is received while we are in the transmit mode we will recognize it as a Reverse Break. This will take us out of the transmit mode and will wait for information from the computer.

2. Generating an EOT

An EOT can be generated by depression of the Interrupt Key while in the transmit mode. L2-4 will go low setting the Interrupt Switch latch. L2-2 is fed into L2-9 which sets the CR/LF Memory latch. When the Interrupt Key is released the Interrupt latch will reset.

b. Receive

1. Interrupt

An Interrupt can be sent by depression of the Interrupt Key in the receive mode. The Interrupt pulse must be between 200 and 300 milliseconds long. An Interrupt can only be sent during the receive mode because Text is fed into reset input of the Interrupt Single-Shot and this input must be low to get a pulse out. L1-6 will go low and trigger the Interrupt Single-Shot.

4-49. 10-10 PRINTER

a. Transmit

1. Switch Functions

The Bail Switches serve only ONE function; they operate as an output device. The Filter Shutter Switch acts as a reference to start the cycle in the logic and as an interlock to tell the logic that the print operation is completed. The Operation Switches serve as output devices, a reference to start the cycle, and as an interlock to tell the logic the operational function is complete. The Shift Interlock Switch is used to transmit a shift code and to indicate that the shift operation is complete. Whenever a switch travels to its opposite state it indicates a function to be carried out. The Filter Shutter Switch should give us a 24 to 28 msec. pulse out when the machine is cycled under power operation. When printing a character the key button is depressed. The interposser releases the Cycle Clutch. The Cycle Clutch drives, rotating the Filter Shaft. The Filter Shaft drives the interposer ahead. The interposer picks up the proper Bails. The Bails drive the latch interposers ahead. The Bail magnets are fastened to the latch interposers and close the proper Bail Switches. Bail Switch closure must occur 1 to 6 msec. before the filter shutter. All Bail Switches must close within 2 msec. of each other. The Bail Switch pulse should be 15 to 20 msec. long. The filter switch pulse should close for approximately 25 msec.

b. Receive

1. Filter Switch

The Filter Switch is the only switch that is used in the receive mode. The Filter Switch closure cuts off the Bail Magnet pulse and generates an interlock in Receive. The Filter Shutter is set to give us a 18 msec. min. Bail Magnet pulse. The Filter Switch cannot dance more than 2 msec.

2. Print

When printing a character in Receive the Cycle Clutch Magnet is energized for 12 msec. When the Cycle Clutch Magnet is de-energized the Bail Magnets are energized. The Filter Shaft will be turning because the Cycle Clutch was tripped. Approximately 18 msec. after the Bail Magnets are energized the Filter Shutter Switch will close de-energizing the Bail Magnets. The closure of the Filter Switch will generate the interlock which will prevent us from printing another character until the Filter Switch has reopened.

4-50. ON–LINE TERMINAL OPERATION

a. Transmit

1. Before we can Transmit these conditions must exist.

   (a) A carrier must be established and the Ready light on.

   (b) The Proceed light on and the Keyboard unlocked.

2. The key "A" is pressed.

3. The Cycle Clutch is tripped.

4. The Filter Shaft picks up the interposer and drives it ahead closing the Bail Switches R_1, R_2, R_{2A} and R-5.

5. The Filter Shaft continues to rotate closing the Filter Shutter switch. The Filter Shutter Switch closure sets Switch Pulse Pulse Delay high (Logic Sheet 7).

6. Switch Pulse Pulse Delay causes $\overline{\text{Register Reset}}$ to go low for 10 microseconds (Logic Sheet 7).

7. $\overline{\text{Register Reset}}$ resets the Print Register latches (Logic Sheet 5).

8. $\overline{\text{Register Reset}}$ is fed into the Output Clock trigger latch which sets Output Clock (Logic Sheet 7).

9. The Bail Switches that are closed or close from the time Output Clock starts to the time it goes back low will be loaded into the Print Register and set their respective latches (Logic Sheet 5).

10. Output Clock is fed into the Keyboard Ready Flip-flop to set it (Logic Sheet 2).

11. Keyboard Ready and $\overline{\text{Cycle}}$ generate S. R. Load (Logic Sheet 2).

12. $\overline{\text{Keyboard Ready}}$ is fed into F3 to turn the Oscillator gate on (Logic Sheet 3).

13. Oscillator Gate generates $\overline{\text{F. D. Reset}}$ (Logic Sheet 3).

14. Oscillator Gate turns on the Clock (Logic Sheet 3).

15. Keyboard Ready sets the Transmit Control Level latch (Logic Sheet 2).

16. S. R. Reset sets the Serial Data Register (Logic Sheet 1).

17. S. R. Reset resets the Parity Generate and Detect Flip-flop (Logic Sheet 9).

18. S. R. Load is fed into the Start Time Flip-flop to set it (Logic Sheet 2).

19. S. R. Load is fed into the Line Encoding Gates which load the Serial Data Register (Logic Sheet 4).

20. S. R. Load is fed into the Start Gate Flip-flop to load the Start Bit (Logic Sheet 1).

21. Start Time is fed into Keyboard Ready to reset it (Logic Sheet 2).

22. Start Time is fed into F3 to hold the Oscillator Gate on after Keyboard Ready goes back high (Logic Sheet 3).

23. Start Time is fed into the Cycle latch to set it (Logic Sheet 2).

24. The Start Bit is now being transmitted (Logic Sheet 2).

25. Starting with the second Clock pulse, transmit, cycle and S. R. Empty, the Shift pulses are generated (Logic Sheet 2).

26. On the 7th Shift pulse we inject the Parity Bit (Logic Sheet 2).

27. On the 8th Shift pulse S. R. Empty will go high (Logic Sheet 4).

28. On the 10th Clock pulse a Stop Time will be generated and the Cycle latch will be reset (Logic Sheet 2).

29. J1-2, the complete character, is then fed into the Output Buffer which gives us the proper levels for Transmitting: −12V to +12V (Logic Sheet 2).

b. Receive

1. Before we can Receive these conditions must exist.

   (a) A carrier must be established and the Ready light on.

   (b) The Keyboard locked and the Proceed light off.

   (c) An EOA must be the first character received so the logic will be put in the Text mode.

2. The information coming in on the receive line is −12V to +12V. The Input Buffer changes it to 0 volts to 4.75 volts (Logic Sheet 2).

3. Serial Data Receive and the Receive Control level make SDR which loads the Serial Data Register (Logic Sheet 2).

4. Cycle Receive Control Level and SDR generate the signal with which to set the Start Time Flip-flop (Logic Sheet 2).

5. H3-2 sets the Start Time Flip-flop (Logic Sheet 2).

6. Start Time turns on the Oscillator Gate (Logic Sheet 3).

7. Start Time sets the Cycle latch (Logic Sheet 2).

8. Oscillator Gate goes high and generates F. D. Reset and sets and resets the Frequency Divider Flip-flops (Logic Sheet 3).

9. F. D. Reset generates S. R. Reset which sets the Serial Data Register (Logic Sheet 1).

10. Cycle holds the Oscillator Gate on after Start Time goes back high (Logic Sheet 3).

11. Through gating we will get the first Clock pulse 3.71 milliseconds after Oscillator Gate goes high (Logic Sheet 3).

12. The first Shift pulse comes the same time as the first Clock pulse (Logic Sheet 2).

13. On the 8th Shift pulse $\overline{\text{Start}}$ will go high (Logic Sheet 2).

14. When $\overline{\text{Start}}$ goes high a $\overline{\text{Stop Time}}$ pulse will be generated on the next Clock Pulse and reset the cycle latch (Logic Sheet 2).

15. Receive, Cycle and $\overline{\text{Start Time}}$ will be high and when Start goes high Receive Ready will be generated (Logic Sheet 7).

16. Receive Ready sets the Receive Cycle Flip-flop (Logic Sheet 7).

17. Receive Ready generates the $\overline{\text{Clock Start}}$ pulse (Logic Sheet 7).

18. $\overline{\text{Clock Start}}$ generates P. R. Load which enables the Line Decoding gates (Logic Sheet 4).

19. P. R. Load is fed into a time delay to reset the Receive Ready Flip-flop (Logic Sheet 7).

20. $\overline{\text{Clock Start}}$ is fed into the Output Clock trigger latch which sets Output Clock trigger latch which set Output Clock (Logic Sheet 7).

21. $\overline{\text{Clock Start}}$ also generates Register Reset which is used to reset the Print Register (Logic Sheet 5).

22. $\overline{\text{Register Reset}}$ and P. R. Load occur at the same time.

23. The Cycle Clutch Magnet Driver will go low at the same time Output Clock goes high and stay low for the same amount of time as Output Clock is high (Logic Sheet 6).

24. $\overline{\text{Print and Space}}$ will go low on the leading edge of Output Clock if it is a print character, setting the Bail Flip-flop (Logic Sheet 6).

25. When Output Clock goes back low the proper Bail Magnet Drivers will go low (Logic Sheet 6).

26. Approximately 20 milliseconds after Output Clock goes low the Filter Shutter will close resetting the Bail Flip-flop (Logic Sheet 6).

27. When the Filter Shutter closes we generate Switch Pulse Pulse Delay (Logic Sheet 7).

28. $\overline{\text{Switch Pulse Pulse Delay}}$ is fed into the Print Interlock latch to reset it (Logic Sheet 7).

29. When $\overline{\text{Switch Pulse Pulse Delay}}$ goes back high the Output Clock trigger latch will be reset (Logic Sheet 7).

4-51. TYPAMATIC/REPEAT

Presently the 1030 logic is used only when the terminal is "on-line". When the terminal is "off-line" the logic is held reset because "link-ready" is in a "low" state. Because the typamatic feature must use active logic while the terminal is off-line, the terminal has been designed so that "link-ready" is "high" even while the terminal is off-line. This poses two problems:

a. How to "reset" the terminal

b. How to keep the 'ready' and 'proceed' lamps off, how to prevent data transmission and how to keep the keyboard unlocked while the terminal is off-line or in "local" mode.

Resetting the terminal is accomplished by forming "link ready" from the auto EOA one-shot, and firing the one-shot every time a transition occurs on either the local/remote switch or the CTS line; initial reset is performed by a "power-on reset" signal at 1B5. The problems posed in (b) above are solved by generating gating levels "SDX ENABLE", "PROCEED ENABLE", "$\overline{\text{KEYBOARD SET}}$", "EOT ENABLE", and "$\overline{\text{READY}}$". These signals will be "high" only when the terminal is in "remote" and a CTS signal is being received from the coupler.

The typamatic circuit does the following:

a. Senses closure of a typamatic switch when a typamatic key is depressed and,

b. After a 100 ms delay, fires the "cycle trip" one-shot. The "cycle-trip" signal gates the contents of the print register (corresponding to the code for the last character entered from the keyboard) to the magnet drivers thus causing the printer to "repeat" the character previously entered.

c. The cycle trip pulse also fires the output clock thus simulating a normal transmit cycle, just as if the character had been tripped manually instead of electrically.

d. When the character has been transmitted the "SR EMPTY" line will permit a second "cycle trip" pulse to be generated and the above sequence of events will continue to be repeated until the typamatic key is released.

4-52. LOGIC SIGNAL INDEX

The Logic Signal Index is listed in Figure 4-155.

Signal Name	IC#	PIN#	Logic Sheet Source
1	K2	9	1
4	K3	9	1
8	K4	5	1
B	K5	5	1
$\overline{B}$	K5	6	1
$\overline{A}$	K4	8	1
$\overline{8}$	K4	6	1
$\overline{4}$	K3	8	1
$\overline{2}$	K3	6	1
$\overline{1}$	K2	8	1
$\overline{C}$	K2	6	1
$\overline{\text{Bk. Space MD}}$	R3	14	6
Bail MD Enable	U3	11	6
$\overline{\text{Bail F. F.}}$	T3	14	6
$\overline{\text{Bail T2 MD}}$	S5	5	6
$\overline{\text{Bail T1 MD}}$	S5	2	6
$\overline{\text{Bail R2A MD}}$	S5	14	6
$\overline{\text{Bail R1 MD}}$	S5	11	6
$\overline{\text{Bail R2 MD}}$	T5	5	6

Signal Name	IC#	PIN#	Logic Sheet Source
$\overline{\text{Bail R-5 MD}}$	T5	2	6
$\overline{\text{Check F. F.}}$	U1	5	9
Check Lamp	A5	–	9
Clock	H3	5	3
$\overline{\text{Clock}}$	D3	2	3
$\overline{\text{Clear to Send}}$	B3	–	11
C.R./L.F. MD	S4	6	6
$\overline{\text{C. D. Switch}}$	T2	14	9
$\overline{\text{Cycle Clutch MD}}$	S4	14	6
Cycle	J3	2	2
$\overline{\text{Cycle}}$	H2	2	2
$\overline{\text{Cycle Trip}}$	B2	2	11
$\overline{\text{Check}}$	L1	14	7
$\overline{\text{Clock Start}}$	P1	14	7
$\overline{\text{E. O. T.}}$	R1	6	10
E. O. T. Enable	B2	4	11
$\overline{\text{E. O. A.}}$	R1	2	10
E. O. A./ E. O. T. Latch	M1	14	10

Figure 4-155. (Sheet 1 of 3)

Signal Name	IC#	PIN#	Logic Sheet Source
$\overline{\text{F. D. Reset}}$	E2	2	3
$\overline{\text{Index MD}}$	S3	14	6
$\overline{\text{Interlock}}$	W2	6	7
$\overline{\text{Interrupt Trigger}}$	L2	2	9
$\overline{\text{Interrupt}}$	K1	11	9
$\overline{\text{Initiate}}$	C2	6	11
Keyboard	T1	14	10
$\overline{\text{Keyboard}}$	M1	11	10
Keyboard Latch	M2	14	10
$\overline{\text{Keyboard Lock MD}}$	M1	5	10
$\overline{\text{Keyboard Set}}$	B2	4	11
$\overline{\text{Keyboard Rdy}}$	H5	12	2
Link Rdy	L5	14	11
$\overline{\text{Link Rdy}}$	B1	6	11
$\overline{\text{Load 1}}$	J3	14	4
$\overline{\text{Load 2}}$	N3	2	4
$\overline{\text{Load 4}}$	N2	2	4
$\overline{\text{Load 8}}$	N2	5	4
$\overline{\text{Load A}}$	P3	2	4
$\overline{\text{Load B}}$	R4	2	4
Oprn. & Cntl.	S3	6	6
Osc. Gate	F3	2	3
$\overline{\text{Osc. Gate}}$	D3	14	3
Output Clock	V2	4	7

Signal Name	IC#	PIN#	Logic Sheet Source
$\overline{\text{Parity}}$	D5	8	9
$\overline{\text{Parity Bit}}$	L4	14	9
$\overline{\text{Print \& Space}}$	U4	5	6
Proceed Enable	B2	4	11
Proceed Lamp	M1	2	10
P. R. Load	F4	14	7
$\overline{\text{P. O. R.}}$	(Check Board Level)		11
Receive	F4	5	2
$\overline{\text{Reset Inhibit}}$	A2	9	11
$\overline{\text{R2A Load}}$	J3	5	4
$\overline{\text{R1 Load}}$	J3	11	4
$\overline{\text{R2 Load}}$	J4	14	4
$\overline{\text{R-5 Load}}$	M4	2	4
R-5	M3	14	5
$\overline{\text{R-5}}$	M3	11	5
R2A	P4	2	5
$\overline{\text{R2A}}$	P4	5	5
R2	N4	14	5
$\overline{\text{R2}}$	N4	5	5
R1	N3	14	5
$\overline{\text{R1}}$	N3	11	5
Rcv. Cycle	F5	3	7
$\overline{\text{Rcv. Cycle}}$	F5	12	7
Ready Lamp	B1	11	11

Figure 4-155. (Sheet 2 of 3)

Signal Name	IC#	PIN#	Logic Sheet Source
$\overline{\text{Reg. Reset}}$	W1	11	7
$\overline{\text{S. R. Reset}}$	E2	14	2
$\overline{\text{S. R. Load}}$	E1	11	2
S. R. Load	E1	14	2
$\overline{\text{Serial Data Xmt}}$	J1	3	2
S. D. Rcv.	H3	14	2
$\overline{\text{S. D. Rcv.}}$	H3	11	2
SDX Enable	B2	4	11
$\overline{\text{S. R. Empty}}$	J1	5	4
S. R. Empty	L4	2	4
Shift	J1	11	2
$\overline{\text{Shift}}$	L5	2	2
$\overline{\text{Shift MD}}$	W4	14	8
Start	K5	9	1
$\overline{\text{Start}}$	K5	8	1

Signal Name	IC#	PIN#	Logic Sheet Source
$\overline{\text{Start Time}}$	F2	12	2
$\overline{\text{Space MD}}$	T5	11	6
Switches	N5	14	5
Sw. P.P.D.	U2	2	7
$\overline{\text{Sw. P.P.D.}}$	U1	11	7
Text	N1	3	10
$\overline{\text{Text}}$	N1	12	10
$\overline{\text{Tab MD}}$	R3	2	6
T2	R4	14	5
T1	P3	14	5
$\overline{\text{T1}}$	P3	5	5
T2	R4	11	5
T2 Load	J5	11	4
T1 Load	J5	14	4
U. S.	W5	5	8
Xmt.	E4	11	2

Figure 4-155. (Sheet 3 of 3)

4-53. MODEM.

The following theory applies to both the plugable and the cabled 9030 type modem.

4-54. INTRODUCTION

A device capable of data modulation and demodulation (modem) is required to interface between the Data Terminal and the telephone line. The transmit and receive data from and to the data Terminal is digital. The logic levels can be 0 and +5 Volts if the data comes directly from the logic, or −12 and +12 if the data is first passed through EIA conditioning circuits.

Transmitted data is converted by the modem to either a 1070 Hz or 1279 Hz signal depending upon the logic level of the data. This modulation process is known as Frequency Shift Keying, (FSK). The transmitted FSK signal is then coupled to the telephone line by electrical coupling, or by acoustical coupling.

The received data from the telephone line is also a FSK signal but the two frequencies are 2025 Hz and 2225 Hz. This received signal is converted to logic levels (demodulated) and passed on to the Data Terminal. The received data is also coupled from the telephone line to the modem by either electrical coupling or acoustic coupling.

The modem described in this manual is capable of receiving information simultaneous with transmission of data. This feature is commonly known as "duplex" operation, as opposed to "half-duplex" operation where a modem is either transmitting *or* receiving at any given time.

In addition to the modulation and demodulation processes (via either electrical or acoustical coupling to the telephone line), the modem may provide various control signals.

4-55. DESCRIPTION

The modem described here is used with COPE 1030 and COPE 1035, Conversational Mode, Input/Output Communication Terminal. It is located on a single circuit board within the terminal itself. Power to the modem is provided by the terminal power supply. A functional block diagram of the modem is shown in Figure 4-156. The paragraphs which follow will briefly describe the operation using the block diagram as a reference.

4-56. TRANSMIT

The transmit section of the modem has only one major circuit, the FSK Oscillator. The Oscillator is capable of generating two discrete frequencies. If the transmitted data from the terminal is a logical zero of low level, the oscillator generates the mark frequency (1270 Hz). When the data line is high, the space frequency of (1070 Hz) is generated. The output of the oscillator is inhibited in the absence of a carrier frequency in the receive channel. This is indicated by the inhibit input to the FSK oscillator from the carrier detector. The block diagram shows that the output from the oscillator goes to both the speaker and to the primary of a transformer, via the level adjust circuit. In practice, only one or the other is used. If the modem output (and input) is connected electrically to a two wire telephone data access arrangement, the acoustic package would be disconnected. If the acoustic package is used, the electrical coupling to the data access arrangement is disconnected. Selection of one or the other is accomplished by placing either the acoustic package connector at the back of the 1030 or 1035 terminal.

When electrical coupling is used, it may be necessary to adjust the level of the transmitted signal to the data access arrangement. The average power of the signal transmitted by the modem should not exceed a level prescribed by the telephone company at the time of installation. This level will range between 0 dbm and −12 dbm into 600 ohms and will be specified in steps of 1 db on the access arrangement.

No adjustment is necessary when acoustical coupling to the telephone line is used.

Note that an EIA output circuit is also provided so that an external modem or data set can be used if desired.

4-57. RECEIVE

The receive portion of the modem is considerably more complex than the transmit section. The receive section must:

a. Be compatible with both electrical coupling or acoustical coupling to the telephone line.

b. Provide amplification of the received FSK signal to the level necessary for dependable demodulation. (Gains are different for electrical and acoustical coupling).

c. Give good noise rejection, so a low error rate can be achieved.

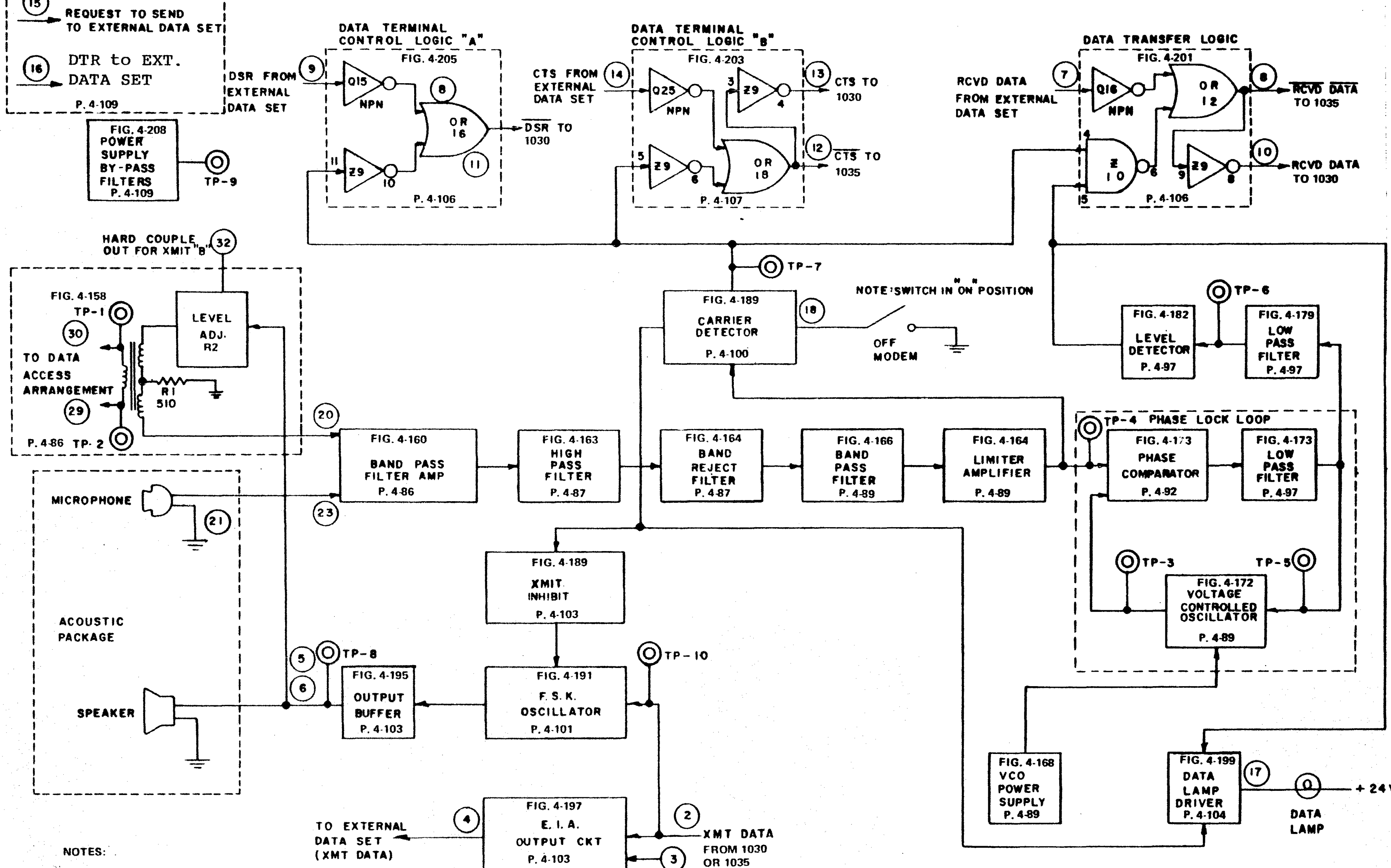
d. Provide high transmit FSK frequency rejection so that it does not interfere with the received signal.

e. Demodulate the FSK signal and provide a Received Data output compatible with the 1030 and 1035.

f. Detect the existence of the received FSK signal and provide Clear To Send and Data Set Ready signals compatible with the 1030 and 1035, as well as provide gating to the Received Data output and the transmit FSK oscillator.

The block diagram of Figure 4-156 shows a Buffer Amplifier connected to a center tapped transformer. This is the input to the receive channel when the modem is electrically coupled to the telephone line. When acoustic coupling is used, the output from the microphone is passed through a relatively high gain amplifier. The amplifier provides approximately the same level at the output of the Band Pass Filter amplifier as the electrical coupling input. Selection of either type of coupling is accomplished by inserting either the acoustic coupling

MODEM BLOCK DIAGRAM



NOTES:

MODEM CIRCUIT CARD USED IN 1030 AND 1035

CIRCLED NUMBERS INDICATE SCOPE POINTS FOUND IN TROUBLESHOOTING CHARTS IN SECTION 5

Figure 4-156.

connector plug or the electrical coupling connector plug at the back of the 1030 or 1035 terminal.

The Band Pass Filter Amplifier has two functions. First, it increases the level of the received FSK signal. Second, it supresses noise and interfering signals which are outside of the received FSK signal band. It is an active filter of the infinite gain single feedback type. Its selectivity and other characteristics are of a non-critical nature due to the demodulation technique used.

During Duplex operation, data is being transmitted simultaneous with the reception of data. When the modem is coupled acoustically or electrically by a two wire arrangement, transmitted data is coupled into the receive channel. The receive channel must therefore provide circuitry which rejects the transmitted signals. The Band Reject Circuit shown in the block diagram is for this purpose. Attenuation of the second harmonic of the transmit signal is accomplished by a network centered at 2540 Hz.

The output of the Band Reject Circuit feeds the Limiting Amplifier. The Limiting Amplifier simply generates a bipolar rectangular signal for signal levels above a predetermined level. This signal characteristic provides a linear transfer characteristic of the phase comparator.

The heart of the receive portion of the modem is the Phase Lock Loop which is used as a frequency discriminator. The characteristics of this type of phase locking circuit make it well suited for the application of FSK demodulation. This circuit is capable of extracting information from a signal with low signal to noise ratios. Additionally, it performs as a very selective band pass filter, a feature that substantially reduces the predemodulation filtering requirements of the modem. Initial calibration of the circuit is extremely simple, because only one adjustment is required.

Operation of the Phase Lock Loop as a frequency discriminator is as follows: The FSK signal appears at the output of the Limiter Amplifier. The frequency of this signal is compared to the frequency of the Voltage Controlled Oscillator. The result of this comparison is an output voltage from the Phase Comparator which is proportional to the phase difference of the incoming frequency and the frequency of the Voltage Controlled Oscillator. This voltage is passed through the Low Pass Filter, which removes the carrier frequency components and establishes the loop band width. The output voltage of the filter adjusts the frequency of the Voltage Controlled Oscillator in such a direction so as to decrease the phase difference. This forces the frequency of the Voltage Controlled Oscillator to be identical to the frequency of the incoming signal. In other words, the Voltage Controlled Oscillator is phase locked with the incoming signal. As the frequency of the incoming signal changes, the output voltage of the Low Pass Filter must also change in order to keep the frequency of the Voltage Controlled Oscillator in phase with the input frequency. It is apparent then, that frequency changes of the input signal are converted to voltage changes at the output of the Low Pass Filter in the loop. This is the basic demodulation process.

As stated previously, the Phase Lock Loop also acts as a band pass filter. The Low Pass Filter in the loop determines, for the most part, the band width of the loop. Information centered about the carrier frequency is translated by the loop to information centered about zero frequency. The loop will reject frequencies greater than the loop band width. So in effect, the loop looks like a band pass filter whose center frequency is the same as the frequency of the voltage controlled oscillator. Several very important features are therefore evident.

a. A very selective band pass filter is obtained as an integral part of the demodulator.

b. The center frequency of the equivalent band pass filter tracks the incoming signal over a limited input signal range.

c. The center frequency can be changed relatively easily by changing the Voltage Controlled Oscillator frequency.

d. Extremely narrow band widths can be obtained with non-critical components.

e. Independent adjustment of band width and center frequency is possible.

f. Predemodulation filtering requirements are greatly reduced since selectivity is an inherent part of the phase lock loop FSK demodulator.

g. Since the information has been translated to zero frequency, additional post demodulation low pass filtering can be used to further enhance the selectivity.

For demodulating the FSK signals, the Voltage Controlled Oscillator is set to 2125 Hz with the output of the low pass filter at zero volts. The oscillator will then track the 2-25 Hz and 2225 Hz FSK signal resulting in voltage changes above and below zero at the loop filter output. This demodulated signal is now passed through a post demodulation Low Pass Filter which removes noise outside of its pass band. The output of this filter feeds a Level Detector with Hysteresis to reject additional noise. The output of the level detector is the received data.

The data is sent to either the 1030 or 1035 by way of the logic shown in Figure 4-197.

The Nand gate does not allow data to pass unless there is an output from the Carrier Detector. The Carrier Detector determines if an FSK signal is present. If there is, data is allowed to pass, if not, the data output is inhibited since it is not valid data. Note that an external Data Set can be used since data from our modem, OR received data from an external data set is passed. This is also true of the Clear to Send and the Data Set Ready outputs which are derived from the Carrier Detector.

As shown in Figure 4-156, a data lamp driver also receives the data signal. The lamp flashes on and off at the data rate and gives a visual indication that data is being received.

Turning the modem ON or OFF is accomplished by the switch connected to the Carrier Detector Output. Closing the contacts disables the Carrier Detector which inhibits the FSK transmit Oscillator and the Received Data Out. It also inhibits the CTS and DSR signals.

4-58. SIGNAL LEVEL AND TRANSMISSION LINE CHARACTERISTICS

a. Prior to initiating a description of the Datel modulator/demodulator (modem) circuitry, we will examine both the form of the incoming data and the condition under which the data arrives. Figure 4-157 displays the spectrum of the incoming signal as seen by the receiving section of the modem.

b. Transmission line and signal level characteristics as seen by the modem are summarized below.

1. Input is from the Acoustic Coupler or Data Access Arrangement.

(a) The receive signal level range is from −6 to −30 dbm and is typically −25 dbm.

(b) A = typical noise level of −42 dbm.

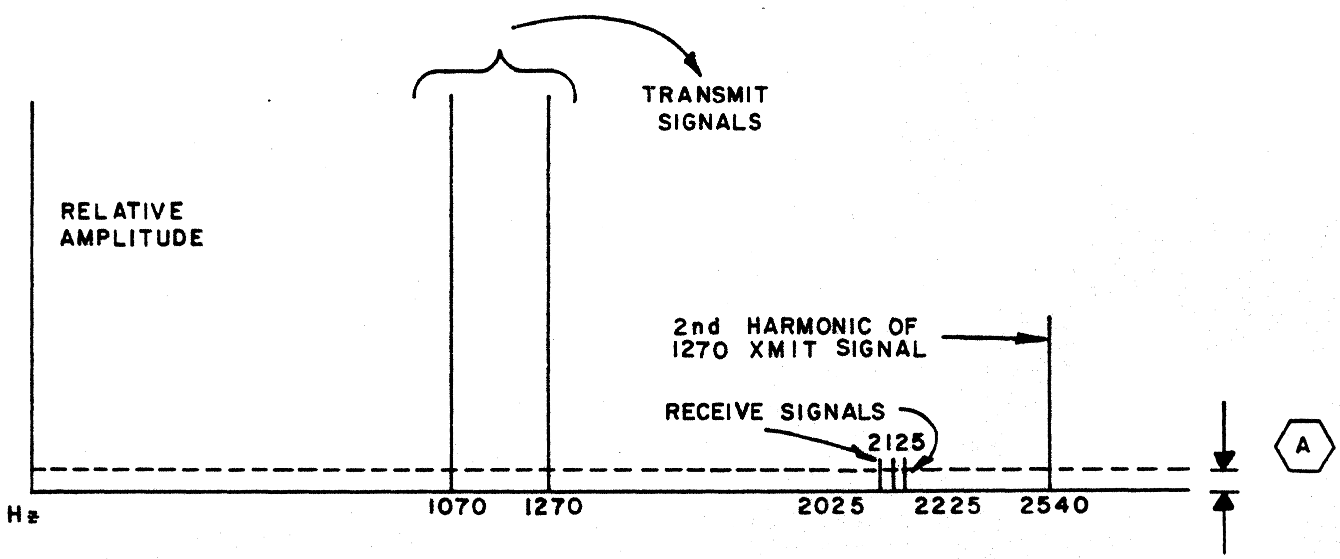


Figure 4-157.

2. The line band width: 300 Hz to 3000 Hz compatible with WE 103 A2 Data Phone.

3. The received frequencies are 2225 Hz for a mark and 2025 Hz for a space.

4. The quiescent condition of the input is the mark frequency of 2225 Hz.

5. The transmitted frequencies are 1270 Hz for a mark and 1070 Hz for a space.

6. The quiescent condition of the output is the mark frequency of 1270 Hz.

4-59. ACOUSTIC OR DIRECT COUPLING

a. When the signal arrives at the modem it is coupled into the first signal conditioning circuit by one of two methods.

1. Through the telephone company supplied Data Access Arrangement (DAA), and then into the Datel supplied coupler circuit as shown in Figure 4-158.

2. Through an acoustic package into the microphone input shown on the Band Pass Filter Amplifier circuit (Figure 4-160).

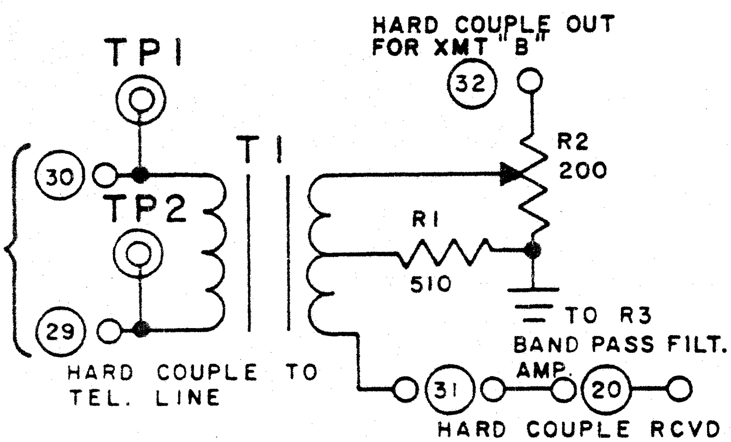


Figure 4-158.

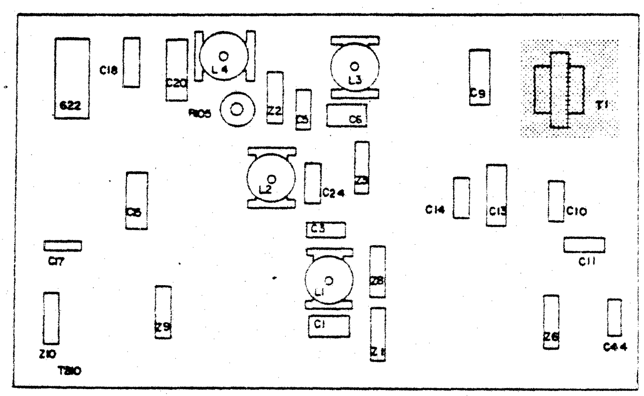


Figure 4-159.

b. If the modem is hard coupled to the DAA, the signal appears on the secondary of T1 as depicted in Figure 4-157, and from there to the Band Pass Filter Amplifier circuit (Figure 4-160).

c. If the signals are acoustically coupled they appear at the base of Q1, and from there to Point A of the Band Pass Filter Amplifier (Figure 4-160).

d. The variable resistor (r2) shown in Figure 4-158 is utilized to adjust the transmit output level to the DAA.

e. The circled numbers on Figure 4-158, and on all the rest of the schematics in this manual, refer to the actual termination points on the modem circuit board.

4-60. BAND PASS FILTER AMPLIFIER (BPFA)

a. The Band Pass Filter Amplifier (BPFA) has two separate functions: first, to pass and amplify the MARK and SPACE signals arriving on that portion of the band centered around 2125 Hz and second, to suppress all other frequencies.

b. If the signals are acoustically coupled to the BPTA (as shown in Figure 4-160), they appear at the base of Q1, which serves as a buffer.

c. The network consisting of L1, C1, C2, R4, Z1 and R7 is tuned, via L1, so that the center frequency of the pass band is set at 2125 Hz. The width of the pass band is approximately 260 Hz at 3 db down.

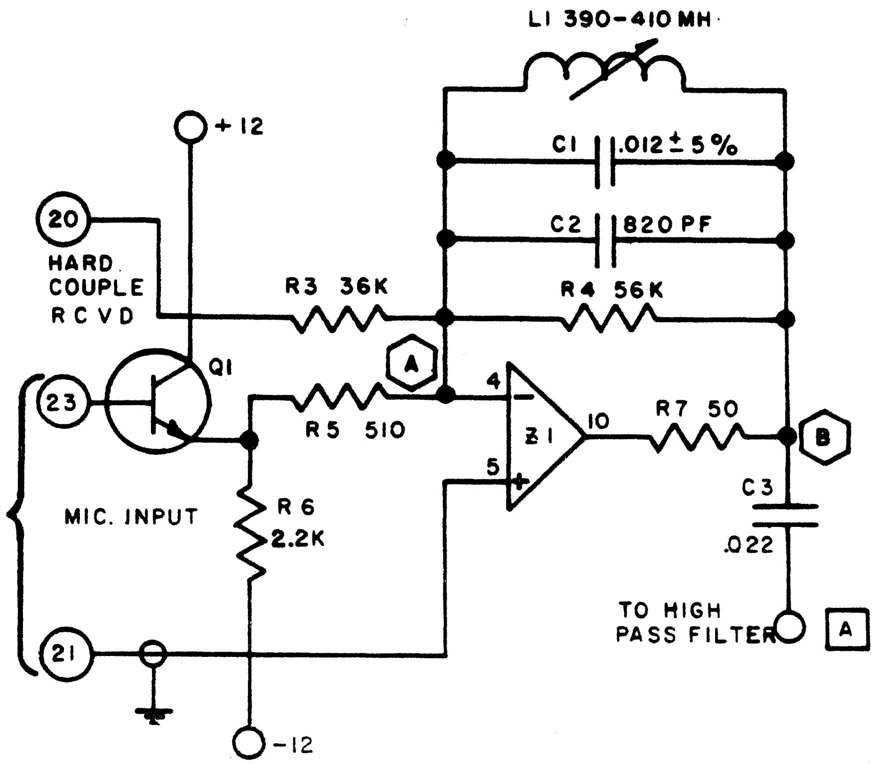


Figure 4-160.

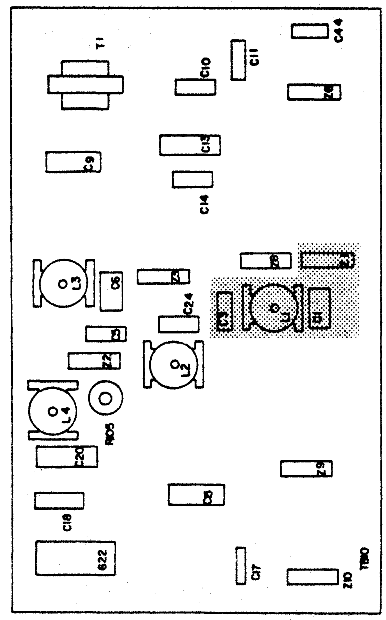


Figure 4-161.

d. Starting at point B on the BPFA, the signal conditioning process is started by:

1. Attenuating all signals outside the 2000 Hz to 2250 Hz band.

2. Amplifying the signals centered around 2125 Hz.

4-61. HIGH PASS FILTER (HPF)

a. The main purpose of the High Pass Filter, illustrated in Figure 4-163, is to pass the 2025 and 2125 Hz signals and suppress the 1070 Hz and 1270 Hz signals. The transmit signals are coupled via transformer T1 secondary, into the receiver section of the modem during transmission.

b. The impedance characteristics of the RC network, plus the impedance of Q2 as an emitter follower, combined with the feedback through R8, results in the 12db/octave cutoff point at 2000.

4-62. BAND REJECT FILTER

a. Function:

1. Suppress the 2540 Hz second harmonic of the 1270 Hz transmit (Mark) carrier frequency.

2. Amplify the 2225 Hz (Mark) and 2025 Hz (Space) frequencies.

b. The signals from the High Pass Filter are coupled through C24, Figure 4-164, to the input to filter network L2, C5, and R12 (point A). Inductor L2 is utilized to tune the circuit to 2540 Hz, therefore, signals of this frequency are rejected by the high impedance of the tuned network.

c. Amplification of the signals passed by the L2-C5 network is carried out by Z2.

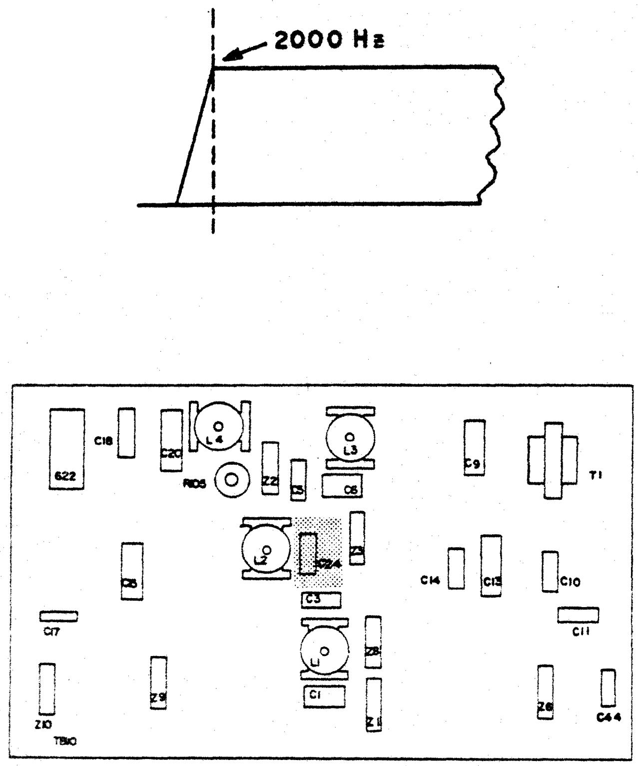


Figure 4-162.

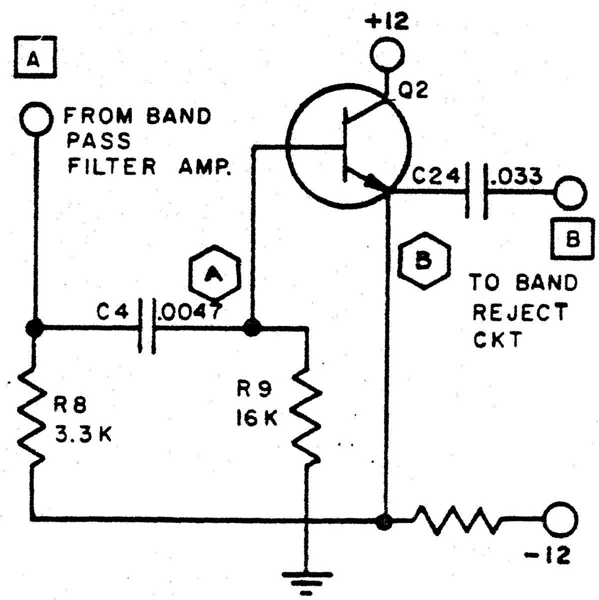


Figure 4-163.

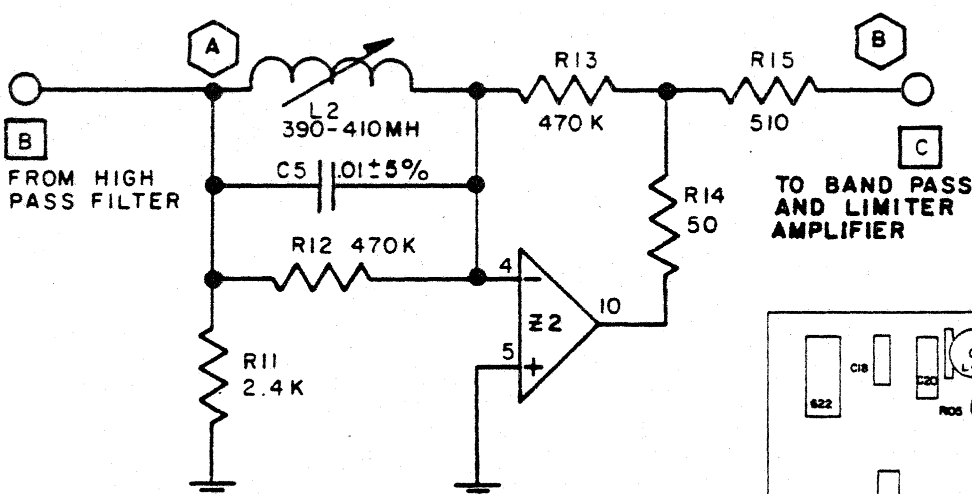


Figure 4-164.

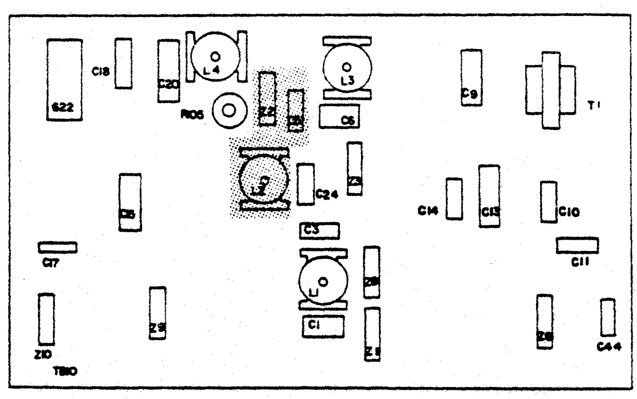


Figure 4-165.

4-63. BAND PASS FILTER AND LIMITER AMPLIFIER (BPF) (LAmp)

a. The output of the BPF is coupled to the Limiter Amplifier (LAmp) via the Band Pass Filter (BPF) made up of R15, L3 and C6. This filter:

1. Has minimum impedance at 2125 Hz.

2. Therefore rejects currents of all other frequencies.

b. Z3 is over driven so that we get a large signal at point B. Diodes VR3 and VR4 are 9.1 Zener diodes wired back to back, so that at point B we get a bi-polar limiting action. This limiting action is a result of the large signal at the Z3 output causing the diodes to conduct in the reverse direction.This effectively shorts the feedback loop, RADICALLY DECREASING the gain of the circuit.

c. The incoming signal, either a MARK signal of 2225 Hz or a SPACE signal of 2025 Hz, has now been amplified and conditioned to the extent that it now represents information that can be correctly translated by the rest of the modem circuitry as data.

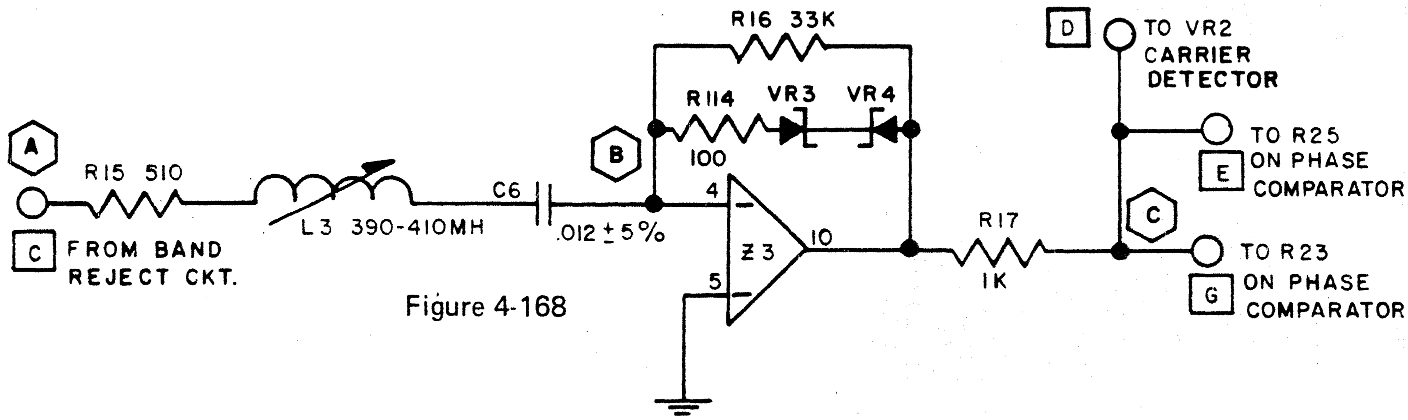


Figure 4-166.

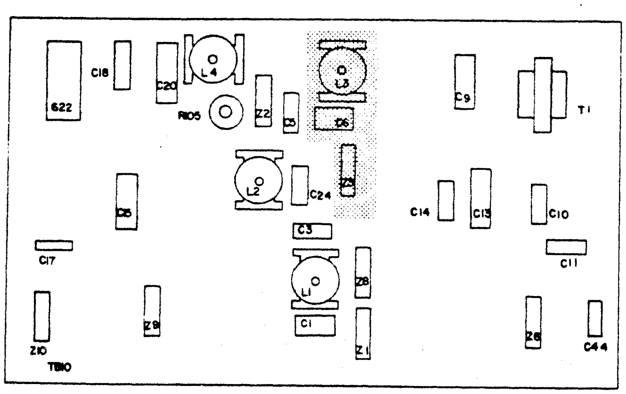


Figure 4-167.

4-64. POWER SUPPLY VOLTAGE CONTROLLED OSCILLATOR (PSVCO)

a. The VCO is a voltage sensitive circuit. Therefore, the supply voltages to this circuit must be closely regulated.

b. Close inspection of the VCO PS (Figure 4-170) indicates that it is not a supply in the true sense of the word. It is a regulating system for the voltages supplied to the VCO from an external supply.

c. The regulating characteristics of the circuit are established by Zener Diodes VR5, R33, R35, R37 and R40. Zener Diode VR5 establishes a fixed reference of +6.2 VDC at point F on Figure 4-168.

d. As the +VDC supply attempts to go more positive, point B tries to go more positive. Since this positive going change is fed back to the inverting input of Z6, the output then goes negative at point D.

e. Q6 is turned on harder causing a larger IR drop across R41, and has therefore caused a negative voltage change at point A which offsets the attempted rise in voltage.

4-65. VOLTAGE CONTROLLED OSCILLATOR (VCO)

a. Although this circuit is part of the Phase Lock Loop, the following description will be developed as if the VCO were a "stand alone circuit". The discussion defining the circuit's dynamic operating characteristics,

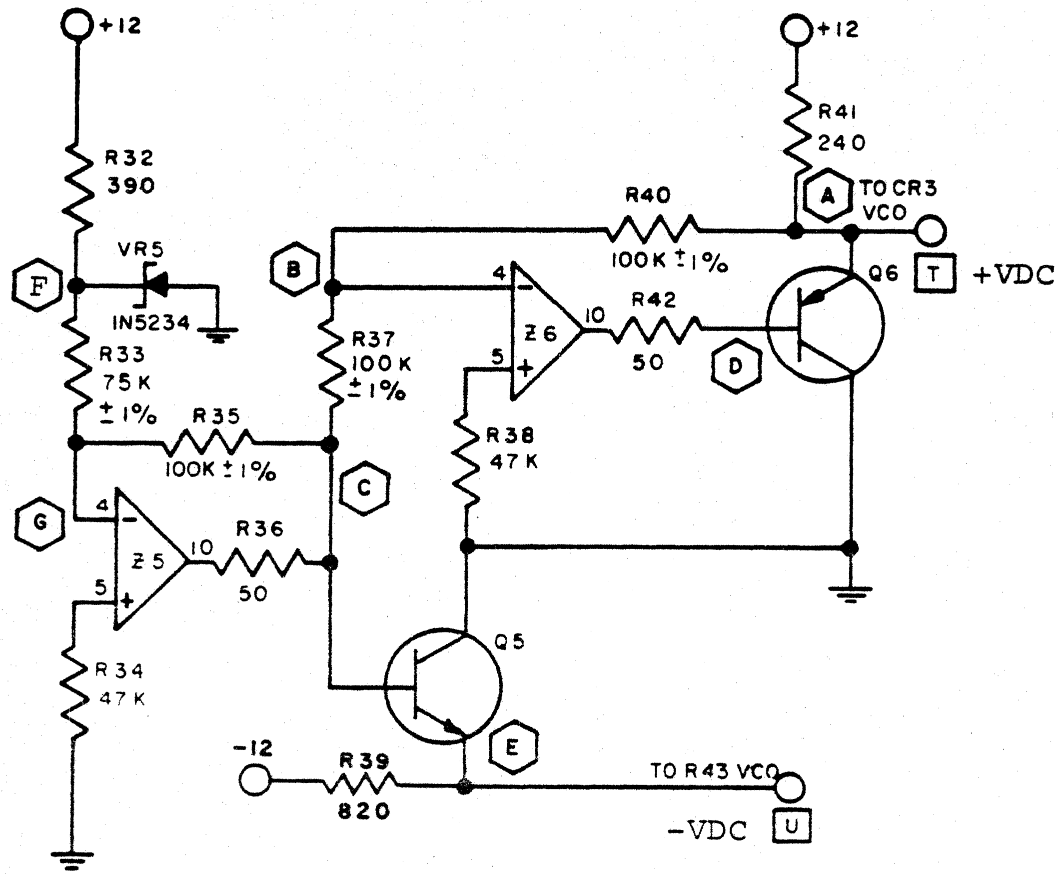


Figure 4-168.

with respect to the other parts of the Phase Lock Loop, will be found in the section dealing with the overall operation of the Loop.

b. Looking at Figure 4-170, we see that the circuit is of a very straight forward design. There are two features that are of importance in the operation of this oscillator. The first feature is the "latch safe-guard" portion of the circuit which guarantees that the VCO will not "latch up" and fail to oscillate as a result of transistors Q7 and Q11 attempting to turn on simultaneously. The second feature is the circuit's ability to change its oscillation frequency, within specified limits, as a result of a varying DC level applied to the bases of Q8 and Q9.

c. In circuits of this type there is always a possibility that the two output transistors (in this case Q7 and Q11) will attempt to turn ON simultaneously when system power is turned on. The portions of the VCO circuit consisting of Q10, R47, C12, R48, CR7, CR8 and CR15 make up the "latch-guard" circuit.

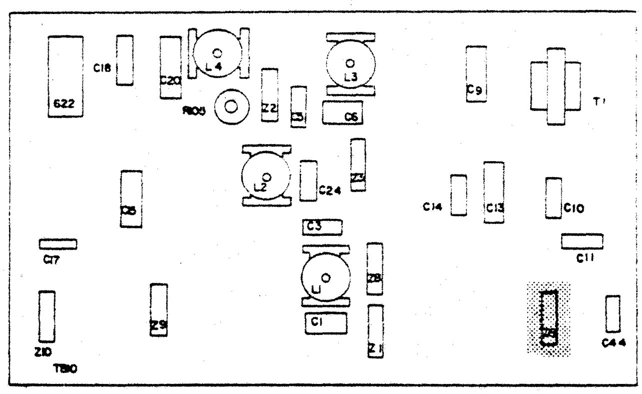


Figure 4-169.

d. During normal operation points a and b are alternately swinging between approximately ±10 VDC. When Q7 is in the OFF condition there is −10 VDC, at point a. This forward biases CR7 and back biases CR8. The current path is from −12 VDC through R44, Cr7, R48 to +12 VDC. As a result of CR8 being back biased, the base of Q10 is open circuited and Q10 is OFF. The identical condition occurs when Q11 is OFF and Q7 is ON. In the latter case, the current path is from −12 VDC, through R51, CR15, R48 to +12 VDC. The result is CR8 is back biased and Q10 is OFF.

e. Now that we have seen what Q10 cannot do when the VCO operates properly, let's take a look at how Q10 solves the latch-up problem:

1. Q7 and Q11 attempt simultaneous turn on. Therefore:

2. +12 VDC appears at points a and b, *back biasing* CR7 and CR15.

3. This condition allows CR8 to become forward biased through R49, R47, CR8, R48 to +12 VDC.

4. As a result of this and the IR drop across R47, Q10 then turns ON and

5. tries to place +12 VDC on the emitter of Q9, for a net +2 VDC *back bias.*

6. This allows the forward biased Q8 to turn ON hard which in turn keeps Q11 on.

7. Since Q9 is now OFF, so is Q7 and point a is at −12 VDC. CR7 is forward biased,

8. CR8 is back biased,

9. and Q10 must turn OFF.

f. The center frequency of 2125 Hz is determined by C10, C11, R43, R46 and R49. This frequency is established by setting the bases of Q8 and Q9 to *zero* volts DC. R43 is then adjusted to "trim up" the C10-R46 and C11-R49 charging paths.

g. The three most important operating characteristics of the Voltage Controlled Oscillator are:

1. An inherent desire to oscillate at a 2125 Hz frequency at ZERO volts base bias.

2. An ability to very rapidly increase frequency of oscillation as a positive DC bias is applied to the bases of Q8 and Q9.

3. An ability to very rapidly decrease frequency of oscillation as a negative DC bias is applied to the bases of Q8 and Q9.

h. When the base bias of Q8 and Q9 is increased or decreased, the conduction of these transistors is either increased or decreased. This increases or decreases the discharging period of C10 and C11. This controls the time that Q7 or Q11 is held in the OFF state.

i. This chain of events initiate the increase or decrease in frequency. The VCO will maintain the increase in oscillator frequency as long as a *positive* level of DC bias is applied to Q8 and Q9.

and

will maintain a *decrease* in oscillator frequency as long as a *negative* level of DC bias is applied to Q8 and Q9.

j. Before proceeding with the detailed explanation of the MARK/SPACE detection process, let's summarize our knowledge of the modem to this point:

1. Incoming data is coupled, either acoustically or through a telephone company supplied DAA to the first stage of filtering and amplification.

2. The Band Pass Filter Amplifier passes the band of incoming frequencies centered around 2125 Hz and attenuates those that lay more than 125 Hz either side of that center frequency.

3. The High Pass Filter passes and amplifies those signals greater than 2000 Hz and attenuates those that are less than 2000 Hz.

4. The Band Reject Filter is specifically designed to reject the frequency of 2540 Hz; the second harmonic of the 1270 Hz Mark signal that is being transmitted at the same instant in time that incoming signals are being received by the modem. The BRF also amplifies the incoming 2025 and 2225 Hz signals.

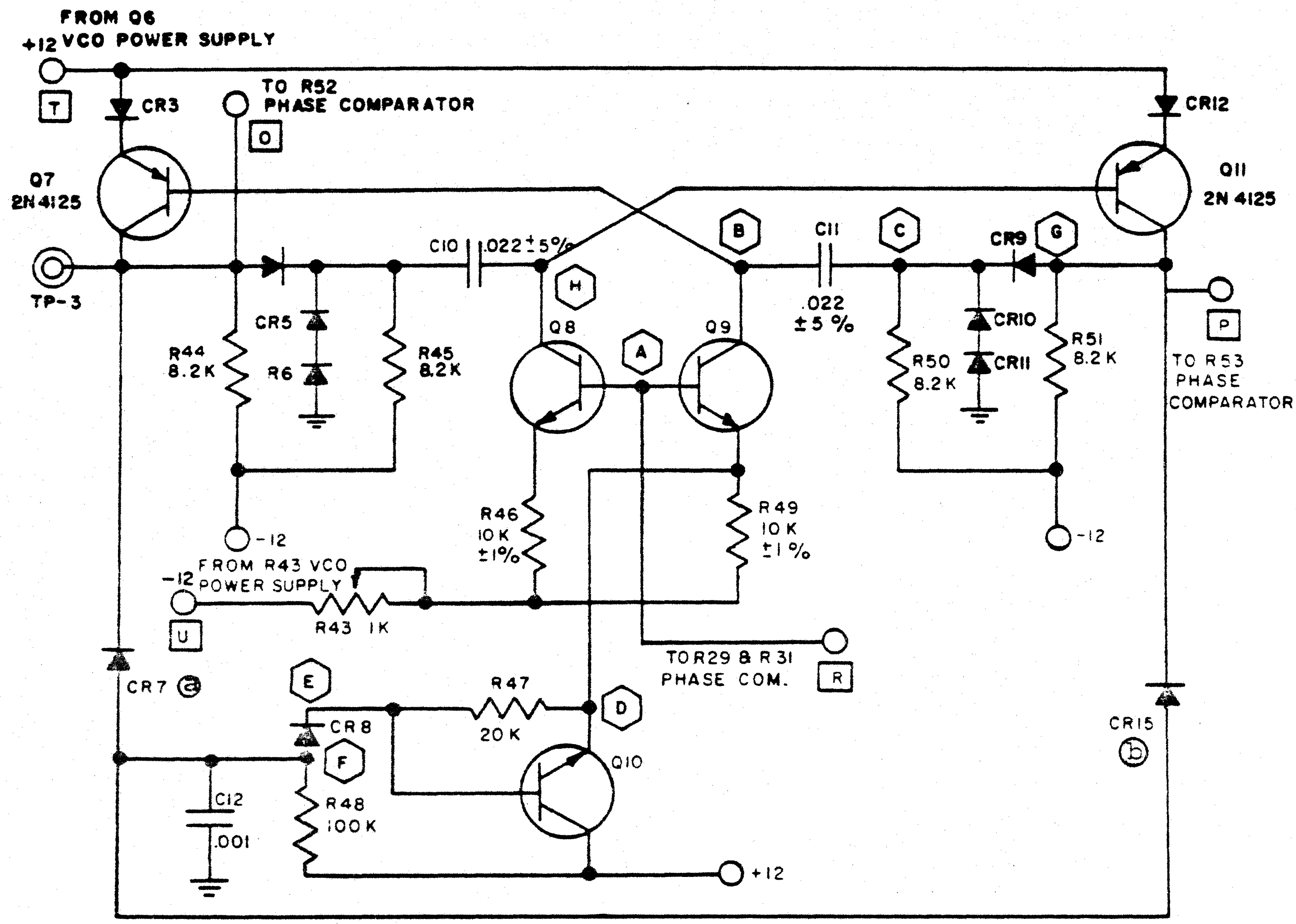


Figure 4-172

Figure 4-170.

5. The Band Pass Circuit further attenuates unwanted signals.

6. The Limiter Amplifier converts the incoming signal from a sinusoidal wave form (sine wave) to a bi-polar rectangular wave form (square wave).

7. The Voltage Controlled Oscillator Power Supply provides closely regulated supply voltages to the VCO.

8. The Voltage Controlled Oscillator helps the Phase Comparator convert frequency changes to voltage changes in the Phase Lock Loop.

4-66. PHASE COMPARATOR

a. Refer to Figure 4-173 and 4-174 for this discussion.

b. Assume that the incoming signal to the Phase Comparator (at points E and G) is 2125 Hz. Further assume that the VCO is oscillating at 2125 Hz. Then Figure 4-175 will describe what happens to the Phase Lock Loop to *keep* the loop output at zero VDC. The VCO is alternately turning Q12 and Q13 ON and OFF. Therefore, points C and D are being alternately grounded.

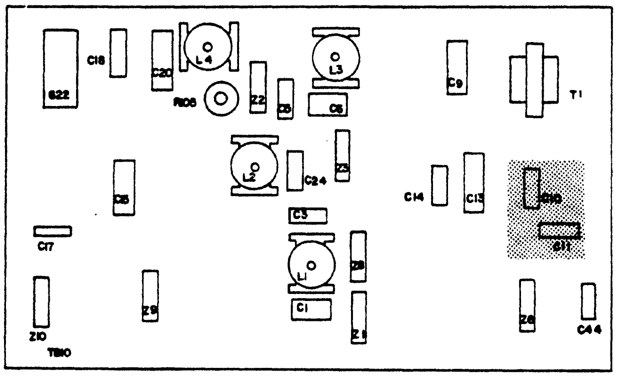


Figure 4-171.

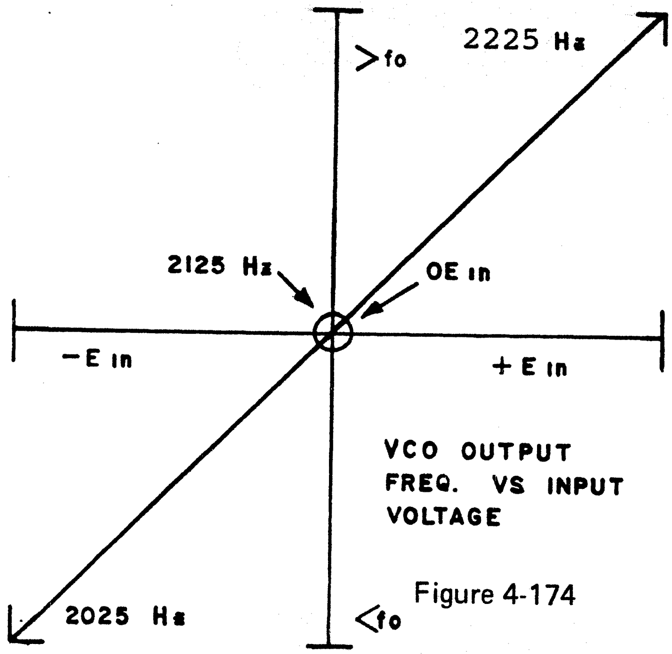


Figure 4-172.

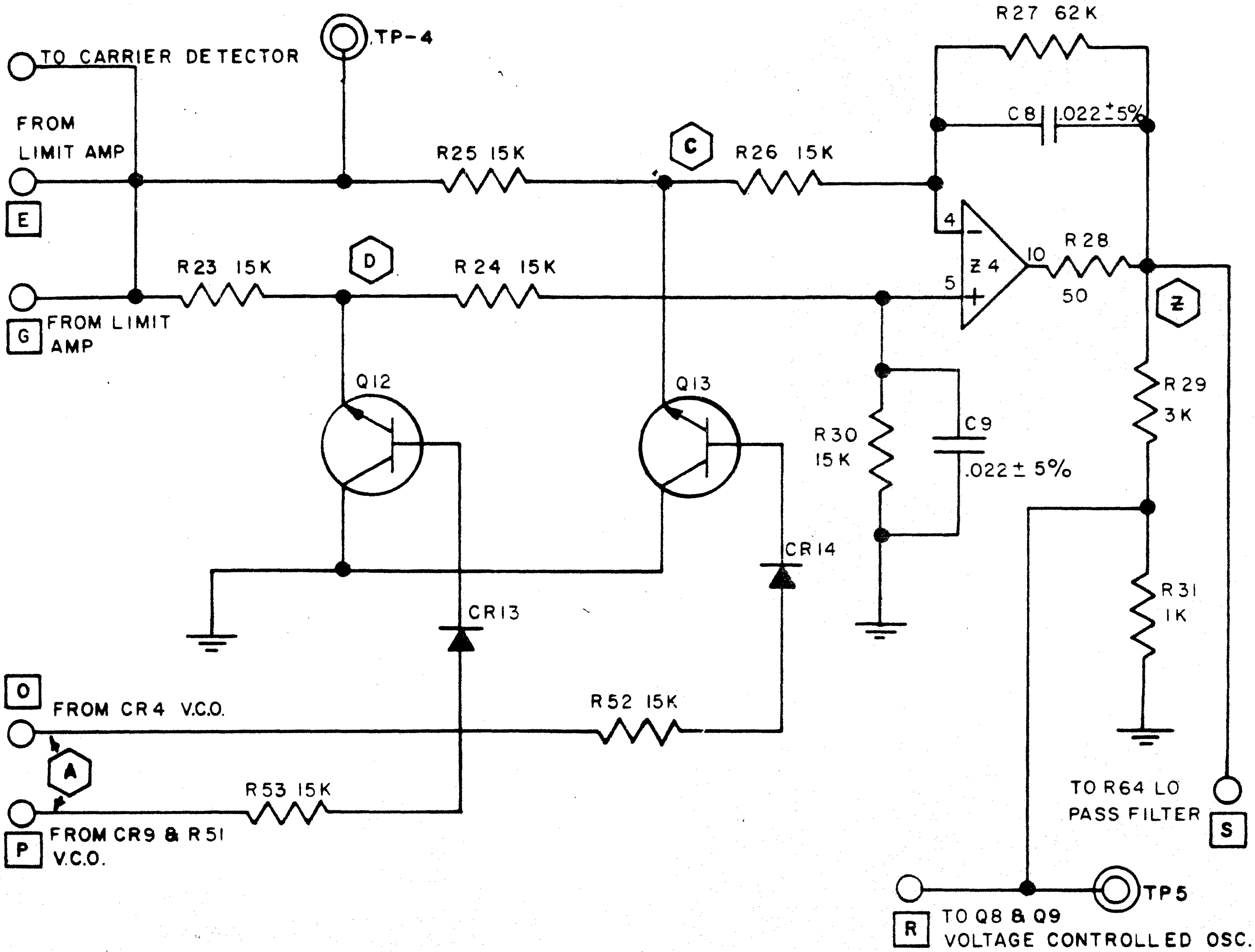


Figure 4-173.

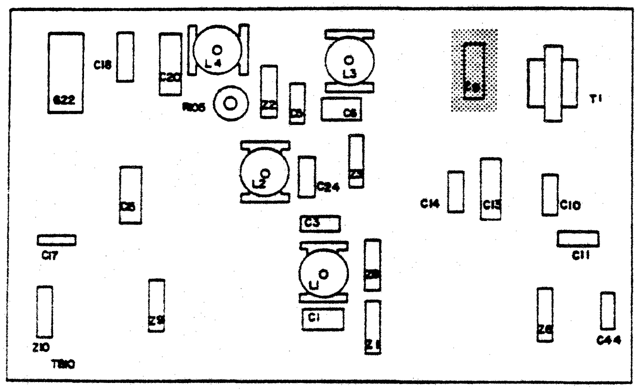


Figure 4-174.

c. We can see that as a result of the VCO actions in Figure 4-175 that only alternate portions of the carrier signal are allowed to reach each input to OA Z4. The portion allowed to reach pin 4 is *inverted* by Z4 (pin 4 is the inverting input). The result of the inversion of the alternate portion of the signal at point F is shown in Figure 4-175. Because there is as much energy in the positive direction as there is in the negative direction (represented by the shaded areas) the actual DC output is *zero*. This occurs when the VCO signal and the carrier signal *are exactly 90°* out of phase.

d. Figure 4-176 and 4-177 illustrate what happens if the incoming carrier signal is *not* 2125 Hz. Figure 4-175 illustrates an input signal of 2025 Hz and Figure 4-177 illustrates an input signal of 2225 Hz.

e. Figure 4-176 shows the input signal and the VCO signal *less than 90 degrees* out of phase.

f. We can see by Figure 4-175 that if the incoming signal frequency is *lower* than 2125 Hz that the resulting phase difference will produce an average *negative* DC output at point F. In Figure 4-176 we see that if the

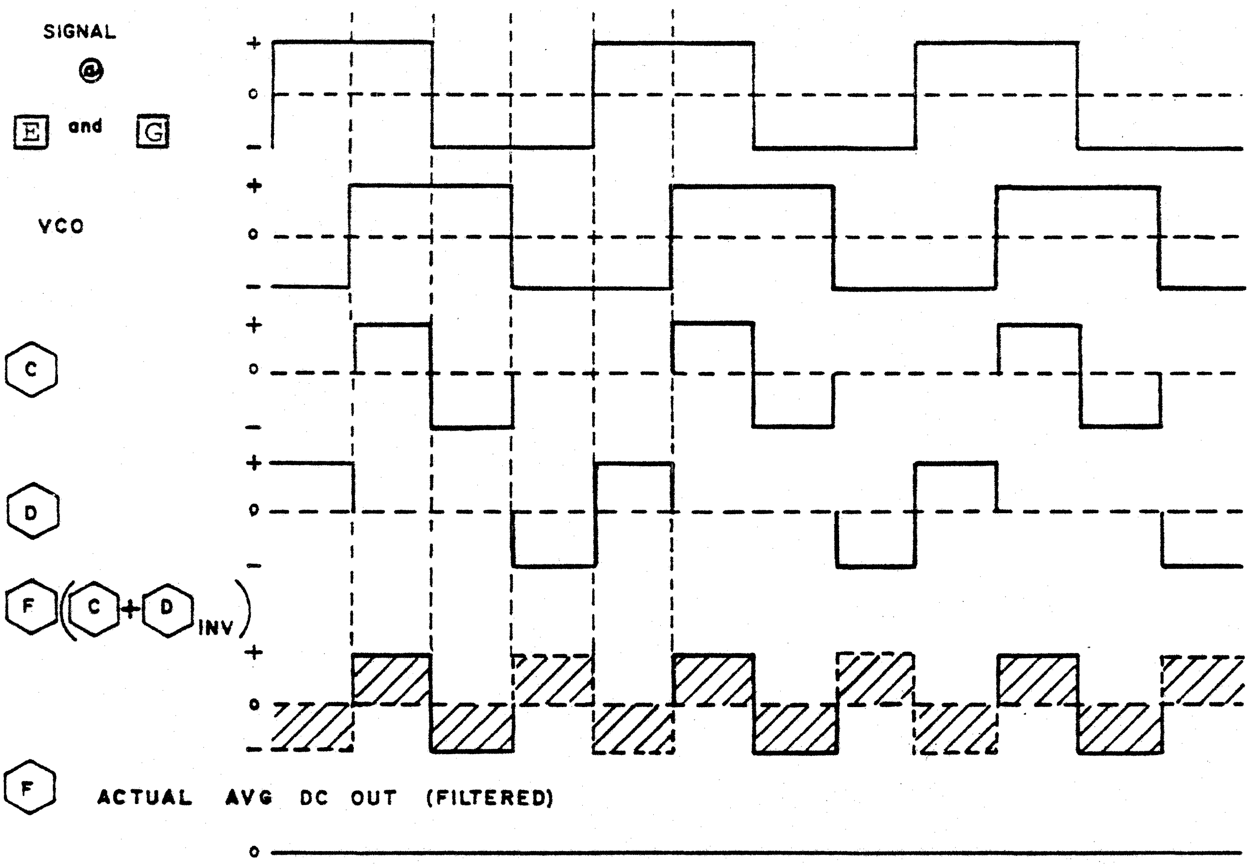


Figure 4-175.

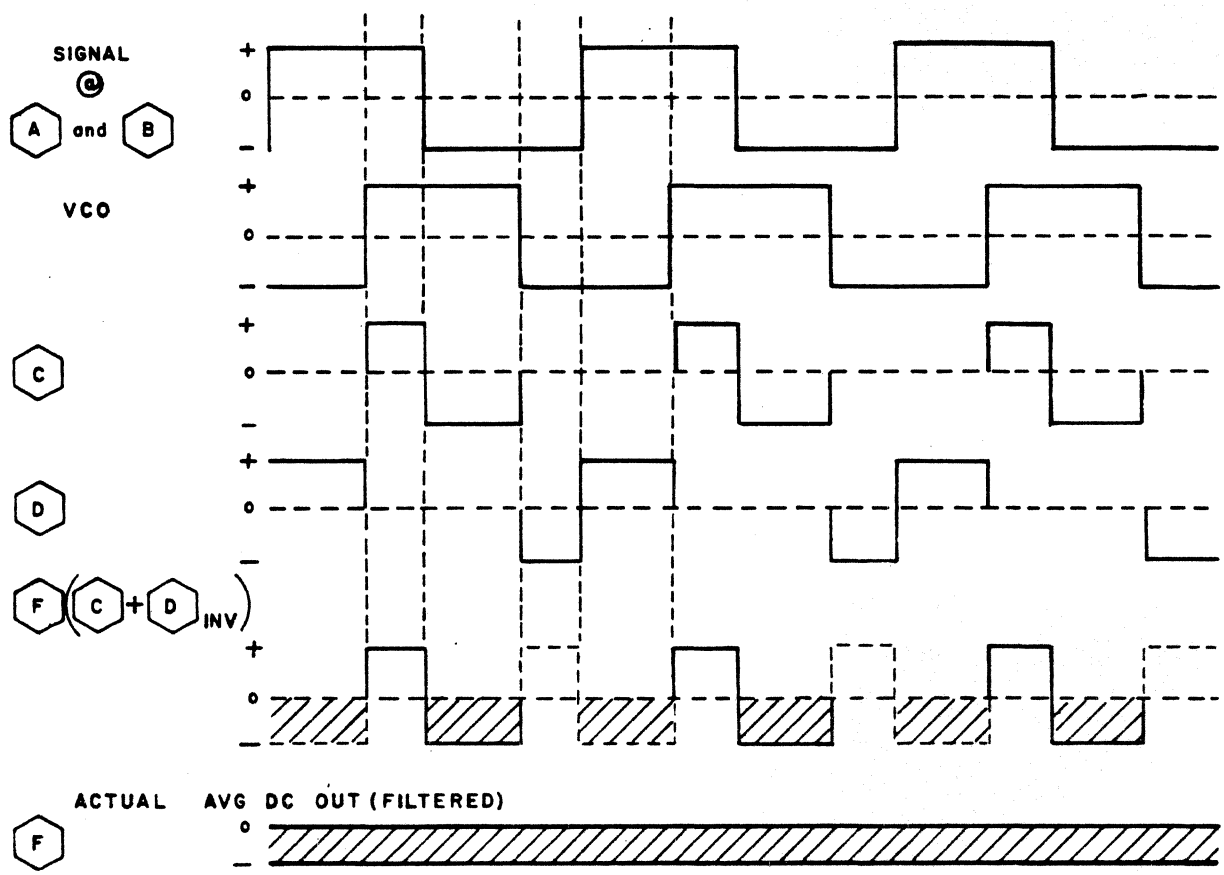


Figure 4-176.

incoming signal frequency is higher than 2125 Hz then the phase difference will produce an average *positive* DC output at point F.

g. The positive or negative voltage that is developed at point F is fed back to the VDC to either increase or decrease its frequency to match that of the incoming signal. When the VCO frequency has matched the incoming signal frequency then the positive or negative DC output at point F will be *maximum.* This can just as easily be put the other way; when loop output voltage is *maximum,* the VCO frequency is the same as the input signal frequency. Therefore, the VCO is *phase-locked* with the input signal.

h. Note that the frequency of the unfiltered output voltage would be twice the input signal frequency.

i. The graph shown in Figure 4-178 describes the operating characteristics of the Voltage Controlled Oscillator, the Phase Comparator individually, and the Phase Lock Loop as a whole. We have shown that it is possible for these circuits to operate separately. In practice, these circuits are *completely dependent on each other.*

1. Actual PLL operating limits 85° – 95° phase relationship between the VCO signal and the carrier signal.

4-67. PHASE LOCK LOOP SUMMARY

a. The heart of the receive portion of the modem is the Phase Lock Loop which is used as a frequency discriminator. The characteristics of this type of phase locking circuit make it suitable for FSK demodulation. This circuit is capable of extracting information from a signal with low signal to noise ratios. It also performs as a very selective band pass filter, a feature that reduces the pre-demodulation filtering requirements of the modem.

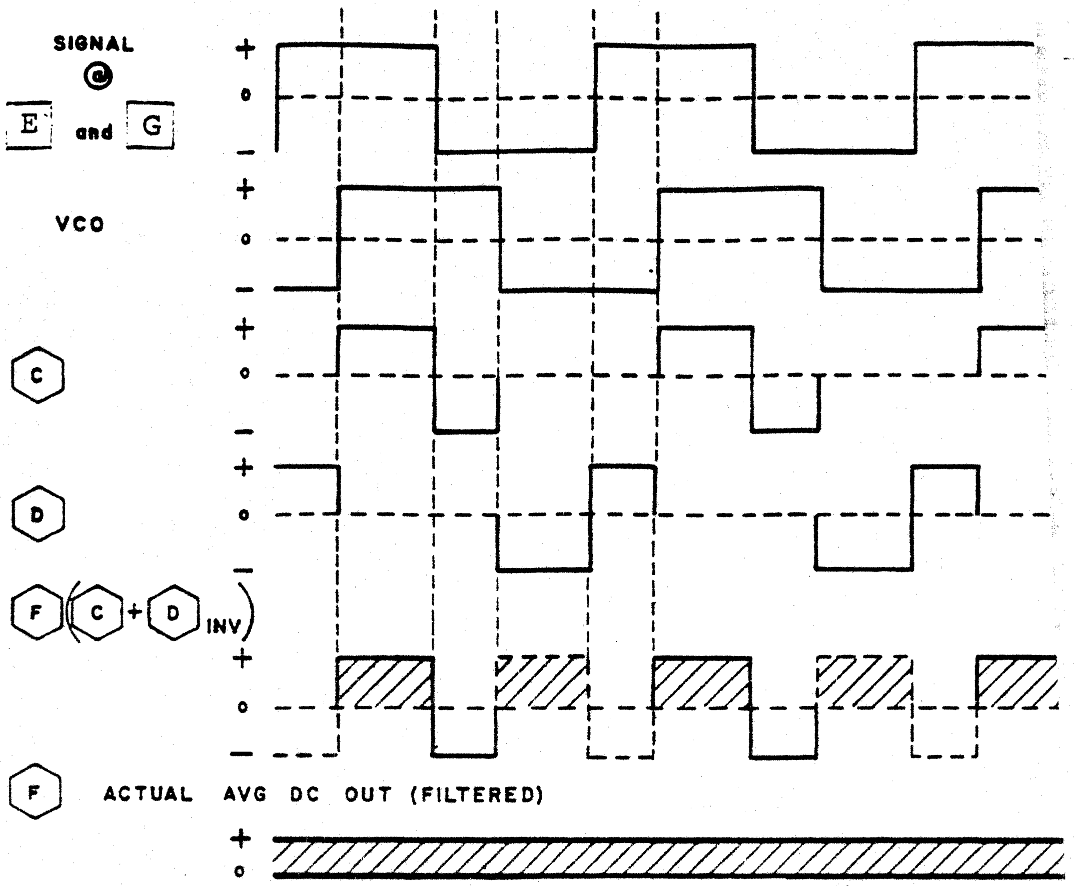


Figure 4-177.

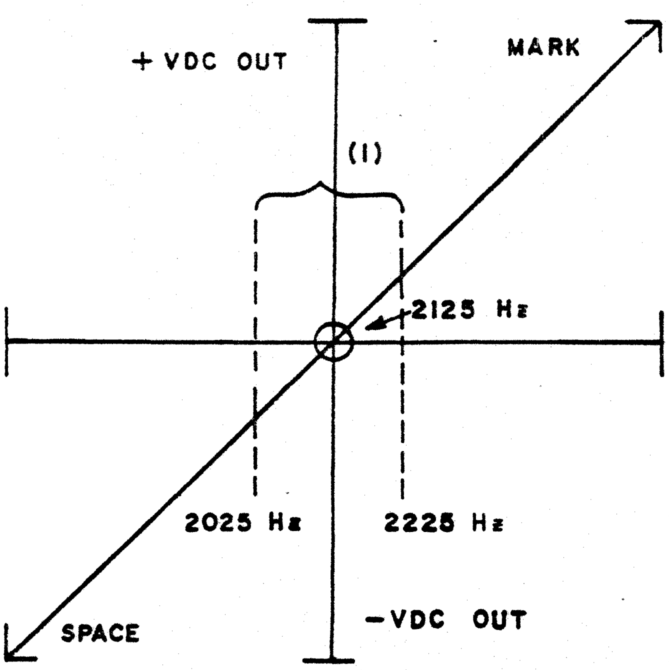


Figure 4-178.

b. Operation of the Phase quency discriminator is FSK signal appears at t Limiter Amplifier. The signal is compared to th Voltage Controlled Osc this comparison is an ou the Phase Comparator w in amplitude and polarit ference of the incoming and the frequency of th trolled Oscillator.

c. This voltage is passed thr Pass Filter which remove quency components and width.

d. The output voltage of th frequency of the Voltage lator to be identical to th incoming signal. In other Controlled Oscillator is *p* the incoming signal.

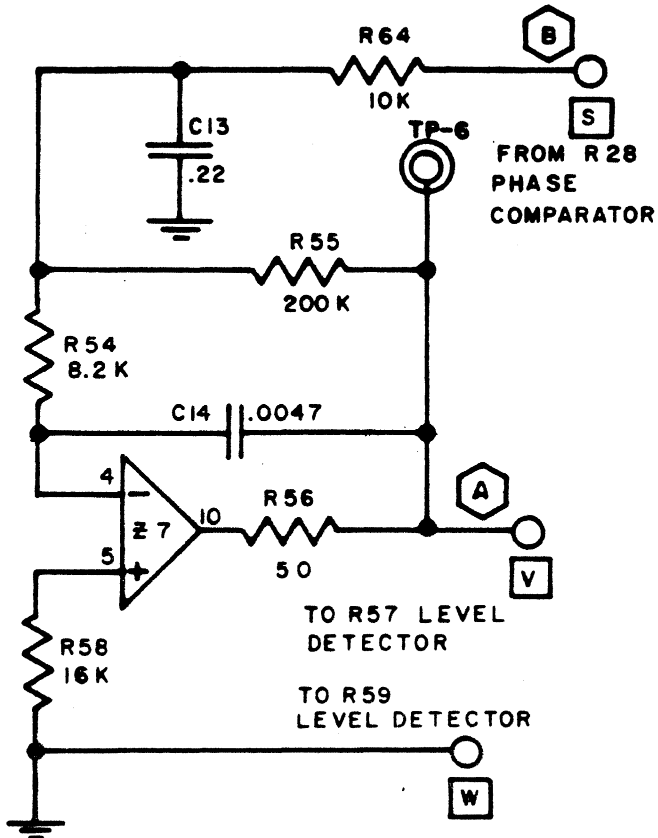


Figure 4-179.

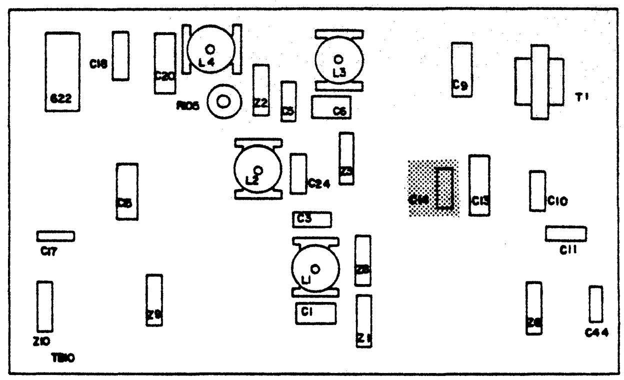


Figure 4-180.

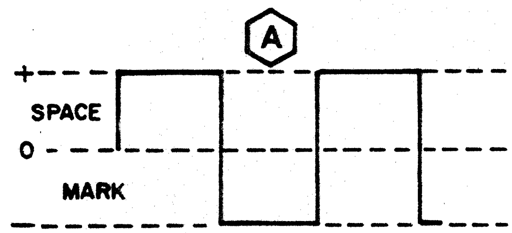


Figure 4-181.

e. As the frequency of the incoming signal changes, the output voltage of the Low Pass Filter also changes in order to keep the frequency of the Voltage Controlled Oscillator the same as the input frequency.

f. It is apparent then, that the frequency changes of the input signal are converted to voltage changes at the output of the Low Pass Filter in the loop. This is the basic demodulation process.

4-68. LOW PASS FILTER (LPF)

a. The ±DC level output of the Phase Lock Loop is fed into the final post-demodulation filter made up of OA Z7 and its associated components.

b. The remnants of the carrier frequency components are filtered out by the action of the filter stage. The signal is inverted by Z7 and sent to the Level Detector.

c. The MARK and SPACE signals as they appear now, ready for final conditioning, are shown in Figure 4-181.

4-69. LEVEL DETECTOR (LD)

a. The basic function of the Level Detector (LD) is detection of the MARK and SPACE signal levels at the output of the Low Pass Filter.

b. A zero crossing detector functions exactly as it sounds. The polarity of the output level changes as the signal input level crosses a zero reference. Our detector circuit does that, except for "hysteresis." The actions of this detector can be described by referring to the schematic in Figure 4-182 and the illustrations of Figure 4-184 through 4-187.

c. Assuming that the incoming signal level is positive, the following conditions will exist at various points in the circuit:

1. Point A is +10 VDC (this is at the *inverting* input).

2. Point B, and therefore the non-inverting input of Z8, is biased at −2.5 VDC as a result of the voltage divider made up of R59 and R61.

   (a) Point D, the base of NPN transistor Q14, is biased slightly negative and is in the OFF condition.

   (b) The collector of Q14, in the OFF condition, at point E, is at +5 VDC.

****THE METHOD****

d. Since pins 4 and 5 are the two inputs to the differential amplifier portion of Z8, the falling edge of the input signal does not (cannot) cause any change of the output status at point C until the negative bias at point B (illustrated by Figure 4-186) is somehow overcome.

When the falling edge arrives at t1 (Figure 4-184) however, the fun begins:

1. At time t2,

2. the falling edge of the signal has crossed the *zero reference,* and

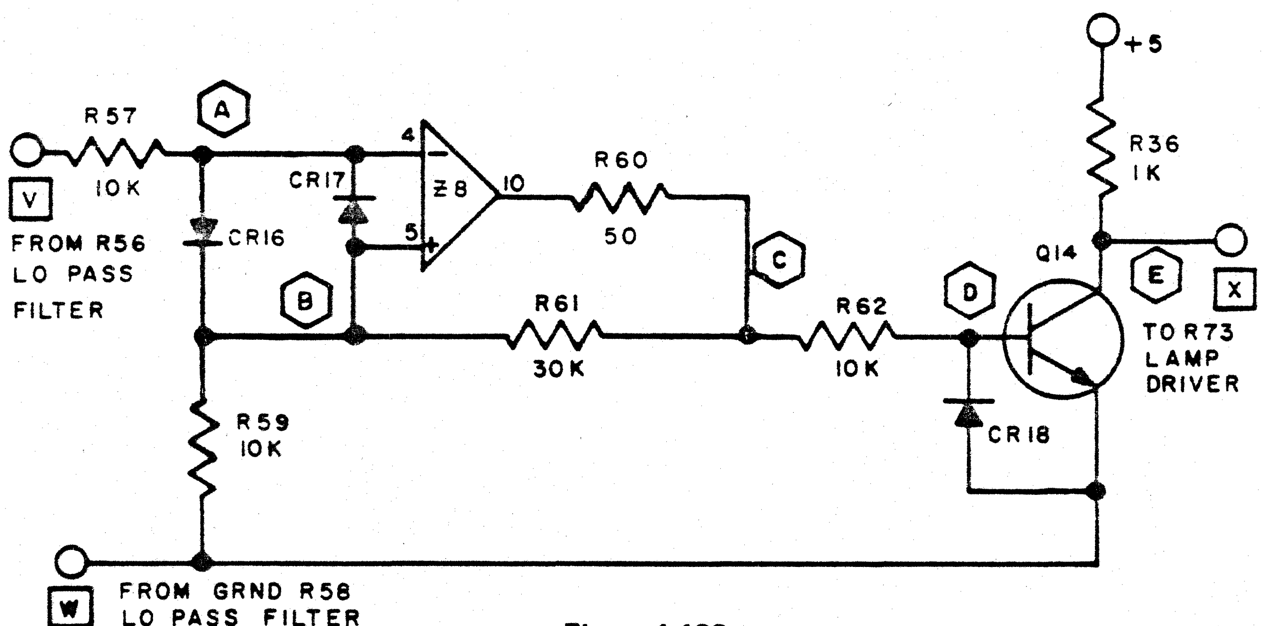


Figure 4-182.

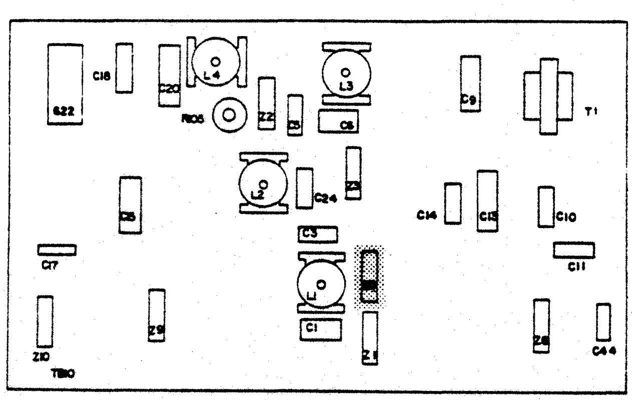


Figure 4-183.

3. has arrived at the −2.5 VDC level.

4. The Operational Amplifier, for a very small instant of time, is exactly balanced; i.e., the output would be at zero volts.

HOWEVER,

5. the falling edge continues, so that at t2+ some small amount,

6. the −2.5 VDC bias at point B has been over-ridden (remember, it only takes a few milli-volts to do it).

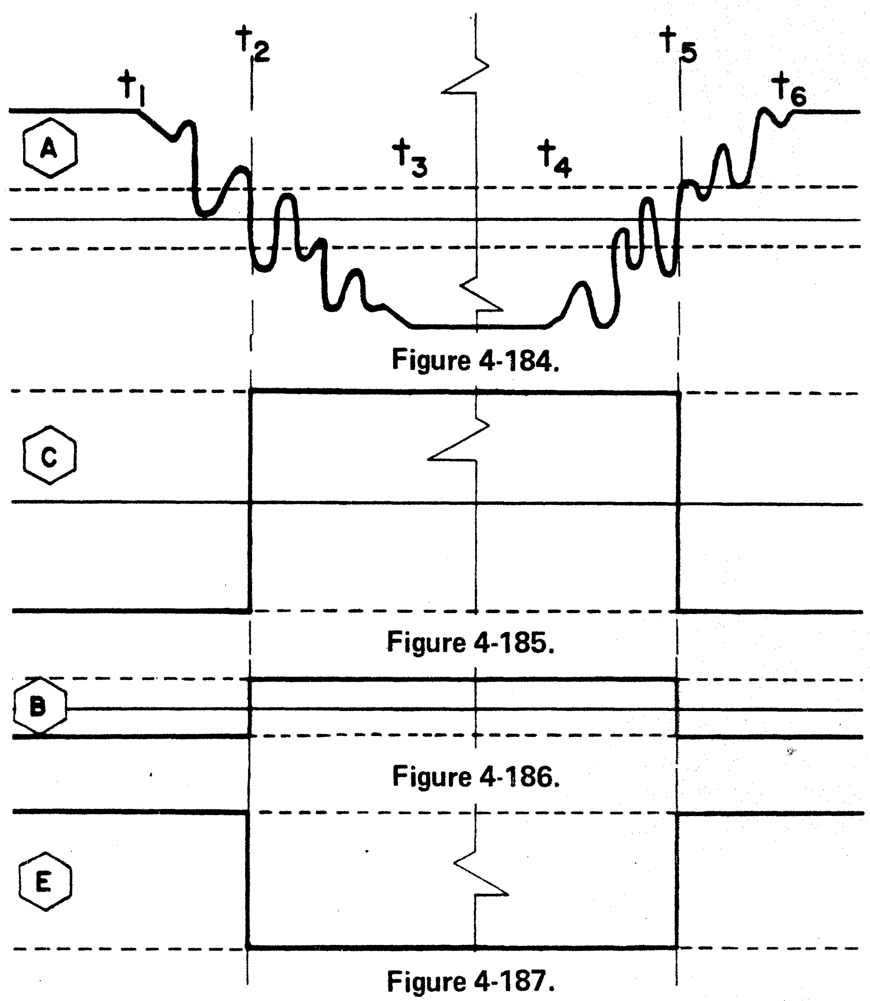


Figure 4-184.

Figure 4-185.

Figure 4-186.

Figure 4-187.

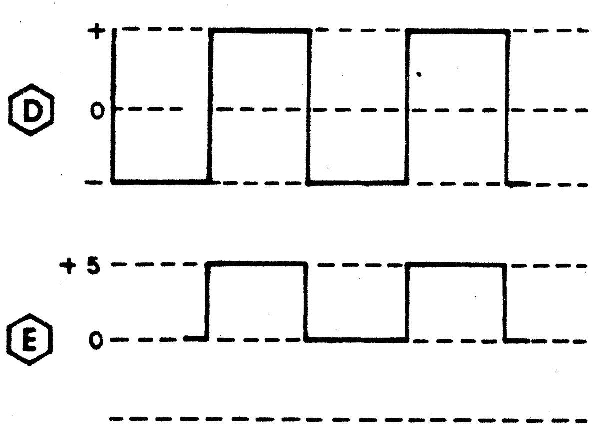


Figure 4-188.

7. The output at point C then rises very rapidly to +10 VDC as indicated in Figure 4-185.

e. A new set of conditions now exist:

1. Point B is biased at *plus 2.5 VDC,*

2. thereby "latching" the circuit with the output at +10 VDC.

3. This places a positive bias on the base of Q14, turning it ON.

4. Point E is now at ground, or zero volts (Figure 4-187).

f. This same basic process occurs every time there is an input signal level change.

g. The positive and negative bias (Figure 4-176) that the Level Detector imposes upon itself at point B in Figure 4-183 is called HYSTERESIS.

h. Despite all of the filtering prior to this stage, there may be ripple due to noise on the rising and falling portions of the incoming signals (shown in Figure 4-185). This ripple can make it appear as though the signal has crossed the zero reference more than once, thereby causing invalid data. It is the hysteresis that prevents this from occurring. It is unlikely that this ripple, during normal circumstances of operation, could overcome the ±2.5 VDC hysteresis (or bias).

4-70. CARRIER DETECTOR (CD)

a. Looking at the modem block diagram (Figure 4-156) we see that the Carrier Detector (Figure 4-189) output directly controls several functions.

1. The CD determines the presence of energy in the receive band width and provides the reference for final disposition of the data.

2. The CD determines if and when the output of the FSK Oscillator shall be transmitted.

b. The input signal to the CD comes directly from the output of the Limiter Amplifier and appears at point A, the CD output. Then:

1. The back-to-back 6.2 Zener diodes, VR1 and VR2, limit the bi-polar input to ±6.2 volts at point B.

2. As the signal swings positive, transistor Q3 is turned ON,

3. which causes point C to decrease and

(a) charge C7 through R19 to the polarity indicated,

(b) which turns Q4 ON.

(c) The voltage across C7 increases with each cycle until

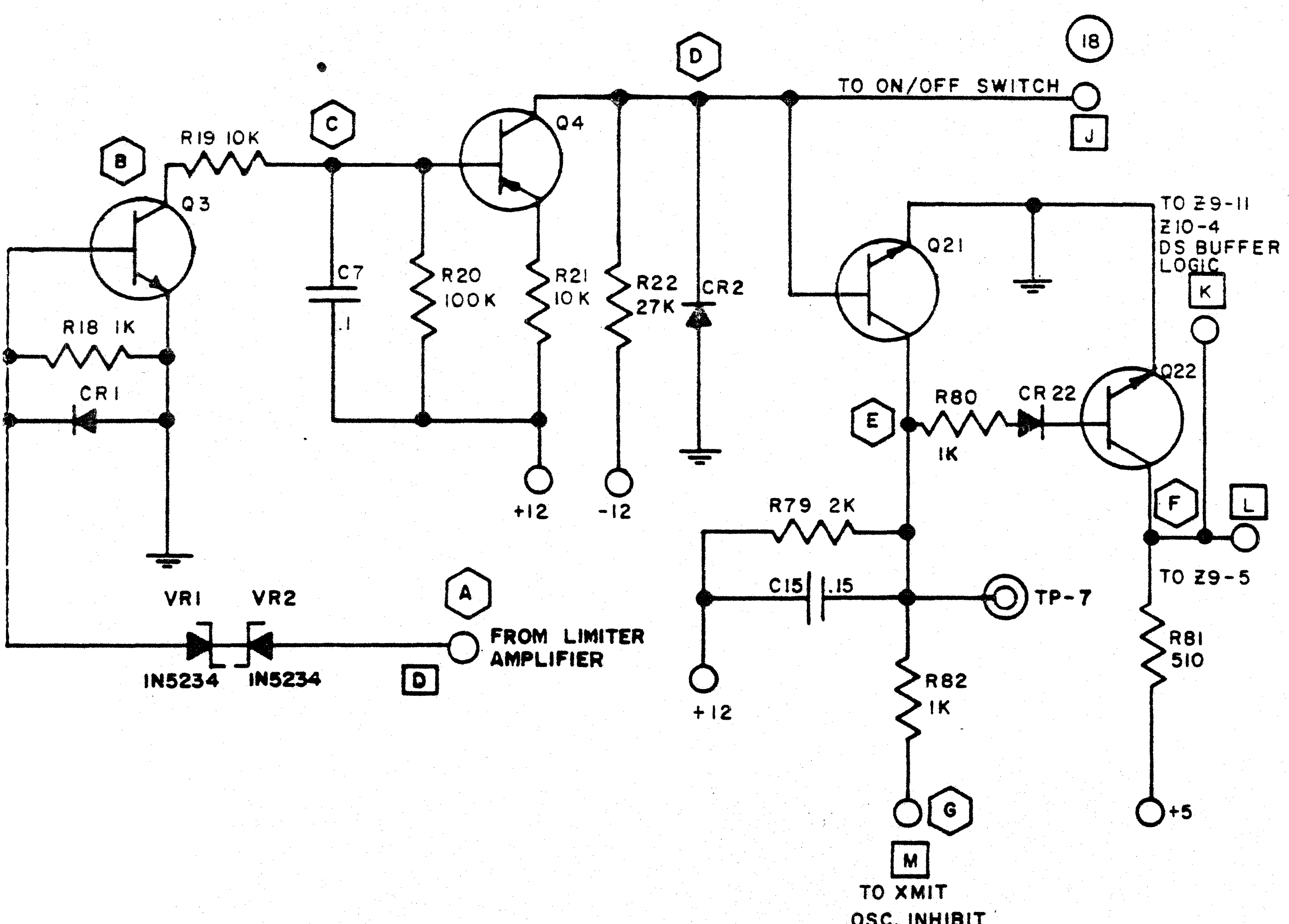


Figure 4-189.

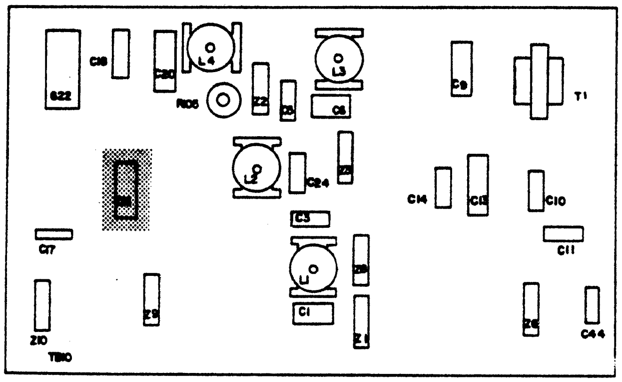


Figure 4-190

(d) point D is changed from a slightly negative level to a positive level,

4. thereby turning Q21 ON, which

5. puts point E at ground,

6. turning Q22 off.

7. Its voltage is then at +5 VDC.

c. When the negative going portion of the input signal arrives at point B, diode CR1 becomes forward biased and clamps the base of Q3 to ground. Even though the diode clamp turns Q3 OFF, there is no *immediate effect* on the rest of the circuitry.

With Q3 OFF, C7 must discharge through R20 and R21, maintaining the low negative bias at the base of Q4. The RC time of C7 and R20 is much greater than the time between positive going excursions of the input signal at point B. Therefore, C7 is effectively functioning as an *integrator*.

d. Once a carrier signal has been detected, either a MARK or a SPACE, *the status of the CD will remain as described here!*

NOTE:

If the carrier signal fails, either as a result of termination of transmission or as a result of component failure, then, as C7 discharges, the increasing positive level at the base of Q4 will eventually turn this transistor OFF causing the output of Q22 (point F) to drop to zero volts.

4-71. DATA TRANSMISSION

a. The entire transmit portion of the modem is comprised of four (4) relatively uncomplicated stages; the FSK Oscillator, the following Output Buffer stage, the E. I. A. Output circuit and the Level Adjusting circuit at the hard coupling transformer (T1).

4-72. FSK OSCILLATOR (FSK Osc.)

a. The Frequency Shift Keyed Oscillator (FSK Osc) represents the major portion of the transmit circuitry. The sole function of the FSK Osc. is that of producing one of two possible frequencies upon receipt of the proper command signal. The two possible frequencies are:

1. A MARK frequency of 1270 Hz or

2. a SPACE frequency of 1070 Hz.

b. The schematic of the FSK Oscillator is shown in Figure 4-191, and has been divided into five sections for clarity.

c. The actual oscillator portion of the circuit consists of areas A, B, and E of Figure 4-193. Areas A and B contain the frequency determining components, C18, C19 and L4 respectively. Area E contains Q34 and Q35 wired as a Darlington Pair. This pair of transistors serve as the power amplifier portion of the oscillator.

d. When power is applied to the modem, Q34 and Q35 are biased ON as a result of the −12 VDC at the emitter and the positive voltage applied through the voltage divider R102-R103.

e. Capacitor C20 provides the necessary positive feedback to the base of Q34 to sustain oscillation.

f. Section C serves as the inverter/buffer input stage, and Section D switches capacitor C18 in and out of the frequency determining circuit. The mechanics of the FSK Oscillator stage are as follows:

1. A positive DC level representing a SPACE arrives at point A,

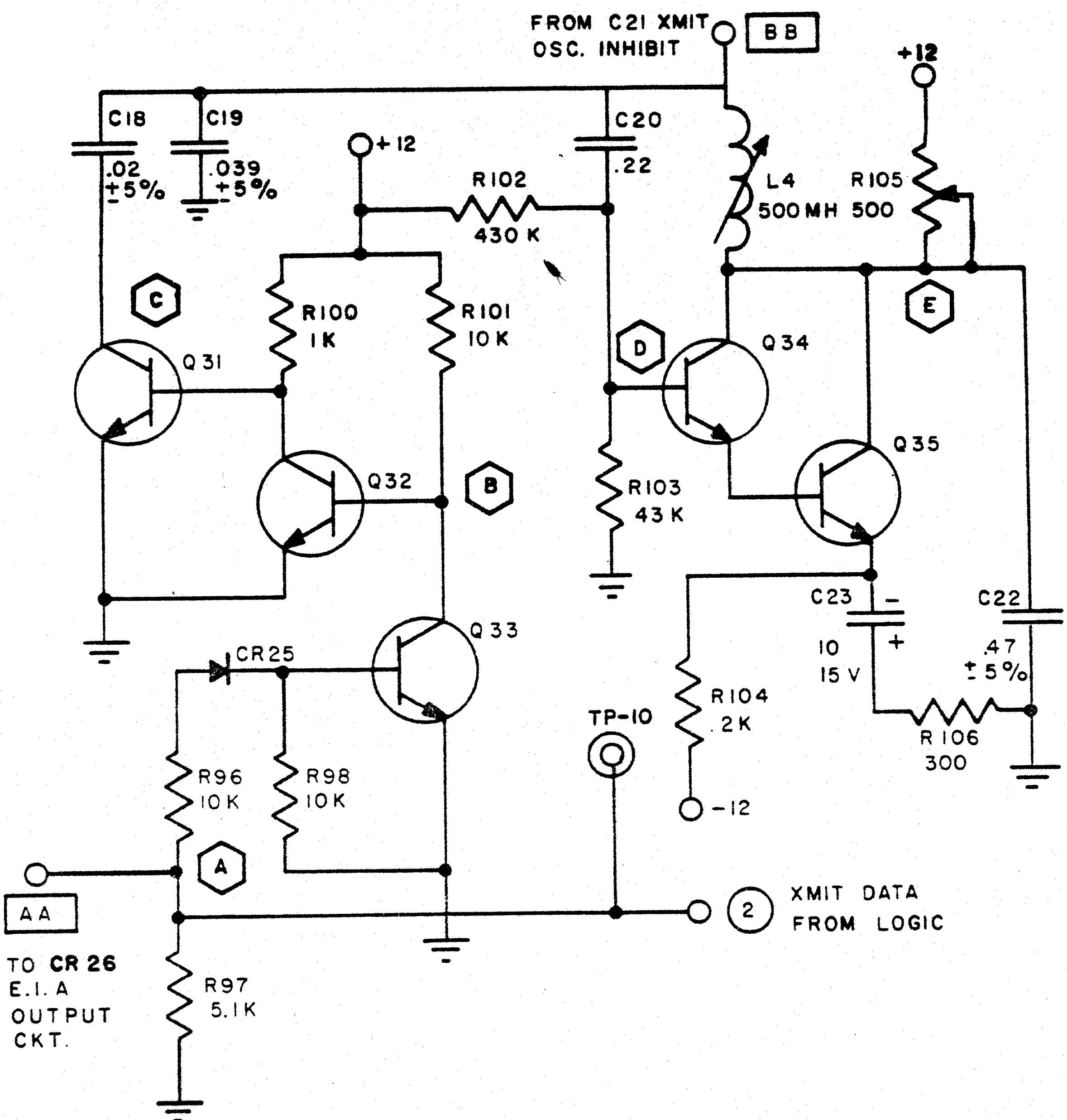


Figure 4-191.

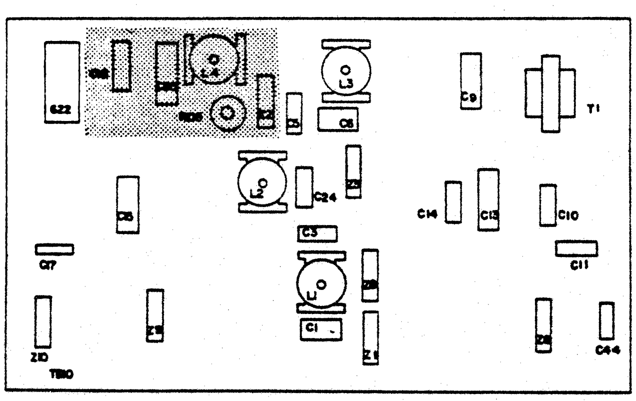


Figure 4-192.

2. causing the base of Q33 to go positive, turning it ON.

3. This in turn puts point B at ground, turning Q32 OFF,

4. thereby allowing the Q31 base to go positive and turning Q31 ON.

5. C18 is now switched into the circuit, and

6. *in parallel* with C19, which decreases the oscillation frequency to 1070 Hz (SPACE).

g. When a MARK signal of zero VDC (or negative VDC) arrives at point A, the chain of events is exactly opposite of that outlined previously. That is, eventually Q31 is turned OFF, *taking C18 out of the circuit,* and establishing an oscillation frequency of 1270 Hz (MARK).

h. The following formulas describe the FSK output frequencies:

1. A SPACE command at point A = C18+C19 and $f_s \approx \dfrac{1}{2\pi\sqrt{L4\ (C18+C19)}}$

2. A MARK command at point A=C19 and $f_m \approx \dfrac{1}{2\pi\ \sqrt{L4\ C19}}$

4-73. TRANSMIT INHIBIT (XMIT INHIB)

a. Referring to the Carrier Detector schematic (Figure 4-189) point G) we see that when the CD has detected a carrier signal, that point A on the Transmit Inhibit input (Figure 4-194) is zero VDC (ground). This means that Q23 is OFF, and the collector at point B is sitting at a positive voltage level.

b. When the above is true, the output of the FSK Oscillator is coupled across C21 to the Output Buffer stage.

c. If the carrier signal has been lost due to termination of transmission or component failure, point A goes positive. Q23 turns ON, and point B is *shorted to ground.*

d. With point B shorted to ground, the output of the FSK Oscillator is coupled across C21 and R85 to *ground.*

4-74. OUTPUT BUFFER (OB)

a. When the Transmit Inhibit (Figure 4-195) is enabled (Q23 OFF), point A of the Output Buffer (OB) is positive. The output of the FSK Oscillator is coupled across C21 and R85 to the base of Q24 (of Darlington Pair Q24, Q26). The pair provides a low output impedance for proper drive to the output.

4-75. E. I. A. OUTPUT CIRCUIT

a. The E. I. A. Output Circuit (Figure 4-197) is designed to convert terminal supplied *zero* (MARK) and *plus five* VDC (SPACE) levels to the −12 VDC (MARK) and +12 VDC (SPACE) levels that are standard.

b. Assmue that a MARK signal, zero VDC, has arrived at point A. Then:

1. The bases of Q29 and Q30 are biased negatively.

2. This bias assures that Q30 is OFF and that W29 is ON.

3. With Q29 ON, the base of Q27 is made positive through R91.

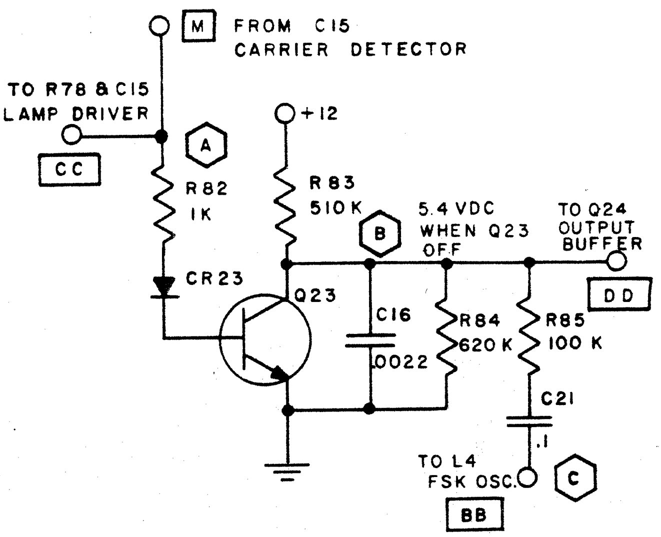


Figure 4-193.

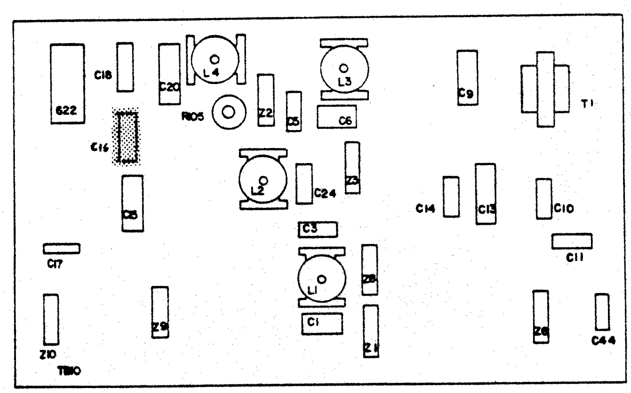


Figure 4-194.

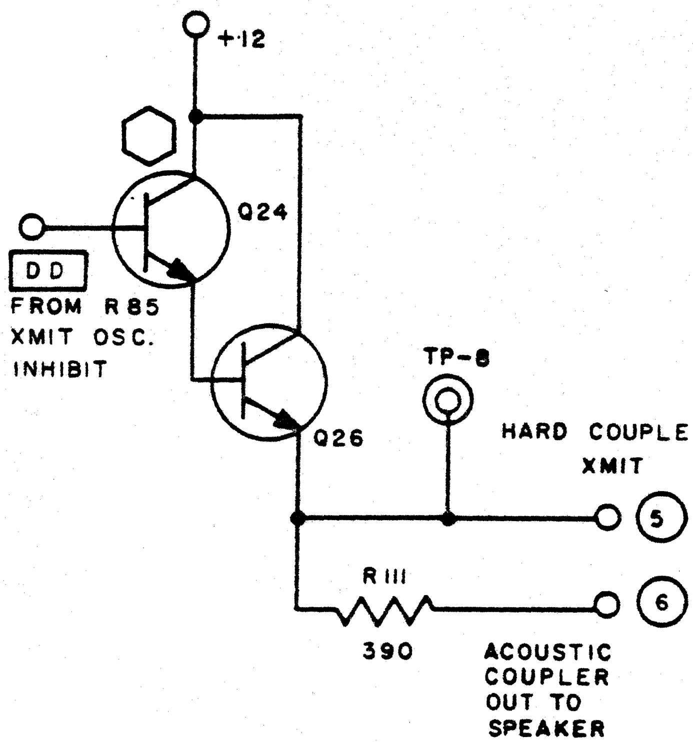


Figure 4-195.

4. As a result, Q27 is turned ON, and

5. −12 VDC is switched to point F.

6. The −12 VDC conforms to the E. I. A. definition of MARK.

c. If the next succeeding signal is +5 VDC (SPACE) then the following cycle of events occurs:

1. The bases of Q29 and Q30 swing to a positive level.

2. W29 is turned OFF and Q30 is turned ON.

3. With Q30 ON, point D goes to ground turning Q28 ON,

4. and shutting Q27 OFF as point E goes back to −12 VDC.

5. Q28 is in the ON condition, *+12 VDC is now switched to point F,*

6. thus conforming to the E. I. A. SPACE.

d. The output of this stage is then coupled to an external Data Set.

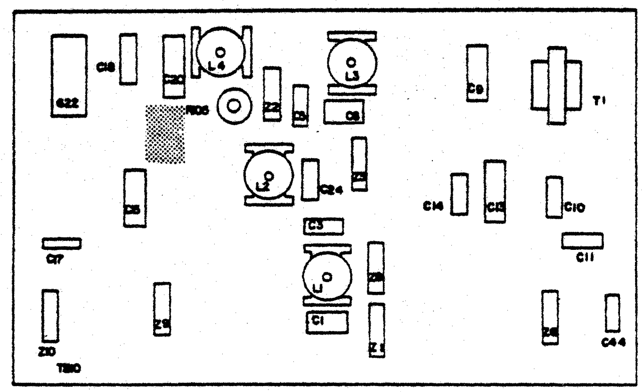


Figure 4-196.

4-76. DATA LAMP DRIVER (DLD)

a. The function of the Data Lamp Driver, Figure 4-199, is: to provide visual indication to the Data Terminal operator that data is being received by the modem.

b. Functionally, the DLD provides a ground return for the Data Lamp which is in series with a +24 VDC supply.

c. The truth table shown in Table 1 (Figure 4-207) indicates the input conditions that must be met before the DLD circuit in Figure 4-201 will turn the Data Light ON.

d. If the input from the Carrier Detector to Q20 at point A is zero volts VDC (or ground), then Q20 is held in the OFF condition. If at the same time that Q20 is OFF, the input from the level Detector at point D is zero volts VDC (or ground) then:

1. Q18 is turned ON, which puts

2. point B, the base of Q19, at some *positive* level,

3. turning Q19 ON and placing point C at ground,

4. thereby allowing the Data Light to turn ON.

e. When the CD signal at point A is +5 VDC, Q20 is turned ON which puts point B at ground and shuts Q19 OFF thereby removing the ground return path at C. The Data Light is now turned OFF.

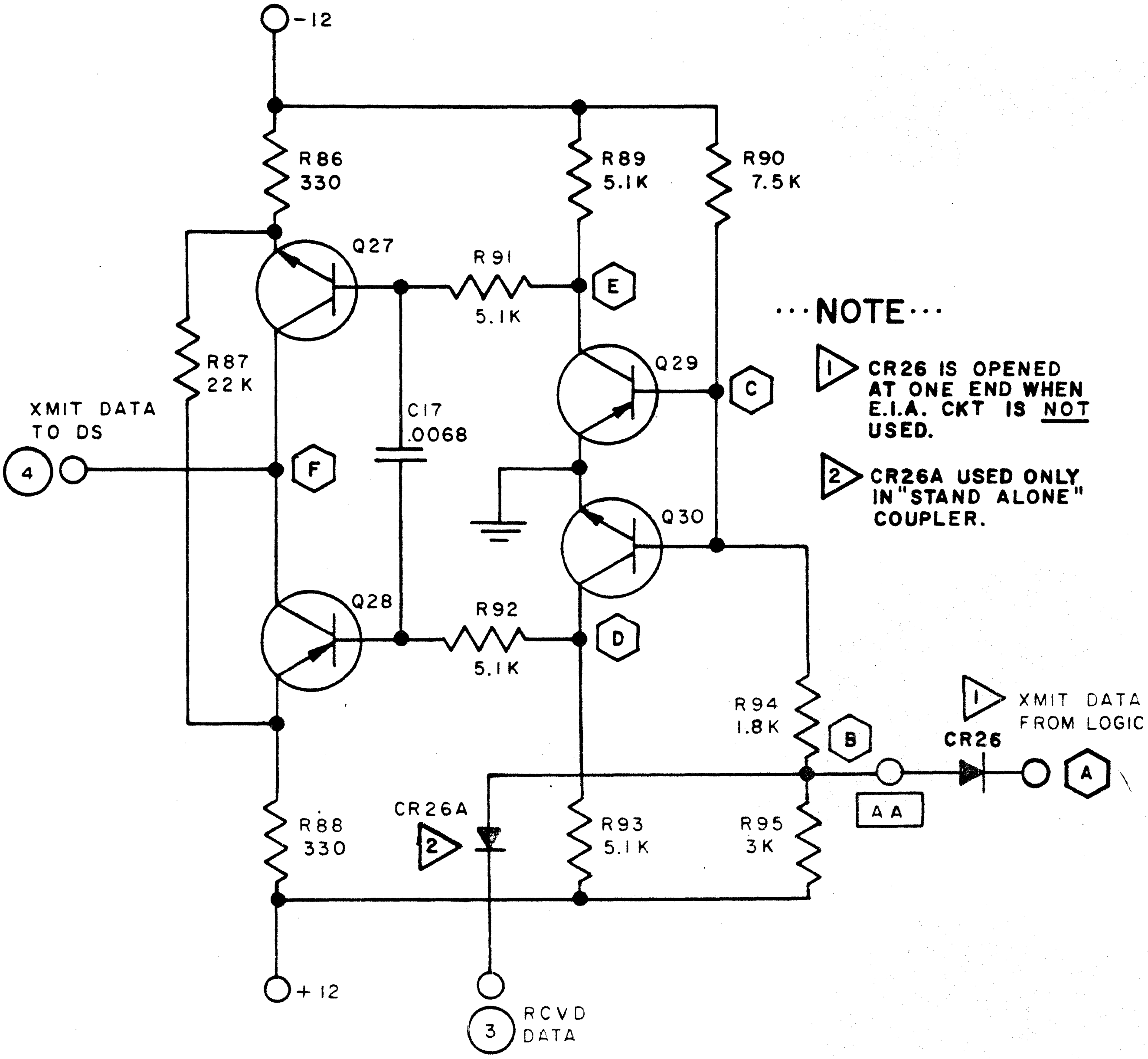


Figure 4-197.

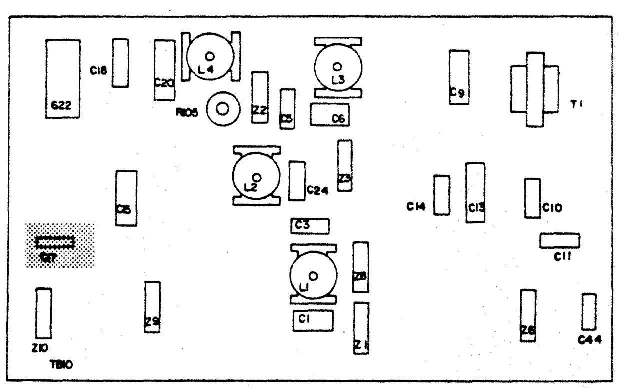


Figure 4-198.

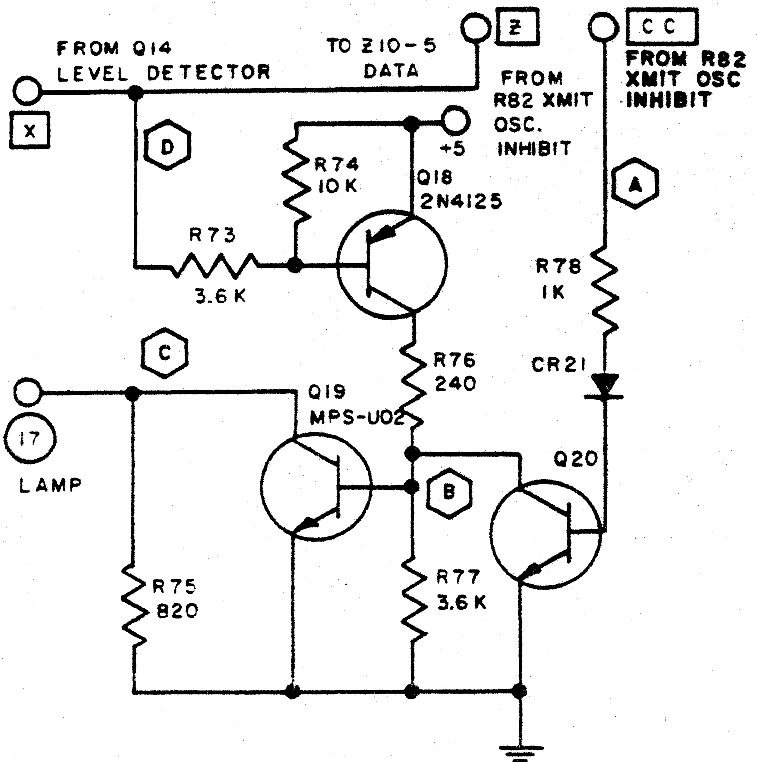


Figure 4-199.

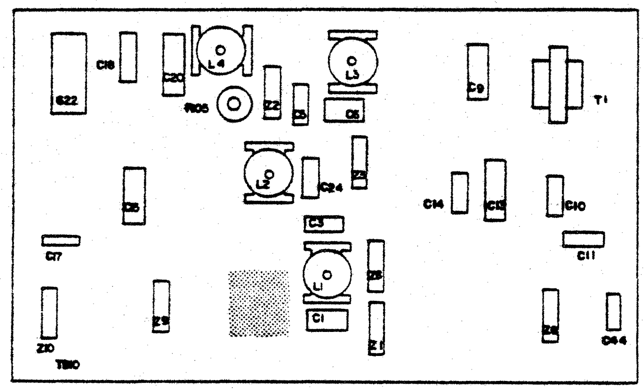


Figure 4-200.

f. Since the signal from the Level Detector at point D is alternating from MARK to SPACE (0 VDC to +5 VDC), the Data Light is turning OFF and ON at the data rate.

4-77. DATA TRANSFER LOGIC (DTL)

a. The function of the DTL circuit in Figure 4-201 is to accept data from either the Modem, or data from an external Data Set, and transfer this data to either the 1030 or 1035 Data Terminal.

b. The truth table of Figure 4-207 describes the logical operation of this circuit. This table shows two conditions.

1. DTL under modem control, and

2. DTL under external Data Set control.

c. We can see from this table that the following is true.

1. If the logic is under modem control, Q16 is OFF and therefore the Level Detector input is the controlling factor.

OR

2. If the logic is under the control of an external Data Set, the Carrier Detector is OFF (low) and therefore the output at points 8 and 10 is controlled by the incoming data at point 7, switching Q16 ON and OFF.

d. Due to pull-up resistors R69 and R70, point 8 goes to +5 VDC and point 10 is low because of Z9 when Q16 is OFF. The opposite is true when Q16 is ON.

4-78. DATA TERMINAL CONTROL LOGIC "A" (DTCL A)

a. This section of modem logic (Figure 4-204) is designed to provide a status signal to the 1030 Terminal. This signal states that the source of incoming data is ready to transmit data to the Data Terminal. That is:

1. If a carrier has been detected by the modem, point K will be high (+5 VDC) and point 11 will be low (0 VDC).

2. If an external Data Set will be sending the data, then point 9 will be high, turning Q15 ON, placing point 11 at ground (low).

The truth table in Figure 4-207 verifies the operation of this circuit.

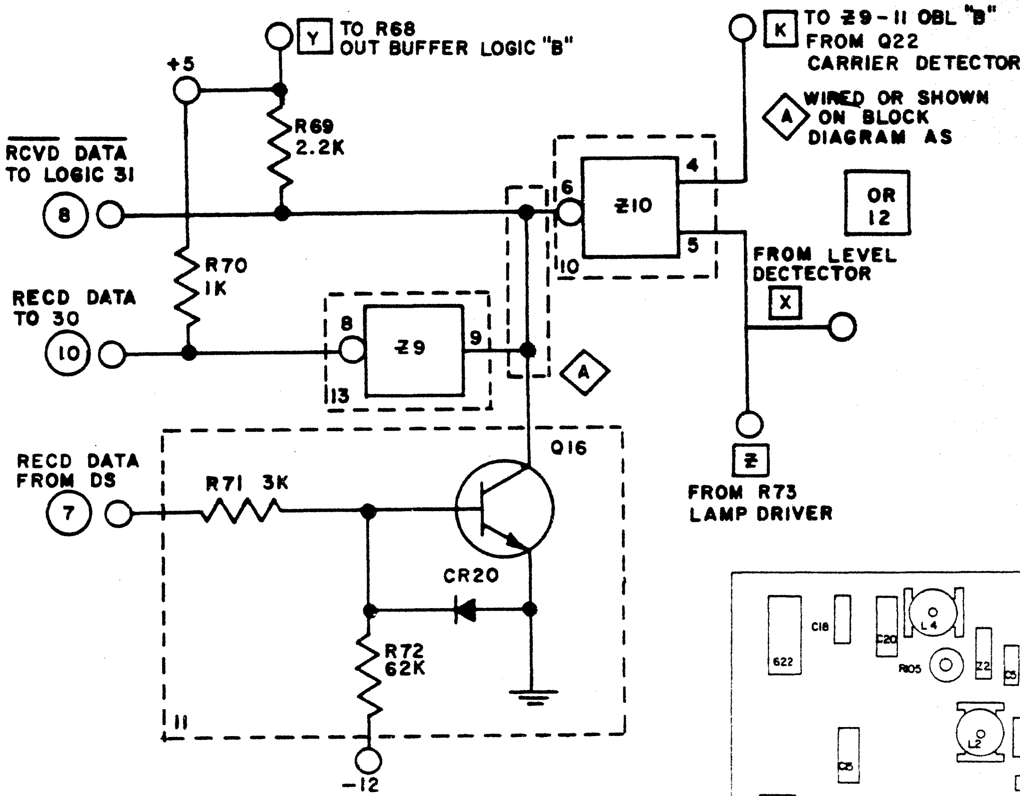


Figure 4-201.

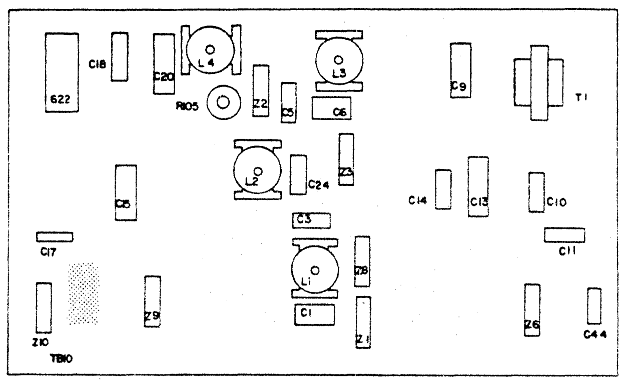


Figure 4-202.

4-79. DATA TERMINAL CONTROL LOGIC "B" (DTCL B)

a. This circuit provides a status signal to either the 1030 or 1035 Data Terminal that states that it is now permissible for the Data Terminal to send data.

This permission is granted if:

1. A carrier has been detected by the modem, which puts point L high, and therefore puts point 12 low and point 13 high.

2. If an external Data Set sends a Clear To Send status signal, then point 14 goes high, turning Q25 ON, putting 12 low and 13 high.

The truth table in Figure 4-207 verifies these conditions.

1. Since pin 4 is *always low,* the input to pin 5 will *not* affect the output condition of NAND Z10.

2. A minus sign (-) represents either "0" VDC, Gnd., or −VDC.

3. When data is arriving via an external data set, the Modem is normally OFF.

4-80. POWER SUPPLY BYPASS FILTERS (PSBF)

a. These capacitors are installed to keep noise and switching transients encountered in the modem from appearing on the voltage supply lines.

4-81. NON–LOGICALLY DERIVED STATUS SIGNALS

a. REQUEST TO SEND TO EXTERNAL DATA SET – sent to an external data set via the RS-232B cable.

b. DATA TERMINAL READY (DTR) – sent to an external data set signalling that the terminal is operational.

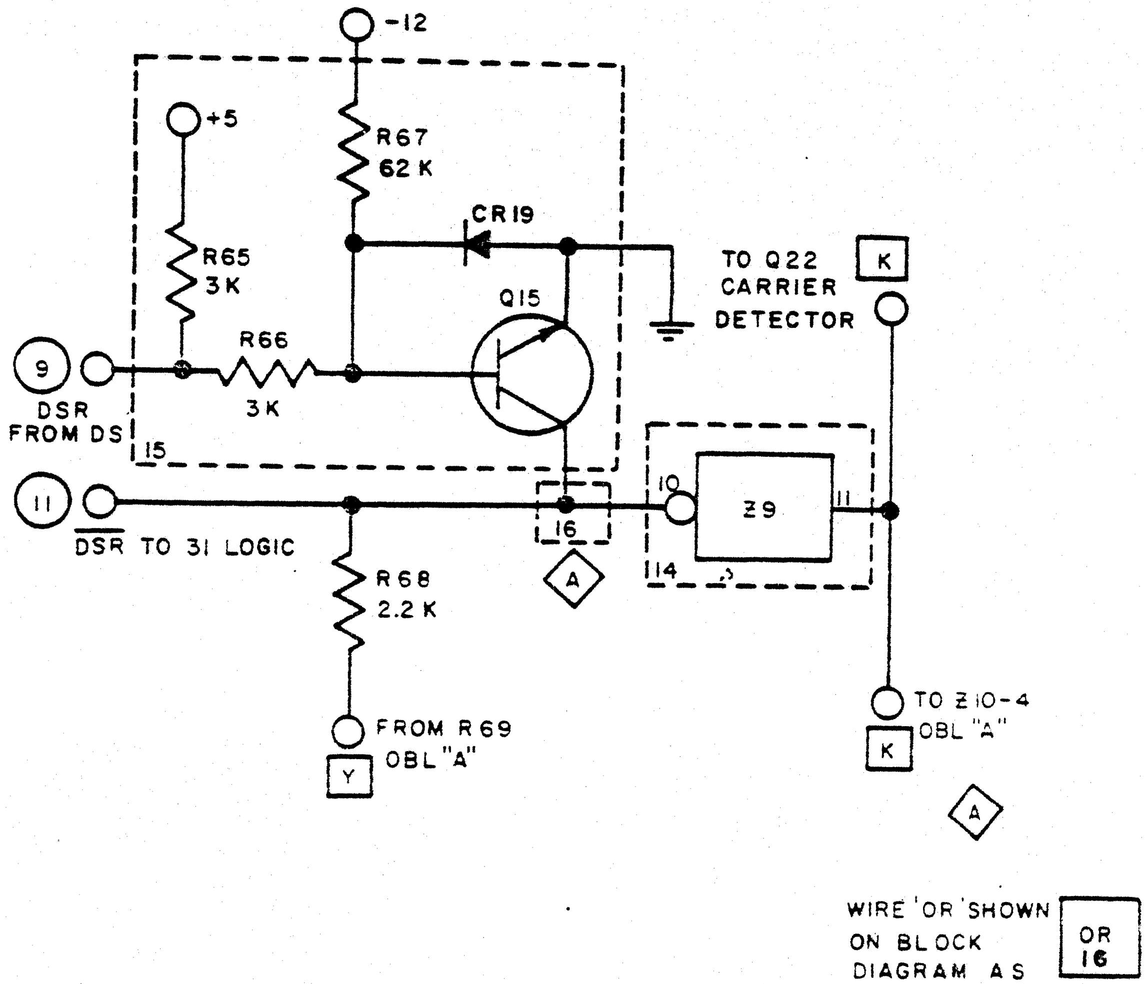


Figure 4-203.

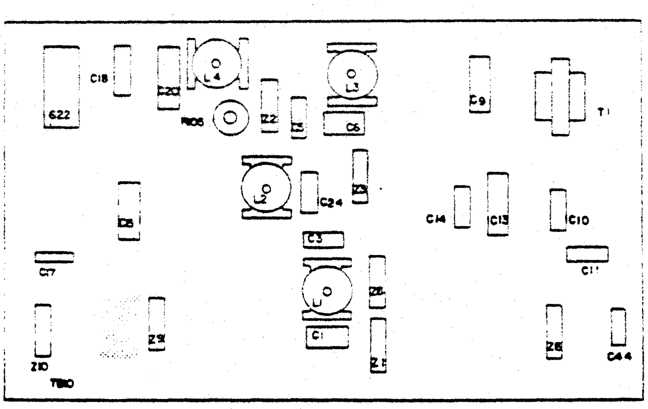


Figure 4-204.

4-82. SPECIAL TERMS

Special terminology used in this section is as defined by the Electronic Industries Association Document RS-232, "Interconnection of Data Terminal Equipment with a Communications Channel."

CLEAR TO SEND (CTS) – A status signal that indicates that the data set has established a connection with the distant data set and that signals may be applied to the Transmit Data Circuit.

DATA SET READY (DSR) – Indicates that the data set is connected to the telephone line and is in the data mode; that is, that it is not in the idle, talk, test, or local condition, nor is it without power.

DATA TERMINAL READY (DTR) – Is used by the customer - provides data terminal to permit the data set to enter and remain in the data mode.

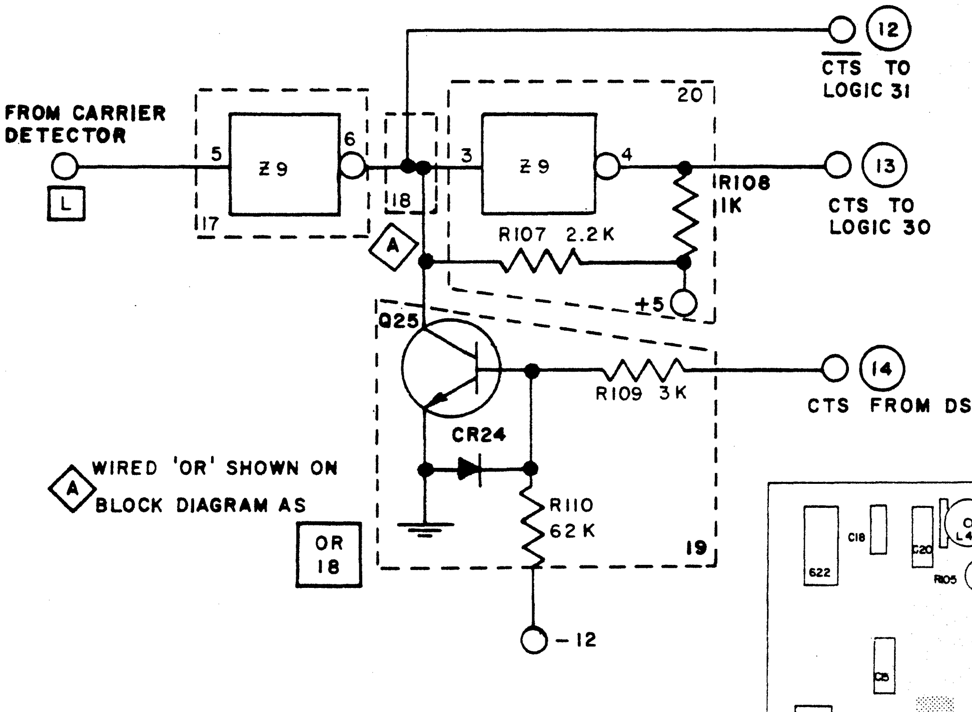


Figure 4-205.

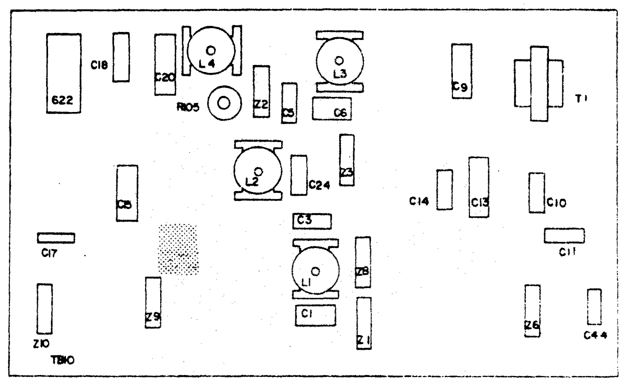


Figure 4-206.

VALID CONDITIONS OF OUTPUT LOGIC

DATA TRANSFER LOGIC									
DATA FROM DATEL MODEM					DATA FROM EXTERNAL DATA SET (3)				
IN			OUT		IN			OUT	
(7)	K	X	(8)	(10)	(7)	K	X	(8)	(10)
RECD DATA FROM DS	Z10 PIN 4	Z10 PIN 5	RCVD DATA TO 31	RECD DATA TO 30	RECD DATA FROM DS	Z10 PIN 4	Z10 PIN 5(1)	$\overline{\text{RCVD}}$ DATA TO 31	RECD DATA TO 30
− (2)	+	−	+	−	−	−	±	+	−
−	+	+	−	+	+	−	±	−	+
DATA TERMINAL CONTROL LOGIC "A"									
	(9)	K	(11)			(9)	K	(11)	
	DSR FROM DS	Z9 PIN 11	$\overline{\text{DSR}}$ TO 31			DSR FROM DS	Z9 PIN 11	$\overline{\text{DSR}}$ TO 31	
	−	+	−			+	−	−	
	−	−	+			−	−	+	
DATA TERMINAL CONTROL LOGIC "B"									
	(14)	L	(12)	(13)		(14)	L	(12)	(13)
	CTS FROM DS	Z9 PIN 5	$\overline{\text{CTS}}$ TO 31	CTS TO 30		CTS FROM DS	Z9 PIN 5	$\overline{\text{CTS}}$ TO 31	CTS TO 30
	−	+	−	+		+	−	−	+
	−	−	+	−		−	−	+	−

Figure 4-207.

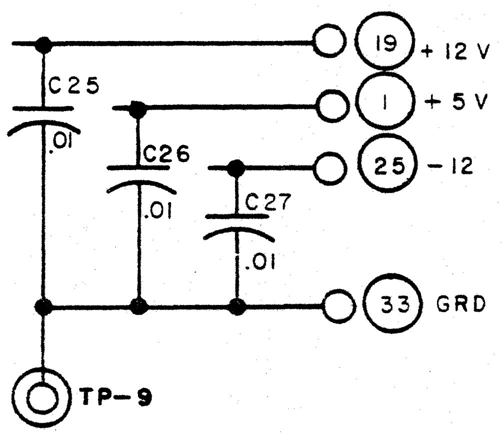


Figure 4-208.

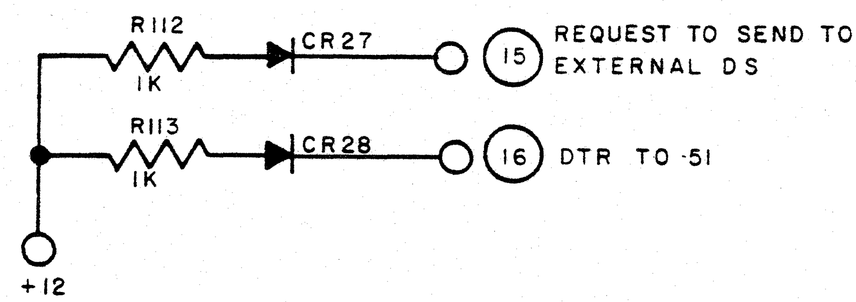


Figure 4-209.

4-83. TERMINAL POWER SUPPLY

The power supply for the logic and the modem is contained in the electronic hub chassis at the rear of the terminal. There are four levels of power supply, A through D. All of them supply the same voltage outputs at Terminal Board 1 and Terminal Board 2 and require the same inputs at Terminal Board 2. The changes in level only enhance the reliability of the supply. Three bridge rectifier networks are directly supplied from the secondaries of power transformer T_1. The output of these networks are regulated and filtered before being supplied to the terminal.

The twenty-four volt supply produces an average current output of 2.5 amps. Saw tooth ripple in the area of 8 volts is normal. Filter capacitor C_1 of this supply is a chassis mounted component.

The five volt supply has a voltage output regulated by integrated circuit IC-1. The IC monitors the current draw of the five volt supply and regulates the voltage according to that need. The operating voltage on IC-1 is +12 volts which is supplied by the +12 volt supply.

NOTE:

If the +12 volt supply goes dead the operating voltage for IC-1 is gone and IC-1 will turn off the +5 supply.

The ±12 volt supplies are identical and in fact share the same bridge rectifiers. The current output of each of these suppliers is 20 milli amps.

SECTION V

SERVICE AND MAINTENANCE

5-1. SCOPE.

This section contains instructions pertaining to inspection, repairs and adjustments, removal and replacement, troubleshooting, and cleaning and lubrication necessary to maintain reliable terminal operation.

Where possible, the paragraphs are so grouped as to give information on only one of three main units at a time. The units are:

a. Keyboard printer

b. Interface

c. Logics

This unit separation inhances fault isolation and any maintenance and/or adjustments that may be required.

5-2. MINIMUM PERFORMANCE STANDARDS.

For minimum performance standards, refer to paragraph 3-3 on page 3-1.

5-3. CALL PREVENTION MACHINE CHECK (C P M C)

The C P M C is to be performed on each and every machine call! It provides you with the surest means of evaluating the machine condition in the shortest possible time. It is not to suffice as an inspection, but will give you an idea of what areas in the inspection and maintenance of your machines should be improved. Performed religiously, you can get your C P M C time down to five minutes. It will be the best invested five minutes you ever spent.

a. Remove Type Element

1. Look for a worn type element
2. Check upper ball socket play (horizontal and vertical)
3. Check tilt ring side play
4. Check carrier shoe clearance
5. Check carrier side play

b. Half Cycle Neg. 5, No Tilt Character

1. Check rotate spring tension
2. Check tilt detent side play
3. Check tilt homing - correct any drift

c. Replace Type Element

1. Check rotate for binds (pull shift arm)
2. Check shirt clearance
3. Half cycle WORMT - check detenting and rotate detent side play
4. Half cycle WTOM - check rotate homing - correct any drift
5. Check timing on M

d. Backspace

1. Check B/S rack free motion
2. Check carrier motion

e. Unlock Keyboard with Machine Off - Depress Center Keylever

1. Check filter shaft clearance
2. Check interposer travel after latching (.015)
3. Check cycle clutch keeper clearance (.000" – .002")
4. Check cycle clutch latch pawl overthrow and clutch latch bite on sleeve
5. Check cycle shaft end play (.002" – .006")
6. Check cycle clutch spring for slippage

f. Trip the Carrier Return and Hand Cycle Slowly

1. Watch latch overthrow past keeper (.020" – .040")

2. Check interposer restoring overthrow (.010" – .030")

3. Check clutch unlatching link

4. Reset keyboard to lock when power is off

g. Lubrication – Every Call

1. Center bearing (oil down side)

2. Print shaft wiper – replace annually

3. Escapement rack

4. Cycle clutch

5. Operational cams and ratchet assembly.

5-4. PREVENTIVE MAINTENANCE.

The preventive maintenance procedures presented in this manual are designed to minimize the requirements for corrective efforts that accrue with neglect. (Figure 5-1)

The maintenance concept for the Selectric Keyboard Printer takes into account cleaning, periodic replacement of parts, check of critical adjustments and the proper lubrication of the machine. The Selectric typewriter must be properly lubricated, and in some very hard usage applications, will not perform more than 120 days without lubrication.

GENERAL INSPECTION PLAN			
EVERY INSPECTION		SECOND INSPECTION (120 days)	
Cleaning	Lubrication	Voltage levels	Electrical character trip and selection
C P M C	On-line check	Electrical operations	Character and operational switches
		Keyboard lock	Special lubrication
FIRST INSPECTION (120 days)		THIRD INSPECTION (120 days)	
Keyboard area	Cycle clutch	Carrier return	Shift and shift indication
Tilt mechanism	Rotate mechanism	Index and paper feed	Space, backspace and print escapement
Alignment	Impression	Tabulation and margin control	Ribbon feed and lift
Special lubrication		Special lubrication	

Figure 5-1

The following maintenance procedure is recommended as a minimum: On hard usage machines, extra attention to lubrication and adjustment is required. The **RECOMMENDED PARTS REPLACEMENT SCHEDULE** should be followed as closely as possible, but if a non-rubber part is obviously good, do not replace it. If it is worn or questionable, it must be replaced. The rubber items, bail and feed rolls and platen, deteriorate with both age and usage, and should be replaced regardless of appearance. In many areas where the ozone content of the air is high, the rubber parts will fail sooner and need more frequent replacement to insure the most reliable operation. (Figure 5-2)

5-5. GENERAL INSPECTION PLAN.

General inspection is in accordance with Figure 5-1.

RECOMMENDED PARTS REPLACEMENT SCHEDULE

Part Name	Part Number	Qty. Per Unit	Time Period
Cycle clutch spring	1166551 (IBM)	1	2 years
Spring shift clutch	1166381 (IBM)	1	2 years
Print shaft wiper	1124647 (IBM)	2	1 year
Print sleeve	1141628 (IBM)	1	As needed
Pawl cam BS	1166317 (IBM)	1	As needed
Pawl cam index	1128413 (IBM)	1	As needed
Shock Mounts	1134857 (IBM)	4	As needed
Drive belt	1124812 (IBM)	1	As needed
LH tilt pulley stud	1134964 (IBM)	1	As needed
Bushing RH Tilt pulley	1123750 (IBM)	1	As needed
Bearing Filter Shaft	1141663 (IBM)	2	As needed
Spring rotate	1132244 (IBM)	1	As needed
Carrier return pinion	1123574 (IBM)	1	As needed
Tab pinion	1123571 (IBM)	1	As needed
Bail roll	1124397 (IBM)	3	As needed
Feed roll rear	1128138 (IBM)	2	As needed
Feed roll front	1128141 (IBM)	2	As needed
Platen 27 tooth	1166976 (IBM)	1	As needed
Reed switches	5000048 (DATEL)	8	As needed
Microswitch	5000015 (DATEL)	1	As needed
Transport cord	1166415 (IBM)	2	As needed
Cherry Switch	5000014 (DATEL)	4-5	As needed

Figure 5-2

5-6. EVERY INSPECTION.

The following steps are to be performed on each and every inspection.

a. Every Inspection - Cleaning

General cleaning: all machines should be thoroughly cleaned with dust covers and outer cover removed. Platen, feed rolls deflector and cardholder should be cleaned. Carrier area should be flushed if excessively dirty. Rotate should be checked and adjusted.

b. Every Inspection - Lubrication (0=IBM #10) (g=IBM #23)

1. Cycle clutch spring and arbor (g).
2. Cycle clutch pulley hub and bearing (o).
3. Operational cam bearing (o).
4. RH operational shaft bearing (g).
5. Shift clutch spring and arbor (g).
6. Print shaft and bearings (o).
7. Ribbon lift-feed and print cams (g).
8. Rocker bearings (o).
9. Upper ball socket and tilt ring pivots (o).
10. Rotate spring (o).
11. Upper idler gear shift (o).
12. Lower idler, cycle shaft bearing and filter shift bearings (o).
13. Rotate and tilt detent pivots (o).

c. Do Not Oil These Items:

1. Motor
2. Selector compensator.
3. Rotate arm wear compensator roller.
4. Ribbon spools and spindles (both fabric and carbon).
5. Carrier return clutch spring.
6. Drive Belt.

d. Every Inspection - Printer Keyboard Check

1. Once specific checks are made and all cleaning (including outer covers) is complete, insert paper in the machine and make a complete strike-up of all print characters being sure to use both ends of the platen and both upper and lower case. Watch closely for any indications of poor print quality and improper detenting. Make the strike-up several times. (Print and print escapement check.)
2. Check carrier return from 1 space out, 10 spaces out, 50 spaces out, and full length of print line. Insure that all CR's are correct. (Carrier return check.)
3. Index should be operated between a character and a pattern, indicating the correct index is made. (Index check.)
4. Space once, type character (N), space again, type across entire print line. Back space twice, type (N); backspace twice, type (N) back across entire line. The line should have light and dark characters next to each other across entire line. (Space and backspace check.)
5. Set tabs at 10 - 15 - 20 - 30 - 40 - 55 - 80 spaces from margin. Return to LH margin tab once, type (1) tab twice, type (2) tab three times, type (3) tab once, and type (1). Do this three to five times to insure positive fast tab. Hold carrier, tab, allow carrier to move slowly into final tab stop. Carrier should unlatch tab at final RH margin. (Tab and mainspring check.)
6. On carbon ribbon machines, insure correct ribbon patterns and insure

proper stencil lockout. On fabric ribbon machines, insure that 1/2 types fully on ribbon in No. 1 lift position. Insure that underscore types fully in No. 3 lift position. Stencil must lock out ribbon lift. Also insure that ribbon will reverse in both directions. (Ribbon check.)

e. Every Inspection - On-line Check

The terminal should be completely assembled with cases on. Check the terminal using the customer's system wherever possible. Check the transmit of the terminal by typing several lines in a copy or recopy program. Test the receive mode of operation by running a listing so that the printout can be proofread easily. Test interrupt if possible. The best method of test is to duplicate as closely as possible the customer's actual method of terminal operation.

ON EVERY INSPECTION THE CALL PREVENTION MACHINE CHECK (C P M C) MUST BE PERFORMED.

5-7. FIRST INSPECTION

The following steps are to be performed on each first inspection.

a. First Inspection - Keyboard Area

1. All keylevers operate freely.

2. All keylevers travel down and cause the selector to overthrow its latch keeper.

3. All keylevers restore and reset.

4. All selectors unlatch the cycle clutch by .002" to .004" when latched on the keeper.

5. Cycle clutch restores by .020" to .040".

6. All latches hang even or .010" over the cycle bail.

(a) Manually half-cycle the following selections and observe the latches. They should not snap off at any time. Observe correct selection. (Figure 5-3)

Latches	Correspondence	BCD
T 2	B	comma
T 1	W	$
R 1	Y	I
R 2A	Q	F
R 1 R-5	/	H
R 2 R 2A	+	B

Figure 5-3

b. First Inspection - Cycle Clutch

1. Check cycle shaft end play, .001" to .003". This will widen with wear (center bearing of machine will wear).

2. Check cycle clutch drive. Slowly cycle the machine under hand operation, using the character one. When the clutch starts to slip stop cycling. Check the position of the print shaft gear. Trip off the character one again and cycle the machine until the check pawl drops in. Check for 3/4 to 1 tooth of motion on the print shaft gear.

3. Insure under power that check pawl is against the face of the check ratchet with each character printed. This is the only dynamic check necessary for cycle clutch.

4. Check for minimum backlash and no binds in the idler gears and end play in print shaft and filter shaft.

c. First Inspection - Tilt Mechanism

1. Check tilt motion.

2. Check tilt detenting, check side play in tilt detent and tilt ring.

d. First Inspection - Rotate Mechanism

1. Check for correct rotate and detenting on these characters in upper case. (Figure 5-4)

Latches	Correspondence	BCD
0	J	&
+5/–5	J	&
+5	– (dash)	period
–5	G	A

Figure 5-4

NOTE:

Insure that all detents fall into typehead 1/4 to 1/2 way down negative side of typehead notch with all play out in the clockwise direction.

2. Correct all adjustments in upper case then adjust lower case to match.

e. First Inspection - Alignment and Impression

1. Check for kinks, nicks and wear on the tilt and rotate tapes.

2. Check for binds and side play in the rotate and tilt detents, tilt ring and upper ball socket.

3. Check print shaft timing and insure that *after* all rotate adjustments are correct, the rotate detent withdraws and just touches the negative side of the tooth when using a lower case –5 character. Check a +5 character to insure positive detenting.

4. Check to insure that skirt clearance is .025″ to .035″ and that when the detents are seated solidly in their respective notches, the clearance between the detent cam follower and the follower roller is .001″. An easy way to check this is to half cycle a –5 character until the check pawl drops at the 90° ratchet notch. Check that the follower roller moves easily on the follower shaft without binds and without left-to-right play.

f. First Inspection - Special Lubrication

1. Oil: (IBM #10)

(a) Cycle clutch latch pivot.

(b) Cycle clutch check latch pivot.

(c) All selector latch pivots.

(d) All differential pivots.

(e) Rotate bellcrank and link (both ends).

(f) Rotate arm pulley and pivot.

(g) Tilt multiplier link (both ends).

(h) Tilt arm pivots and tilt pulleys.

(i) Tilt arm pivots and tilt pulleys.

(j) All selector bail pivots.

(k) All negative 5 cam follower pivots.

(l) All keyboard bail pivots.

(m) All keyboard selector clevises and pivots.

(n) All cycle clutch link pivots.

(o) All bail armature pivot points.

(p) All inner carriage pivots.

(q) Cycle clutch latch pivot.

(r) Center bearing.

2. Grease (IBM #23)

(a) All bail spacers (use spring hook).

(b) Cycle clutch keeper and link guide.

(c) Selector latch surfaces (including negative 5).

(d) Cycle clutch sleeve steps.

(e) Cycle clutch restoring roller.

(f) Negative 5 roller and selector rollers.

(g) Cycle shaft cam surfaces.

(h) All selector interposer sliding surfaces (lightly).

5-8. SECOND INSPECTION.

The following steps are to be performed on each second inspection.

a. Second Inspection - Voltage Levels

1.	24V	Check 24V with scope to insure that the low portion of ripple does not go below 24V.
2.	4.75V	Check 4.75V for less than 25 millivolts ripple with scope.
3.	−12 + 12V	Check −12 and +12 for less than 100 millivolts ripple.

b. Second Inspection - Electrical Character Trip and Selection

1. Character trip: The character trip should be set so that the character will trip at no less than .005″ and no more than .015″, when the feeler gauge is placed between the armature and housing and the armature is attracted manually.

2. Selection armatures: Check the armature to limit clearance .055″ to .060″. Adjust each selection armature so that it will move its respective latch (printer cycle clutch at its latched position) at .015″ but not at .002″ when the armature is attracted manually.

c. Second Inspection - Electrical Operations

1. Operational housing: Check to insure that the operational solenoids have not worn through the teflon tape on the cores. If so, replace the tape to prevent any residual magnetism problems.

2. Operation Adjustment: With power off the machine, check that when an armature is attracted manually, it will *just* trip its interposer. (More than about .002″ trip will cause failure on repeated operations.)

d. Second Inspection - Character and Operational Switches

1. Character switches: Check the adjustment of the bail reed switches. Check for loose magnet holders. The reeds should be replaced and readjusted if necessary. Closure is 16 (+4, −2) ms. The switches must close 1 to 6 ms prior to filter switch closure and within 2 ms of each other. If necessary, adjust or replace filter shutter at this time.

2. Operational switches: Check the adjustment of the operational switches. Replace if necessary and, using the scope, insure that:

   (a) CR and index is no longer than 80 ms, with 7 ms bounce (LE) and 1 ms (TE).

   (b) Tab, space and backspace are no longer than 58 ms with 7 ms bounce (LE) and 1 ms bounce (TE).

e. Second Inspection - Keyboard Lock

1. Electrical test: Using link ready button, insure that:

   (a) The shift unlock link will unlock the shift immediately.

   (b) The keyboard lock link locks the keyboard immediately.

   (c) The operational lockout operates immediately.

2. Mechanical test: Using on-off keybutton, insure that the motion provided

by the solenoid is duplicated by the keybutton. This will insure positive keyboard lock in the OFF position.

f. Second Inspection - Special Lubrication

1. Oil:

(a) Armature pivots (lightly).

(b) Cycle clutch trip link (armature end).

(c) Operational pivot (lightly).

(d) Operational interposer latch pivots.

(e) Operational latch pivots.

(f) Shift unlock link (both ends).

(g) Keyboard lock link (both ends).

(h) Clamp pivot.

(i) Lockout bail.

(j) On-off link.

(k) Keyboard lockout bellcrank link.

(l) Operational cam wicks.

(m) Operational cam pawl pivots.

2. Grease:

(a) Operational cam surfaces, follower rollers and ratchet.

(b) Cycle clutch trip link (bail end).

5-9. THIRD INSPECTION

The following steps should be performed on each third inspection.

a. Third Inspection - Carrier Return

1. With power off:

(a) Check carrier return clutch latch overthrow with 360 cam on its high point. The latch should clear the keeper by .010" to .020".

(b) The carrier return shoe should cause the carrier to start left before the escapement pawl clears the rack.

(c) The escapement pawl shoe should allow the carrier to move right just as the bottom face of the carrier return clutch latch clears the keeper.

2. With power on:

(a) The carrier should move the margin rack and latch keeper away from the end of the clutch latch by .005" to .015" when pushing down on the clutch latch.

(b) The carrier return torque limiter should provide 1/2 to 1 pound pull on the carrier at the left hand unlatching point.

(c) Check the single operation of the carrier return cam.

b. Third Inspection - Shift and Shift Indication

1. Shift:

(a) Check shift release adjustments. The release arm should clear both the inner and the outer lug of the shift ratchet by .005".

(b) Check the ratchet adjustment. The ratchet should rotate .045" to .060" when released with detent roller dead in the notch.

(c) Hold the detent roller out of the notch and power cycle the shift from upper to lower case and back to upper. Whenever the detent roller is allowed to re-enter the cam it should always bottom out in the detent notch.

2. Shift Indication:

(a) Using scope, check to insure that the shift pulse never goes past 72 ms. Check to insure that the pulse is never shorter than 10 ms in duration nor has bounce time in excess of 250 microseconds. Replace switch if necessary.

c. Third Inspection - Index and Paper Feed

1. Index:

(a) Check for platen latch problems and defective platen bearings.

(b) With index in the 2-line position, the index pawl should be .010" to .050" away from platen ratchet.

(c) Pull detent roller out of platen and hand cycle an index. The platen should *never* move when the detent re-enters.

(d) Check the single operation of the index cam.

2. Paperfeed:

(a) Check for adequate tension on both the front and rear feed rolls to prevent paper slippage.

d. Third Inspection - Space, Backspace and Print Escapement

1. Space:

(a) Check that the space bar causes smooth escapement throughout entire printing line.

(b) Insure that the escapement and backspace pawls move out of the rack by .008" to .010" prior to trigger action.

(c) Check for frayed or broken transport cords. Replace if necessary.

(d) Check for 1/2 to 3/4 pound mainspring pressure as carrier tabs through linelock at RH margin.

(e) Check for single operation of the space cam.

2. Backspace:

(a) Check that there is .001" to .003" clearance between backspace rack and its pawl with carrier at rest.

(b) Check that backspace just fails under hand-operated backspace and that it overthrows slightly under power.

(c) Check for single operation of backspace cam.

3. Print Escapement:

(a) Check with machine at rest that there is no clearance between the space bar latch lever screw and the escapement trigger level.

(b) Check on both 1/2 cycles of the escapement cam that trigger action occurs.

(c) Check that the escapement cam is positioned radially on the filter shaft so that escapement always occurs after print.

e. Third Inspection - Tabulation and Margin Control

1. Tab:

(a) Check tab set and clear for reliable operation.

(b) Check to insure that the tab lever will overthrow the tab latch by .005" to .010" at both ends of the writing line.

(c) Check that the carrier return reliably unlatches the tab during any tab operation.

(d) Check for single operation of the tab cam.

2. Margin Control:

(a) Check for proper action of margin release.

(b) Check that the pointer lines up with the case scales and that the keyboard locks at the RH margin stop.

(c) Check that both the LH margin stop and the margin stop final stop unlatch the carrier return by the same amount.

f. Third Inspection - Ribbon Feed and Lift

1. Ribbon Feed and Lift:

(a) Fabric ribbon:

(1) Remove ribbon plate and check carefully for cracks in the ribbon drive cam follower.

(2) With plate on machine, check both spools for accurate, reliable ribbon reverse.

(3) Check ribbon cartridge holddown springs and replace if necessary.

(4) Check the ribbon stencil position and all three ribbon lift positions. If customer is using red-black ribbon, be sure that the lift causes print correctly on the ribbon.

(b) Carbon ribbon:

(1) Check with operator to insure there are no ribbon spill-off problems.

(2) Clean and replace drive rollers if necessary.

(3) Check to insure that the ribbon pattern is correct and check typing carefully for ribbon flake-off and smearing. (Remember to check character detenting and print shaft timing if a problem is noted.)

g. Third Inspection - Special Lubrication

1. Oil:

(a) All cord pulleys and escapement shaft bearings.

(b) All carrier return operational pivots.

(c) Shift arm pivot and lube wick.

(d) Shift arm roller pivot and pulley.

(e) Shift cam back-up, roller pivot.

(f) Shift indication vane pivots.

(g) All index operational pivots.

(h) Index link (both ends).

(i) Platen bearings.

(j) Escapement torque bar pivots.

(k) All space, backspace and escapement pivots.

(l) Tab torque bar and tab rack pivots.

(m) All tab and margin control pivots.

(n) Tab lever and latch.

(o) Escapement and backspace pawl.

(p) Tab set/clear pivots.

(q) Ribbon mechanism pivots.

(r) Ribbon lift pivots.

(s) Print cam follower pivots.

(t) Escapement cam follower roller pivot.

(u) Tab governor spring (one drop).

(v) Mainspring.

2. Grease:
(a) Carrier return latch face.

(b) Shift arm roller.

(c) Shift cam face.

(d) Shift cam back-up roller.

(e) Feed roll pivots.

(f) Escapement rail.

(g) Backspace rack slides.

(h) Escapement trigger face.

(i) Tab set/clear bellcrank.

(j) Inner carriage guides (both sides).

(k) Print cam and cam follower.

(l) Ribbon drive and detent cam.

(m) Ribbon lift cam.

(n) Velocity control plate pin.

(o) Escapement cam follower roller.

5-10. SELECTRIC I/O KEYBOARD PRINTER ADJUSTMENTS.

The following adjustments are the basic adjustments for the I/O Printer. They will enable you to take a non-working printer and properly adjust any mechanism on it. The sequence of adjustments in each mechanism of the machine is important and must be followed in order.

5-11. MOTOR AND DRIVE

a. Cycle Shaft End Play

Shim the shaft to obtain .001" to .006" end play of the cycle shaft. The shims are placed between the left hand bearing and the check ratchet. The shims are available in various thicknesses and are coded by shape as described in the Parts Catalog. (Figure 5-5)

CAUTION: The slight end play of the cycle shaft ensure that it will rotate freely. Excessive play could allow a coil of the cycle clutch spring to wedge between the two hub members of the clutch causing a machine lock-up.

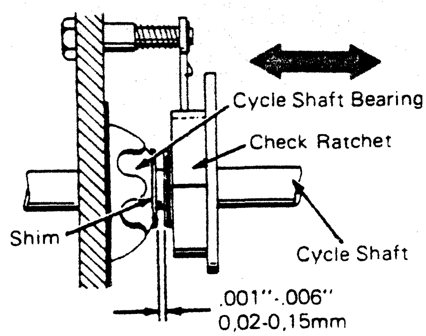


Figure 5-5.

b. Gear Train Backlash

Adjust the idler gear studs so minimum backlash is present between mating gears. The mechanism must be free of binds throughout 360 deg. rotation of the gears. Minimum backlash is necessary to prevent erratic operation of the drive train and to ensure minimum overthrow of the driven shafts. The lower idler gear must be adjusted first because the upper idler gear is adjusted to the final position of the lower gear. (Figure 5-6)

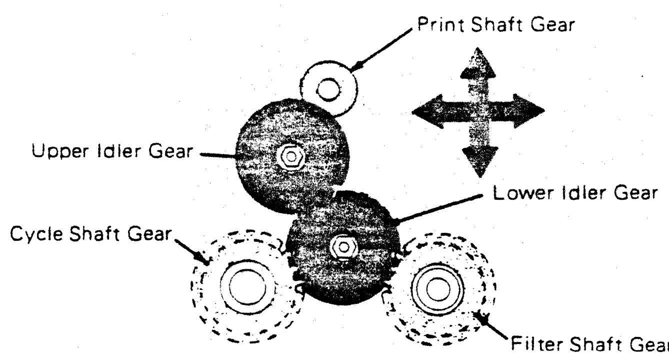


Figure 5-6.

c. Cycle Clutch Latch Bracket

Adjust the bracket vertically so the Hoovero-meter, set on the No. 3 scribe line, just spans the distance between the print shaft and the cycle clutch latch pivot pin.

If the bracket were adjusted too low, the steps would be at an angle to the line of motion of the cycle clutch latch. The latch would have difficulty in moving forward to release the clutch sleeve, and a slow, hesitant operation would result. With the bracket too high, the force of stopping the cycle shaft through the cycle clutch sleeve would tend to cam the latch forward. A repeat cycle operation could result. (Figure 5-7)

NOTE:

Recheck the cycle clutch latch restoring adjustment after changing this adjustment.

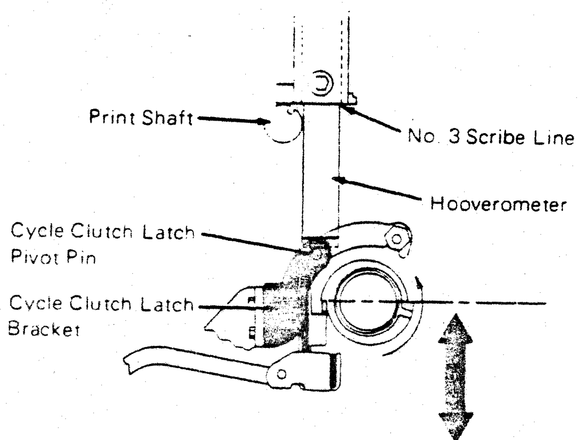


Figure 5-7.

d. Cycle Clutch

The cycle clutch must be adjusted to satisfy the following conditions:

1. Loosen the collar and position the spring left to right so the right end of the spring will clear the face of the cycle clutch pulley be .004" to .012". (Figure 5-8)

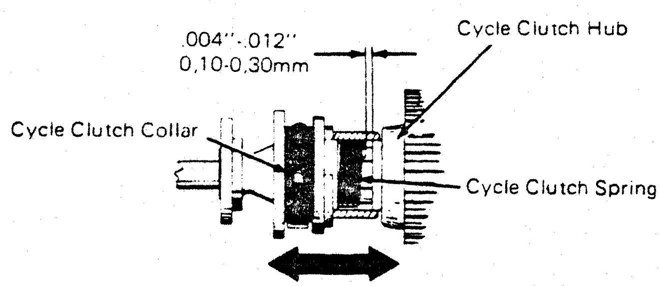


Figure 5-8.

2. Position the collar left to right so the sleeave will have .10" to .015" end play. (Figure 5-9)

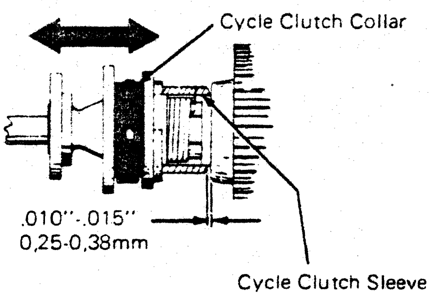


Figure 5-9.

3. When a zero tilt, negative five rotate character is hand cycled, adjust the collar and spring rotationally so the cycle clutch spring will begin to slip when the print shaft is 1/2 – 1 tooth from its rest position. (Figure 5-10)

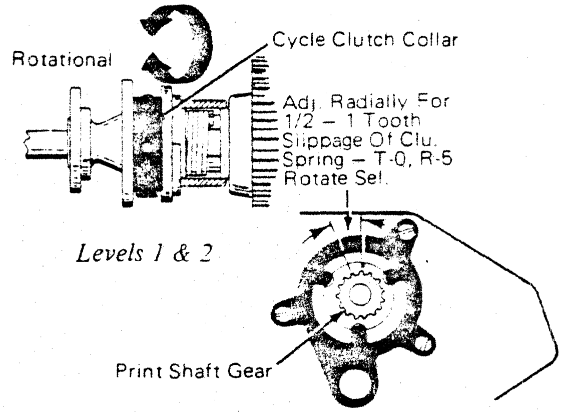


Figure 5-10.

4. Position the overthrow stop so it will allow the cycle shaft to overthrow its latched position by .007" to .015". (Figure 5-11)

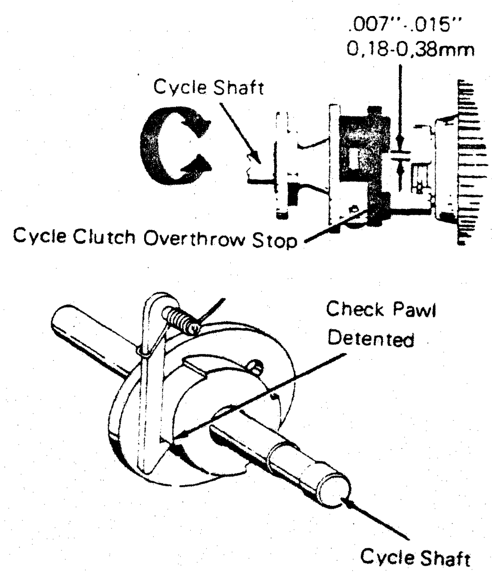


Figure 5-11.

An easy method to obtain this adjustment with "power on" is as follows:

1. Leave the right hand dust shield in place while performing this "power on" adjustment. This will eliminate the danger of the bristo wrench being thrown out of the machine due to the possibility of it contacting the torque limiter hub. Rotation of the cycle clutch pulley and drive belt does not constitute a hazard as there are no exposed projections which could propel the bristo wrench out of the machine.

2. Insert the "L" shaped foot of the Hooverometer into the cycle clutch latch link to prevent accidental cycling of the machine while performing the "power on" adjustment of the cycle clutch. (Figure 5-12)

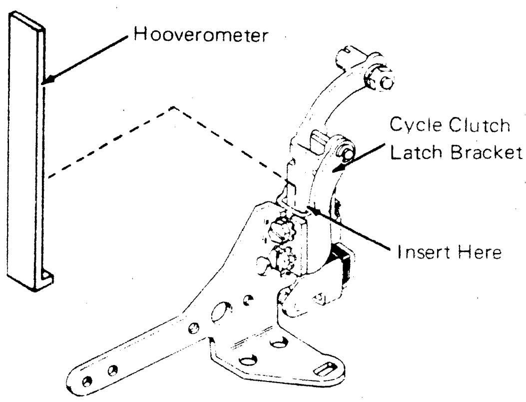


Figure 5-12.

3. Turn machine on, position the cycle clutch collar screw up, then position the carrier into the RH margin to prevent cycling of the cycle shaft.

4. Loosen the cycle clutch clamp screw and overthrow stop screws then advance print shaft (top to rear). Caution: Do not trip the cycle clutch with the bristo wrench in the clamp screw.

5. At this time check the lateral position of the cycle clutch spring. Expand the cycle clutch spring by pushing the LH side of the spring with a spring hook. The lateral position of the spring can be changed by pushing left or right for proper adjustment with the cycle pulley.

6. Rotate the print shaft a complete cycle (top to rear) until the cycle shaft check pawl drops in. Back the cycle shaft up against the check pawl.

7. Position the overthrow stop for .007" to .015" clearance and tighten the clamp screw. This will give approximately 1/2 tooth of motion to "unwrap" the spring in its rest position. Observe this motion at the print shaft gear by hand cycling a zero tilt, negative-five character with the power off.

e. Drive Belt

Adjust the motor mounting brackets front to rear to obtain a minimum amount of belt noise. The belt must not be loose enough to allow the belt to jump cogs on the motor pulley. Check by operating the carrier return mechanism and holding the carrier while simultaneously operating the shift mechanism. This loads the motor to a point where failure will be most probable. (Figure 5-13)

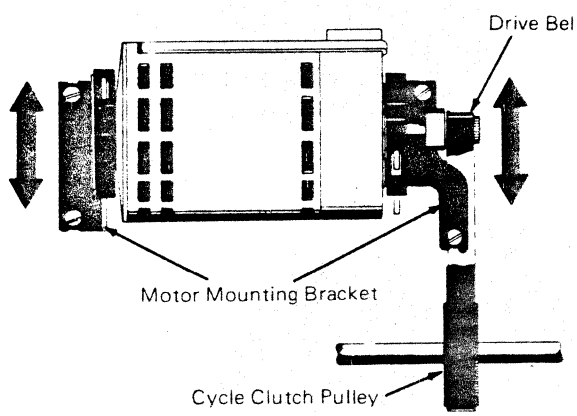
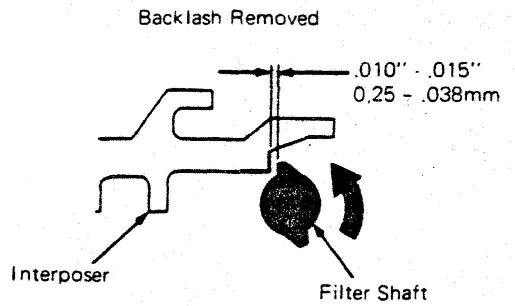


Figure 5-13.

5-12. KEYBOARD

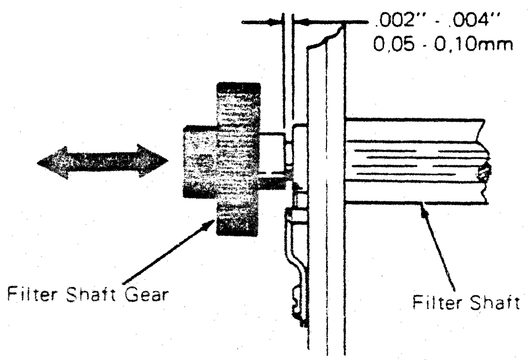
a. Filter Shaft

With the machine at rest and all gear train backlash removed in the forward direction, the working surface of the filter shaft should clear the rear of any latched interposer by .010" to .015". (Figure 5-14) Loosen the filter shaft gear and adjust the filter shaft rotationally to meet this condition. Be sure to maintain .002" to .004" end play of the filter shaft within the left hand filter shaft bearing. This adjustment affects the spacebar lockout cam and the escapement cam timing. (Figure 5-15)



Side View

Figure 5-14.



Front View

Figure 5-15.

Insufficient clearance between the filter shaft and the interposers could allow the filter shaft to stop just under the rear of the interposers. The keyboard would then be inoperative, because the interposers could not be depressed.

Excessive clearance would delay the operation of the interposers. The selector latches would not be pulled forward until after having been pulled down slightly by the latch bail. This would result in excessive wear and a noisy operation as the latches were snapped forward from under the bail.

b. Rear Interposer Guide Comb

With the end interposer latched down, pull any other interposer down with a spring hook. The second interposer should clear the tip of the filter shaft. Loosen the four screws on the guide comb and move it vertically to satisfy this condition. (Figure 5-16)

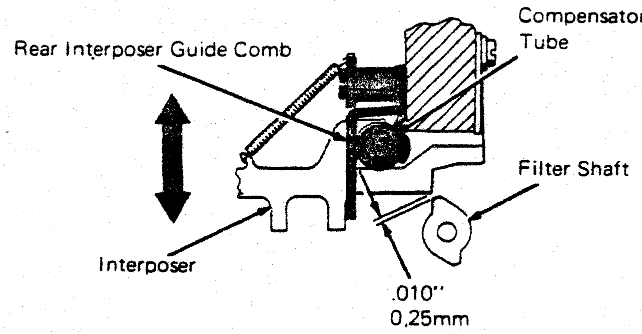


Figure 5-16.

NOTE:

The selector compensator tube is mounted to the rear of the interposer guide comb by four clamps and must move vertically with the guide comb when the guide comb adjustment is made. Be sure to loosen the guide comb mounting screws before attampting to move the guide comb. DO NOT HAMMER THE GUIDE COMB INTO POSITION AS THIS CAN CAUSE THE COMPEN-SATOR TUBE TO SHIFT WITH RESPECT TO THE GUIDE COMB. The vertical position of the tube on the guide comb is set with respect to the stop strap riveted along the bottom of the guide comb and should not be disturbed.

c. Bail Mounting Plate

Position the left hand bail mounting plate to satisfy the following conditions. The selector bails should be parallel front to rear with the lugs on the interposers. At the same time, the cycle bail must be parallel vertically with the lugs on the interposers. (Figure 5-17)

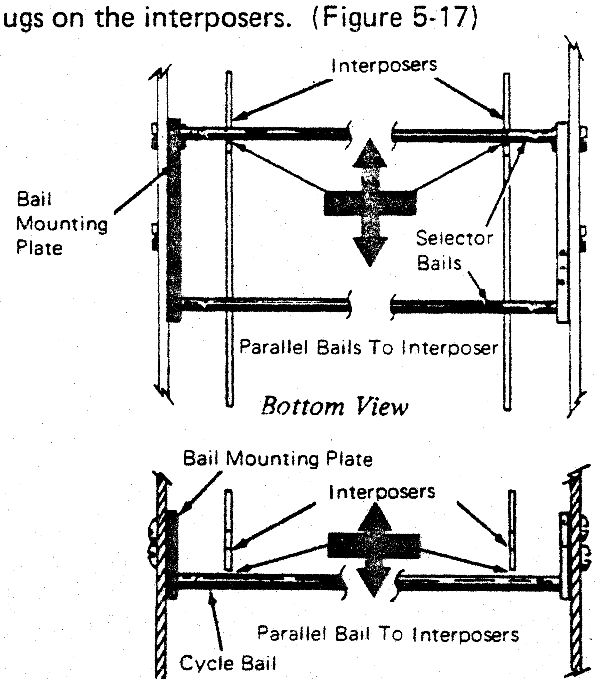


Figure 5-17.

d. Keeper Bracket

With the machine at rest, the cycle clutch latch should engage the sleeve by the thickness of its metal. Adjust the keeper bracket front to rear to obtain this condition. (Figure 5-18)

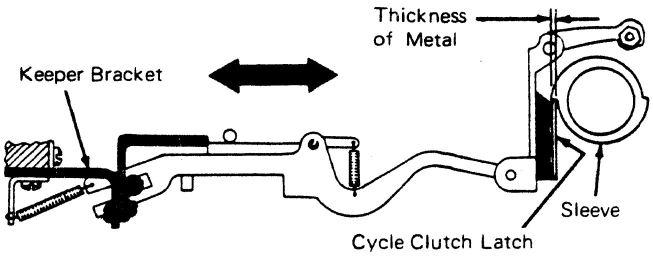


Figure 5-18.

e. Cycle Clutch Latch Restoring

Adjust the restoring stud vertically so, as the machine is hand cycled, the latch link pawl is pulled .020" to .025" to the rear of the keeper before it restores. Check this clearance on both lobes of the restoring cam and adjust the stud on the lobe providing the least amount of motion. (Figure 5-19)

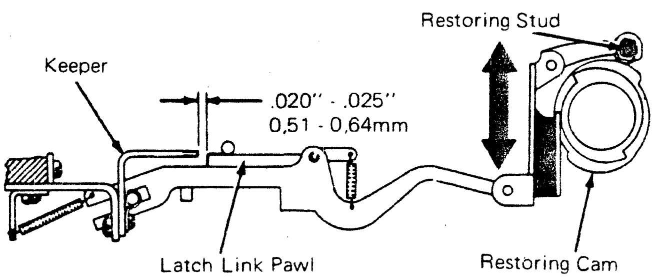


Figure 5-19.

f. Interposer Latch Springs

Adjust the right interposer latch spring vertically so that the springs are flush with the bottom edge of the interposer. (Figure 5-20)

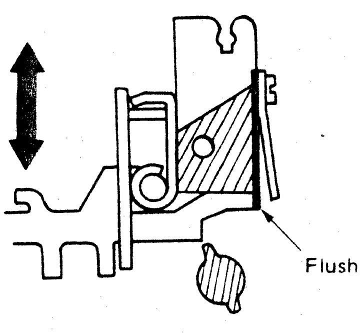


Figure 5-20.

g. Cycle Clutch Keeper

With the +/= interposer latched down, adjust the keeper vertically to obtain .000" to .002" clearance between the cycle clutch latch link pawl and the lower side of the keeper. Then, position the left and right interposer latch springs vertically to maintain the .000" to .002" keeper clearance with various interposers latched down. (Figure 5-21)

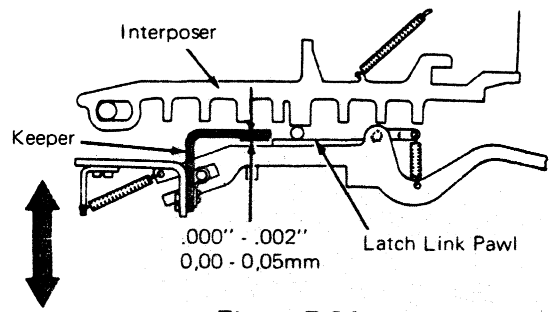


Figure 5-21.

NOTE:

This clearance should be maintained on the low side of the adjustments. Too much clearance can cause an erroneous selection because of flicking aciton on the keylevers causing the cycle clutch to be released without latching an interposer down. As a result, the filter shaft will not drive an interposer forward and the hyphen or underscore will be printed.

Insufficient clearance does not ensure that the clutch will be released when an interposer is latched down. If an interposer is latched down without releasing the cycle clutch, the keyboard will be locked because the interposer will remain in the compensator tube.

h. Cycle Bail Upstop

Adjust the cycle clutch bail upstop vertically so the cycle clutch latch link pawl engages the cycle clutch keeper by half its thickness with the machine at rest. The bail stop is mounted with two nuts and two screws. These nuts and screws also control the position of the character interrupter bail plate. In order to adjust the cycle clutch bail stop, loosen both nuts and only the front screw. Do not loosen the rear screw. (Figure 5-22)

Insufficient bite will increase the possibility of a repeat cycle because positive latching is not ensured. Excessive bite will affect the touch of the keyboard because the latch pawl must be moved farther in order to trip the cycle clutch.

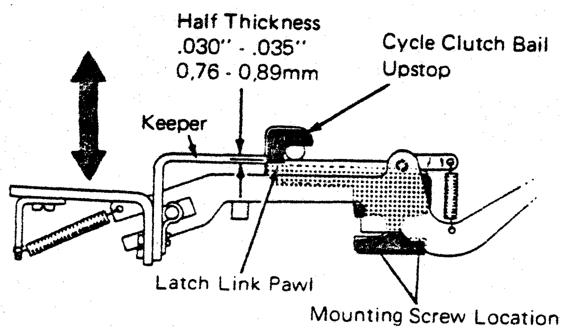


Figure 5-22.

i. Front Keylever Guide Comb

With the power on, depress and slowly release keybuttons on the right, left and middle of the keyboard. There should be .030" clearance between the keylever and the top of the slot in the guide comb as the keylever pawl resets above the interposer. Adjust the front keylever guide comb vertically to satisfy this condition. Individual keylevers that do not conform to the majority may be formed at the horseshoe bracket. (Figure 5-23)

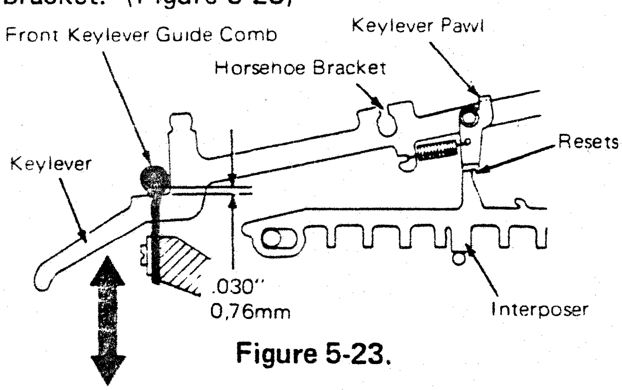


Figure 5-23.

j. Compensator Tube

Adjust the left and right end plugs for best possible touch. There should be no hesitation as you depress the keylevers. (Figure 5-24)

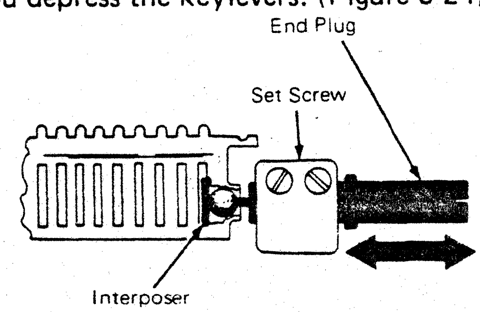


Figure 5-24.

k. Switch Link

Adjust the switch link clevis so the on-off keybutton matches the slope of the keyboard in the off position. (Figure 5-25)

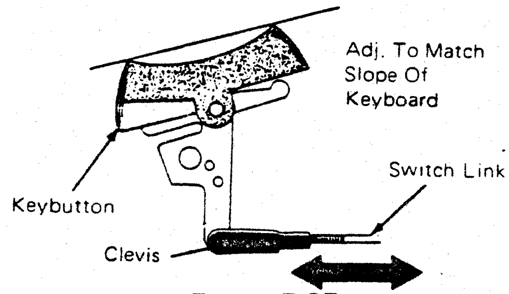


Figure 5-25.

l. Lockout Bail Link

Adjust the keyboard lockout bail link clevis to obtain equal motion over center of the lockout bail bellcrank. (Figure 5-26)

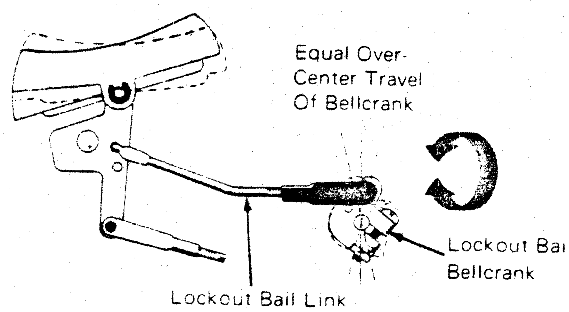


Figure 5-26.

m. Lockout Bail Bellcrank

Adjust the lockout bail bellcrank rotationally on the lockout bail shaft so the lockout bail is positioned beneath the lug on the cycle clutch latch pawl when the switch is in the off position. (Figure 5-27)

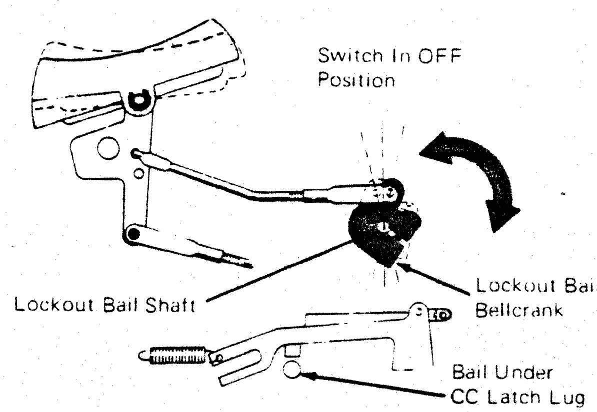


Figure 5-27.

n. Keyboard Lock Bellcrank Link

Machines equipped with this link should be adjusted so the bellcrank is fully bottomed in the selector compensator tube without choking off the action of the lockout bail. (Figure 5-28)

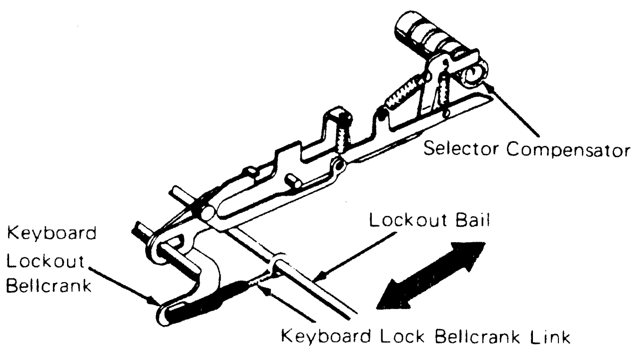


Figure 5-28.

5-13. SHIFT

a. Shift Cam Backup Roller (Early Machines)

Adjust the backup roller eccentric left to right so .001" to .004" of the cam bearing extends beyond the cam. The eccentric should be kept in the bottom half of its orbit. (Figure 5-29)

CAUTION: Any change in the rest position of the backup roller, directly affacts the typehead homing and the shift arm motion adjustments. Be sure to recheck these adjustments.

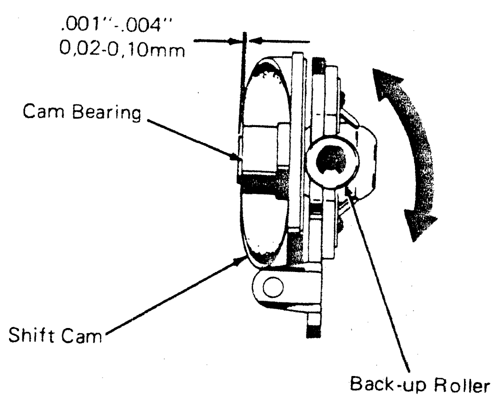


Figure 5-29.

b. Shift Spring Clutch Retaining Plate

With the machine off and the shift cam in the lower case rest position, adjust the retaining plate rotationally so the ratchet will rotate one tooth when released. (Figure 5-30)

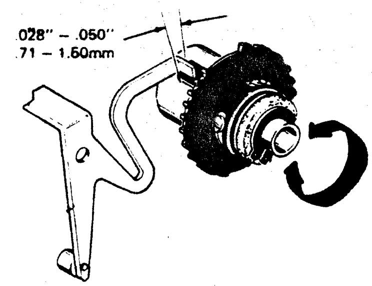


Figure 5-30.

c. Shift Overthrow Stop

With all parts at rest, adjust the shift overthrow stop to obtain .010" to .030" clearance between the stop and the inner lug of the shift ratchet. (Figure 5-31)

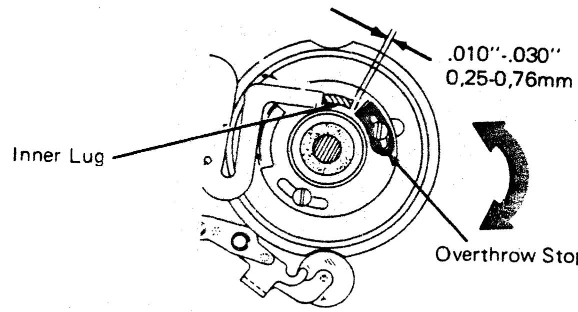


Figure 5-31.

d. Shift Brake

Adjust the shift brake to obtain .035" to .040" rise as the brake contacts the working surface of the shift cam. (Figure 5-32)

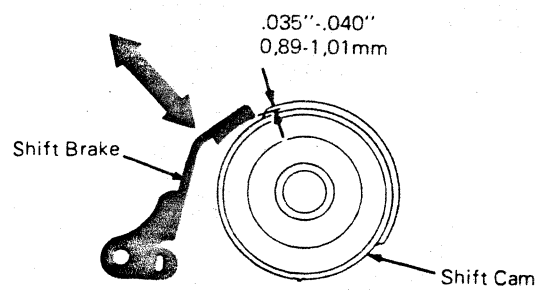


Figure 5-32.

e. Shift Release

Position the shift bellcrank rotationally on the shift bail to have the same overcenter travel in both directions. Adjust the shift release link so release occurs when the keylever is depressed two-thirds of the way down. As the keylever is allowed to restore from a fully depressed position, the shift should again operate when two-thirds travel of the keylever has been reached. A balance between the two releasing points ensures proper adjustment. (Figure 5-33)

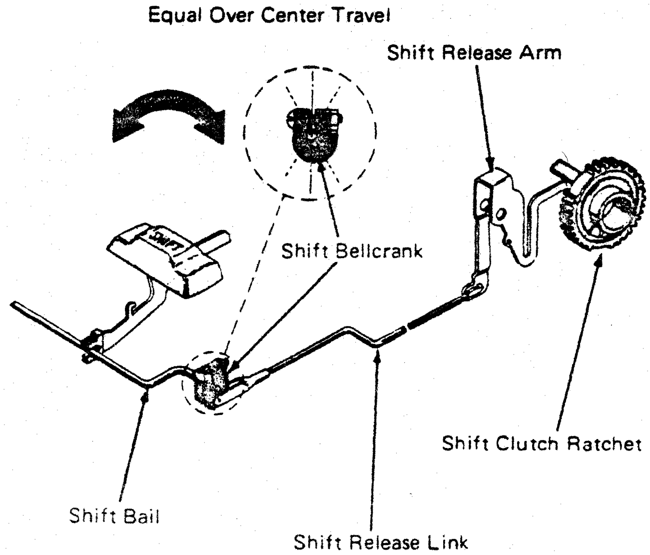


Figure 5-33.

f. Shift Lock

Adjust the shift lock bracket vertically so the shift lock engages just as the shift operates or lsightly afterward. The lock should not engage before the shift release occurs. The shift lock must be released easily by depressing either shift keybutton. (Figure 5-34)

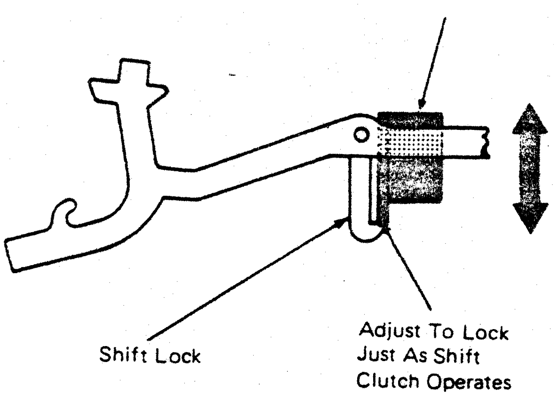


Figure 5-34.

g. Shift Interlock Arm

With the shift interlock on the low point of the cam, adjust the interlock by its adjusting screw so that the tip just bottoms between two teeth of the shift clutch ratchet. (Figure 5-35)

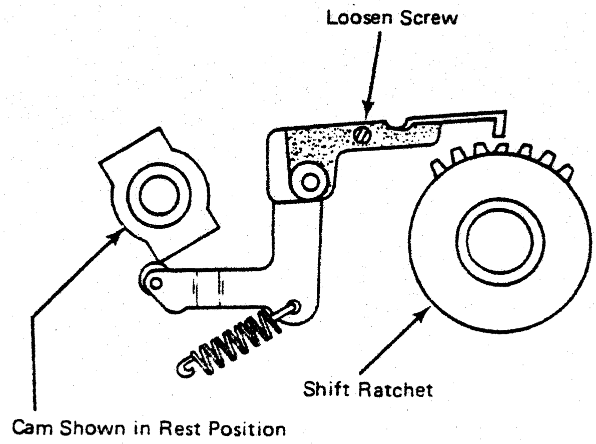


Figure 5-35.

h. Shift Interlock Cam

Release the shift ratchet and hand cycle the shift cam so that the cycle clutch interlock is in its activated position. Trip the cycle clutch by depressing a keybutton, and rotate the filter shaft top flute toward the front of the machine removing backlash of the gear train and cycle clutch. Adjust the shift interlock cam so that the follower roller is just ready to leave the high point of the interlock cam. (Figure 5-35)

i. Cycle Clutch Interlock Arm Plate

Raise or lower the interlock plate so that the interlock arm clears the step on the cycle clutch sleeve by .005" to .015". (Figure 5-36)

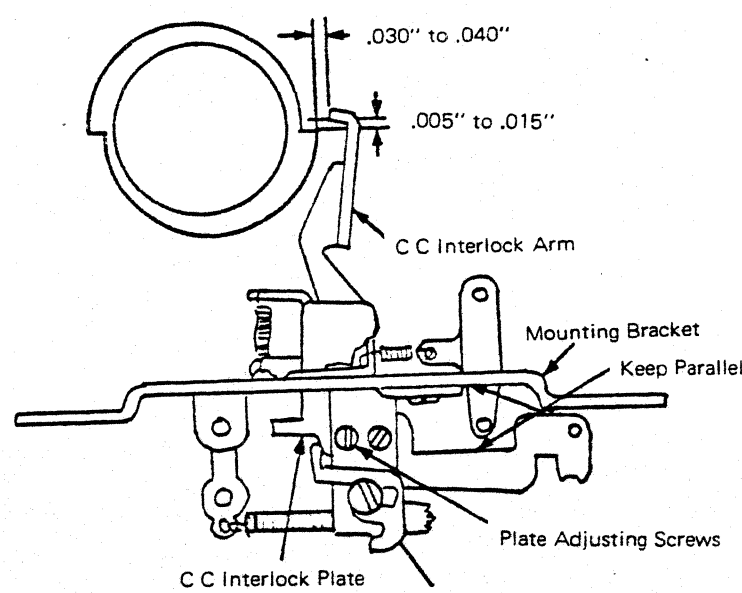


Figure 5-36.

NOTE:

When adjusting the mounting plate, exercise care to prevent the mounting plate from rotating about the mounting screws. Keep the mounting plate parallel to the cycle clutch trip mounting bracket. Failure to do so may cause cycle clutch lock-up due to failure of the interlock arm to restore.

j. Link or Cable

Adjust the length of the link or the cable to obtain 50% bite of the shift interlock arm over the cycle clutch sleeve when interlocked. (Figure 5-37)

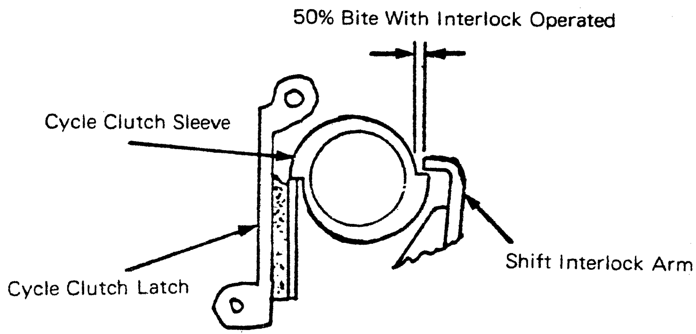


Figure 5-37.

5-14. FINE ALIGNMENT

a. Carrier Shoe

The carrier shoe eccentric mounting stud for .002" to .006" between the carrier shoe and the escapement rack. This adjustment should be checked at several points along the escapement rack. (Figure 5-38)

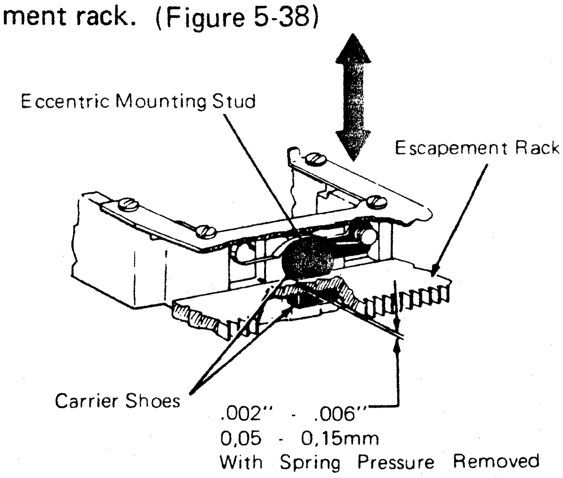


Figure 5-38.

This amount of vertical play assures free horizontal movement of the carrier, yet restricts vertical movement to help prevent variation in the vertical alignment of the type characters.

b. Print Sleeve Side Play

The print sleeve must have .002" to .004" side play. This adjustment is obtained by adjusting the ribbon lift cam left to right. The print cam set screw tightens into a dimple in the print sleeve. (Figure 5-39)

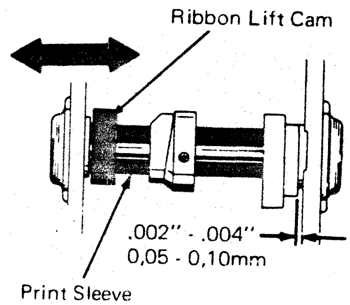


Figure 5-39.

c. Rocker Side Play

Adjust the rocker shaft to obtain .002" to .004" side play. The side play exists between a C-clip around the shaft at the right of the rocker and a thrust washer against the carrier casting at the left of the rocker. The rocker shaft is held in place by a set screw at the left end of the rocker shaft in the carrier casting. This adjustment should be kept to the minimum side of the specification. (Figure 5-40)

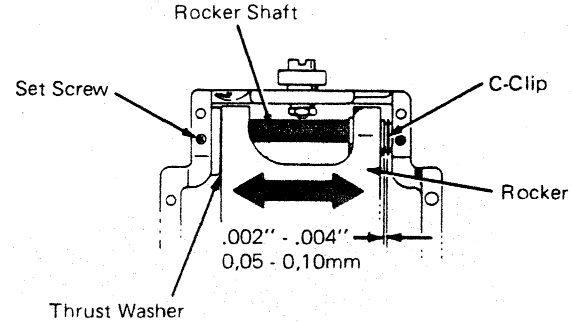


Figure 5-40.

d. Rotate Shaft Endplay

Adjust the rotate pulley vertically to obtain .002" to .004" vertical motion of the rotate shaft. The rotate pulley is secured to the rotate shaft by a wedging block and a set-screw. The pulley is accessible from the bottom of the machine with the carrier centered over the cycle shaft and the machine in upper case. DO NOT rotate the rotate shaft when the pulley is loose as this affects homing. Recheck typehead homing after making this adjustment. (Figure 5-41)

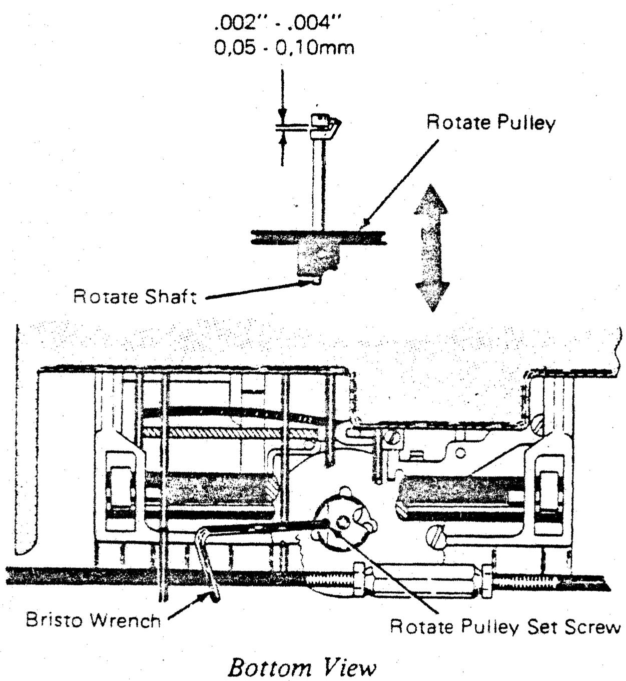


Figure 5-41.

e. Upper Ball Socket

Shim the tilt ring spacer so there is no vertical play in the upper ball socket but it is still free to rotate. (Figure 5-42)

Vertical play in the upper ball socket will affect vertical alignment and impression because the typehead will not maintain a definite position when printing.

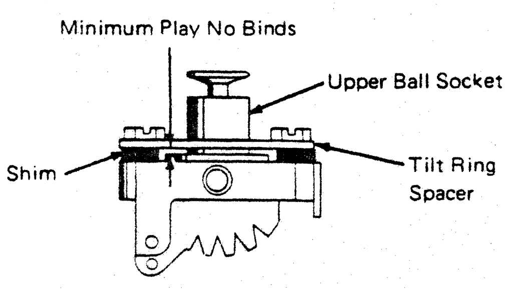


Figure 5-42.

A bind in the upper ball socket can result in poor horizontal alignment if the rotate detent fails to seat in the detent notch before print occurs. A bind can also cause the nylon roller to drop on compensator equipped machines during a negative selection. Binds in the carrier area can be detected by manually operating the shift arm in and out with the typehead installed.

f. Rotate Detent

Adjust the front and rear rotate detent guides so the detent will operate vertically with no binds, but has no horizontal movement. This adjustment should be checked by half cycling a "J" and checking for rotational movement of the typehead. Excessive play in the rotate detent will cause poor horizontal alignment because the detent will not positively position the typehead. (Figure 5-43)

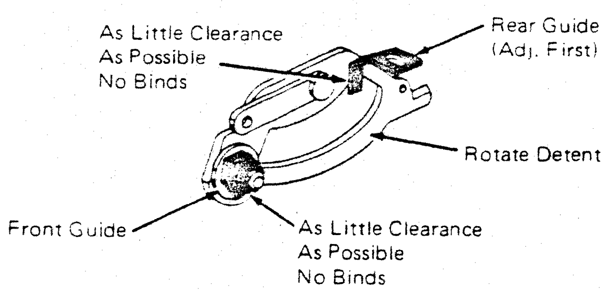


Figure 5-43.

This adjustment can best be made with the tilt ring off of the machine. Loosen the front guide nut approximately a half turn to assure that it will not interfere while adjusting the rear guide. Remove the rotate detent spring and adjust the rear rotate detent guide until a very slight amount of friction exists as the rear tip of the detent is moved up and down. It should be noted that the rear guide is on an angle and the closer the detent travels to the tilt ring, the tighter it will be wedged. Reconnect the rotate detent spring and adjust the front guide adjusting nut until it restricts the rotate detent from being pulled to its seated position by the rotate detent spring, then loosen the nut until the detent snaps into place. This method will give minimum clearance with no binds. If you removed the tilt ring, do not reinstall at this time.

g. Tilt Detent

The tilt detent should pivot freely about its pivot screw but have no side play. (Figure 5-44) This can best be achieved by loosening both the pivot screw and the guide screw and disconnecting the tilt spring. If you did not have to remove the tilt ring to perform the rotate detent adjustment, disconnect the rotate detent spring. Adjust the pivot screw until it produces a very slight amount of friction on the tilt detent lever and tighten the lock nut. Adjust the guide screw so that no side movement is allowed when the detent lever is operated past the guide screw. Reconnect the tilt and rotate detent lever springs.

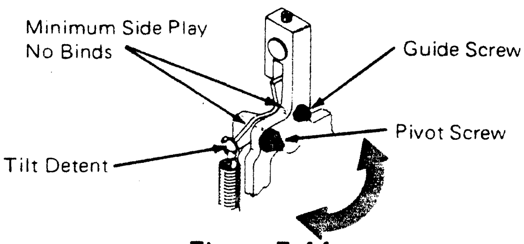


Figure 5-44.

h. Tilt Ring

If the tilt ring had been removed previously, reinstall at this time. The tilt ring should be centered in the yoke with no side play. Adjust the pivot pins to satisfy this condition. Once installed there should be absolutely no side play to the tilt ring. (Figure 5-45)

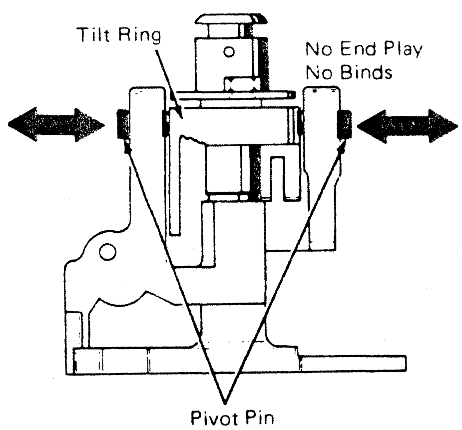


Figure 5-45.

i. Detent Cam Follower

The detent cam follower mounting bracket should be adjusted to satisfy the following conditions: (a) Front to rear for a clearance of .015" between the print sleeve and the end of the pin on the cam follower. (Figure 5-46) (b) Vertically so the top of the cam follower is in line with the No. 1 scribe line on the Hooverometer with the Hooverometer resting on the print sleeve. Machines equipped with a roller on the detent cam follower should be positioned so the bottom surface of the pin is in line with the No. 1 scribe line.

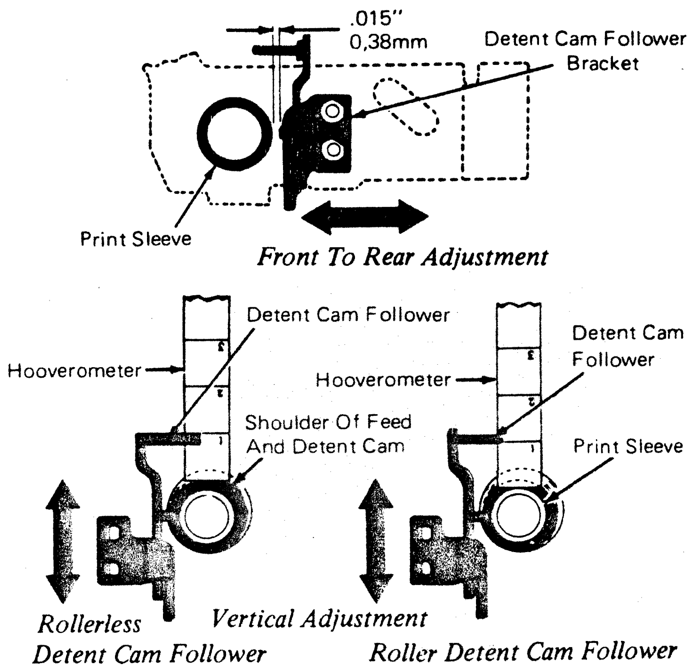


Figure 5-46.

j. Detent Skirt Clearance

The detent mechanism must be adjusted to satisfy the following conditions: (a) With the cycle shaft at rest and the typehead manually held at the tilt two position, adjust the ribbon feed and detent cam left to right on the print sleeve to obtain .025" to .035" clearance between the rotate detent and the teeth on the typehead skirt. (Figure 5-47)

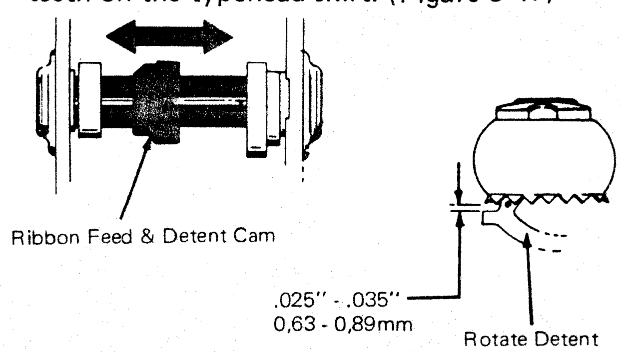


Figure 5-47.

(b) With the detent cam follower on the low dwell of the cam, loosen the lock nut on the detent actuating lever support and adjust the bristo screw up or down until there is a clearance of .001" felt between the detent actuating lever and the detent cam follower. (Figure 5-48)

NOTE:

These two adjustments directly affect each other and must be adjusted alternately to obtain the correct clearance.

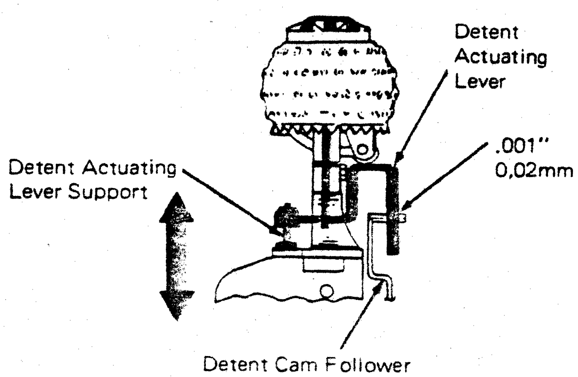


Figure 5-48.

5-15. CHARACTER SELECTION

NOTE:

Shift adjustments must be correct before attempting to make coarse alignment adiustments. Remove the typehead before beginning adjustments.

a. Preliminary Timing

Loosen the print shaft gear and the print shaft so that its keyway is in line with the screw on the left side of the carrier casting. This coarse adjustment assures that the detents will operate at approximately the right time in the cycle. (Figure 5-49)

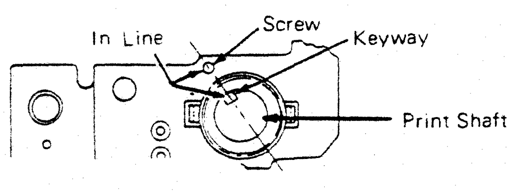


Figure 5-49.

b. Interposer Stop Lugs

Form the selector latch interposer stop lugs to obtain .001" to .005" clearance between each latch interposer's upright lug and its respective selector bail. This adjustment establishes a fixed position for the interposers and will directly affect selection latch timing. (Figure 5-50)

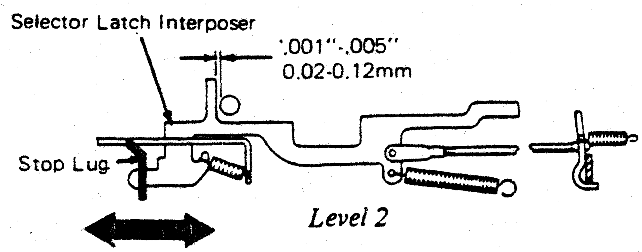


Figure 5-50.

c. Selector Latch Links

With the machine at rest, adjust the selector latch links so that the tips of the latches overlap the bail with .000" to .010" overhang. More or less overhand can cause the latches to "pop" out from under the bail. (Figure 5-51)

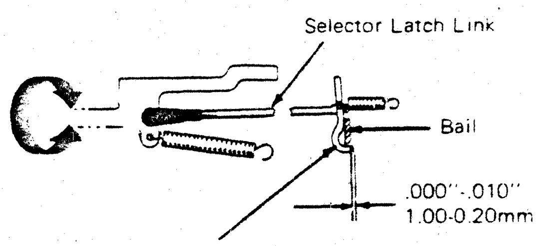


Figure 5-51.

d. Negative 5 Latch Link

With the machine at rest, adjust the negative 5 latch link so that the negative 5 latch will overlap the stop screw head by .050" to .060". (Figure 5-52)

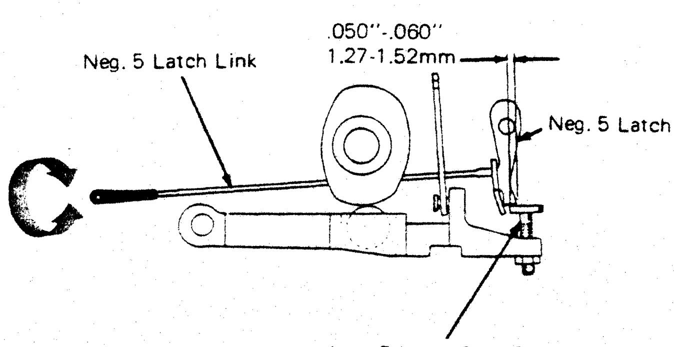


Figure 5-52.

e. Rotate Spring Tension

Shift the machine into lower case and half-cycle an "m". Adjust the rotate spring cage until a 1 7/8 to 2lb. reading is obtained on the spring scale just as the shift arm contacts the stop screw. This is a CRITICAL adjustment. Excessive tension will cause increased wear in the system; insufficient tension will not provide the torque necessary for rapid lower case negative rotate operations. (Figure 5-53)

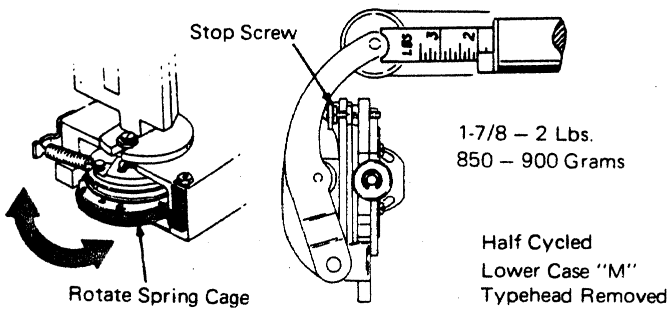


Figure 5-53.

f. Latch Stop Pads

Form the latch stop pads by tapping them with a hammer and screwdriver. The latches should reset under the bail at the same time the cycle clutch check pawl resets. (Figure 5-54)

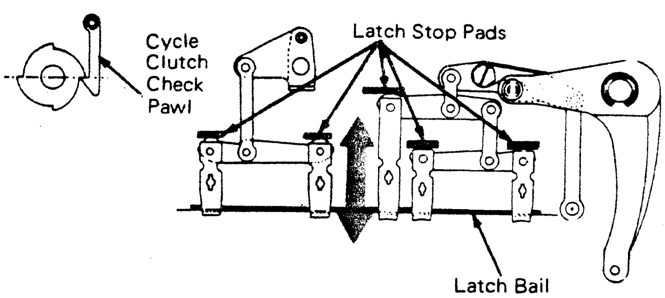


Figure 5-54.

When adjusting the stop pads and the negative 5 latch stop screw, it is helpful to place a finger on the pawl while observing the latches resetting. This allows you to observe exactly when the latches reset and at the same time feel when the check pawl drops in.

It is not necessary to get the check pawl and latches EXACTLY together. If the resetting of the latches slightly precedes the pawl, consider this okay. If the latches lag the pawl, readjust their rest position.

g. Negative 5 Bail Stop Screw

Adjust the negative 5 stop screw so that the negative five latch resets at the same time that the cycle clutch check pawl resets when a negative 5 character is slowly hand-cycled. (Figure 5-55)

NOTE:

Unless adjustments f and g are correct excessive bandwidth will result.

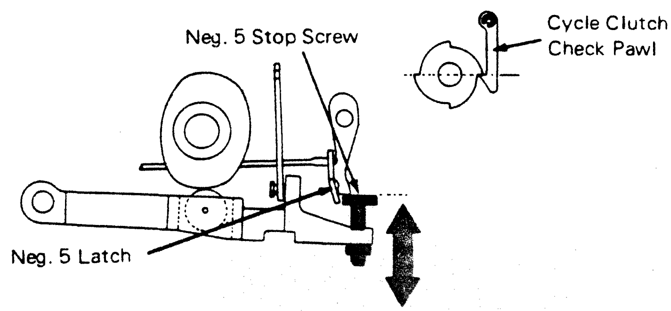


Figure 5-55.

h. Tilt Arm Motion

Adjust the link up or down on the tilt arm so that the tilt ring will coarse align the same for a "Z" as it does for a "J". (Figure 5-56)

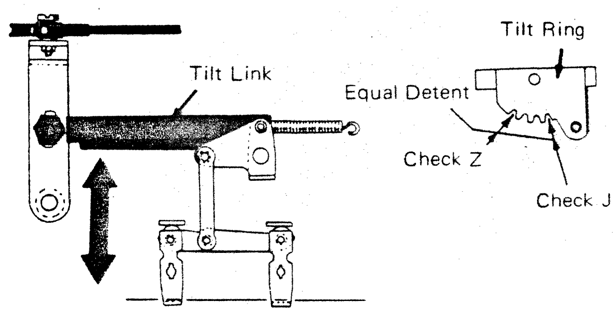


Figure 5-56.

i. Tilt Ring Homing

With a "Z" character half cycled and the tilt ring play removed in the negative direciton (restoring direction), adjust the right hand tilt pulley so the rear of the tilt ring will rise approximately .010" when the detent is manually allowed to seat in the detent notch. As a further check remove the tilt ring play in the positive direction and observe the detent entry on the forward side of the notch. The detent should enter far down the forward slope of the detent notch, but not so far that it contacts the tip of the tooth. By homing the tilt ring off center, favoring the positive side of the detent notch, a maximum amount of wear potential is achieved. (Figure 5-57)

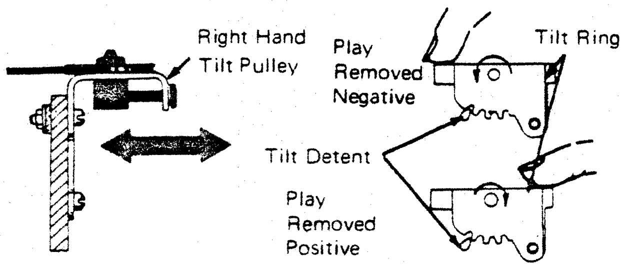


Figure 5-57.

j. Rotate Arm Vertical

To ensure equal arcs of motion of the rotate arm for both negative and positive characters, the rotate arm must be vertical. This is a preliminary adjustment, and is made by adjusting the turnbuckle on the rotate link. Adjust the link so that the center of the top of the rotate arm is in line with the No. 1 scribe line of the Hooverometer when the Hooverometer is against the sideframe. (Figure 5-58)

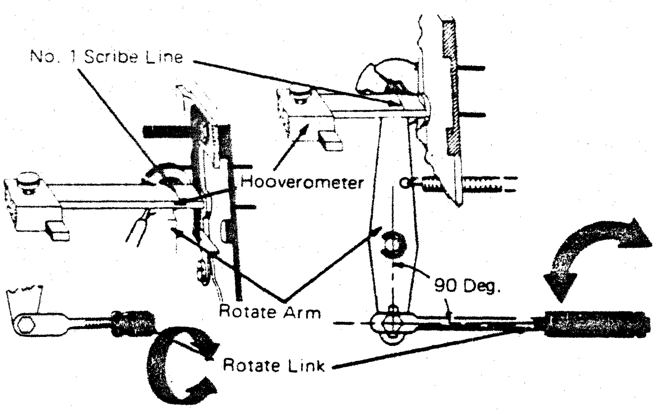


Figure 5-58.

The remaining adjustments MUST be made with the machine in upper case. Reinstall the typehead.

k. Typehead Homing

Half-cycle a "T" and check to ensure that the detent enters the proper tooth. If it does not, loosen the rotate pulley set screw and slip the typehead around until the detent enters the correct tooth. Set the detenting in this tooth to approximately .015" down the negative slope of the typehead notch, with the headplay removed in the negative direction, before tightening the setscrew. (Figure 5-59)

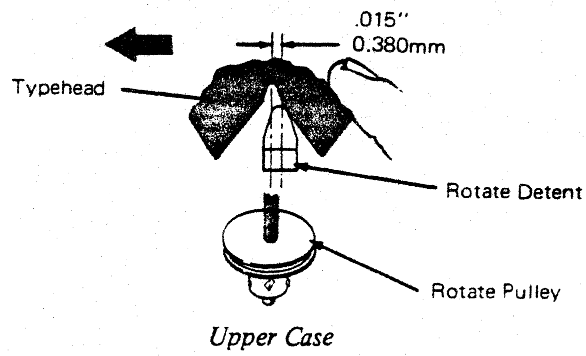


Figure 5-59.

It is not necessary to slip the typehead if the detent enters the correct tooth. Usually, refinement of the rotate link is sufficient to achieve proper homing.

l. Balance Arm

The balance arm is adjusted to obtain proper balance between positive and negative selections. Make this adjustment by first half-cycling a "T" and observing its detent entry. Next, half-cycle a "B" while manually withholding the negative 5 latch. This will yield a "cancelled B" resulting in the "T" being selected. Now adjust the balance arm left or right until the detenting of the "cancelled B" matches the detenting of the "T" previously observed. (Figure 5-59A)

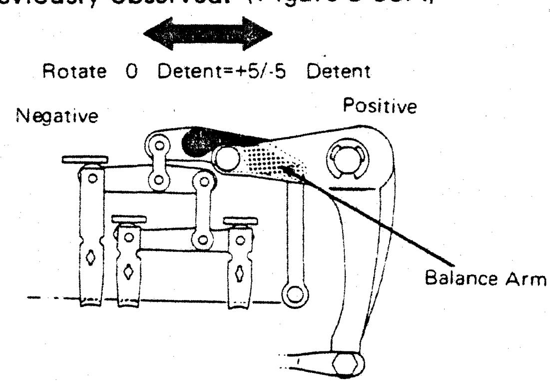


Figure 5-59A.

m. Rotate Arm Motion

To provide the proper motion in each direction of typehead rotation, the stud at the bottom of the rotate arm must be vertically positioned in its slot. The correct position of the stud is determined by alternately observing the detenting of the "M" and "W" while changing the stud's position. When the detenting is equal, the stud is correctly positioned. (Figure 5-60)

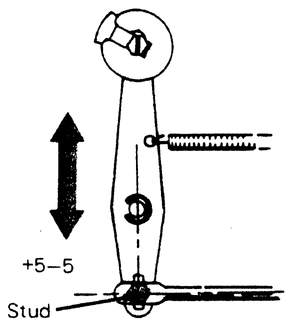


Figure 5-60.

n. Rotate Link

Adjust the rotate link so the rotate detent contacts the negative slope of the typehead .005" to .020" from the center of the notch when the home character is half-cycled. This adjustment allows the greatest amount of wear potential available before a failure can occur. (Figure 5-61)

REMEMBER, on machines using the solid rotate arm, homing should be checked on EVERY call.

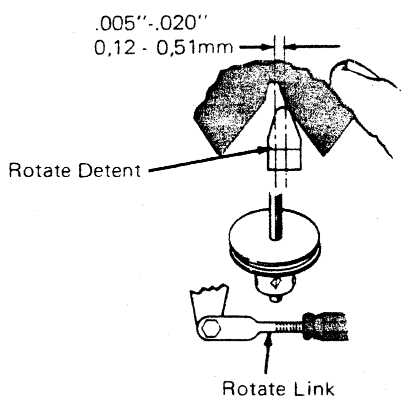
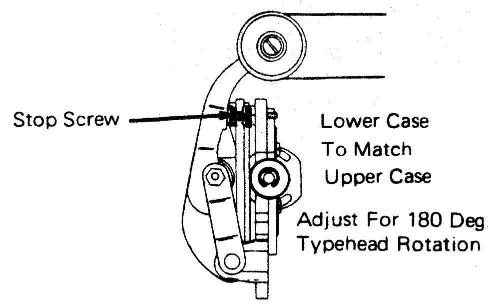


Figure 5-61.

o. Shift Motion

Now, shift the machine into lower case so that the shift arm contacts its stop screw. Adjust the stop screw so that a lower case "t" detents EXACTLY the same as an upper case "T". (Figure 5-62)



Die Cast Shift Arm

Figure 5-62.

p. Final Timing

Loosen the print shaft gear and advance or retard the print shaft so that the detent enters the proper tooth with .001" to .015" clearance. Remove the headplay from the typehead as an "M" is slowly hand-cycled. You should try to favor the low side of this adjustment. Be sure to maintain .002" to .004" end play in the print shaft. (Figure 5-63)

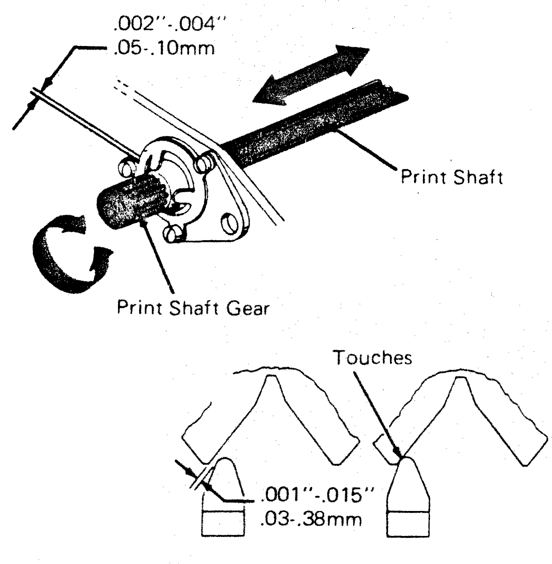


Figure 5-63.

If difficulty is encountered in obtaining the correct detent timing, check the following items:

1. Detent skirt clearance - favor the high side of the tolerance.

2. Typehead homing - favor the high side of the tolerance.

3. Bandwidth - make sure that it is not excessive.

4. Head play - it should be .050" to .065" measured at the typehead skirt. If excessive head play is suspected the dog bone should be replaced and the typehead homing adjustment refined.

CAUTION: Excessively advanced or retarded timing can cause parts damage as well as poor horizontal alignment or improper selection. This could happen if the detent entered the wrong notch or remained in the notch too long.

q. Rotate Pulley Guard

Adjust the rotate pulley guard rotationally at 45 degrees left of vertical. The guard must clear the rotate tape by .005" with the rotate arm in the negative 5 position. (Figure 5-64)

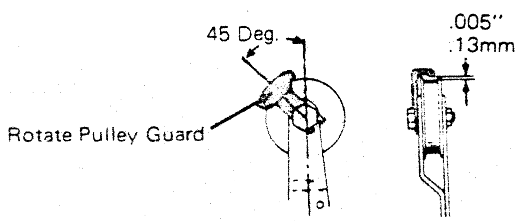


Figure 5-64.

r. Final Check

After completing the foregoing adjustments, a final check should be made to see if any refinements are necessary. Compare the detenting for the letters WOMT. These letters are chosen because of their rotate selections. If an excessive bandwidth exists (in excess of .015"), it will be greatest amoung these characters. In making the final check, follow this sequence:

EXCESSIVE BANDWIDTH

Between	Causes
"T" (zero) and "O"	Incorrect balance
"M" (-5) and "W" (+5)	Incorrect rotate arm motion
"M". "W" and "T"	Adjustments f and g.

If the bandwidth appears to be all right but the alignment is not satisfacotry, check the following items:

1. Excessive play in the carrier or rocker.
2. Play or binds in the tilt or rotate detent.
3. Loose-fitting upper ball socket.
4. Binds in the rocker parts.

This completes the coarse alignment adjustments. The following chart may be used to determine the rotate and tilt locations of characters on typehead. (FIgure 5-65)

STANDARD U.S. TYPE ELEMENTS

Upper Case

-5	-4	-3	-2	-1	Home	+1	+2	+3	+4	+5	
[	'	&	*	$	Z	@	%	¢	)	(	T-0
X	U	D	C	L	T	N	E	K	H	B	T-1
M	V	R	A	O	°	.	"	I	S	W	T-2
G	F	:	,	?	J	+	P	Q	Y	_	T-3

Lower Case

-5	-4	-3	-2	-1	Home	+1	+2	+3	+4	+5	
]	3	7	8	4	z	2	5	6	0	9	T-0
x	u	d	c	l	t	n	e	k	h	b	T-1
m	v	r	a	o	!	.	'	i	s	w	T-2
g	f	;	,	/	j	=	p	q	y	-	T-3
-5	-5, 1	-5, 2	-5, 1, 2	-5, 2, 2A	Home	1	2	1, 2	2, 2A	1, 2, 2A	

Figure 5-65.

PROCEDURE FOR CRIPPLING COMPENSATOR–TYPE ROTATE ARMS

1. Break off the lug on the bottom of the eccentric rotate arm assembly. (Figure 5-66)

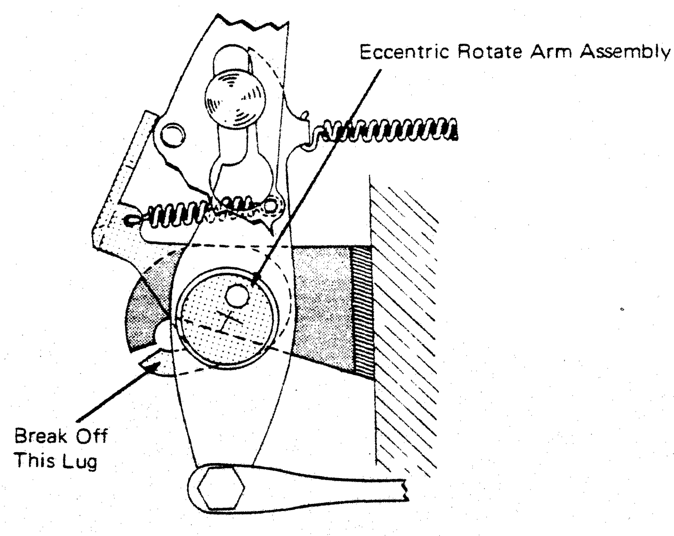


Figure 5-66.

2. Place the wear compensator wedge at the top of the slot.

3. Disconnect the spring from the rotate arm and connect it to the middle compensator arm assembly. (Figure 5-67)

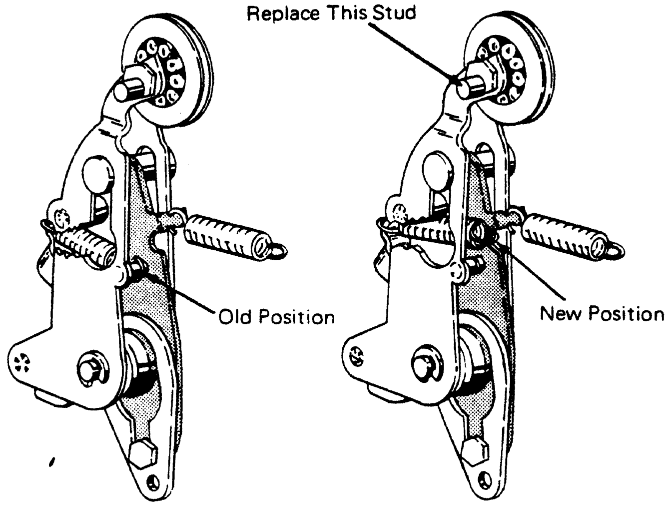


Figure 5-67.

4. Replace the eccentric stud with the pulley stud for the solid arm, and adjust the system the same as you would adjust a solid rotate arm mechanism.

5-16. PRINT

a. Copy Control Lever

With the copy control lever detented in the forward position, the high point of the eccentric should be up. Loosen the control lever setscrews and rotate the shaft to satisfy this condition. The stop ears on the copy control detent spring should be formed to provide positive detenting in the extreme front and rear positions of the lever. (Figure 5-68)

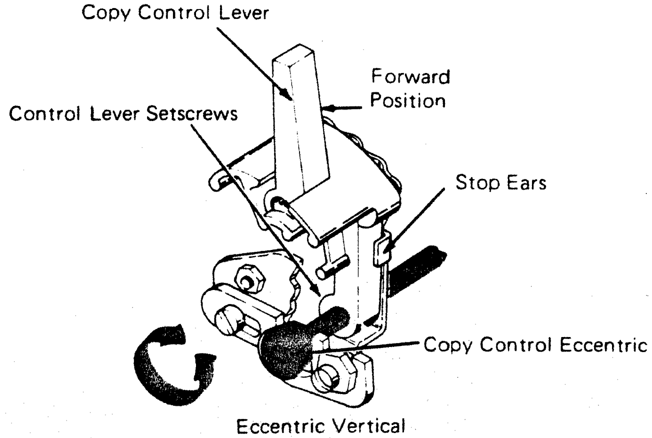


Figure 5-68.

b. Platen Adjusting Plates

Adjust the eccentric retaining plates front to rear on level 1 machines or the copy control eccentric left to right on level 2 machines so there is no front to rear motion and no binds exist between the eccentric and the platen adjusting plates on each side of the machine. (Figure 5-69)

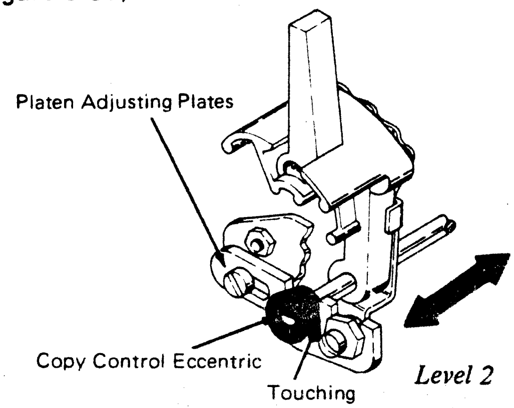


Figure 5-69.

c. Platen Latches

Adjust the platen latch eccentrics, with the high part down, so the platen is held firmly in position vertically and horizontally. The latches should latch and unlatch freely with the feed rolls released. (Figure 5-70)

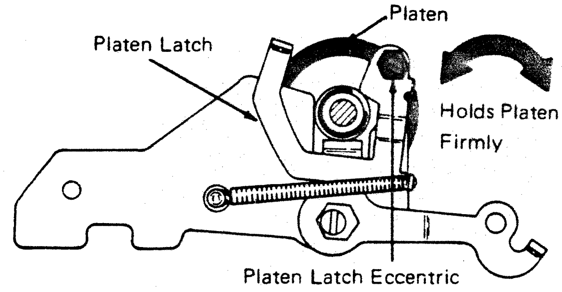


Figure 5-70.

d. Platen Position

To properly adjust the print mechanism, the correct position of the platen must be established first and then the print adjustments made relative to the platen position. With the copy control lever forward and the print shaft keyway down, loosen the platen eccentrics and move the platen to the extreme rear and as low as possible. Rest the hooverometer on the print shaft and escapement rack at one extreme end of the machine. Adjust the platen front to rear and platen height until the platen just touches the hooverometer. Be certain the tool maintains proper contact with the print shaft and the escapement rack. Move the tool to the opposite end of the machine and repeat the procedure. Check for a parallel condition by sliding the tool back to the beginning end. With the tool removed, the platen height adjustment should now be refined to provide even top and bottom color of printed characters. (Figure 5-71)

CAUTION: Any change in the front to rear position of the platen necessitates a readjustment of the velocity control plate and anvil on early level machines. Also, any change in the platen position may alter the paper feed adjustments. All paper feed adjustments should be check and readjusted if necessary.

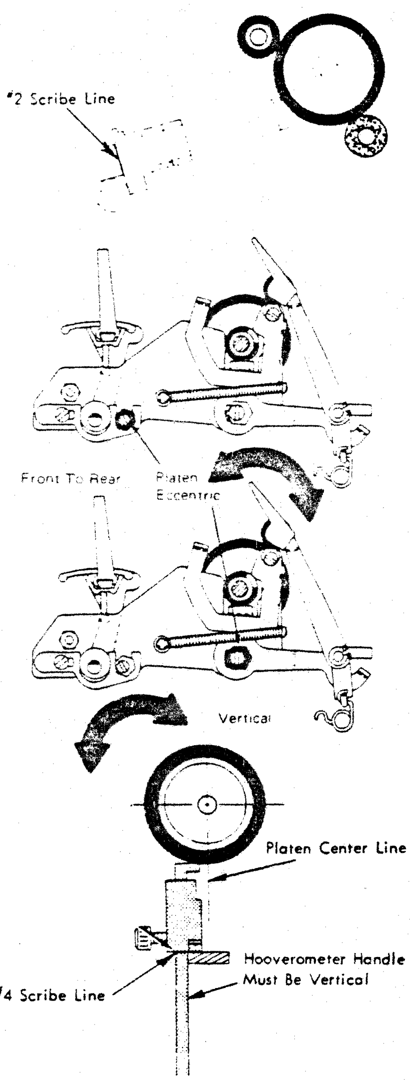


Figure 5-71.

e. Carrier Support

Adjust both ends of the carrier support vertically to obtain .001" to .004" clearance with the bottom of the carrier pad along the entire length of the writing line. The support is secured to the machine power frame by a binding screw at each end. (Figure 5-72)

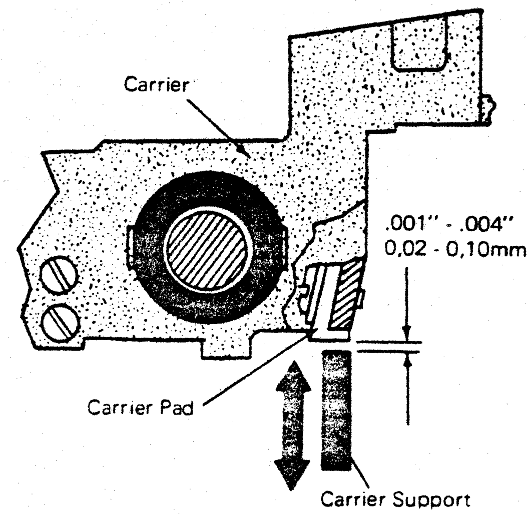


Figure 5-72.

f. Print Cam Follower Stop Screw (All Machines)

Adjust the print cam follower stop screw so the print cam follower roller clears the print cam by .020" when the machine is at rest. This clearance allows the roller to shift from one lobe to the other without rubbing on the cam. (Figure 5-73)

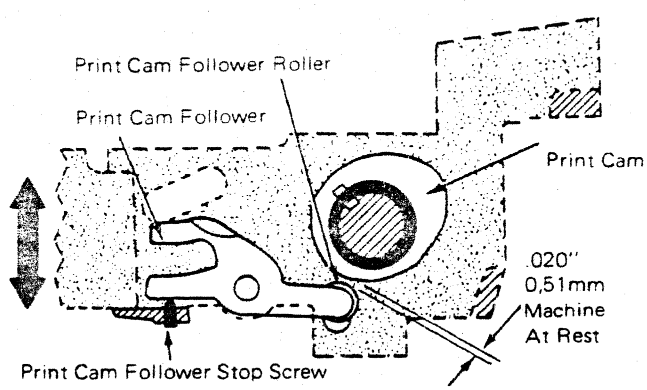


Figure 5-73.

This adjustment may be checked by applying a light film of grease on the print cam and then observing the track that the roller makes in the grease when the machine is hand cycled. If the stop screw has been adjusted properly, the roller track in the grease should begin at point "A" on the print cam. This is the beginning of the second low dwell on the print cam.

If the roller track begins before point "A", the roller is adjusted too close to the print cam when the machine is at rest. Improper roller to cam clearance may cause the roller to drag on the print cam as it shifts during a low velocity selection. Thus, the roller may fail to shift, or shift improperly. Also, if the roller is adjusted too close to the cam at rest, it may receive a ski-jump effect from the print cam as it attempts to follow the print cam from the first low dwell to the second low dwell. This will create excessive noise and wear along with adverse effect on typehead impact velocity. (Figure 5-74)

If the roller track begins after point "A", the roller rests too far away from the first low dwell of the print cam and a loss of typehead velocity may result.

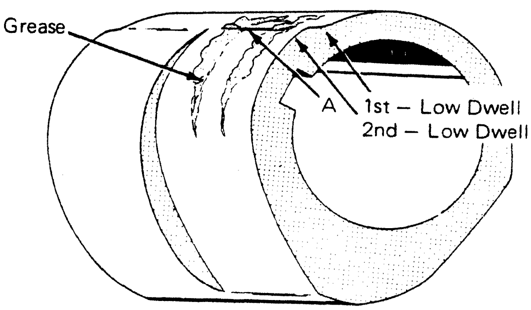


Figure 5-74.

g. Velocity Control Cable Clamp (No Print Only)

Adjust the cable sheath left to right under the carrier clamp until the end of the sheath is flush to .010" recessed with the right hand edge of the cable clamp. This adjustment prevents the yoke actuating lever from choking off against the cable sheath. (Figure 5-75)

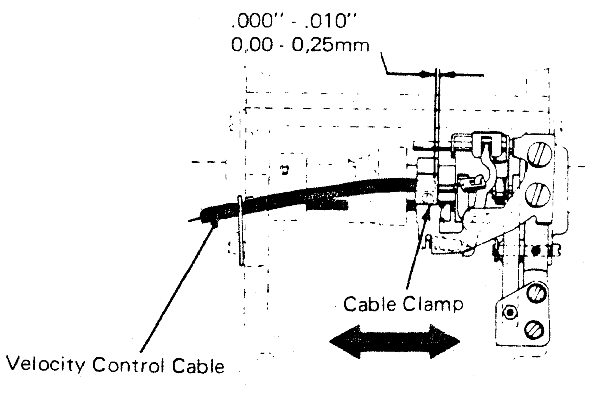


Figure 5-75.

h. Carrier Cable Deflector (No Print Only)

Form the deflector to the rear as far as possible without touchina the power frame. (Figure 5-76)

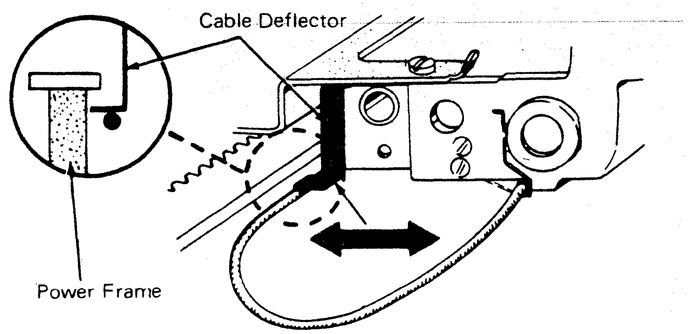


Figure 5-76.

i. Center Cable Clamp (No Print Only)

Position the cable sheath left to right within the right within the center cable clamp so the bend in the cable will just touch the machine left hand side frame when the carrier is resting two spaces from the extre,e left hand margin. This adjustment allows the carrier to operate freely along the entire writing line and allows the velocity control cable to operate with a minimum of flexing. (Figure 5-77)

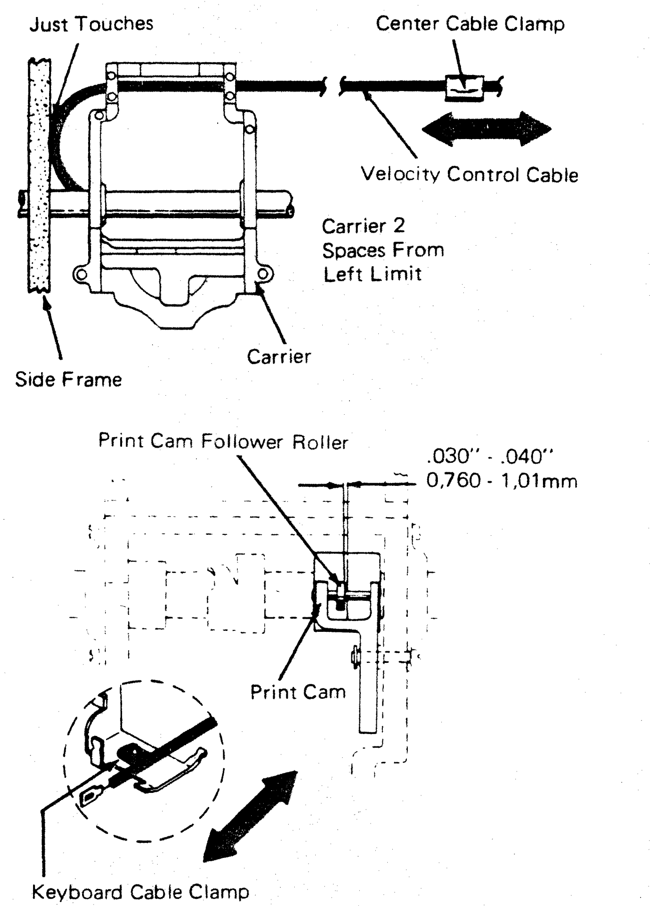


Figure 5-77.

j. Velocity Control Keyboard Cable Clamp (No Print Only)

Adjust the cable sheath front to rear under the clamp so the print cam follower roller will shift onto the low velocity lobe of the print cam by the width of the roller plus .030" to .040" when a low velocity character is half cycled. Moving the cable sheath to the rear will produce more motion to the roller.

The adjustment should be checked by observing the track of the roller in the grease on the print cam.

k. Powered Travel (All Machines)

With the machine latched at rest and the impression control lever set at position 4, loosen the binding screw and move the detent plate front to rear until the foot of the Hooverometer will just span the distance between the center of the letter "Z" and the platen. (Figure 5-78)

CAUTION:

The copy control lever must be positioned all the way forward when making adjustment no. k and l.

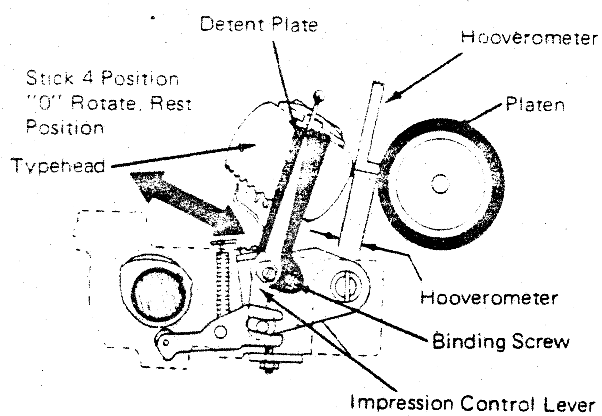


Figure 5-78.

l. Free Flight (All Machines)

With the impression control lever set at 4 and a letter "Z" half cycled until the machine is resting on the high point of the print cam, the pusher end of a large spring hook (.035") should just span the distance between the letter "Z" and the platen. Adjust the eccentric on the impression control lever to obtain this condition keeping the high part of the eccentric forward. (Figure 5-79)

NOTE:

Adjustment k and l directly affect each other and must be adjusted alternately until both are correct.

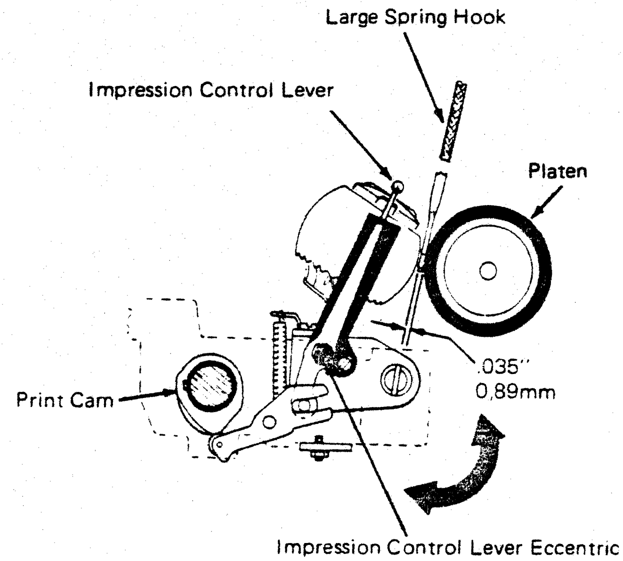


Figure 5-79.

m. Even Printing (All Machines)

Position the yoke rotationally under its mounting screws so the density of the left and right sides of a printed character is uniform. (Figure 5-80)

This adjustment will affect the tilt ring homing adjustment, the typehead homing adjustment, and skirt clearance. Be sure to check these adjustments after changing the position of the yoke.

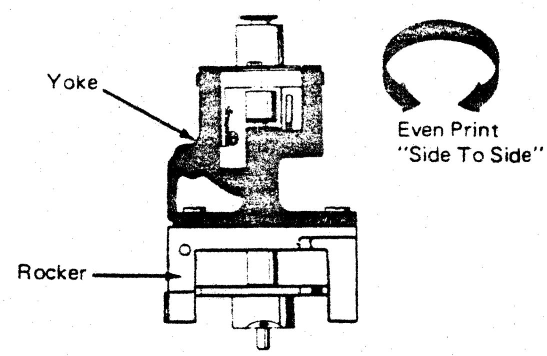


Figure 5-80.

5-17. PAPER FEED

NOTE:

The platen position must be correct before any paper feed adjustments are attempted.

a. Paper Feed Support

With the feed roll tension springs disconnected the center support bracket should be positioned so that the forward lug just touches the underside of the feed roll actuating shaft while the rear lug just touches the top of the carriage tie rod. The center support bracket should not bow the copy control shaft. (Figure 5-81)

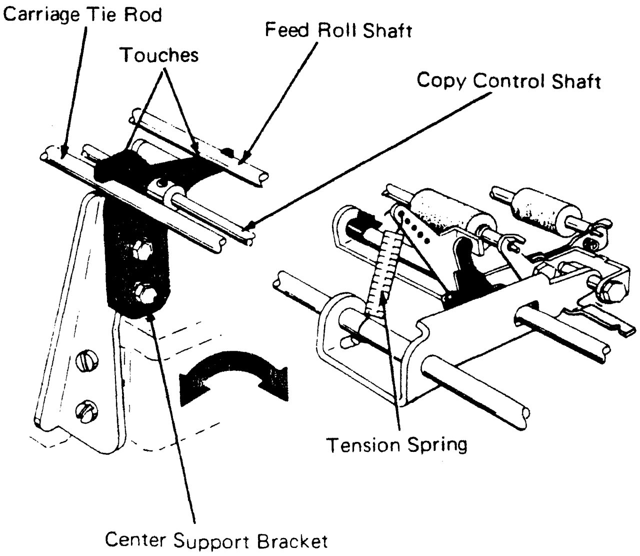


Figure 5-81.

b. Feed Roll Tension

Place the feed roll tension springs in the hole of the feed roll arms that will provide proper tension measured at the front feed roll pivot points. The machine should be adjusted for 2-2 1/2 pounds tension. (Figure 5-82)

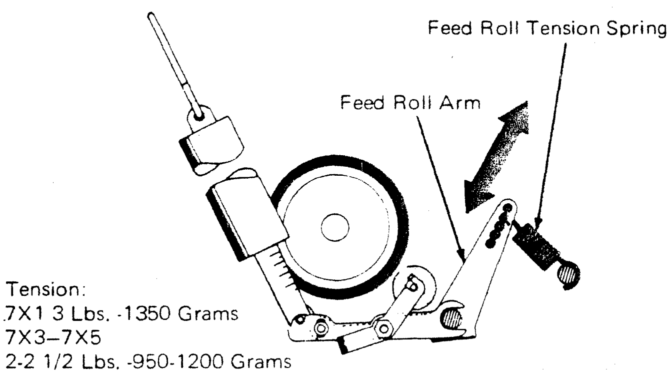


Figure 5-82.

c. Feed Roll Side Play

The left and right hand front feed roll arm assemblies should be adjusted by moving the grip clips on the feed roll actuating shaft to permit the feed rollers to have a slight amount of side play without touching the openings in the deflectors. (Figure 5-83)

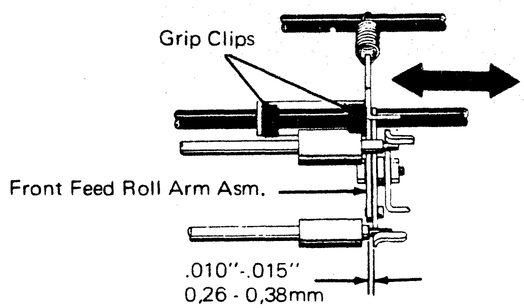


Figure 5-83.

d. Feed Roll Adjustment

Adjust the front feed roll arms vertically to obtain a slight clearance between the rear feed rollers and the platen when two tab cards are between the front feed rollers and the platen. With one tab card between the front feed rollers and the platen, the rear feed rollers should have a slight drag on the platen. (Figure 5-84)

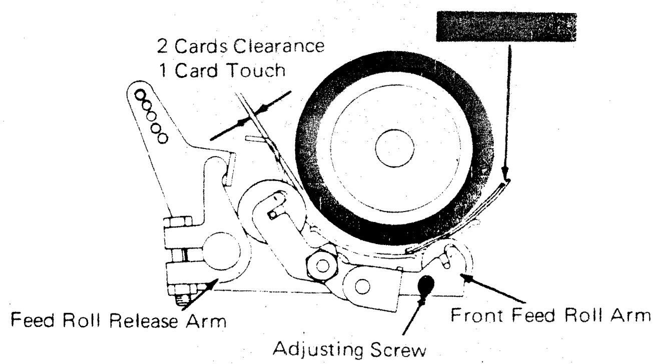


Figure 5-84.

An easy method to make this adjustment is as follows:
Remove the paper deflector and insert three tab cards between the rear feed rollers and the platen. Loosen the adjusting screw. While pressing the front feed roll arm toward the platen, tighten the adjusting screw. Do the same for the opposite end. Then check for the above adjustment. The feed roll release arms must not restrict the feed roll arms.

e. Paper Release

Adjust the feed roll release arms front to rear to obtain .055" to .065" clearance between the rear feed rollers and the platen when the feed rollers are released. (Figure 5-85)

The excessive clearance can cause interference between the front feed roll and the carrier, whereas insufficient clearance will not permit straightening of thick paper packs.

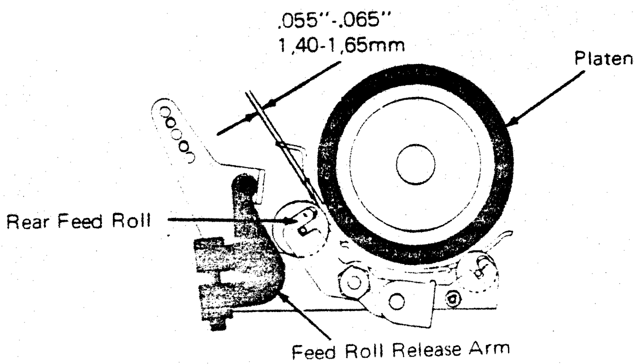


Figure 5-85.

f. Deflector

Form the deflector supporting tabs on the front and rear feed roll arms to obtain a clearance of .010" to .020" between the deflector and the platen. Three tab cards inserted between the platen and the deflector, at the front and rear, should provide a slight drag. No drag should be felt when one tab card is inserted. (Figure 5-86)

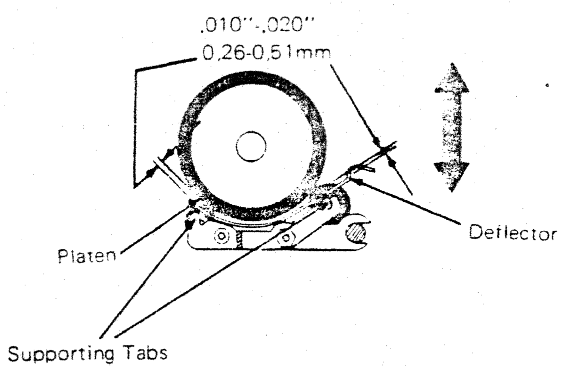


Figure 5-86.

g. Paper Bail

Adjust the grip clip on the paper bail pivot shaft to obtain .002" to .006" end play of the paper bail arm. (Figure 5-87)

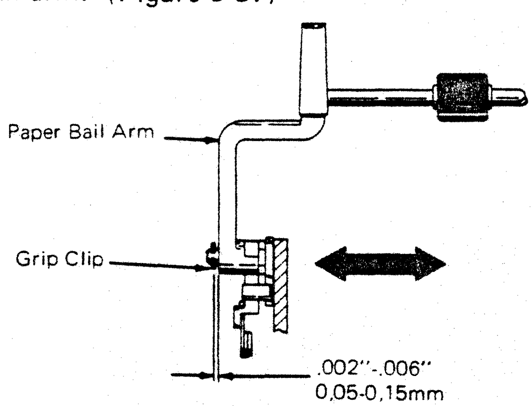


Figure 5-87.

h. Cardholder

Adjust the cardholder brackets front to rear to obtain .005" to .015" clearance with the platen. The vertical adjustment should be such that the horizontal gradual is parallel and .002" to .005" below the feet of the typed characters when viewed from the operator's position. Adjust the cardholder left to right so the point of the letter "v" will align with the vertical graduals on the cardholder. (Figure 5-88)

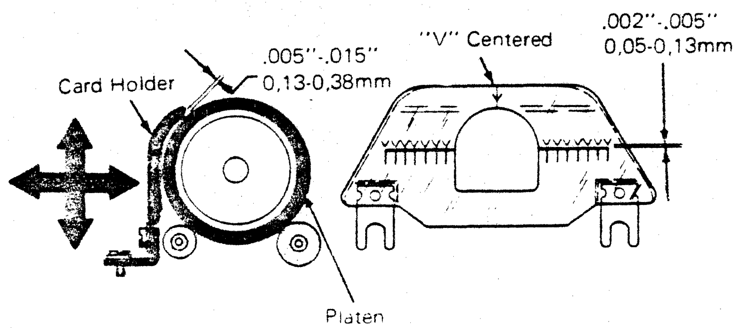


Figure 5-88.

5-18. ESCAPEMENT

a. Escapement Rack

With the print shaft rotated so the keyway is down, position the platen gage to rest on the print shaft and the escapement rack. The correct position of the escapement rack is the distance spanned by the gage plus .030". Adjust the escapement rack to this dimension and parallel to the print shaft. If the platen gage is not available, the escapement rack position may be set from the No. 1 scribe line on the hooverometer. It should just span the distance from the print shaft. (Figure 5-89)

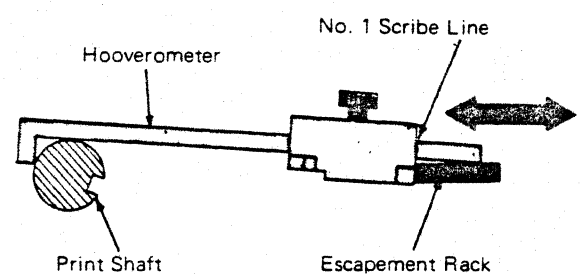


Figure 5-89.

b. Escapement Bracket

Position the escapement bracket to parallel the tab torque bar with .0005" to .002" clearance. Be sure this clearance is not observed at the boss on the escapement bracket. (Figure 5-90)

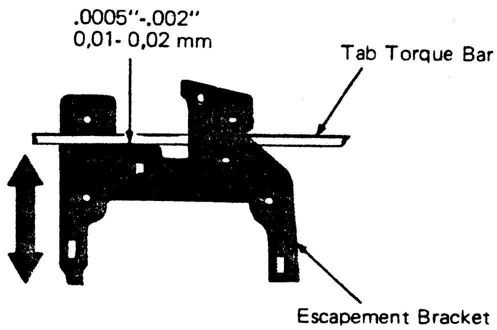


Figure 5-90.

c. Escapement Torque Bar Stop

Adjust the escapement torque bar stop to obtain .008" to .010" clearance between the rear of the torque bar and the lug on the escapement pawl with all parts at rest. Machines equipped with a form lug on the left hand end of the escapement torque bar should be adjusted for .002" to .006" clearance between the rear of the torque bar and the lug on the escapement pawl with all parts at rest. (Figure 5-91)

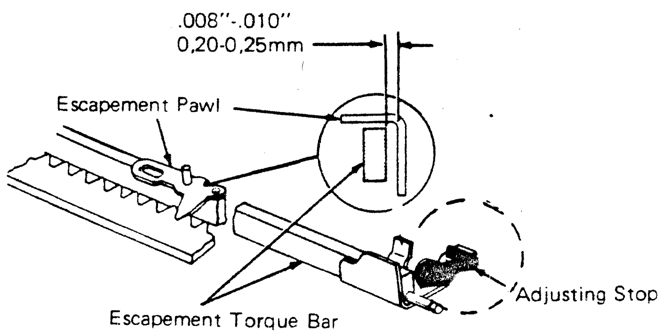


Figure 5-91.

d. Pawl Mounting Stud

Adjust the pawl mounting stud rotationally to obtain .001" clearance between the mounting stud and the front of the escapement torque bar. Keep the eccentric in the left half of its orbit. (Figure 5-92)

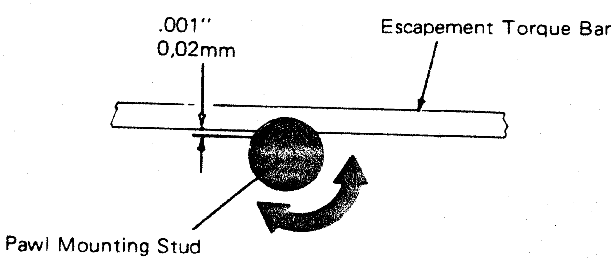


Figure 5-92.

e. Torque Bar Backstop (7X3–7X5)

Form the backstop front to rear to obtain .001" to .005" clearance between the stop and the rear of the torque bar. (Figure 5-93)

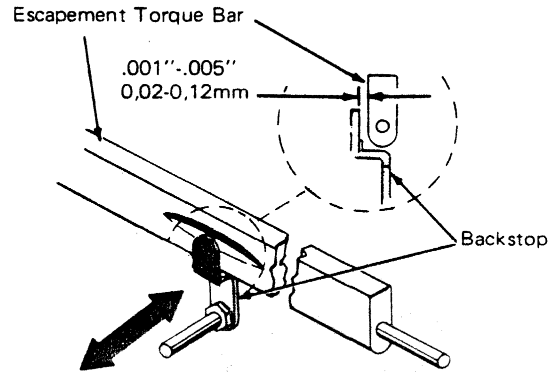


Figure 5-93.

f. Escapement Cam

With the machine at rest, adjust the cam radially on the filter shaft so the cam follower roller is resting at the start of the low dwell. (Figure 5-94)

On machines equipped with the old-style space-bar lockout mechanism, the lockout cam adjustment must be checked each time the escapement cam adjustment is changed. Advancing or retarding the escapement cam could allow the lockout cam to disable the spacebar mechanism.

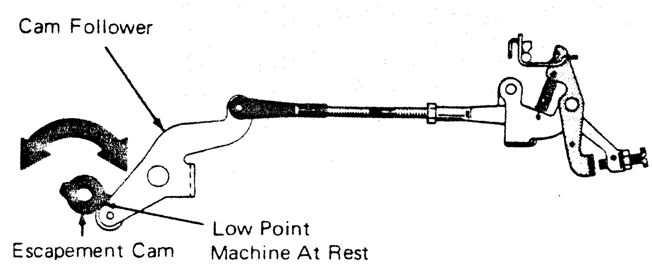


Figure 5-94.

g. Escapement Trip Link

With the machine latched at rest, adjust the escapement trip link to obtain .007" to .010" clearance between the hook on the trigger and the extension on the escapement torque bar. Be sure the trigger lever upstop is not restricting the trigger. (Figure 5-95)

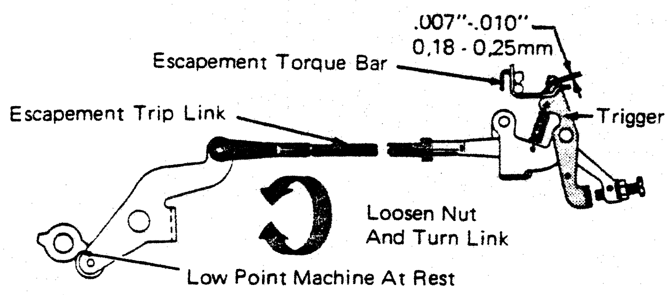


Figure 5-95.

h. Trigger Knockoff

Adjust the trigger guide (level 1), the trigger knockoff eccentric stud (level 2), or the knockoff adjusting screw (level 3) so the escapement trigger will cam off the torque bar lug when the escapement pawl clears the rack by .010" to .015". (Figure 5-96)

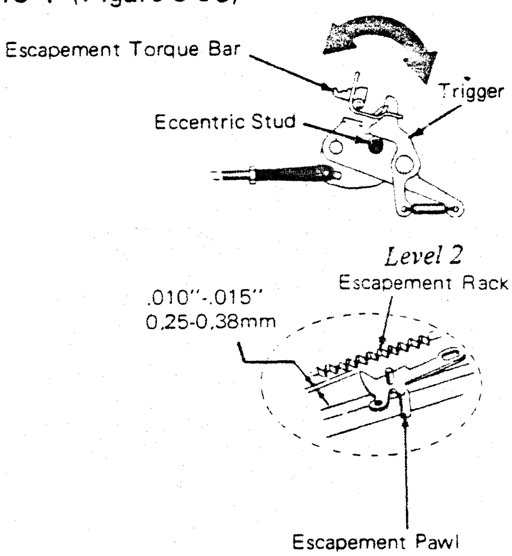


Figure 5-96.

i. Trigger Lever Upstop (7X3—7X5)

With all parts at rest, adjust the trigger lever upstop vertically to obtain .001" to .005" clearance between the upstop and the trigger lever. (Figure 5-97)

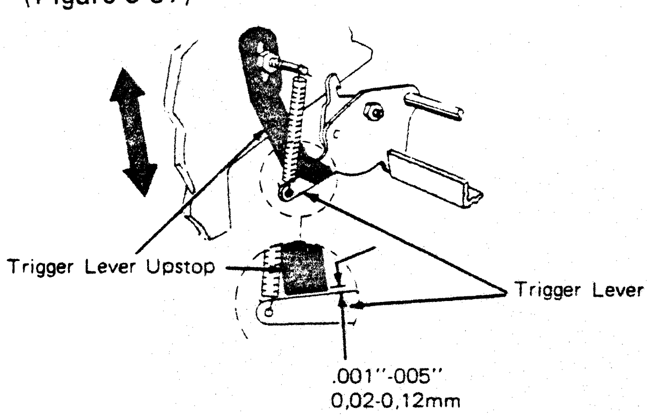


Figure 5-97.

j. Mainspring Tension

With the carrier resting at the extreme right hand margin, wind the mainspring seven turns. (Figure 5-98)

CAUTION:

The mainspring should be handled with care to prevent it from slipping when the tension is being increased or decreased.

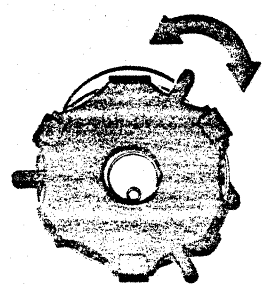


Figure 5-98.

k. Idler Pulley Eccentric

The eccentric mounting stud for the front idler pulley should be set so that the pin is horizontal and above center on the eccentric. The pin will then be angled toward the left slightly. (Figure 5-99)

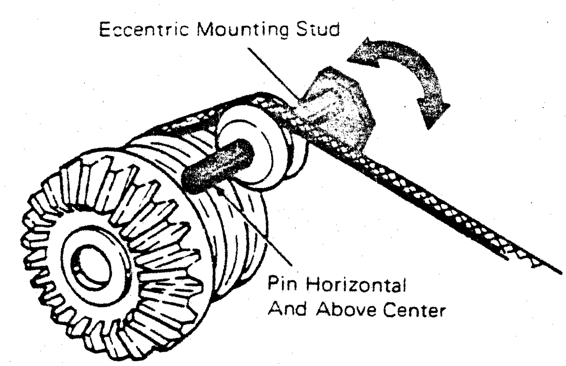


Figure 5-99.

l. Cord Tension

With the cords properly threaded, adjust the carrier return cord drum so that the inner flange of the cord tension pulley is 3/16" to 1/4" from the powerframe. (Figure 5-100)

The position of the pulley ensures that it will not contact the cover as it compensates for the cord stretch. Adjusting the pulley nearer the powerframe puts an unnecessary load on the cords.

CAUTION:

Be sure to remove all end play from the escapement shaft before tightening the carrier return cord drum. End play is removed by holding the escapement shaft forward while the cord drum is moved to the rear against the rear bearing.

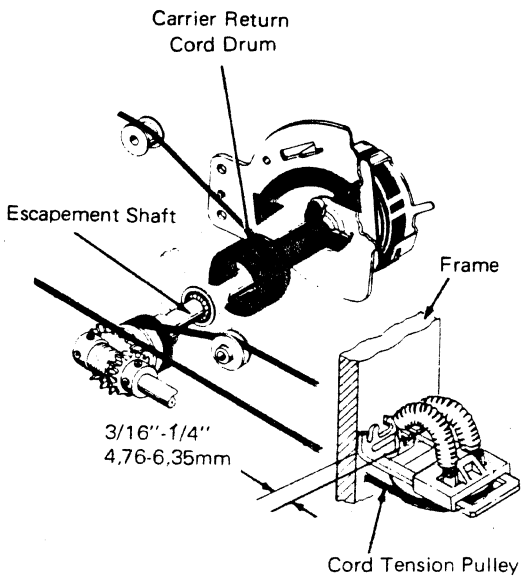


Figure 5-100.

5-19. OPERATIONAL CONTROL AND SPACEBAR

a. Operational Shaft Position And End Play

Position the operation shaft laterally so the crown surfaces of the escapement cord drum and the carrier return pinion are even while maintaining .002" to .004" end play of the operational shaft. On the Model 7X1 this adjustment is controlled by the operational cam ratchet and the shift clutch arbor. On longer machines, the position is controlled by a collar screwed to the operational shaft and the shift clutch arbor. (Figure 5-101)

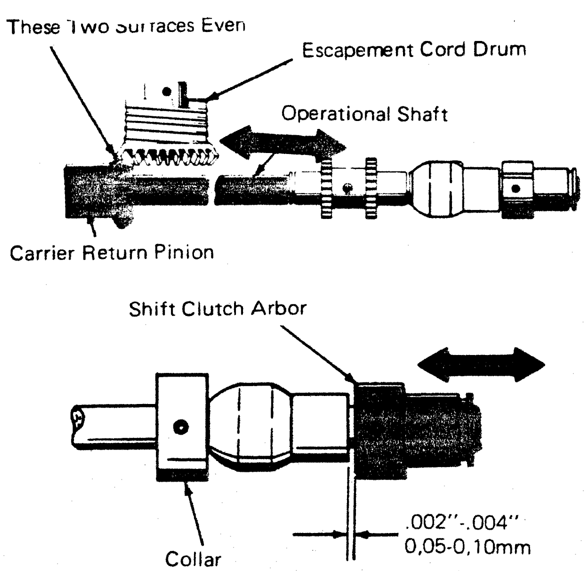


Figure 5-101.

b. Carrier Return Pinion Backlash

Adjust the escapement cord drum gear front to rear to obtain .002" to .004" backlash between the carrier return pinion and the escapement cord drum gear. (Figure 5-102)

NOTE:

Recheck adjustment a. after making this adjustment.

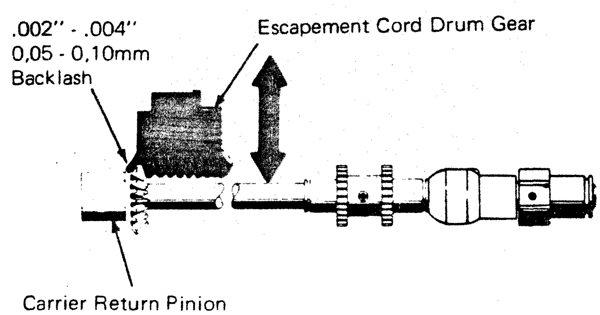


Figure 5-102.

c. Carrier Return Pinion Side Play

Adjust the torque limiter hub left or right so there is .002" to .004" clearance between the carrier return pinion and the torque limiter arbor. (Figure 5-103)

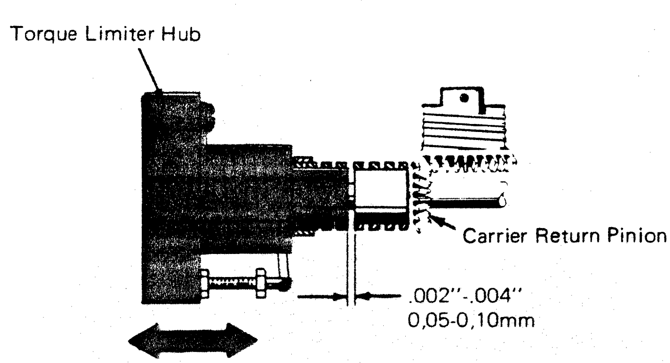


Figure 5-103.

d. Tab Pinion Backlash

Adjust the tab governor assembly left or right to obtain .002" to .004" backlash between the tab pinion and the escapement cord drum gear. The pinion should have a minimum of end play between the tab governor hub and collar yet still rotate freely. (Figure 5-104)

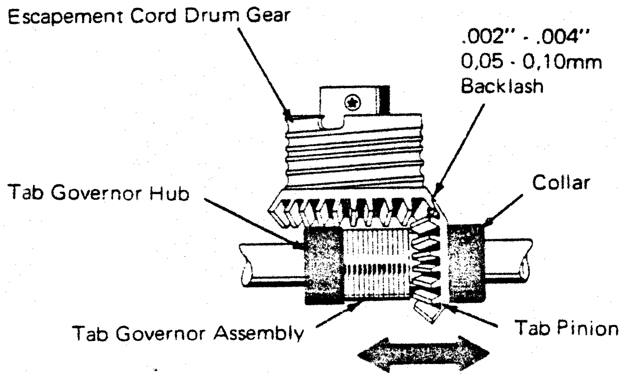


Figure 5-104.

e. Keylever Pawl Overlap

Adjust each keylever pawl guide so the keylever pawls overlap their respective interposers by .035" to .045" with both parts at rest. The index keylever pawl guide should be adjusted for .040" to .060" overlap. This overlap ensures proper repeat/non-repeat operation. (Figure 5-105)

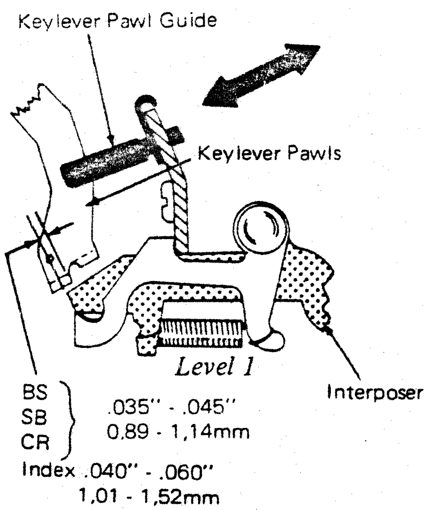


Figure 5-105.

f. Keylever Pawl To Interposer Clearance

Adjust the keylever pawls up and down to obtain the following clearances:

1. Adjust the interposer latch plate for .020" to .025" between the index keylever pawl and its interposer.
2. Adjust the eccentric on the spacebar keylever mounting stud, on early machines, and the adjusting slots on late level machines for .005" to .015" clearance between the keylever pawl and the spacebar interposer.
3. Adjust the keylever slots for a clearance of .020" to .030" between the backspace and carrier return keylever pawls and their interposers. (Figure 5-106)

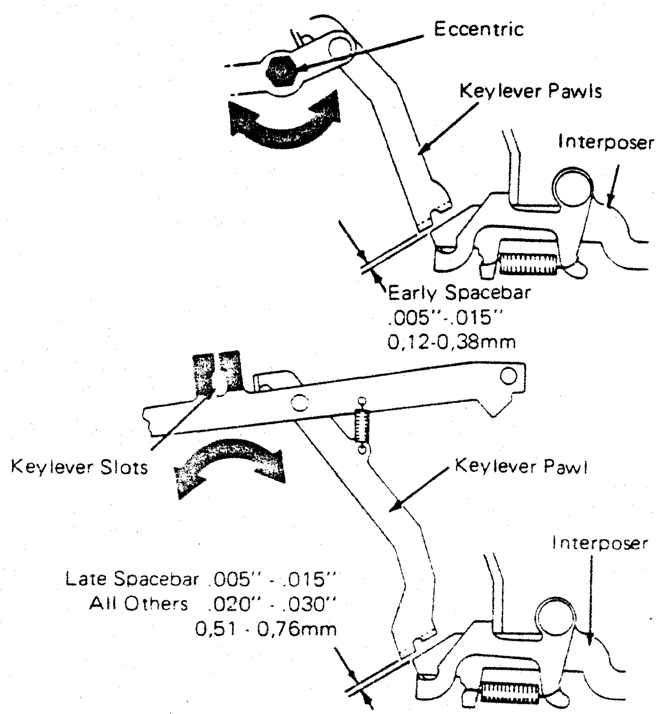


Figure 5-106.

g. Operational Cam Check Ring

Adjust the operational cam check ring eccentric so that .010" to .030" exists between the tip of the cam pawl and the teeth of the operational cam ratchet with the cam latched in the rest position. (Figure 5-107)

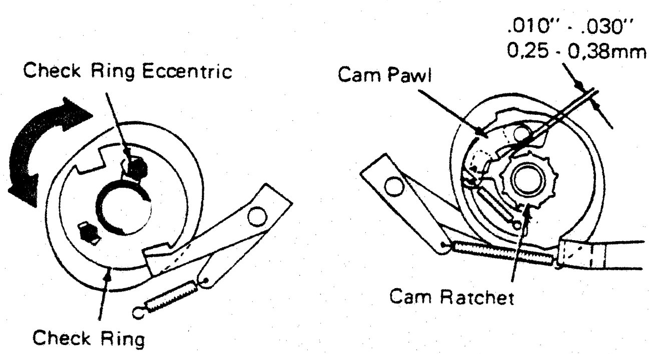


Figure 5-107.

NOTE:

Both the check ring mounting studs must be loosened before making this adjustment.

h. Clutch Release Arm Bite

Form the adjustable stop lugs on the operational control bracket so each clutch release arm engages its clutch wheel by .030" to .040". This adjustment may be observed by measuring the amount of clearance that exists between the stop lugs and the lower extension of each clutch release arm when the release arm has released the clutch wheel and is resting against the high portion of the clutch wheel tooth. On longer machines (7X3 and 7X5), the operational cam assembly should be positioned left to right so that the clutch release arm for both the single and double lobed cams will take an equal lateral bite on its respective clutch wheel. (Figure 5-108)

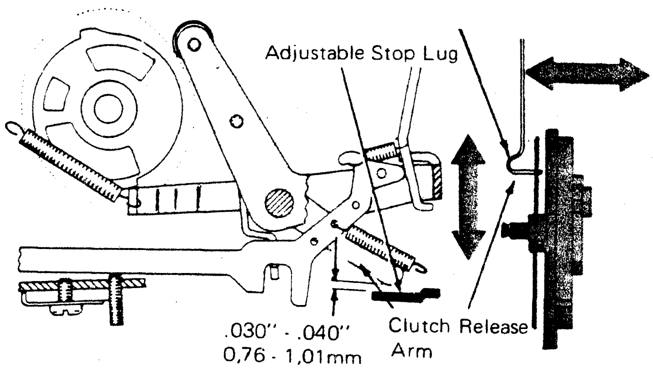


Figure 5-108.

i. Clutch Release Arms

With the operational interposers and operational cams in their rest position, form the lug at the bottom of each clutch release arm so it clears the operational interposer lugs by .030" to .040". This adjustment ensures the proper timing of the operational cam in relationship to the rest of the mechanism. (Figure 5-109)

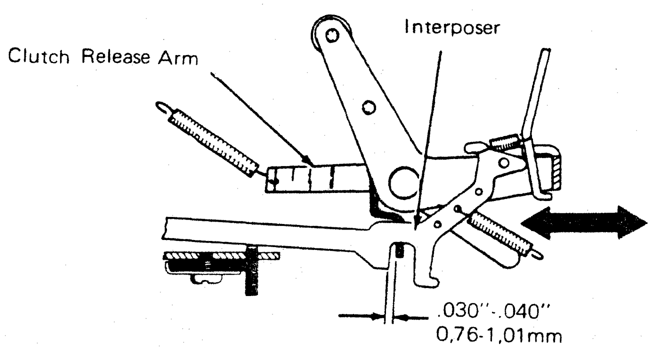


Figure 5-109.

j. Interposer Restoring Bail

Form the lug at each side of the restoring bail so the interposers will be restored forward .010" to .030" past their latching point when either cam is operated. The lugs should be formed forward or back to obtain this adjustment. Forming the lugs forward increases the throw of the interposers. This adjustment ensures positive relatching of the interposers without excessive overthrow. (Figure 5-110)

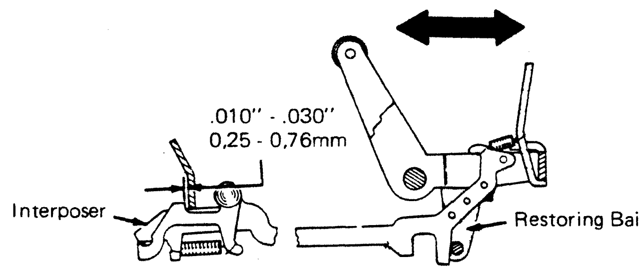


Figure 5-110.

k. Interposer Adjusting Screws

Adjust the four interposer adjusting screws so a front to rear clearance of .005" to .015" exists between all the operational latches and their respective cam followers. (Figure 5-111)

This adjustment may be checked by operating the operational cams enough to move the cam followers down slightly at the rear. With the machine on its back, the latches can be pushed against the cam followers to estimate the clearance.

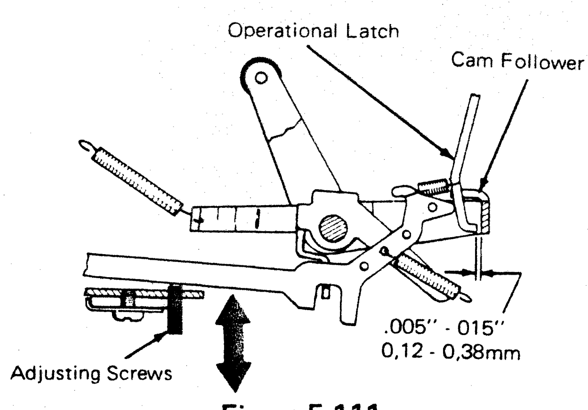


Figure 5-111.

NOTE:

Due to the relationship between this adjustment and the operational latch height adjustment of the Backspace, Carrier Return and Spacebar mechanisms, this adjustment must be rechecked after making the latch height adjustment.

The following adjustments are for spacebar mechanism only.

l. Operational Latch Height

Adjust the latch adjusting screw so the spacebar latch will pass under the cam follower with a clearance of .001" to .015". (Figure 5-112)

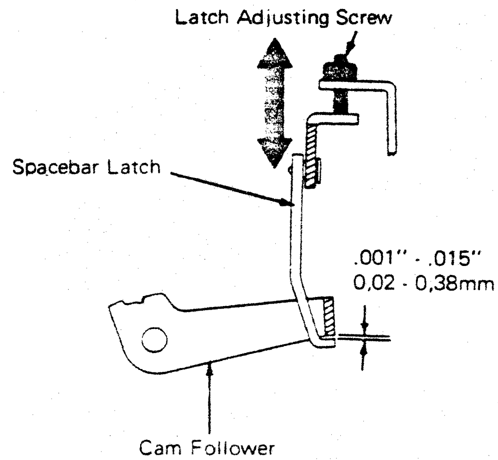


Figure 5-112.

NOTE:

This clearance can be observed by pulling the latch to the rear with a spring hook while the machine is at rest.

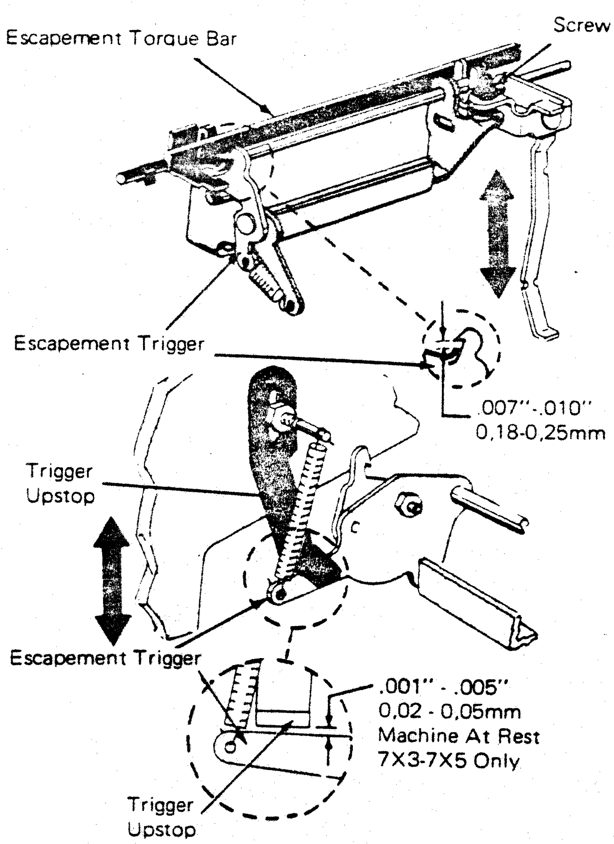


Figure 5-113.

m. Spacebar Latch Lever Screw

Adjust the screw so that .007" to .010" clearance exists between the escapement trigger and the escapement torque bar. Disconnect the escapement trip link before making this adjustment. On long carriage machines (7X3 and 7X5), the trigger upstop should be moved up out of the way when making this adjustment. After completing the adjustment, the upstop should be readjusted so it clears the trigger lever by .001" to .005". (Figure 5-113)

n. Spacebar Guide

Adjust the spacebar guide for free up and down travel of the spacebar keybutton and for 1/16" to 1/32" between the rear edge of the spacebar keybutton and the front edge of the fourth row character keybuttons. (Figure 5-114)

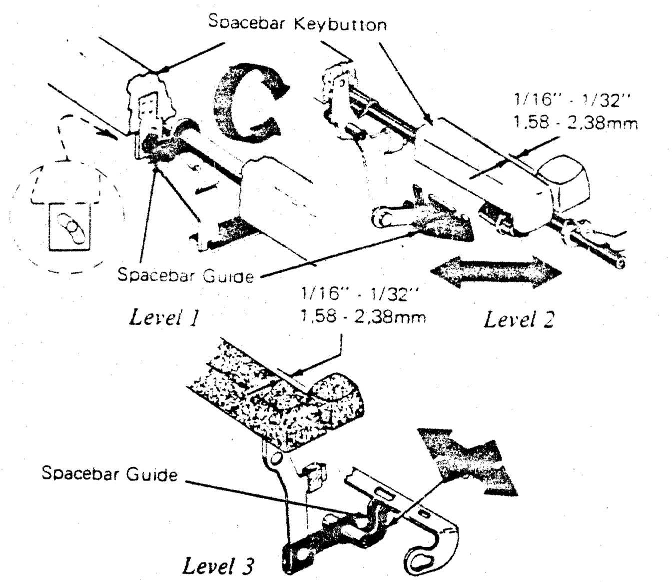


Figure 5-114.

o. Spacebar Final Stop

Adjust the spacebar final stop to obtain .005" to .015" clearance between the stop and the spacebar stem at the time a repeat operation occurs. (Figure 5-115)

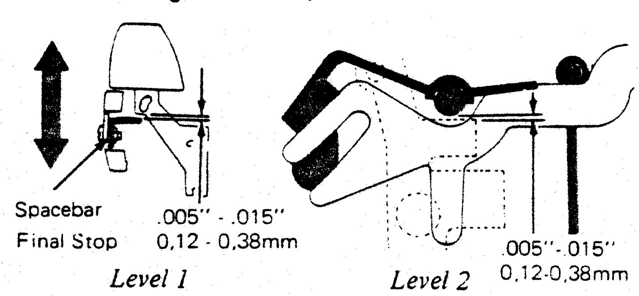


Figure 5-115.

p. Spacebar Interlock Cam

Adjust the spacebar interlock cam radially on the filter shaft so that when the machine is at rest the spacebar interlock interposer is on the high point of the cam. (Figure 5-116)

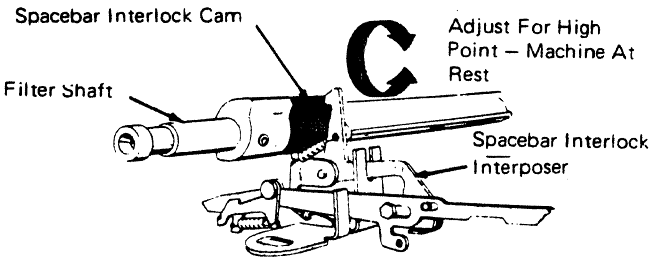


Figure 5-116.

q. Space Interlock Bracket

With the machine at rest and the spacebar interposer released, adjust the interlock bracket front to rear to obtain a clearance of .040" to .050" between the interlock interposer and the adjustable stop on the spacebar interposer. (Figure 5-117)

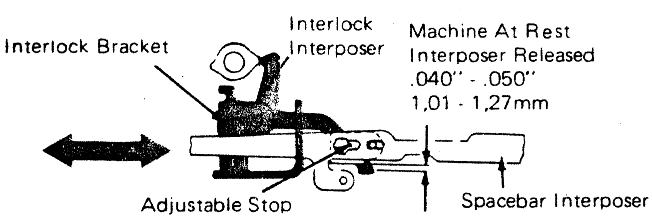


Figure 5-117.

r. Interlock Stop

With the machine half cycled and the spacebar interposer latched at rest, adjust the spacebar interposer interlock stop so there is .020" to .025" between the interlock stop and the spacebar interlock interposer. (Figure 5-118)

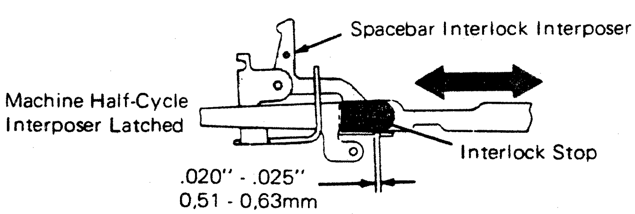


Figure 5-118.

5-20. BACKSPACE

a. Backspace Latch Height

Adjust the backspace latch adjusting screw for .001" to .015" clearance between the latch and the cam follower lever. This adjustment should be made to the low side of the spec to ensure a minimum of lost motion. (Figure 5-119)

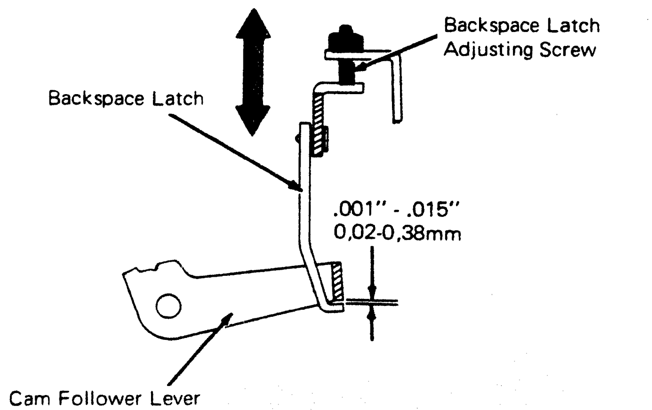


Figure 5-119.

b. Tab Lever Stop

Form the stop front - to - rear for a clearance of .001" to .003" between the vertical lug on the tab lever and the backspace pawl when the pawl is bottomed in its rack. (Figure 5-120)

NOTE:

Make sure the escapement bracket and all print escapement adjustments are correct before forming the stop.

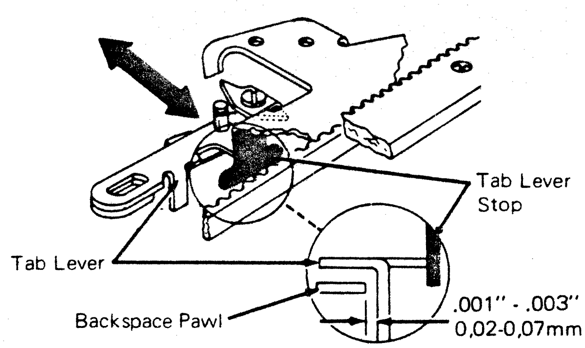


Figure 5-120.

This adjustment ensures that the backspace pawl will not be prevented from bottoming in its rack during a backspace operation. It also determines the motion necessary for the tab lever to remove the escapement and backspace pawls from their racks furing a tab operation.

c. Backspace Rack

With the machine at rest, adjust the backspace bellcrank screw in or out to obtain .005" to .015" clearance between the working surface of a rack tooth and the backspace pawl. Check at both ends of the writing line.

This adjustment minimizes lost motion and ensures that the backspace pawl will positively reset in the next rack tooth at the completion of a backspace operation.

Excessive clearance can cause escapement problems as well as backspace problems by allowing the backspace pawl, instead of the escapement pawl, to hold the carrier. (Figure 5-121)

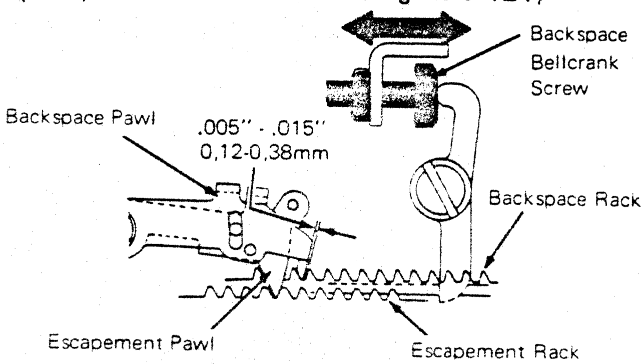


Figure 5-121.

d. Level 2 and 3

Adjust the intermediate lever on level 2 and the backspace bellcrank adjusting screw on level 3 so that a backspace operation just fails under hand operation. During a powered backspace operation, the carrier develops enough momentum for a positive operation. Too much motion will cause double or space-and-a-half backspacing. (Figure 5-122)

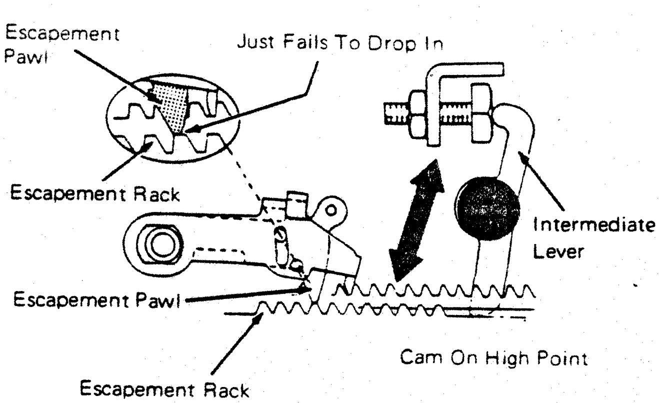


Figure 5-122.

5-21. TABULATOR

a. Tab Rack—Radially

With the tab lever latched to the rear, the unset tab stops should be centered between the tab lever pawl and the tab set lug on the escapement bracket. Loosen the screw on the tab set and clear bellcrank and rotate the tab rack to make this adjustment. (Figure 5-123)

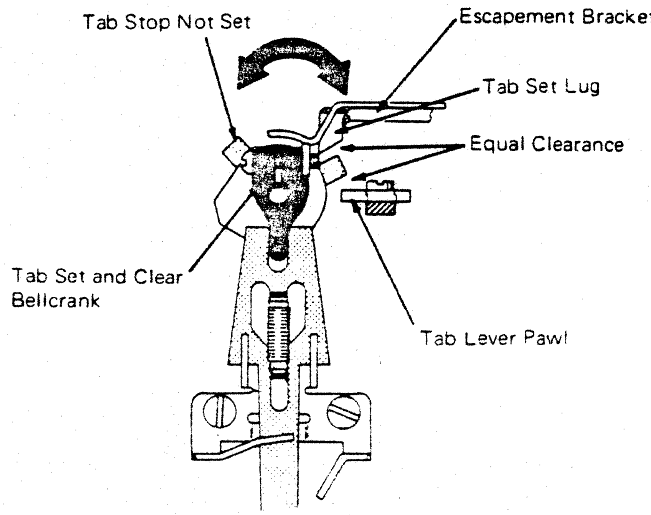


Figure 5-123.

b. Tab Set and Clear Bracket

Form the stop lugs on the set and clear bracket so that the movement of the set and clear arm is restricted as the tab stops fully reach their set or clear position. (Figure 5-124)

NOTE:

On the early style tab set and clear mechanism, the stop lugs were anchored and adjusted by two screws on the outside of the power frame.

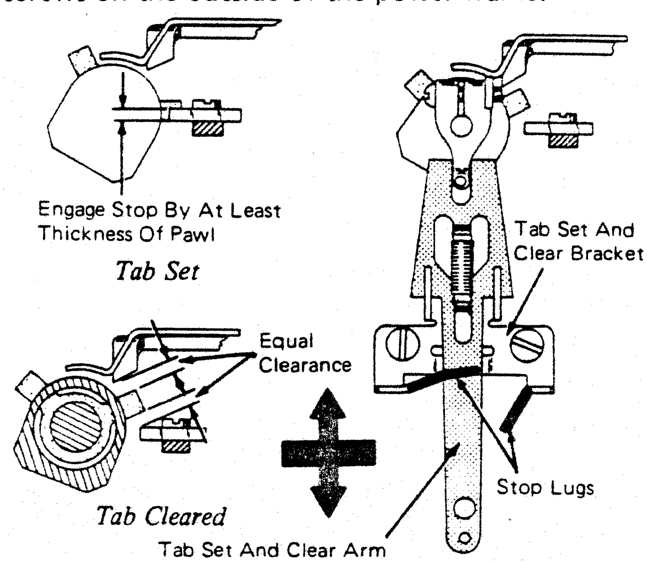


Figure 5-124.

c. Tab Lever Stop

Form the stop front to rear for a clearance of .001" to .003" between the vertical lug on the tab lever and the backspace pawl when the pawl is bottomed in its rack. (Figure 5-125)

NOTE:

Make sure all escapement bracket and print escapement adjustments are correct before forming this stop.

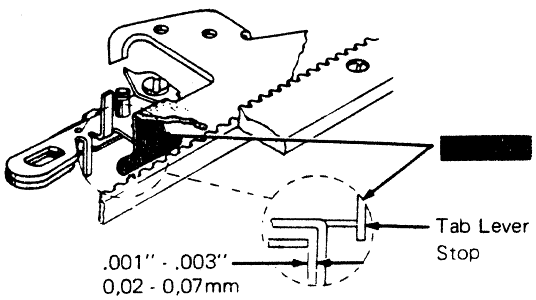


Figure 5-125.

d. Tab Lever Pawl

Adjust the tab lever pawl front to rear for .035" to .045" clearance between the tip of the tab lever pawl at rest and the set tab stops. The adjustment of the tab lever pawl has an effect on the amount of overlap between the tab stop and the pawl tip in the active position. It also affects pawl clearance during tabulation. Unless the tab lever pawl is properly adjusted, correct pawl clearance cannot be obtained. (Figure 5-126)

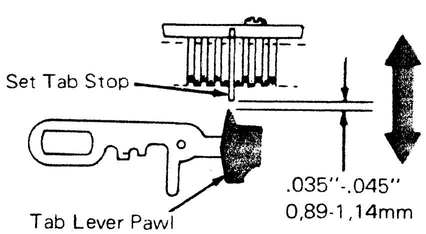


Figure 5-126.

e. Pawl Clearance

Form the upright lug on the tab latch for a clearance of .005" to .015" between the tip of the escapement pawl and escapement rack teeth with the tab lever latched to the rear. This adjustment ensures that the escapement pawl will re-enter the rack as quickly as possible to minimize the chances of entering the wrong tooth. (Figure 5-127)

The upright lug of the tab latch may be formed with the three inch screwdriver by using it as a lever through the hole in the escapement bracket.

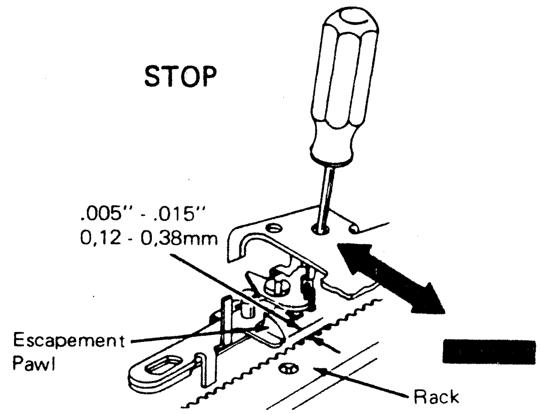


Figure 5-127.

Check with your instructor

before doing this adjustment !

This adjustment is OLD STYLE ONLY !

f. Tab Trigger Extension

Form the front (curved) lug of the tab trigger to obtain .016" to .023" clearance between this lug and the tab torque bar with all parts at rest. (Figure 5-128)

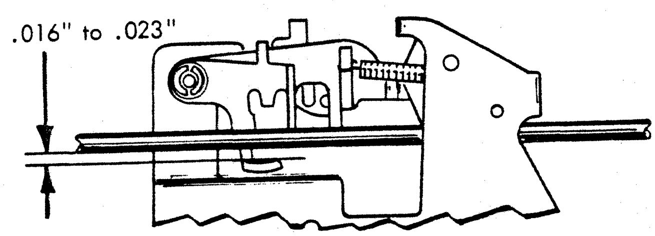


Figure 5-128.

g. Tab Lever Overthrow

With the tab cam on its high point, adjust the torque bar actuating link for .005" to .010" overthrow between the tab latch and tab lever. (Figure 5-129)

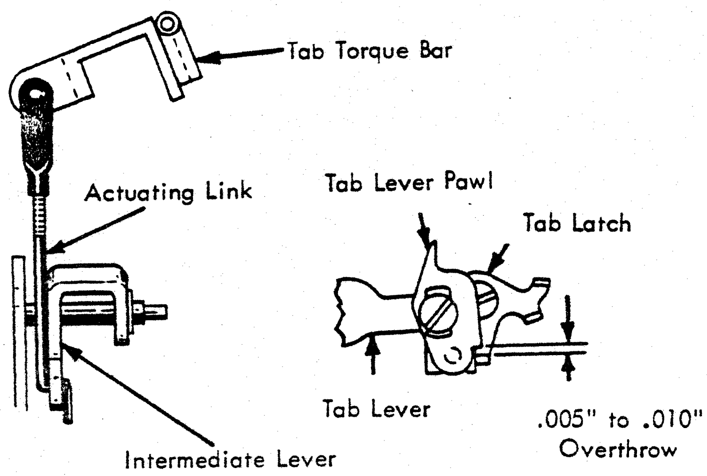


Figure 5-129.

h. Overthrow Stop

Adjust the stop front to rear for .005" to .015" clearance between the lug on the overthrow stop and the upright lug on the tab lever trigger with the tab lever latched to the rear. (Figure 5-129A)

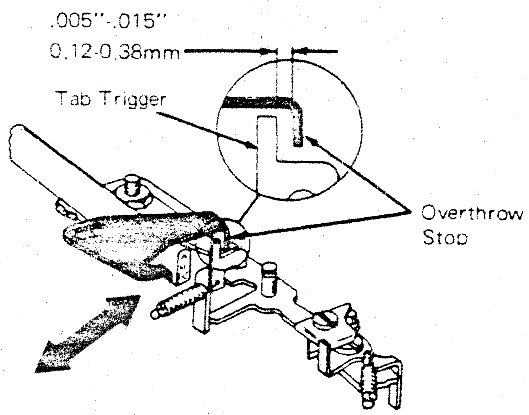


Figure 5-129A.

i. Tab Rack Left to Right

Adjust the tab rack left to right for .005" to .020" clearance between the tip of the tab lever pawl and the left side of a set tab stop. (Figure 5-130)

To make this adjustment, clear all the tab stops. Set one tab stop, backspace once and then turn the machine off. The tip of the tab lever pawl should be just to the left of the tab stop. Hold the carrier to prevent it from moving and observe the tab lever pawl as you slowly depress the tab keybutton. The tip of the tab lever pawl should clear the left side of the tab stop by .005" to .020".

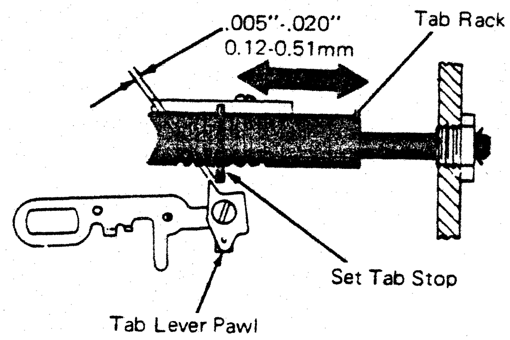


Figure 5-130.

j. Tab Interlock

With the carrier return clutch latched, the escapement torque bar should rotate the tab latch away from the tab lever pawl by .005" to .025".

This adjustment is obtained by forming the lug on the tab latch that extends down behind the escapement torque bar. The adjustment ensures that the carrier return and tab cannot both be latched out simultaneously. If both were allowed to latch, the tab lever pawl would lock against a set tab stop during the carrier return operation. (Figure 5-130A)

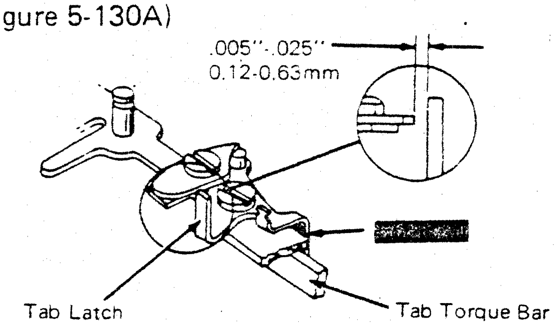


Figure 5-130A.

k. Gang Clear Bracket

Adjust the gang clear bracket front to rear for .010" to .020" between it and the upper lug on a set tab stop. If necessary, form the tip of the gang clear bracket to ensure that it does not contact the tab rack at any place along the writing line. Clearance between the tab rack and the tip of the gang clear bracket should be kept to a minimum. (Figure 5-131)

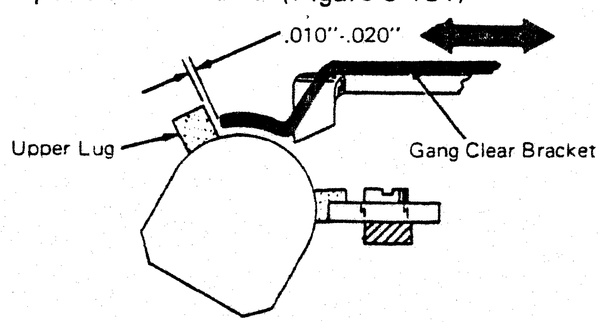


Figure 5-131.

l. Tab Set And Clear Link

Adjust the tab set and clear link so the tab set and clear keybutton matches the slope of the keyboard. (Figure 5-132)

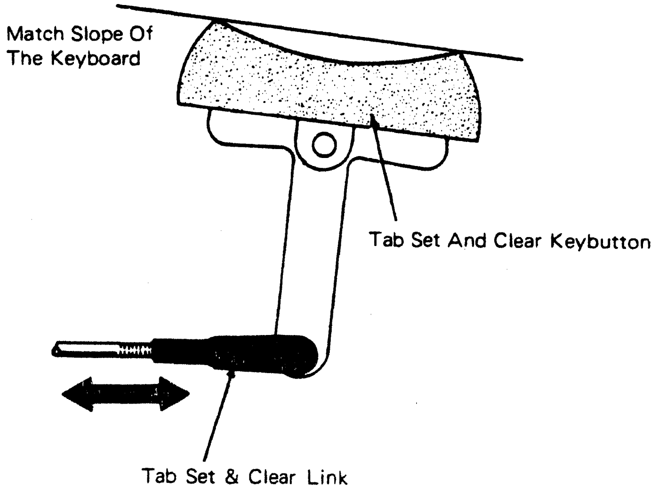


Figure 5-132.

5-22. CARRIER RETURN AND INDEX

NOTE:

All operational control adjustments must be correct before attempting to make carrier return adjustments.

a. Pawl Clearance

Adjust the clutch latch eccentric so the escapement pawl will clear the rack teeth by .005" to .015" when the latch is being held down by the keeper. Caution: Do not form the tip of the carrier return clutch latch. (Figure 5-133)

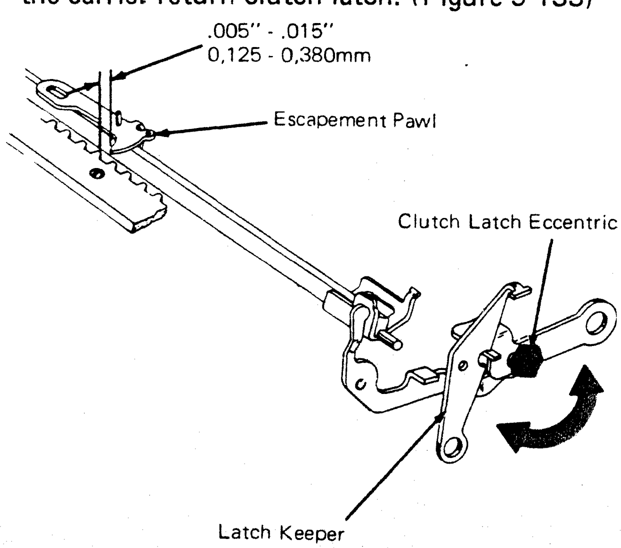


Figure 5-133.

This adjustment assures the escapement pawl will not drag along the escapement rack during a carrier return and that the pawl will be allowed to re-enter the rack quickly at the completion of a carrier return operation.

c. Carrier Return Latch Height

Adjust the carrier return latch adjusting screw to obtain .001" to .015" clearance between the latch and the cam follower lever. This adjustment should be made to the low side of the spec to ensure a minimum of lost motion. (Figure 5-134)

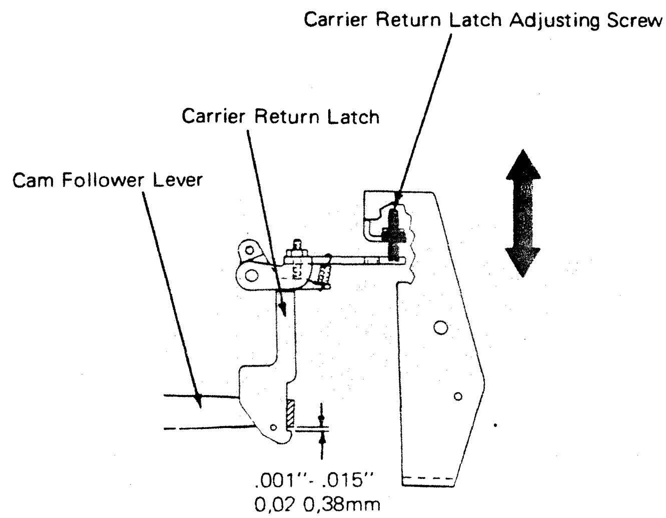


Figure 5-134.

d. Clutch Latch Overthrow

With the carrier return/index cam on the high point, adjust the adjusting screw in the carrier return latch arm to obtain .030" to .040" overthrow between the tip of the carrier return clutch latch and the clutch latch keeper. (Figure 5-135)

Be sure the set screw that locks the carrier return lever to the pivot shaft is tight as this will cause insufficient carrier return latch overthrow.

NOTE:

This adjustment should be made with the platen, deflector and feed rolls in the machine. After making this adjustment, be sure to recheck the carrier return latch height adjustment. This can be found in the operational control and space bar section.

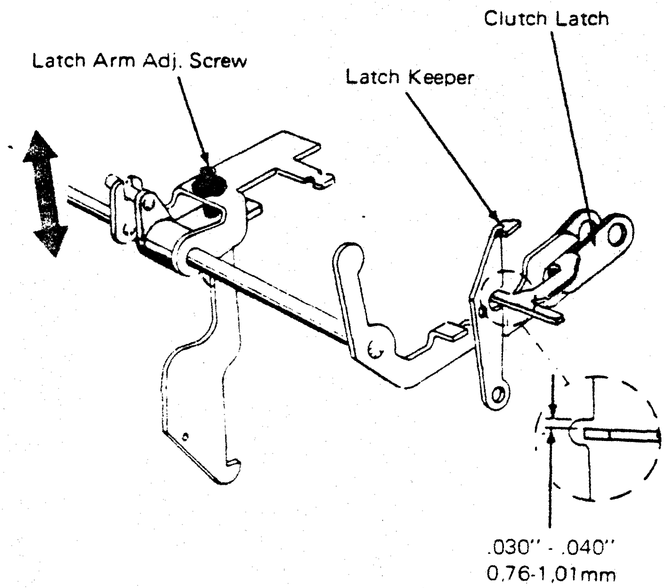


Figure 5-135.

e. Carrier Return Shoe Overlap

Adjust the carrier return actuating arm bracket left or right so the carrier return shoe overlaps the last three coils on the right hand end of the carrier return clutch spring. This ensures that all coils of the clutch spring will be used in the clutch operation. (Figure 5-135A)

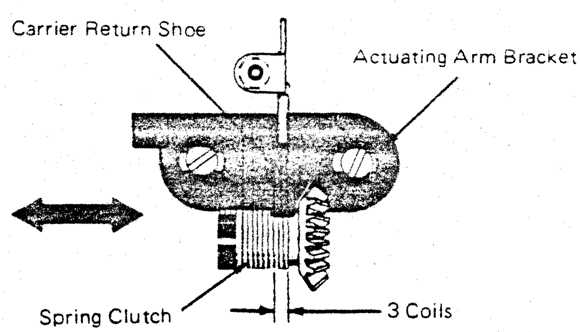


Figure 5-135A.

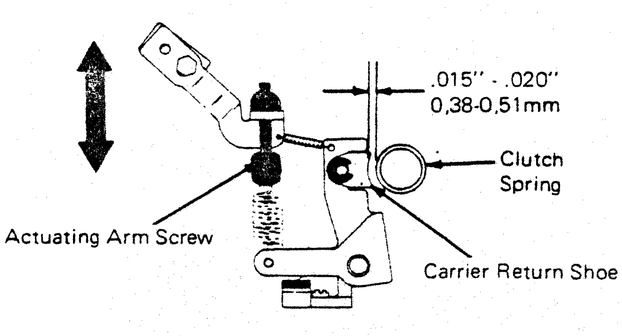


Figure 5-136.

f. Carrier Return Shoe Clearance

Adjust the actuating arm spring screw vertically to obtain .015" to .020" clearance between the carrier return shoe and the carrier return clutch spring with all parts at rest. (Figure 5-136)

g. Overbank (Late Level)

With the carrier resting at the left hand margin, adjust the overbank guide left to right to obtain .001" to .005" clearance between the left hand margin stop and the carrier stop latch. On machines equipped with the floating stop latch, the floating action of the latch must be removed by pulling the latch to the right with a spring hook before this clearance can be observed. (Figure 5-137)

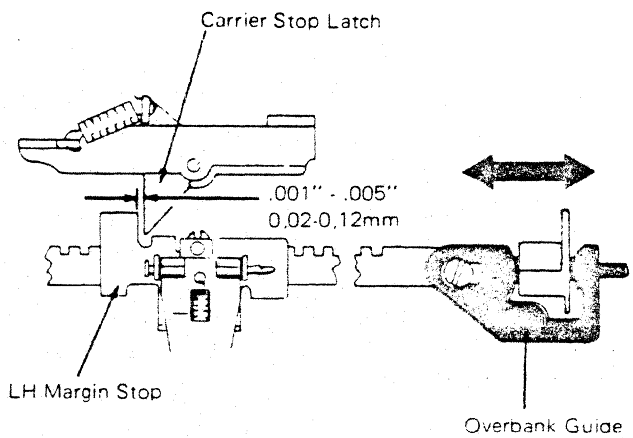


Figure 5-137.

The adjustment of the overbank guide on the margin rack determines the rest position of the margin rack. This adjustment ensures that the left hand margin stop will set accurately when the stop is moved to the right against the carrier. The adjustment of the overbank guide, plus the amount of lateral motion that the guide permits, automatically provides the carrier with the overbank required for proper escapement pawl re-entry at the completion of a carrier return operation.

h. Clutch Unlatching

With the power on, hold the clutch latch down. The carrier return latch by .005" to .015" at the unlatching point. Lengthen or shorten the carrier return unlatching link to obtain this clearance. (Figure 5-138)

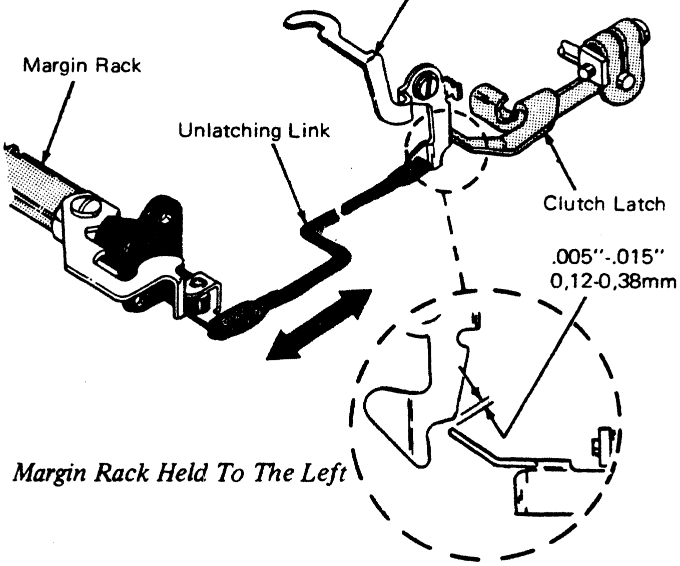


Figure 5-138.

NOTE:

On machines equipped with the early style margin rack, check the margin rack eccentric adjustment if the clutch fails to latch properly. The eccentric may be holding the rack too far to the left restricting the margin rack motion and reducing the amount of bite that the keeper may take on the latch.

i. Torque Limiter

Adjust the eccentric stud on the torque limiter hub to provide one to two pounds pull on the carrier as the carrier is unlatching the clutch at the left margin. If sufficient adjustment is not available at the eccentric, the torque limiter spring may be shifted on the torque limiter hub by repositioning the torque limiter spring clamp. (Figure 5-139)

If no spring scale is available, the torque may be estimated by holding the carrier while the clutch

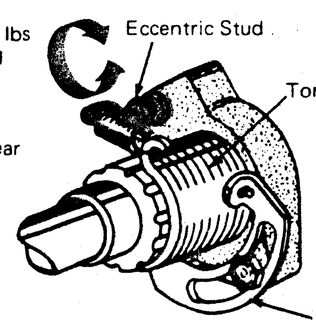


Figure 5-139.

is engaged. The torque limiter should slip readily yet return the carrier positively without any hesitation when the carrier is released.

(INDEX)

NOTE:

All operational control adjustments must be correct before attempting to make the following index adjustments.

j. Multiplying Lever Stop

On machines equipped with either a 27 or 54 tooth ratchet, adjust the mulitplying lever stop front to rear to produce 3/8" motion to the index link when the carrier return index cam is operated to its high point (platen removed). (Figure 5-140)

On machines equipped with other ratchets, adjust the multiplying lever stop front to rear to produce approximately 13/32" motion to the index link when the carrier return index cam is operated to its high point (platen removed).

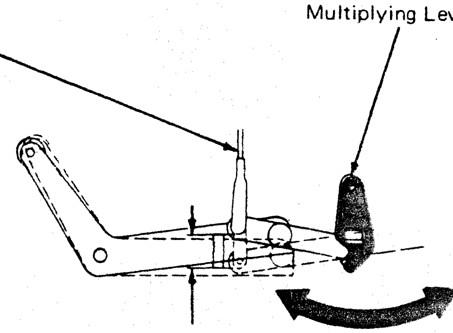


Figure 5-140.

NOTE:

This adjustment may be measured with the hoomerometer and a feeler gage. The handle of the hooveromerer is 3/8" wide. The 13/32" adjustment can be gaged by the width of the hooverometer handle plus a .035" feeler gage.

k. Index Link

As a preliminary step, loosen the platen overthrow stop and move it to the front of the machine. With the platen installed and the feed rolls engaged, hold the detent roller disengaged from the platen ratchet. Manually cycle an index operation. At the end of the cycle, allow the detent roller to re-enter the platen ratchet.

If the index link is properly adjusted, the detent roller will seat between the two ratchet teeth without causing any rotational movement to the platen. Adjust the index link clevis to obtain this condition. (Figure 5-141)

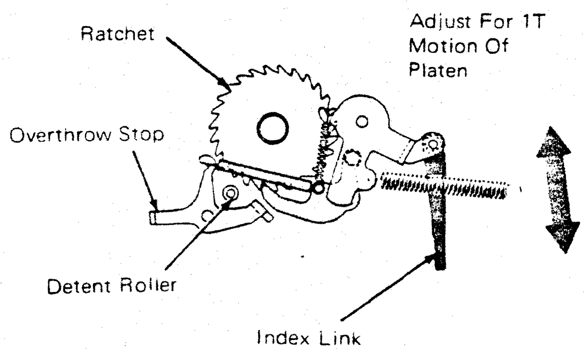


Figure 5-141.

l. Platen Overthrow Stops

Adjust the platen overthrow stop front to rear to obtain a clearance of .005" between the index pawl and the platen overthrow stop with the index cam rotated to its high point. (Figure 5-142)

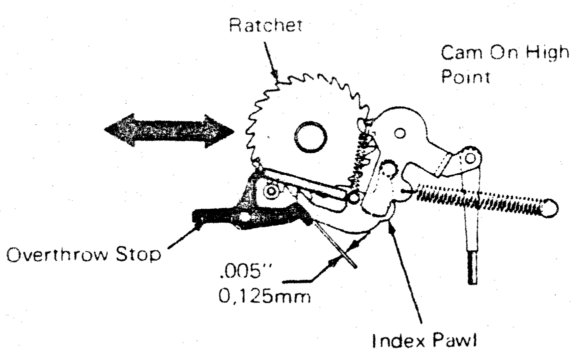


Figure 5-142.

m. Index Selector Cam

With the index cam at rest and the index lever in the double space position, adjust the selector cam front to rear so the index pawl clears the platen ratchet by .015" to .050". With the index lever in the single space position, adjust the selector cam vertically so the index pawl is centered on the cam surface. (Figure 5-143)

These adjustments must be considered together and refined until both are correct.

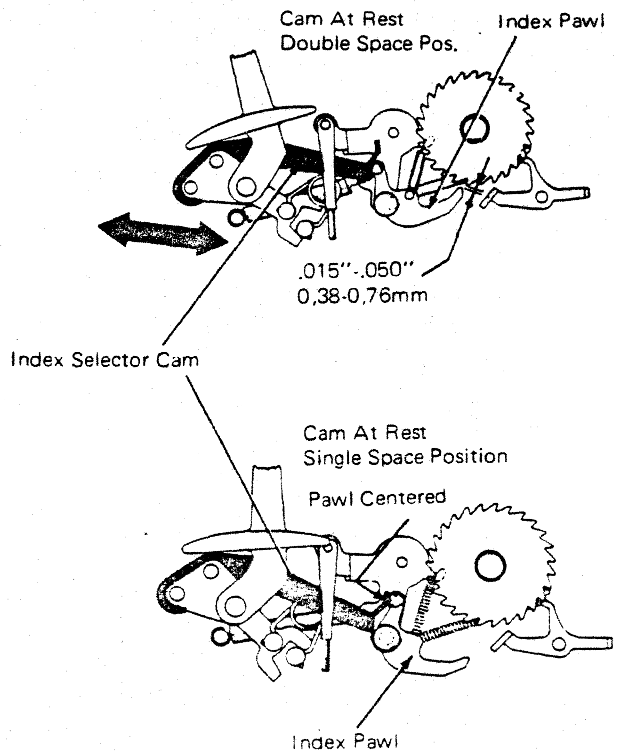


Figure 5-143.

On machines equipped with a 54 tooth ratchet, adjust the index selector detent stud so the index pawl will reliably enter the correct ratchet tooth to produce a feed of 2, 3, or 4 ratchet teeth when the index lever is placed in first, second or third index position. (Figure 5-144)

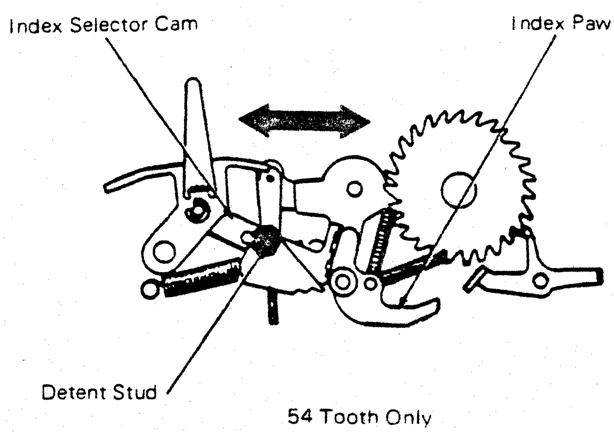


Figure 5-144.

5-23. MARGIN

a. Margin Rack Horizontal

The margin rack must rest on a horizontal plane. Adjust the left hand margin release lever. Maintain .030" between the release lever and the power frame. (Figure 5-145)

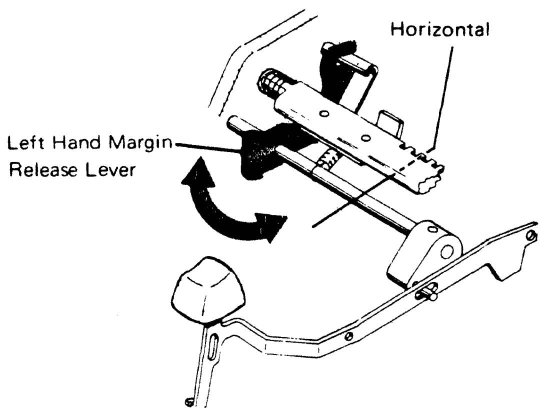


Figure 5-145.

b. Left Hand Final Stop

Position the margin set lever stop left to right on the margin rack so it will clear the margin stop by .001" to .010" when the margin stop pin is fully seated in the extreme left hand tooth of the margin rack. (Figure 5-146)

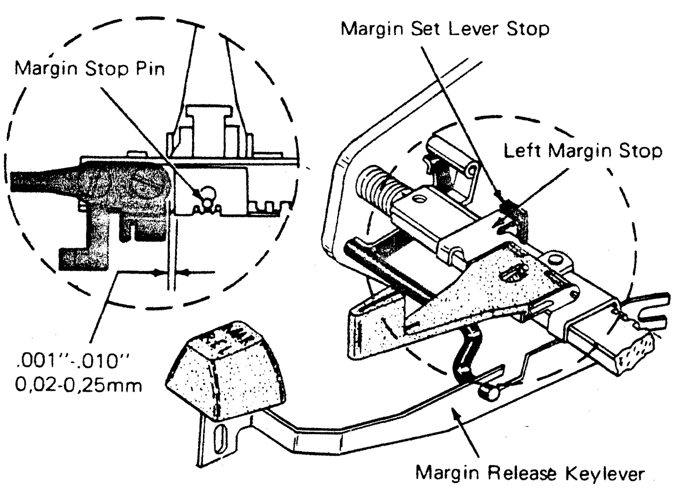


Figure 5-146.

c. Line Lock Bracket

Adjust the linelock bracket up or down so the bellringer bellcrank contacts the bracket .050" to .060" from the top. (Figure 5-147)

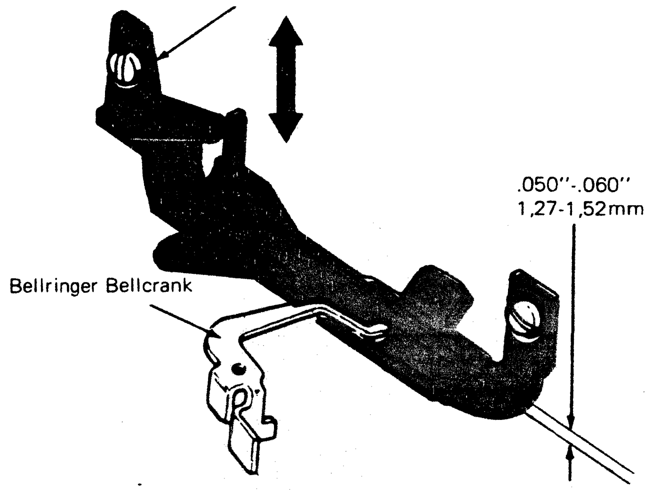


Figure 5-147.

d. Bellringer Bail Extension

Form the bellringer bail extension up or down so the character keybuttons lock when the red pointer is directly above the right hand margin set lever. (Figure 5-148)

CAUTION:

The linelock should not be felt in the space preceding the desired locking point.

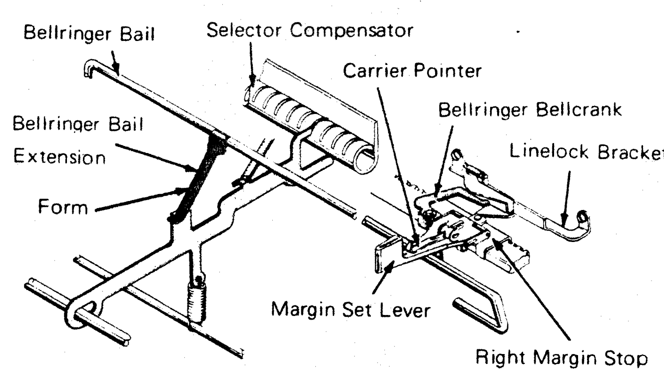


Figure 5-148.

5-24. FABRIC RIBBON

a. Cartridge Guide Lugs:

Form the cartridge guide lugs so the cartridge spools will be centered over the ratchets. Side play of the cartridge must be limited within .005" to .010". (Figure 5-149)

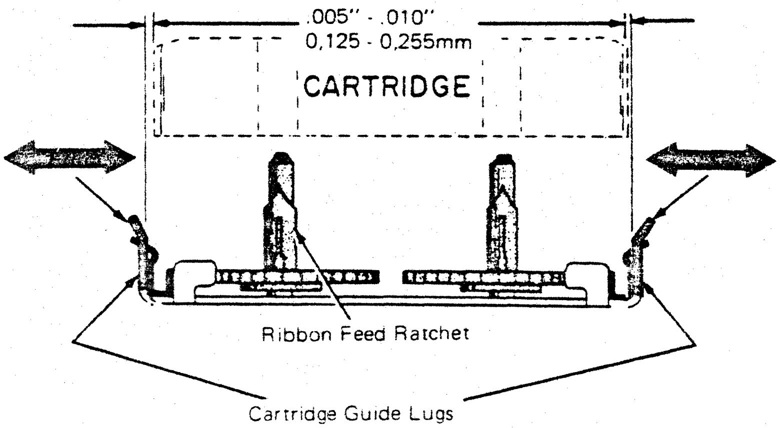


Figure 5-149.

b. Cartridge Retaining Springs (Level 2 Only)

The cartridge retaining springs should be positioned laterally so they are FLUSH against the feed plate; then adjust front to rear so the cartridge retaining fingers are centered in the holes of the cartridge guide lugs. The ratchet brake portion of the spring should exert a small drag on the feed ratchet. Form only as necessary. (Figure 5-150)

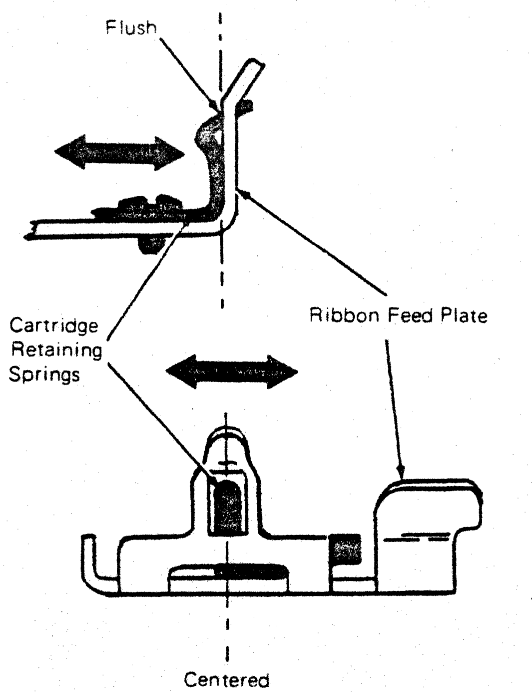


Figure 5-150.

NOTE:

Excessive or insufficient tension could result in reverse failure.

c. Ribbon Lift Lever

Three conditions must be met as follows:

1. Form the lift lever finger tab left or right so the ribbon feed pawl will center between the two feed ratchets when the lift lever is placed in stencil position. (Figure 5-151)

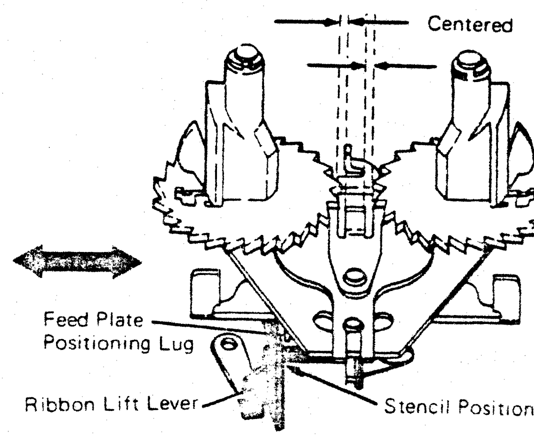


Figure 5-151.

2. Form the rear lug so a clearance of .010" to .040" exists between the lug and the feed plate positioning lug when the LEFT HAND RATCHET IS FEEDING. (Figure 5-152)

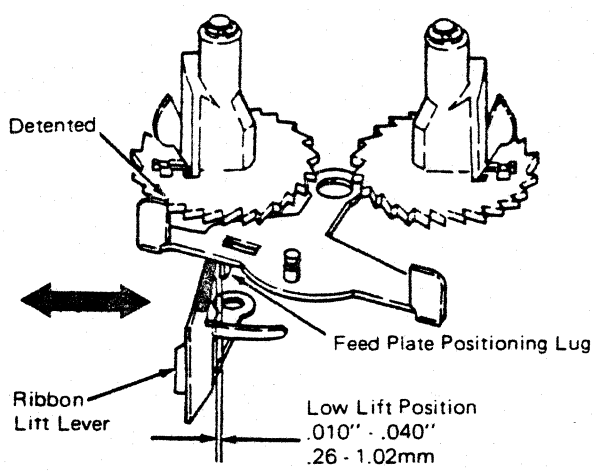


Figure 5-152.

3. Form the front lug so a clearance of .010" to .040" exists between the lug and the feed plate positioning lug when the

RIGHT HAND RATCHET IS FEEDING.
(Figure 5-153)

NOTE:

Avoid forming the ribbon feed plate positioning lug, since the breakage would require replacement of the entire feed plate.

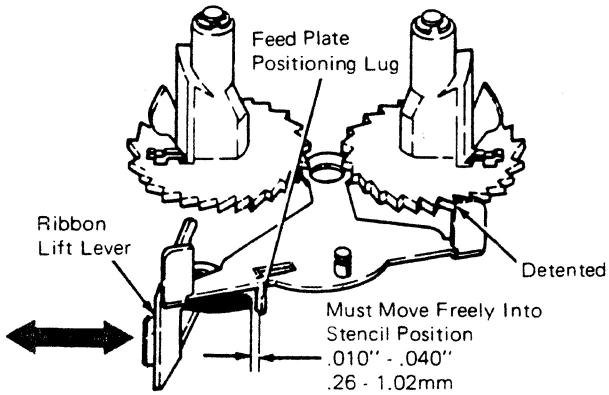


Figure 5-153.

d. Ratchet Detent Lever Lugs

These should be formed as follows:
(Figure 5-154)

1. Left or right, so the ribbon feed ratchet tooth overthrows past the edge of the detented lug by .025" to .050" when hand cycling to the high point of the ribbon feed cam.

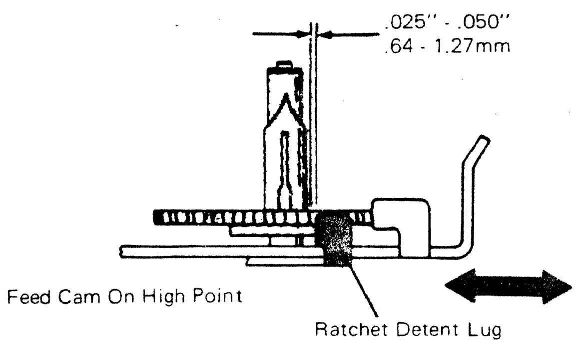


Figure 5-154.

2. Form the detent lugs front to rear so the ribbon feed pawl engages a ratchet tooth by approximately 1/2 the depth of the ratchet tooth. (Figure 5-155)

NOTE:

The feed pawl spring lug should clear the teeht of the opposite ratchet by at least .015" when the feed pawl is being withdrawn to the rest position at the end of an operation. Failure to clear the teeth of the opposite ratchet under power may result in a lockup and consequent failure of the ribbon feed operation.

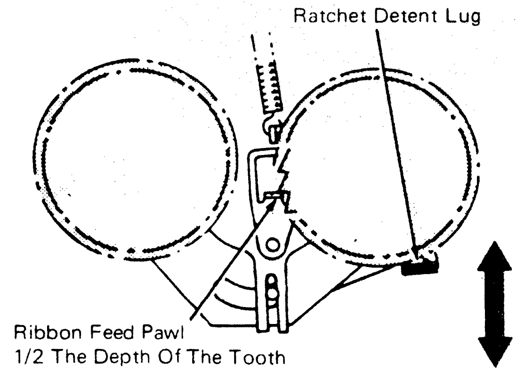


Figure 5-155.

e. Ribbon Lift Guide Plate

Adjust the plate as low as possible without causing a change in the ribbon lift guide height as the ribbon lift lever is moved from the low lift to the high lift position. The ribbon lift cam should be at the low point when the check is made. (Figure 5-156)

This adjustment ensures the same relative throw for both the high and low lift position.

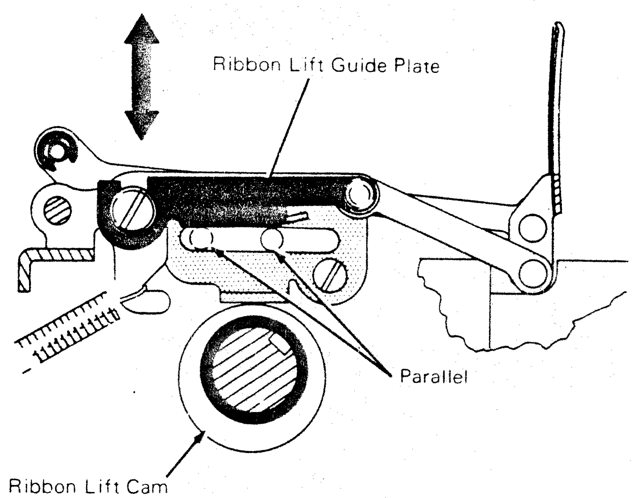


Figure 5-156.

f. Ribbon Lift Control Link

Adjust the link forward or back by means of its clevis so the underscore will strike the ribbon .030" to .045" from the bottom edge. The ribbon lift lever must be in the high lift position when this check is made. (Figure 5-157)

CAUTION:

Do not adjust the link so short that it chokes off the front end of the cam follower slot as the ribbon lift lever is moved into the high lift position.

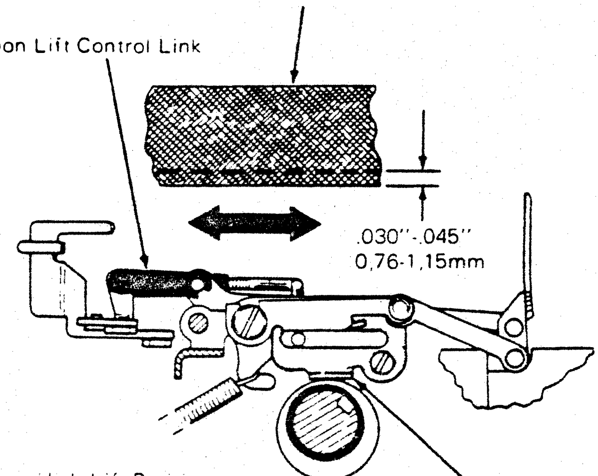


Figure 5-157.

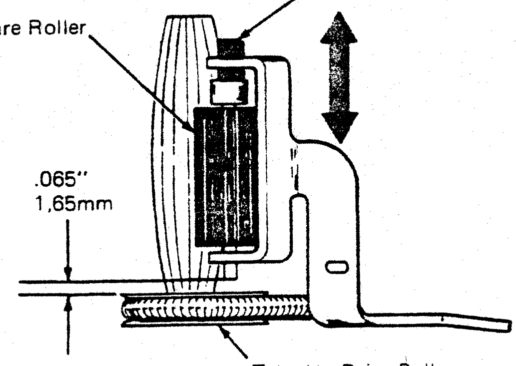


Figure 5-159

5-25. FILM RIBBON

a. Ribbon Feed Cam Follower Bracket

Wi th the nylon carrier pad against the carrier casting, the ribbon feed cam follower bracket should be centered left to right in its mounting hole. Keep the bottom of the bracket parallel to the carrier pad. (Figure 5-158)

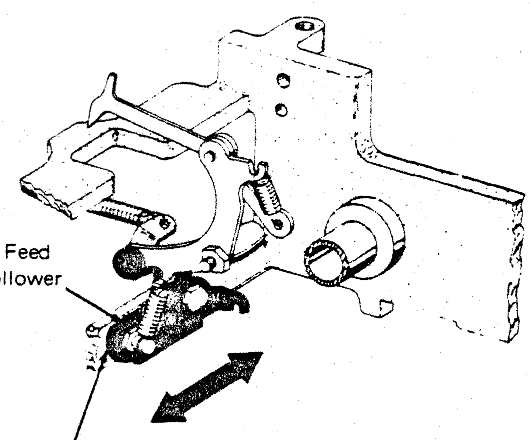


Figure 5-158.

b. Pressure Roller

Machines with the adjustable geared pressure roller should be adjusted so the lower end of the pivot screw clears the take-up drive pulley by .065". (Figure 5-159)

c. Ribbon Plate

Adjust the ribbon plate left to right so the ribbon feed pawl is centered in the operating slot. The ribbon feed pawl must move freely front to rear in its slot. (Figure 5-160)

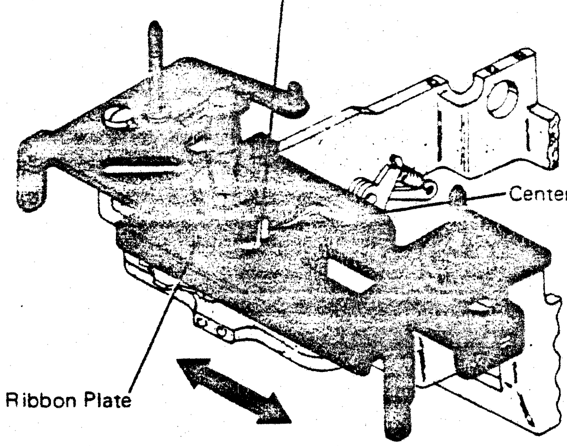


Figure 5-160.

d. Ribbon Feed Cam Follower Stud

Hand cycle the machine and observe the lift control lever stud as it moves from the low point to the high point on the ribbon feed and lift wheel. Adjust the ribbon feed cam follower eccentric stud so the ribbon lift control lever stud overthrows the detent notch in the ribbon feed and lift wheel by .005" to .015". Machines not equipped with the detented positions on the ribbon feed and lift wheel should be adjusted so the lift control lever roller is centered on the high dwell of the ribbon feed and lift wheel. (Figure 5-161)

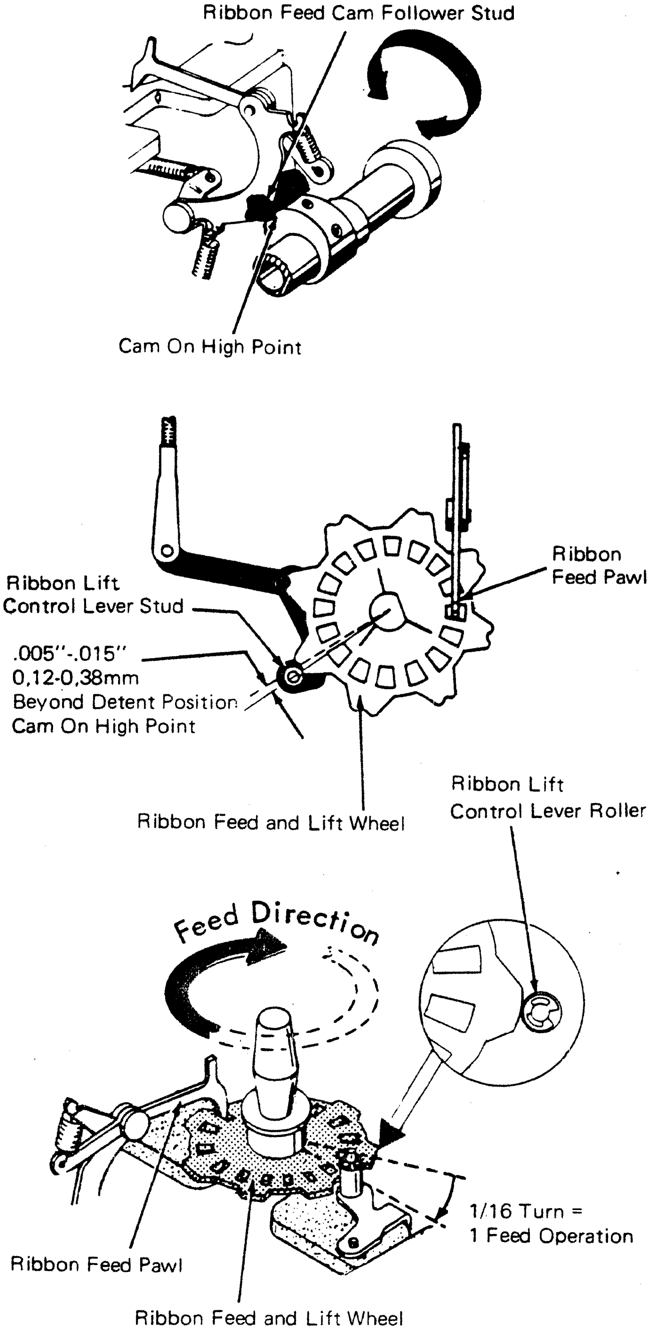


Figure 5-161.

e. Ribbon Lift Guide Plate

With the ribbon lift cam follower on the low point of the ribbon lift cam, position the lift guide plate on the arm of the lift guide assembly to satisfy the following conditions. (Figure 5-162)

1. Position the lift guide plate vertically so the rear of the lift guide assembly rests .030" above the carrier casting when the stencil lever is not in the stencil position.

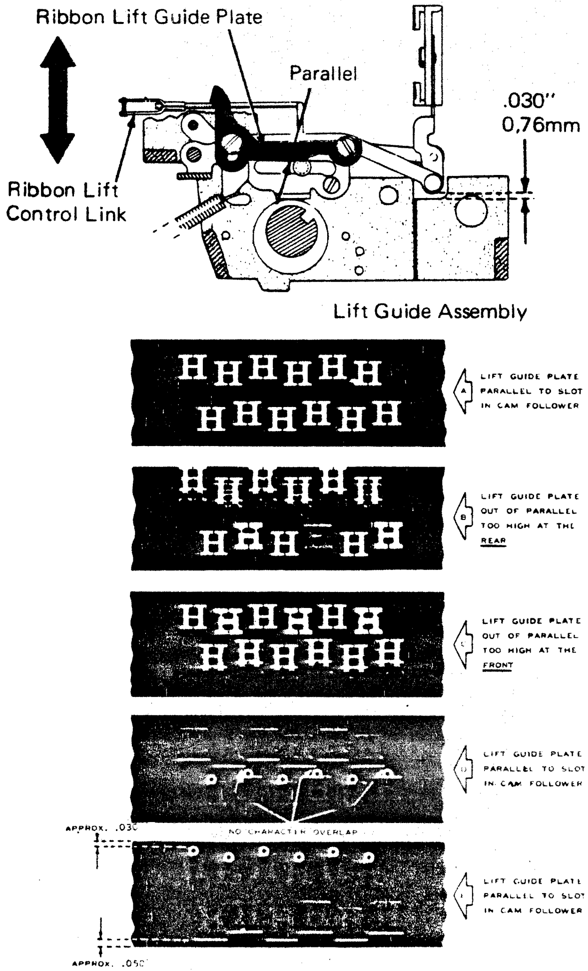


Figure 5-162.

The verticalness of the lift guide plate may be checked by observing the lift guide assembly while manually pushing the control link all the way to the rear into its stencil position. The guide assembly should drop .030" at the rear if the adjustment is correct.

2. Position the lift guide plate horizontally so its bottom surface is parallel to the slot in the cam follower.

The parallel adjustment of the lift guide plate may be checked in the following manner. With the cam follower resting on the low point of the lift cam, disconnect the control link and manually slide the link front to rear through the four lift positions. If the plate is parallel, no movement will be produced to the ribbon lift guide assembly while sliding the link back and forth. Do not slide the link into the stencil position while making this check.

f. Lift Control Link

Adjust the clevis on the ribbon lift control link so the lowest underscore prints .035" to .065" from the bottom edge of the ribbon. The degree character should be at least .030" from the top of the ribbon. (Figure 5-163)

NOTE:

The adjustment of the ribbon lift control link positions the lift pattern on the ribbon and does not have any affect on the distance or spread between each of the four lift positions in the pattern.

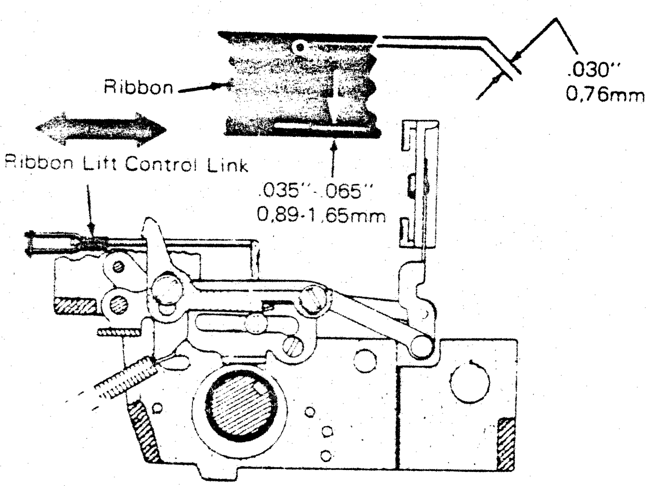
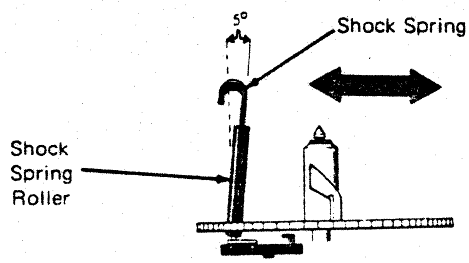


Figure 5-163.

g. Shock Spring

Form the shock spring to satisfy the following conditions:

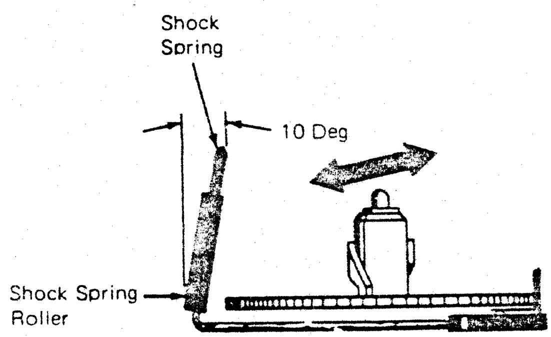
1. When viewed from the front of the machine, the shock spring should be formed to make the roller on the shock spring lean 5 deg. to the right. (Figure 5-164)



Front View

Figure 5-164.

2. When viewed from the side, the shock spring should be formed so the roller leqns to the front 10 deg. (Figure 5-164A)



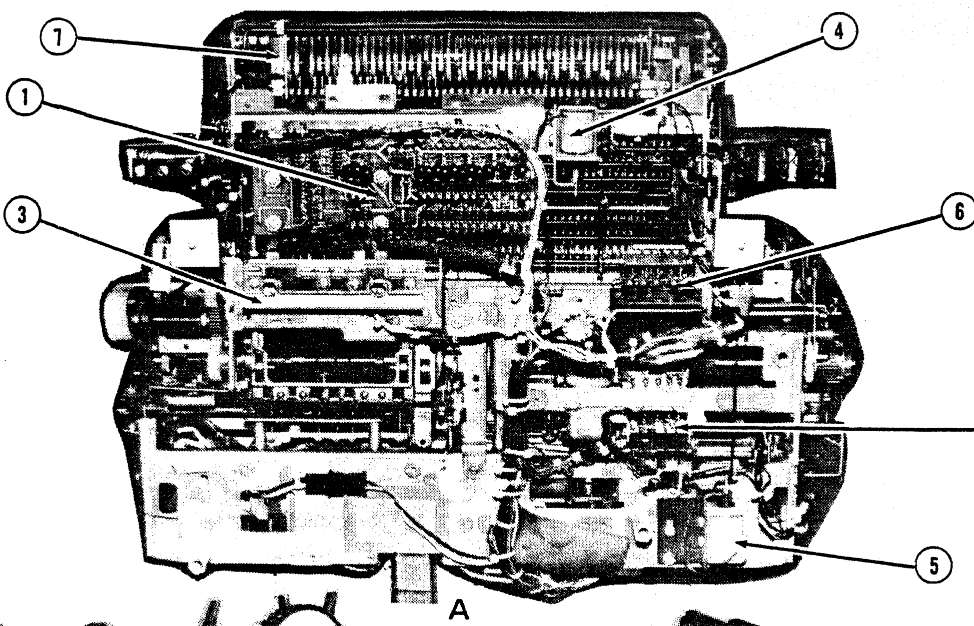
Side View

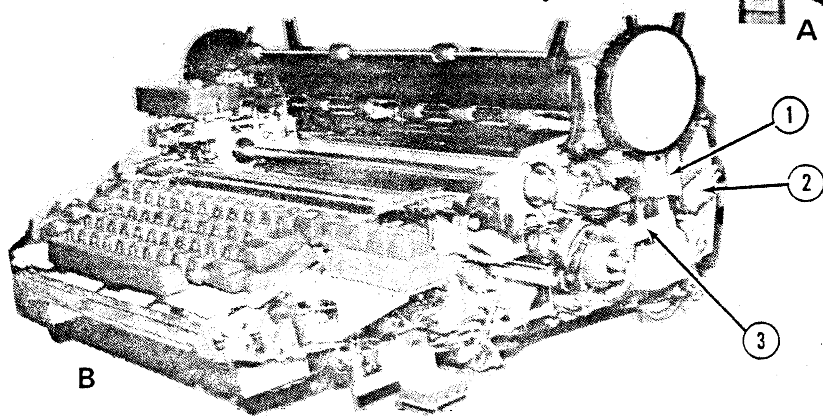
Figure 5-164A.

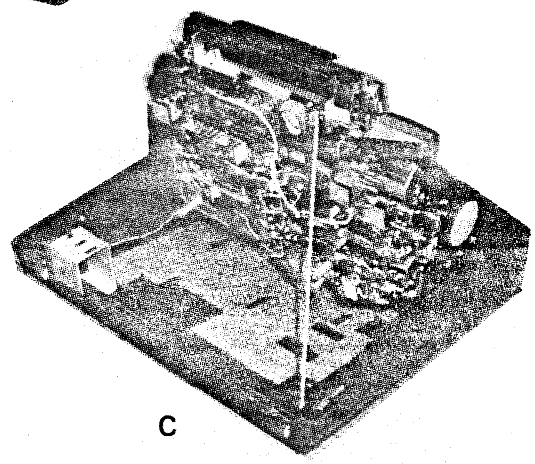
5-26. I/O INTERFACE.

Paragraphs 5-27 through 5-38 explain the mechanical adjustments and electrical timing of the I/O interface. Figure 5-165 shows the I/O Printer and calls attention to the location of the interface components.

1. INTERFACE BOARD
2. OPERATIONAL SWITCHES
3. SELECTOR LATCH SOLENOIDS
4. KEYBOARD LOCK SOLENOID
5. SHIFT SOLENOID
6. OPERATIONAL SOLENOIDS
7. SHIFT SWITCH







1. SHIFT INTERLOCK SWITCH
2. CARRIER RETURN SWITCH (SIDE MOUNTED)
3. SHIFT CAM FOLLOWER OR VANE

Figure 5-165.

5-27. SOLENOIDS (ARMATURE TYPE)

Adjust the solenoid(s) itself before fitting it in the machine. (All except some levels of the operational solenoids, which must be installed before adjusting). The armature when pushed lightly against both sides of the solenoid frame must never touch the solenoid core. (Figure 5-166) There is no adjustment for this but should you find this condition, check the armature to insure that it is perfectly flat. If not, form it or replace it with a new one. Armature pivot plate should be adjusted so that with the armature pushed firmly against the solenoid frame .001" to .008" exists between the pivot plate and the armature solenoid frame. (Figure 5-166) Armature limit plate should be adjusted so that with the armature pushed firmly against the solenoid frame .055" to .065" clearance exists between the limit plate and the armature. (Figure 5-166)

5-28. KEYBOARD LOCK SOLENOID

Should be adjusted as that with the solenoid energized .060" to .080" should exist between the plunger and the plunger limit. (Figure 5-167)

Position the solenoid to insure that the plunger bottoms out in the solenoid only when the dummy character interposer bottoms out in the compensator tube. Adjust the shift lock interposer clevis to insure that if the shift keylever is locked down when the keyboard lock solenoid is operated the shift will unlock. Adjust the operational keylever pawl lockout mechanism so that no operational interposer may be released when the solenoid is energized.

5-29. BAIL SOLENOID

After all the adjustments in paragraph 5-27 are correct the bail solenoid may be repositioned in

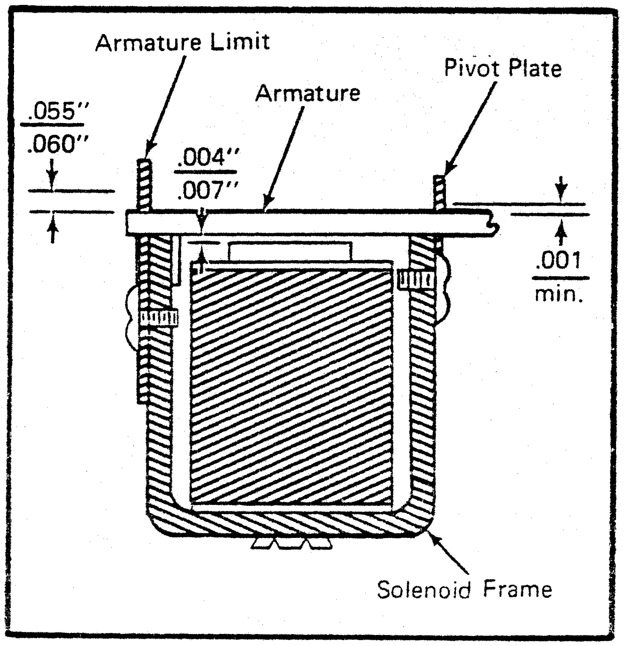


Figure 5-166.

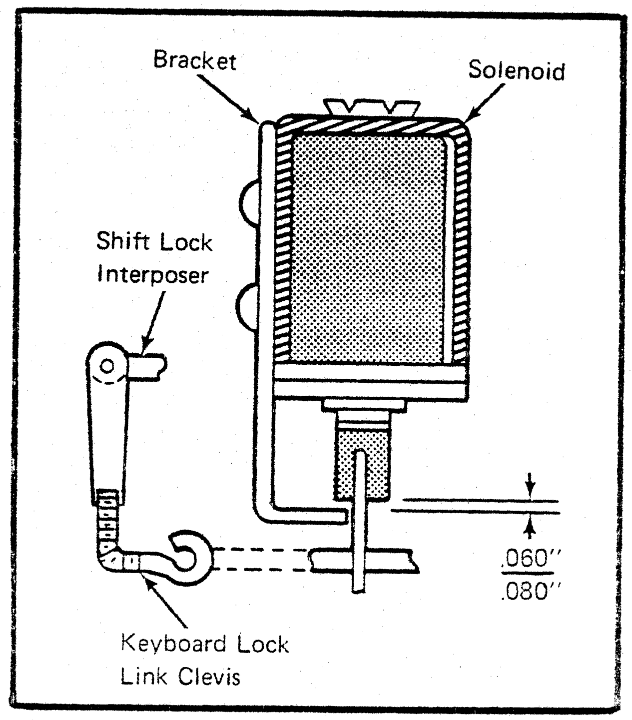


Figure 5-167.

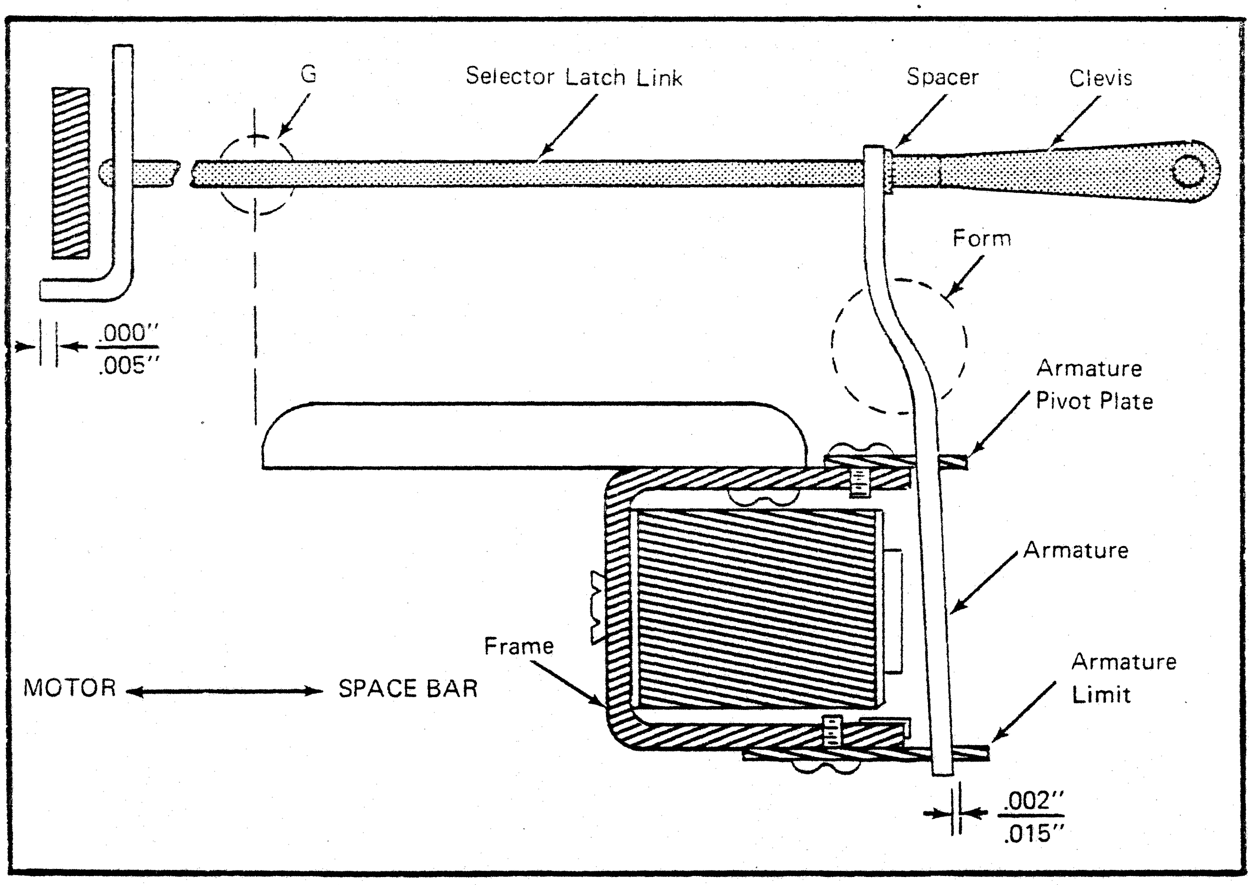


Figure 5-168.

5-32. OPERATIONAL SOLENOID

You may find as many as four levels of operational solenoid assemblies in the field.

In every case it is important to remember the following.

a. An operational interposer cannot be restricted by a short trip link or armature, to the point where it will repeat or extra cycle. It must be allowed to obtain full bite (latching surface) on the keylever pawl guide bracket.

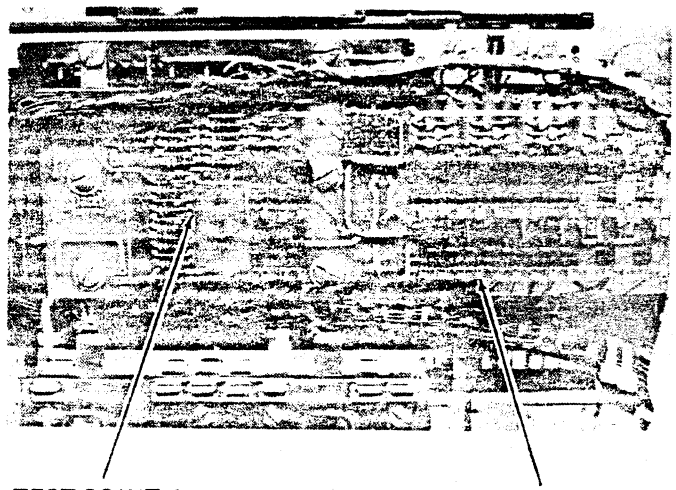
b. There must be some clearance between the trip link or armature, and the operational interposer. The armature must have some "free flight" travel before it picks up the load of unlatching the interposer. If there is no "free flight" travel the solenoid may not be strong enough to unlatch the interposer.

   The interposer must be released before the armature bottoms out on the solenoid frame. If the link is too long the armature may bottom out before the interposer is fully released.

Restrict the Armatures energized movement with your finger and slowly allow it to move toward the solenoid. The interposer must release just before your finger is removed from the armature.

5-33. FILTER SHUTTER DURATION

The duration of filter shutter can be observed by placing channel # one scope probe on a test point A on the interface board. Set the VOLTS/DIV switch on 2 (.2 if times 10 probe) and the TIME/DIV Switch set to 5 milliseconds/Div. Set the trigger level (NORM TRIGGER) to fire the scope trace at +2.5 Volts on a negative going slope. The signal level will set at +5 Volts and go to 0 Volts when the switch closes. It will remain at 0 Volts until the switch re-opens at which time it will return to +5 Volts.



The length of time that the switch remains closed or the signal level stays at 0 Volts must be adjusted to 26 MS ±2 MS. (Figure 5-172) Adjust the duration by moving the magnet and/or magnet holder about its mounting to vary the magnetic flux density about the contacts of the reed switch.

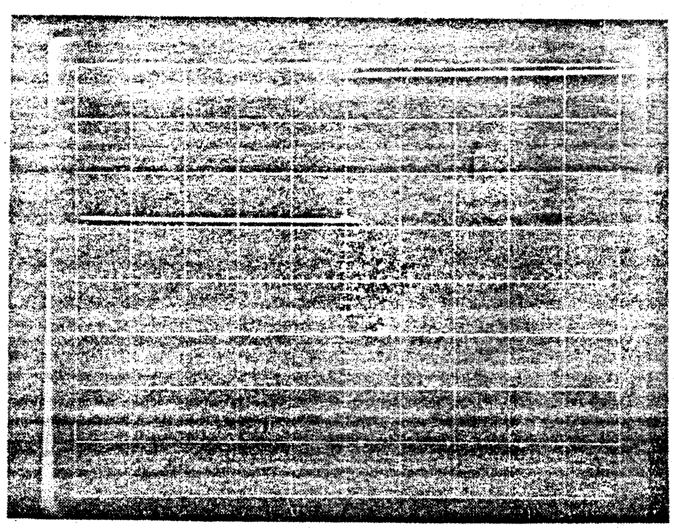


Figure 5-172.

NOTE:

If the signal level is setting at 0 Volts (but will go to +5 Volts) when the machine is at rest, the position of the bow tie shaped vane must be changed before you can adjust the duration of filter shutter. A preliminary setting is to loosen the two bristo set screws that mount the filter shaft HUB to the filter shaft gear and rotate the vane so that the trailing edge plane is parallel to the bottom surface of the printer. (Figure 5-173) Retighten the screws and proceed with the above mentioned adjustment.

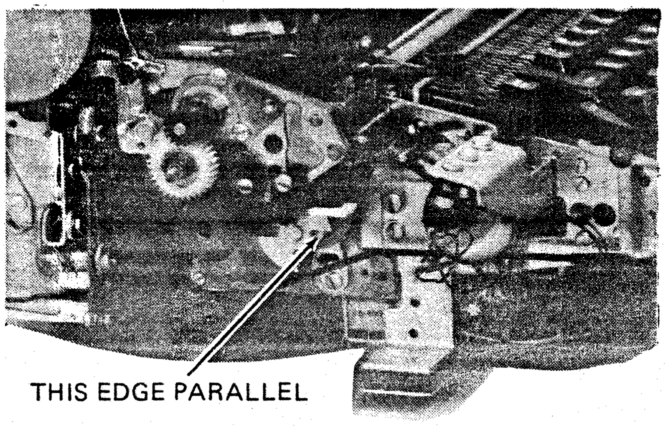


Figure 5-173.

5-34. FILTER SHAFT TIMING

The leading edge (LE) of the filter shutter signal occurs when the +5 volts at test point A drops to 0 Volts. The trailing edge (TE) when it returns to +5 Volts. The trailing edge will be used to tell the logic that the mechanical printing of a character is completed. The trailing edge of filter shutter must be adjusted to indicate that the cycle ends at 58 MS ±1 MS.

To initiate the cycle we use repeat and trip the cycle clutch by turning on the cycle clutch mag driver.

Theoretically as soon as the input to the cycle clutch mag driver goes low you have begun the cycle.

So the input to the cycle clutch mag driver going low represents the beginning of the cycle and filter shutter (TE) going high 58 MS ±1 MS represent the end of the print cycle.

To check or make this adjustment we place channel # one scope probe on test point B of the interface board and channel # two on test point A. Trigger the scope internally on channel # one only. Turn both (channel # one and channel # two) VOLTS/DIV switches to 2. Turn the TIME/DIV Switch on 10 M seconds/Div.

Set the trigger level (NORM TRIGGER) to fire the channel # one trace when channel one signal (cycle clutch driver) has reached +2.5 Volts on a negative going slope. Observe a 12 to 13 ms. low pulse on channel # one. Select the chop mode and observe channel # two (filter shutter) display going low for 26M ±2 MS with the trailing edge ending 58 ms ±1 ms after the leading edge of channel # one (cycle clutch mag driver pulse) goes low. (Figure 5-174) This timing is extremely critical and must be held within tolerance. If filter shutter TE dances more than two ms, check trouble shooting section. Insure that the longest cycle NEVER exceeds 59 ms. To change this adjustment loosen the two bristo set screws on the filter shutter hub and advance (top to front) or retard (top to rear) the filter shutter closure.

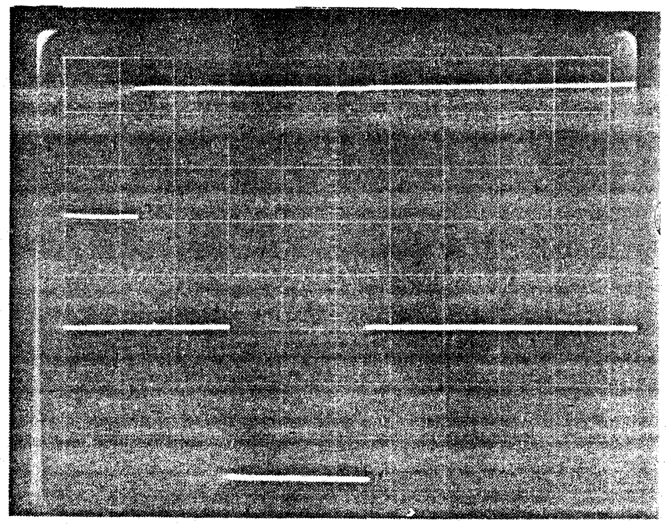


Figure 5-174.

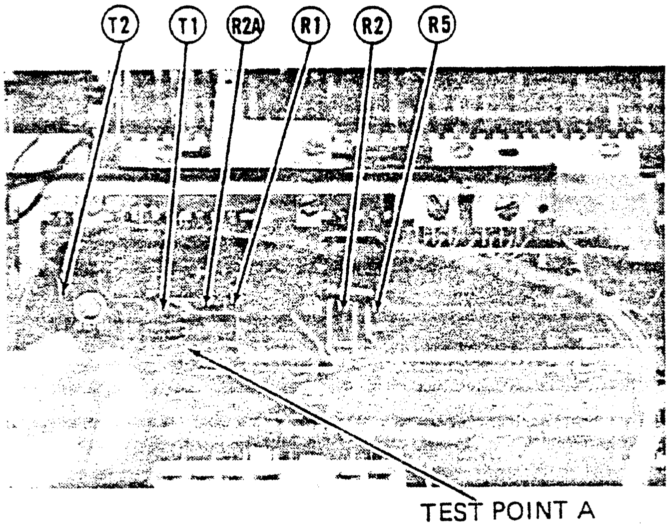
5-35. BAIL SWITCH TIMING

Now that the duration of filter shutter and its timing have been established, we can begin to adjust other signals to it.

The leading edge of filter shutter tells the logic when to check the bail reed switches for print character data. The bail switch pulses are 17 ms ±3 ms long. The duration of the bail switch pulse is not critical only the LE of the pulse with regard to the LE of filter shutter. Because of bail switch bounce (250 microseconds max allowable) we must be sure that the bail switch is clean when the LE of filter shutter occurs.

By moving the BAIL SWITCH magnet back and forth in the magnet holder we can advance (pull to ront) or retard (push to rear) the closure of the bail reed switch with regard to LE filter shutter.

Attach channel # one probe to Bail switch T2 as shown (or at land #29 on interface board) and channel # two to test point A.



The scope should be set up as described in paragraph 5-34 except that the TIME/DIV Switch should be set to 5 ms. Type a character "one" on the keyboard and observe that the bail switch closes (goes low) one to six MS before the LE of filter shutter. (Figure 5-175) Reposition the Bail switch magnet to obtain this timing and insure that all six bail switches are within 2 ms of each other.

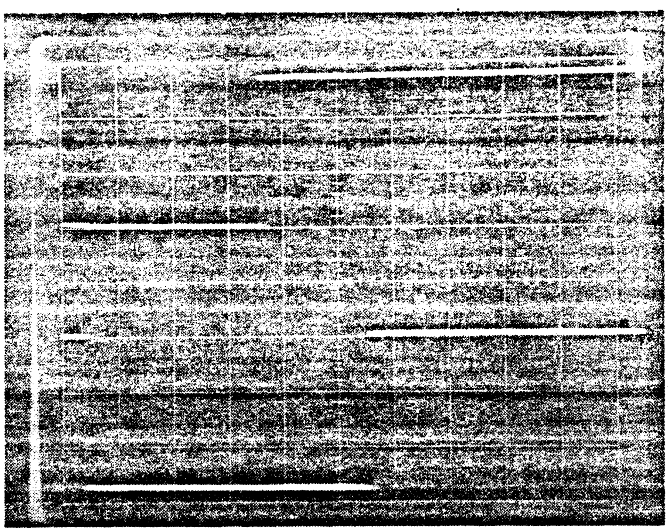


Figure 5-175.

5-36. TAB, SPACE, AND BACKSPACE

Attach channel # one probe to the input of the mag driver of the operation you are checking. Attach channel # two probe to the cherry switch of the same operation. Set the scope up exactly as

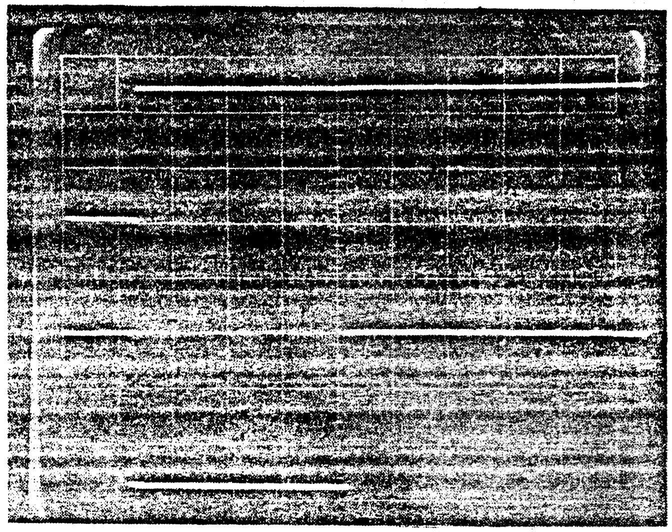
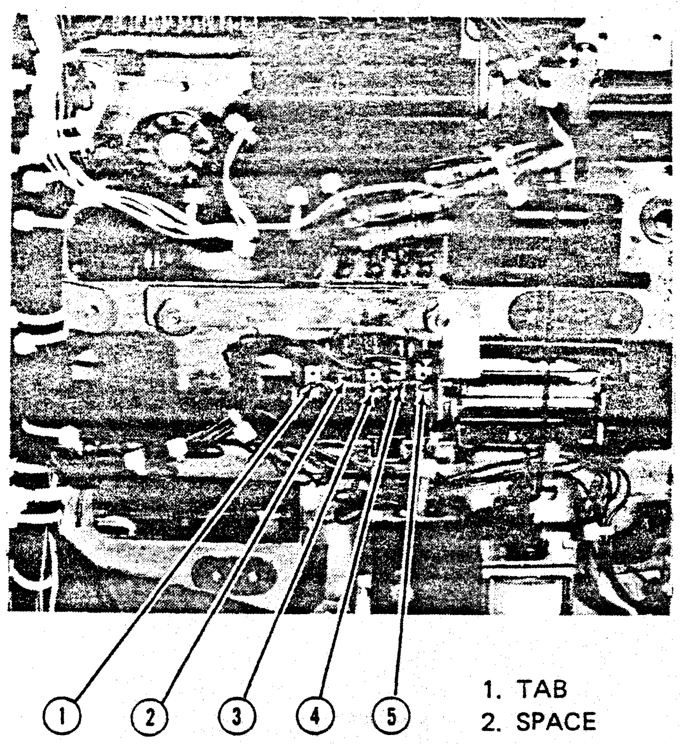


Figure 5-176.

in paragraph 5-34. Push the keybutton of the operation in test and then depress the repeat keybutton. Channel # one (input to mag driver) LE begins the cycle and the TE of channel # two (output from cherry switch) ends it. For these three switches the maximum allowable cycle length is 59 ms. The cycle may end sooner than that, as the one in the picture did. (Figure 5-176) You may reposition the cherry switch mounting bracket (see photo below) to change all the switch timing at one time or, you may form the cherry switch operating lever of any individual switch to alter that operations timing.



1. TAB
2. SPACE
3. BACKSPACE
4. C.R.
5. INDEX

Forming the lever toward the rear of the machine will shorten the duration of the switch and end the cycle sooner.

Forming it toward the front of the machine will lengthen the duration and make the cycle longer.

5-37. CARRIER RETURN AND INDEX

All of the procedures described in paragraph 5-36 should be followed for carrier return and index. The difference between these switches and the tab, space and backspace is the duration of the pulse and the length of the cycle. Maximum allowable cycle length is 80 ms. (Figure 5-177) Again the cycle may be shorter but not longer. The adjustments are made as in paragraph 5-36.

a. Some machines have a side mounted carrier return switch. (Figure 5-178) The switch is operated by the motion of the carrier return latch arm.

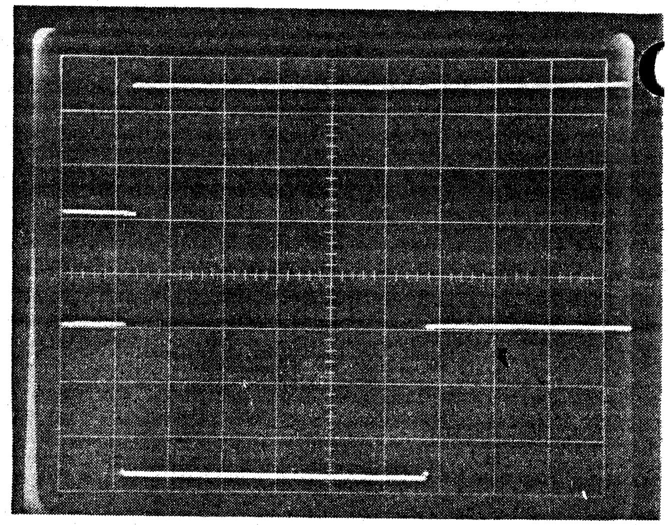


Figure 5-177.

When the carrier return operates the normally open contact makes and takes the switch input to logic to ground. This causes the machine to transmit a carrier return. If the carrier is at the right hand side of the

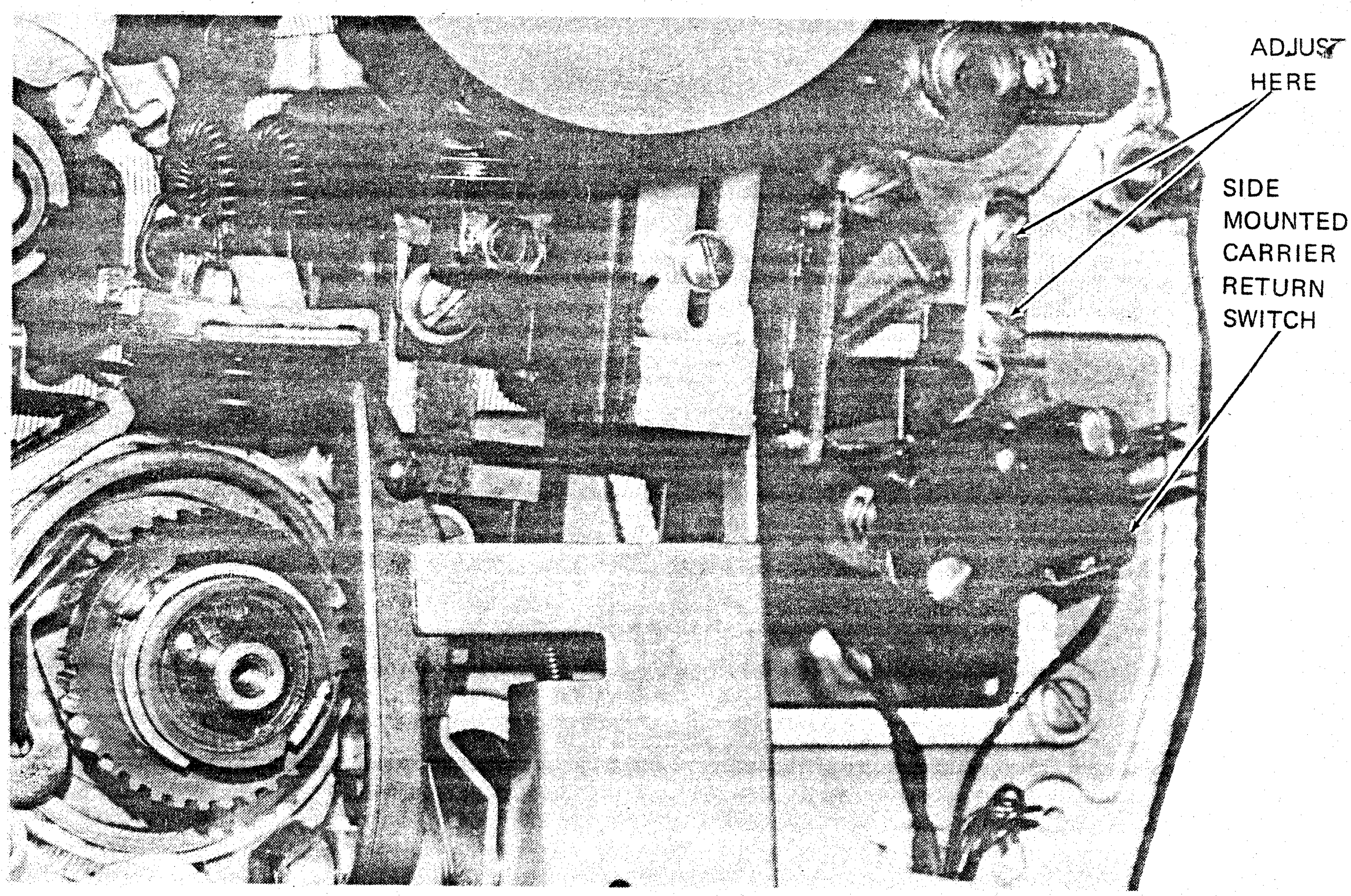


Figure 5-178.

machine, the latch arm will be held down until the carrier reaches the left hand margin. When the latch arm is unlatched the normally open contact of the switch breaks goes back high and we transmit on EOT. The advantage of this switch is to insure that an EOT is not transmitted until the carrier has completed its movement and is in a position to print.

The timing is no more than to position the switch so that it will transfer when the carrier return latches and insure that it is not made when the carrier return is unlatched.

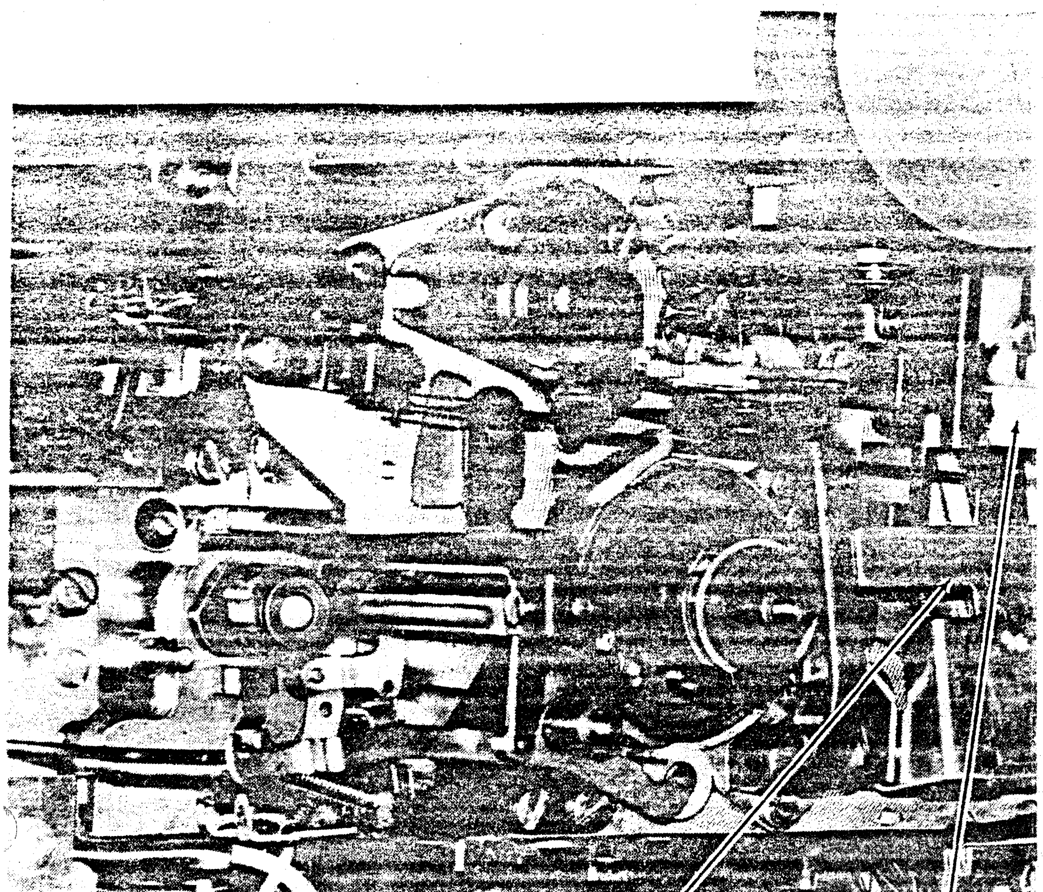
5-38. SHIFT SWITCH

The shift switch should be adjusted so that when the shift keylever is locked down the operating arm of the switch has transferred and caused the normally closed contact to break. The switch bracket should be low enough to permit easy unlocking of the shift lock by further depression of the shift keylever. With the shift keylevers at rest the normally closed contact must be made.

SHIFT SWITCH

5-39. SHIFT INTERLOC

Preliminary adjustments a switch and magnet mountin shift vane will move freely t the magnetic field so that th mally sits closed at rest, will as the shift vane is pulled aw machine.



SHIFT CAM FOLLOWER OR VANE

SHIFT MAGNET

Final adjustment is to connect the channel # one scope probe to the normally closed contact of the shift switch, it should be setting low at rest. Connect the channel # two scope probe to land # 35 on the interface board (shift interlock switch) it will also be setting low.

a. Upshift

Trigger the scope to fire when channel # one reaches the 2.5 Volt level of a positive going slope.

Depress the shift keybutton and with the scope in the chop mode observe channel # two, and adjust the magnetic field so that the shift interlock pulse is a minimum of 10 ms long. Adjust the cam follower section of the actuating arm by forming to insure that the TE of the shift interlock switch pulse occurs before 72 ms of the cycle. (Figure 5-179)

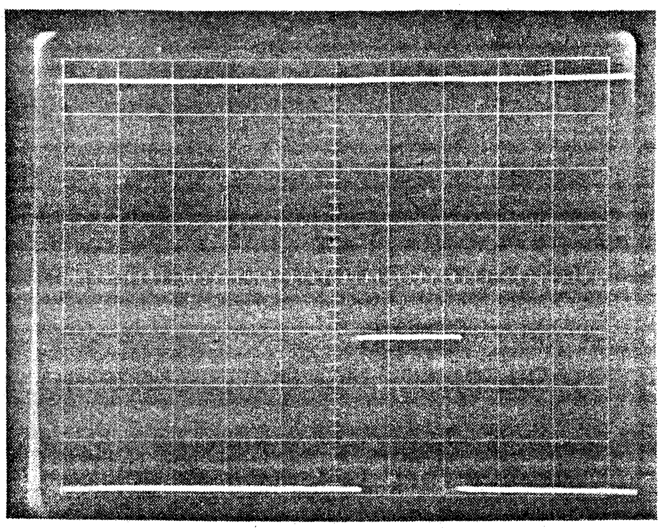


Figure 5-179.

b. Downshift

Change the slope on the scope from positive to negative. Release the shift keybutton and again observe channel # two. The duration of the pulse should be the same length as it was in step a. The cycle has to end before 72 ms. If it takes more or less time than the upshift cycle form the cam follower arm until both the upshift and downshift cycles take the same time. (Figure 5-180)

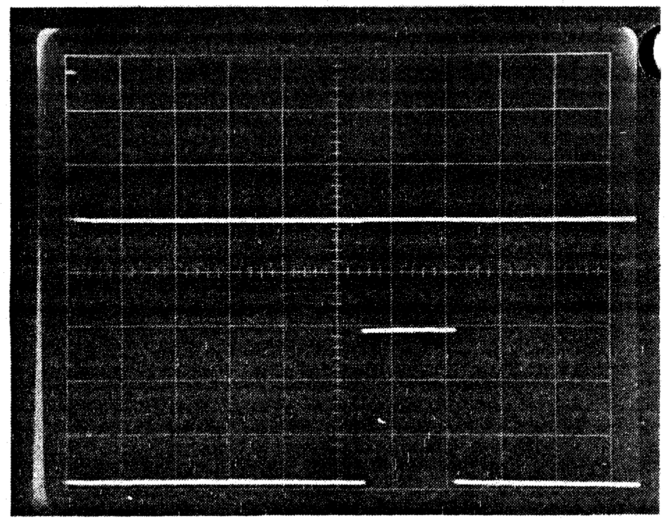


Figure 5-180.

NOTE:

Neither cycle can take more than 72 ms. You must change the slope of the scope to get accurate triggering. Positive slope for upshift and negative slope for downshift.

5-40. TYPAMATIC ASSEMBLY ADJUSTMENTS

Adjustment of the 1030 Typamatic assembly (Space/BS/Underscore) should be as follows:

a. The Repeat Bail should be adjusted so that it is parallel with the front Keylever Guide Comb. This adjustment is achieved by positioning the Bail Bracket on the left of the Repeat Bail; a single #6 machine screw secures the bracket. When the adjustment is properly made the clearance between the BS Keylever and the Repeat Bail will be .18" ±.02"; the Space and BS Keylevers will strike near the center of their respective positions on the Repeat Bail; and the CR Keylever, when fully depressed, *will not* make contact with the bail.

b. Clearance between the Space Keylever and the Repeat Bail should be .20" ±.02". If an adjustment is necessary it is made by forming the tab on the bail.

c. Clearance between the Repeat Bail and the Bail operated Repeat Switch Actuating Lever should be approximately .12". This clearance is achieved by positioning the Switch Bracket forward or backward. The

Bracket is secured by a single #6 machine screw.

d. Adjust the position of the Repeat Switch, using the two #4 machine screws, to provide a switch closure with .025" to .030" overtravel before the Space and BS Keylevers mechanically bottom.

e. The clearance between the Underscore Keylever and the Underscore Repeat Switch should be approximately .25". This is a preliminary adjustment made using the two #4 machine screws which secure the Switch to the Bracket. This adjustment is then refined to provide a Switch closure with .025" to .030" overtravel before the Underscore Keylever mechanically bottoms.

f. When the Spacebar, BS Key, or Underscore key is fully depressed, the $\overline{\text{Auto SW}}$ signal level should be ≤ 0.1 Volt.

g. When the Repeat Underscore Keylever is fully depressed the Cycle Clutch Bail should not trip off multiple cycles.

5-41. WHAT—NO SCOPE?!!

A "Make Work" procedure that can be followed if you have no scope is:

a. Filter Shutter

Find a long wire (paper clip, solder, etc) and fasten it to the printer using the Right Hand Print shaft bearing retainer plate screws. Form the wire so as to use it as a pointer or degree indicator on the hand cycle tool. With power off set the wheel at 0° and then trip of the cycle clutch. Slowly hand cycle the machine while watching a VOM (Resistance scale X 1) connected across the filter shutter switch. The meter should jump to 0 when you have cycled to 90° ±2°. The meter will indicate an open where you hand cycle to 160° ±2°.

NOTE:

This switch may be checked with voltage on it if you remove the motor drive belt from the motor pulley.

b. Bail Switch

With power off take a spring hook and move each selection interposer forward (toward the space bar). After you have moved it about 1/16 of an inch you should be able to hear the reed switch "snap" closed. As you let the interposer come back to rest against the up stop, you will hear the reed switch "snap" open again. Adjust the magnets so that the reed switches close after the individual interposer has moved the same amount.

c. To test your adjustments depress the one key with power on. Depress the repeat key and a one should print on paper. Depress the dash (corr) or the period (BCD) and then repeat and the same character should print on paper. If the correct character does not print examine the latch code of the character you tried to print and that of what did print and find out whether you are adding or dropping bail switches, and which ones. If you are dropping switches you will have to move the magnet forward (closer to the space bar). If you are adding them move magnets toward the rear.

d. The operational switches can be checked by turning power off and manually releasing an operational interposer. When it has snapped to the rear it will no longer hold the operating strap of the switch forward and the switch will be made.

At this time you can meter (Resistance scale X 1) the switch and see if it has actually transferred. Hold your meter lead in place and move the switch operating strap with your finger, you should be able to see the meter needle jump as the switch changes. Restore the interposer in question and insure that the switch bracket is in position to hold the switch open with the machine at rest.

e. To check operation of a solenoid or whether its mag driver is firing or not, use the meter on the 5 Volt scale to check the input to the mag driver. Check the output of the mag driver on the 25 or 50 Volt scale (depending on your meter) as it is a 24 Volt signal.

NOTE:

The signal "Switches" at N-5-14 must be low before typamatic/Repeat will operate. If you have a high at that point (machine at rest) your interface is telling the logics that the printer is busy, and the logics cannot start another cycle until "switches" goes back low.

5-42. LOGIC ADJUSTMENTS.

There are three adjustments on the logic board. Once *properly* adjusted and painted in place the pots that control these adjustments should not change.

a. Output Clock Pot R55 should be adjusted so that a 12.5MS ±.5MS pulse occurs at V2-4 when output clock fires.

b. Cycle Trip Pot R53 should be adjusted so that a 12.5MS ±.5MS pulse occurs at B2-1 when a character is repeated.

c. Initiate Pot R54 should be adjusted so that the output at C2-6 lags the input (clear to send) at B2-8 by 700MS. You can generate CTS by whistling up a modem or by releasing the reset switch on the link ready button.

5-43. MODEM ADJUSTMENTS.

a. The output of the Phase Comparator must be set so that when receiving data a scope connected to test point 5 will show an equal swing above and below ground reference, (positive peeks equal in amplitude to negative peeks). Adjust Pot R43.

b. Data Access arrangement transmit level. On each DAA the phone company is responsible for indicating a DBM level. Somewhere on the box you will find a number similar to -(N) DBM. Locate that number on the DBM to VOLTS chart (Figure 5-181) and find its correponding P to P (scope) or RMS (meter) voltage level.

CAUTION: If you use a scope you must "float" the AC ground. This can be done by using a three wire to two wire AC outlet adapter with the ground wire left disconnected. Damage will result if you don't "float" the scope.

Connect the scope probe to one side of the telephone line and the scope ground to the other.

With the terminal or line and in proceed mode adjust Pot R2 for the proper voltage level.

5-44. POWER SUPPLY ADJUSTMENTS.

a. All connectors on the terminal boards must be screwed down securely.

b. The +5 volt power supply *will* be adjusted to +4.75 VOLTS with a full load connected. (Pot R7)

5-45. TROUBLESHOOTING INFORMATION.

This section is designed to help you troubleshoot the COPE 1030. If you follow the flow of troubles indicated by the charts, you will be led directly and quickly to many (but not all) of your problems. You must first generally determine if you have a mechanical problem, a transmit problem, or a receive problem. Go then to the correct page in your diagnostic chart and follow the questions until you can finally determine your problem. These charts, with the exception of the power supply chart, reference the fact that *all* voltages are correct.

It is important that you attempt to find the logic problem, but if you can save some time by working on the board at the shop, replace it.

The most powerful troubleshooting tool you have for mechanical problems is the CPMC found in paragraph 5-3. Use it.

5-46. SYSTEM FAILURE - CHECK ERROR

Note: The conditions described below may cause a "System Failure". These failures will *usually* be displayed as a check error.

a. A solid check error occurs when a character or a space is received. Failure of either the space or cycle clutch to perform when either is pulsed will cause the interlock circuit to produce the check error.

b. An INTERMITTENT CHECK ERROR is the type which may occur at random, for example, once per line to once per week.

c. Logic failures can be verified by exchanging the logic board.

d. Follow special instructions in the "Operational Receive Failure" (paragraph 5-49) section to aid in troubleshooting the remainder of this path.

e. Cycle the machine by depressing repeat and check filter shutter = 59 ms maximum. Also check shift interlock switch pulse = 72 ms maximum. (See step No. 2 "Check Slow Machine" below).

f. Check Slow Machine

1. Filter Shutter Time is 59 ms. CH 1 PROBE triggered on Cycle Clutch mag driver (Low Going). CH 2 PROBE on filter shutter signal on interface board. CH 2 should go back high 59 ms after CH 1 goes low. If the machine will not do this, check the following:

(a) Binds in the idlers.

(b) Cycle shaft, filter shaft, print shaft, sleeve end play.

(c) OP shaft end play.

(d) Shift ratchet adjustment.

(e) Excessive rotate spring tension (appears only in UC +5 character).

(f) Cam Bearing support (OP Shaft) too high.

(g) Belt tension too tight.

(h) Cycle clutch adjustments.

(i) Weak motor (at lower voltages).

2. Shift interlock switch time-triggering on shift switch and reading the interlock switch pulse (the pulse should not exceed 72 ms). The pulse may not be less than 10 ms in duration. If the machine will not do this, check the following:

(a) Shift ratchet adjustment.

(b) Sh

(c) Ca

(d) Cy

(e) Be

(f) Sh

(g) Sh

(h) Sh

(i) Sh

(j) Ro

(k) Op

(l) Sh
ma

g. Power suppl
placing the p

h. Scope the in
or noise.

i. Discuss prob
mine a cours
equipment o
filter.

j. Computer pr
on-the-line to
similar applic

k. Discuss possi

l. Telephone pr
of the follow

1. Hang up

2. Move te
try agai

m. Discuss prob
ble have cust
pany about t

(See Figure 5-181

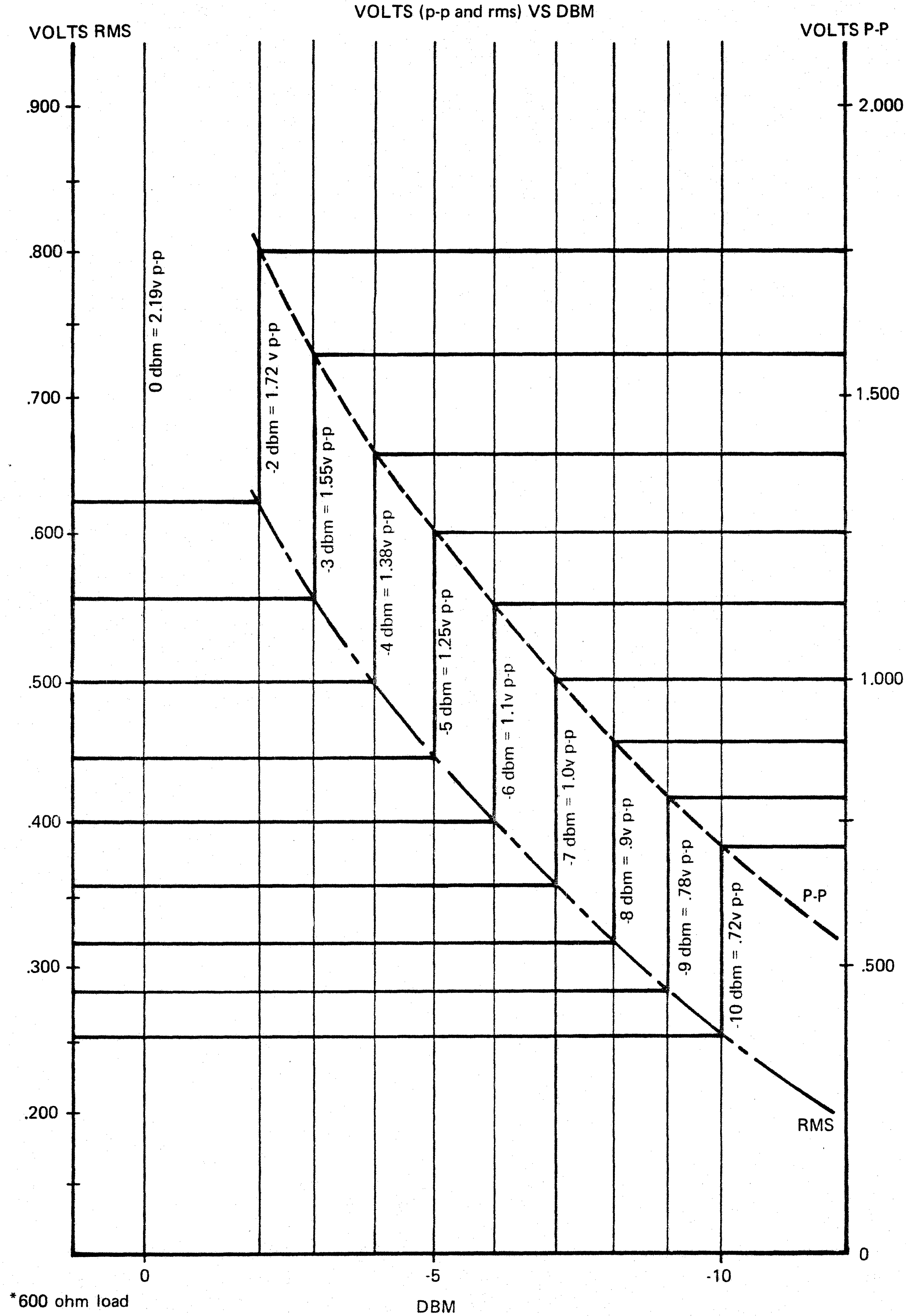

VOLTS (p-p and rms) VS DBM
VOLTS RMS
VOLTS P-P
.900
.800
.700
.600
.500
.400
.300
.200
2.000
1.500
1.000
.500
0
0 dbm = 2.19v p-p
-2 dbm = 1.72 v p-p
-3 dbm = 1.55v p-p
-4 dbm = 1.38v p-p
-5 dbm = 1.25v p-p
-6 dbm = 1.1v p-p
-7 dbm = 1.0v p-p
-8 dbm = .9v p-p
-9 dbm = .78v p-p
-10 dbm = .72v p-p
P-P
RMS
0
-5
-10
*600 ohm load
DBM

Figure 5-181.

17. POWER SUPPLY FAILURE

Check these voltages:

4.75	At bus on logic board and at point 16 on the printer interface board.
+12	At +12 input on logic board.
-12	At -12 input on logic board.
+24V	To 24-volt rosette on bottom of printer.

FUSES BLOWING

a. 4.75V fuse

1. Short on logic board.

2. Short on printer interface board.

(a) Unhook logic board from power supply and isolate problem.

(b) Using ohmmeter, check for 24 to 4.75 voltage short (only on printer interface board).

(c) Using ohmmeter, check diodes and transistors.

b. 24V fuse (Note: 24V is used in printer and associates harness only.)

1. Shorts in diodes, transistors or coils.

2. Bad component in power supply.

See Figure 5-182 and 5-183.

5-48. OPERATIONAL TRANSMIT FAILURE

a. Operational switch bracket adjustment per paragraph number 5-36 or 5-37.

On machines with a multiple operation transmit problem, check very closely for switch bounce.

c. Using Logic Schematics, Sheet 5, check to see that the proper operational code is loaded in the print register.

OPERATIONAL CODES ARE:

Backspace	R2, R5 & T1
Space	R1, R2 R2A, T1 & T2
Tab	R1 & R2
Carrier Return	R1, R2 & T1
Index	R1, R2 & T2

d. Check Encoder and Serial Data Transmit Logic Schematic.

e. Replace logic board and repair it in shop. See Figure 5-184.

5-49. OPERATIONAL RECEIVE FAILURE

a. Using Logic Schematics, Sheet 5, check to see that the proper operational code is loaded in the print register.

OPERATIONAL CODES ARE:

Backspace	R2, R5 & T1
Space	R1, R2, R2A, T1 & T2
Tab	R1 & R2
Carrier Return	R1, R2 & T1
Index	R1, R2 & T2

b. Check Serial Data Receive Control logic and BCD Decoding logic.

c. Replace logic board and repair it in shop.

d. Check operational solenoid adjustment per paragraph number 5-32. See Figure 5-185.

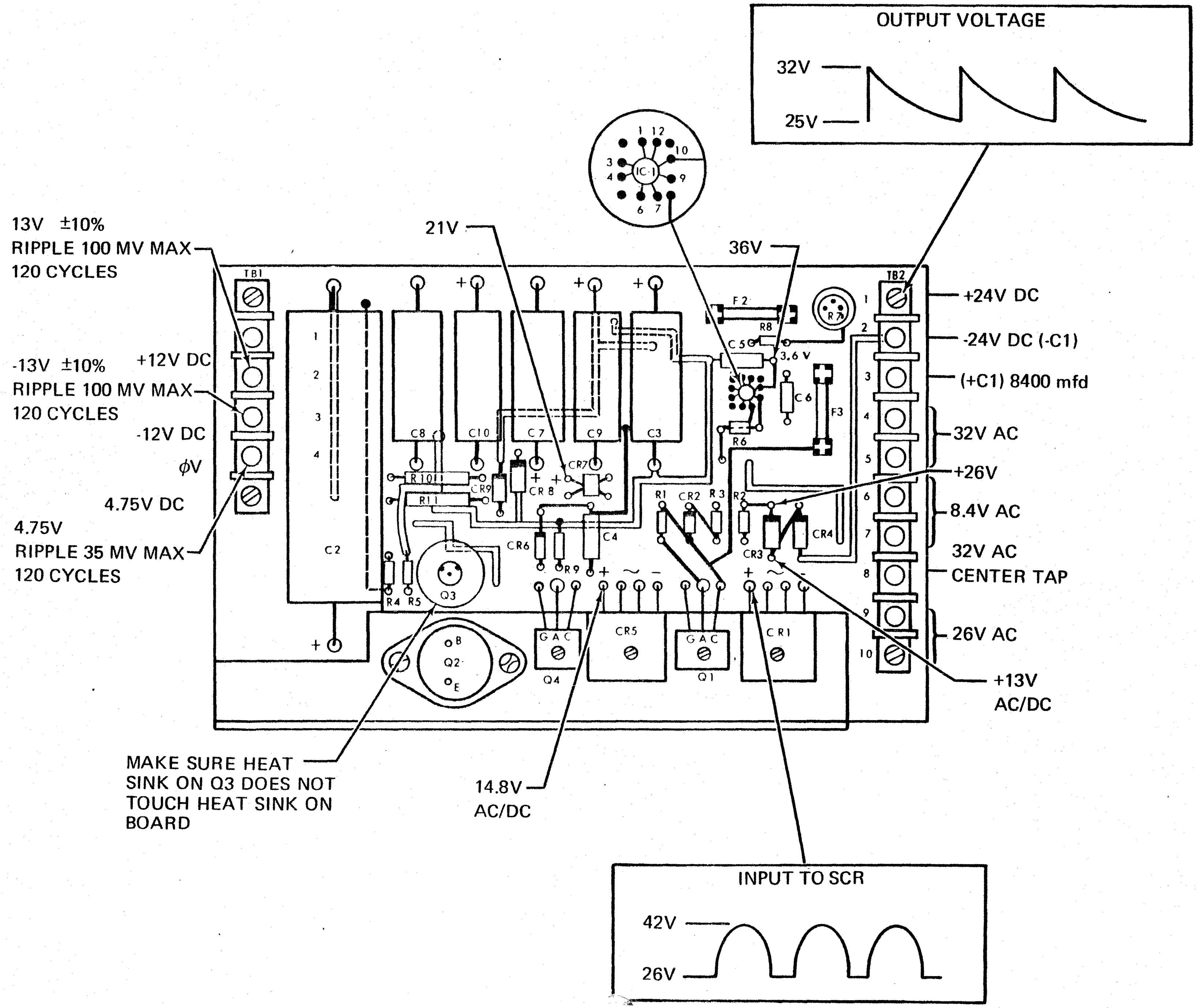

OUTPUT VOLTAGE
32V
25V
13V ±10%
RIPPLE 100 MV MAX
120 CYCLES
+12V DC
-13V ±10%
RIPPLE 100 MV MAX
120 CYCLES
-12V DC
ϕV
4.75V DC
4.75V
RIPPLE 35 MV MAX
120 CYCLES
21V
36V
IC-1
TB1
TB2
C2
C8
C10
C7
C9
C3
C4
C5
C6
CR6
CR7
CR8
CR9
R10
R11
R9
R4
R5
Q3
Q2
B
E
F2
F3
R8
R7
R6
3.6 V
R1
CR2
R3
R2
CR3
CR4
G A C
Q4
CR5
Q1
CR1
+24V DC
-24V DC (-C1)
(+C1) 8400 mfd
32V AC
+26V
8.4V AC
32V AC
CENTER TAP
26V AC
+13V
AC/DC
MAKE SURE HEAT SINK ON Q3 DOES NOT TOUCH HEAT SINK ON BOARD
14.8V
AC/DC
INPUT TO SCR
42V
26V

Figure 5-182.

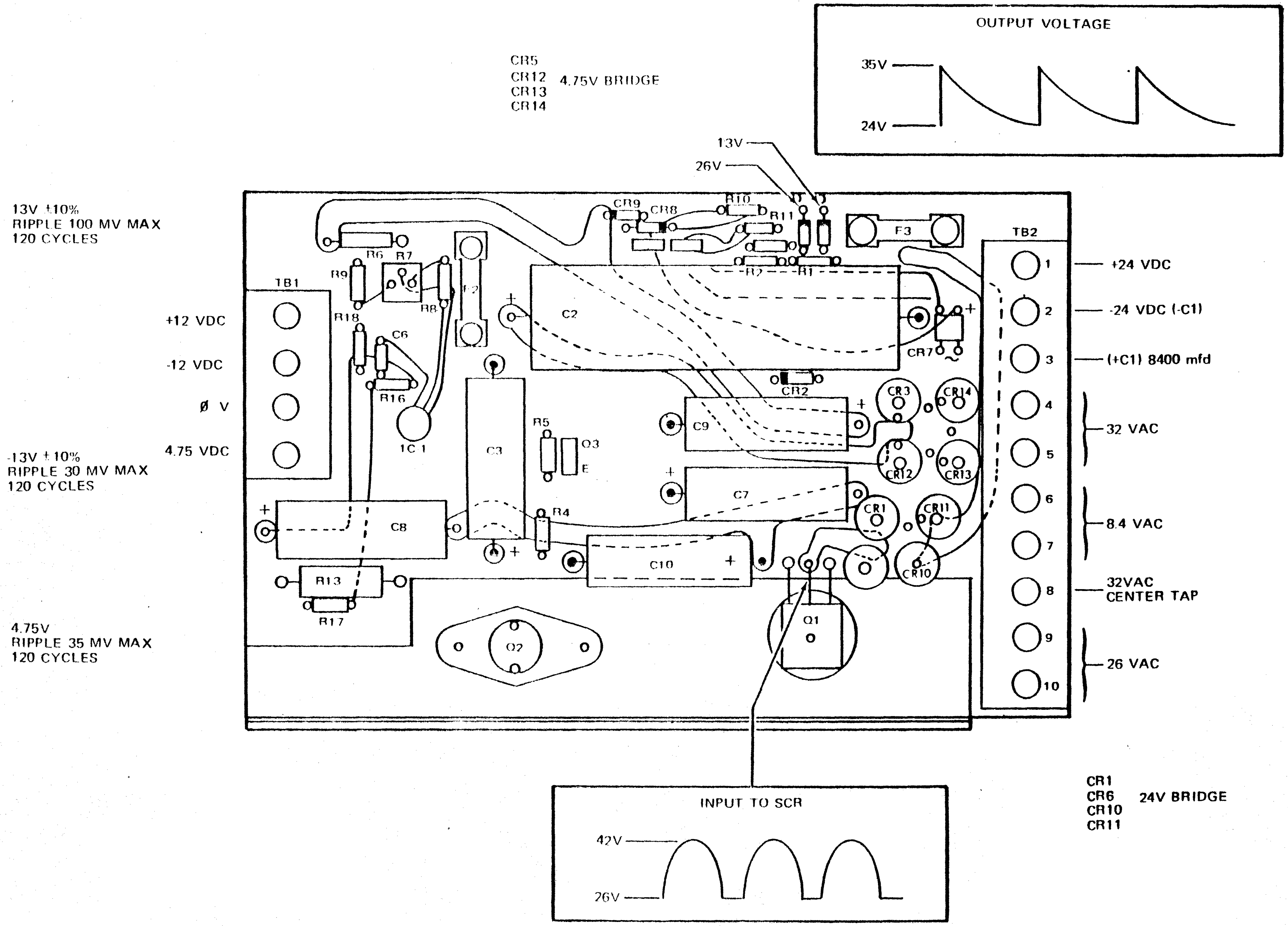
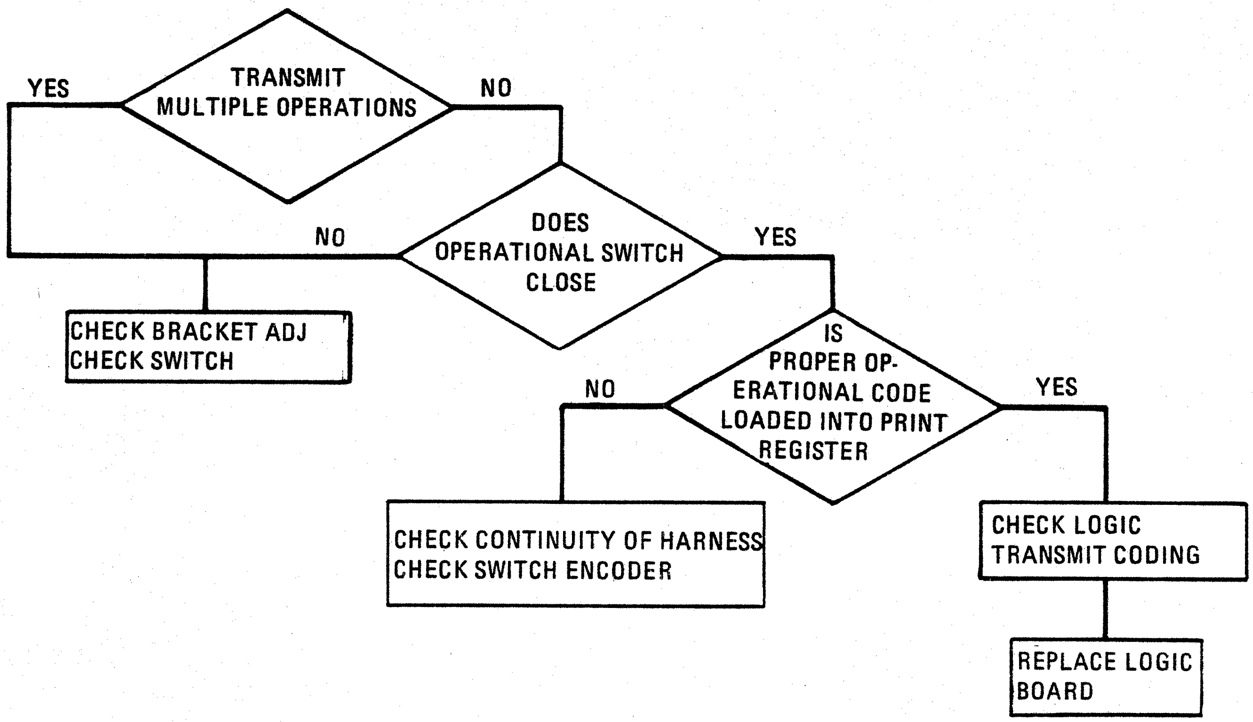
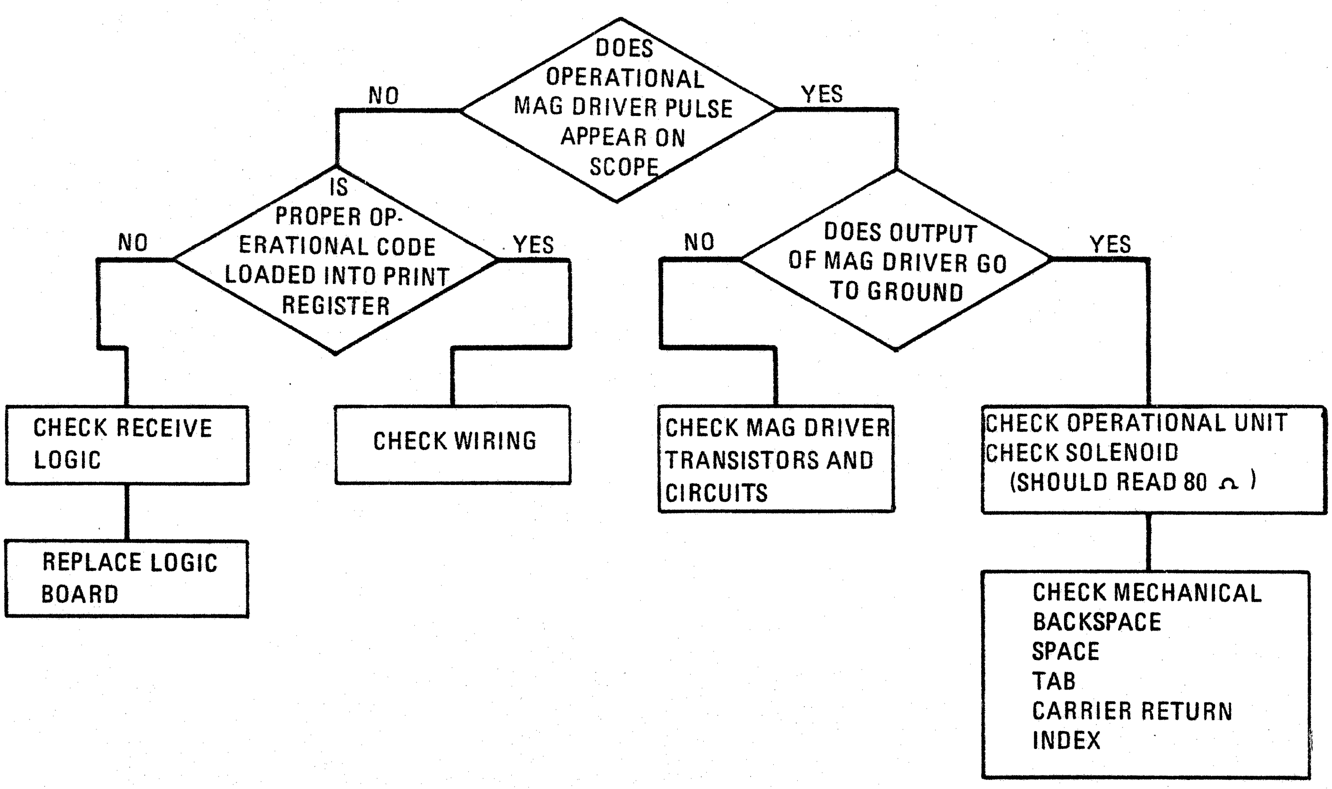

OUTPUT VOLTAGE
35V
24V
CR5
CR12
CR13
CR14
4.75V BRIDGE
13V
26V
13V ±10%
RIPPLE 100 MV MAX
120 CYCLES
-13V ±10%
RIPPLE 30 MV MAX
120 CYCLES
4.75V
RIPPLE 35 MV MAX
120 CYCLES
TB1
+12 VDC
-12 VDC
Ø V
4.75 VDC
TB2
+24 VDC
-24 VDC (-C1)
(+C1) 8400 mfd
32 VAC
8.4 VAC
32VAC
CENTER TAP
26 VAC
CR1
CR6
CR10
CR11
24V BRIDGE
INPUT TO SCR
42V
26V

Figure 5-183.



OPERATIONAL TRANSIT FAILURE

Figure 5-184.

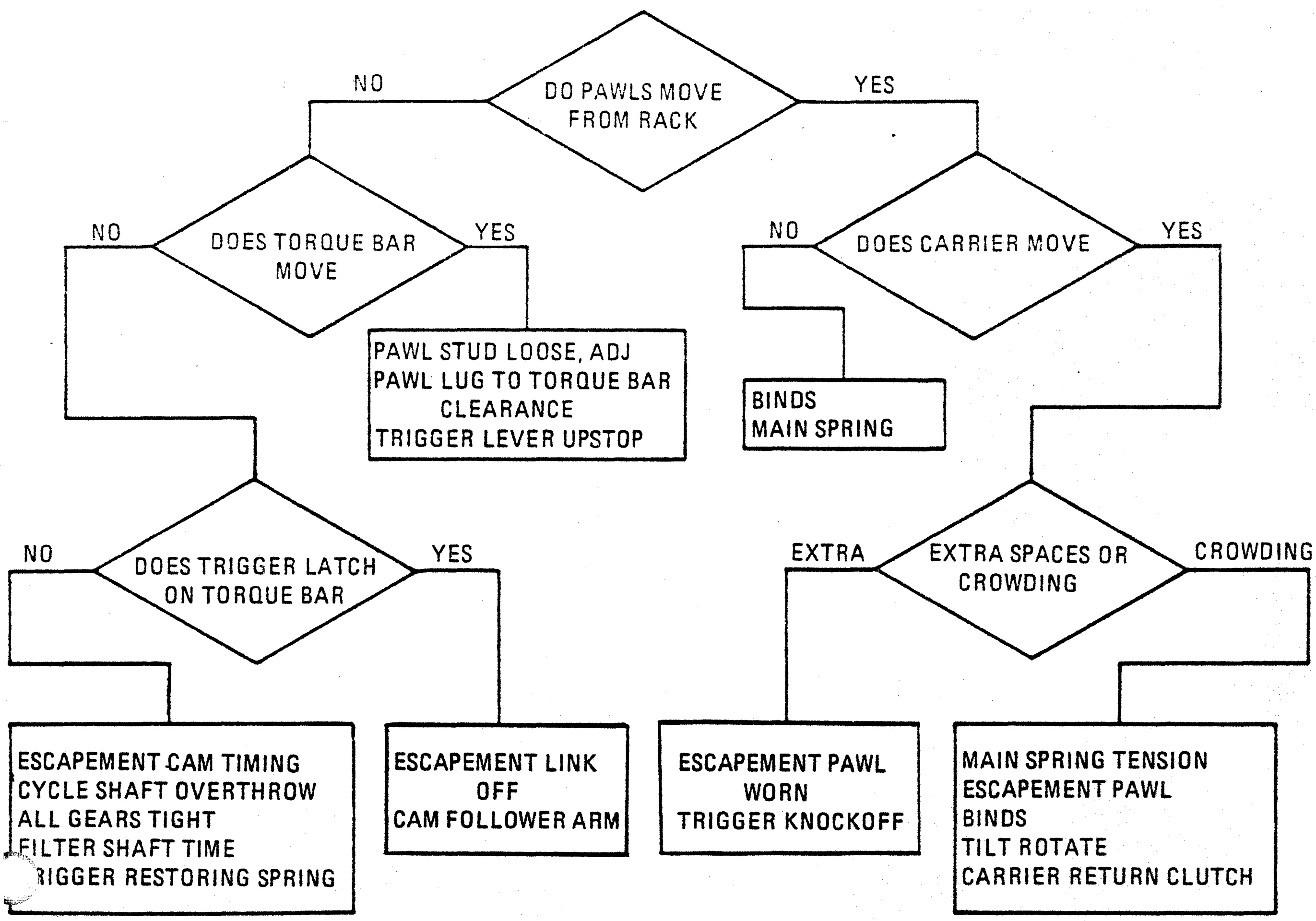


OPERATIONAL RECEIVE FAILURE

Figure 5-185.

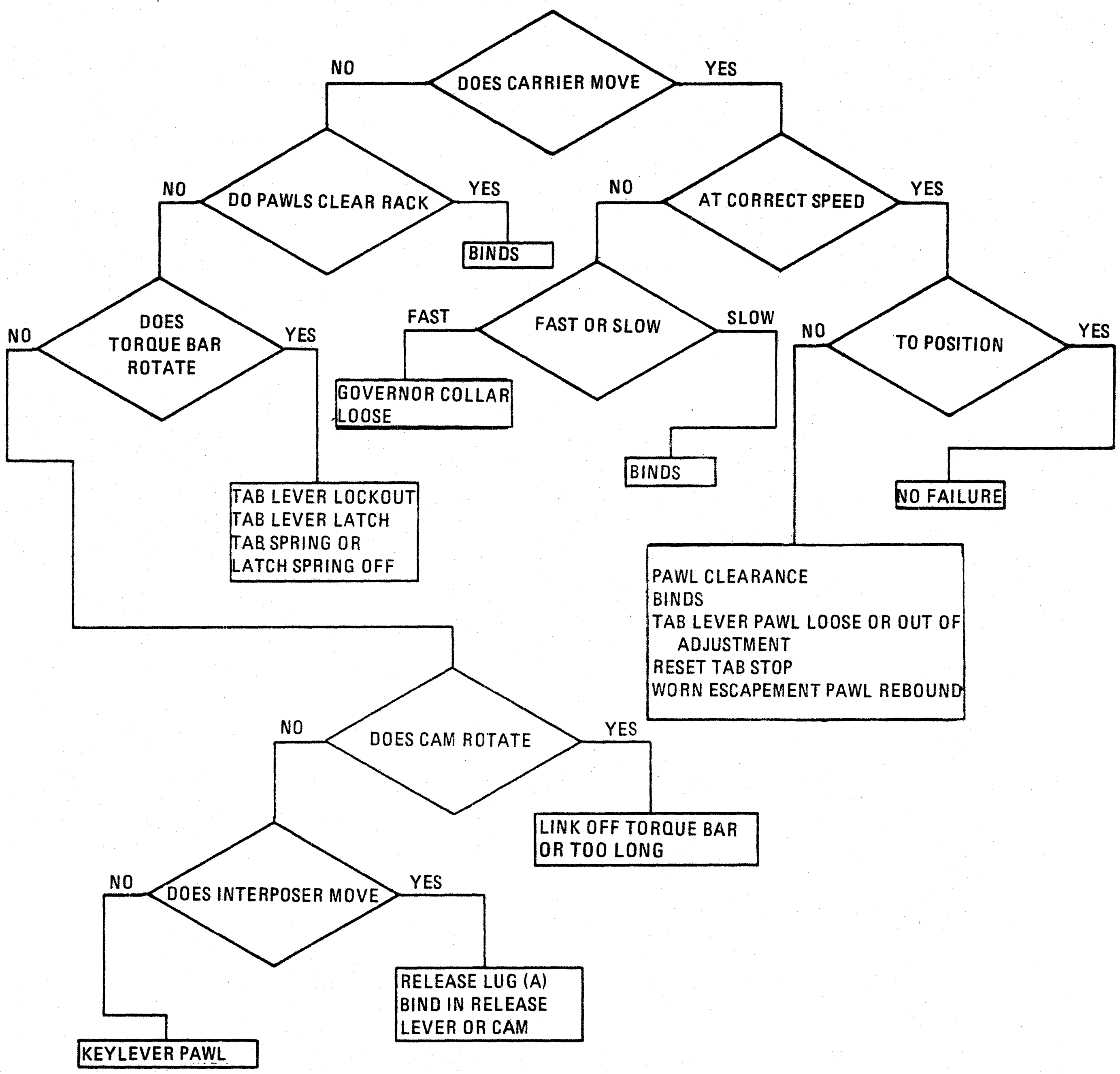
50. CHARTS

The remainder of the removal section consists of diagrams to quickly enable you to evaluate the extent of the failure. For more detailed information, once you have located your failure, refer to the adjustment or theory section of this manual.

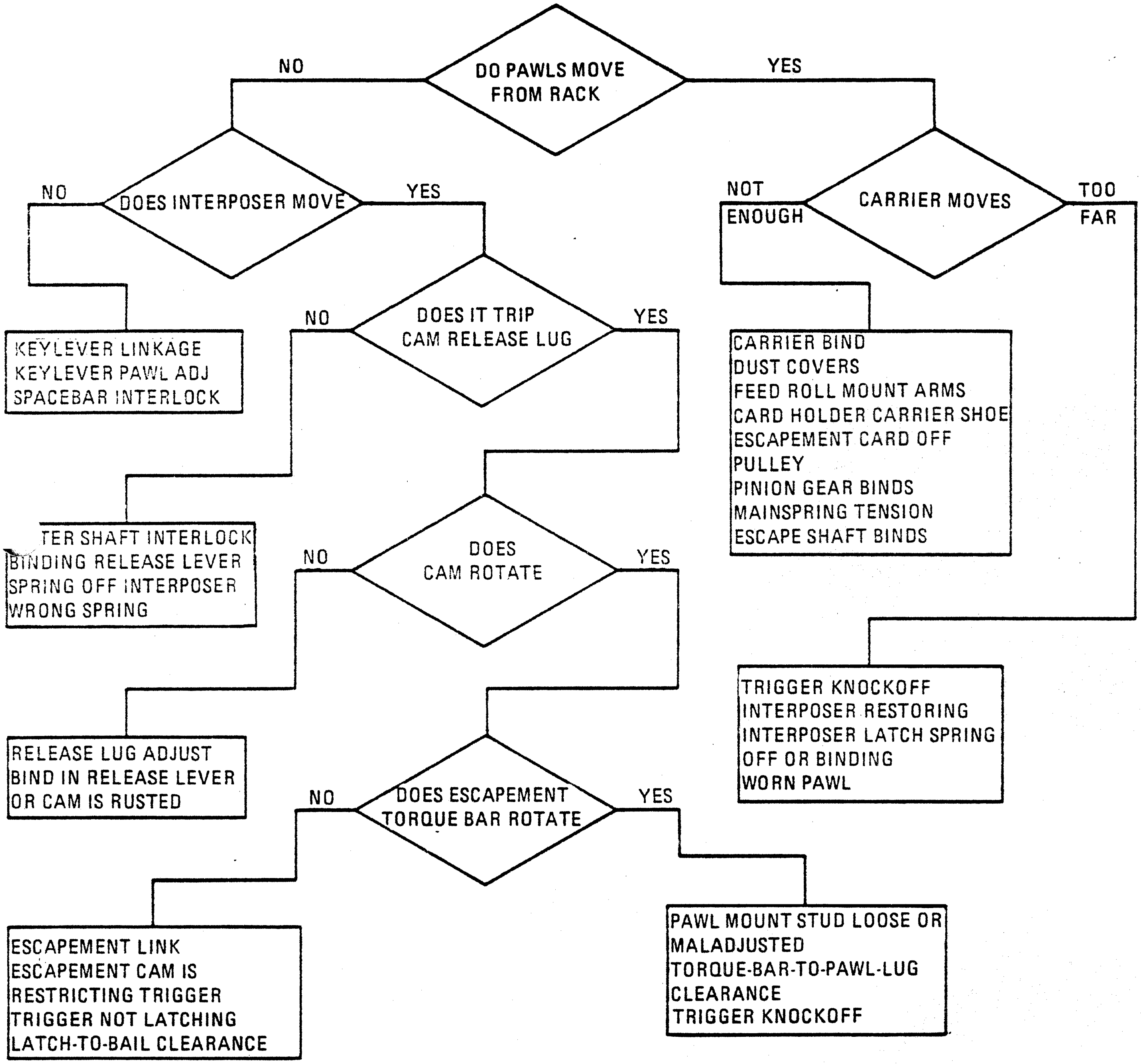


PRINT ESCAPEMENT FAILURE

Figure 5-186.

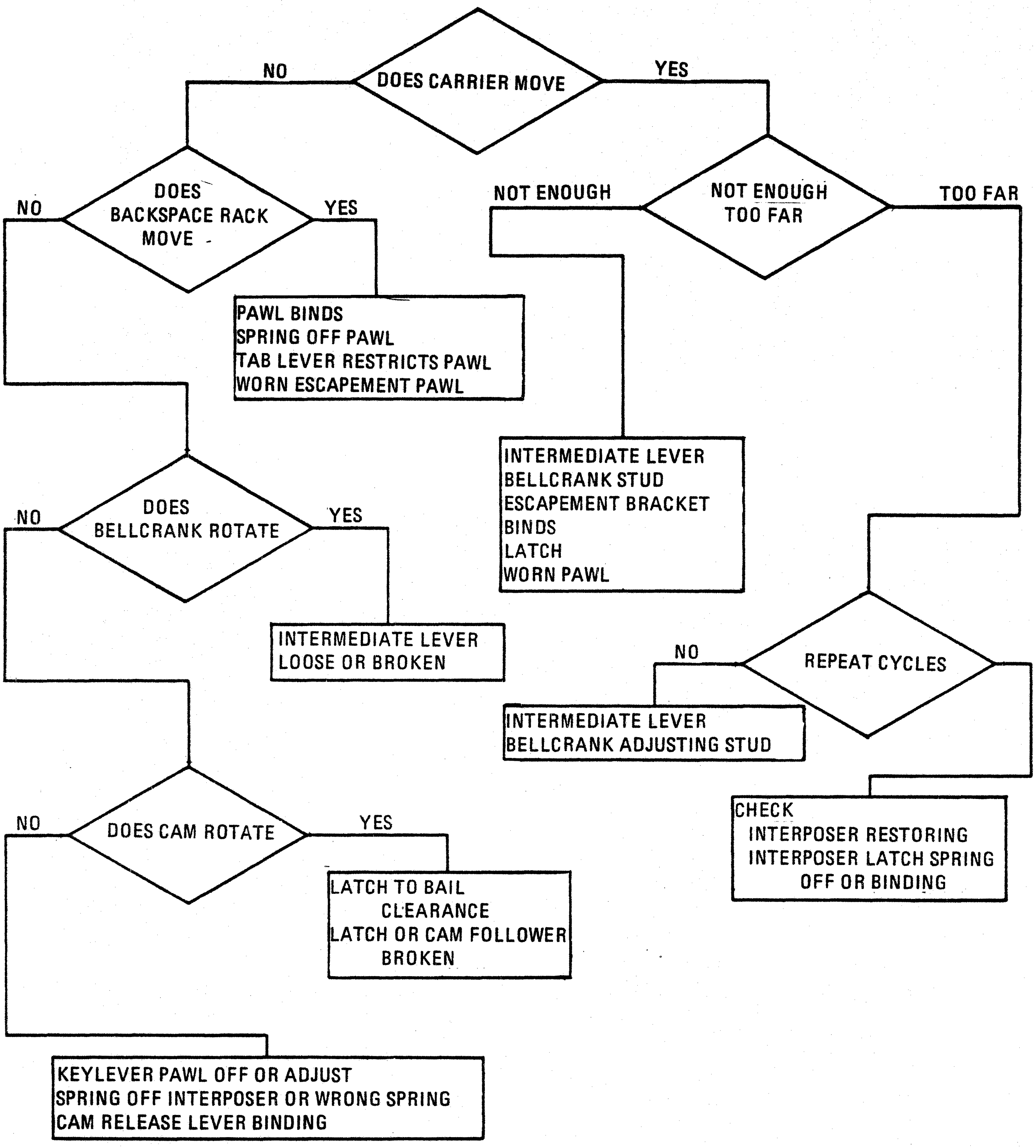


MECHANICAL TAB FAILURE
Figure 5-187.



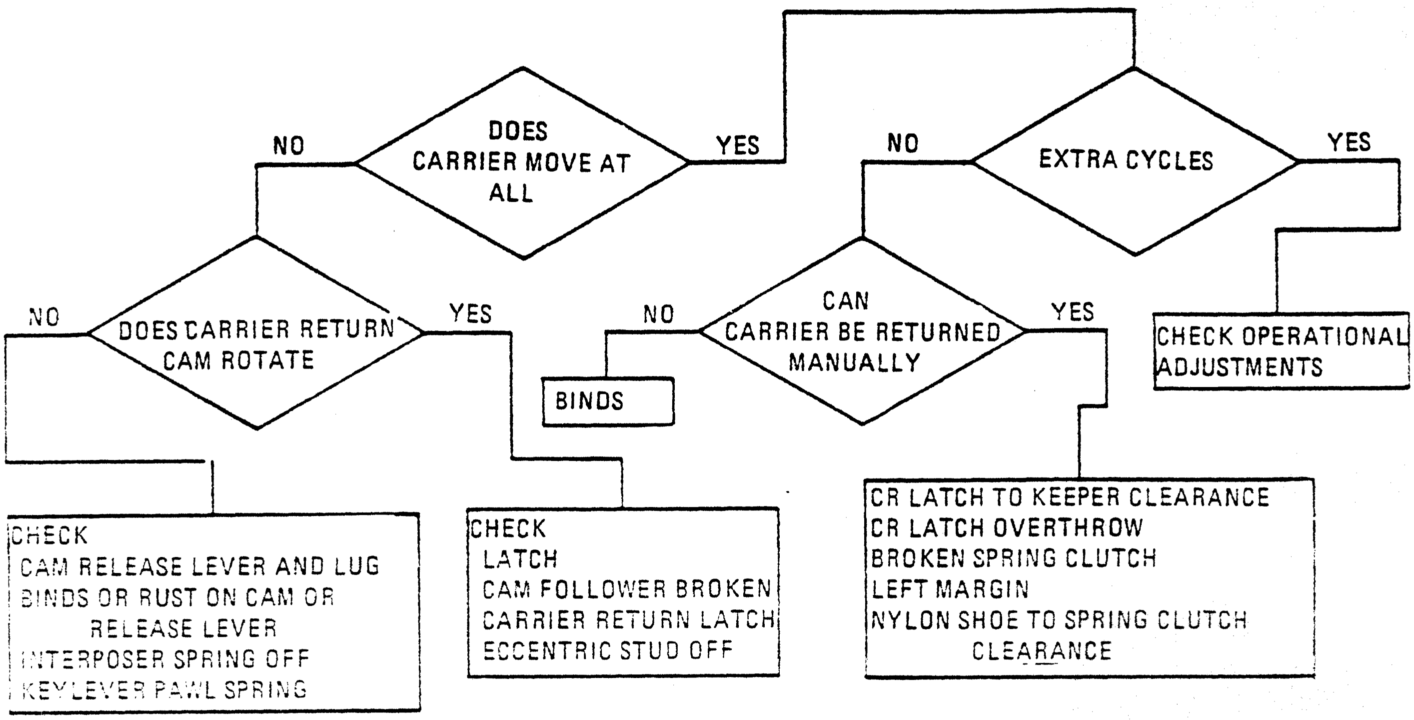
MECHANICAL SPACE FAILURE

Figure 5-188.



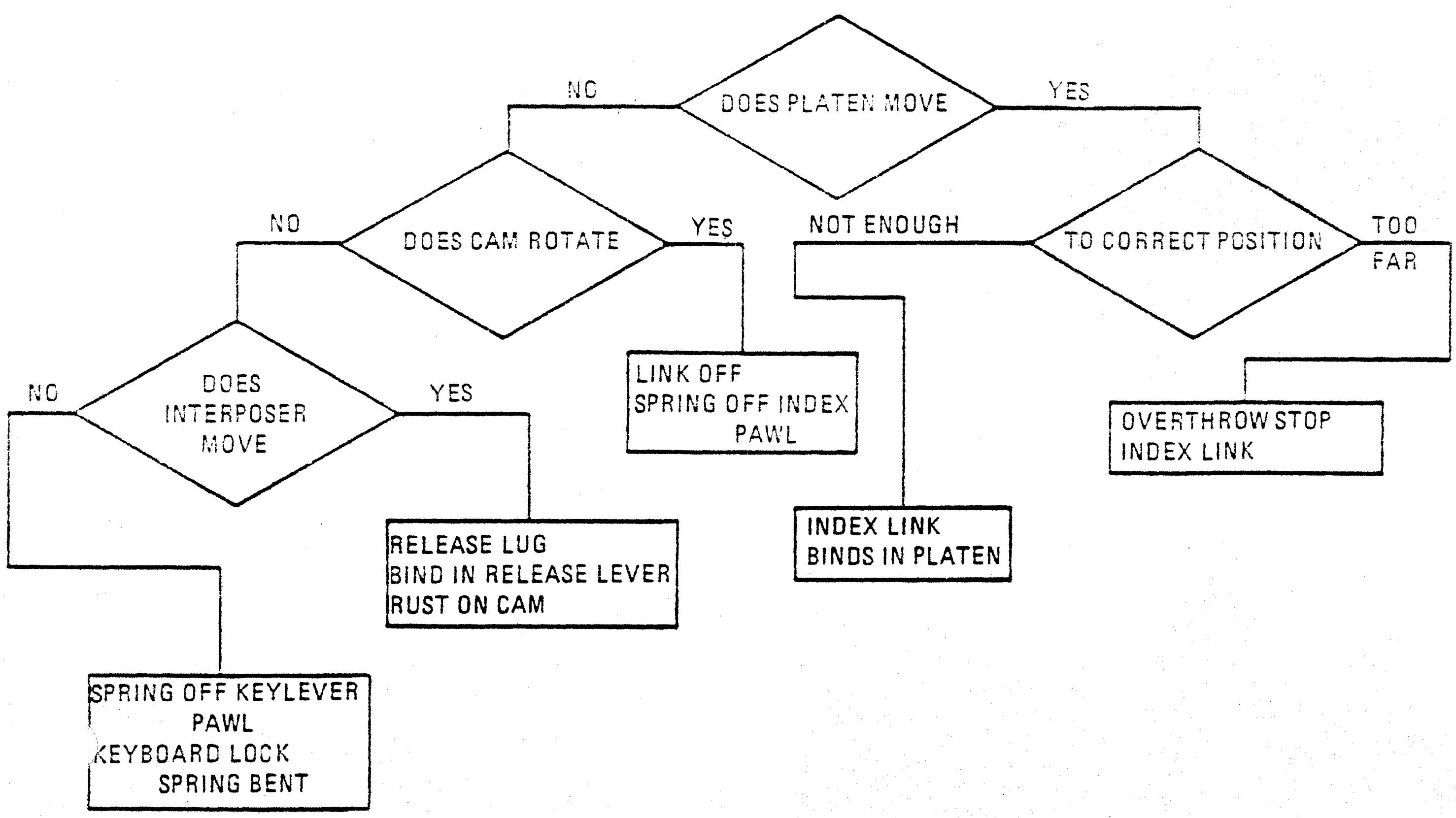
MECHANICAL BACKSPACE FAILURE

Figure 5-189.



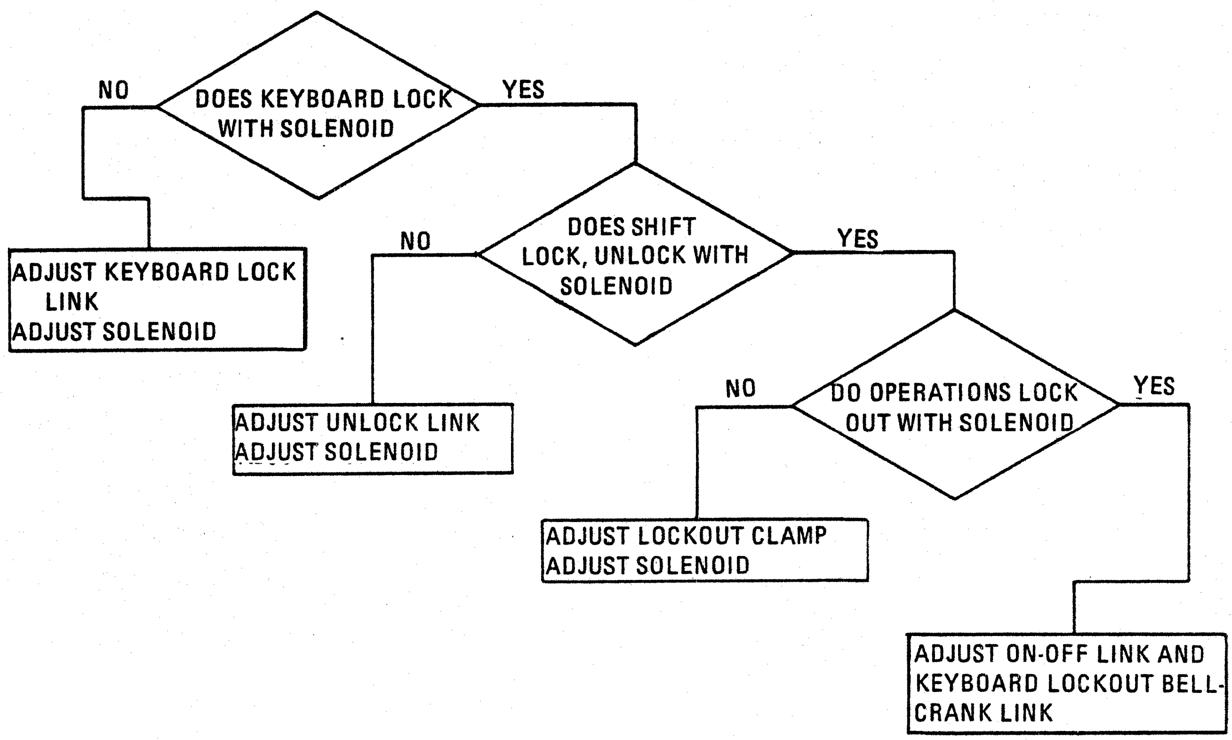
MECHANICAL CARRIER RETURN FAILURE

Figure 5-190.



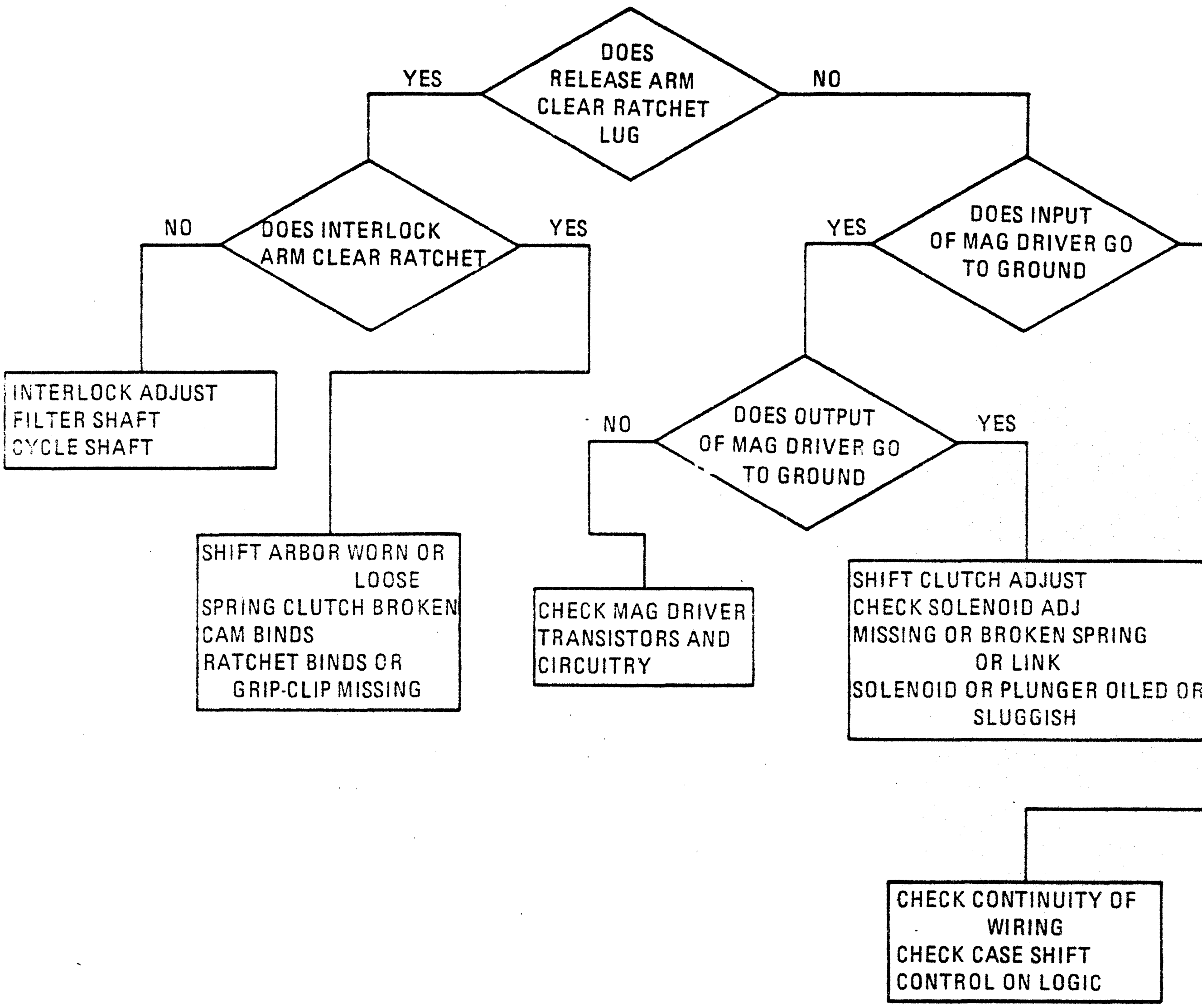
MECHANICAL INDEX FAILURE

Figure 5-191.



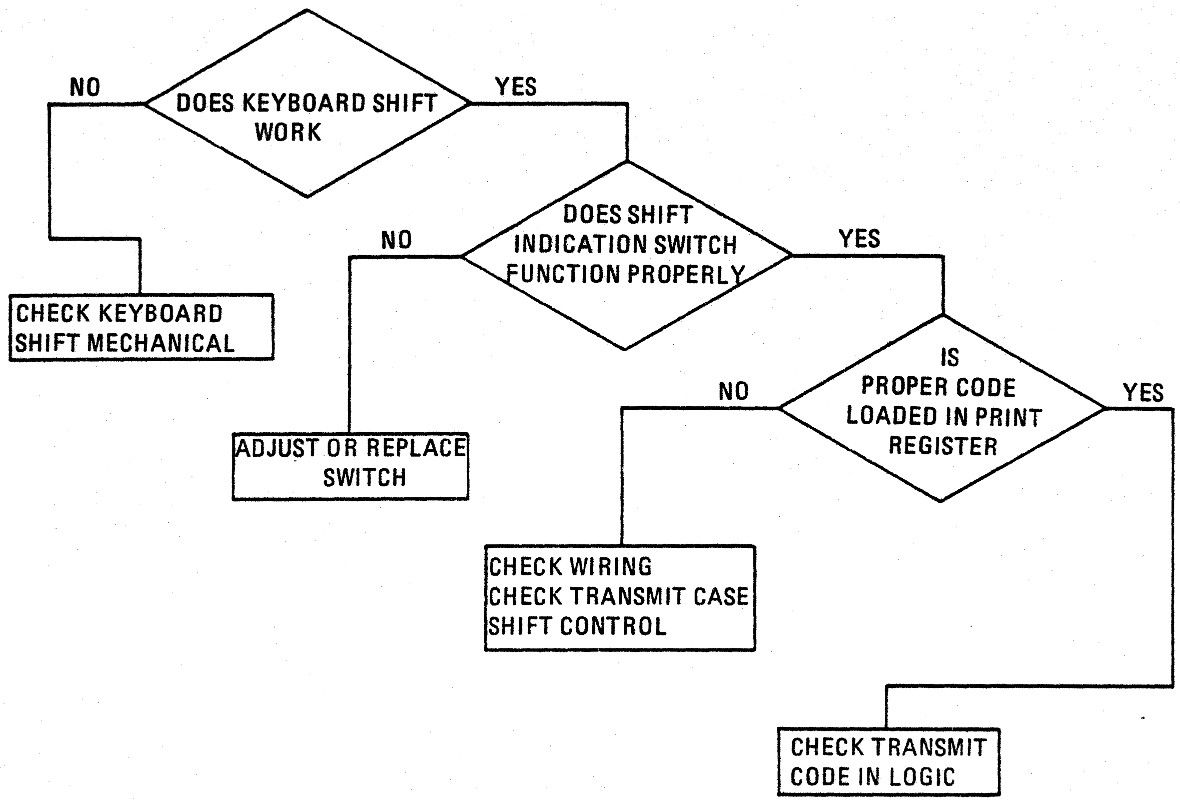
MECHANICAL KEYBOARD LOCK FAILURE

Figure 5-192.



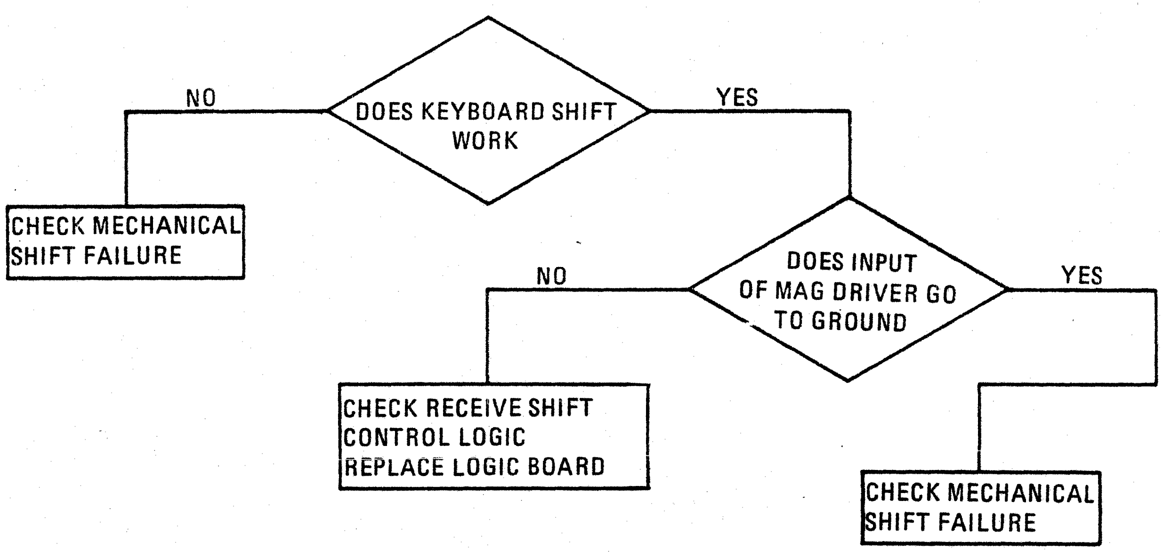
KEYBOARD SHIFT FAILURE

Figure 5-193.



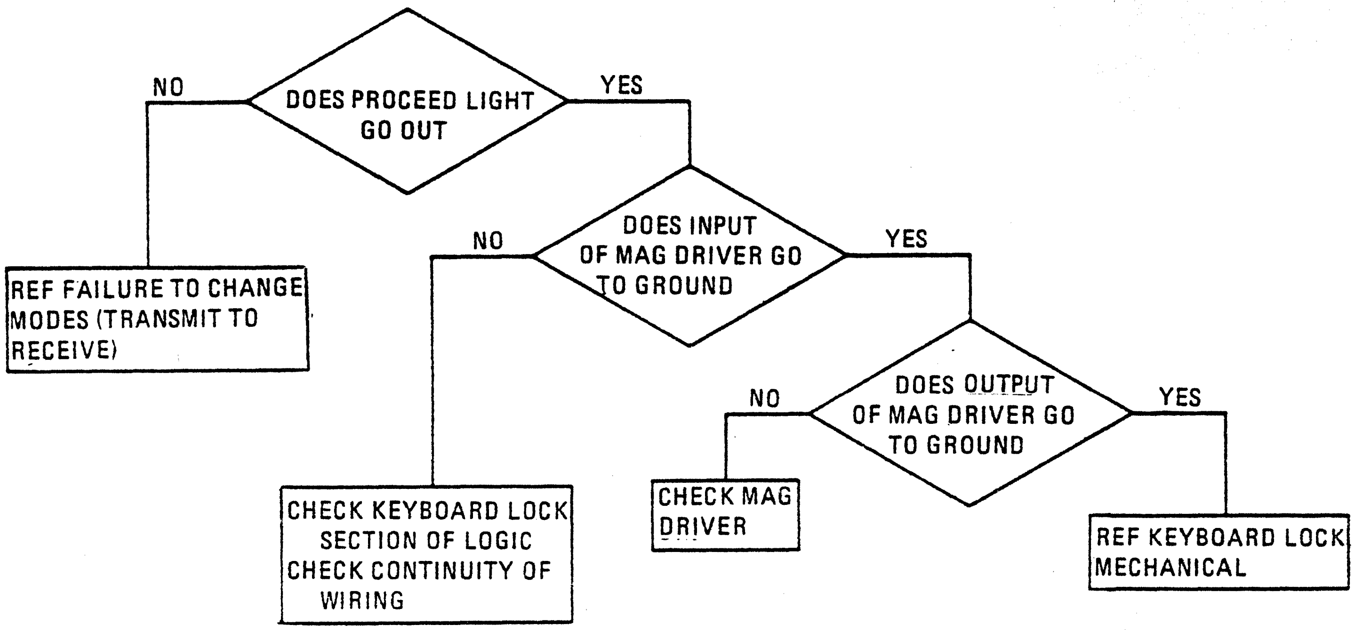
SHIFT TRANSMIT FAILURE

Figure 5-194.



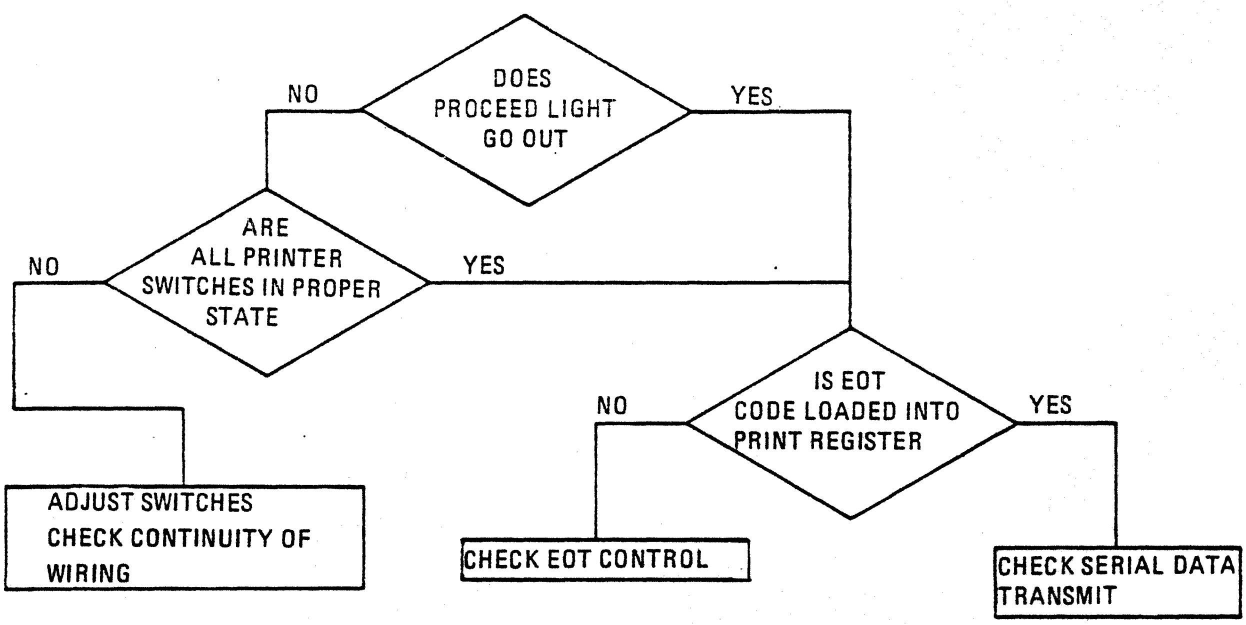
SHIFT RECEIVE FAILURE

Figure 5-195.



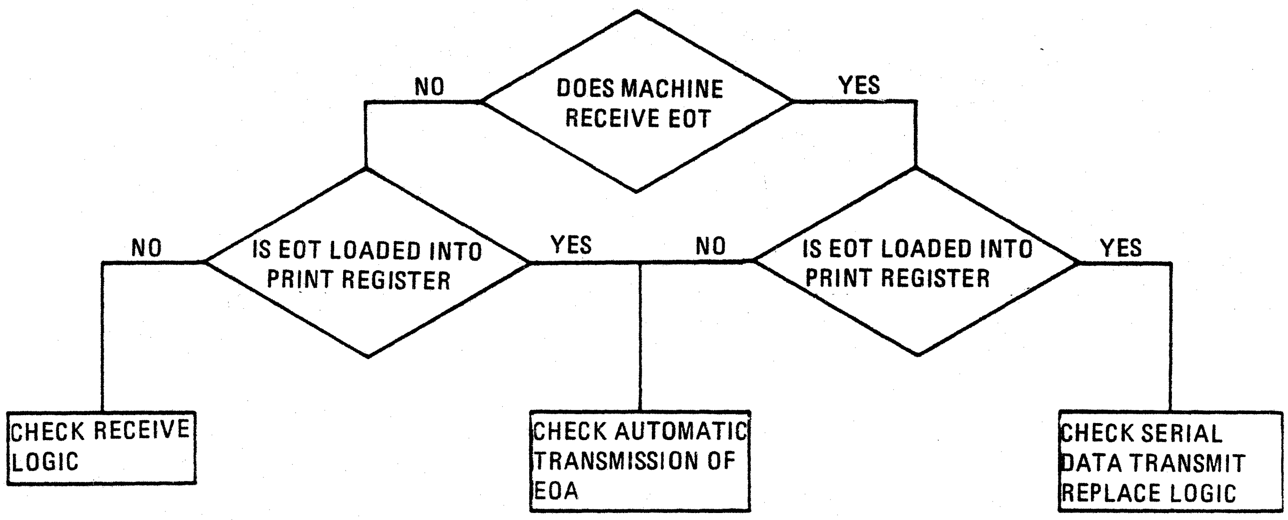
RECEIVE KEYBOARD LOCK FAILURE

Figure 5-196.



FAILURE TO CHANGE MODES FROM TRANSMIT TO RECEIVE

Figure 5-197.



FAILURE TO CHANGE MODES RECEIVE TO TRANSMIT
Figure 5-198.

BCD KEYBOARD								LATCH CODE						
B	A	8	4	2	1	C	CODE	R_1	R_2	R_{2A}	R_5	C	T_1	T_2
					X		1	X	X	X	X		X	X
				X			2		X	X			X	X
				X	X	X	3		X	X	X		X	X
			X				4	X		X			X	X
			X		X	X	5	X		X	X		X	X
			X	X		X	6			X			X	X
			X	X	X		7			X	X		X	X
		X					8	X			X		X	X
		X			X	X	9	X					X	X
		X		X		X	Ø				X		X	X
X	X				X		A	X	X	X	X			
X	X			X			B		X	X				
X	X			X	X	X	C		X	X	X			
X	X		X				D	X		X				
X	X		X		X	X	E	X		X	X			
X	X		X	X		X	F			X				
X	X		X	X	X		G			X	X			
X	X	X					H	X			X			
X	X	X			X	X	I	X						
X					X	X	J	X	X	X	X		X	
X				X		X	K		X	X			X	
X				X	X		L		X	X	X		X	
X			X			X	M	X		X			X	
X			X		X		N	X		X	X		X	
X			X	X			O			X			X	
X			X	X	X	X	P			X	X		X	
X		X				X	Q	X			X		X	
X		X			X		R	X					X	
	X			X		X	S		X	X				X
	X			X	X		T		X	X	X			X
	X		X			X	U	X		X				X
	X		X		X		V	X		X	X			X
	X		X	X			W			X				X
	X		X	X	X	X	X			X	X			X
	X	X				X	Y	X			X			X
	X	X			X		Z	X						X
		X		X	X		#(EOA)						X	X
	X	X		X	X	X	,							X
X		X		X	X	X	$						X	
X	X	X		X	X		.							
	X				X	X	/	X	X	X	X			X
	X						@	X	X	X				X

Figure 5-199.

CORRESPONDENCE

KEYBOARD								LATCH CODE						
B	A	8	4	2	1	C	CODE	R_1	R_2	R_{2A}	R_5	C	T_1	T_2
					X		1	X	X	X	X	X	X	X
				X			2		X	X		X	X	X
				X	X	X	3		X	X	X		X	X
		X					4	X			X	X	X	X
			X				5	X		X		X	X	X
			X	X		X	6			X			X	X
			X		X	X	7	X		X	X		X	X
			X	X	X		8			X	X	X	X	X
		X		X	X		9EOA						X	X
		X			X	X	0	X					X	X
X			X	X	X	X	A			X	X		X	
	X	X		X	X	X	B							X
	X		X	X	X	X	C			X	X			X
	X		X		X		D	X		X	X	X		X
	X		X			X	E	X		X				X
X	X			X	X	X	F		X	X	X			
X	X				X		G	X	X	X	X	X		
	X	X			X		H	X				X		X
X			X	X			I			X		X	X	
X	X					X	J	X	X	X				
	X		X	X			K			X		X		X
	X	X				X	L	X			X			X
X					X	X	M	X	X	X	X		X	
	X			X		X	N		X	X				X
X		X				X	O	X			X		X	
X	X		X				P	X		X		X		
X	X		X	X		X	Q			X				
X			X		X		R	X		X	X		X	
X		X			X		S	X				X	X	
	X						T	X	X	X		X		X
	X			X	X		U		X	X	X	X		X
X				X	X		V		X	X	X	X	X	
X		X		X	X	X	W						X	
	X				X	X	X	X	X	X	X	X		X
X	X	X			X	X	Y	X						
		X		X		X	Z				X		X	X
X			X			X	' "	X		X			X	
X	X		X	X	X		,			X	X	X		
X		X		X	X	X	;	X		X	X			
X				X		X	.		X	X			X	
X	X	X					/	X			X			
X							1/4 1/2	X	X	X		X	X	
X	X	X		X	X		-					X		
X	X			X			+ =		X	X				

All operations and control codes are the same as for BCD.

Figure 5-200.

KEYBOARD CODING								LATCH CODE						
B	A	8	4	2	1	C	CODE	R_1	R_2	R_{2A}	R_5	C	T_1	T_2
X							-	X	X	X			X	
X	X					X	&	X	X	X				
						X	SPACE	X	X	X			X	X
X		X	X	X		X	BK-SP		X		X		X	
		X	X	X			UC		X		X		X	X
X	X	X	X	X			LC		X		X			
X	X	X	X		X		TAB	X	X					
X		X	X		X	X	CR/LF	X	X				X	
	X	X	X		X	X	INDEX	X	X					X
		X	X	X	X	X	EOT		X				X	X
	X	X	X	X	X		ATC		X					X
X	X	X	X	X	X	X	COR.D		X					
X		X	X	X	X		IDLE		X				X	
	X	X		X			(print o)				X			X
X		X		X			(print -)				X		X	
X	X	X		X		X	(print ?)				X			
		X	X			X	(oprn)	X	X		X		X	X
	X	X	X				(oprn)	X	X		X			X
X		X	X				(oprn)	X	X		X		X	
X	X	X	X			X	(oprn)	X	X		X			
		X	X		X		(oprn)	X	X				X	X
	X	X	X	X		X	(oprn)		X		X			X

Figure 5-201.

5-51. REMOVAL & REPLACEMENT.

The purpose of this section is to assist the Field Engineer in removing and replacing terminal components. After a component is replaced refer to the adjustment section of the manual and insure that all the requirements of the adjustments are met.

Note: Not all components are listed in the removal and replacement section because of their simplicity of installation.

5-52. TILE RING AND ROTATE SHAFT REMOVAL

a. Remove the dust cover and ribbon.

b. Center the carrier over the cycle shaft.

c. Shift the machine to upper case.

d. Half cycle a zero rotate, tilt 1 character.

e. Remove the c-clip and disconnect the tilt pulley link.

f. Loosen the tilt ring pivot pin setscrews.

g. Remove the two pivot pins.

h. Remove the tilt ring and dog bone.

i. Loosen the rotate pulley setscrew.

j. Use the butt end of the small spring hook as a follower to push out the rotate shaft. This prevents the wedge from being lost. When replacing the shaft, be sure the pin is pointing toward the front-left and right-rear corners.

k. The following adjustments should be checked after the rotate shaft and tilt ring are replaced:

1. Tilt detent
2. Typehead homing
3. Tilt ring
4. Upper ball socket

5-53. CARRIER AND ROCKER ASSEMBLY REMOVAL

a. Remove the platen, deflector and feed rolls.

b. Remove the card holder and brackets.

c. Remove the tilt tape.

d. Release the rotate spring tension and remove the rotate tape.

e. Disconnect the carrier return and escapement/tab cords from the carrier.

f. Disconnect the velocity cable from the carrier.

g. Remove the escapement bracket screws and work the carrier out from beneath the escapement bracket.

h. Remove the print shaft.

1. Level 1 print shafts are removed by removing the print shaft gear and sliding the print shaft out through the right bearing.

2. Level 2 print shafts are removed by removing the c-clip to the right of the left bearing and sliding the print shaf out through the left bearing.

i. The carrier assembly may now be lifted from the machine.

5-54. ROCKER ASSEMBLY REMOVAL

a. Remove the ribbon mechanism.

b. Remove the cardholder brackets.

c. Slowly release the rotate spring tensions.

d. Disconnect the rotate tape.

e. Disconnect the tilt tape.

f. Remove the gearless tilt pulley.

g. Remove the tape guide.

h. Remove the striker if present.

i. Remove the rotate spring.

j. Remove the rotate pulley.

k. Remove the impression control or velocity plate.

l. Loosen the rocker shaft setscrew.

m. Remove the c-clip from the right side of the rocker shaft.

n. Remove the rocker shaft.

o. The rocker assembly may now be removed from the carrier.

5-55. ROTATE SPRING REPLACEMENT

a. Remove the left dust shield.

b. Center the carrier over the cycle shaft.

c. Remove the tension from the rotate spring gradually.

d. Remove the screws from the rotate spring retaining plate.

e. Remove the rotate spring retaining plate. The rotate spring may now be removed.

f. The following adjustments should be checked after the rotate spring is replaced:

1. Rotate spring tension.
2. Typehead homing.
3. Damper spring (if used).

5-56. OPERATIONAL SHAFT REMOVAL

a. Remove the c-clip from the right end of the operational shaft and remove the shift clutch ratchet.

b. Remove the shift clutch spring.

c. Loosen the torque limiter hub.

d. Loosen the tab governor collars.

e. Loosen the operational cam ratchet.

f. Loosen the collar at the right side of the operational shaft.

g. Install the hand cycle tool.

h. Pull the operational shaft slightly to the right and remove the c-clip(s) from the carrier return pinion.

i. The operational shaft may now be pulled to the right.

5-57. PRINT SLEEVE REMOVAL

a. Center the carrier.

b. Remove the ribbon mechanism.

c. Remove the print shaft.

1. Level 1 print shafts are removed by removing the print shaft gear and sliding the print shaft out through the right bearing.
2. Level 2 print shafts are removed by removing the c-clip to the right side of the left bearing and sliding the print shaft out through the left bearing.

d. Remove the left print shaft wiper retainer.

e. Loosen the ribbon lift cam.

f. Loosen the ribbon feed and detent cam.

g. Loosen the print cam.

h. Slide the ribbon feed and detent cam to the right against the print cam.

i. Slide the ribbon lift cam to the right and onto the print shaft key.

j. Slide the print sleeve to the left.

k. Remove the print cam.

l. Remove the ribbon feed and detent cam.

m. Slide the print sleeve to the right.

n. Slide the ribbon lift cam to the left.

o. Remove the print shaft key.

p. Pull the print sleeve out through the left carrier bearing while sliding the ribbon lift cam off.

q. The following adjustments should be checked after replacing the print sleeve:

1. Print sleeve end play.

2. Detent skirt clearance.

3. Print shaft timing.

4. Ribbon plate.

5-58. ESCAPEMENT PAWL REMOVAL

a. Remove the platen.

b. Remove the deflector and feed rolls.

c. Position the carrier near the left margin.

d. Remove the nut from the escapement pawl mounting stud.

e. Remove the escapement pawl mounting stud.

f. Remove the escapement pawl and backspace pawl.

g. Installation of the escapement and backspace pawls and spacer will be much easier if the two pawls and spacer are assembled and retained with a rubber band. Then the three parts can be installed as a single unit and the rubber band cut away.

h. The following adjustments should be checked after the escapement pawl is replaced:

1. Escapement torque bar stop.

2. Pawl mounting stud.

3. Torque bar backstop.

4. Carrier return pawl clearance.

5. Tab pawl clearance.

6. Backspace rack.

7. Backspace motion.

5-59. CYCLE CLUTCH AND CYCLE SHAFT REMOVAL

a. Position the carrier to the extreme right.

b. Remove the left dust cover.

c. Remove the gear guard.

d. Remove the cycle clutch check pawl and spring.

e. Remove the lower idler gear.

f. Remove the three bearing plate screws.

g. Loosen the bearing plate from the frame by prying it away from the frame (front first) with a screwdriver.

h. Remove the positive bail spring.

i. Force the positive bail down with a screwdriver and remove all latches from beneath the bail.

j. Remove the cycle shaft, pushing the Negative 5 and Rotate 2 links out of the way with the pusher end of a spring hook.

k. Remove the shims from the old shaft and put them on the new one. Check to see that proper end play (.001" – .006") is present. Reshim if necessary.

l. The following adjustments should be checked after the cycle shaft is replaced:

1. Idler gears.

2. Cycle shaft end play.

3. Cycle clutch spring.

4. Cycle clutch latch bite.

5. Damper spring (if used).

6. Filter shaft timing.

7. Print shaft timing.

5-60. DRIVE BELT REMOVAL

a. Position the carrier to the extreme right.

b. Remove the left dust cover.

c. Remove the gear guard.

d. Remove the cycle clutch check pawl and spring.

e. Remove the lower idler gear.

Remove the three bearing plate screws.

g. Loosen the bearing plate from the frame by prying it away from the frame (front first) with a screwdriver.

h. Remove the positive bail spring.

i. Force the positive bail down with a screwdriver and remove all latches from beneath the bail.

j. Remove the cycle shaft, pushing the Negative 5 and Rotate 2 links out of the way with the pusher end of a spring hook.

k. Remove the drive belt.

l. The following adjustments should be checked after the drive belt is replaced:

   1. Idler gear.
   2. Cycle clutch spring.
   3. Filter shaft timing.
   4. Print shaft timing.
   5. Drive belt tension.

5-61. ROTATE SELECTION DIFFERENTIAL REMOVAL

a. Position the carrier to the extreme right.

b. Remove the left dust cover, platen, feed rolis, and paper deflector.

c. Remove the machine from the bottom pan.

d. Disconnect the clevises and remove them from the selector latch links.

e. Remove the latch bail spring.

f. Remove the motor.

g. Remove the rotate latch springs.

Pull out the rotate links.

i. Disconnect the tilt differential spring.

j. Remove the upper guide bracket screws.

k. Remove the balance arm mounting stud.

l. Disconnect the minus five bail drive link from the right end of the balance arm.

m. Rotate the cycle shaft until the cam followers are on the low points of the cams.

n. Remove the rotate differential assembly.

o. The following adjustments should be checked after the rotate selection differential assembly is replaced:

   1. Typehead homing.
   2. Rotate latch clearance.
   3. Rotate differential guides.
   4. Selector latch links.

5-62. KEYBOARD INTERPOSER REMOVAL

a. Align the carrier over the line lock interposer.

b. Disconnect the operational keylever springs and repeat bail spring.

c. Remove keylever unstop.

d. Remove the spacebar equalizing rod.

e. Remove the bell bail lever.

f. Remove the bell ringer bail.

g. Remove the margin rack.

h. Slip sound deadening over operational keybuttons and pivot the keyboard up and out of the way.

i. Push the fulcrum rod to the interposer being removed with a fulcrum rod tool.

j. Remove the spring from the interposer being removed.

5-63. SHIFT CAM REMOVAL

a. Turn the typehead counterclockwise and remove the relaxed rotate tape from the shift arm pulley and put it around the tilt pulley. Note: On one piece shift arm the rotate tape must be disconnected from the right side of the carrier.

b. Remove the shift interlock spring, the shift release arm spring and the shift detent spring.

c. Remove the c-clip from the operational shaft and remove the shift clutch ratchet.

d. Disconnect the shift release link.

e. Remove the shift support bracket screw.

f. Remove the shift support bracket, interlock and shift release lever as an assembly.

g. Remove the detent arm.

h. Remove the shift clutch spring (behind the ratchet). Note: Observe the spring position for replacement.

i. Remove the shift clutch arbor.

j. Remove the shift cam.

5-64. CORD REPLACEMENT

a. Carrier centered – remove both cords if one is frayed or broken.

b. Turn front drum slot upwards; attach the escapement cord to the drum and thread out through the side frame.

c. Hold the metal anchor with scissor clamps or spring hook, and wind the cord onto the drum (turning by hand) until the anchor is drawn to the side frame.

d. Hook a new return cord to the carrier, thread through and attach to the rear drum. Disregard the slack.

e. Now, with the clamps or spring hook, pull the escapement cord around the tension pulley and hook it to the carrier. This will wind up the return cord.

f. Recheck mainspring tension; this may have decreased while turning the shafts with the cords disconnected.

g. Check for correct position of the RH cord tension pulley. Also check for correct position of the tension pulley bracket (new-style) to prevent accidental and premature fraying of cords on the power frame or on the pulley flanges.

5-65. ROTATE TAPE REPLACEMENT

a. Half cycle the machine with the typehead on.

b. Manually withdraw the rotate detent and use the typehead to wind the rotate spring approximately 3-1/2 turns or until the slot for the tape is accessible at near 3-1/2 turn

c. Allow the rotate detent to re-enter. It will hold the position of the head and rotate pulley.

d. Insert the tape anchor into the pulley and thread the eye end through the rotate arm, shift arm, and on to the anchor in the right of the carrier.

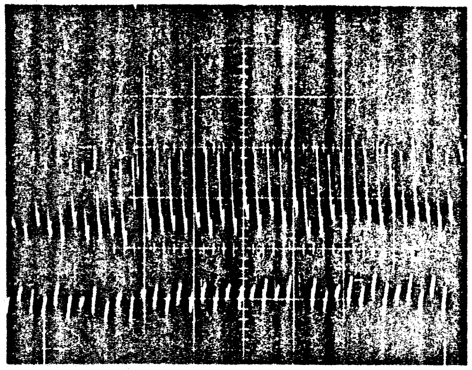
e. Allow the shift arm to drop down and take up slack in the tape.

f. Hold the typehead and manually withdraw the detents. Control the type element to allow the rotate spring to slowly wind the tape as you guide it correctly around each of its pulleys.

g. Half cycle the machine to a lower case "m" and check rotate spring tension. Check homing and other adjustments as necessary.

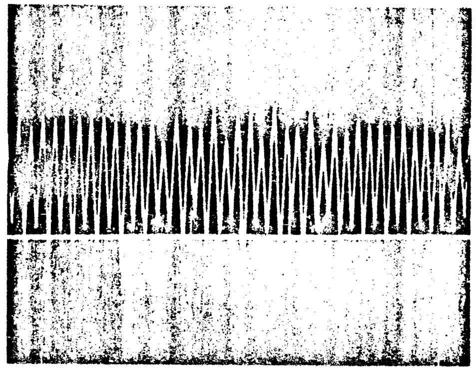
NOTE

The following illustrations in this section are provided for MODEM troubleshooting.



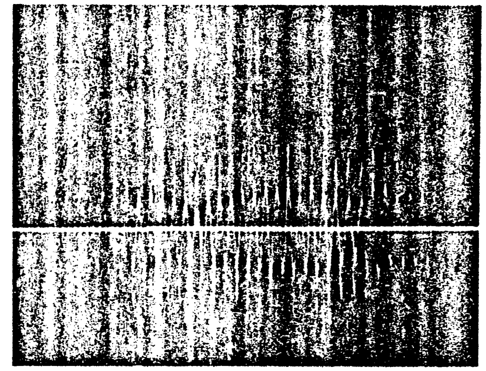
(20) (23) Figure 4-160 2ms/div @ 1mv/div

Band Pass Filter Amplifier (BPFA)



(B) Figure 4-163 2ms/div @ 5.0 mv/div

High Pass Filter (HPF)



(A) Figure 4-164 2ms/div @ 20mv/div

Band Reject Filter (BRF)

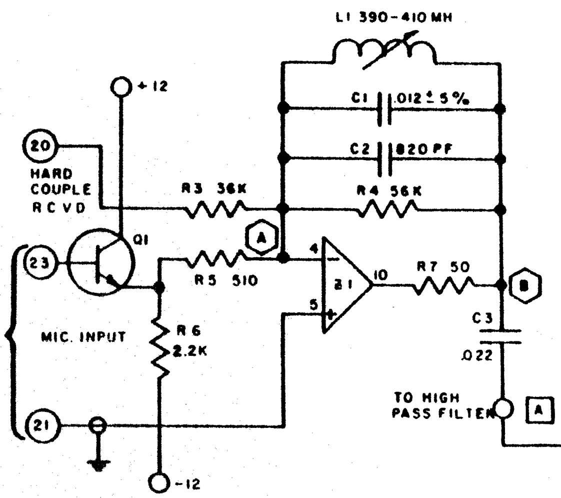


Figure 4-160, Page 4-86

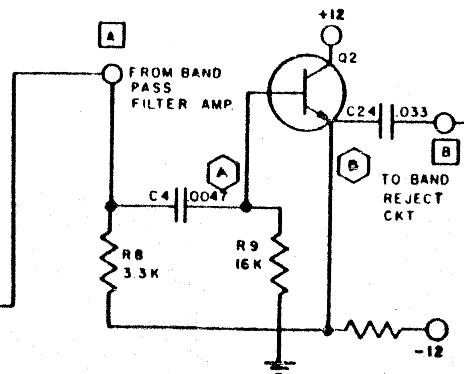


Figure 4-163, Page 4-87

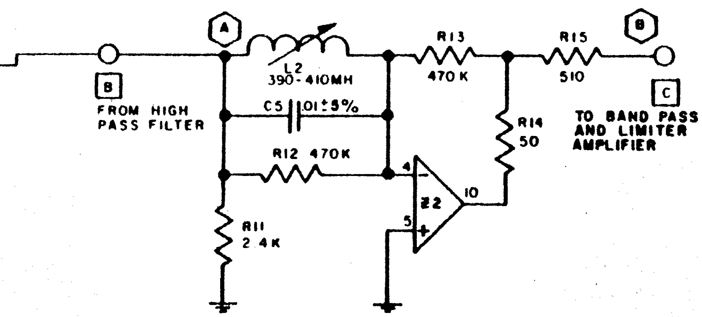
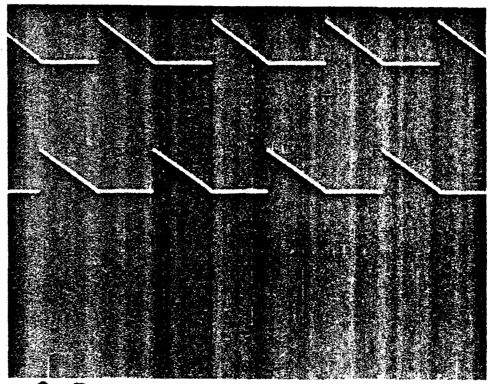


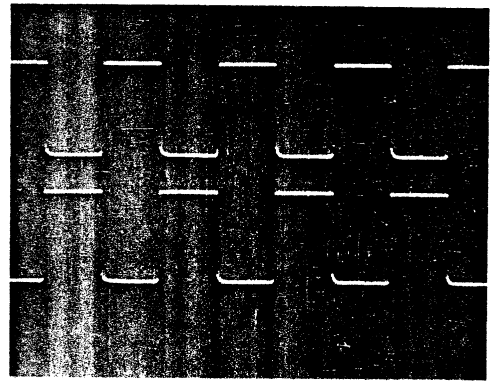
Figure 4-164, Page 4-87



(B) (H) Figure 4-172 .2ms/div @ 1V/div

Power Supply

Voltage Controlled Oscillator (PSVCO)



[P] TP3 Figure 4-172 .2ms/div @ 1V/div

Voltage Controlled Oscillator (VCO)

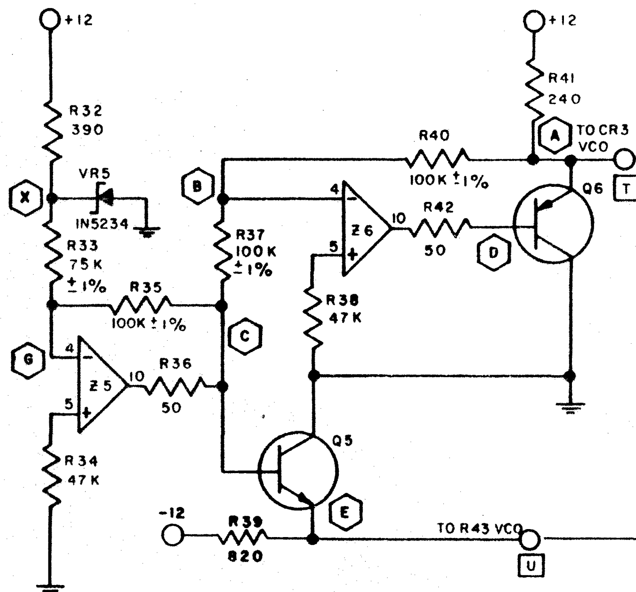


Figure 4-168, Page 4-89

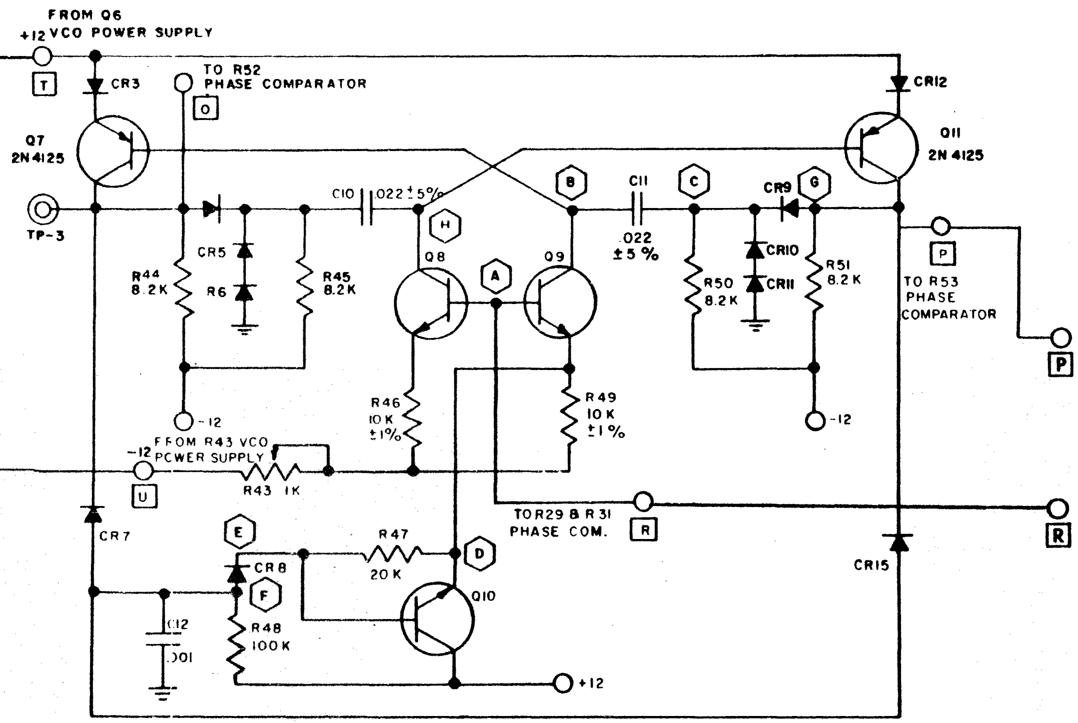
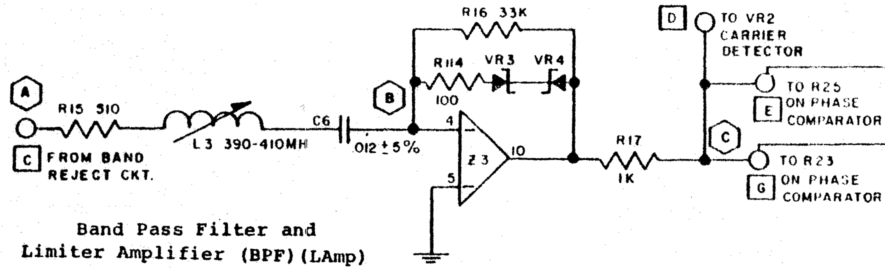
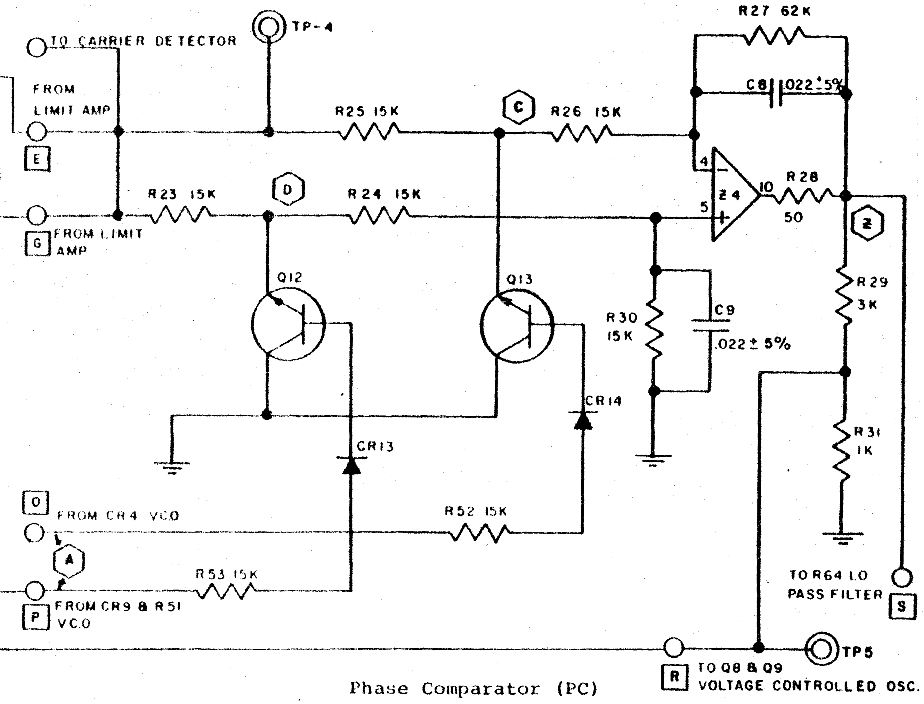


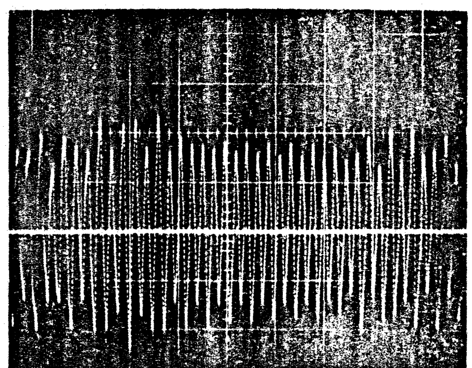
Figure 4-172, Page 4-89



Band Pass Filter and Limiter Amplifier (BPF)(LAmp)
Figure 4-166/4-164, Page 4-89



Phase Comparator (PC)
Figure 4-173, Page 4-92



(A) Figure 4-166 2ms/div @ 1V/div

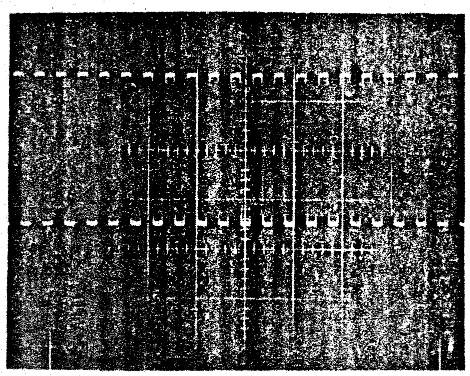
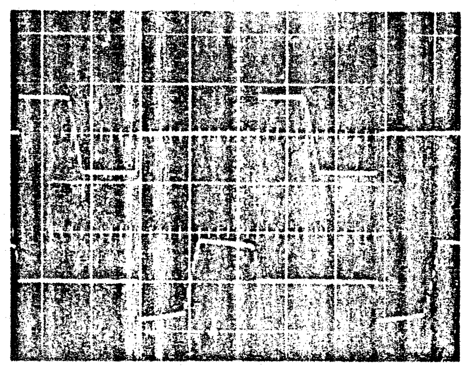


Figure 4-173 TP4 1ms/div @ 5V/div



(C) Figure 4-173 .1ms/div @ 5V/div
(D) Figure 4-173 .1ms/div @ 5V/div

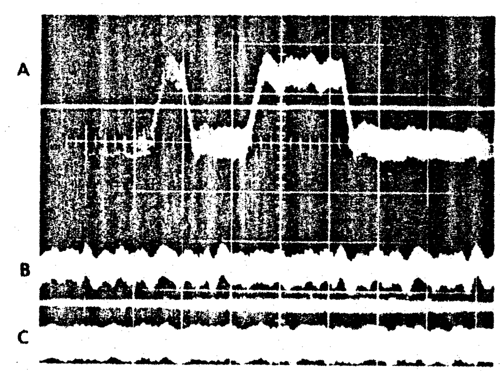
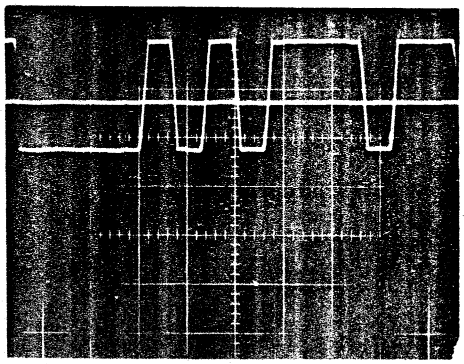
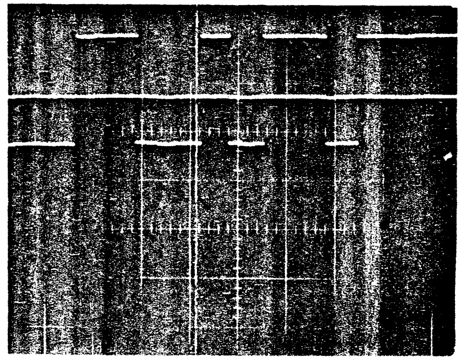


Figure 4-173 TP5
A. RANDOM DATA
B. CONT. MARK 10ms/div @ 5V/div
C. CONT. SPACE



(A) Figure 4-179 10ms/div @ 10V/div



(C) Figure 4-182 10ms/div @ 10V/div

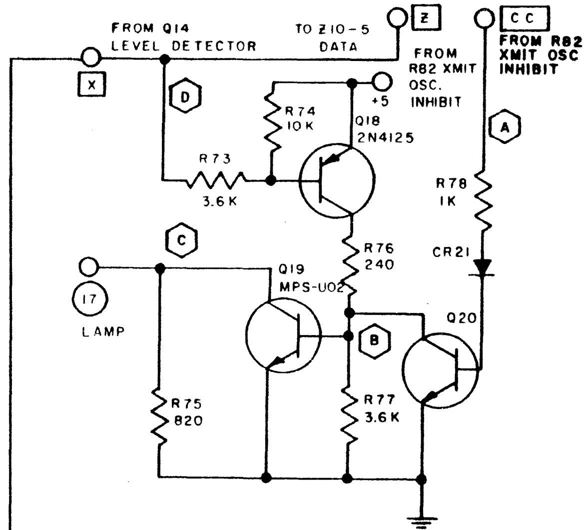


Figure 4-199, Page 4-104
Data Lamp Driver (DLD)

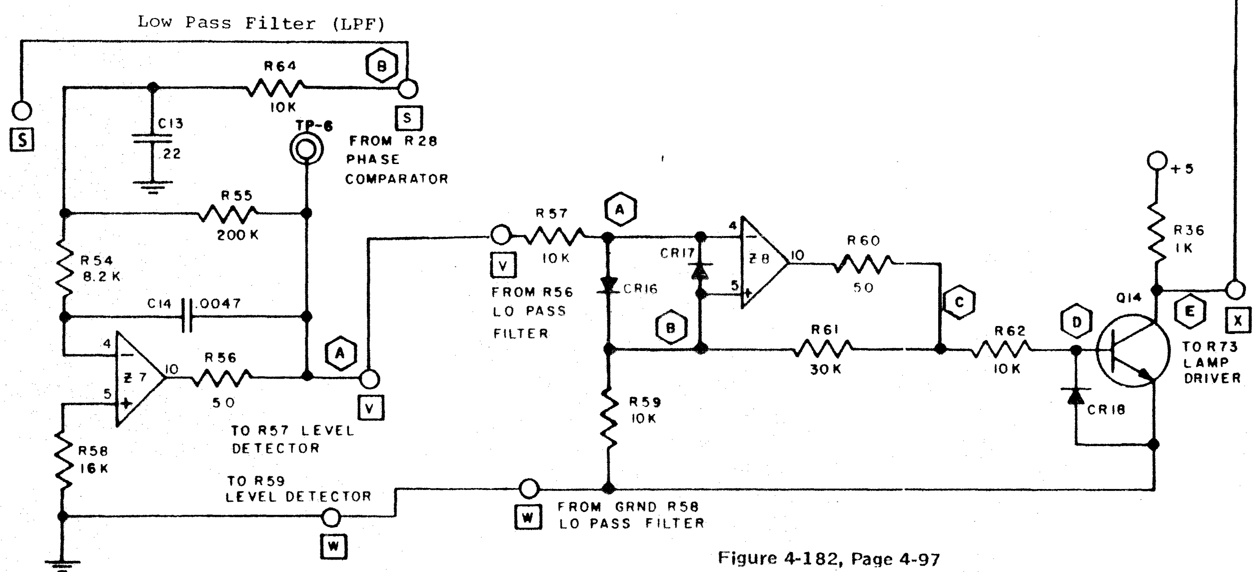
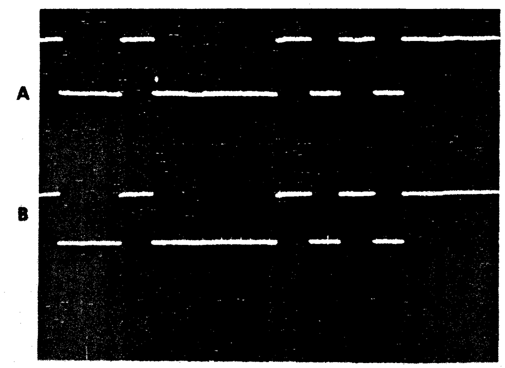
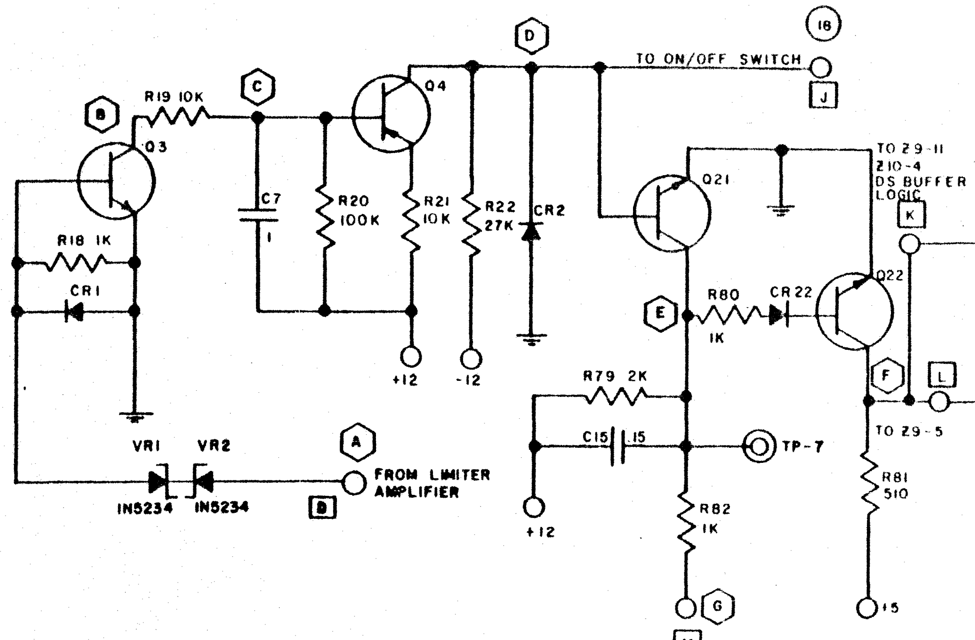


Figure 4-173, Page 4-97

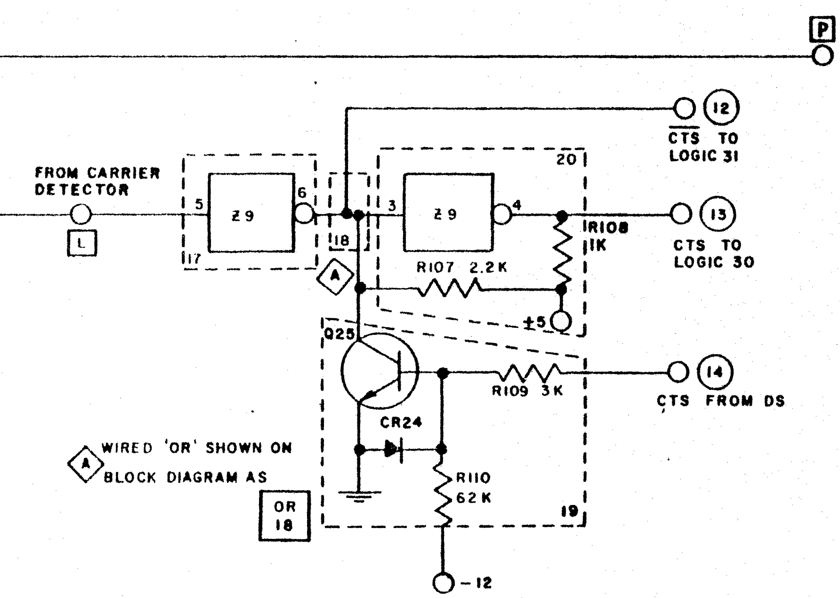
Figure 4-182, Page 4-97



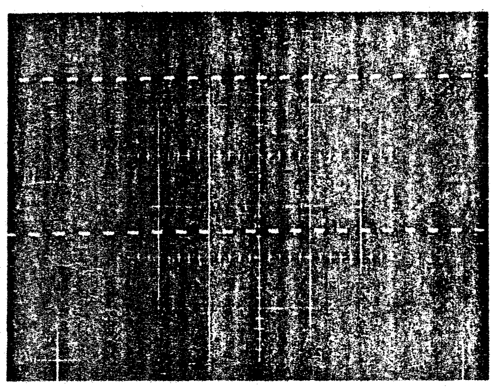
(C)(D) Figure 4-199 Data In 10ms/div @ 5V/div
Lamp 10ms/div @ 20V/div



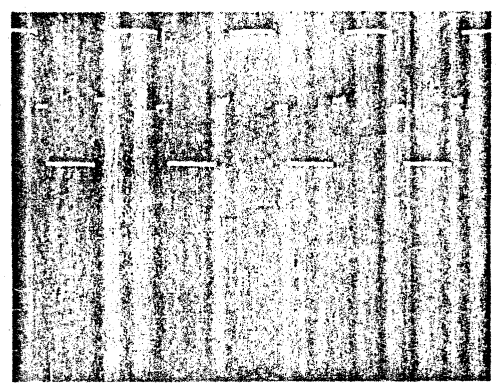
Carrier Detector (CD)
Figure 4-189, Page 4-100



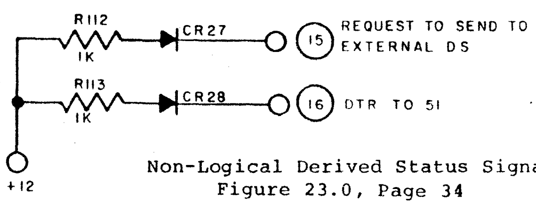
Data Terminal Control Logic "B" (DTCL "B")
Figure 4-203, Page 4-107



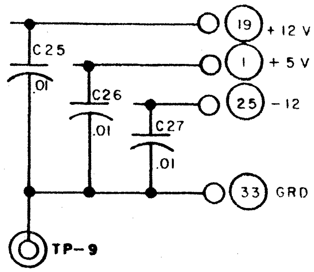
(A) Figure 4-189 1ms/div @ 5V/div



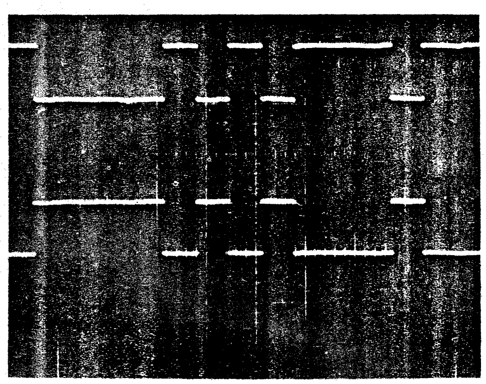
(B) Figure 4-189 .2ms/div @ 1V/div



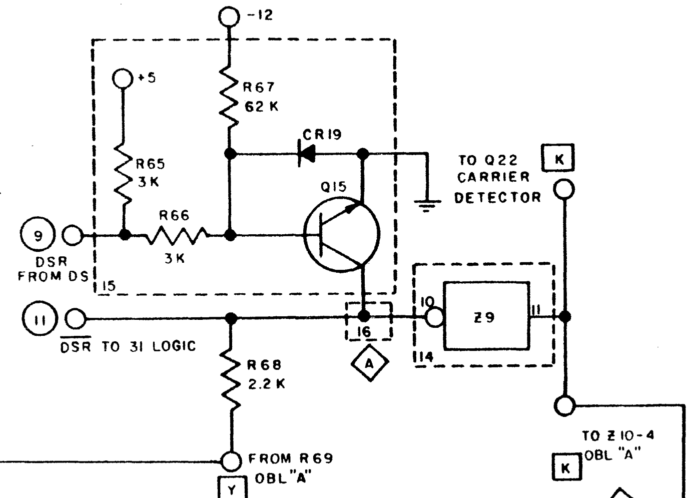
Non-Logical Derived Status Signals
Figure 23.0, Page 34

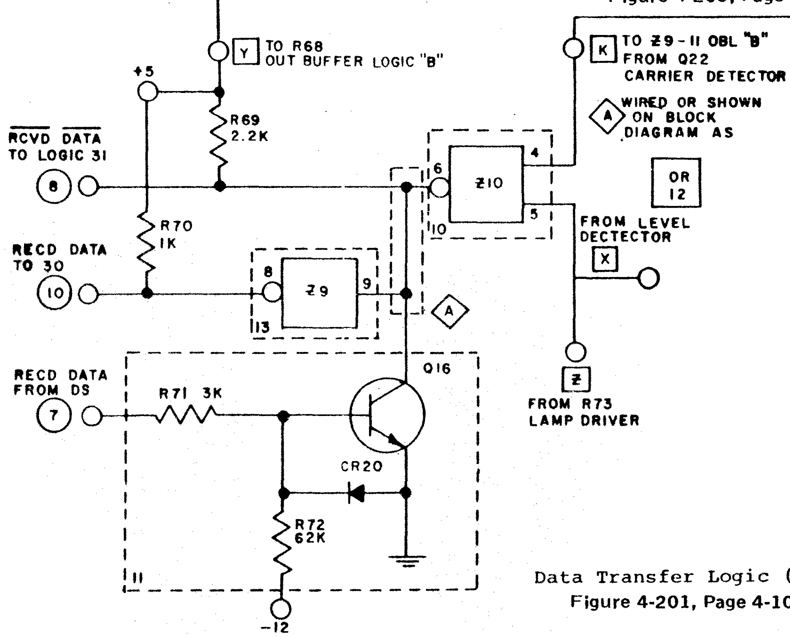


Power Supply Bypass Filters (PSBF)
Figure 4-208, Page 4-109



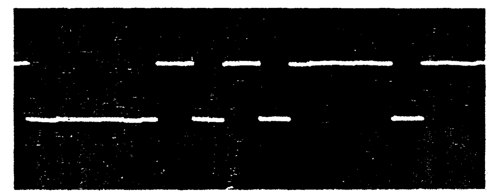
(8)(10) **Figure 4-201** 10ms/div @ 5V/div



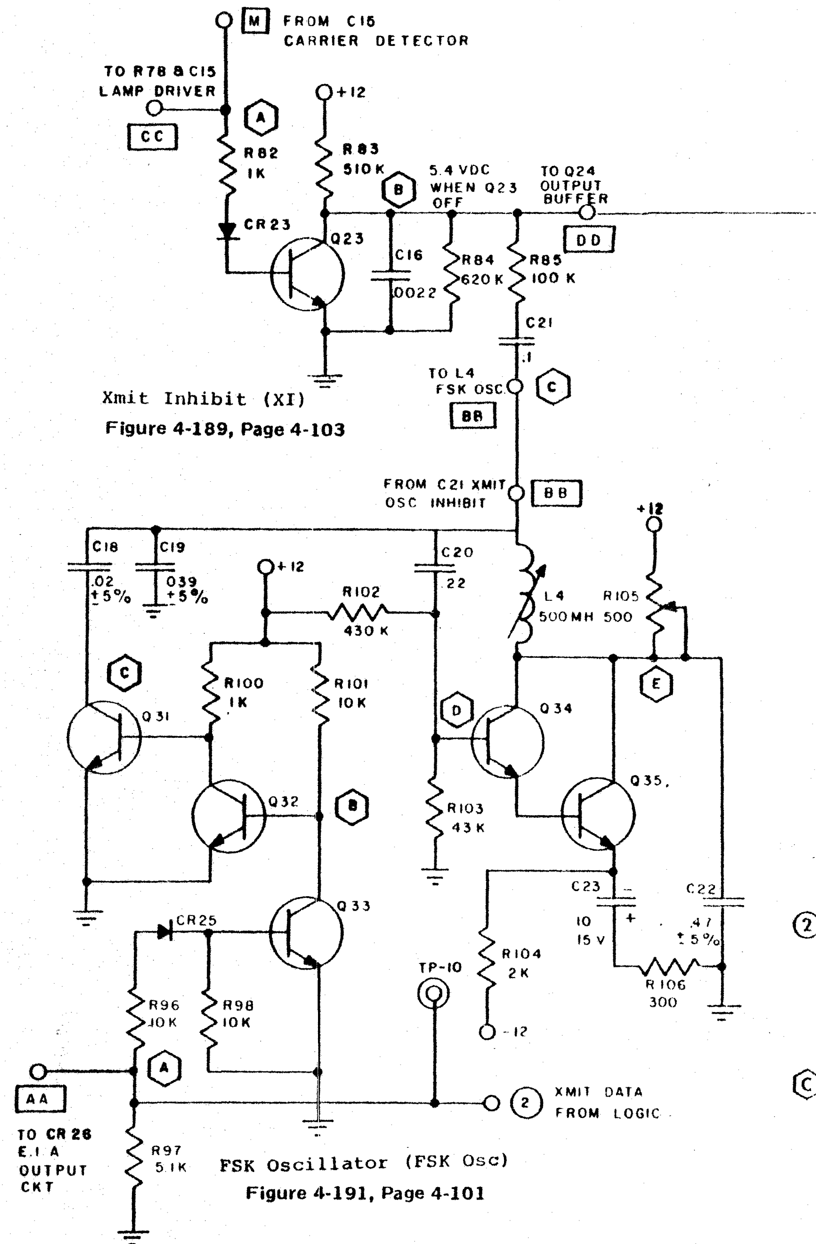


Data Terminal Control Logic "A" (DTCL "A")
Figure 4-205, Page 4-106

Data Transfer Logic (DTL)
Figure 4-201, Page 4-106



X **Figure 4-201** 10ms/div @ 10V/div

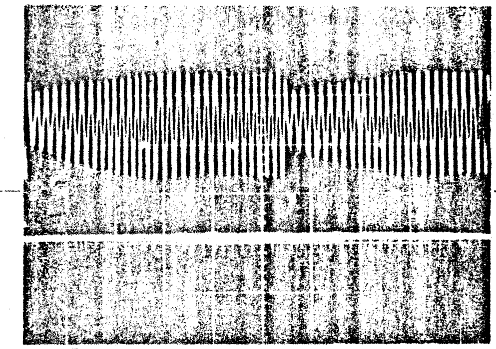


Xmit Inhibit (XI)

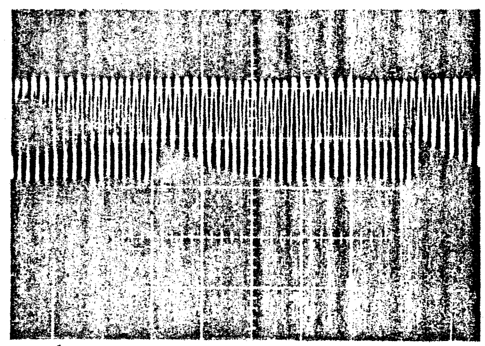
Figure 4-189, Page 4-103

FSK Oscillator (FSK Osc)

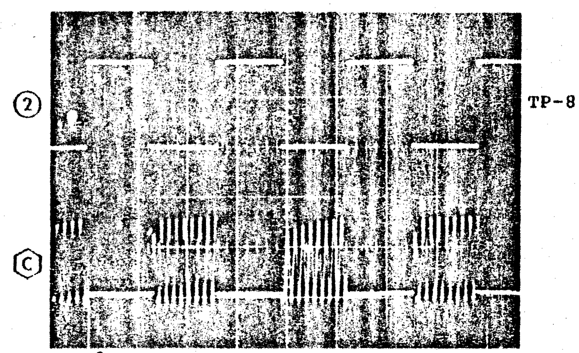
Figure 4-191, Page 4-101



(B) Figure 4-195 5ms/div @ 2V/div

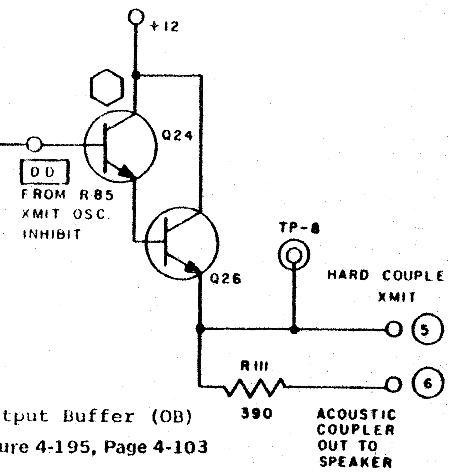


(E) Figure 4-191 5ms/div @ 2V/div



(C) Figure 4-191 5ms/div @ 5V/div

(2) Figure 4-191 5ms/div @ 2V/div



Output Buffer (OB)

Figure 4-195, Page 4-103

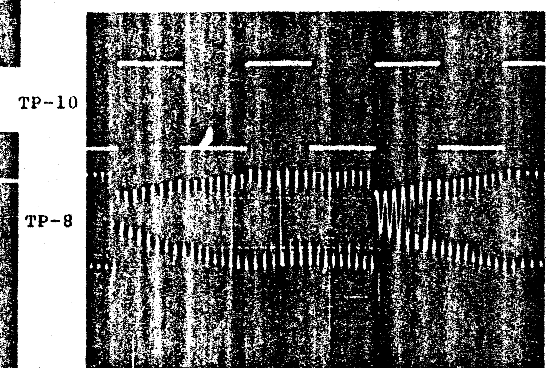
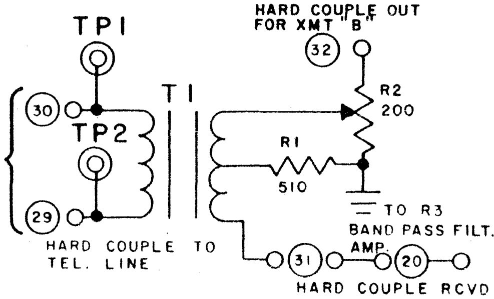


Figure 13.0 TP-10
Figure 15.0 TP-8
5ms/div @ 2V/div



Modem to Data Access Arrangement
Figure 4-158, Page 4-86

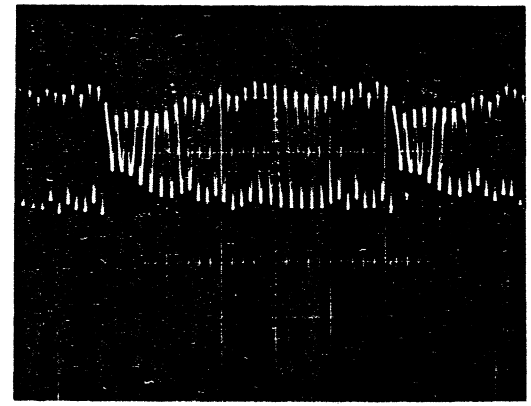
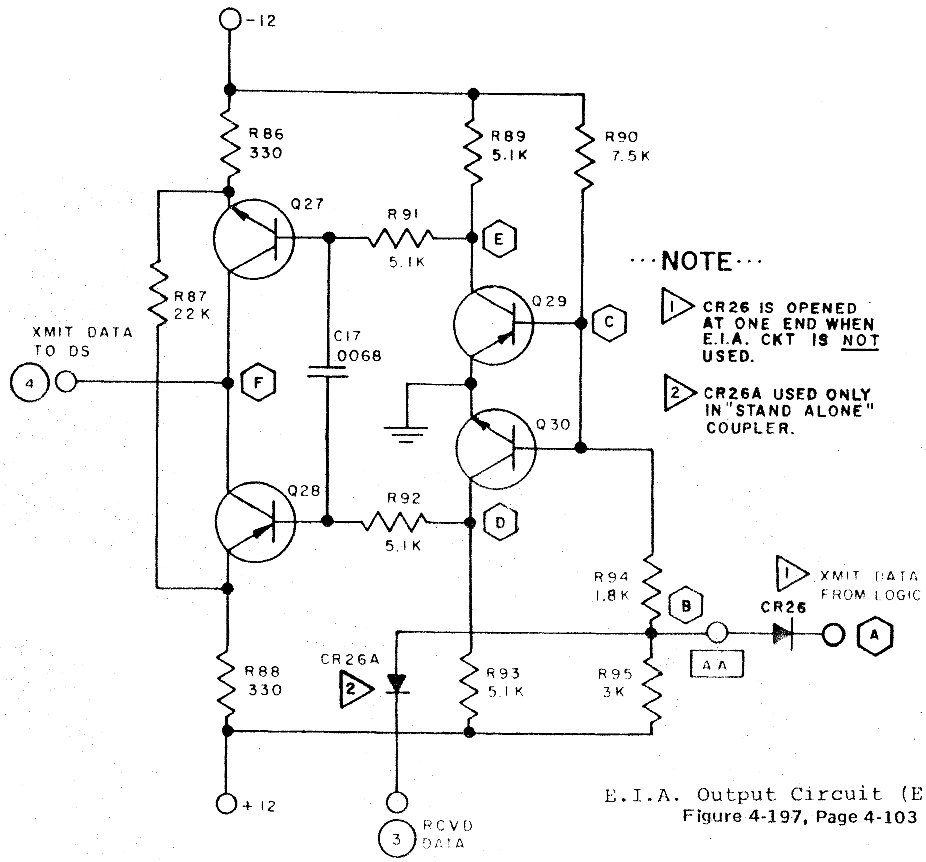


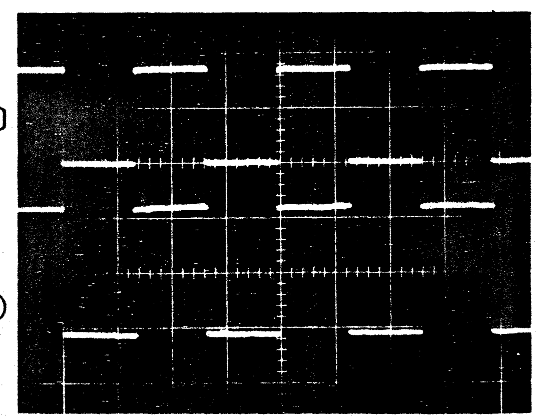
Figure 4-158 TP1/TP2 5ms/div @ .5V/div



E.I.A. Output Circuit (E.I.A. Out)
Figure 4-197, Page 4-103

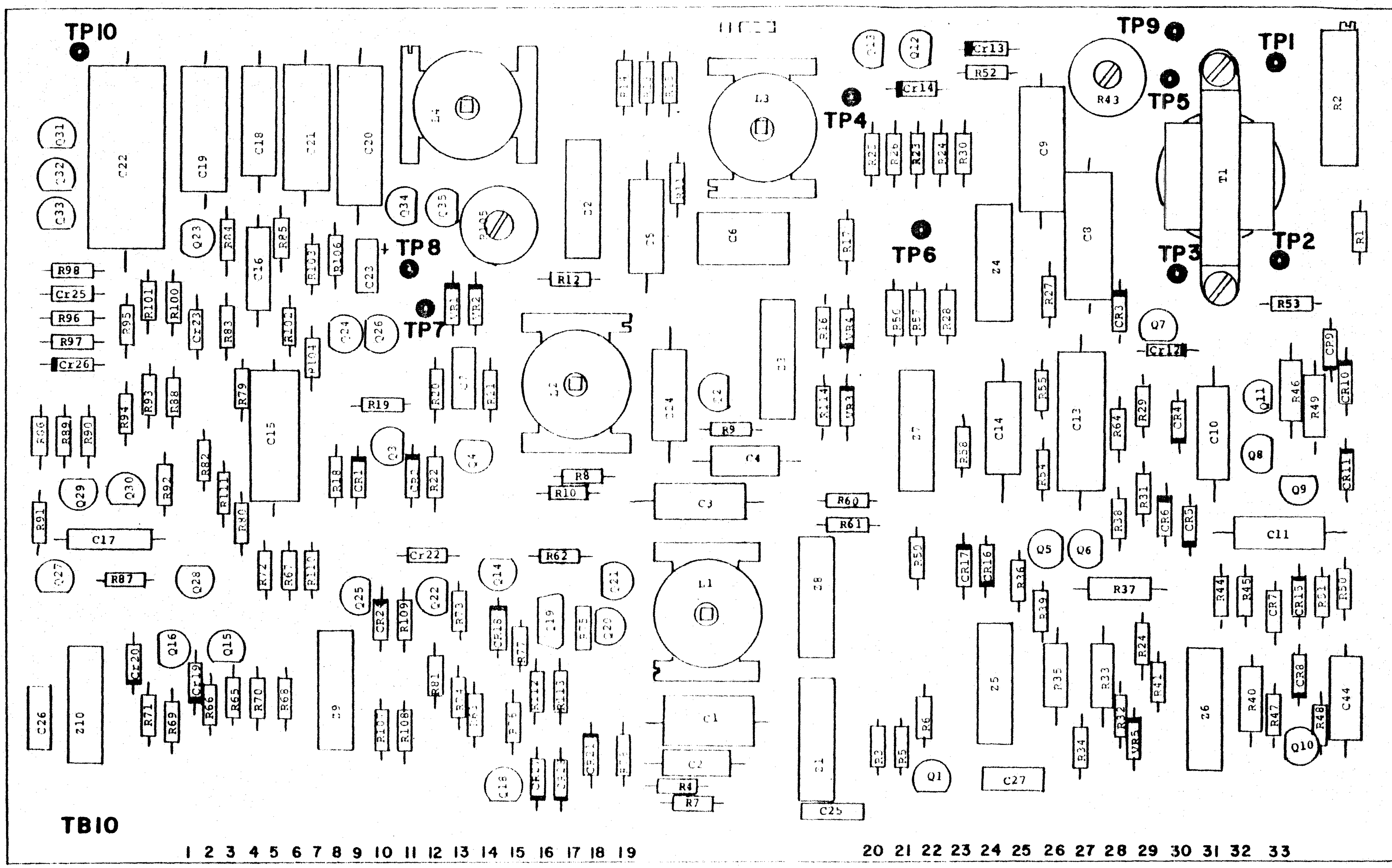
B

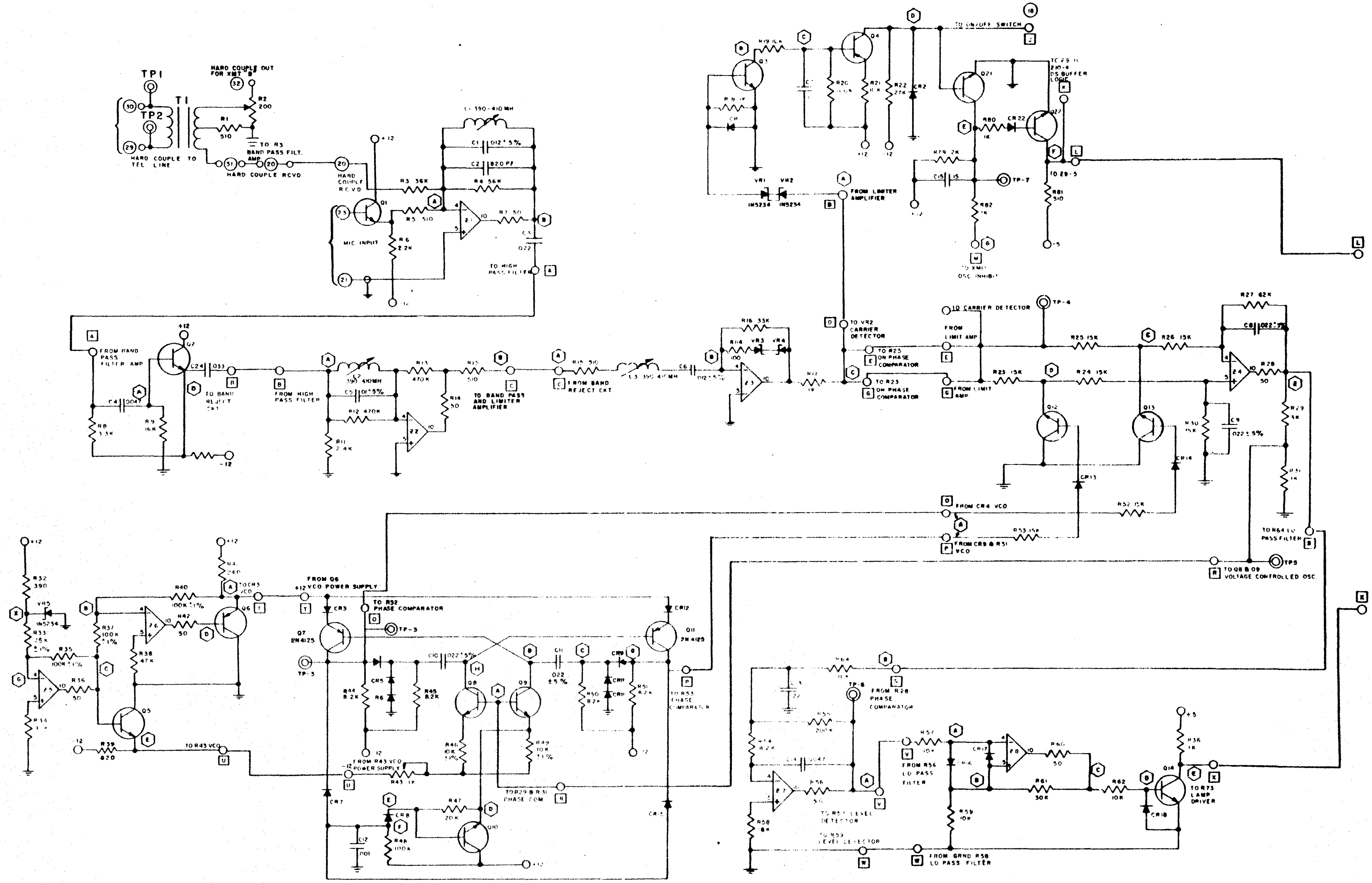
4

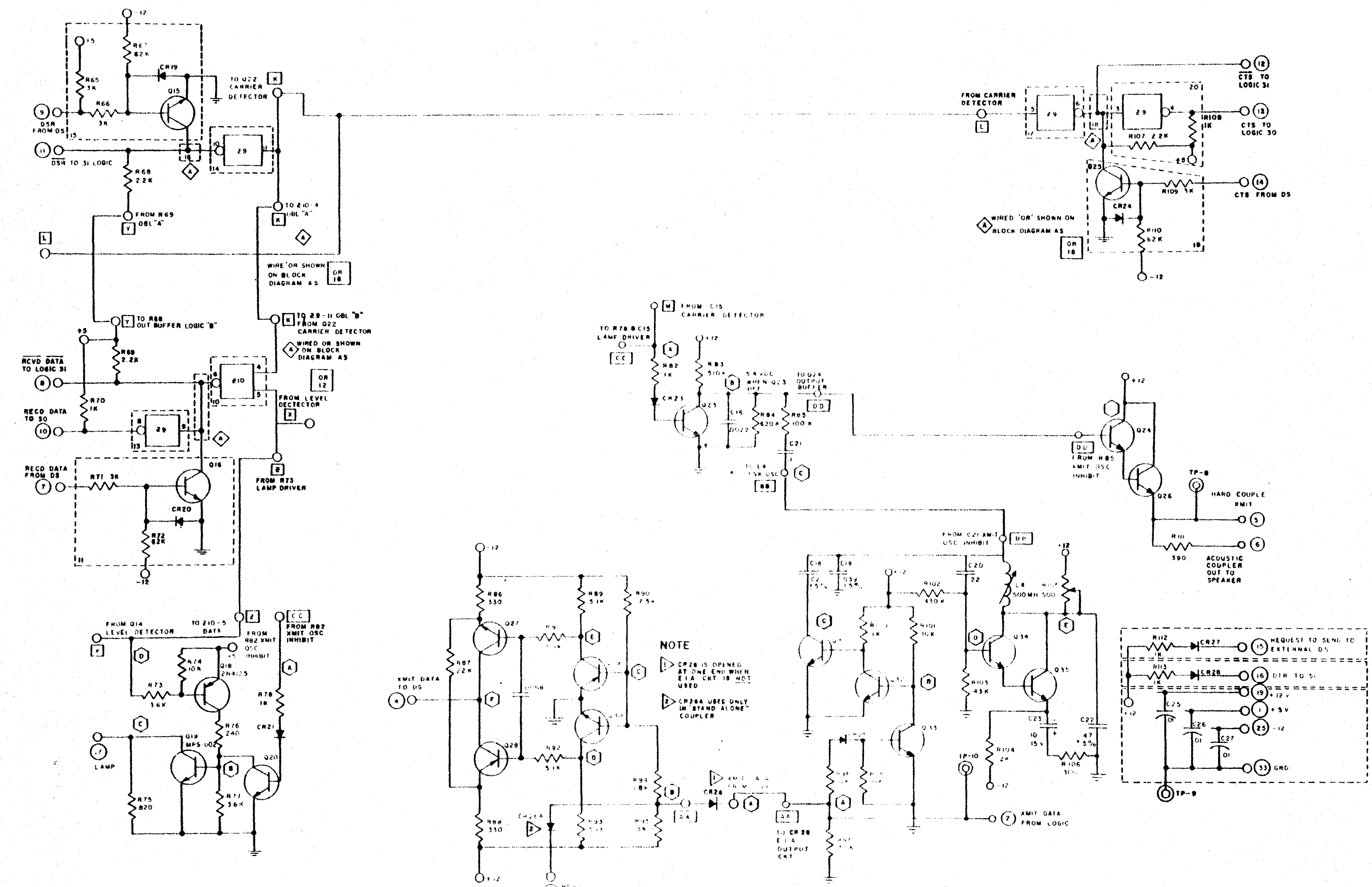


B 4 Figure 4-197 5ms/div @ 2V/div

5ms/div @ 2V/div

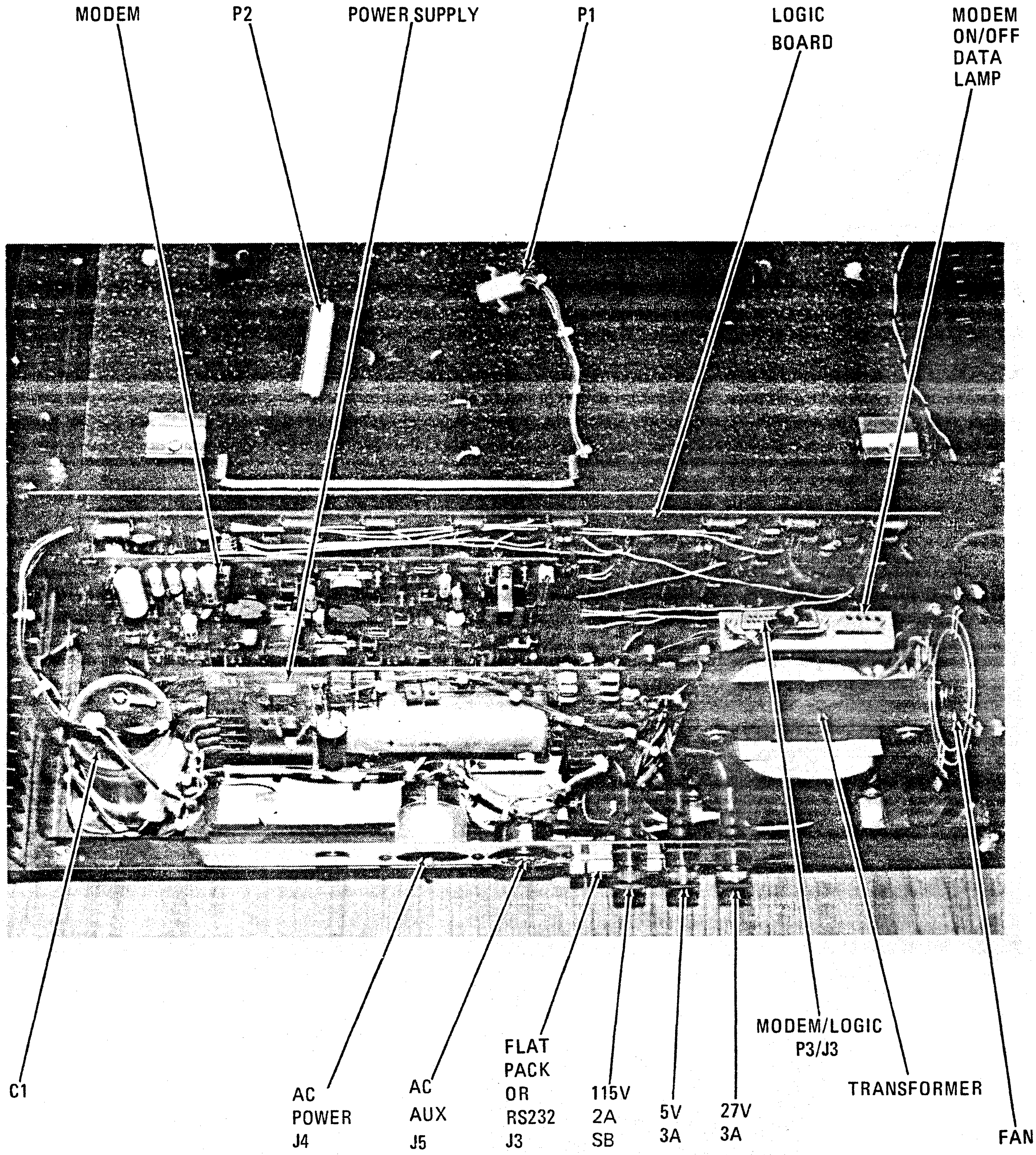

TP10
TP9
TP1
TP5
TP4
TP8
TP6
TP3
TP2
TP7
TB10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31 32 33

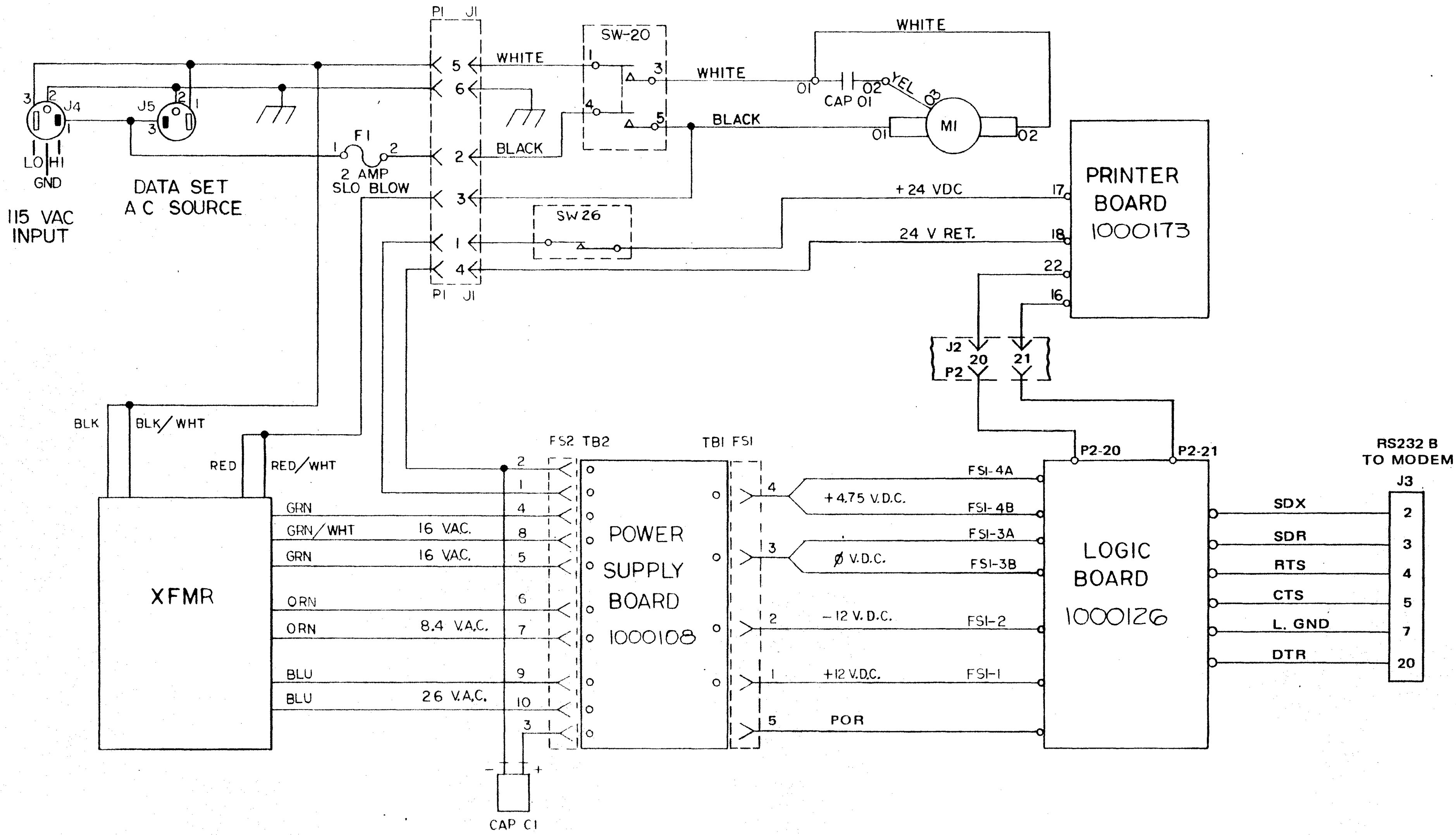

TP1
TP2
T1
HARD COUPLE OUT FOR XMT
HARD COUPLE TO TEL LINE
HARD COUPLE RCVD
TO R3 BAND PASS FILT. AMP
MIC INPUT
TO HIGH PASS FILTER
FROM BAND PASS FILTER AMP
TO BAND REJECT CKT
FROM HIGH PASS FILTER
TO BAND PASS AND LIMITER AMPLIFIER
FROM BAND REJECT CKT
FROM LIMITER AMPLIFIER
TO ON/OFF SWITCH
TO VR2 CARRIER DETECTOR
TO R25 ON PHASE COMPARATOR
TO R23 ON PHASE COMPARATOR
TO CARRIER DETECTOR
FROM LIMIT AMP
FROM CR4 VCO
FROM CR9 & R51 VCO
TO R64 LO PASS FILTER
TO Q8 & Q9 VOLTAGE CONTROLLED OSC
FROM Q6 +12 VCO POWER SUPPLY
TO R52 PHASE COMPARATOR
TO R43 VCO
FROM R43 VCO POWER SUPPLY
TO R53 PHASE COMPARATOR
FROM R28 PHASE COMPARATOR
FROM R56 LO PASS FILTER
TO R57 LEVEL DETECTOR
TO R53 LEVEL DETECTOR
FROM GRND R58 LO PASS FILTER
TO R73 LAMP DRIVER
TP-3
TP-4
TP-5
TP-6
TP-7


TO Q22 CARRIER DETECTOR
DSR FROM DS
DSR TO 31 LOGIC
FROM R69 OBL "A"
TO Z10-4 OBL "A"
WIRE 'OR' SHOWN ON BLOCK DIAGRAM A5
TO R68 OUT BUFFER LOGIC "B"
TO Z9-11 OBL "B" FROM Q22 CARRIER DETECTOR
WIRED OR SHOWN ON BLOCK DIAGRAM A5
RCVD DATA TO LOGIC 31
RECD DATA TO 30
FROM LEVEL DECTECTOR
RECD DATA FROM DS
FROM R73 LAMP DRIVER
FROM Q14 LEVEL DETECTOR
TO Z10-5 DATA
FROM R82 XMIT OSC INHIBIT
LAMP
XMIT DATA TO DS
NOTE
CR28 IS OPENED AT ONE END WHEN EIA CKT IS NOT USED
CR26A USED ONLY IN "STAND ALONE" COUPLER
FROM CARRIER DETECTOR
CTS TO LOGIC 31
CTS TO LOGIC 30
CTS FROM DS
WIRED 'OR' SHOWN ON BLOCK DIAGRAM A5
FROM C15 CARRIER DETECTOR
TO R78 & C15 LAMP DRIVER
TO Q24 OUTPUT BUFFER
FROM R85 XMIT OSC INHIBIT
HARD COUPLE XMIT
ACOUSTIC COUPLER OUT TO SPEAKER
FROM C21 XMIT OSC INHIBIT
REQUEST TO SEND TO EXTERNAL DS
DTR TO 51
GRD
TP-8
TP-9
TP-10
XMIT DATA FROM LOGIC
TO CR 28 EIA OUTPUT CKT

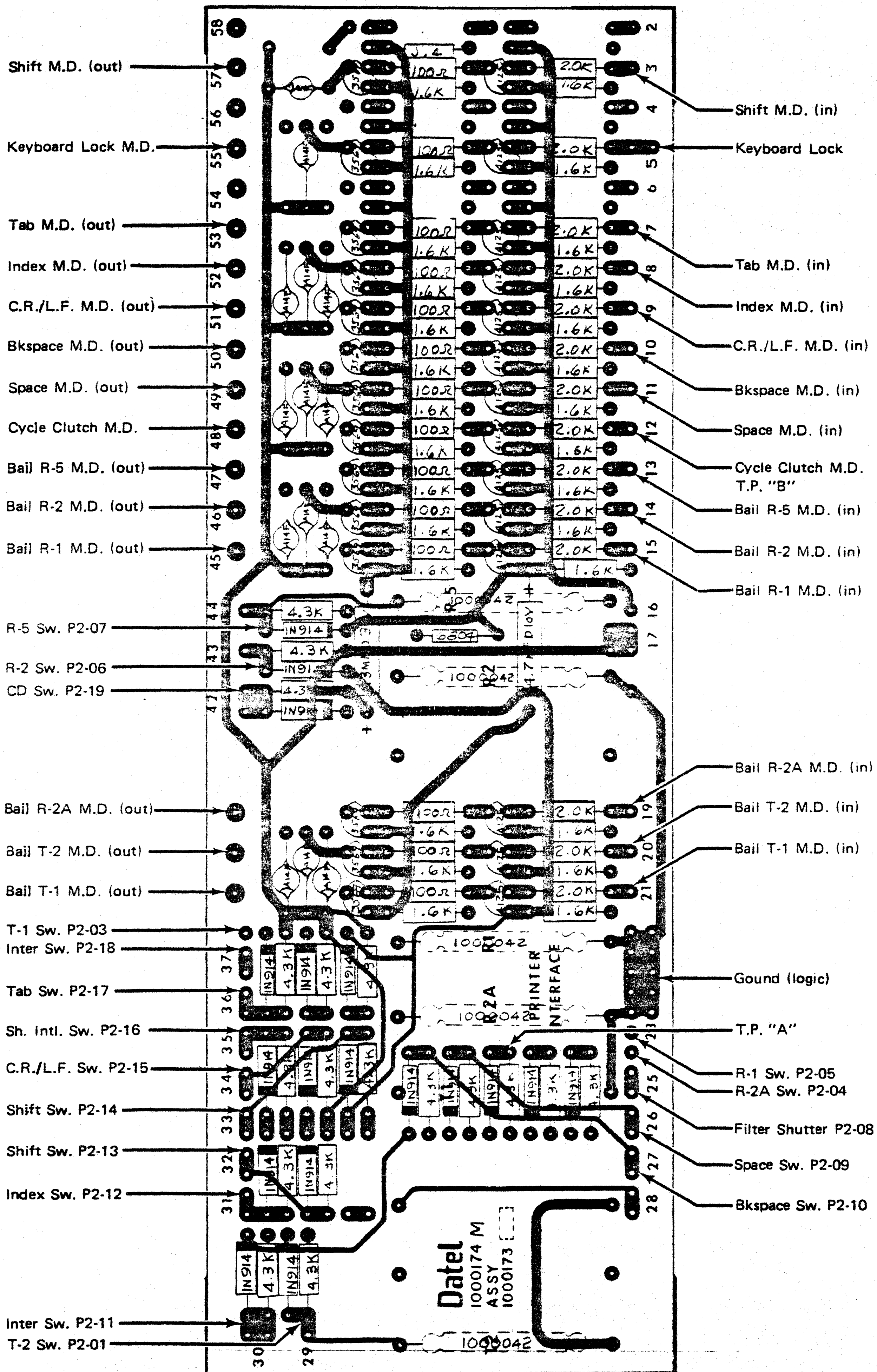
SECTION VI

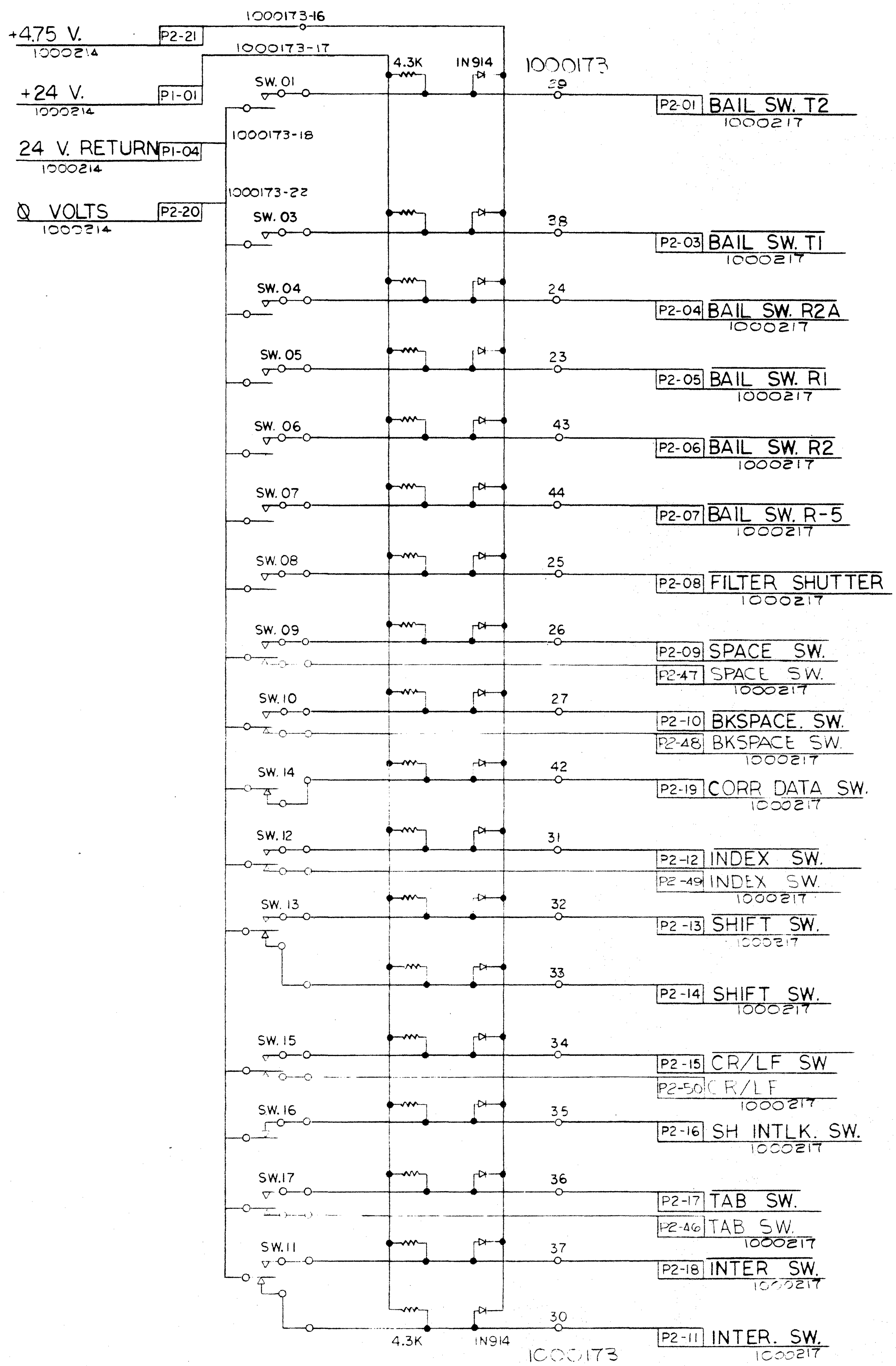
WIRING DIAGRAMS



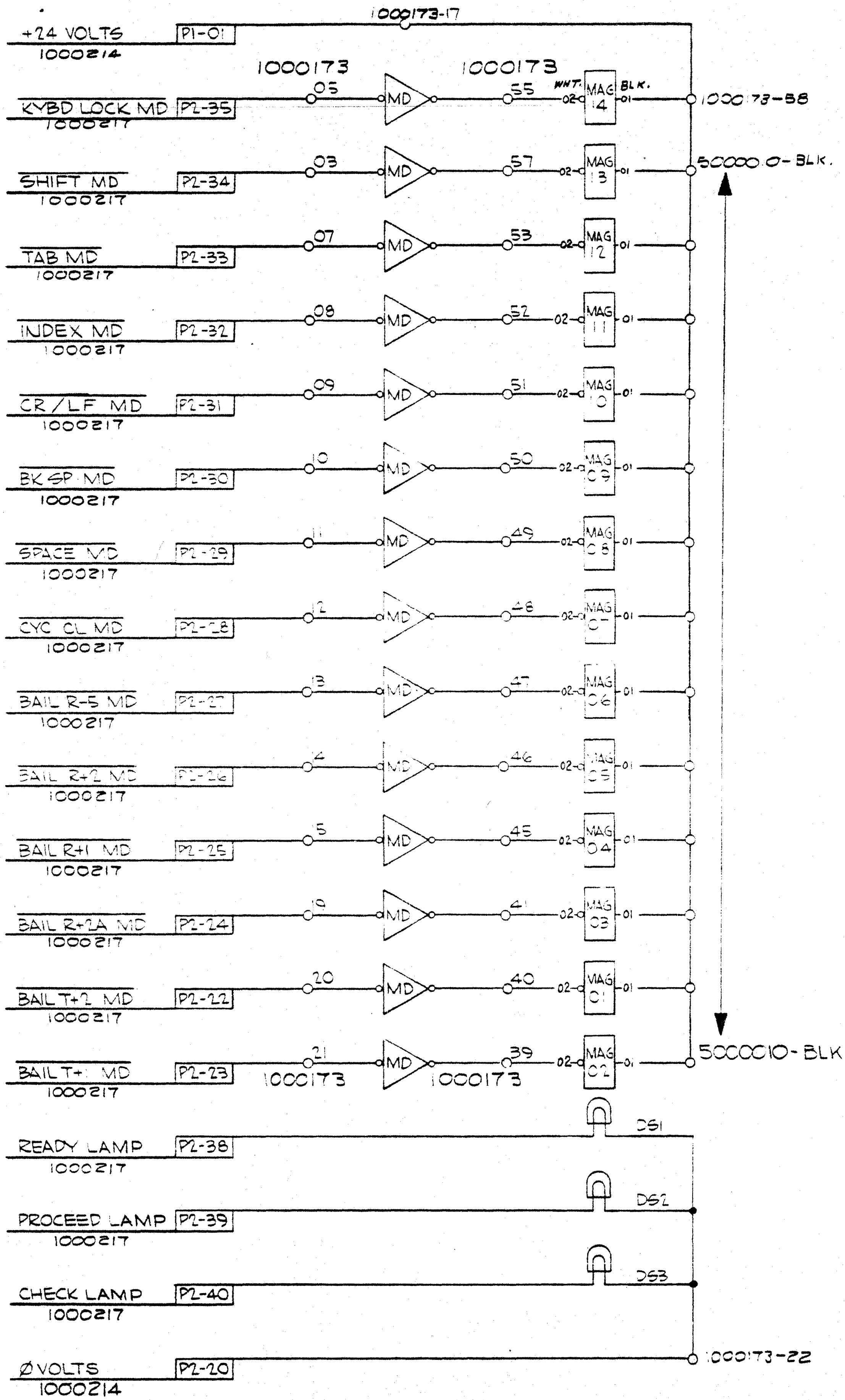


115 VAC INPUT
LO HI GND
J4
J5
DATA SET A C SOURCE
F1
2 AMP SLO BLOW
P1 J1
WHITE
BLACK
SW-20
SW 26
WHITE
BLACK
CAP 01
YEL
M1
+24 VDC
24 V RET.
PRINTER BOARD 1000173
J2
P2
P2-20
P2-21
BLK
BLK/WHT
RED
RED/WHT
XFMR
GRN
GRN/WHT
16 VAC.
GRN
16 VAC.
ORN
ORN
8.4 V.A.C.
BLU
BLU
26 V.A.C.
FS2 TB2
POWER SUPPLY BOARD 1000108
TB1 FS1
FS1-4A
+4.75 V.D.C.
FS1-4B
FS1-3A
Ø V.D.C.
FS1-3B
−12 V.D.C.
FS1-2
+12 V.D.C.
FS1-1
POR
LOGIC BOARD 1000126
RS232 B TO MODEM
J3
SDX
SDR
RTS
CTS
L. GND
DTR
CAP C1

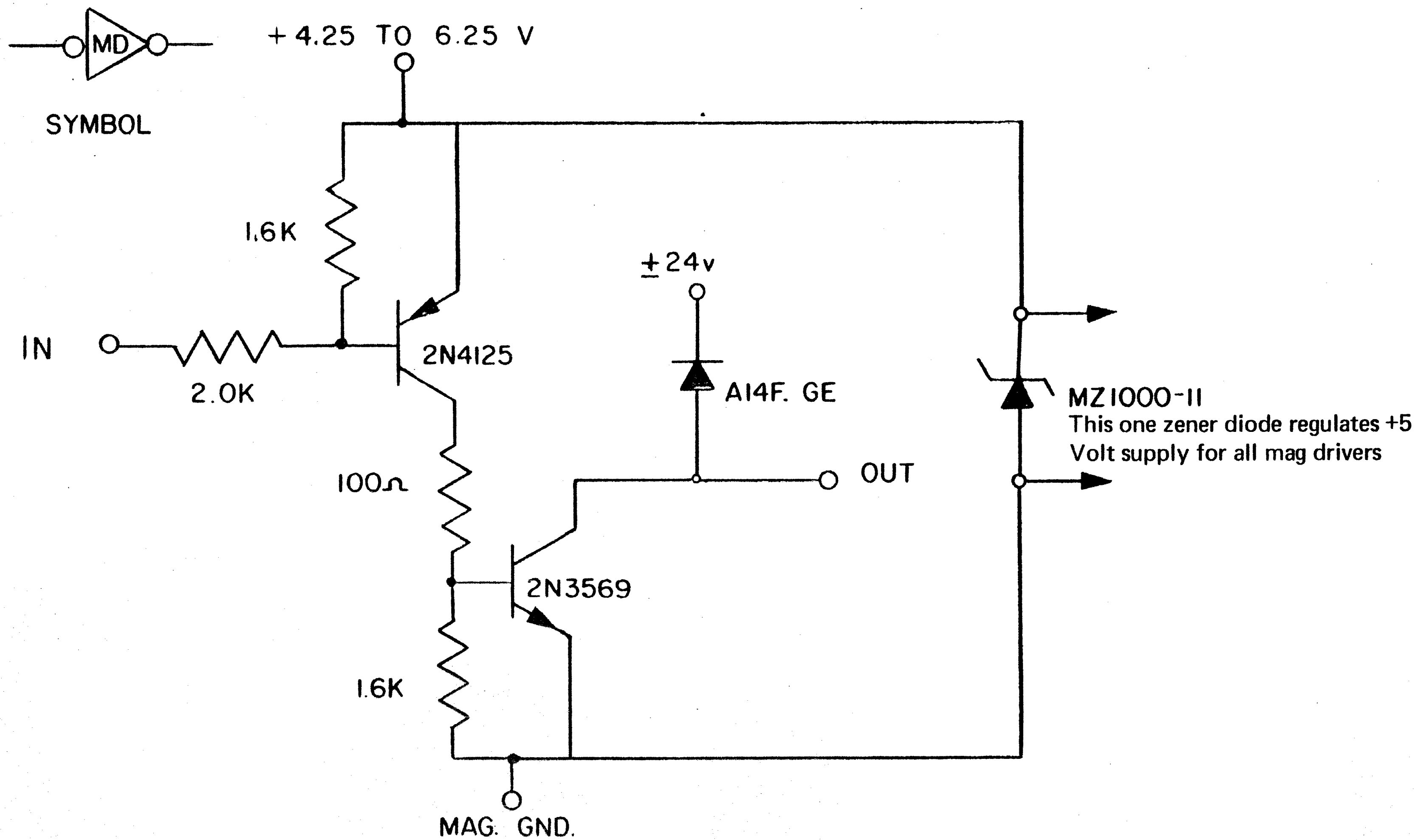

Shift M.D. (out)
Keyboard Lock M.D.
Tab M.D. (out)
Index M.D. (out)
C.R./L.F. M.D. (out)
Bkspace M.D. (out)
Space M.D. (out)
Cycle Clutch M.D.
Bail R-5 M.D. (out)
Bail R-2 M.D. (out)
Bail R-1 M.D. (out)
R-5 Sw. P2-07
R-2 Sw. P2-06
CD Sw. P2-19
Bail R-2A M.D. (out)
Bail T-2 M.D. (out)
Bail T-1 M.D. (out)
T-1 Sw. P2-03
Inter Sw. P2-18
Tab Sw. P2-17
Sh. Intl. Sw. P2-16
C.R./L.F. Sw. P2-15
Shift Sw. P2-14
Shift Sw. P2-13
Index Sw. P2-12
Inter Sw. P2-11
T-2 Sw. P2-01
Shift M.D. (in)
Keyboard Lock
Tab M.D. (in)
Index M.D. (in)
C.R./L.F. M.D. (in)
Bkspace M.D. (in)
Space M.D. (in)
Cycle Clutch M.D.
T.P. "B"
Bail R-5 M.D. (in)
Bail R-2 M.D. (in)
Bail R-1 M.D. (in)
Bail R-2A M.D. (in)
Bail T-2 M.D. (in)
Bail T-1 M.D. (in)
Gound (logic)
T.P. "A"
R-1 Sw. P2-05
R-2A Sw. P2-04
Filter Shutter P2-08
Space Sw. P2-09
Bkspace Sw. P2-10
PRINTER INTERFACE
Datel
1000174 M
ASSY
1000173



+4.75 V.
1000214
P2-21
1000173-16
1000173-17
+24 V.
1000214
P1-01
24 V. RETURN
1000214
P1-04
1000173-18
Ø VOLTS
1000214
P2-20
1000173-22
4.3K
IN914
1000173
SW. 01
39
P2-01 BAIL SW. T2
1000217
SW. 03
38
P2-03 BAIL SW. T1
1000217
SW. 04
24
P2-04 BAIL SW. R2A
1000217
SW. 05
23
P2-05 BAIL SW. R1
1000217
SW. 06
43
P2-06 BAIL SW. R2
1000217
SW. 07
44
P2-07 BAIL SW. R-5
1000217
SW. 08
25
P2-08 FILTER SHUTTER
1000217
SW. 09
26
P2-09 SPACE SW.
P2-47 SPACE SW.
1000217
SW. 10
27
P2-10 BKSPACE. SW.
P2-48 BKSPACE SW.
1000217
SW. 14
42
P2-19 CORR DATA SW.
1000217
SW. 12
31
P2-12 INDEX SW.
P2-49 INDEX SW.
1000217
SW. 13
32
P2-13 SHIFT SW.
1000217
33
P2-14 SHIFT SW.
1000217
SW. 15
34
P2-15 CR/LF SW
P2-50 CR/LF
1000217
SW. 16
35
P2-16 SH INTLK. SW.
1000217
SW. 17
36
P2-17 TAB SW.
P2-46 TAB SW.
1000217
SW. 11
37
P2-18 INTER SW.
1000217
30
P2-11 INTER. SW.
1000217
4.3K
IN914
1000173

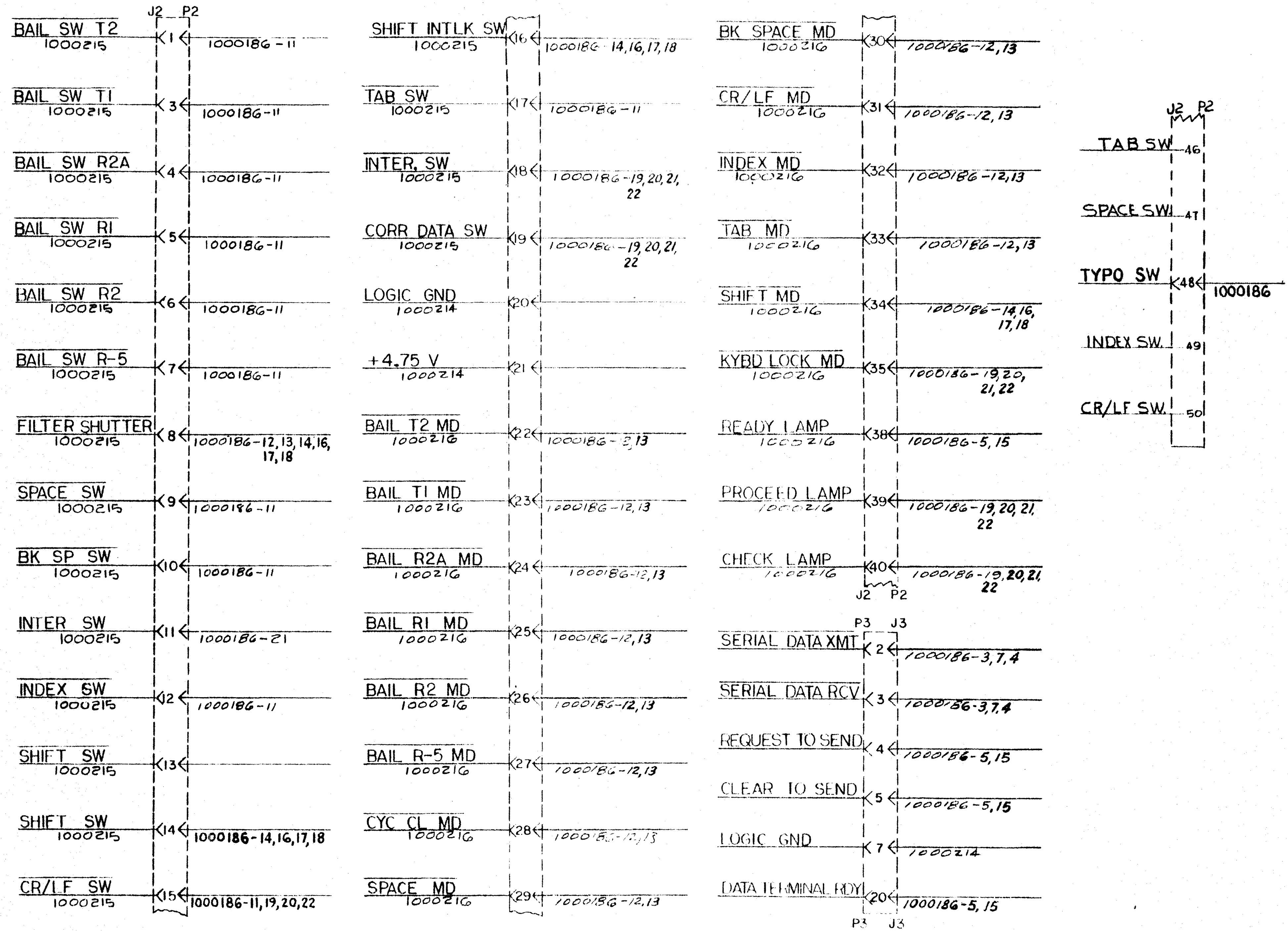


+24 VOLTS
1000214
P1-01
1000173-17
1000173
KYBD LOCK MD
1000217
P2-35
05
MD
55
WHT.
02
MAG 14
BLK.
01
1000173-58
SHIFT MD
1000217
P2-34
03
57
MAG 13
500000-BLK.
TAB MD
1000217
P2-33
07
53
MAG 12
INDEX MD
1000217
P2-32
08
52
MAG 11
CR/LF MD
1000217
P2-31
09
51
MAG 10
BK SP MD
1000217
P2-30
10
50
MAG 09
SPACE MD
1000217
P2-29
11
49
MAG 08
CYC CL MD
1000217
P2-28
12
48
MAG 07
BAIL R-5 MD
1000217
P2-27
13
47
MAG 06
BAIL R+2 MD
1000217
P2-26
14
46
MAG 05
BAIL R+1 MD
1000217
P2-25
15
45
MAG 04
BAIL R+2A MD
1000217
P2-24
19
41
MAG 03
BAIL T+2 MD
1000217
P2-22
20
40
MAG 01
BAIL T+1 MD
1000217
P2-23
21
39
MAG 02
500010-BLK
READY LAMP
1000217
P2-38
DS1
PROCEED LAMP
1000217
P2-39
DS2
CHECK LAMP
1000217
P2-40
DS3
Ø VOLTS
1000214
P2-20
1000173-22

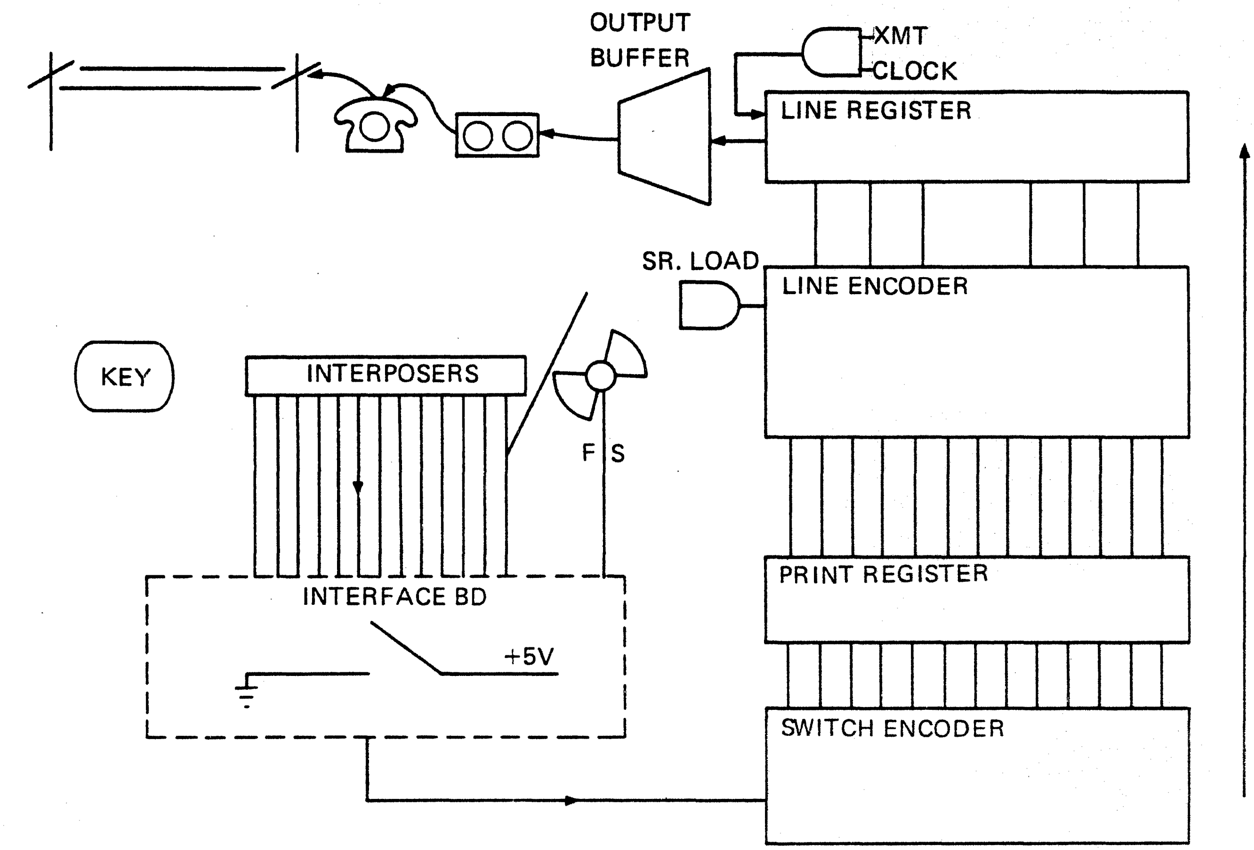


NOTES
1. ALL RESISTORS 1/4 WATT ±5% CARBON
2. EACH INPUT REPRESENTS 1 UNIT OF LOAD =1.8 MA @ 25° C V_{CC} = 4.5v
3. OUTPUT WILL DRIVE 1 SOLENOID AT 500 MA., 24v ± 2v

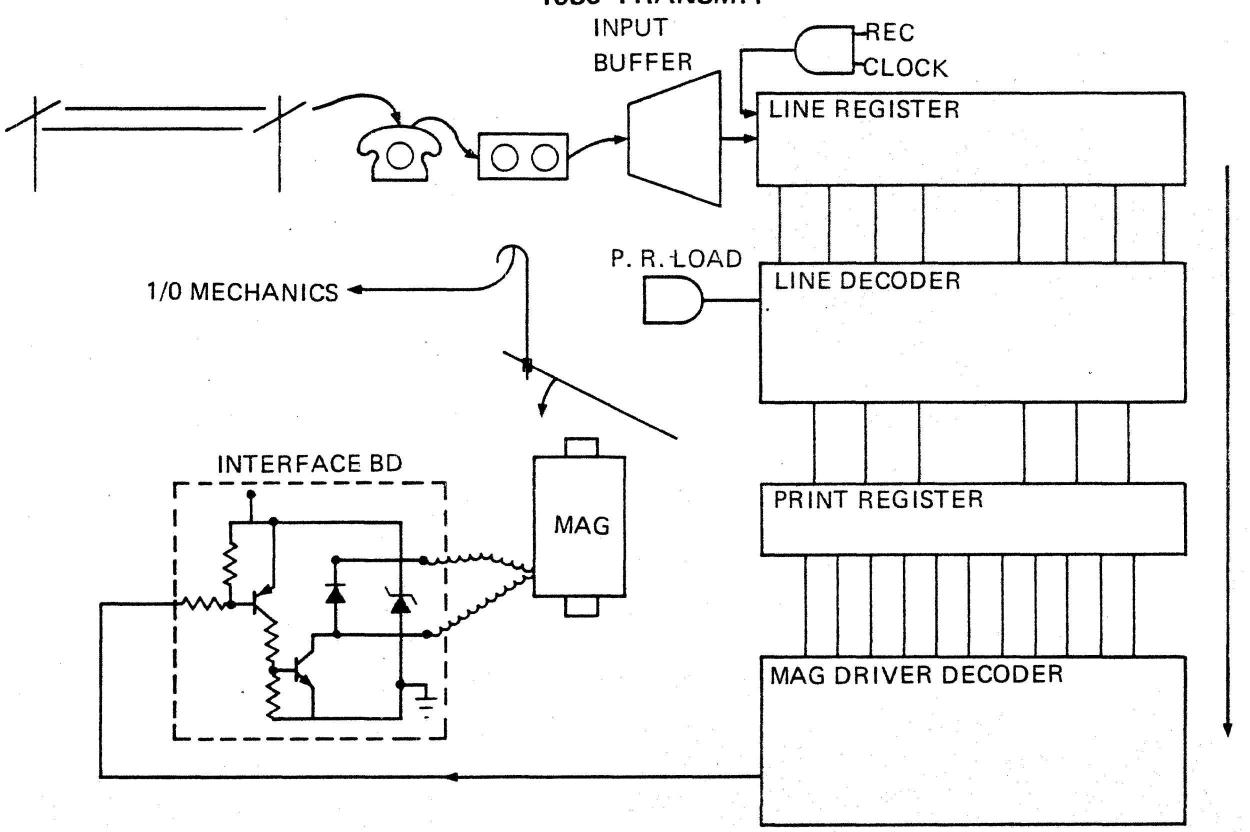
MAGNET DRIVER



J2 P2
BAIL SW T2 1000215 1 1000186-11
BAIL SW T1 1000215 3 1000186-11
BAIL SW R2A 1000215 4 1000186-11
BAIL SW R1 1000215 5 1000186-11
BAIL SW R2 1000215 6 1000186-11
BAIL SW R-5 1000215 7 1000186-11
FILTER SHUTTER 1000215 8 1000186-12,13,14,16, 17,18
SPACE SW 1000215 9 1000186-11
BK SP SW 1000215 10 1000186-11
INTER SW 1000215 11 1000186-21
INDEX SW 1000215 12 1000186-11
SHIFT SW 1000215 13
SHIFT SW 1000215 14 1000186-14,16,17,18
CR/LF SW 1000215 15 1000186-11,19,20,22
SHIFT INTLK SW 1000215 16 1000186-14,16,17,18
TAB SW 1000215 17 1000186-11
INTER. SW 1000215 18 1000186-19,20,21, 22
CORR DATA SW 1000215 19 1000186-19,20,21, 22
LOGIC GND 1000214 20
+4.75 V 1000214 21
BAIL T2 MD 1000216 22 1000186-12,13
BAIL T1 MD 1000216 23 1000186-12,13
BAIL R2A MD 1000216 24 1000186-12,13
BAIL R1 MD 1000216 25 1000186-12,13
BAIL R2 MD 1000216 26 1000186-12,13
BAIL R-5 MD 1000216 27 1000186-12,13
CYC CL MD 1000216 28 1000186-12,13
SPACE MD 1000216 29 1000186-12,13
BK SPACE MD 1000216 30 1000186-12,13
CR/LF MD 1000216 31 1000186-12,13
INDEX MD 1000216 32 1000186-12,13
TAB MD 1000216 33 1000186-12,13
SHIFT MD 1000216 34 1000186-14,16, 17,18
KYBD LOCK MD 1000216 35 1000186-19,20, 21,22
READY LAMP 1000216 38 1000186-5,15
PROCEED LAMP 1000216 39 1000186-19,20,21, 22
CHECK LAMP 1000216 40 1000186-19,20,21, 22
J2 P2
P3 J3
SERIAL DATA XMT 2 1000186-3,7,4
SERIAL DATA RCV 3 1000186-3,7,4
REQUEST TO SEND 4 1000186-5,15
CLEAR TO SEND 5 1000186-5,15
LOGIC GND 7 1000214
DATA TERMINAL RDY 20 1000186-5,15
P3 J3
J2 P2
TAB SW 46
SPACE SW 47
TYPO SW 48 1000186
INDEX SW 49
CR/LF SW 50



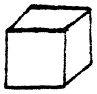
1030 TRANSMIT



1030 RECEIVE

1030

TRANSMIT

↓  Key

↓ Filter Shutter & Bail Switch or Operational Switch

↑ S. P. P. D.

↓ Reg. Reset (print reg.) ↑ Output Clock

↓ Output Clock (end of) ↑ KYBD RDY ↑ Start Time

↑ Cycle

↓ S R Reset ↓ S R Load

↑ Osc. Gate

↑ F D Reset ↑ S R Reset

↑ Clock ↓ Start Time ↓ KYBD RDY ↑ S R Load

↓ Shift (until line reg. is empty) = SDX
(when check bit is in start ff check parity)

↑ S R Empty

↓ Cycle

END

NOTE:

USE IN CONJUNCTION WITH PARAGRAPH 4-50.

RECEIVE

↑ S. D. R.

↑ Start Time ↑ Cycle ↑ Osc. Gate

↑ Clock ↓ Shift (until line reg. is full)

↓ Start Time (after first shift pulse)

↑ Shift ↓ Cycle ↓ Osc. Gate ↑ REC RDY
(check parity, if hi=even, light lamp)

↓ Reg. Reset (pr reg) ↑ Output Clock

↓ Print Reg. Load

→ Line Decoder

→ Print Reg.

→ Mag. Dr. Decoder

↑ Output Clock ↓ Print+Space

↓ Cycle Clutch Mag. Dr.

↓ Output Clock ↑ Bail Mag. Dr. Enable

↓ Bail Mag. Dr.

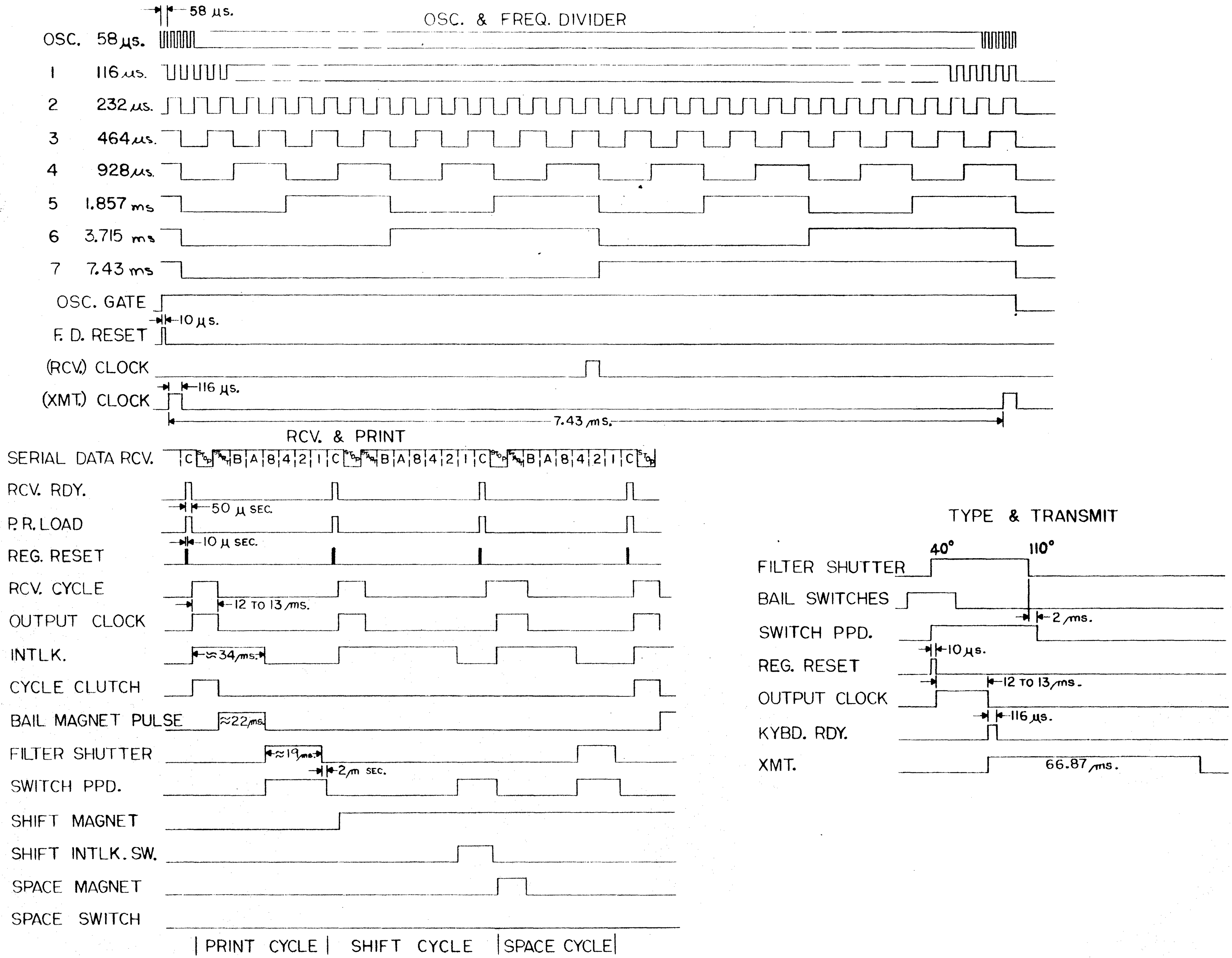
↓ Filter Shutter ↓ Bail Latch

↓ Bail Mag. Dr. Enable

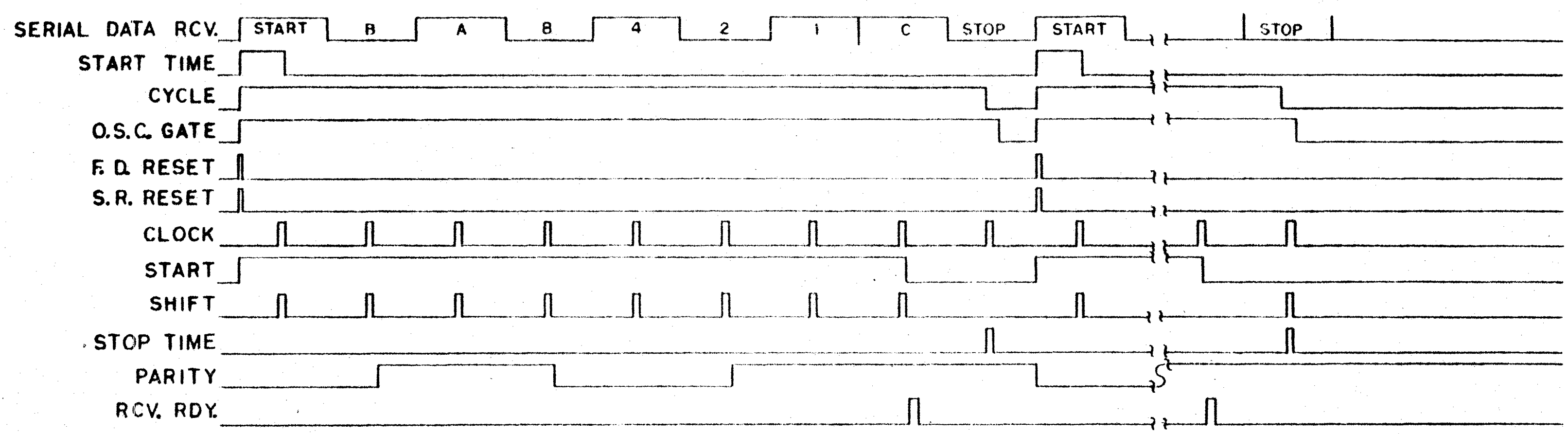
↓ S. P. P. D.

↑ Interlock Latch (reset)

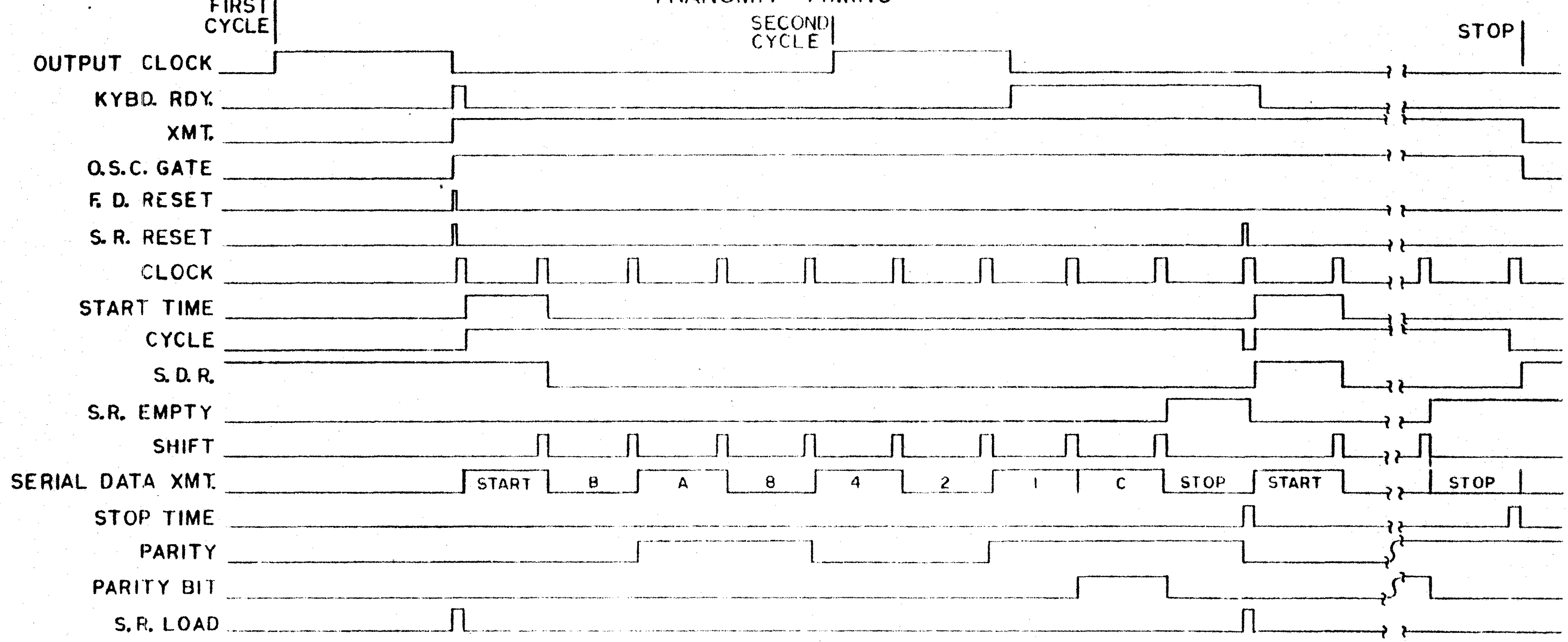
END

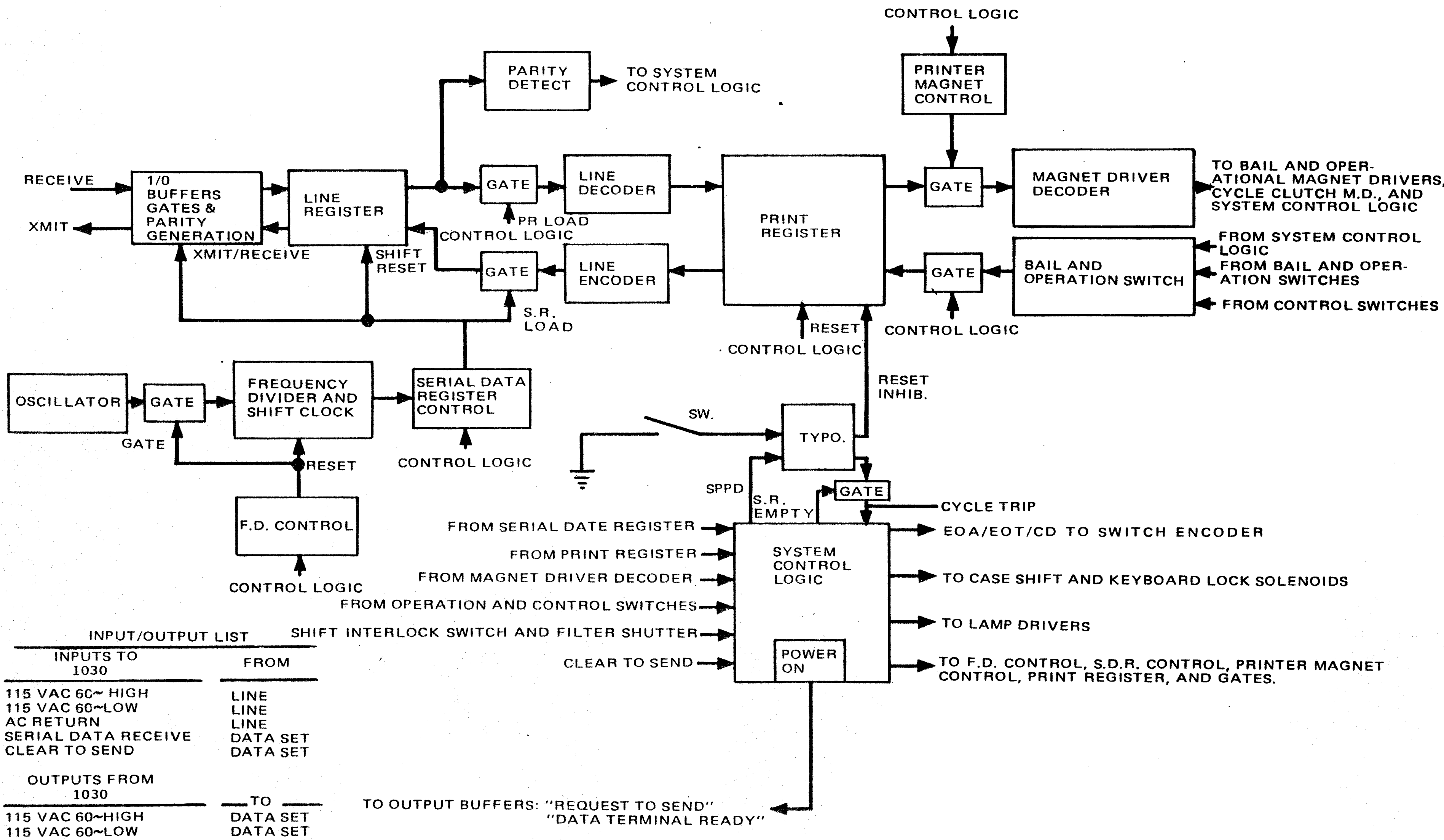

OSC. & FREQ. DIVIDER
58 µs.
OSC. 58 µs.
1 116 µs.
2 232 µs.
3 464 µs.
4 928 µs.
5 1.857 ms
6 3.715 ms
7 7.43 ms
OSC. GATE
10 µs.
F. D. RESET
(RCV.) CLOCK
116 µs.
(XMT.) CLOCK
7.43 ms.
RCV. & PRINT
SERIAL DATA RCV.
C B A 8 4 2 1 C B A 8 4 2 1 C B A 8 4 2 1 C
RCV. RDY.
50 µ SEC.
P. R. LOAD
10 µ SEC.
REG. RESET
RCV. CYCLE
12 TO 13 ms.
OUTPUT CLOCK
INTLK.
≈34 ms.
CYCLE CLUTCH
BAIL MAGNET PULSE
≈22 ms.
FILTER SHUTTER
≈19 ms.
2 m SEC.
SWITCH PPD.
SHIFT MAGNET
SHIFT INTLK. SW.
SPACE MAGNET
SPACE SWITCH
PRINT CYCLE
SHIFT CYCLE
SPACE CYCLE
TYPE & TRANSMIT
40°
110°
FILTER SHUTTER
BAIL SWITCHES
2 ms.
SWITCH PPD.
10 µs.
REG. RESET
12 TO 13 ms.
OUTPUT CLOCK
116 µs.
KYBD. RDY.
XMT.
66.87 ms.

RECEIVING TIMING



TRANSMIT TIMING





INPUT/OUTPUT LIST

INPUTS TO 1030	FROM
115 VAC 60~ HIGH	LINE
115 VAC 60~LOW	LINE
AC RETURN	LINE
SERIAL DATA RECEIVE	DATA SET
CLEAR TO SEND	DATA SET

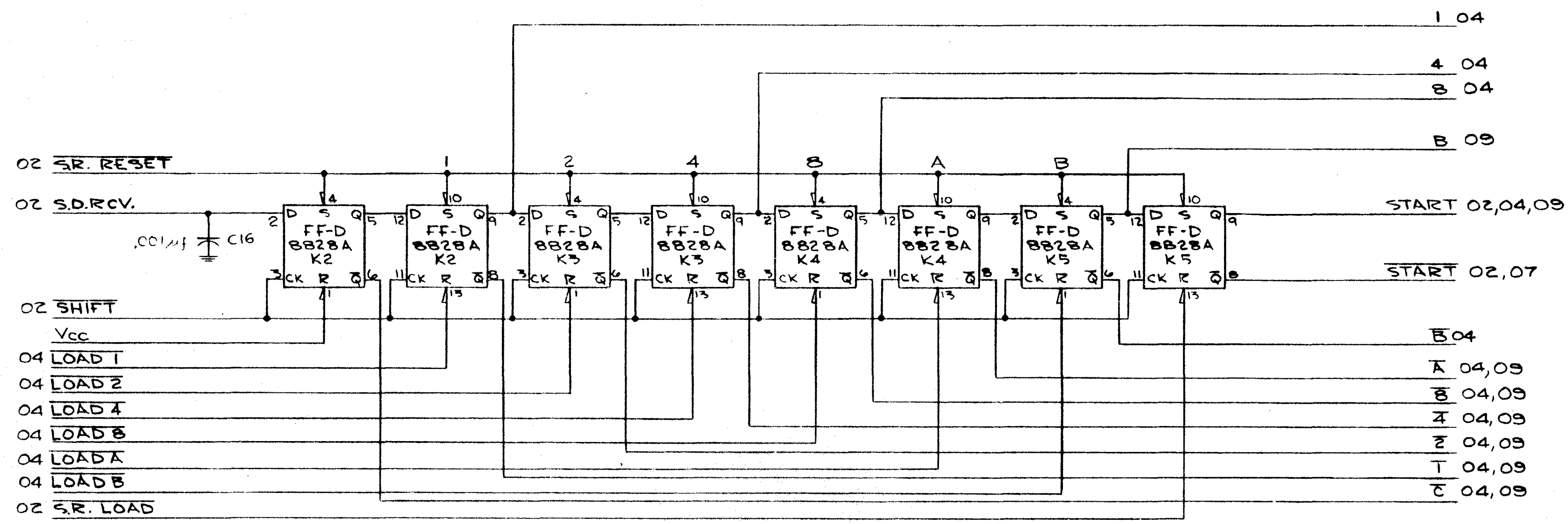
OUTPUTS FROM 1030	TO
115 VAC 60~HIGH	DATA SET
115 VAC 60~LOW	DATA SET
AC RETURN	DATA SET
SERIAL DATA TRANSMIT	DATA SET
REQUEST TO SEND	DATA SET
DATA TERMINAL READY	DATA SET
LOGIC GROUND	DATA SET

FUNCTIONAL BLOCK DIAGRAM AND INPUT/OUTPUT LIST

D C B A

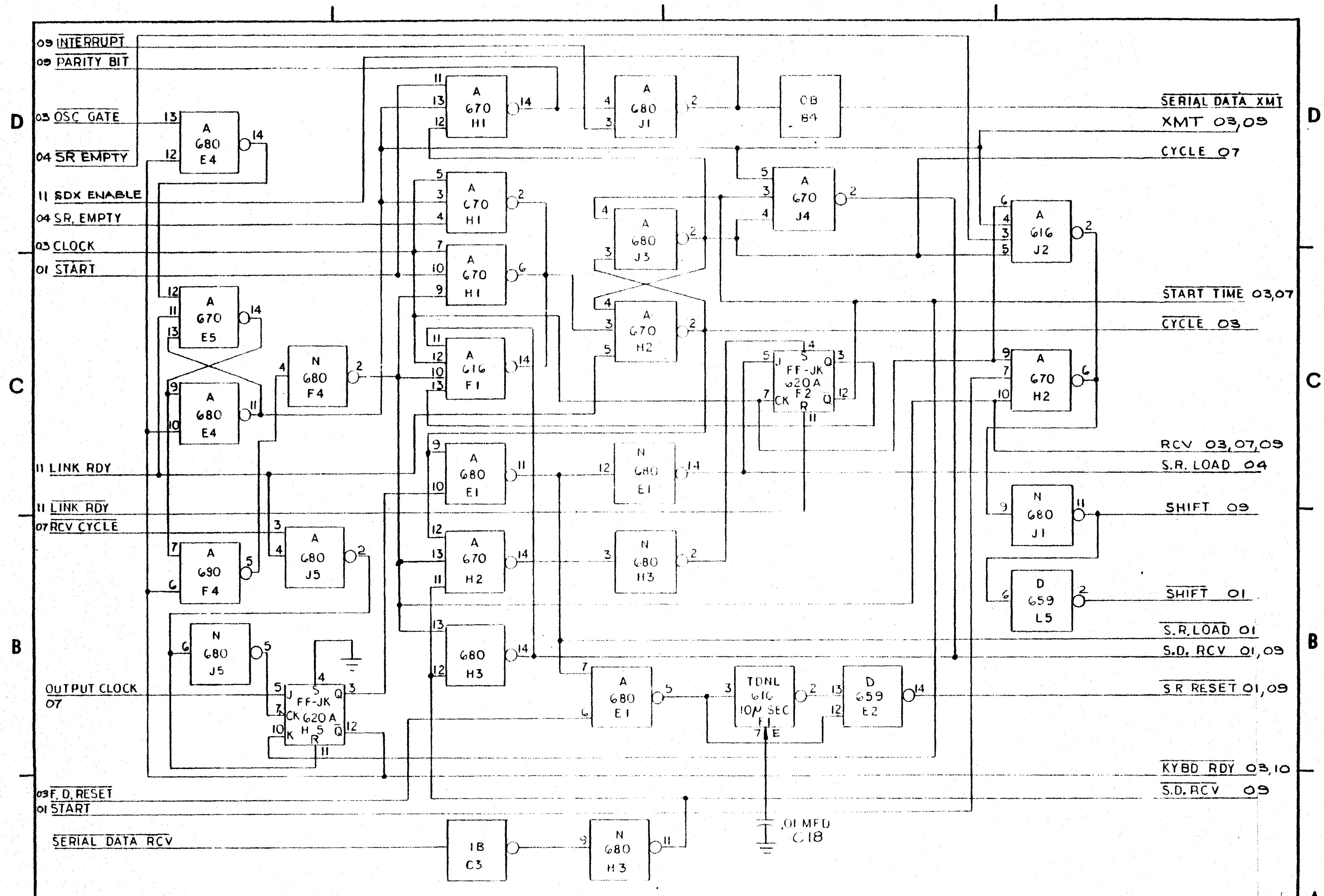
SHEET	TITLE	LATEST REV.
1	LINE REGISTER	M
2	LINE REGISTER CONTROL	M
3	LINE CLOCK	M
4	LINE ENCODER AND DECODER	M
5	SWITCH ENCODER AND PRINT REGISTER	M
6	MAGNET DRIVER DECODER	R
7	PRINT REGISTER CONTROL	M
8	CASE SHIFT CONTROL	M
9	ERROR DETECTION	Q
10	TERMINAL MODE CONTROL	T
11	TERMINAL MODE CONTROL	U
12	DISCRETE LOGIC	N
13	DISCRETE LOGIC	M
14	LOGIC FORMAT	M

SHEET 0



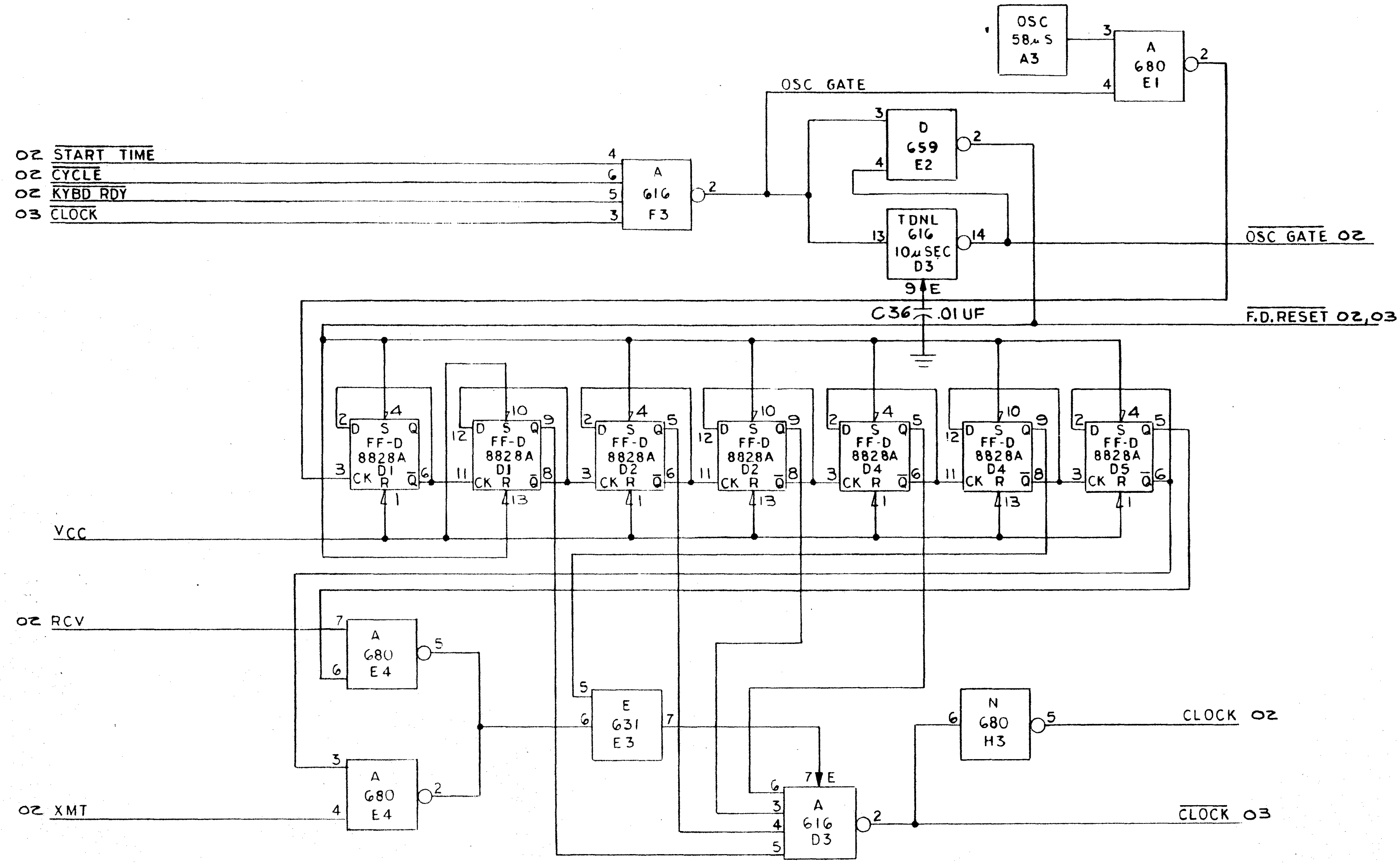
LINE REGISTER

SHEET 1



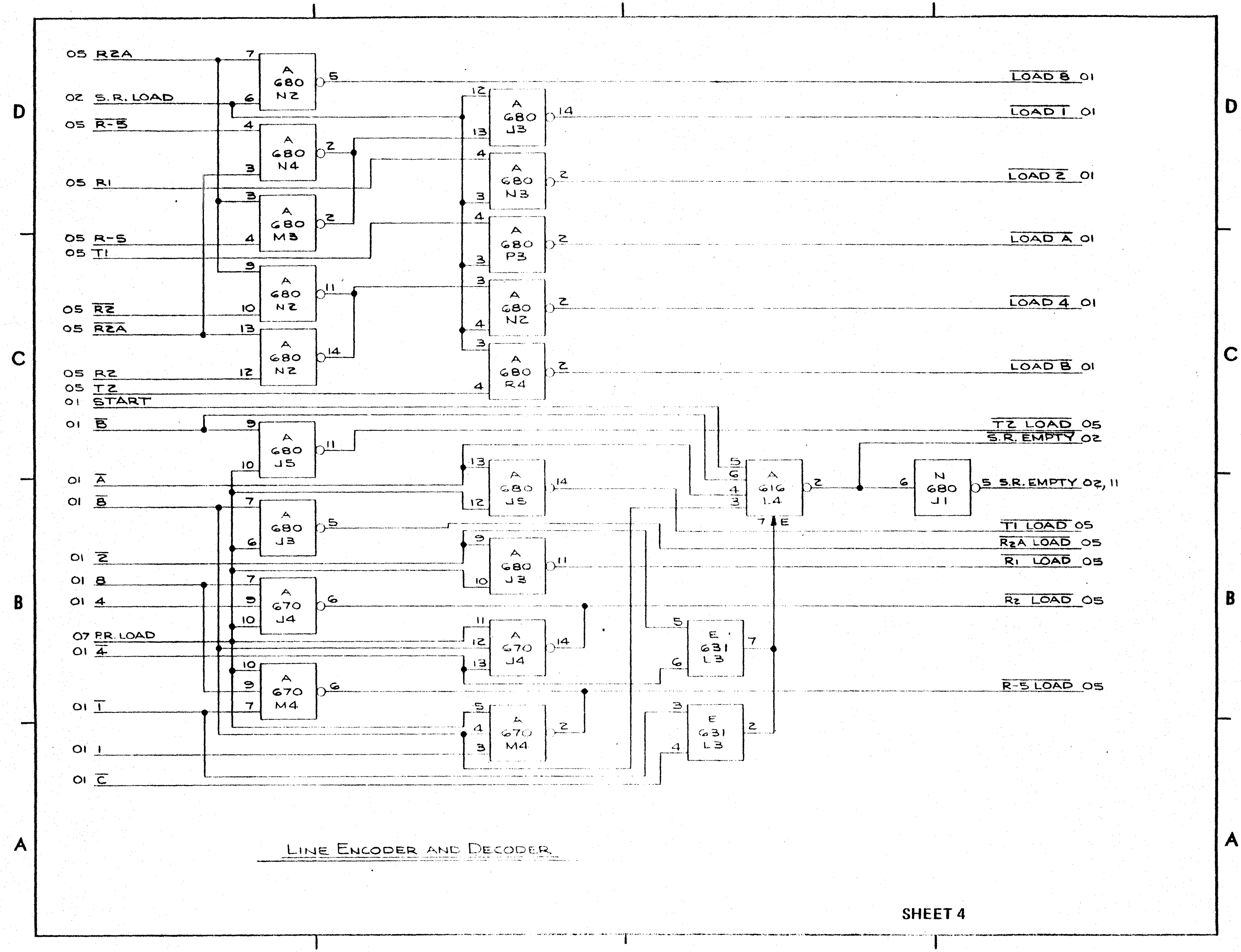
LINE REGISTER CONTROL

SHEET 2



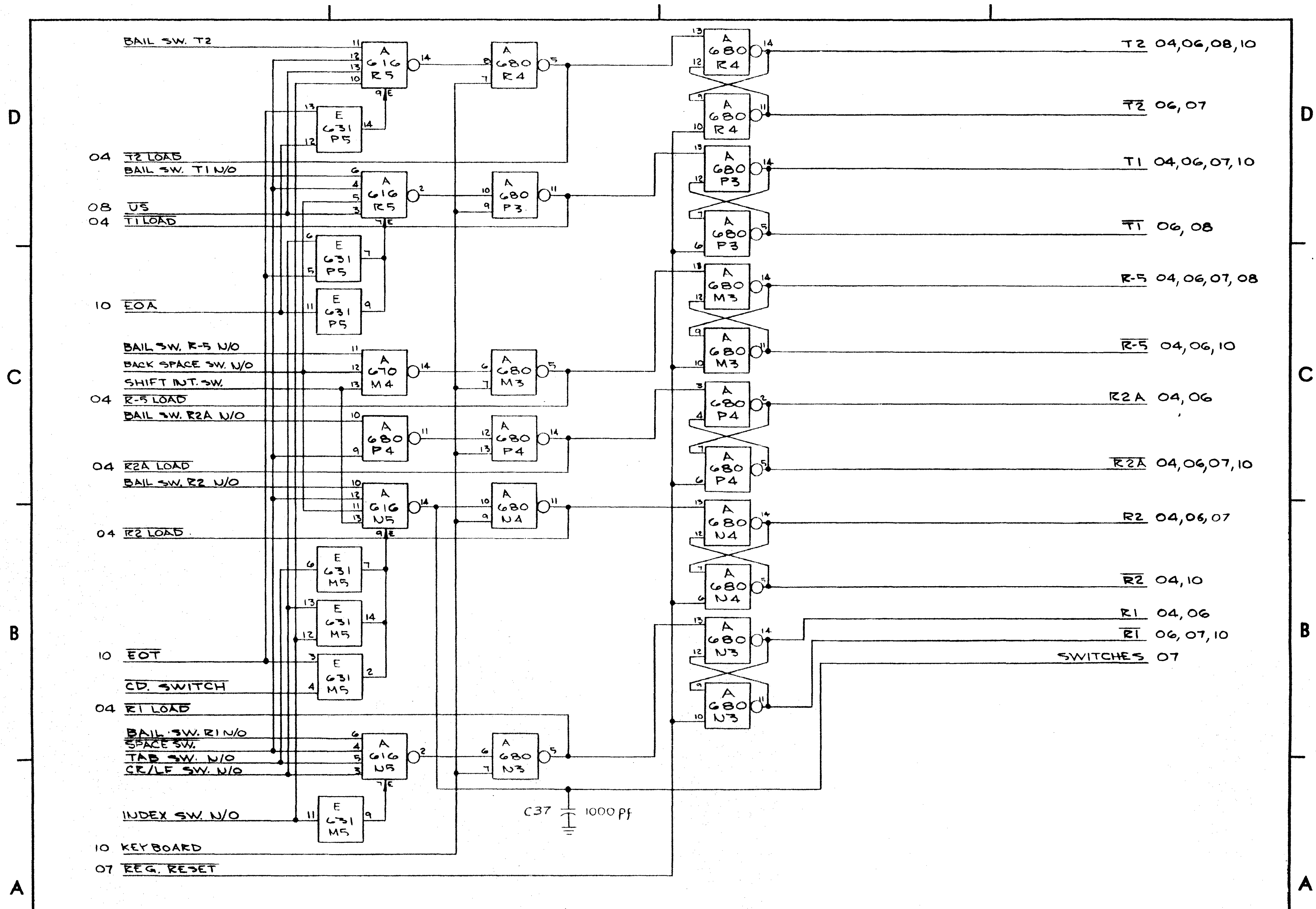
LINE CLOCK

SHEET 3



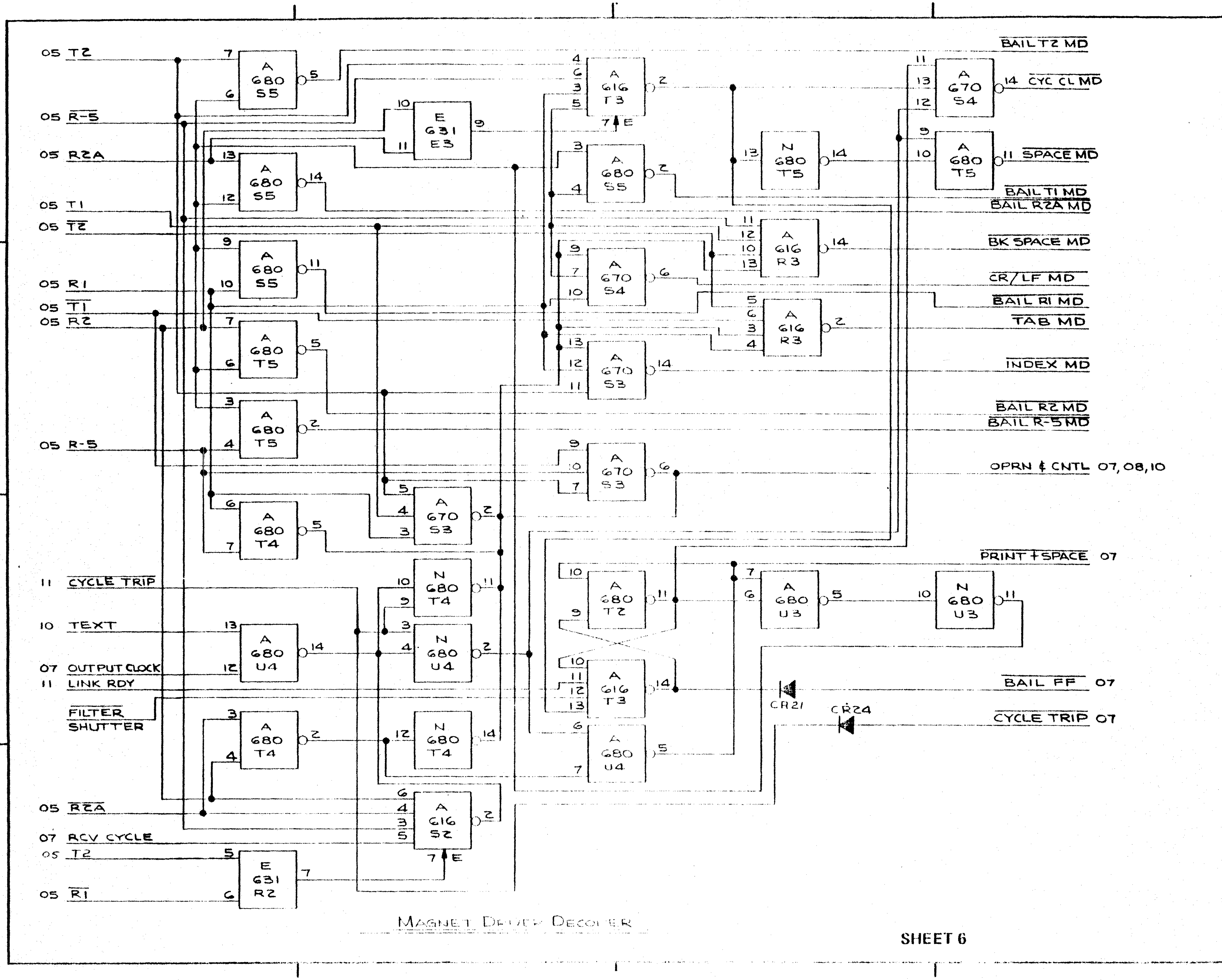
LINE ENCODER AND DECODER

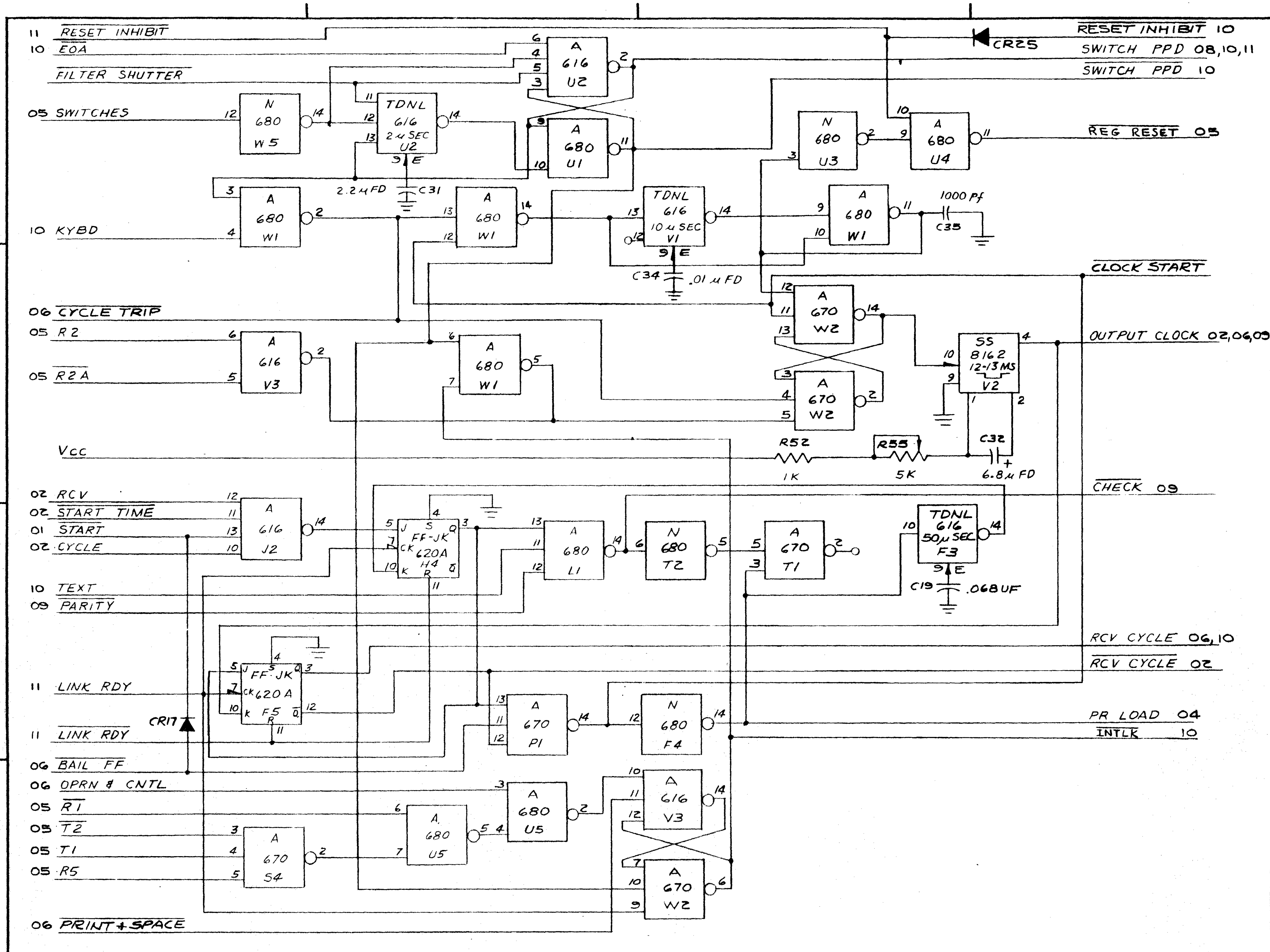
SHEET 4



SWITCH ENCODER AND PRINT REGISTER

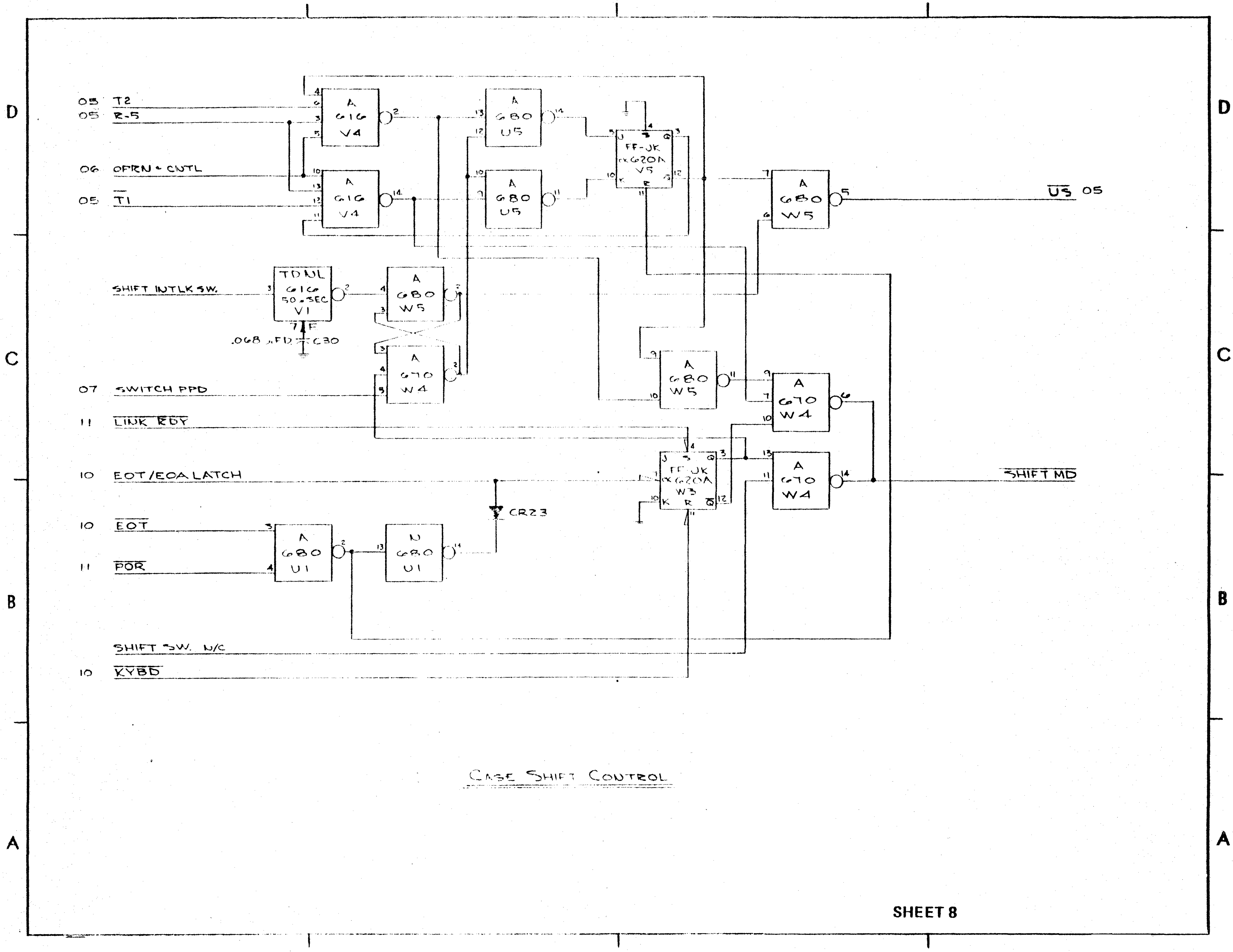
SHEET 5


05 T2
05 R-5
05 R2A
05 T1
05 T2
05 R1
05 T1
05 R2
05 R-5
11 CYCLE TRIP
10 TEXT
07 OUTPUT CLOCK
11 LINK RDY
FILTER SHUTTER
05 R2A
07 RCV CYCLE
05 T2
05 R1
BAIL T2 MD
CYC CL MD
SPACE MD
BAIL T1 MD
BAIL R2A MD
BK SPACE MD
CR/LF MD
BAIL R1 MD
TAB MD
INDEX MD
BAIL R2 MD
BAIL R-5 MD
OPRN & CNTL 07, 08, 10
PRINT + SPACE 07
BAIL FF 07
CYCLE TRIP 07
CR21
CR24
D
C
B
A
MAGNET DRIVER DECODER
SHEET 6



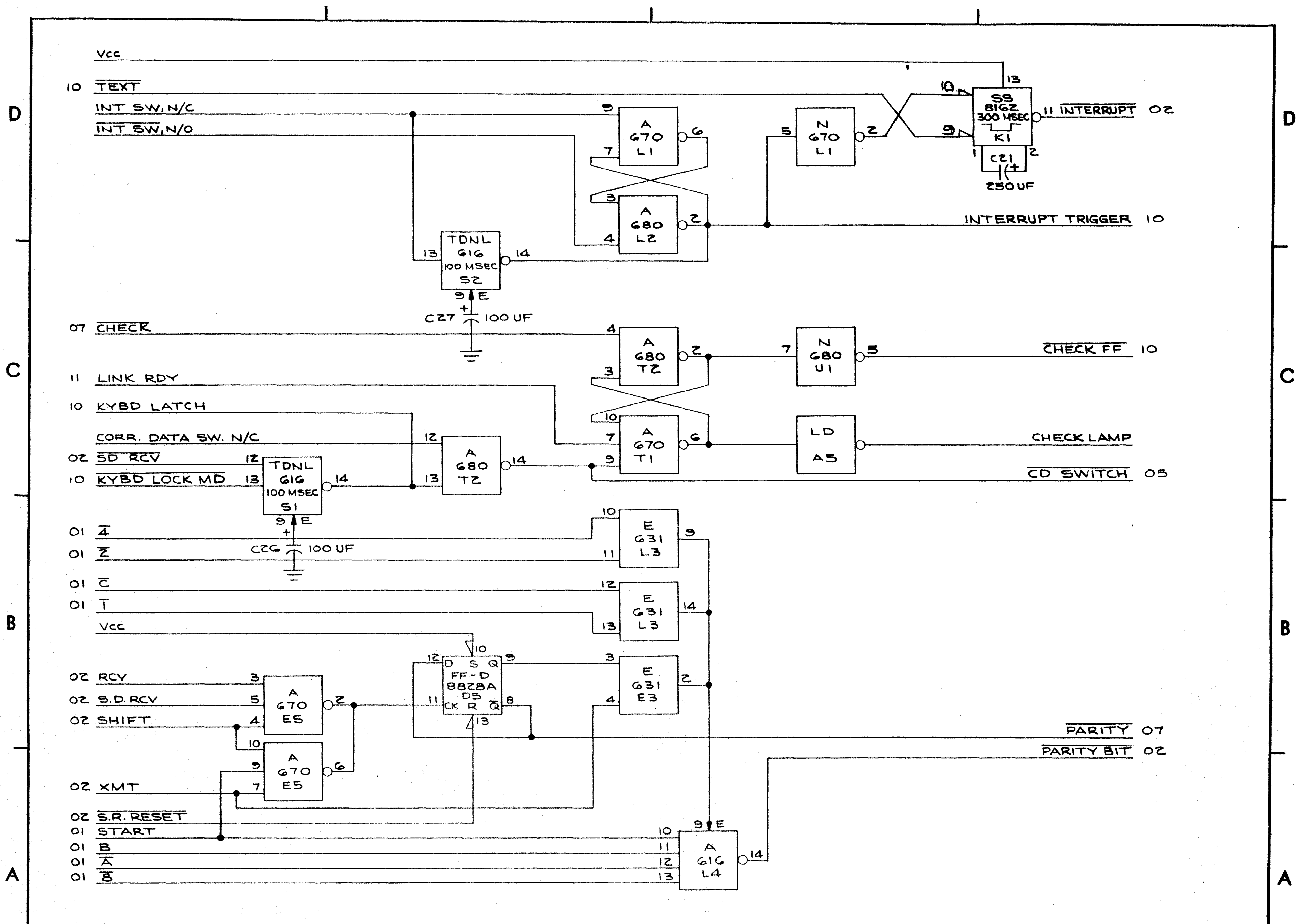
PRINT REGISTER CONTROL

SHEET 7



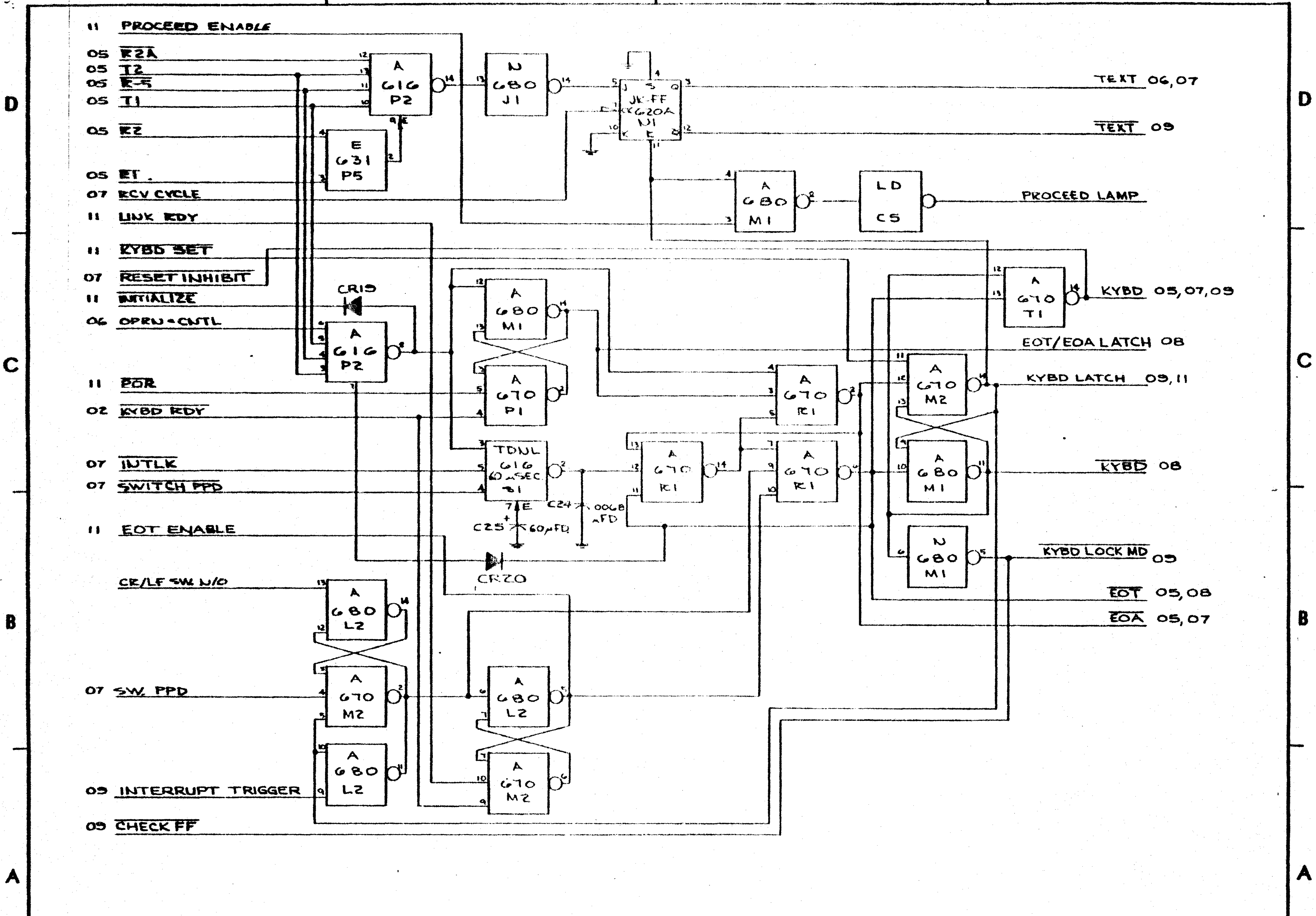
Case Shift Control

SHEET 8



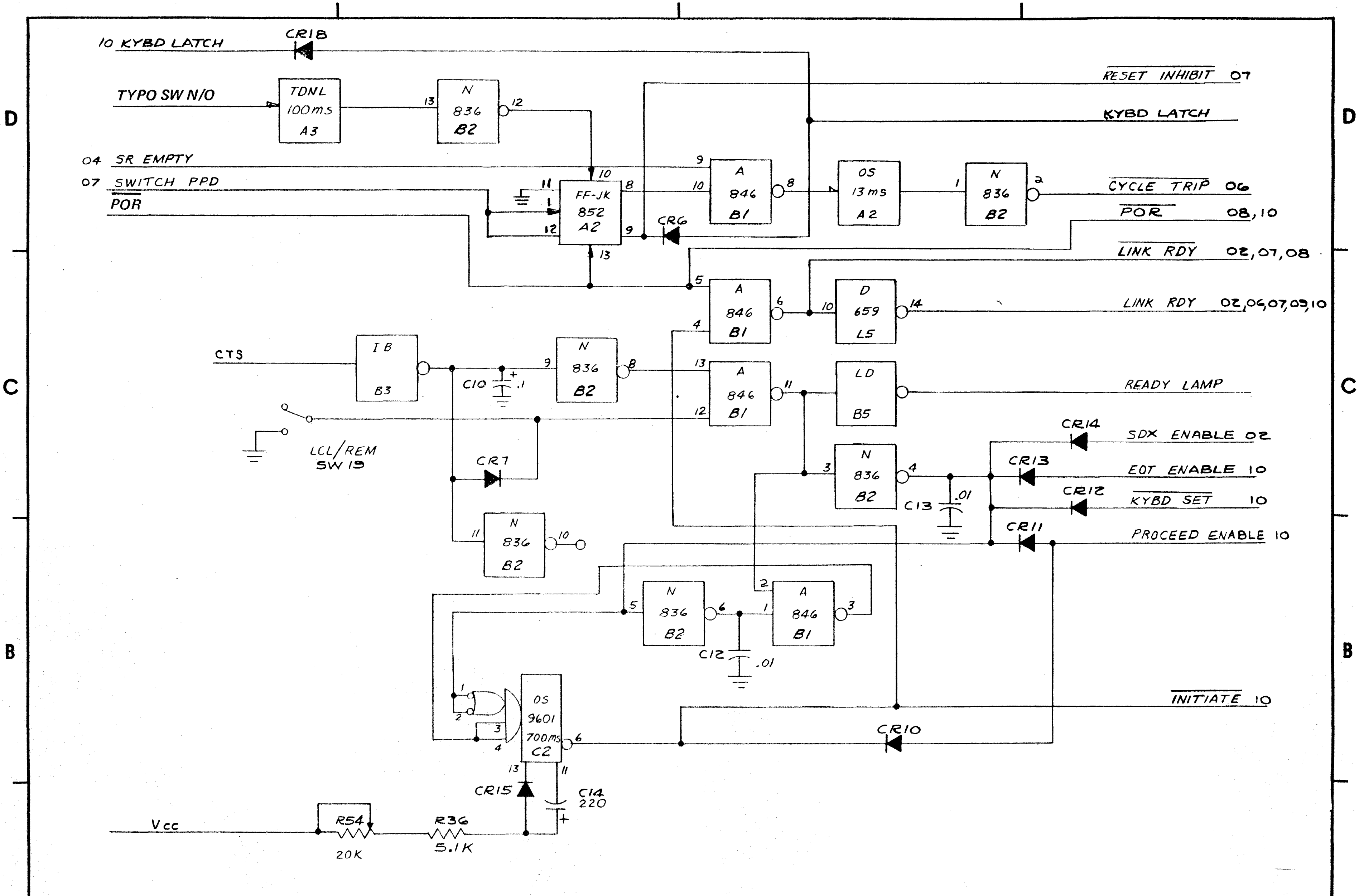
ERROR DETECTION

SHEET 9



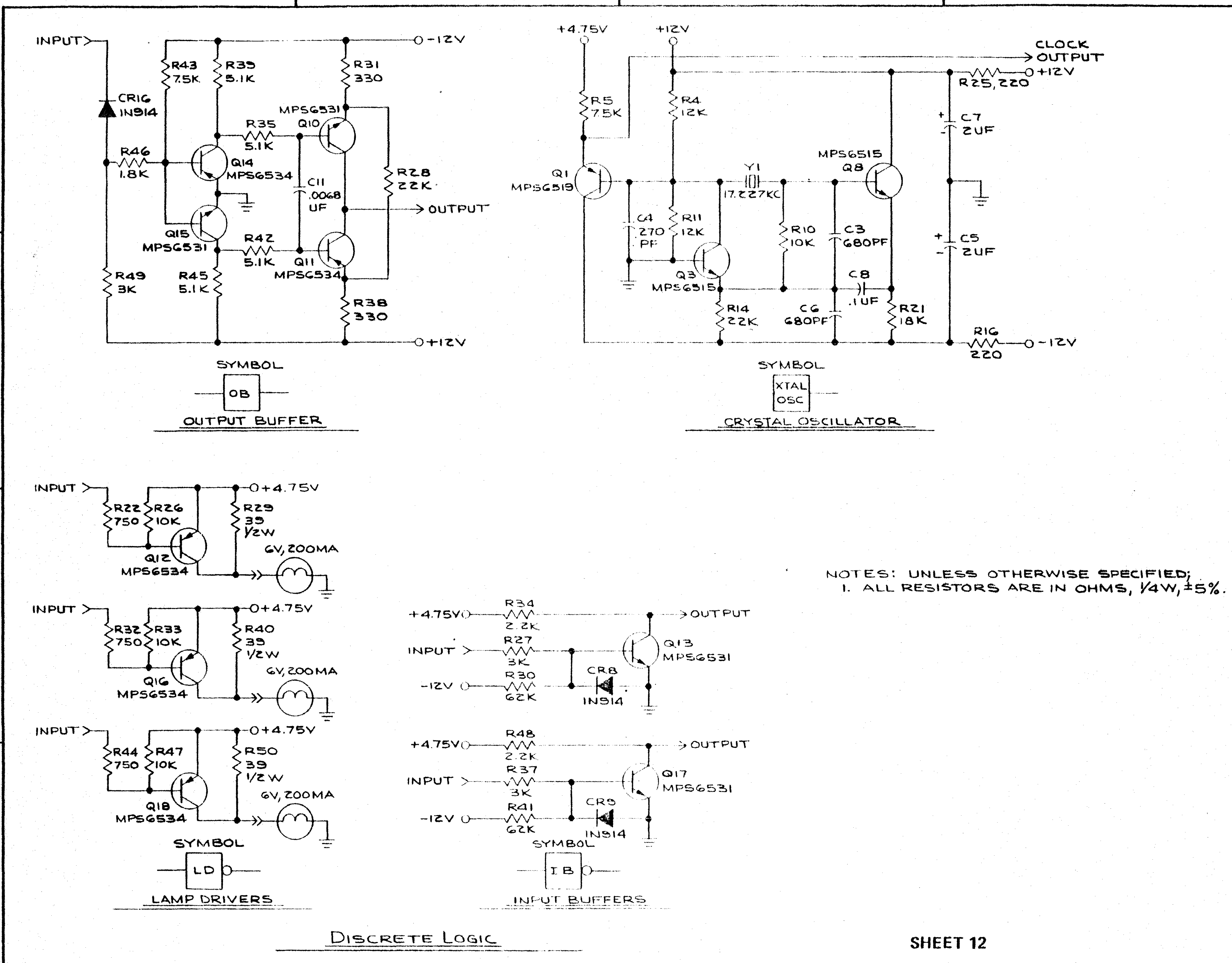
TERMINAL MODE CONTROL

SHEET 10



TERMINAL MODE CONTROL

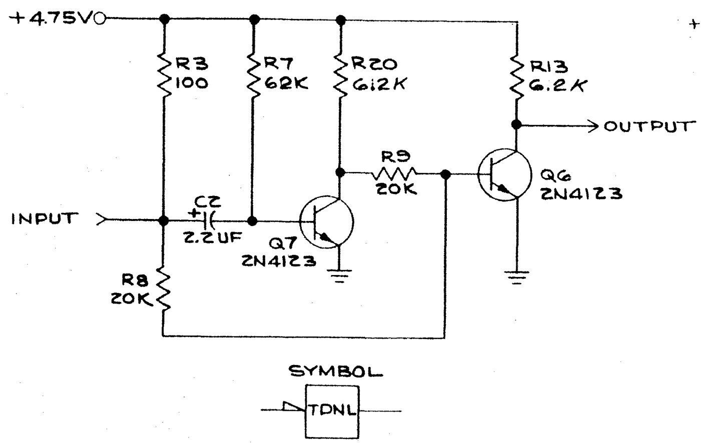
SHEET 11



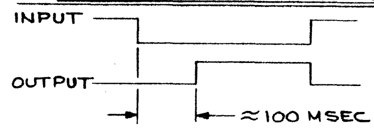
NOTES: UNLESS OTHERWISE SPECIFIED;
1. ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.

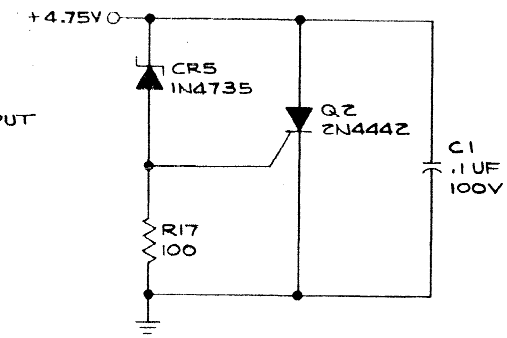
DISCRETE LOGIC

SHEET 12

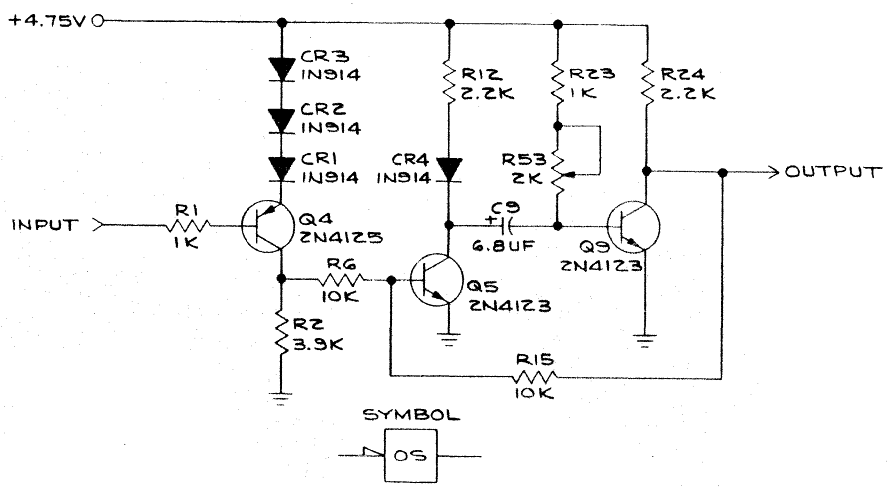


TIME DELAY NON LINEAR

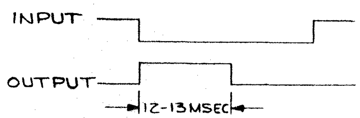




LOGIC CROWBAR



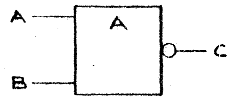
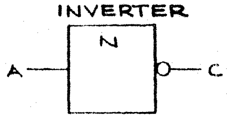
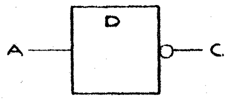
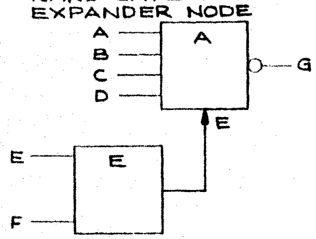
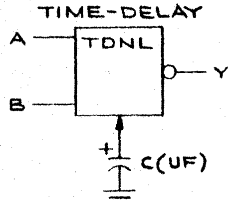
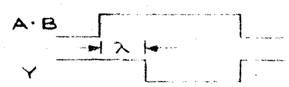
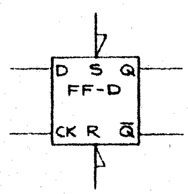
ONE SHOT ~12-13 MSEC

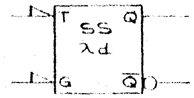
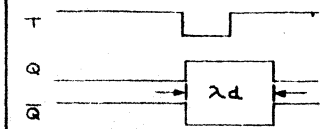
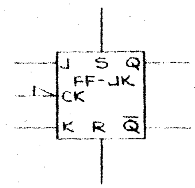
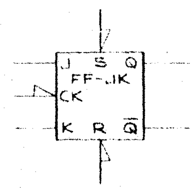


NOTES: UNLESS OTHERWISE SPECIFIED;
1. ALL RESISTORS ARE IN OHMS, 1/4 W, ± 5%.

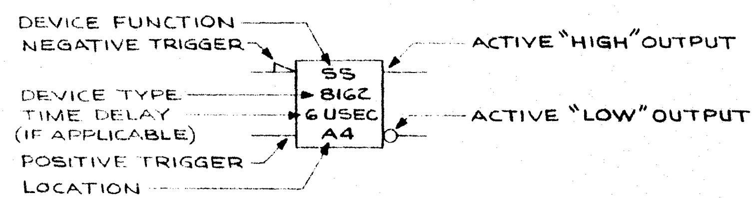
DISCRETE LOGIC

SHEET 13

SYMBOL & TITLE	BOOLEAN EQN	COMMENT
NAND GATE 	$C=\overline{A}+\overline{B}$	FANOUT = 8
INVERTER 	$C=\overline{A}$	FANOUT = 8
DRIVER 	$C=\overline{A}$	FANOUT = 16
NAND GATE WITH EXPANDER NODE 	$G=\overline{A}+\overline{B}+\overline{C}+\overline{D}+\overline{E}+\overline{F}$	
TIME-DELAY 	$Y=\overline{A}+\overline{B}$ $\lambda \approx$ 1MSEC/UF	
"D" FLIP-FLOP 		A "LOW" INPUT ON S OR R FORCES Q OR $\overline{Q}$ "HIGH", RESPECTIVELY. D IS GATED TO Q UPON A POSITIVE TRANSITION OF THE CLOCK.

SYMBOL & TITLE	BOOLEAN EQN	COMMENT
SINGLE-SHOT 		
"JK" FLIP-FLOP 		"HIGH" ON S OR R FORCES Q OR $\overline{Q}$ "HIGH, RESPECTIVELY. NEGATIVE TRANSITION ON J OR K SETS Q OR $\overline{Q}$ "HIGH", RESPECTIVELY. THE JK INPUTS ARE GATED INTO Q AND $\overline{Q}$, RESPECTIVELY, UPON A NEGATIVE TRANSITION OF THE CLOCK.
"JK" FLIP-FLOP 		A "LOW" ON S OR R FORCES Q OR $\overline{Q}$ "HIGH, RESPECTIVELY. THE J & K INPUTS ARE GATED TO Q AND $\overline{Q}$, RESPECTIVELY, UPON A NEGATIVE TRANSITION OF THE CLOCK.

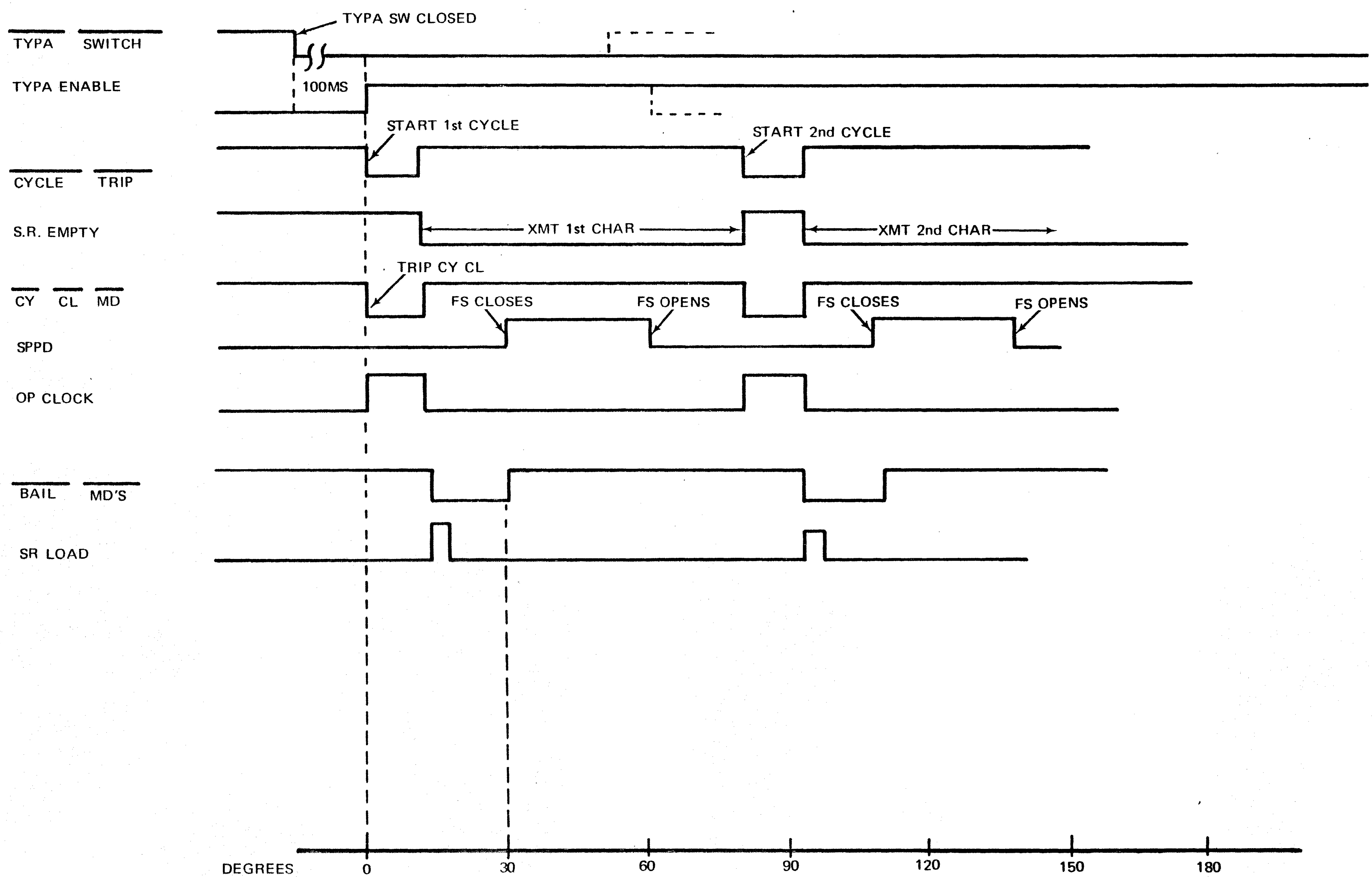
NOTES:
1. SEE FOLLOWING FOR LOGIC SYMBOL FORMAT.



LOGIC FORMAT

SHEET 14

TYPAMATIC - CHARACTER



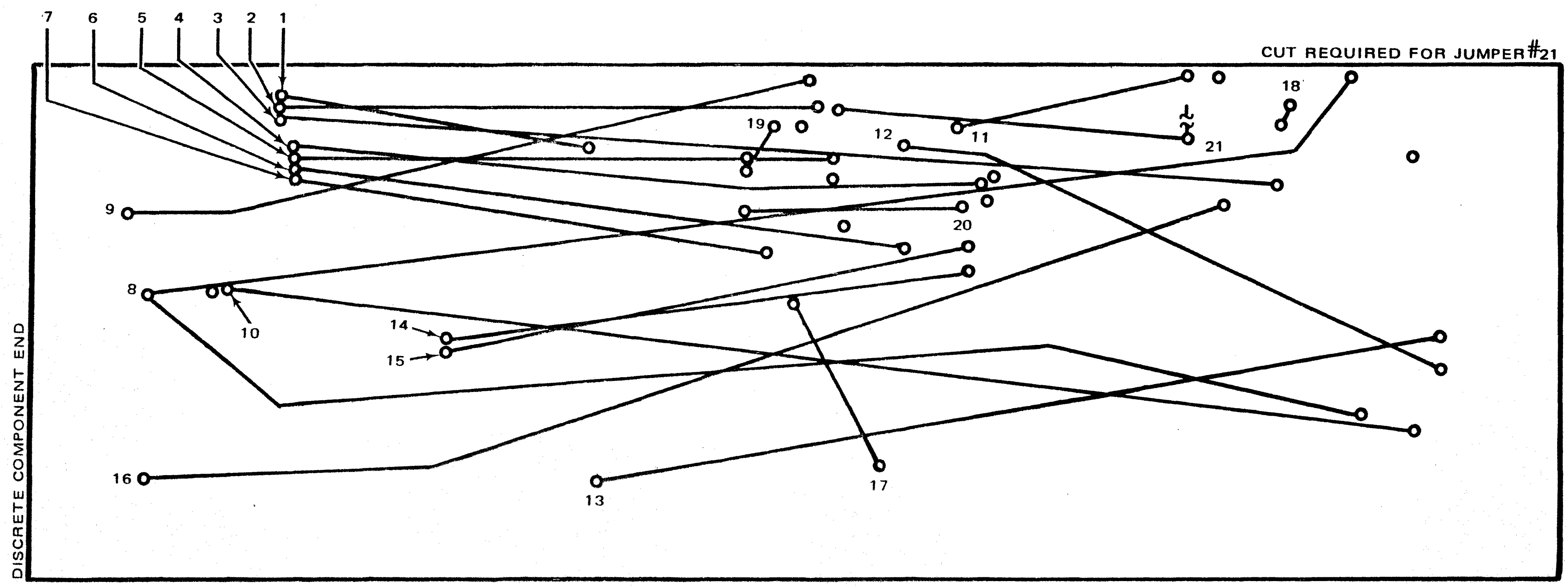
STANDARD JUMPERS

NO.	TITLE	FROM	TO
1	SR EMPTY	B1-9	J1-5
2	SW PPD	A2-1	W1-3
3	$\overline{\text{POC}}$	A2-13	U1-4
4	$\overline{\text{INIT}}$	C2-6	P2-2
5	PROC EN	B2-4	M1-3
6	$\overline{\text{KYBD SET}}$	B2-4	M2-11
7	EOT EN	B2-4	L2-5
8	$\overline{\text{RESET INH}}$	A2-9	U4-10
9	KYBD LATCH	A2-9	I/O BD, L-35
10	$\overline{\text{CYCLE TRIP}}$	B2-2	U4-3
11		M2-14	S1-14
12		W3-7	M1-14
13		F5-11	W3-4
14		E3-11	N2-9
15		E3-10	N2-12
16	CHECK LAMP	LD-A5	T1-6
17	$\overline{\text{CR SW}}$	M5-13	L2-13
18		U1-5	M1-5
19		K1-10	L1-2
20		N1-12	K1-9

OPTION JUMPERS

NO.	TITLE	FROM	TO
41		T1-2	V1-12
42		B2-10	M1-5
43		M2-10	P1-5
44		L1-14	K1-10
45		M2-14	K1-9

STANDARD JUMPERS FOR TYPAMATIC LOGIC

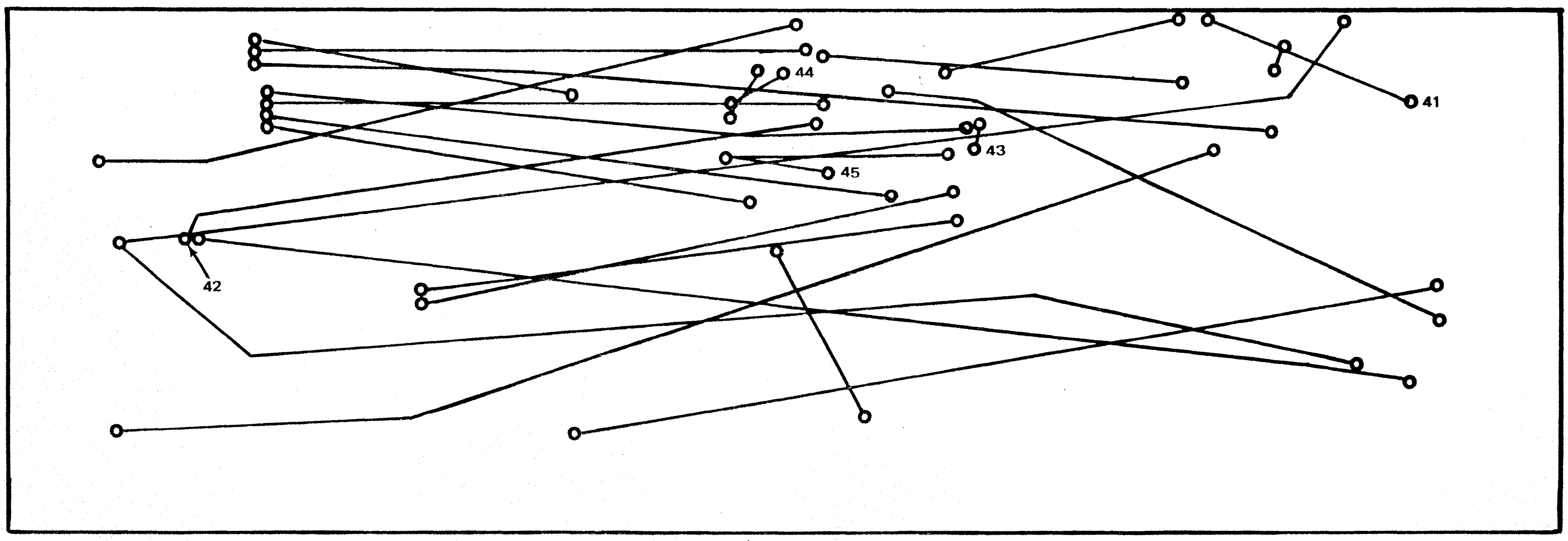


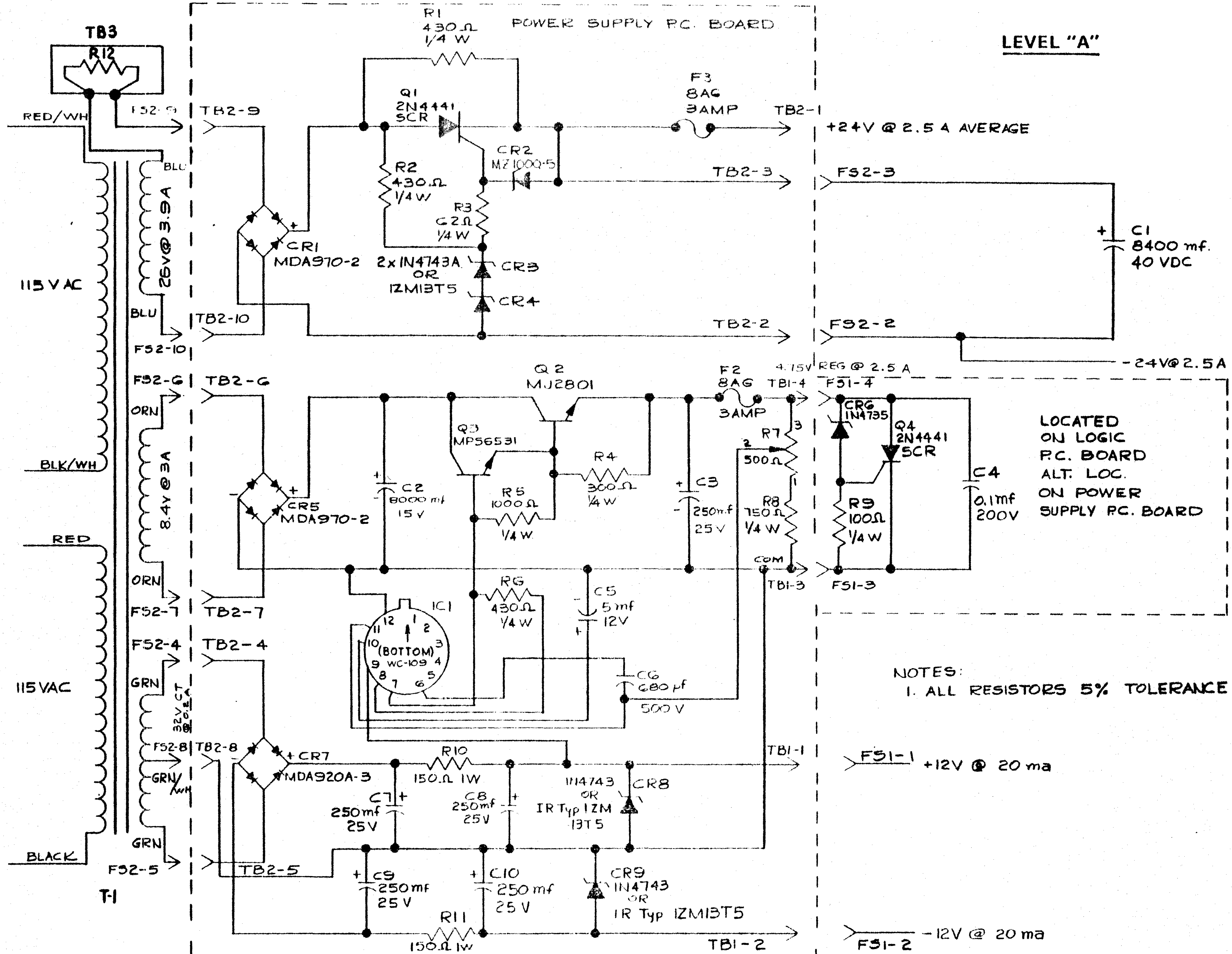
JUMPER #21 USED ONLY ON F REVISION
BOARDS S1-13 TO M1-5

OPTIONS

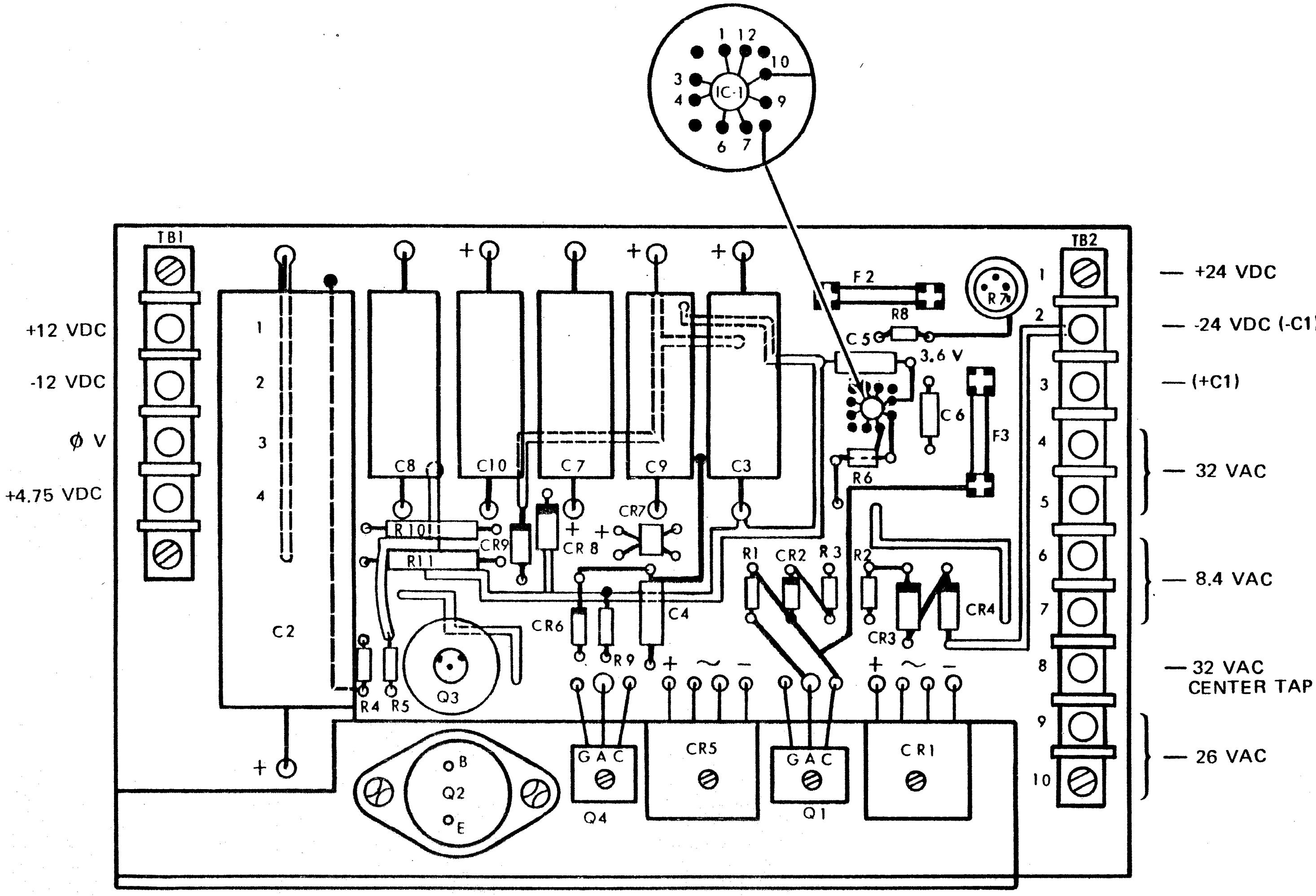
1. Error Graphic: Add Jumper No. 41.
2. Kybd Lock Switch: Add Jumper No. 42.
3. Auto EOA Inhibit: Remove Jumper No. 4, Add Jumper No. 43.
4. EOT Inhibit: Remove Jumper No. 17 and add switch, (Ref. F12)
5. Check Interrupt Enable: Add Diode (1N141) between Pads 44 (Cathode toward L1-14)
6. Kybd Lock Inhibit: Remove Jumper No. 18.
7. Interrupt Inhibit: Remove Jumper No. 19.
8. RCV Mode Interrupt: Remove Jumper No. 20, add Jumper No. 45.
9. Check Lamp Disable: Tie right-hand end of Jumper No. 16 to Vcc, (lift from pad).

OPTION JUMPERS

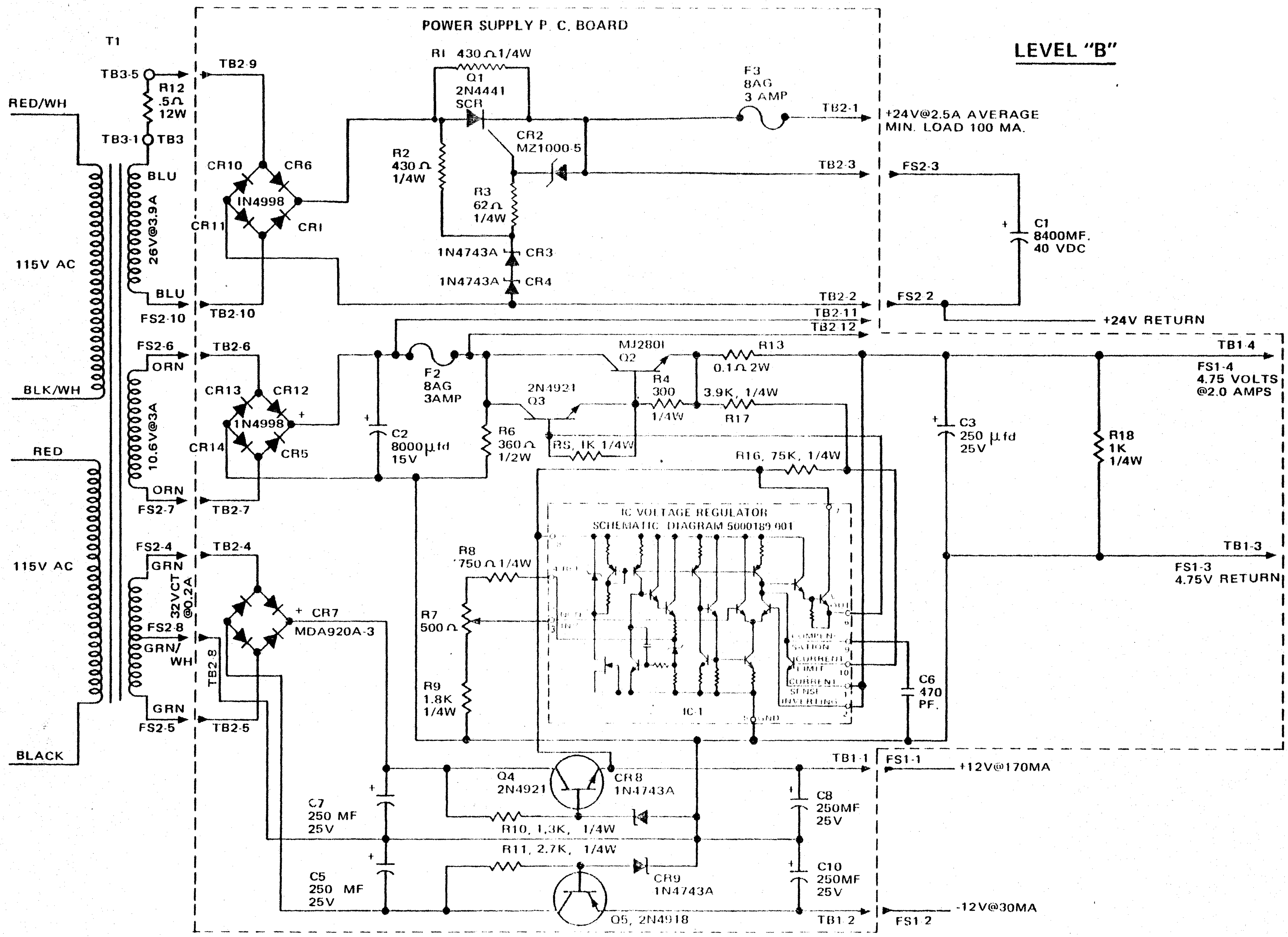




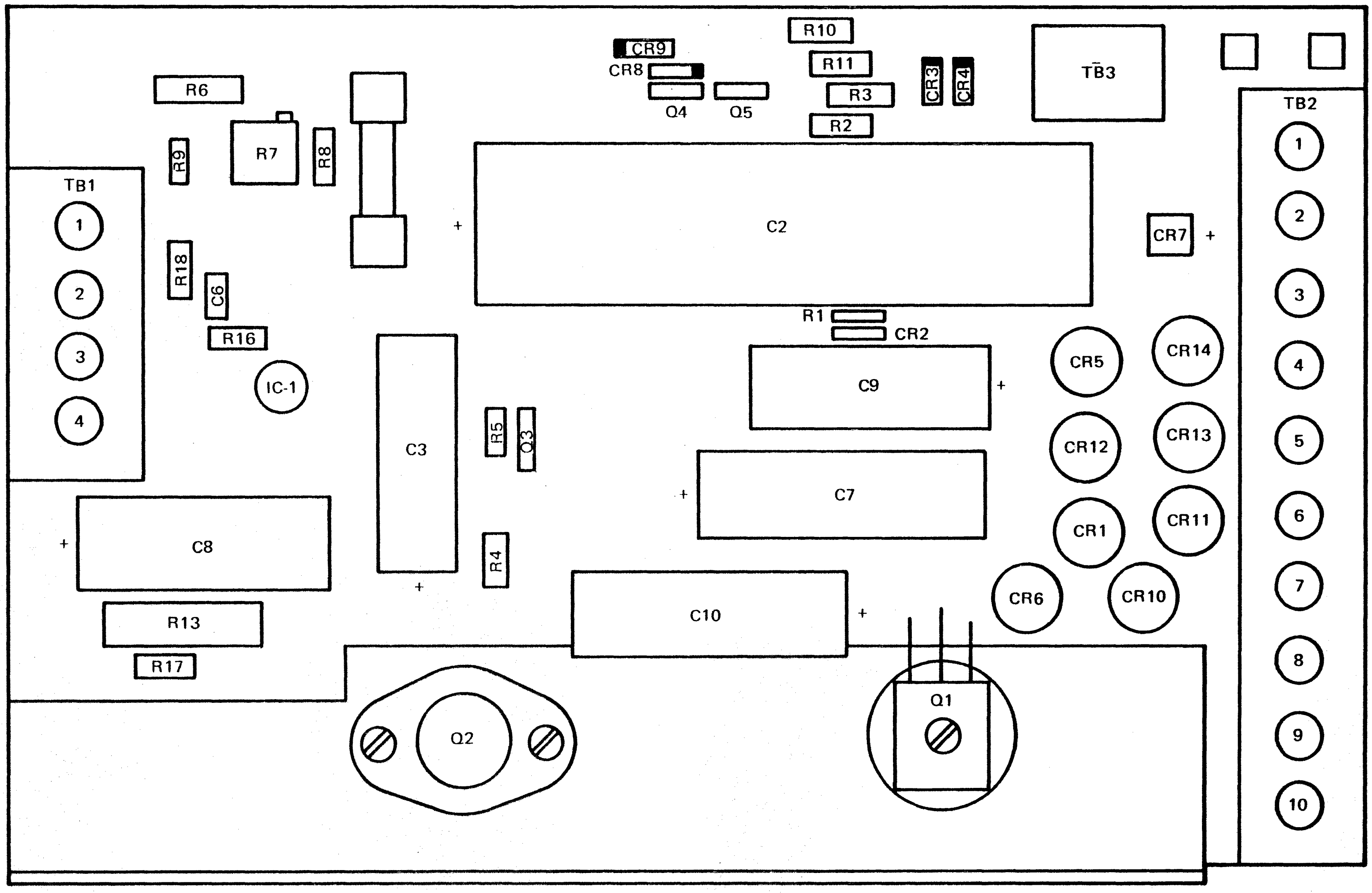
LEVEL "A"
POWER SUPPLY P.C. BOARD
TB3
R12
RED/WH
FS2-9
TB2-9
R1 430Ω 1/4 W
Q1 2N4441 SCR
CR2 MZ1000-5
F3 8AG 3AMP
TB2-1
+24V @ 2.5 A AVERAGE
TB2-3
FS2-3
R2 430Ω 1/4 W
R3 62Ω 1/4 W
CR1 MDA970-2
2x 1N4743A OR 1ZM13T5
CR3
CR4
C1 8400 mf. 40 VDC
115 VAC
26V @ 3.9A
BLU
TB2-10
FS2-10
TB2-2
FS2-2
-24V @ 2.5A
FS2-6
TB2-6
ORN
Q2 MJ2801
Q3 MPS6531
F2 8AG 3AMP
4.75V REG @ 2.5 A
TB1-4
FS1-4
CR6 1N4735
Q4 2N4441 SCR
R7 500Ω
R4 300Ω 1/4 W
C3 250mf 25 V
R8 750Ω 1/4 W
R9 100Ω 1/4 W
C4 0.1mf 200V
LOCATED ON LOGIC P.C. BOARD
ALT. LOC. ON POWER SUPPLY P.C. BOARD
BLK/WH
8.4V @ 3A
CR5 MDA970-2
C2 8000 mf 15 V
R5 1000Ω 1/4 W
COM
TB1-3
FS1-3
RED
FS2-7
TB2-7
R6 430Ω 1/4 W
C5 5 mf 12V
IC1
(BOTTOM) WC-109
C6 680 pf 500 V
FS2-4
TB2-4
GRN
32V CT
NOTES:
1. ALL RESISTORS 5% TOLERANCE
FS2-8
TB2-8
CR7 MDA920A-3
R10 150Ω 1W
TB1-1
FS1-1
+12V @ 20 ma
GRN/WH
C7 250mf 25V
C8 250mf 25V
1N4743 OR IR Typ 1ZM 13T5
CR8
BLACK
FS2-5
TB2-5
T-1
C9 250mf 25V
C10 250 mf 25 V
CR9 1N4743 OR IR Typ 1ZM13T5
R11 150Ω 1W
TB1-2
FS1-2
-12V @ 20 ma


IC-1
1
12
10
3
4
9
6
7
TB1
+12 VDC
-12 VDC
ϕ V
+4.75 VDC
C2
C8
C10
C7
C9
C3
R10
R11
CR9
CR 8
CR7
CR6
R9
C4
R4
R5
Q3
F 2
R8
R7
C 5
3.6 V
C 6
F3
R6
R1
CR2
R 3
R2
CR3
CR4
G A C
Q4
CR5
Q1
C R1
B
Q2
E
TB2
+24 VDC
-24 VDC (-C1)
(+C1)
32 VAC
8.4 VAC
32 VAC
CENTER TAP
26 VAC

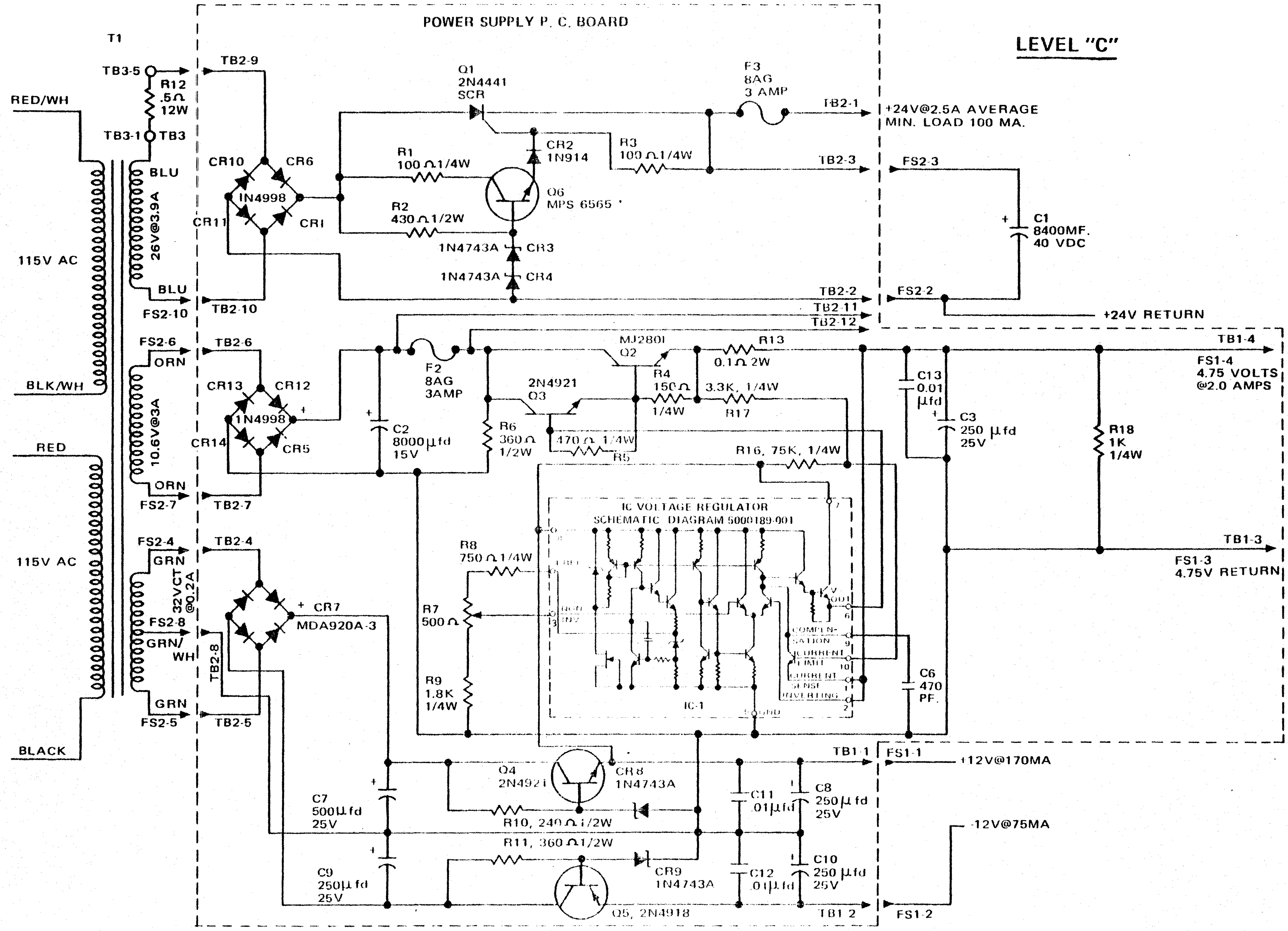
LEVEL "A"


POWER SUPPLY P. C. BOARD
LEVEL "B"
T1
TB3-5
R12 .5Ω 12W
TB3-1
TB3
RED/WH
BLK/WH
115V AC
RED
115V AC
BLACK
BLU
26V@3.9A
BLU
FS2-10
TB2-9
TB2-10
CR10
CR6
1N4998
CR11
CR1
R1 430Ω 1/4W
Q1 2N4441 SCR
R2 430Ω 1/4W
R3 62Ω 1/4W
CR2 MZ1000-5
1N4743A CR3
1N4743A CR4
F3 8AG 3 AMP
TB2-1
+24V@2.5A AVERAGE MIN. LOAD 100 MA.
TB2-3
FS2-3
C1 8400MF. 40 VDC
TB2-2
FS2-2
TB2-11
TB2-12
+24V RETURN
FS2-6
TB2-6
ORN
10.6V@3A
ORN
FS2-7
TB2-7
CR13
CR12
1N4998
CR14
CR5
C2 8000μfd 15V
F2 8AG 3AMP
MJ2801 Q2
R13 0.1Ω 2W
R4 300 1/4W
3.9K, 1/4W R17
2N4921 Q3
R6 360Ω 1/2W
R5, 1K 1/4W
R16, 75K, 1/4W
TB1-4
FS1-4 4.75 VOLTS @2.0 AMPS
C3 250 μfd 25V
R18 1K 1/4W
TB1-3
FS1-3 4.75V RETURN
IC VOLTAGE REGULATOR SCHEMATIC DIAGRAM 5000189-001
COMPENSATION
CURRENT LIMIT
CURRENT SENSE
INVERTING
IC-1
GND
R8 750Ω 1/4W
R7 500Ω
R9 1.8K 1/4W
C6 470 PF.
FS2-4
TB2-4
GRN
32VCT @0.2A
FS2-8
GRN/WH
TB2-8
GRN
FS2-5
TB2-5
CR7 MDA920A-3
Q4 2N4921
CR8 1N4743A
TB1-1
FS1-1
+12V@170MA
C7 250 MF 25V
R10, 1,3K, 1/4W
C8 250MF 25V
R11, 2.7K, 1/4W
C5 250 MF 25V
CR9 1N4743A
C10 250MF 25V
Q5, 2N4918
TB1-2
FS1-2
-12V@30MA

LEVEL "B"

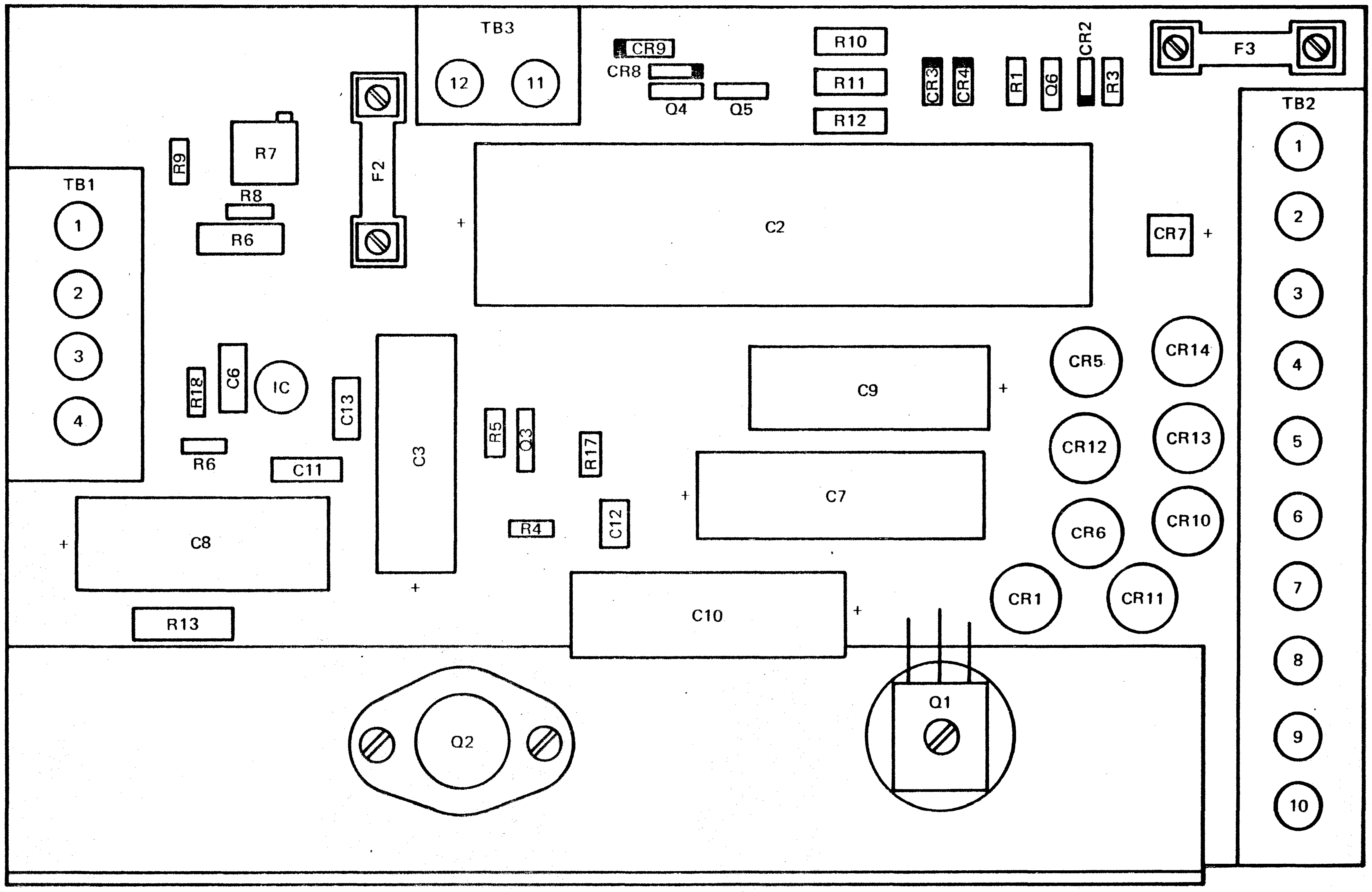


R10
CR9
CR8
R11
R3
CR3
CR4
TB3
R6
Q4
Q5
R2
TB2
R7
R9
R8
TB1
C2
CR7
R18
C6
R1
CR2
R16
CR5
CR14
IC-1
C9
C3
R5
Q3
CR12
CR13
C7
C8
CR1
CR11
R4
CR6
CR10
C10
R13
R17
Q1
Q2

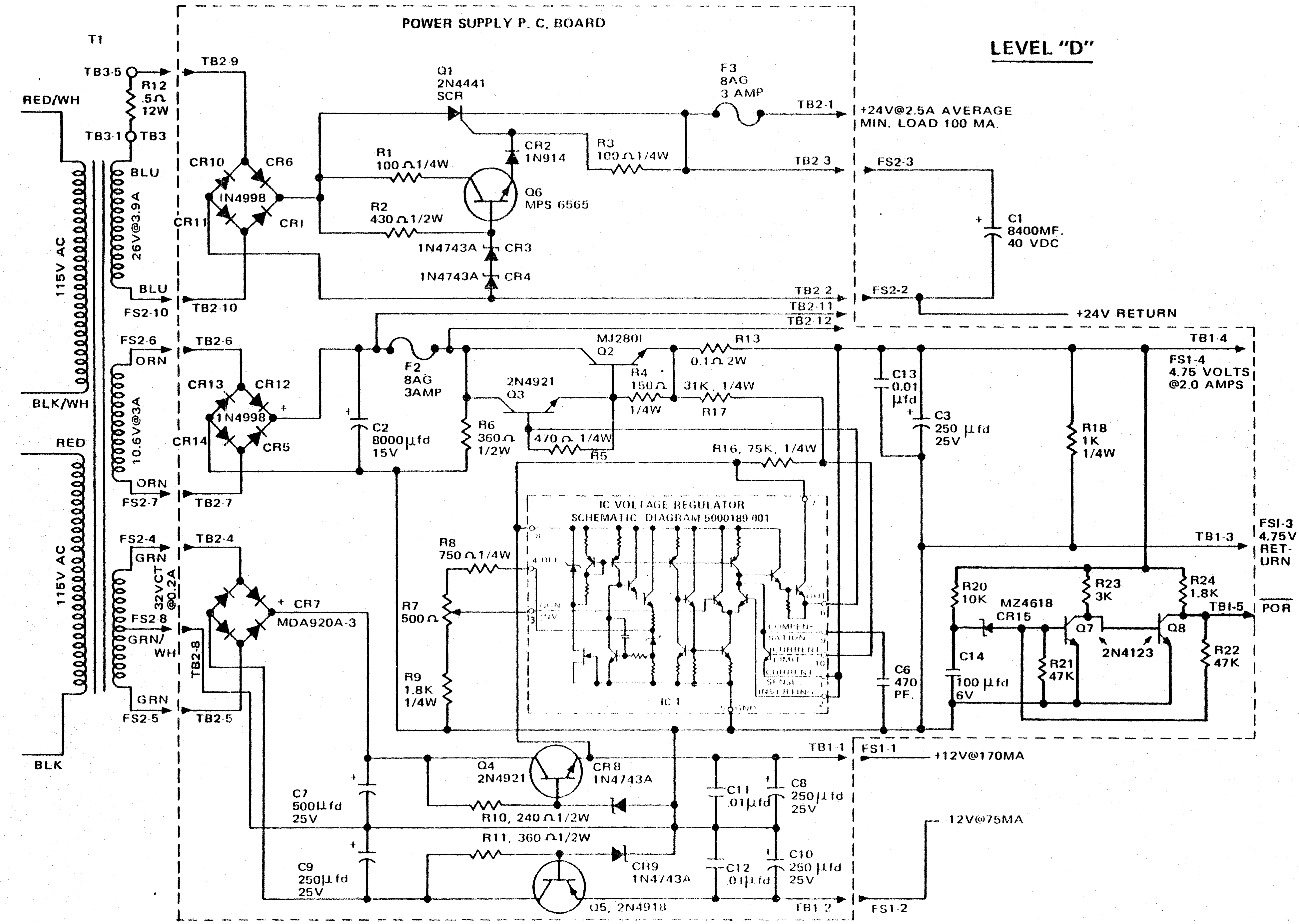


POWER SUPPLY P. C. BOARD
LEVEL "C"
T1
TB3-5
R12 .5Ω 12W
TB3-1
TB3
RED/WH
BLK/WH
115V AC
RED
115V AC
BLACK
BLU
26V@3.9A
BLU
FS2-10
TB2-9
TB2-10
CR10
CR6
1N4998
CR11
CR1
Q1 2N4441 SCR
R1 100Ω 1/4W
R2 430Ω 1/2W
CR2 1N914
Q6 MPS 6565
1N4743A CR3
1N4743A CR4
R3 100Ω 1/4W
F3 8AG 3 AMP
TB2-1
+24V@2.5A AVERAGE
MIN. LOAD 100 MA.
TB2-3
FS2-3
C1 8400MF. 40 VDC
TB2-2
FS2-2
+24V RETURN
TB2-11
TB2-12
FS2-6
TB2-6
ORN
10.6V@3A
ORN
FS2-7
TB2-7
CR13
CR12
1N4998
CR14
CR5
F2 8AG 3AMP
C2 8000 µfd 15V
MJ2801 Q2
R13 0.1Ω 2W
R4 150Ω 1/4W
3.3K, 1/4W R17
2N4921 Q3
R6 360Ω 1/2W
470Ω 1/4W R5
R16, 75K, 1/4W
C13 0.01 µfd
C3 250 µfd 25V
R18 1K 1/4W
TB1-4
FS1-4
4.75 VOLTS
@2.0 AMPS
TB1-3
FS1-3
4.75V RETURN
IC VOLTAGE REGULATOR
SCHEMATIC DIAGRAM 5000189-001
IC-1
COMPEN-SATION
CURRENT LIMIT
CURRENT SENSE
INVERTING
R8 750Ω 1/4W
R7 500Ω
R9 1.8K 1/4W
C6 470 PF.
FS2-4
TB2-4
GRN
32VCT @0.2A
FS2-8
GRN/WH
TB2-8
GRN
FS2-5
TB2-5
CR7
MDA920A-3
C7 500µfd 25V
Q4 2N4921
CR8 1N4743A
R10, 240Ω 1/2W
C11 .01µfd
C8 250µfd 25V
TB1-1
FS1-1
+12V@170MA
-12V@75MA
R11, 360Ω 1/2W
C9 250µfd 25V
CR9 1N4743A
C12 .01µfd
C10 250µfd 25V
Q5, 2N4918
TB1 2
FS1-2

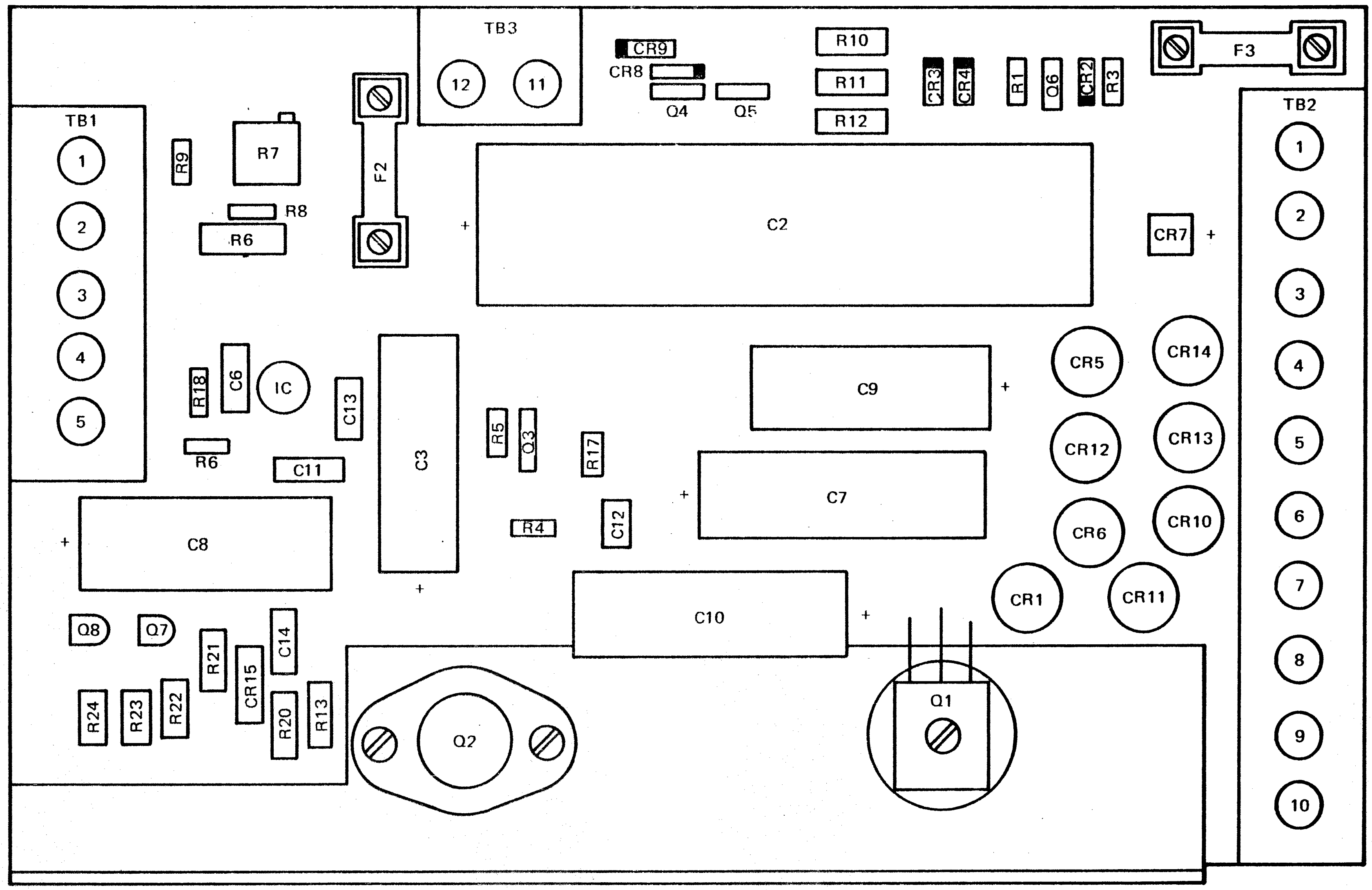
LEVEL "C"



TB3
12
11
CR9
CR8
Q4
Q5
R10
R11
R12
CR3
CR4
R1
Q6
CR2
R3
F3
TB2
1
2
3
4
5
6
7
8
9
10
R7
R9
F2
TB1
1
2
3
4
R8
R6
C2
CR7
CR5
CR14
C9
CR12
CR13
C7
CR6
CR10
CR1
CR11
R18
C6
IC
C13
C3
R5
Q3
R17
R6
C11
C8
R4
C12
C10
R13
Q2
Q1


POWER SUPPLY P. C. BOARD
LEVEL "D"
T1
TB3-5
R12 .5Ω 12W
RED/WH
TB3-1
TB3
BLU
26V@3.9A
BLU
115V AC
CR10
CR6
1N4998
CR11
CR1
TB2-9
TB2-10
FS2-10
Q1 2N4441 SCR
CR2 1N914
R1 100 Ω 1/4W
R2 430 Ω 1/2W
Q6 MPS 6565
1N4743A CR3
1N4743A CR4
R3 100 Ω 1/4W
F3 8AG 3 AMP
TB2-1
+24V@2.5A AVERAGE MIN. LOAD 100 MA.
TB2-3
FS2-3
C1 8400MF. 40 VDC
TB2-2
FS2-2
TB2-11
TB2-12
+24V RETURN
BLK/WH
FS2-6
ORN
10.6V@3A
ORN
FS2-7
TB2-6
TB2-7
CR13
CR12
1N4998
CR14
CR5
C2 8000µfd 15V
F2 8AG 3AMP
2N4921 Q3
R6 360 Ω 1/2W
470 Ω 1/4W R5
MJ2801 Q2
R4 150 Ω 1/4W
R13 0.1 Ω 2W
31K, 1/4W R17
R16, 75K, 1/4W
C13 0.01 µfd
C3 250 µfd 25V
R18 1K 1/4W
TB1-4
FS1-4 4.75 VOLTS @2.0 AMPS
TB1-3
FSI-3 4.75V RET-URN
IC VOLTAGE REGULATOR SCHEMATIC DIAGRAM 5000189-001
IC 1
COMPEN-SATION
CURRENT LIMIT
CURRENT SENSE
INVERTING
R8 750 Ω 1/4W
R7 500 Ω
R9 1.8K 1/4W
C6 470 PF.
R20 10K
R23 3K
R24 1.8K
MZ4618 CR15
Q7
Q8
2N4123
TBI-5
POR
C14 100 µfd 6V
R21 47K
R22 47K
RED
115V AC
FS2-4
GRN
32VCT @0.2A
FS2-8
GRN/WH
TB2-8
GRN
FS2-5
TB2-4
TB2-5
CR7 MDA920A-3
BLK
C7 500µfd 25V
C9 250µfd 25V
Q4 2N4921
CR8 1N4743A
R10, 240 Ω 1/2W
R11, 360 Ω 1/2W
CR9 1N4743A
Q5, 2N4918
C11 .01µfd
C8 250µfd 25V
C12 .01µfd
C10 250µfd 25V
TB1-1
FS1-1
+12V@170MA
-12V@75MA
TB1-2
FS1-2

LEVEL "D"



TB3
12
11
CR9
CR8
Q4
Q5
R10
R11
R12
CR3
CR4
R1
Q6
CR2
R3
F3
TB1
1
2
3
4
5
R9
R7
R8
R6
F2
C2
CR7
TB2
1
2
3
4
5
6
7
8
9
10
R18
C6
IC
C13
C3
R5
Q3
R17
C9
CR5
CR14
CR12
CR13
R6
C11
C7
CR6
CR10
C8
R4
C12
C10
CR1
CR11
Q8
Q7
R21
C14
CR15
R24
R23
R22
R20
R13
Q2
Q1

SECTION VII

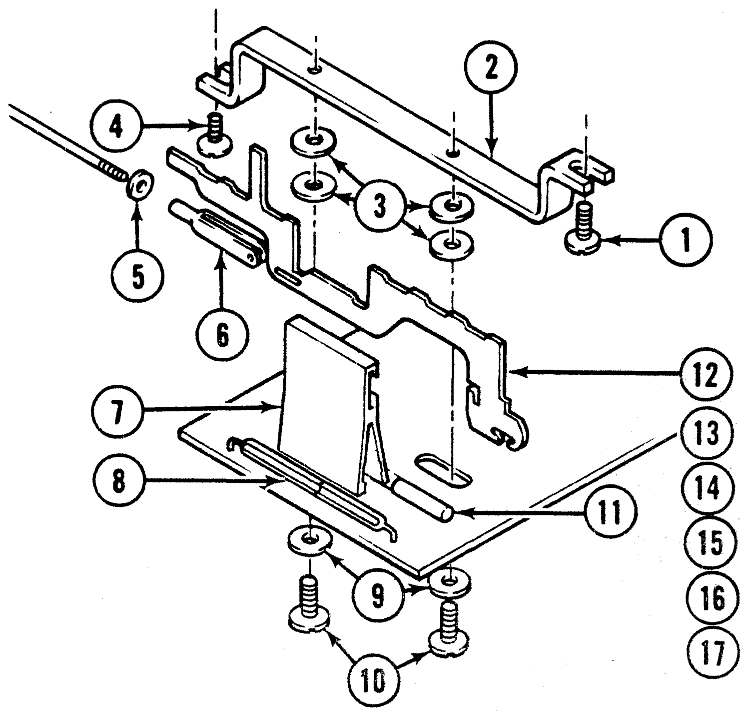
PARTS LIST

Code #	Datel Dash #	Part #	Description
2–A	–001	5000349	2– x 5/16
2–B	–002		2–56 x 3/8
2–C	–003		2–56 Hex Nut
2–D	–004		2–64 Hex Nut 3/16 thick
4–A	–005	5000349	4–40 x 1/8
4–B	–006		4–40 x 3/16
4–C	–007		4–40 x 1/4
4–D	–008		4–40 x 1/4 Filister Head
4–E	–009		4–40 x 5/16
4–F	–010		4–40 x 5/16 "Sems"
4–G	–011	5000349	4–40 x 3/8
4–I	–012		4–40 x 1/2
4–J	–013		4–40 x Button Head Socket
4–K	–014		4–40 Hex Nut
4–L	–015		4–40 Hex "Kep"
4–M	–016	5000349	#4 Flat Washer
4–N	–017		#4 Nylon Washer
4–S	–018		4–40 Hex Nut, Nylon
5–A	–019		5–40 x 3/16
5–B	–020	5000349	#5 Flat Washer
6–A	–021		6–32 x 1/8 Splined Set
6–B	–022		6–32 x 3/16
6–C	–023	5000349	6–32 x 1/4 Self Tap
6–D	–024		6–32 x 1/4
6–E	–025		6–32 x 1/4 "Sems"
6–F	–026		6–32 x 5/16
6–G	–027	5000349	6–32 x 5/16 "Sems"
6–H	–028		6–32 x 3/8
6–I	–029		6–32 x 3/8 Self Tap
6–J	–030	5000349	6–32 x 3/8 "Sems"
6–K	–031		6–32 x 3/8 Flat Head 820
6–L	–032		6–32 x 3/8 Button Head Socket
6–M	–033		6–32 x 7/16 "Sems"
6–N	–034	5000349	6–32 x 1/2
6–P	–035		6–32 x 3/4
6–Q	–036		6–32 x 3/4 Button Head Socket
6–R	–037		6–32 x 1"
6–S	–038	5000349	6–32 x 1 1/4"
6–T	–039		#6 Flat Washer
6–U	–040		#6 Washer Nylon
6–V	–041		#6 Hex Nut 5/16
6–W	–042	5000349	#6 Hex Nut 1/4"
6–X	–043		#6 Square Nut
6–Y	–044		#6 "Kep"

Code #	Datel Dash #	Part #	Description
8–A	–045	5000349	8–32 x 1/4
8–B	–046		8–32 x 3/8
8–C	–047		8–32 x 3/8 Button Head
8–D	–048		8–32 x 1/2
8–E	–049	5000349	8–32 x 5/8
8–F	–050		#8 Flat Washer
8–H	–051		#8 Ext. Star Washer
8–G	–052		#8 Hex Nut
8–I	–053	5000349	#8 Kep Nut
1/4–A	–054		1/4–20 x 3/8
1/4–B	–055		1/4–20 x 3/4 Hex Head
1 1/4–C	–056	5000349	1/4–20 x 1"
1/4–D	–057		1/4 Washer
A–B	–058		Teflon Tape .005 Thick
A–C	–059	5000349	Spring 1133659 (BM)
A–F	–060		Clamp Spacer 1/8" thick
A–G	–061		.040 Shims (First 200 units only)
A–I	–062	5000349	Fish Paper .005 thick
A–J	–063		Fiber spacer for power supply
	–064	5000349	4–40 x 5/32 Soc. Hd. Cap Screw
	–065		4–40 x 1/2 "Sems" Screw
	–066		4–40 x 3/4 Pan Head
	–067		6/32 x 1/8 Set Screw, Soc. Head Cup Joint
	–068	5000349	6/32 x Soc. Head Cap Screw
	–069		#6N Flat Washer
	–070		8–32 x 5/16 Pan Head
	–071		10–32 x 1/2 Slotted CSK Screw
	–072	5000349	10–32 x 1/2 Soc. Head Cap Screw
	–073		6–32 x 5/8 Pan Head
	–074		6–32 x 1/8 Set Screw, Soc. Bd. Cone Joint
	–075	5000349	4–40 x 5/8 Pan Head Screw

NOTE: All screws are SAE Standard, steel, cadmium plated, pan head or binder head unless noted.

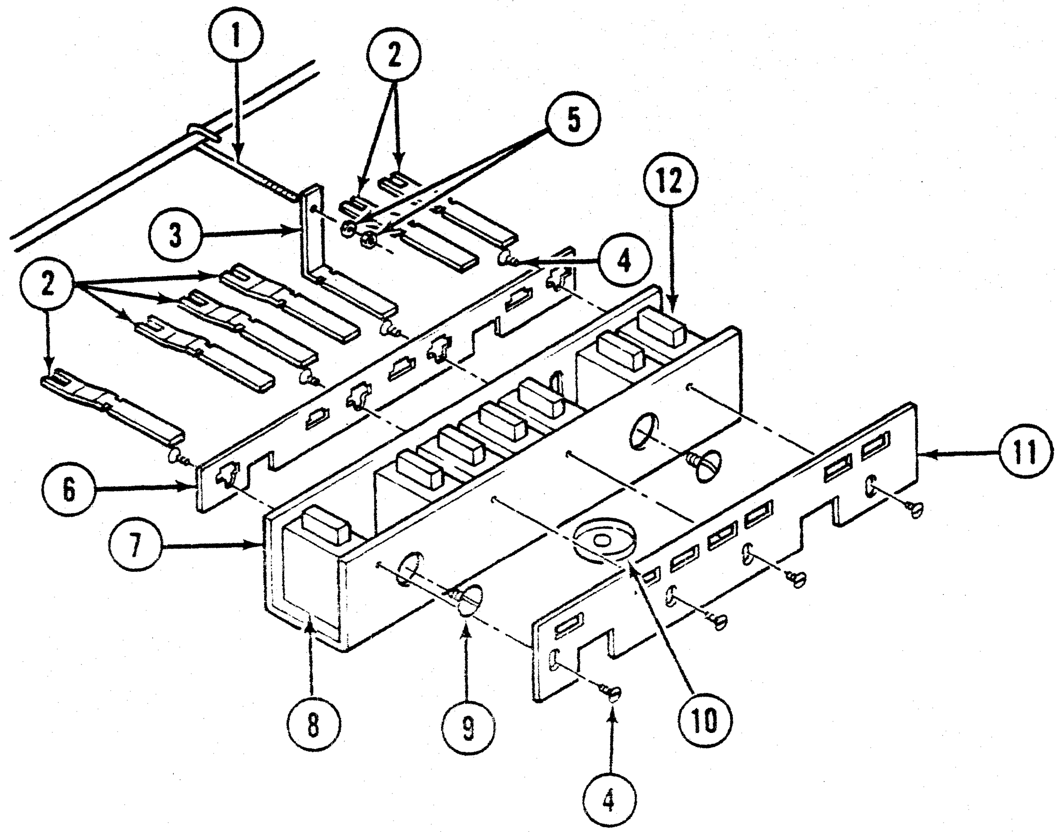
BAIL SWITCHES



NOTE: T2 Shown

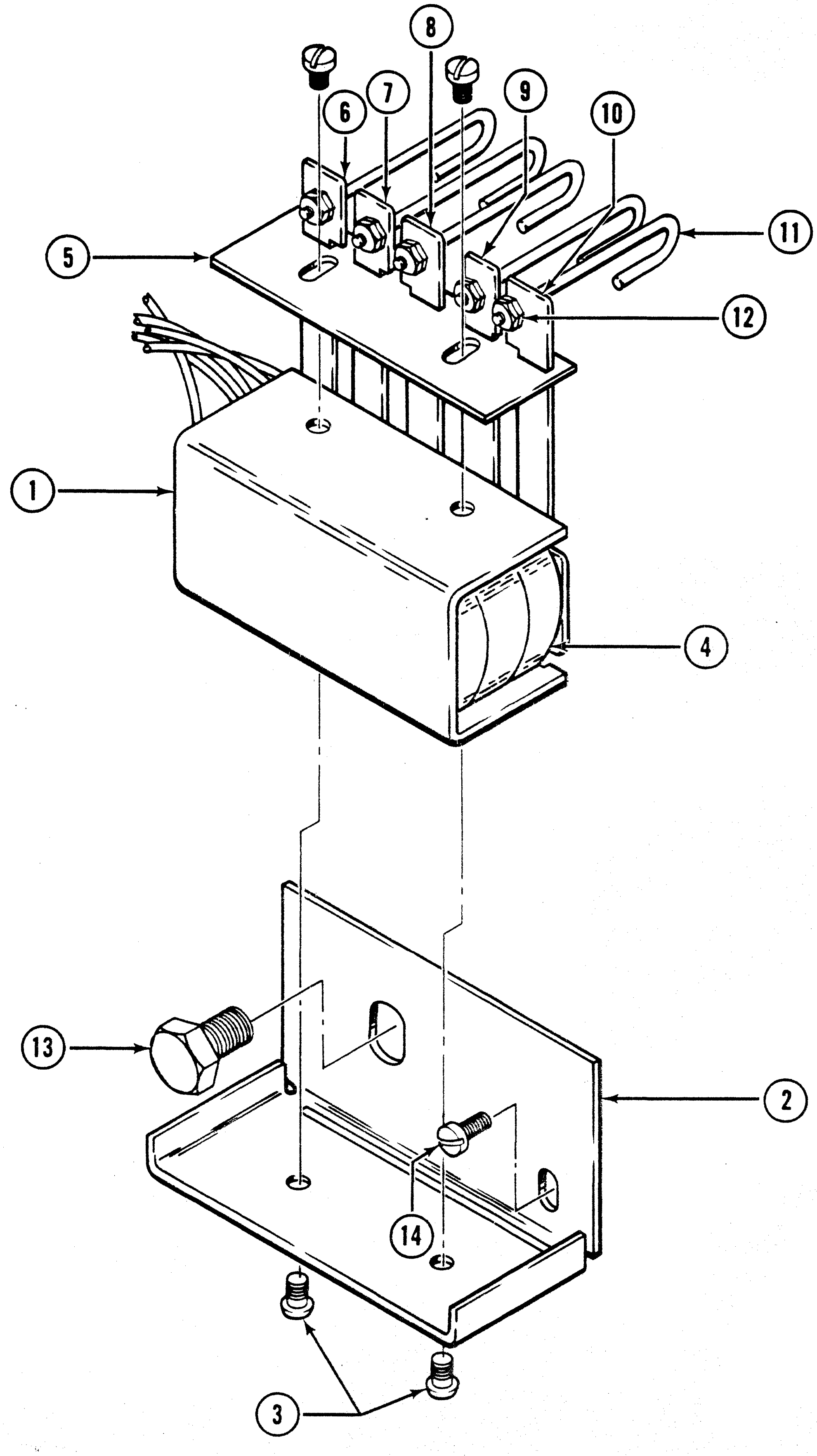
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			BAIL SWITCHES	
1	5000349	028	Screw	2
2	1000094		Mag. Board Bracket	2
3	5000349	040	Nylon Washer	8
4	5000349	024	Screw	2
5	1000288		Special Spacer	6
6	1000286		Modified Clevis	6
7	1000227		Magnet Holder	6
8	5000048		Reed Switch (Will be prebent on order if specified)	6
9	5000349	040	Nylon Washer	4
10	5000349	028	Screw	4
11	1000046		Magnet	6
12	1000211	006	Mod Interposer No. 1 (T2)	1
13	1000211	005	Mod Interposer No. 3 (T1)	1
14	1000211	003	Mod Interposer No. 4 (R2A)	1
15	1000211	001	Mod Interposer No. 5 (R1)	1
16	1000211	002	Mod Interposer No. 6 (R2)	1
17	1000211	004	Mod Interposer No. 7 (R5)	1

BAIL MAGNETS



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			BAIL MAGNETS	
1	1000287		Trip Link	1
2	1000088		Bail Armature	6
3	1000092		Trip Armature	1
4	5000349	005	Screw	8
5	5000349	004	Nut	2
6	1000089		Armature Pivot	1
7	1000119		Bail Housing	1
8	1000076		Coil	7
9	5000349	023	Mounting Screw	2
10	5000014	011	Rubber Grommet	1
11	1000090		Armature Limit	1
12	5000349	058	Teflon Tape	NA
13	M100081		Complete Assembly	1

OPERATION MAGNETS

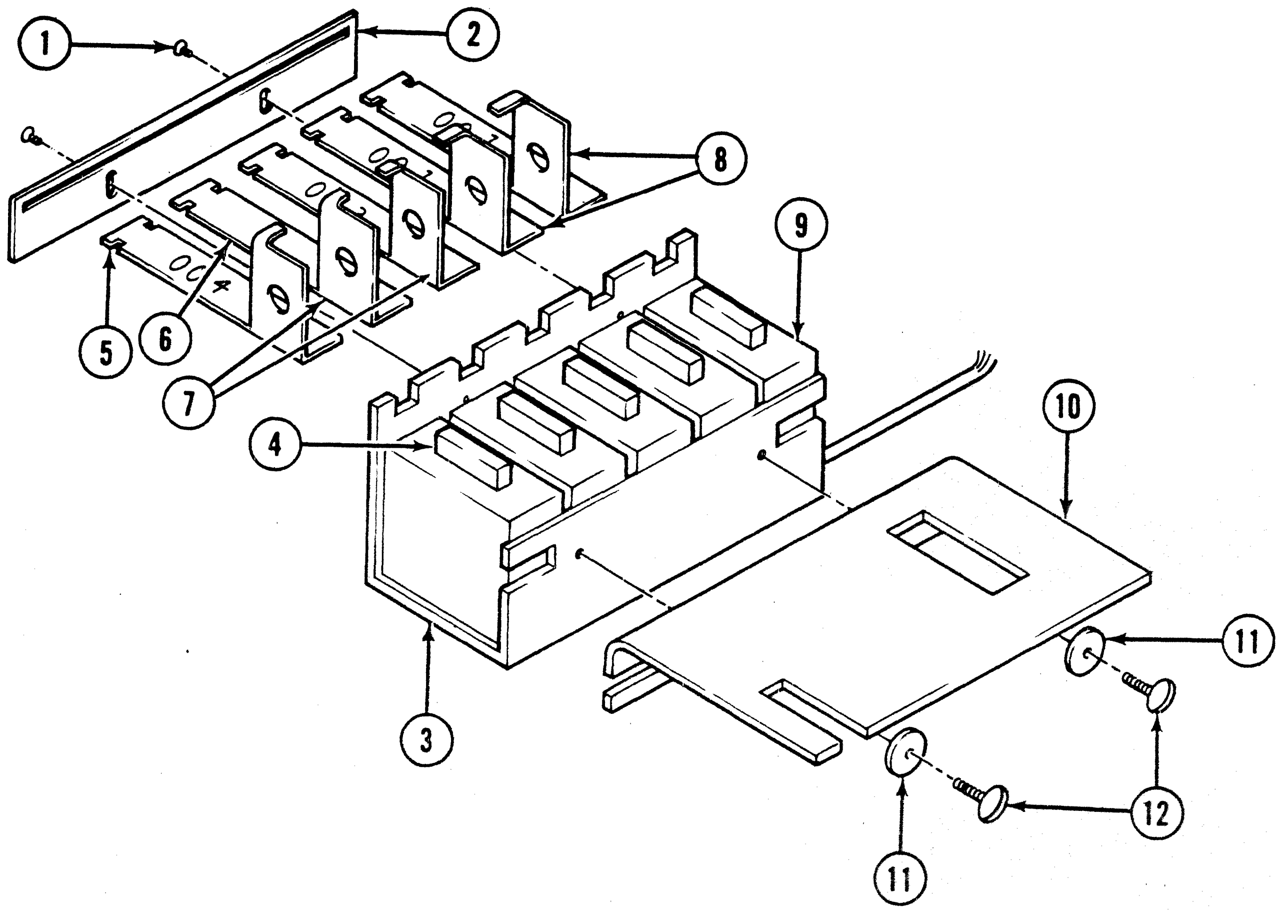


REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			OPERATION MAGNETS	
1	1000425	001	Solenoid Housing Assembly	1
2	1000427	001	Bracket, Solenoid Housing	1
3	5000349	005	Screw, 4–40 x 1/8 Pan Head	4
4	1000076	001	Coil	6
5	1000419	001	Limit, Armature	1
6	1000421	001	Armature, Tab	1
7	1000420	001	Armature, Space	1
8	1000420	002	Armature Backspace	1
9	1000422	001	Armature, Carrier Return	1
10	1000421	002	Armature, Index	1
11	1000423	001	Link	5
12	5000403	001	Nut, 0–80, Self Locking	5
13	1000456	001	Screw, Modified	1
14	5000349	007	Screw 6–32 x 1/4	1
15	1000452	001	Complete Assembly (Includes Ref. 17–21)	1

OPERATION MAGNETS

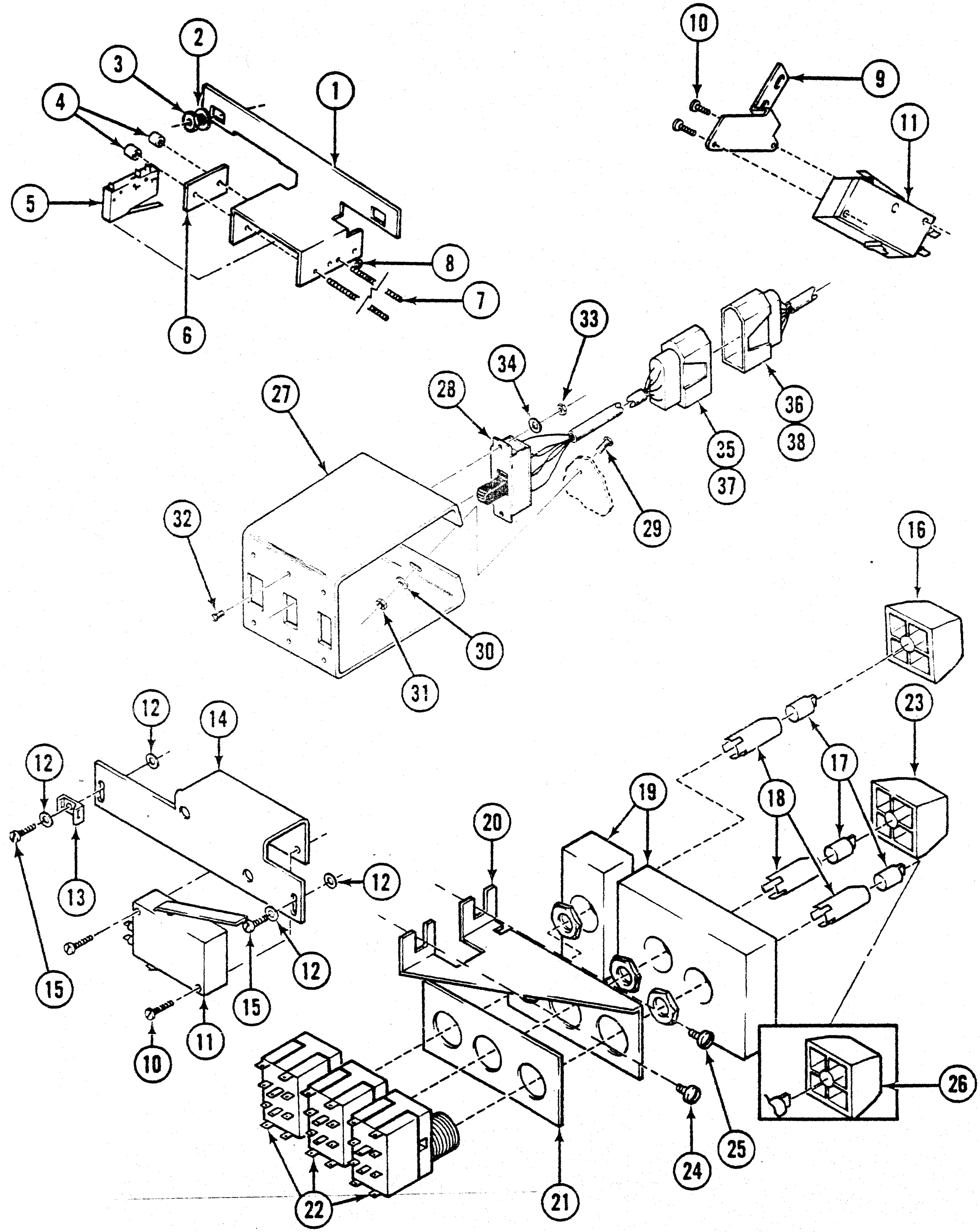
NOTE 1:

Old style operation magnet parts are not available due to legal involvement.
Replace old style with complete assembly M100078.



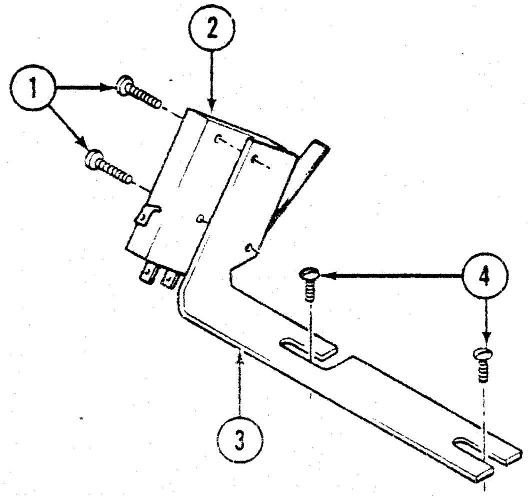
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			OPERATION MAGNETS	
1	5000349	004	Screw	2
2	1000225		Arm Limit	1
3	1000206		Housing Assy.	1
4	5000349	058	Teflon Tape	NA
5	1000200	004	Armature Ind.	1
6	1000201		Armature CR.	1
7	1000200	002	Armature BS	1
8	1000200 (See Note)	001	Armature Tab SB	2
9	1000076		Coil	5
10	1000205		Bracket	1
11	5000349	039	Washer	2
12	5000349	024	Screw	2
13	M100078		Complete Assy.	1

OPERATIONAL SWITCHES

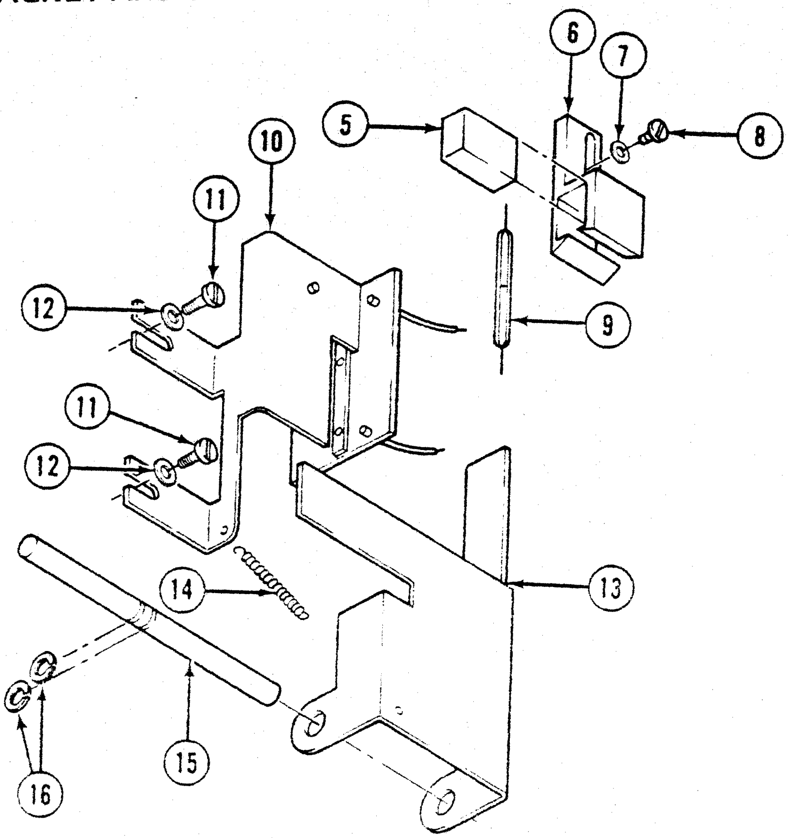


REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			OPERATIONAL SWITCHES	
1	1000100		Operational sw Bracket	1
2	5000349	039	Washer	2
3	5000349	041	Nut	2
4			Spacer 1/4 inch	2
5	5000014		Switch	5
6	1000074		Spacer Foam	1
7	1000041		Switch Shaft	2
			Note - use new style for all replacements	
8	5000030	002	C-Clip	4
9	1000193		CR Switch Bracket	1
10	5000349	012	Screw	2
11	5000015		Switch	1
12	5000349	016	Washer	4
13	5000323	001	Block, Strap	1
14	1000417	011	Strobe switch Bracket	1
15	5000349		Screw	2
16	1000052	001	Attn. keytop, grey	1
	0000303	001	Attn. keytop, black	1
17	1000049	011	Keytop Adapter	3
18	5000017	010	Switch insert (part of 5000017–210)	3
19	1000176		Foam Shield	1
20	D000289		Rpt. sw Bracket	1
21	1000031		Rpt. sw Plate	1
22	5000017	210	Switch	3
23	0000303	003	CD keytop, black	1
	100051		CD keytop, Grey	1
24	5000349	024	Screw	1
25	5000349	045	Screw	1
26	0000303	002	Repeat Keytop, black	1
27	1000332	001	Mounting Bracket Local/Remote Switch	1
28	5000291	221	Switch, Slide Loc/Rmt	1
29	5000349	030	Mounting Screw, Bracket	2
30	5000349	039	Washer	2
31	5000349	042	Nut	2
32	5000349	011	Mounting Screw Switch	2
33	5000349	014	Nut	2
34	5000349	016	Washer	2
35	5000297	002	Connector J-8 2 Pin Nylon	1
36	5000297	003	Connector P-8 2 Pin Nylon	1
37	5000146	001	Terminal Wire Pin Type	2
38	5000146	002	Terminal Wire Pin Type	2

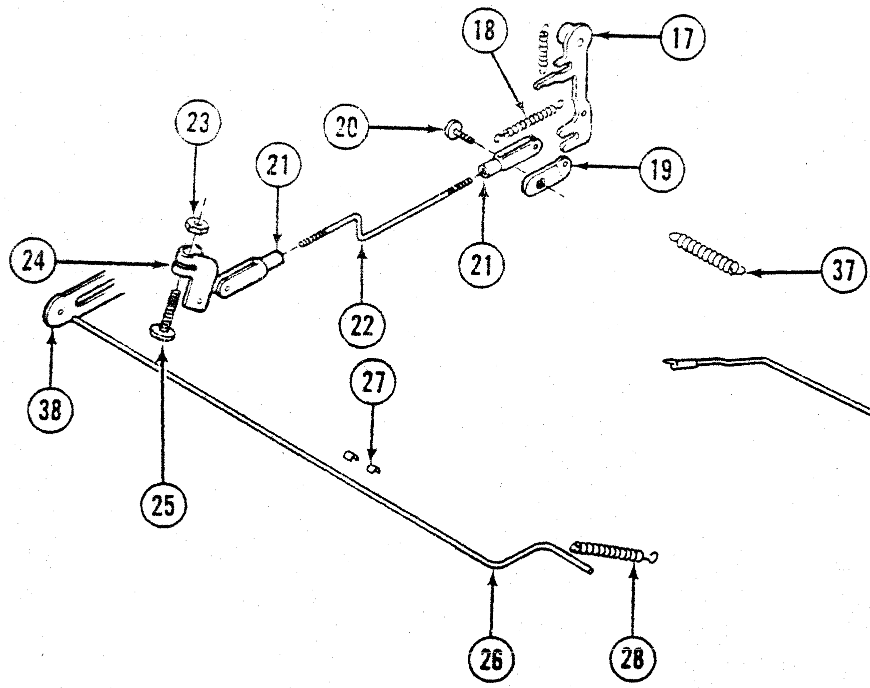
SHIFT MAGNET AND SWITCHES



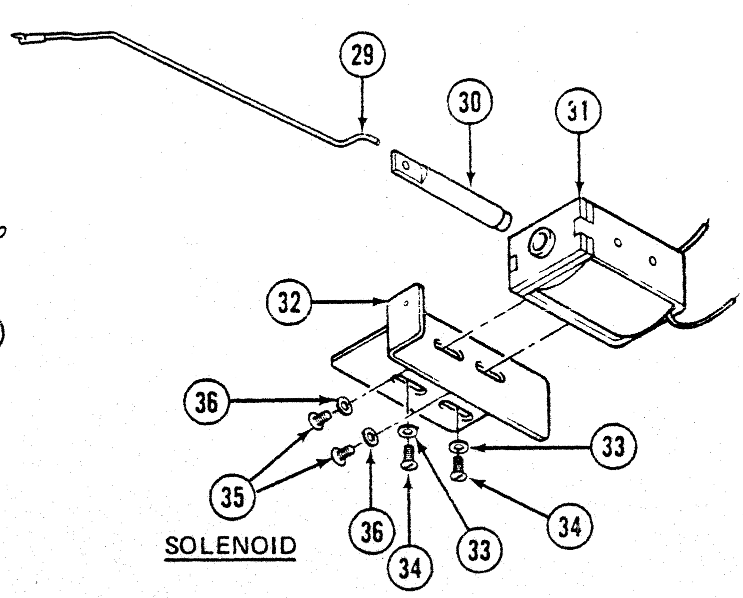
SWITCH



INDICATION SWITCH



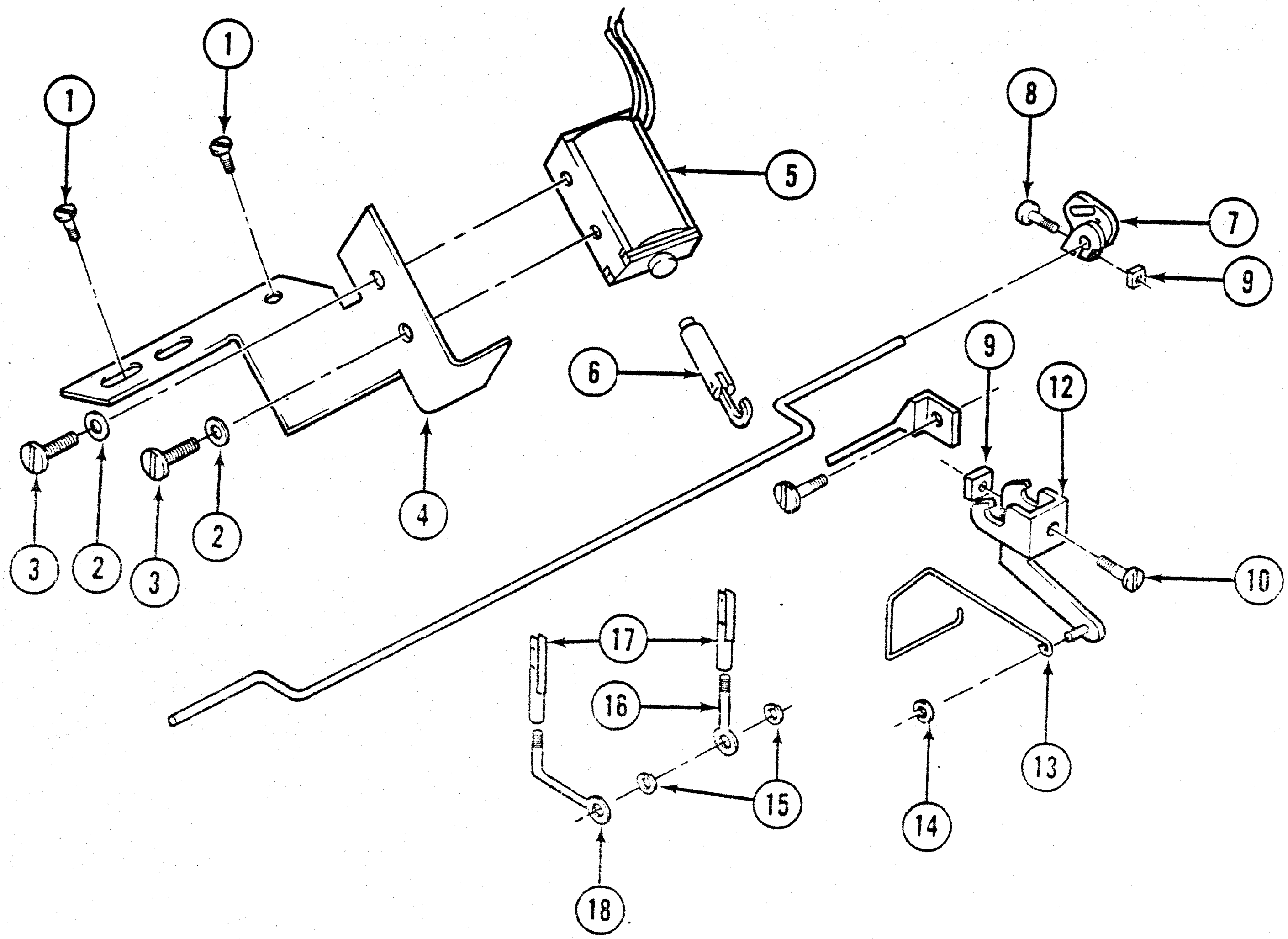
SHIFT TO PRINT INTERLOCK



SOLENOID

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			SHIFT MAGNET AND SWITCHES	
1	5000349	012	Screw	2
2	5000015		Switch	1
3	1000166		Sh. Sw. Bracket	1
4	5000349	028	Mount Screw	2
5	1000043		Magnet	1
6	1000199		Magnet Holder	1
7	5000349	016	Washer	1
8	5000349	009	Holder Screw	1
9	5000048	001	Reed Switch	1
10	M100083		Complete Switch Assy.	1
11	5000349	028	Mount Screw	2
12	5000349	039	Washer	2
13	1000101		Indication Vane	1
14	1000053		Spring	1
15	1000037		Shift Ind. Shaft	1
16	5000030	006	C-Clip #18	2
17	1000489		Mod Print Inhibit	1
18	5000349	059	Spring	1
19	1000487		Spring Anchor	1
20	5000349	006	Anchor Screw	1
21	1000165	235	Clevis	1
22	1000488		Shift Interlock Link	1
23	37913		IBM Nut	1
24	1000609	001	Interlock Bellcrank	1
25	186924		IBM Screw	
26	1000453	001	Interlock Bail	1
27	1000165	236	Retainer	2
28	1000165	237	Spring	1
29	1000032		Shift Link	1
30	1000072		Solenoid Plunger	1
31	1000097		Shift Solenoid	1
32	1000103		Solenoid Bracket	1
33	5000349	039	Washer	2
34	5000349	024	Mounting Screws	2
35	5000349	019	Solenoid Screws	2
36	5000349	020	Washers	2
37	1000053		Spring	1
38	1000165	234	Plate	1

KEYBOARD LOCK (LEVEL A)

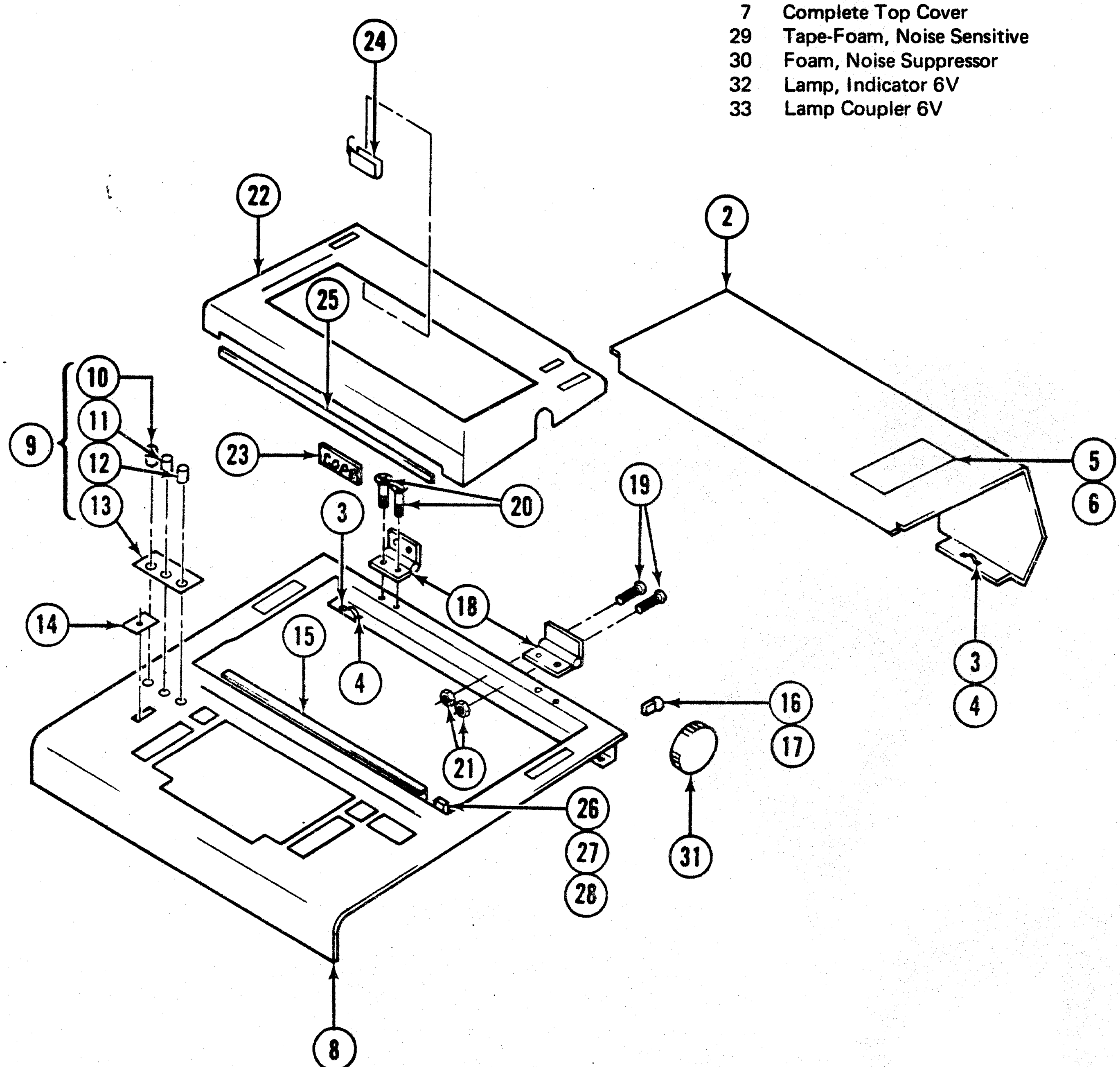


REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			KEYBOARD LOCK (Level A)	
1	5000349	028	Screw	2
2	5000349	020	Washer	2
3	5000349	019	Screw	2
4	1000091		KBLK Bracket	1
5	1000097		Solenoid	1
6	M100132		Plunger	1
7	1000083		Bellcrank	1
8	5000349	034	Screw	1
9	5000349	043	Nut	1
12	1000099		Lockout Clamp	1
13	1000075		Lockout Wire	1
14	5000030	003	C-Clip	1
15	5000030	005	C-Clip	2
16	1000165	003	Lockout Link	1
17	1000165	004	Clevis	2
18	1000236		Shift Unlock Link	1

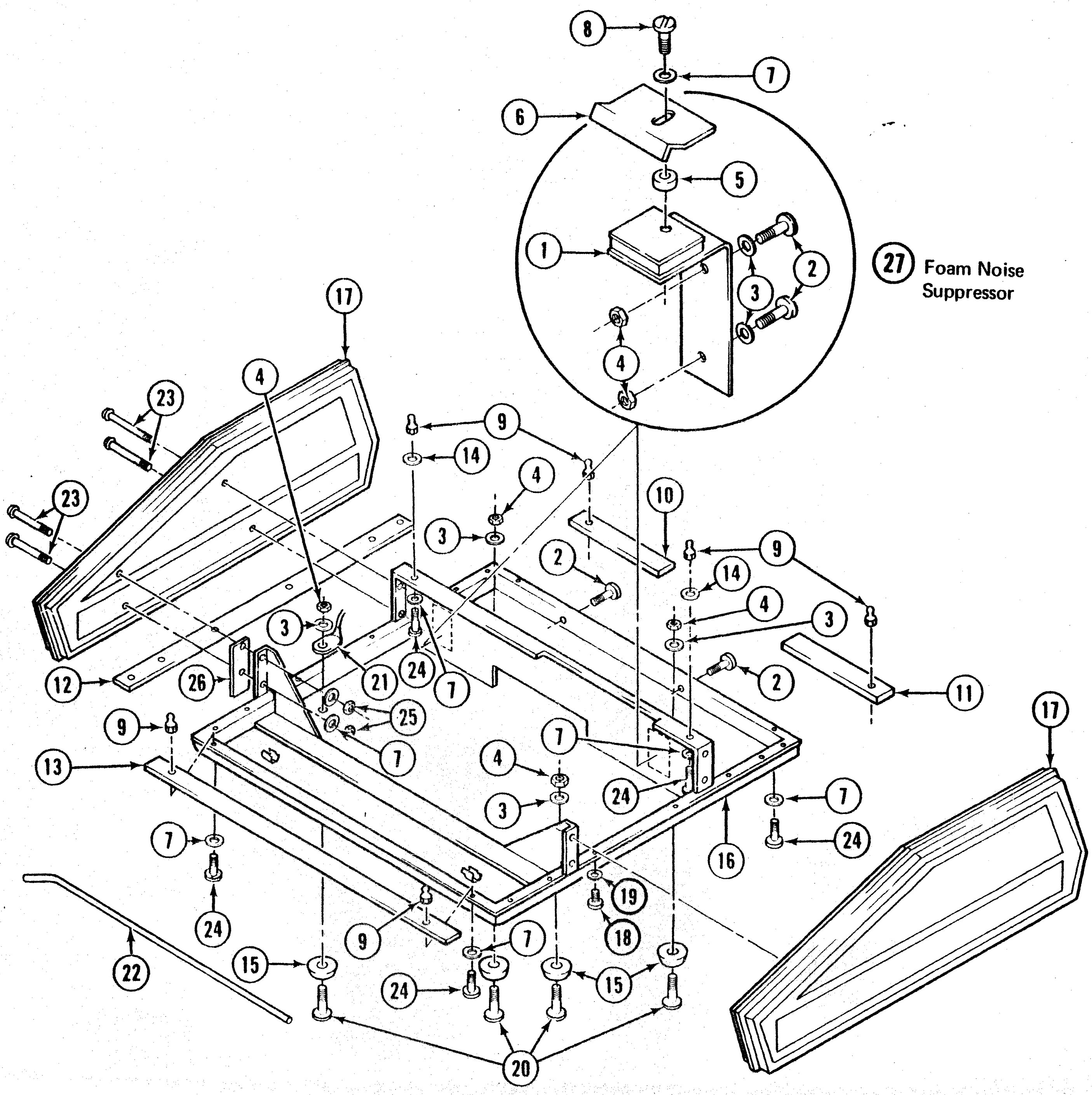
COVERS LEVEL B

These items not shown

1	Complete Back Cover
7	Complete Top Cover
29	Tape-Foam, Noise Sensitive
30	Foam, Noise Suppressor
32	Lamp, Indicator 6V
33	Lamp Coupler 6V

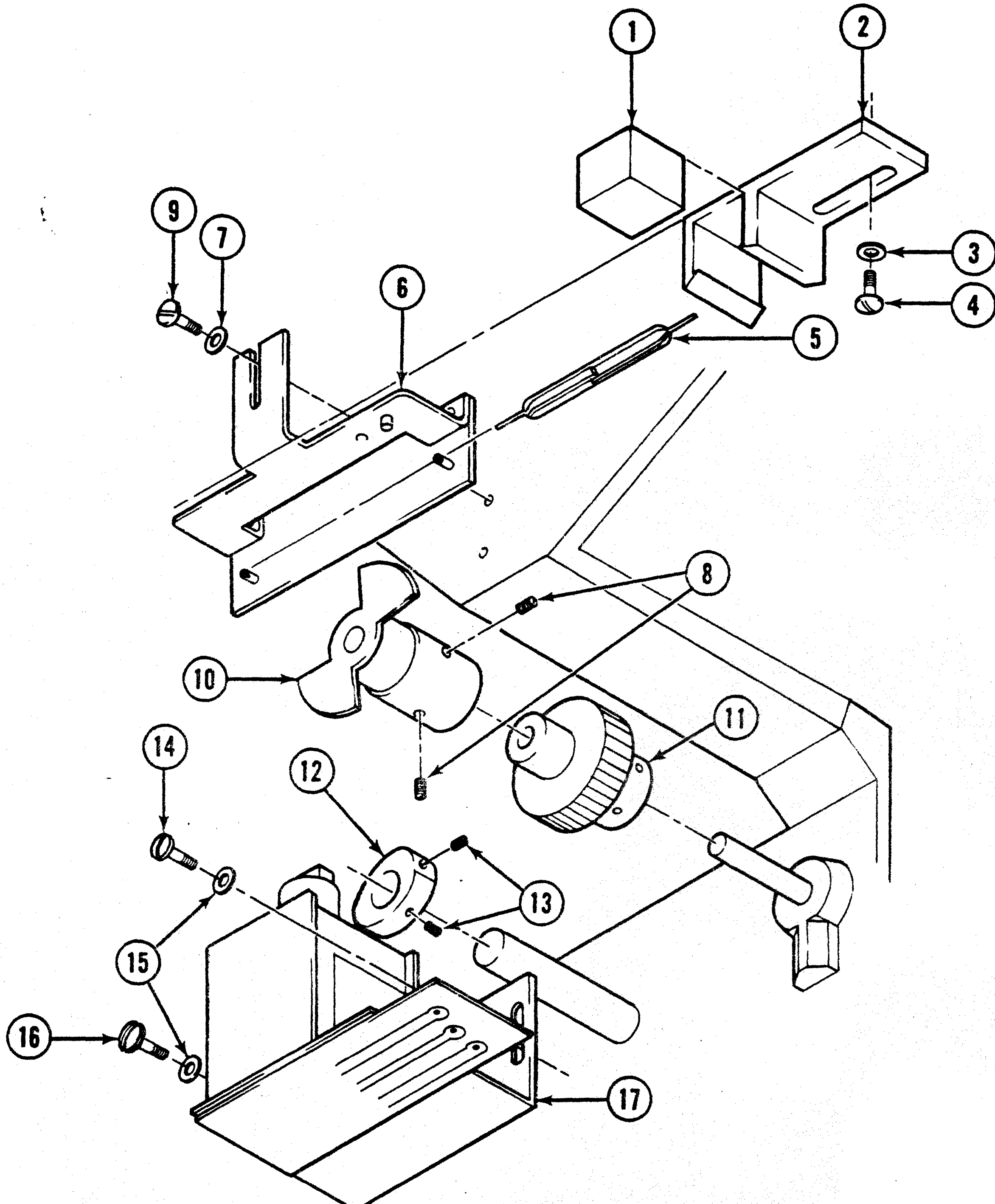


REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			COVERS LEVEL B	
1	M100179		Complete Back Cover (Contains Ref. 2–6)	1
2	0000104	001	Rear Panel	1
3	5000157	002	Bail Clip	4
4	5000065	001	Rivet, blend	8
	5000340	001	Screw, 2–56 x 1/4"*	8
	5000340	003	Nut, 2–56*	8
			*Replace rivet for field replacement	
5	0000296	001	Bezel, blank	1
6	5000349	015	Nut, 4–40 hex "kep"	2
7	M100180		Complete top cover (Contains Ref. 8–30)	1
8	0000102	001	Case, front, bare	1
9	1000016	001	Bezel Assembly, light	1
10	1000015	001	Lens, Blue	1
11	1000015	002	Lens, Green	1
12	1000015	003	Lens, Red	1
13	1000248		Bezel, light	1
14	0000299	001	Bezel, Loc/Rem.	1
15	1000165	037	Trim, 15 inch	1
16	5000158	003	Stud-ball	2
17	5000349	025	Screw, 6–32 x 1/4 sems	2
18	0000099		Hinge, Platen Cover	2
19	5000349	032	Screw, 6–32 x 3/8 socket hd.	4
20	5000349	028	Screw, 6–32 x 3/8 pan head	4
21	5000349	044	Nut, No. 6 "kep"	8
22	0000098	001	Cover, platen	1
23	11361000		Logo, COPE 1030 Note Vendor Code #18 Specify 1030	1
24	1000165	004	Paper Guide	1
25	1000165	035	Scale, 10 pitch	1
25	1000165	036	Scale, 12 pitch	1
26	0000285	001	Spring Clip, platen cover	2
27	5000349	032	Screw, 6–32 x 3/8 socket head	2
28	5000349	044	Nut No. 6 "kep"	2
29	5000177	004	Tape-foam, noise sensitive	
30	0000244	001	Foam Pad, noise suppressor	1
31	0000105	001	Platen knob	2
32	5000258	008	Lamp, Indicator 6 V	3
33	5000258	006	Lamp, Coupler 6 V	1


27 Foam Noise Suppressor

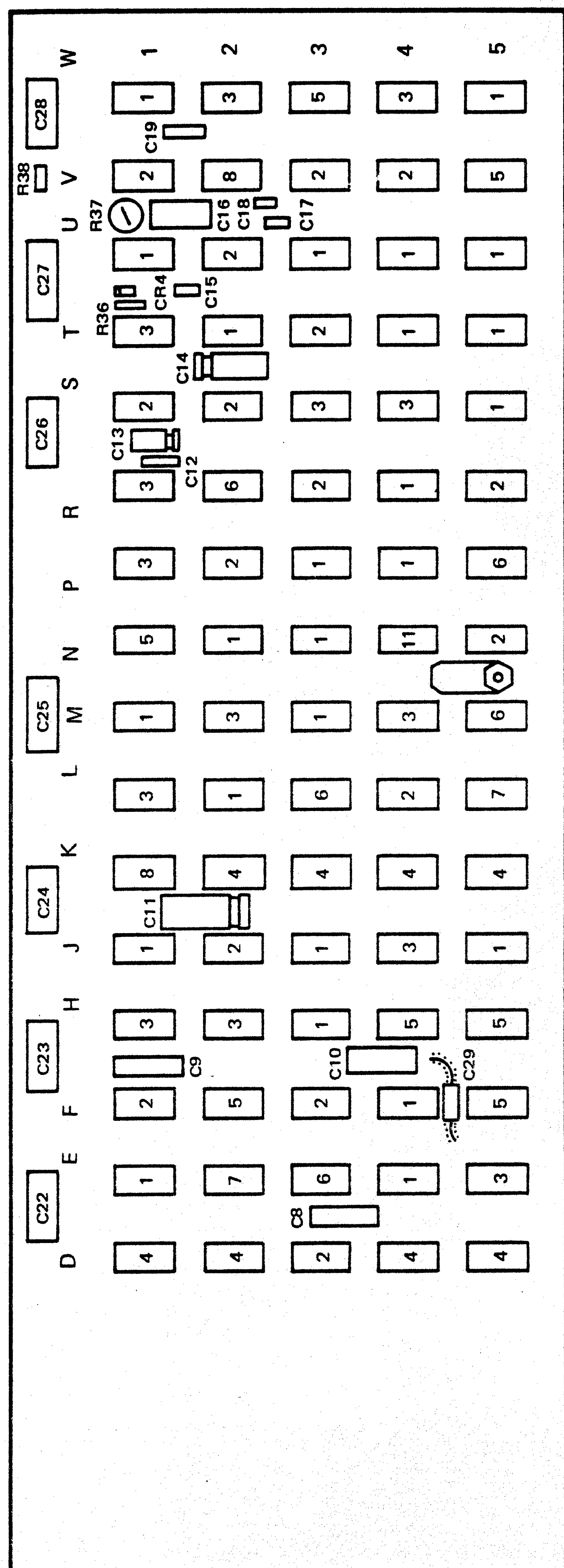
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			COVERS LEVEL B	
1	M100166		Rear Shock Mount	2
2	5000349	046	Mount Screw	4
3	5000349	050	Washer	4
4	5000349	053	"Kep" Nut	4
5	5000349	060	Clamp Spacer	2
6	0000193	001	Clamp	2
7	5000349	039	Washer	2
8	5000349	030	"Sems" Screw	2
9	5000158	003	Ball Stud	6
10	0000204	002	Shim LH Back	1
11	0000204	003	Shim RH Back	1
12	0000204	004	Side Shim	1
13	0000204	001	Front Shim	1
14	0000204	005	Stud Ball Shim	6
15	5000101	001	Rubber Foot	4
16	0000094	001	Bottom Panel	1
17	0000091	001	Side Casting	2
18	5000349	012	Side Cast Adj. Screw	14
19	5000349	016	Washer	14
20	5000349	048	Foot Screw	4
21	0000237		Tilt Back Cable	1
22	0000110	001	Tilt Back Rod	1
23	5000349	013	Side Casting Screw	8
24	5000349	033	"Sems" Screw	6
25	5000349	015	"Kep" Nut	6
26	5000349	061	1040 Shims (First 200 units only)	0
27	0000243		Foam Noise Suppressor	

FILTER SHUTTER ASSEMBLY



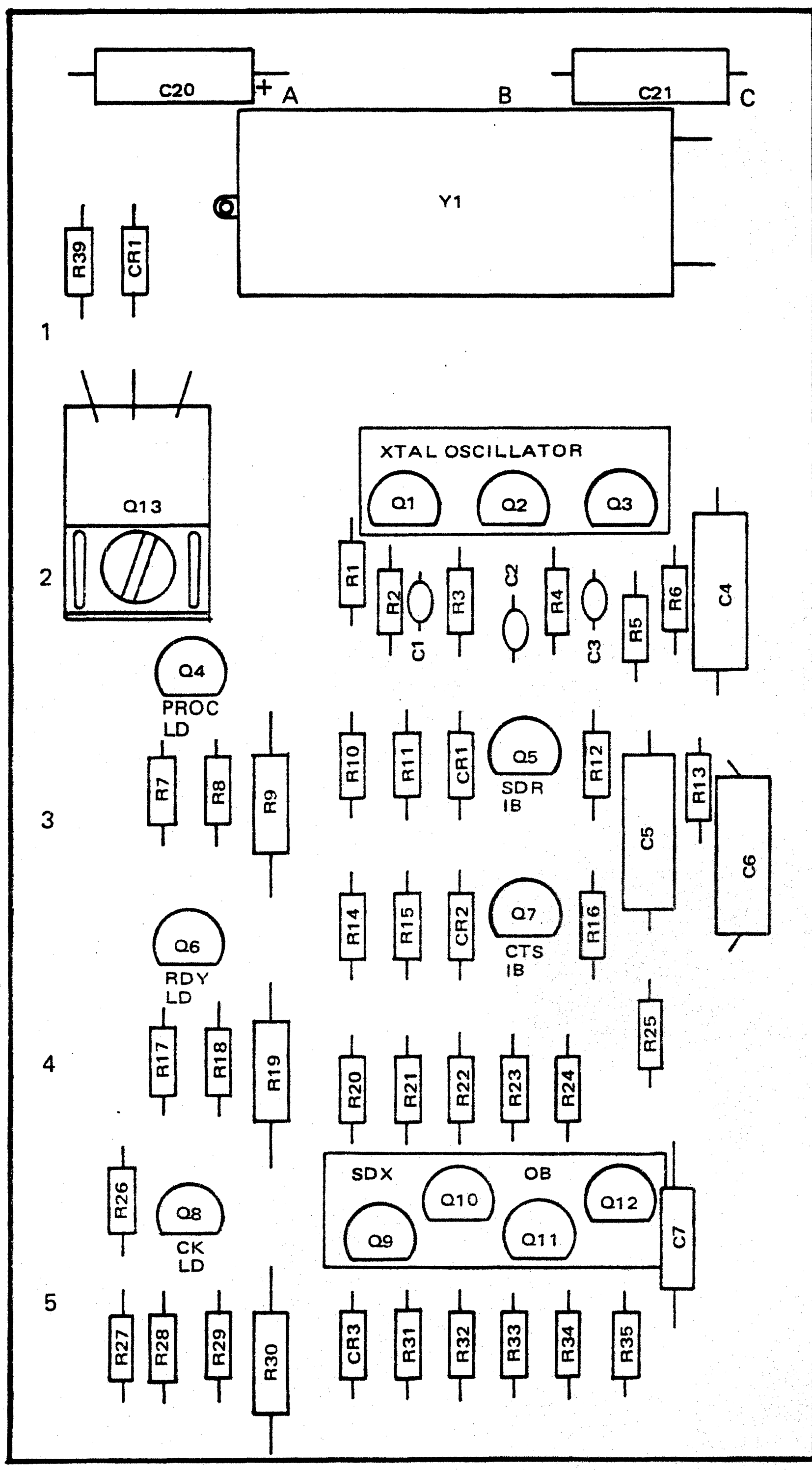
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			FILTER SHUTTER ASSEMBLY	
1	1000043		Magnet	1
2	1000199		Magnet holder	1
3	5000349	016	Washer	1
4	5000349	006	Screw	1
5	5000048	001	Reed Switch	1
6	M100084		Comp. Sw. Assm.	1
7	5000349	039	Washer	1
8	5000349	021	Set Screw	2
9	5000349	028	Screw	1
10	M10008		Filter Shutter A	1
11	1000224		Mod. F. Shaft Gear	1
12	1000165	232	Cam, Blue	1
13	1000165		Set Screw	2
14	5000349	011	Screw	1
15	5000349	016	Washer	2
16	5000349	012	Screw	1
17	M100149		Filter Shutter B Comp. Assm.	1

LOGIC BOARD LEVEL A



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level A	
1	5000332	007	Quad–1 Input Gate SP680A	
2	5000332	001	Dual–4 Input Gate SP616A	
3	5000332	006	Triple–3 Input Gate SP670A	
4	5000336	002	Dual Flip-Flop N8828A	
5	5000332	002	JK Binary F-F SP620A	
6	5000332	004	Quad–2 Input Gate SP631A	
7	5000332	005	Dual–4 Input Gate SP659A	
8	5000336	001	Single Shot N8162A	
CR4	5000007		Diode 1N914	
R36	5000020	623	Resistor 62K	
R37	5000337	001	Pot 5K 5W	
R38	5000020	102	Resistor 1K	
C8	5000223	046	Capacitor .01mfd	
C9	5000223	046	Capacitor .01mfd	
C19	5000223	046	Capacitor .01mfd	
C10	5000223	056	Capacitor .068mfd	
C16	5000223	056	Capacitor .068mfd	
C11	5000089	043	Capacitor 200mfd	
	5000089	044	Capacitor 250mfd	
	5000089	046	Capacitor 300mfd	
C12	5000223	044	Capacitor .0068mfd	
C13	5000089	032	Capacitor 10mfd	
C14	5000088	011	Capacitor 100mfd	
C15	5000262		Capacitor 2.2mfd 20V	
C17	5000262		Capacitor 2.2mfd 20V	
C18	5000262	028	Capacitor 6.8mfd 6V	
C22	5000224	050	Capacitor .022mfd	
C23	5000224	050	Capacitor .022mfd	
C24	5000224	050	Capacitor .022mfd	
C25	5000224	050	Capacitor .022mfd	
C26	5000224	050	Capacitor .022mfd	
C27	5000224	050	Capacitor .022mfd	
C28	5000224	050	Capacitor .022mfd	
C29	5000223	034	Capacitor .001mfd	
9	5000323	001	Panduit Block	
10	5000349	028	Screw	
11	5000349	041	Nut	
Q1	5000262	005	Transistor 6519	
Q2	5000318	001	Transistor 6515	
Q3	5000318	001	Transistor 6515	
Q4	5000009		Transistor 6534	
Q6	5000009		Transistor 6534	
Q8	5000009		Transistor 6534	
Q10	5000009		Transistor 6534	
Q11	5000009		Transistor 6534	
Q5	5000008		Transistor 6531	
Q7	5000008		Transistor 6531	
Q9	5000008		Transistor 6531	
Q12	5000008		Transistor 6531	
Q13	5000005		SCR2N4441	

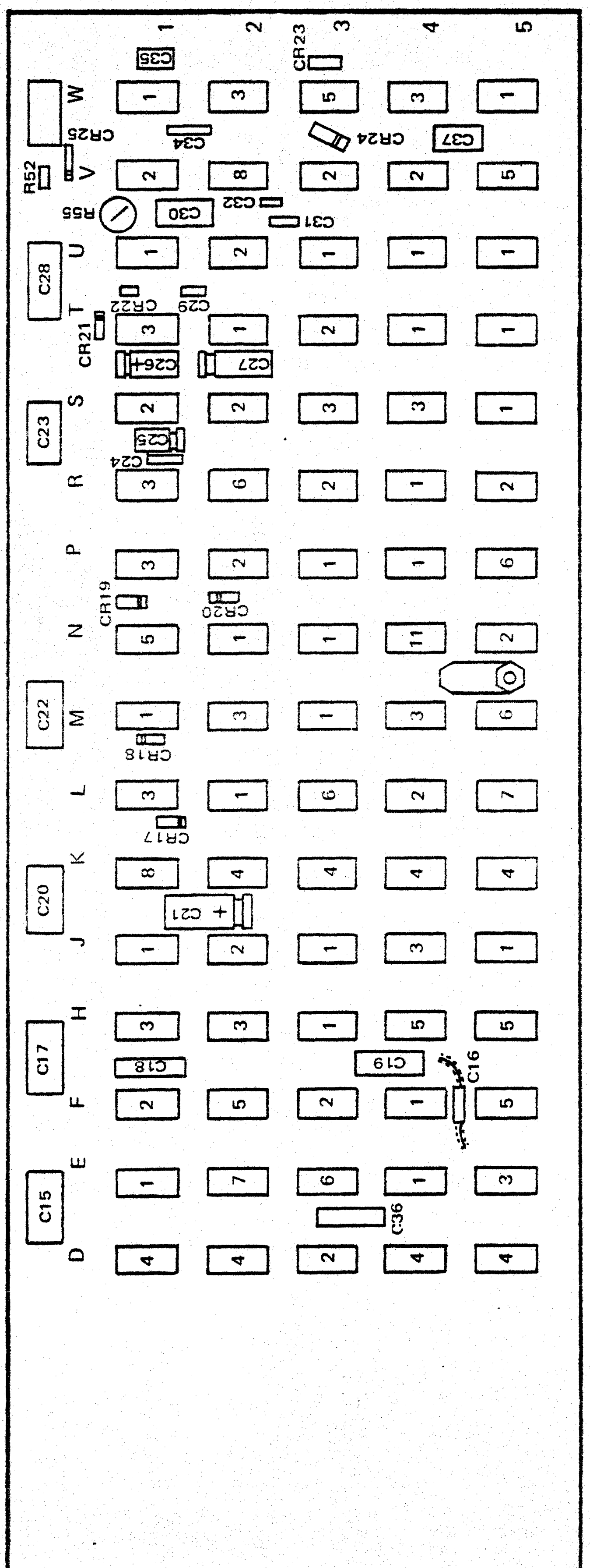
LOGIC BOARD LEVEL A



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level A (Cont)	
R1	5000020	752	Resistor 7.5K	
R21	5000020	752	Resistor 7.5K	
R2	5000020	123	Resistor 12K	
R3	5000020	123	Resistor 12K	
R4	5000020	223	Resistor 22K	
R34	5000020	223	Resistor 22K	
R5	5000020	103	Resistor 10K	
R7	5000020	103	Resistor 10K	
R17	5000020	103	Resistor 10K	
R28	5000020	103	Resistor 10K	
R6	5000020		Resistor 18K	
R8	5000020	751	Resistor 750	
R18	5000020	751	Resistor 750	
R29	5000020	751	Resistor 750	
R9	5000023	390	Resistor 39 1/2W	
R19	5000023	390	Resistor 39 1/2W	
R30	5000023	390	Resistor 39 1/2W	
R10	5000020	302	Resistor 3K	
R14	5000020	302	Resistor 3K	
R31	5000020	302	Resistor 3K	
R11	5000020	623	Resistor 62K	
R15	5000020	623	Resistor 62K	
R12	5000020	222	Resistor 2.2K	
R16	5000020	222	Resistor 2.2K	
R13	5000020	221	Resistor 220	
R25	5000020	221	Resistor 220	
R20	5000020	182	Resistor 1.8K	
R22	5000020	512	Resistor 5.1K	
R23	5000020	512	Resistor 5.1K	
R32	5000020	512	Resistor 5.1K	
R33	5000020	512	Resistor 5.1K	
R24	5000020	331	Resistor 330	
R35	5000020	331	Resistor 330	
R26	5000020	202	Resistor 2K	
R27	5000020	202	Resistor 2K	
R39	5000020	101	Resistor 100	
C1	5000099	046	Capacitor 270pfd	
C2	5000099	052	Capacitor 680pfd	
C3	5000099	052	Capacitor 680pfd	
C4	5000224	058	Capacitor .1mfd	
C20	5000224	058	Capacitor .1mfd	
C5	5000096	136	Capacitor 2mfd	
C6	5000096	136	Capacitor 2mfd	
C21	5000224	050	Capacitor .022mfd	
CR1	5000007		Diode 1N914	
CR2	5000007		Diode 1N914	
CR3	5000007		Diode 1N914	
CR5	5000191		Diode, Zener 1N4735	
Y1	5000339		Crystal 17.227Khz	

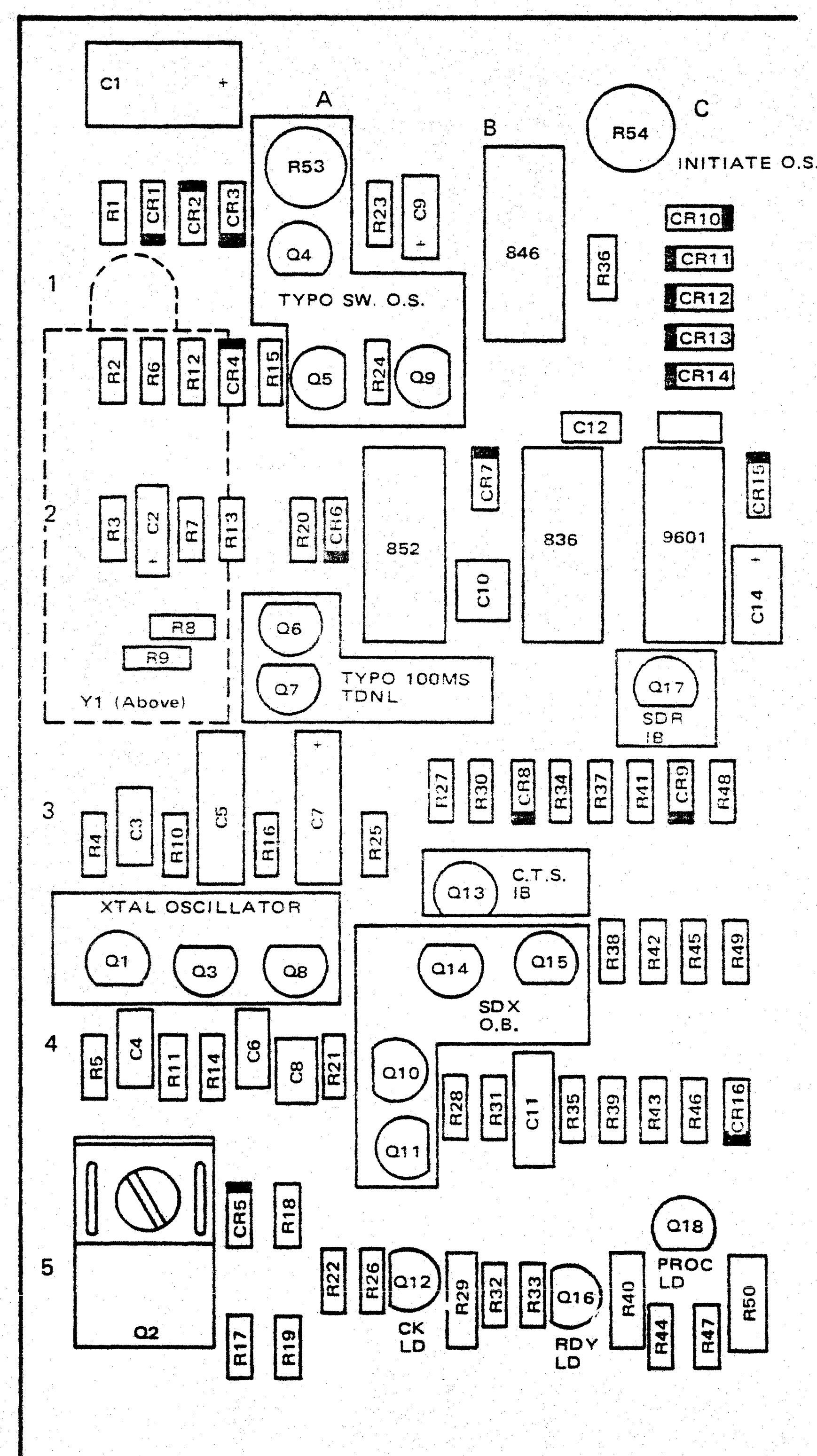
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level A (Cont)	
1	5000323	001	Panduit Block	
2	5000349	034	Screw	
3	5000349	041	Nut	
4	5000194	001	Mica Washer	
5	5000349	001	Screw	
6	5000349	062	Fish Paper	
7	5000349	003	Nut	
8	5000322	001	Panduit Strap	

LOGIC BOARD LEVEL B (TYPAMATIC)



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level B (Typamatic)	
1	5000332	007	SP680A Quad–1 Input Gate	
2	5000332	001	SP616A Dual–4 Input Gate	
3	5000332	006	SP670A Triple–3 Input Gate	
4	5000336	002	N8828A Dual Flip-Flop	
5	5000332	002	SP620A JK Binary F–F	
6	5000332	004	SP631A Quad–2 Input Gate	
7	5000332	005	SP659A Dual–4 Input Gate	
8	5000336	001	N8162A Single Shot	
C15	5000224	050	Capacitor .022mfd	
C17	5000224	050	Capacitor .022mfd	
C20	5000224	050	Capacitor .022mfd	
C22	5000224	050	Capacitor .022mfd	
C23	5000224	050	Capacitor .022mfd	
C28	5000224	050	Capacitor .022mfd	
C33	5000224	050	Capacitor .022mfd	
C16	5000223	034	Capacitor .001mfd	
C14	5000223	046	Capacitor .01mfd	
C34	5000223	046	Capacitor .01mfd	
C36	5000223	046	Capacitor .01mfd	
C19	5000223	056	Capacitor .068mfd	
C30	5000223	056	Capacitor .068mfd	
C21	5000089	043	Capacitor 200mfd	
	5000089	044	Capacitor 250mfd	
	5000089	046	Capacitor 300mfd	
C24	5000223	044	Capacitor .0068mfd	
C25	5000089	032	Capacitor 60mfd	
C26	5000088	011	Capacitor 100mfd	
C27	5000088	011	Capacitor 100mfd	
C29	5000088	011	Capacitor 47mfd	
C31	5000262	226	Capacitor 2.2mfd 20V	
C32	5000262	028	Capacitor 6.8mfd 6V	
C35	5000099	054	Capacitor .001mfd	
C37	5000099	054	Capacitor .001mfd	
R52	5000020	102	Resistor 1K	
CR17	5000311	001	Diode 1N141	
CR18	5000311	001	Diode 1N141	
CR19	5000311	001	Diode 1N141	
CR21	5000311	001	Diode 1N141	
CR23	5000311	001	Diode 1N141	
CR24	5000311	001	Diode 1N141	
CR25	5000311	001	Diode 1N141	
CR20	5000007		Diode 1N914	
CR22	5000007		Diode 1N914	
R55	5000327	009	Resistor, VAR .5K1W	
9	5000323	001	Panduit Block	
10	5000349	028	Screw	
11	5000349	041	Nut	
1	5000196	001	IC 836	
2	5000196	002	IC 846	

LOGIC BOARD LEVEL B (TYPAMATIC)

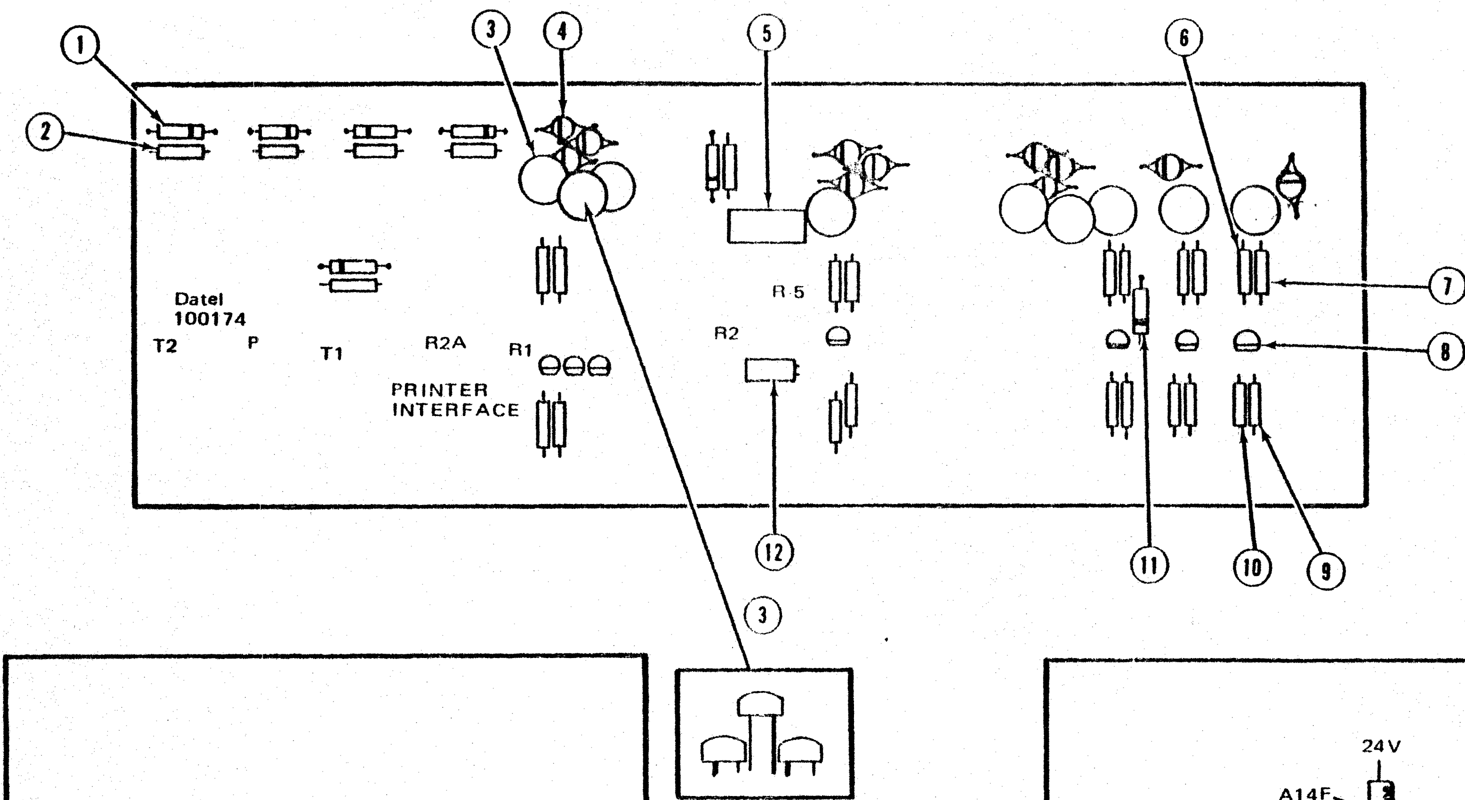


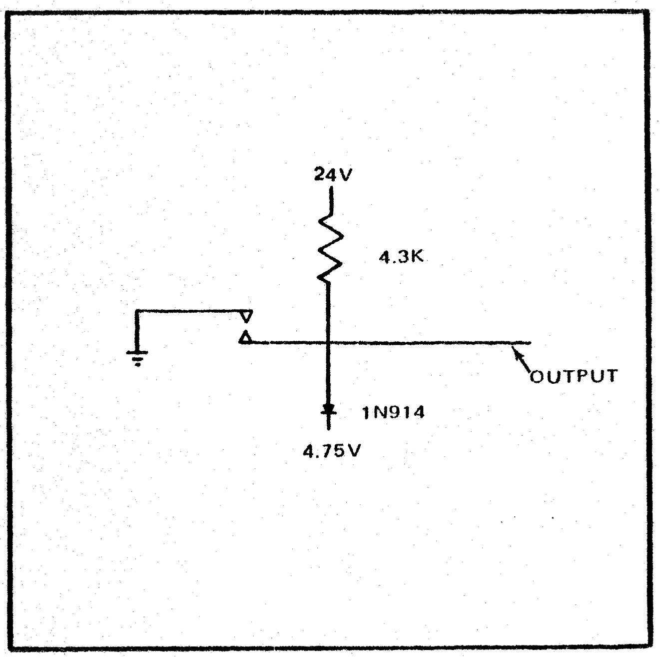
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level B (Typamatic) (Cont)	
3	5000196	010	IC 852	
4	5000196		IC 9601	
C1	5000224	058	Capacitor .1mfd	
C2	5000262	226	Capacitor 2.2mfd 20V	
C3	5000099	052	Capacitor 680pfd	
C6	5000099	052	Capacitor 680pfd	
C4	5000099	046	Capacitor 270pfd	
C5	5000096	136	Capacitor 2mfd 25V	
C7	5000096	136	Capacitor 2mfd 25V	
C8	5000088	019	Capacitor .1mfd 35V	
C10	5000334	002	Capacitor .1mfd 35V	
C9	5000262	028	Capacitor 6.8mfd 6V	
C11	5000223	044	Capacitor .0068mfd	
C12	5000099	002	Capacitor .01mfd	
C13	5000099	002	Capacitor .01mfd	
C14	5000088	008	Capacitor 220mfd	
Q1	5000318	005	Transistor 6519	
Q2	5000005	001	SCR 2N4441	
Q3	5000318	001	Transistor 6515	
Q8	5000318	001	Transistor 6515	
Q4	5000002		Transistor 2N4125	
Q5	5000001		Transistor 2N4123	
Q6	5000001		Transistor 2N4123	
Q7	5000001		Transistor 2N4123	
Q9	5000001		Transistor 2N4123	
Q10	5000008		Transistor 6531	
Q13	5000008		Transistor 6531	
Q15	5000008		Transistor 6531	
Q17	5000008		Transistor 6531	
Q11	5000009		Transistor 6534	
Q12	5000009		Transistor 6534	
Q14	5000009		Transistor 6534	
Q16	5000009		Transistor 6534	
Q18	5000009		Transistor 6534	
R1	5000020	102	Resistor 1K	
R23	5000020	102	Resistor 1K	
R2	5000020	392	Resistor 3.9K	
R3	5000020	101	Resistor 100Ω	
R17	5000020	101	Resistor 100Ω	
R4	5000020	123	Resistor 12K	
R11	5000020	123	Resistor 12K	
R5	5000020	752	Resistor 7.5K	
R43	5000020	752	Resistor 7.5K	
R6	5000020	103	Resistor 10K	
R10	5000020	103	Resistor 10K	
R15	5000020	103	Resistor 10K	
R26	5000020	103	Resistor 10K	
R33	5000020	103	Resistor 10K	
R47	5000020	103	Resistor 10K	

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level B (Typamatic) (Cont)	
R7	5000020	623	Resistor 62K	
R30	5000020	623	Resistor 62K	
R41	5000020	623	Resistor 62K	
R8	5000020	203	Resistor 20K	
R9	5000020	203	Resistor 20K	
R12	5000020	222	Resistor 2.2K	
R24	5000020	222	Resistor 2.2K	
R34	5000020	222	Resistor 2.2K	
R38	5000020	222	Resistor 2.2K	
R13	5000020	622	Resistor 6.2K	
R20	5000020	622	Resistor 6.2K	
R14	5000020	223	Resistor 22K	
R28	5000020	223	Resistor 22K	
R16	5000020	221	Resistor 220	
R25	5000020	221	Resistor 220	
R18	5000020	202	Resistor 2K	
R19	5000020	202	Resistor 2K	
R21	5000020	183	Resistor 18K	
R22	5000020	721	Resistor 750	
R32	5000020	721	Resistor 750	
R44	5000020	721	Resistor 750	
R27	5000020	302	Resistor 3K	
R37	5000020	302	Resistor 3K	
R49	5000020	302	Resistor 3K	
R29	5000023	390	Resistor 39Ω 1/2W	
R40	5000023	390	Resistor 39Ω 1/2W	
R50	5000023	390	Resistor 39Ω 1/2W	
R31	5000020	331	Resistor 330Ω	
R38	5000020	331	Resistor 330Ω	
R35	5000020	512	Resistor 5.1K	
R36	5000020	512	Resistor 5.1K	
R39	5000020	512	Resistor 5.1K	
R42	5000020	512	Resistor 5.1K	
R45	5000020	512	Resistor 5.1K	
R46	5000020	182	Resistor 1.8K	
R53	5000327	008	Resistor Var 2K 1W	
R54	5000327	011	Resistor Var 20K 1W	
CR1	5000007		Diode 1N914	
CR2	5000007		Diode 1N914	
CR3	5000007		Diode 1N914	
CR4	5000007		Diode 1N914	
CR8	5000007		Diode 1N914	
CR9	5000007		Diode 1N914	
CR15	5000007		Diode 1N914	
CR16	5000007		Diode 1N914	
CR5	5000191	108	Diode 1N4735A	
CR6	5000311	001	Diode 1N141	
CR7	5000311	001	Diode 1N141	
CR10	5000311	001	Diode 1N141	

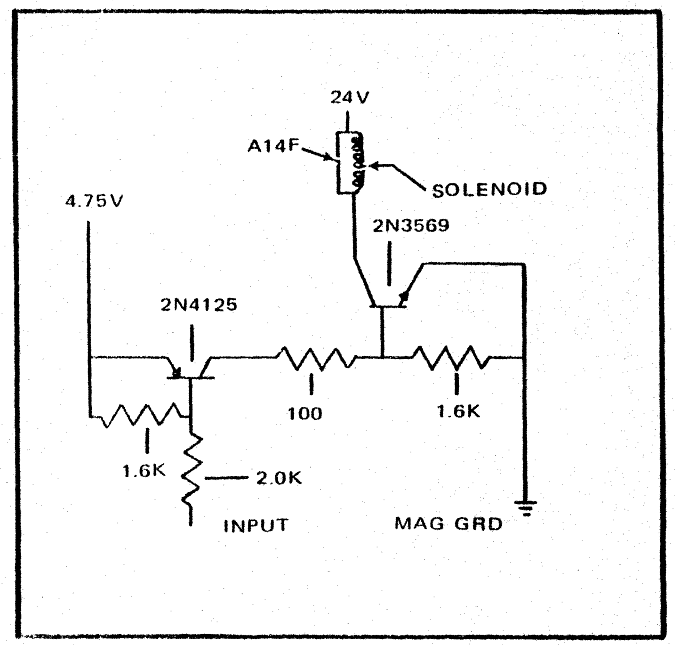
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			LOGIC BOARD Level B (Typamatic) (Cont)	
CR11	5000311	001	Diode 1N141	
CR12	5000311	001	Diode 1N141	
CR13	5000311	001	Diode 1N141	
CR14	5000311	001	Diode 1N141	
Y1	5000339	001	Crystal 17227Khz	

PRINTER INTERFACE BOARD





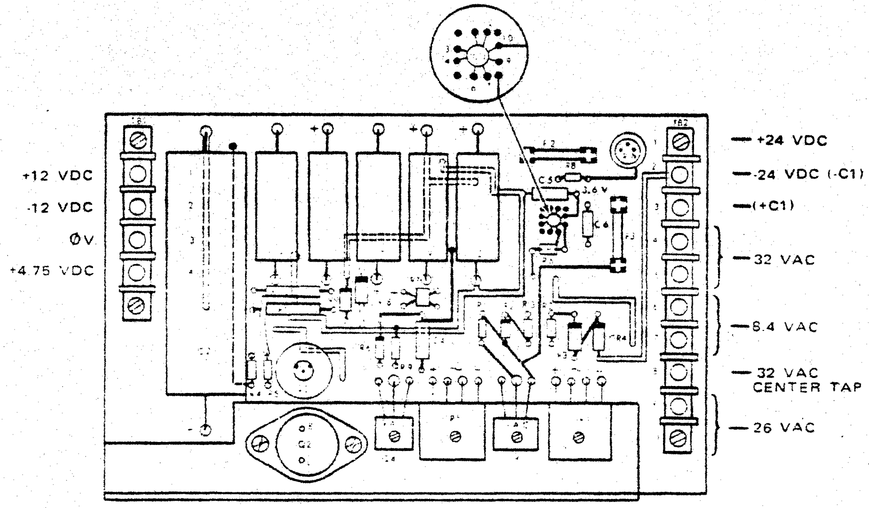
SWITCH TERMINATION



MAG DRIVER

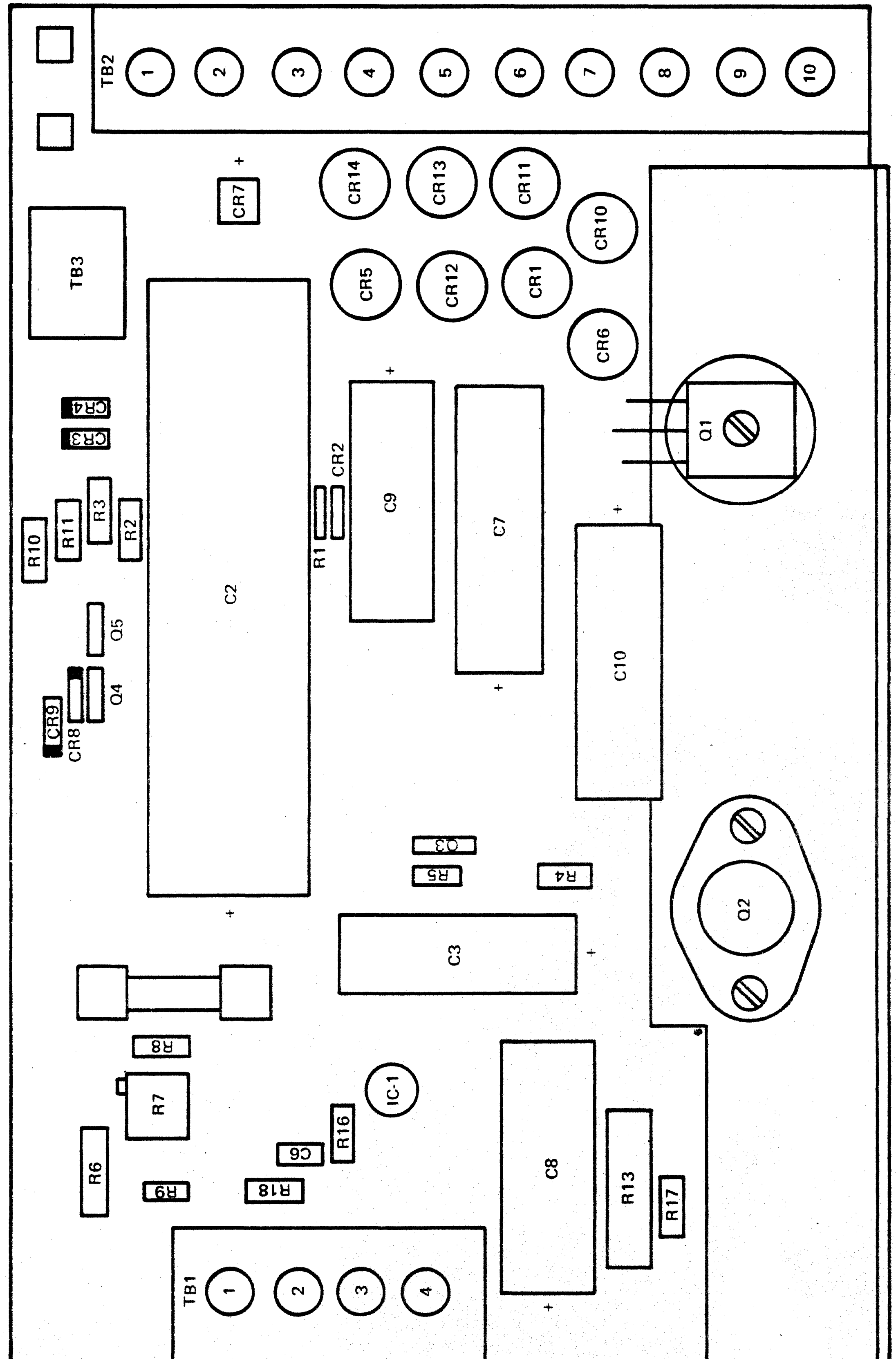
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			PRINTER INTERFACE BOARD	
1	5000007		Diode 1N914	
2	5000020	443	Resistor 4.3K	
3	5000338	001	Transistor –2N3569	
4	5000235	001	Diode A14F	
5	5000088	029	Capacitor 6.8mfd 35V	
6	5000020	163	Resistor 1.6K	
7	5000020	101	Resistor 100Ohms	
8	5000008		Transistor 2N4125	
9	5000020	203	Resistor 2.0K	
10	5000020	163	Resistor 1.6K	
11	5000183	011	Diode Zener	
12	5000262	090	Capacitor 4.7mfd 10V	
	M100075		Interface Board Assembly Complete	

POWER SUPPLY LEVEL A



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY BOARD Level A	
R1	5000020	431	Resistor, 430Ω, 1/4W ±5%	3
R2	5000020	431	Resistor, 430Ω, 1/4W ±5%	3
R6	5000020	431	Resistor, 430Ω, 1/4W ±5%	3
R3	5000020	620	Resistor, 62Ω, 1/4W ±5%	1
R4	5000020	301	Resistor, 300Ω, 1/4W ±5%	1
R5	5000020	102	Resistor, 1K, 1/4W ±5%	1
R7	5000187	017	Potentiometer, 500 ohm, 1/2W (Bourns 3257–P1–500)	1
R8	5000020	751	Resistor, 750Ω, 1/4W ±5%	1
R10	5000020	151	Resistor, 150Ω, 1W ±5%	2
R11	5000020	151	Resistor, 150Ω, 1W ±5%	2
C2	5000184	074	Capacitor, 8000mfd, 15V	1
C3	5000096	152	Capacitor, 250mfd, 25V	5
C7	5000096	152	Capacitor, 250mfd, 25V	5
C8	5000096	152	Capacitor, 250mfd, 25V	5
C9	5000096	152	Capacitor, 250mfd, 25V	5
C10	5000096	152	Capacitor, 250mfd, 25V	5
C5	5000096	060	Capacitor, 5mfd, 12V	1
C6	5000099	052	Capacitor, 680pf, 500V	1
CR2	5000183	005	Zener Diode, MZ–1000–5	1
CR3	5000191	016	Zener Diode, 1N4743A	4
CR4	5000191	016	Zener Diode, 1N4743A	4
CR8	5000191	016	Zener Diode, 1N4743A	4
CR9	5000191	016	Zener Diode, 1N4743A	4
CR7	5000188	010	Rectifier, MDA–920A–3	1
CR1	5000426	005	Rectifier, MDA–970–2	2
CR5	5000426	005	Rectifier, MDA–970–2	2
Q1	5000005	001	SCR, 2N4441	1
Q2	5000133	001	Transistor, MJ2801	1
Q3	5000008	001	Transistor, MPS6531	1
IC1	5000349	102	Integrated Circuit, WC109T	1
F1	5000142	010	Fuse, 3 amp, 8AG	2
F2	5000142	010	Fuse, 3 amp, 8AG	2

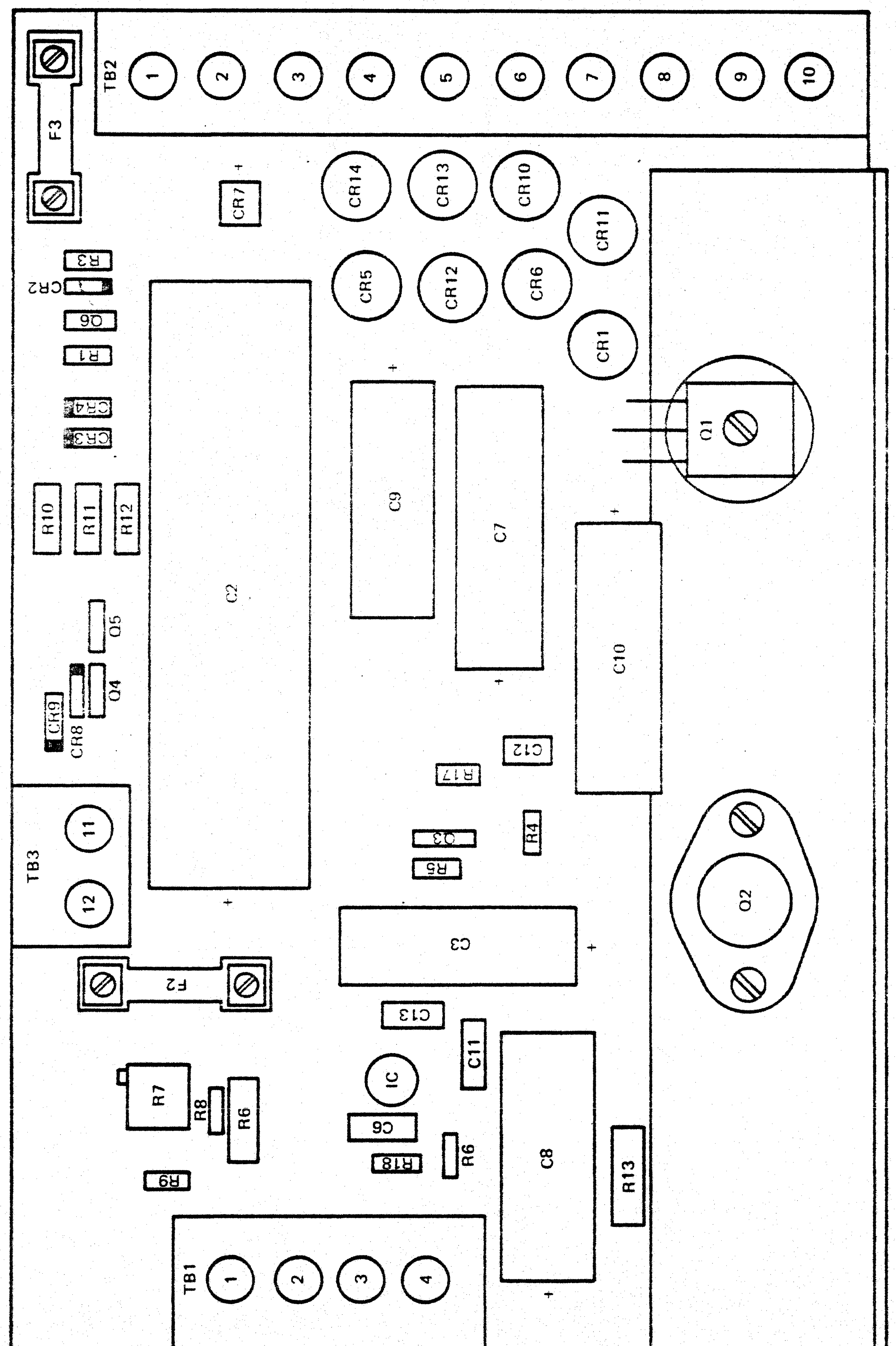
POWER SUPPLY BOARD LEVEL B



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY BOARD (Level B)	
1	1000078		Bracket, Mounting	
2	M100128		Complete PS Board	
1G1	5000189	001	ICMA 723 C	
R1–2	5000020	431	Resistor 430–1/4	
R3	5000020	620	Resistor 62–1/4	
R4	5000020	301	Resistor 300–1/4	
R5	5000020	102	Resistor 1K–1/4	
R6	5000023	361	Resistor 360–1/2	
R7	5000187	017	Pot 500	
R8	5000020	751	Resistor 750–1/4	
R9	5000020	182	Resistor 1.8K–1/4	
R10	5000020	132	Resistor 1.3K–1/4	
R11	5000020	272	Resistor 2.7K–1/4	
R13	5000074	001	Resistor .1ohm2W	
R16	5000020	753	Resistor 75K–1/4	
R17	5000020	392	Resistor 3.9K–1/4	
R18	5000020	102	Resistor 1K–1/4	
C2	5000184	074	Cap. 8000mfd	
C3	5000096	152	Cap. 250mfd	
C6	5000099	015	Cap. 470pfd	
C7	5000096	152	Cap. 250mfd	
C8	5000096	152	Cap. 250mfd	
C9	5000096	152	Cap. 250mfd	
C10	5000096	152	Cap. 250mfd	
CR1	5000192	009	Rect 1N4998	
CR2	5000183	005	Diode Zener 1000–5	
CR3	5000191	016	Diode Zener 1N4743A	
CR4	5000191	016	Diode Zener 1N4743A	
CR5	5000192	009	Rect 1N4998	
CR6	5000192	009	Rect 1N4998	
CR7	5000188	010	Bridge MDA 920A–3	
CR8	5000191	016	Diode 1N4743A	
CR9	5000191	016	Diode 1N4743A	
CR10	5000192	009	Rect 1N4998	
CR11	5000192	009	Rect 1N4998	
CR12	5000192	009	Rect 1N4998	
CR13	5000192	009	Rect 1N4998	
CR14	5000192	009	Rect 1N4998	
Q1	5000005	001	Rect 2N4441 w/i mica washer	
Q2	5000133	001	Transistor MJ2801	
Q3	5000004	001	Transistor 2N4921	
Q4	5000004	001	Transistor 2N4921	
Q5	5000003	001	Transistor 2N4918	
TB1	5000193	004	Terminal	
TB2	5000193	010	Terminal	
TB3	5000193	002	Terminal	
			Mounting Hardware	
	5000194	001	Mica Washer (Q2)	
	5000349		Fiber Washer	

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY BOARD (Level B) (Cont)	
	5000349	034	Screw 1/2	
	5000349	042	Nut	
	5000011	308	Nylon Screw	
	5000084	001	Nylon Nut	
	5000190		Fuse Clip	
	5000349	007	Screw	
	5000349	015	Nut	

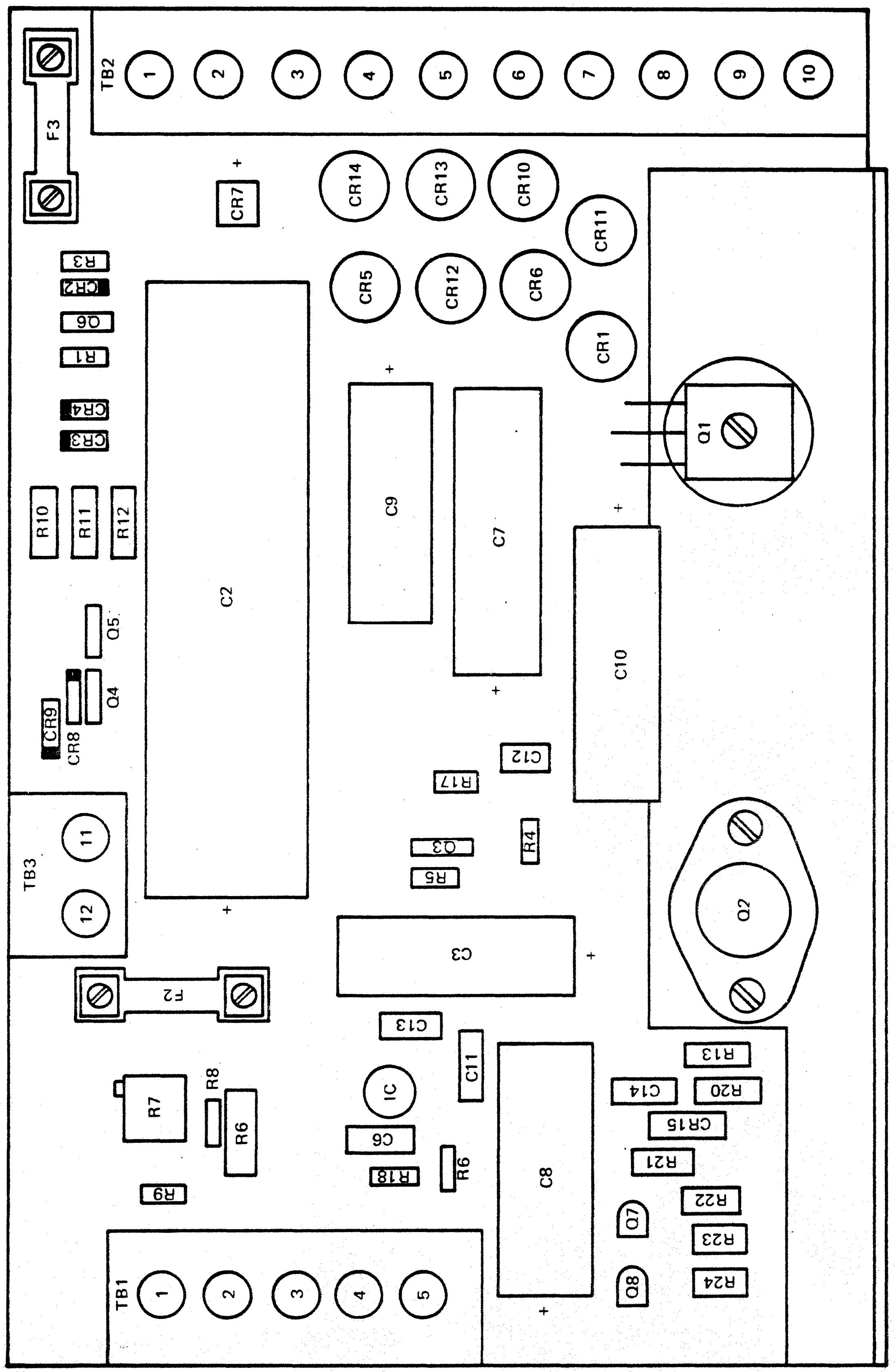
POWER SUPPLY LEVEL C (COUPLER)



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY Level C (Coupler)	
IC–1	5000189	001	IC MA723C	
Q1	5000005	001	Rectifier 2N4441	
Q2	5000133	001	Transistor MJ2801	
Q3	5000004	001	Transistor 2N4921	
Q4	5000004	001	Transistor 2N4921	
Q5	5000003	001	Transistor 2N4918	
Q6	5000246		Transistor 6565	
CR1	5000192	009	Rectifier IN4998	
CR5	5000192	009	Rectifier IN4998	
CR6	5000192	009	Rectifier IN4998	
CR10	5000192	009	Rectifier IN4998	
CR11	5000192	009	Rectifier IN4998	
CR12	5000192	009	Rectifier IN4998	
CR13	5000192	009	Rectifier IN4998	
CR14	5000192	009	Rectifier IN4998	
CR5	5000007		Diode IN914	
CR3	5000191	016	Zener Diode IN4743A	
CR4	5000191	016	Zener Diode IN4743A	
CR8	5000191	016	Zener Diode IN4743A	
CR9	5000191	016	Zener Diode IN4743A	
CR7	5000188	010	Bridge 920A	
C2	5000184	074	Capacitor 800mfd	
C3	5000096	152	Capacitor 250mfd	
C8	5000096	152	Capacitor 250mfd	
C9	5000096	152	Capacitor 250mfd	
C10	5000096	152	Capacitor 250mfd	
C6	5000099	015	Capacitor 470pfd	
C7	5000096	155	Capacitor 500mfd	
C11	5000099	002	Capacitor .01mfd	
C12	5000099	002	Capacitor .01mfd	
C13	5000099	002	Capacitor .01mfd	
R1	5000020	101	Resistor 100	
R3	5000020	101	Resistor 100	
R2	5000023	431	Resistor 430 1/2W	
R4	5000020	151	Resistor 150	
R5	5000020	471	Resistor 470	
R6	5000023	361	Resistor 360	
R11	5000023	361	Resistor 360	
R7	5000187	017	Resistor Var 500	
R8	5000020	751	Resistor 750	
R9	5000020	182	Resistor 1.8K	
R10	5000023	241	Resistor 240	
R13	5000074	001	Resistor .1 2W	
R16	5000020	753	Resistor 75K	
R17	5000020	332	Resistor 3.3K	
R18	5000020	102	Resistor 1K	
1	5000011	308	Nylon Screw	
2	5000349	018	Nylon Nut	
3	5000194	001	Mica Washer	

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY Level C (Coupler) (Cont)	
4	5000349	034	Screw	
5	5000349	042	Nut	
6	5000349	063	Fiber Spacer	
7	5000190		Fuse Clip	
8	5000349	007	Screw	
9	5000349	015	Kep Nut	
10	1000078		Mounting Bkt	
			LEVEL D	
R20	5000020	103	Resistor 10K 1/4W	
R21	5000020	473	Resistor 47K 1/4W	
R22	5000020	473	Resistor 47K 1/4W	
R23	5000020	302	Resistor 3K 1/4W	
R24	5000020	182	Resistor 1.8K 1/4W	
C14	5000088	004	Capacitor 100mfd 6 VDC	
Q7	5000001	001	Transistor, 2N4123	
Q8	5000001	001	Transistor, 2N4123	
CR15	5000321	005	Diode Zener, MZ4618	
TB1	5000193		Terminal Strip, 5	
			NOTE: Level C & D use the same components except that level D has POR added.	

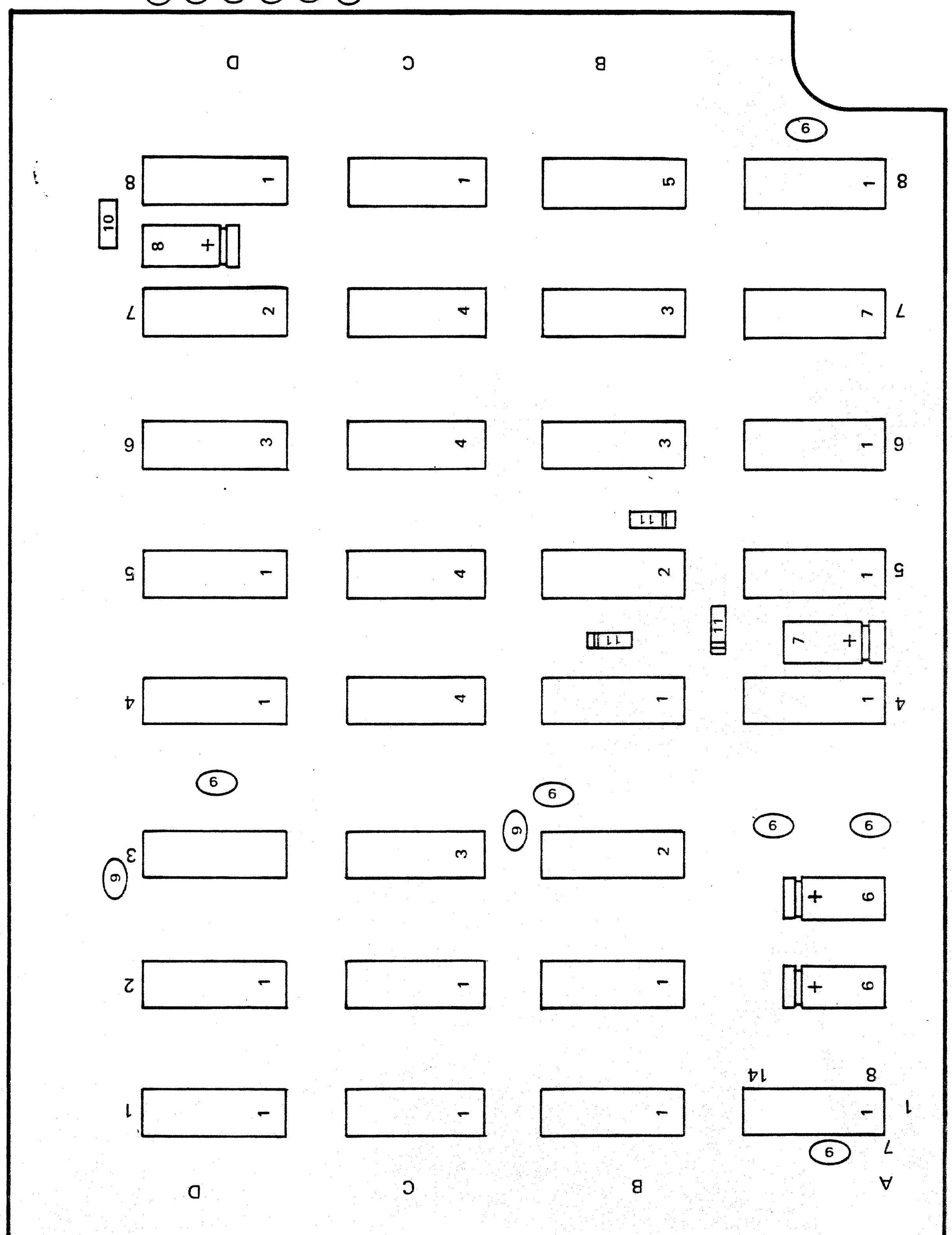
POWER SUPPLY LEVEL D (POR)



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			I/O INTERLOCK BOARD	
1	5000332	001	Quad 2 input Gate	
2	5000332	001	Dual 4 input Gate	
3	5000332	006	Triple 3 input Gate	
4	5000196	010	J.K. Flip-Flop	
5	5000196	002	J.K. Quad Dual Gate	
6	5000089	026	Capacitor, 2mfd	
7	5000089	034	Capacitor, 20mfd	
8	5000089	029	Capacitor, 5mfd	
9	5000099	029	Capacitor, .047mfd	
10	5000021	201	Resistor 200	
11	5000007	001	Diode 1N914	
12	5000035		Speed Clip	
13	1000399		Cover	
14	5000057		Spacer	
15	5000349	038	Screw	
16	M100147		Harness Assy.	
17	M100146		Complete board with cover	

I/O INTERLOCK BOARD

(12) SPEED CLIP
(13) COVER
(14) SPACER
(15) SCREW
(16) HARNESS
(17) COMPLETE BOARD



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			REAR SUB-CHASSIS ASSEMBLY	
1	0000109	001	Bottom Pan	1
2	1000023	001	Card Bracket	2
3	5000349	039	6 Flat Washer	4
4	5000349	044	6 Kep Nut	13
5	5000205		Card guide	2
6	5000012	001	Resistor 1 ohm 8W (R12)	1
7	5000322	001	Cable hold-down	1
8	5000349	053	8 Kep Nut	10
9	5000349	050	8 Flat Washer	10
10	5000349	026	Screw	2
11	5000198	001	Fan Grille	1
12	0000191	002	Fan Bracket	1
13	M100031		Transformer Assy.	1
14	5000075		Fuseholder Assy.	3
15	5000066	008	Shrink Tube 5/8"	
16	17–305–1		Data Connector	1
17	5000349		Hex Spacer	2
18	5000175	001	Access Receptacle	1
19	5000349	031	Button Cap Screw	3
20	5000237	001	Power Receptacle	1
21	5000225	368	LR Switch Assy.	1
22	M100128		Power Supply Assy.	1
23	5000038	002	Capacitor Bracket	1
24	5000086	085	Capacitor 8400mfd 40V (C1)	1
25	M100022		Logic Card Assy.	1
26	5000349	034	Screw	1
27	5000349	041	Nut	1
28	5000197	001	Fan	1
29	5000349	007	Screw	2
30	M100163		PS Harness Complete with power receptacles	1
31	M100181		Complete Sub-Chassis Assembly	1

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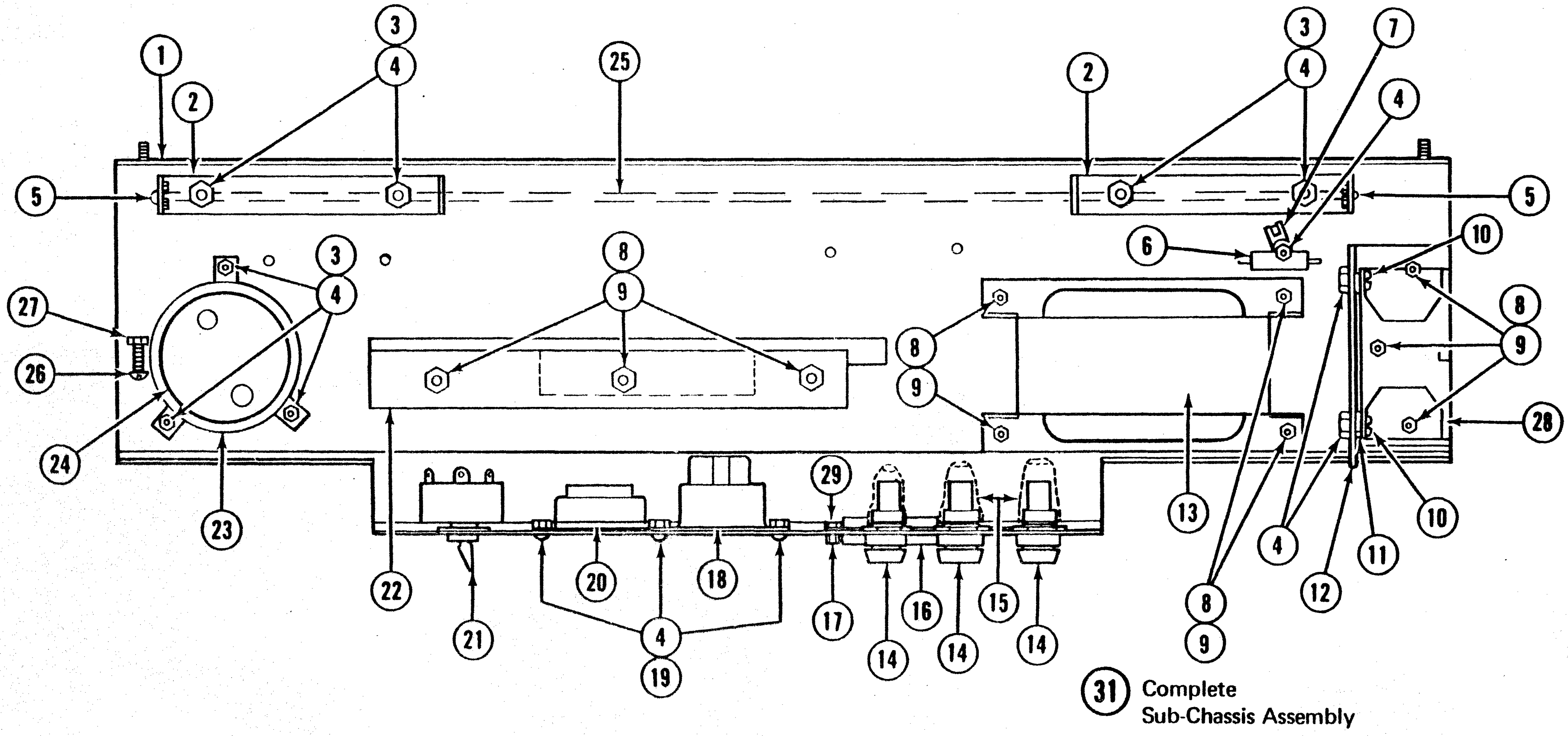
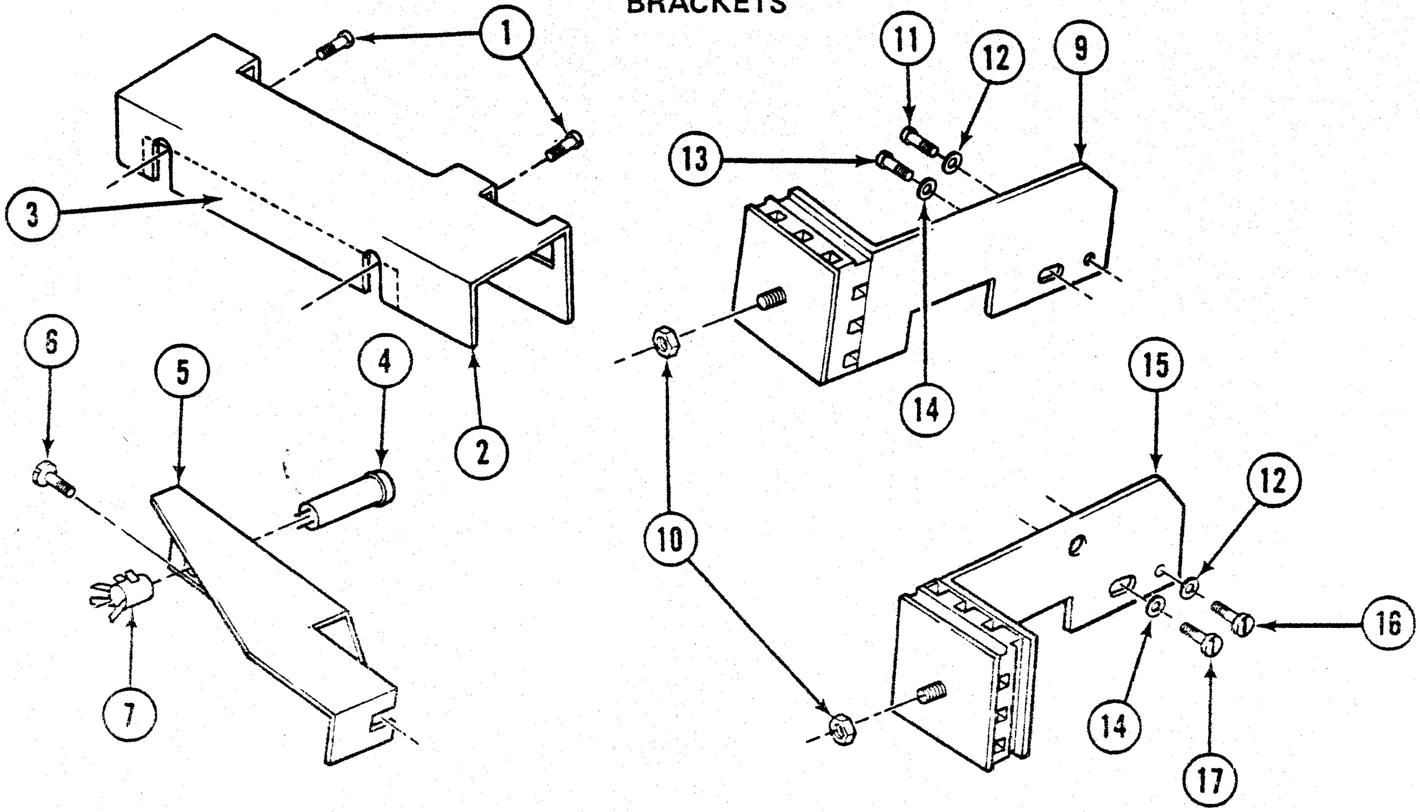
REAR SUB-CHASSIS ASSEMBLY

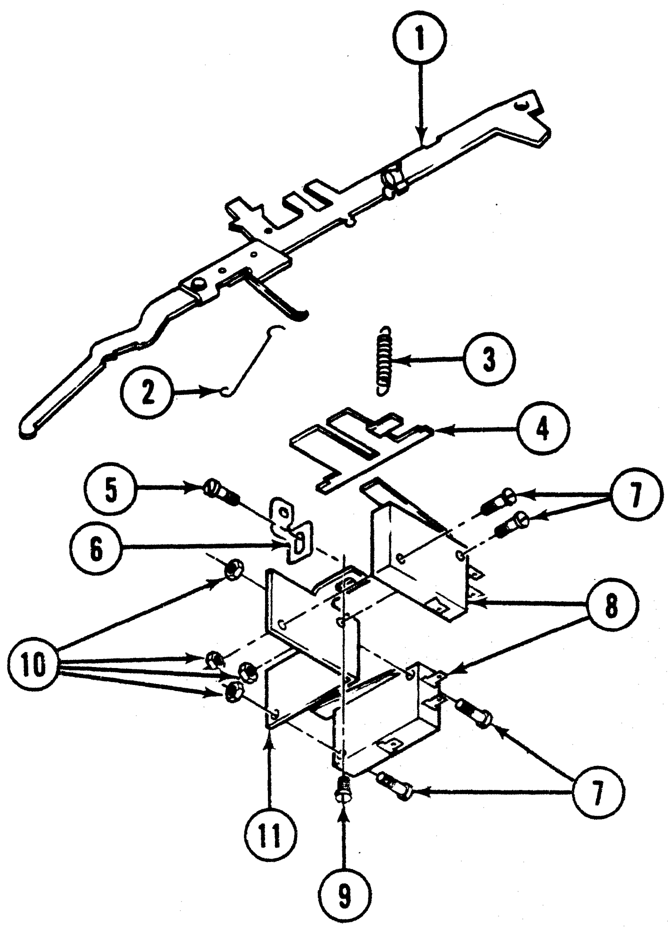


BRACKETS



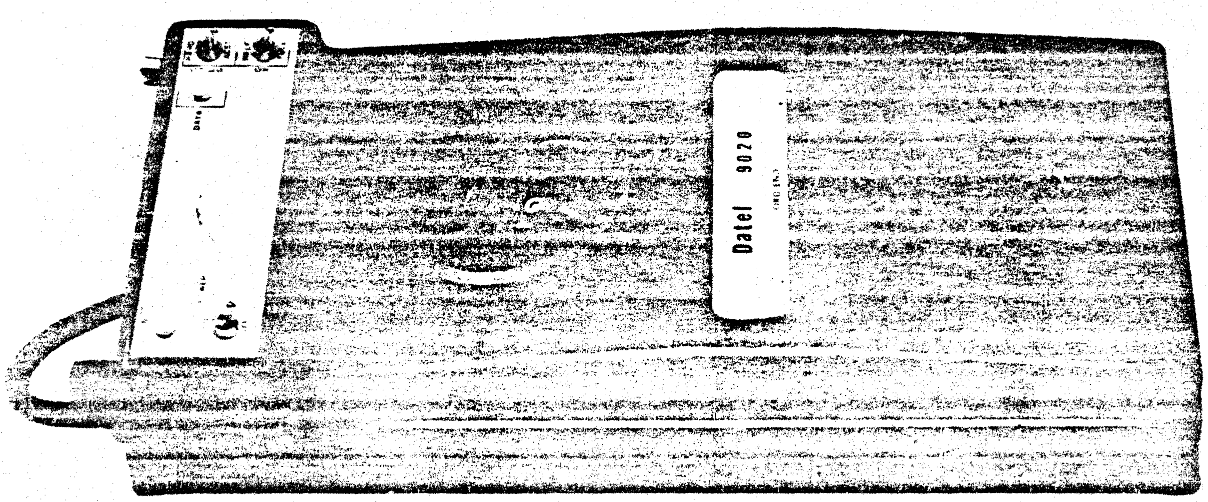
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			BRACKETS	
1	5000349	028	Screw	2
2	1000368		Connector Bracket	1
3	5000349	062	Fish Paper	1
4	5000258	008	Lamp 6V	3
5	1000109		Lamp Bracket	1
6	5000349	030	Screw	1
7	5000035	001	Lamp Clip	3
9	M100164	002	Shock Mount LH	1
10	5000349	051	Hold Down Nut	2
11	5000349	030	Screw Sems	1
12	5000349	039	Washers	2
13	5000349	046	Screw Sems	1
14	5000349	050	Washers	2
15	M100164	001	Shock Mount RH	1
16	5000349	025	Screw Sems	1
17	5000349	045	Screw Sems	1

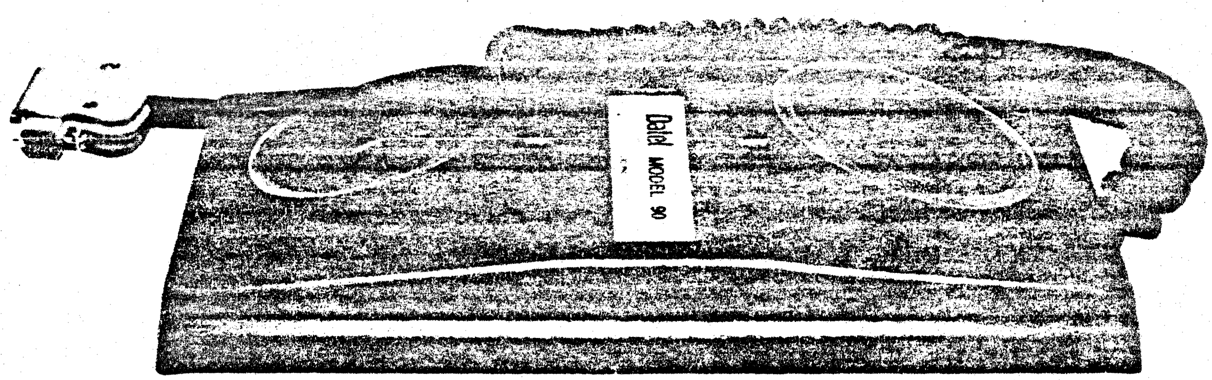
TYPAMATIC SWITCHES



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			TYPAMATIC SWITCHES	
1	1176591		Special Keylever (First row only)	1
2	1134972		Rep Keylever Spring	1
3	1000165	239	Override Spring	1
4	1000562		Repeat Bail	1
5	5000349	030	Bail Bracket Screw Sems	1
6	1000563		Bail Bracket	1
7	5000349	012	Switch Screw	2
8	5000015		Switch	1
9	5000349	030	Switch Bracket Screw	1
10	5000349	015	Nut "Kep"	4
11	1000540		Typamatic Switch Bracket	1

ACOUSTIC COUPLERS • MODEMS

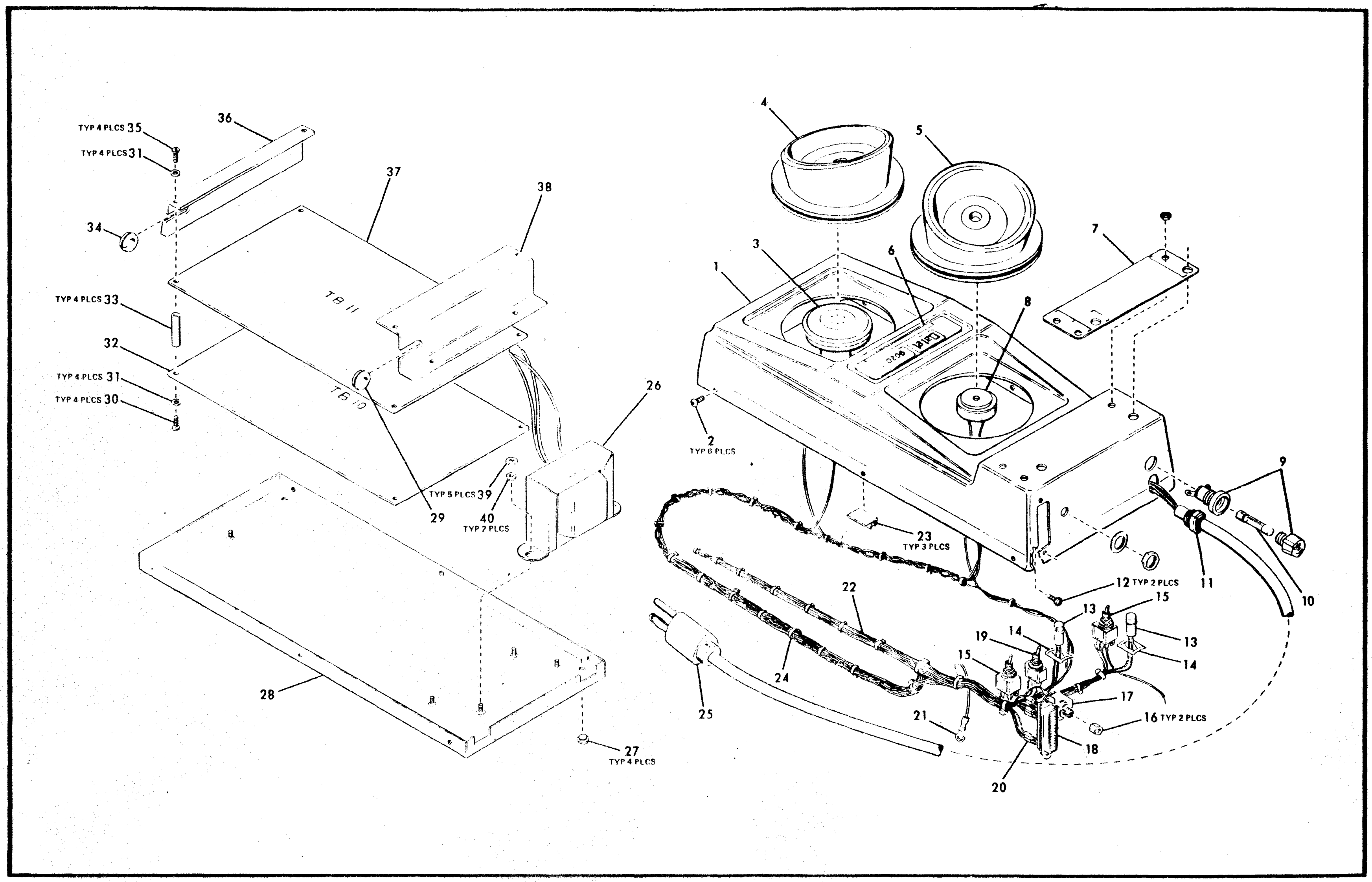




REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			ACOUSTIC COUPLER PARTS LISTING	
1	0000075	001	Coupler Assembly (Complete)	1
2	0000242	001	Case Top, Coupler	1
3	0000240	001	Base Assembly, Coupler	1
4	0000288	001	Logo, Datel Model 90	1
5	0000238	001	Cup, Earphone	1
6	0000238	002	Cup, Microphone	1
7	5000289	001	Earphone Element	1
8	5000180	001	Microphone	1
9	5000151	002	Bumper, Rubber	4
10			4–40 x 1/4" Black Button Head Screw	7
11	5000093	001	Bushing, Strain Relief	1
12	5000203	001	Cable, Coupler, (Belden 8491)	1
13	5000343	003	Boot, Cable	1
14	5000209	003	Connector, (Plug) 25 Pin	1
15	5000217	002	Connector Hood	1
16	5000208	001	Contact, Male (Amphenol)	9
	5000066	002	Shrink Tubing	

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			9020 STAND ALONE COUPLER	
–	0000181	001	Stand Alone Coupler, Complete with Cables	1
1	0000149	001	Case, 9020 Acoustic Coupler	1
2	5000349	077	Screw, case, 4–40 x 1/4 button head soc.	6
3	5000289	001	Earphone element, magnetic	1
–	5000208	001	Contact, male, crimp	2
4	0000238	001	Cup, earphone	1
5	0000238	002	Cup, microphone	1
6	9000015	001	Logo, Datel 9020	1
7	0000151	001	Bezel, switch	1
8	5000180	001	Microphone	1
9	5000255	001	Fuseholder, 1/4 x 1 1/4 fuse	1
10	5000276	010	Fuse, slo-blo, 250V 1/4 Amp	1
11	5000093	001	Bushing, cable strain relief	1
12	5000349	078	Screw, 4–40 x 3/16 pan head sems	2
13	5000258	006	Indicator	2
14	5000360	001	Nut	2
15	5000303	002	Switch-Toggle, DPDT, S1 & S3	2
16	5000056	002	Nut, 1/4" hex	2
17	5000535	001	Phone jack, 2 conductor (J1)	1
18	5000210	003	Connector, receptacle, 25 contact (J1)	1
19	5000303	001	Switch-Toggle, SPDT, S2	1
–	5000208	002	Contact, female, crimp	16
20	5000066	002	Shrink Tubing (Specify length)	–
21	5000092	007	Terminal-Ring, crimp	2
22	5000118	000	Wire, stranded AWG 18 black (Specify length)	–
22	5000122	000	Wire, stranded AWG 22 black (Specify length)	–
22	5000122	002	Wire, stranded AWG 22 red (Specify length)	–
22	5000122	005	Wire, stranded AWG 22 green (Specify length)	–
22	5000122	006	Wire, stranded AWG 22 blue (Specify length)	–
22	5000124	0000	Wire, stranded AWG 24 black (Specify length)	–
22	9000008	005	Wire, twisted pair black and white (Specify length)	–
23	0000434	001	Clip, wire bundle	3
24	5000322	006	Panduit, cable	–
25	5000170	001	Power Cord, 3 conductor (P3)	1
26	5000299	001	Transformer (T1)	1
27	5000151	002	Bumper	4
28	0000148	001	Base Assembly	1
29	5000140	011	Grommet	1
30	5000349	007	Screw, 4–40 x 1/4 pan head	4
31	5000349	016	#4 Flat Washer	8
32	0000287	002	Modem Board 9020 (TB10)	1
33	5000056	012	Standoff, threaded	4
34	5000140	009	Grommet	1
35	5000349	078	Screw, 4–40 x 7/16 pan head	4
36	0000153	001	Bracket, mounting	1
37	0000347	001	Power Supply/EIA Board, (TB11)	1
38	5000309	001	Heatsink	1
39	5000349	044	Nut, 6–32 kep	5
40	5000349	039	#6 Flat Washer	2
–	0000451	001	Carrying Case, 9020 (Not Shown)	1

9020 ACOUSTIC COUPLER



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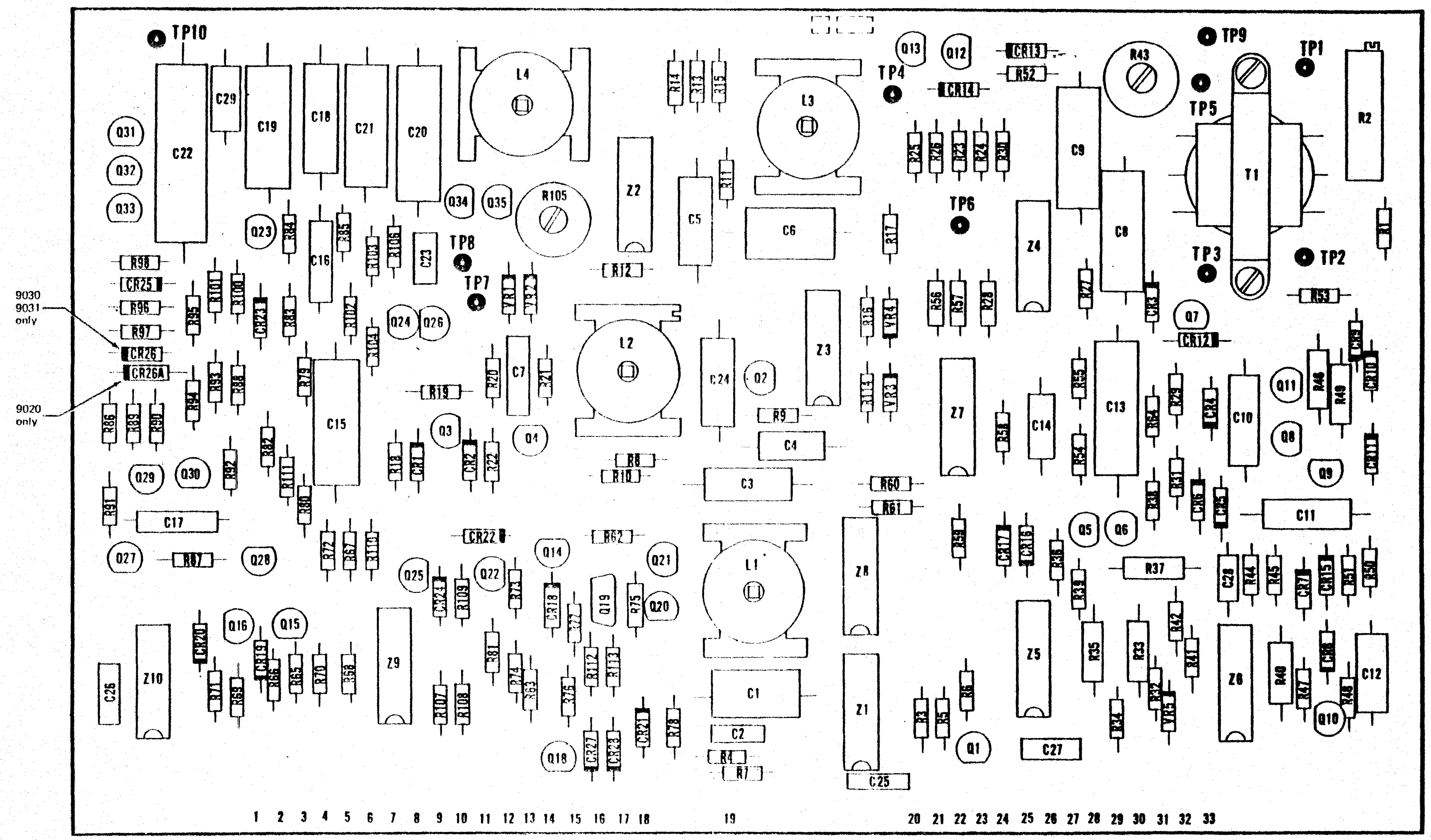
MODEM BOARD



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			MODEM BOARD	
–	0000287	002	Modem Board, Complete, Stand Alone Coupler	1
–	0000287	001	Modem Board, Complete, Datel 30	1
–	0000305	001	Modem Board, Complete, Datel 31	1
–	0000286	001	P. C. Board, Bare, 9020 and 9030	1
–	0000304	001	P. C. Board, Bare, 9031	1
			NOTE: All Resistors are 1/4W ±5% unless otherwise noted.	
R1	5000020	511	Resistor 510Ω	4
R5	5000020	511	Resistor 510Ω	4
R15	5000020	511	Resistor 510Ω	4
R81	5000020	511	Resistor 510Ω	4
R2	5000076	003	Potentiometer 200Ω (Bourns EzTrim)	1
R3	5000020	363	Resistor 36K	1
R4	5000020	563	Resistor 56K	1
R6	5000020	222	Resistor 2.2K	4
R68	5000020	222	Resistor 2.2K	4
R69	5000020	222	Resistor 2.2K	4
R107	5000020	222	Resistor 2.2K	4
R7	5000020	510	Resistor 51Ω	7
R14	5000020	510	Resistor 51Ω	7
R28	5000020	510	Resistor 51Ω	7
R36	5000020	510	Resistor 51Ω	7
R42	5000020	510	Resistor 51Ω	7
R56	5000020	510	Resistor 51Ω	7
R60	5000020	510	Resistor 51Ω	7
R8	5000020	332	Resistor 3.3K	2
R10	5000020	332	Resistor 3.3K	2
R9	5000020	163	Resistor 16K	2
R58	5000020	163	Resistor 16K	2
R11	5000020	242	Resistor 2.4K	1
R12	5000020	474	Resistor 470K	2
R13	5000020	474	Resistor 470K	2
R16	5000020	333	Resistor 33K	1
R17	5000020	102	Resistor 1K	13
R18	5000020	102	Resistor 1K	13
R31	5000020	102	Resistor 1K	13
R63	5000020	102	Resistor 1K	13
R70	5000020	102	Resistor 1K	13
R78	5000020	102	Resistor 1K	13
R80	5000020	102	Resistor 1K	13
R82	5000020	102	Resistor 1K	13
R100	5000020	102	Resistor 1K	13
R108	5000020	102	Resistor 1K	13
R111	5000020	102	Resistor 1K	13
R112	5000020	102	Resistor 1K	13
R113	5000020	102	Resistor 1K	13
R19	5000020	103	Resistor 10K	10
R21	5000020	103	Resistor 10K	10
R57	5000020	103	Resistor 10K	10

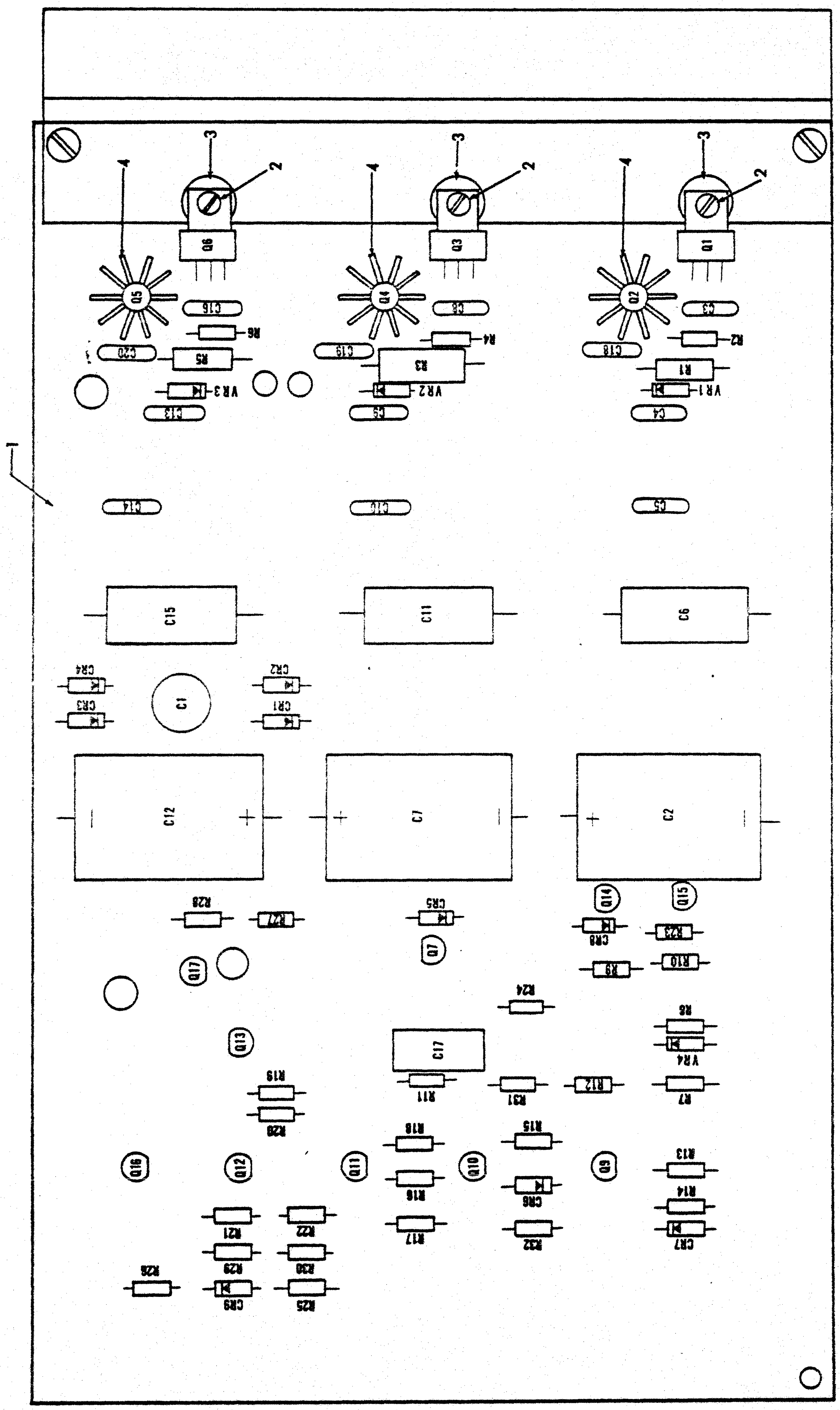
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			MODEM BOARD (Cont)	
R59	5000020	103	Resistor 10K	10
R62	5000020	103	Resistor 10K	10
R64	5000020	103	Resistor 10K	10
R74	5000020	103	Resistor 10K	10
R96	5000020	103	Resistor 10K	10
R98	5000020	103	Resistor 10K	10
			NOTE: All resistors are 1/4W ±5% unless otherwise noted.	
R101	5000020	103	Resistor 10K	10
R20	5000020	104	Resistor 100K	3
R48	5000020	104	Resistor 100K	3
R85	5000020	104	Resistor 100K	3
R22	5000020	273	Resistor 27K	1
R23	5000020	153	Resistor 15K	7
R24	5000020	153	Resistor 15K	7
R25	5000020	153	Resistor 15K	7
R26	5000020	153	Resistor 15K	7
R30	5000020	153	Resistor 15K	7
R52	5000020	153	Resistor 15K	7
R53	5000020	153	Resistor 15K	7
R27	5000020	623	Resistor 62K	4
R67	5000020	623	Resistor 62K	4
R72	5000020	623	Resistor 62K	4
R110	5000020	623	Resistor 62K	4
R29	5000020	302	Resistor 3K	6
R65	5000020	302	Resistor 3K	6
R66	5000020	302	Resistor 3K	6
R71	5000020	302	Resistor 3K	6
R95	5000020	302	Resistor 3K	6
R109	5000020	302	Resistor 3K	6
R32	5000020	391	Resistor 390Ω	1
R33	5000283	485	Resistor 75K 1/4W ±1%	1
R34	5000020	473	Resistor 47K	2
R38	5000020	473	Resistor 47K	2
R35	5000283	501	Resistor 100K 1/4W ±1%	3
R37	5000283	501	Resistor 100K 1/4W ±1%	3
R40	5000283	501	Resistor 100K 1/4W ±1%	3
R39	5000020	821	Resistor 820Ω	1
R41	5000020	241	Resistor 240Ω	2
R76	5000020	241	Resistor 240Ω	2
R43	5000282	102	Potentiometer 1K (Digilog Mod. 21)	1
R44	5000020	822	Resistor 8.2K	5
R45	5000020	822	Resistor 8.2K	5
R50	5000020	822	Resistor 8.2K	5
R51	5000020	822	Resistor 8.2K	5
R54	5000020	822	Resistor 8.2K	5
R46	5000283	401	Resistor 10K 1/4W ±1%	2
R49	5000283	401	Resistor 10K 1/4W ±1%	2
R47	5000020	203	Resistor 20K	1

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			MODEM BOARD (Cont)	
R55	5000020	204	Resistor 200K	1
R61	5000020	303	Resistor 30K	1
R73	5000020	362	Resistor 3.6K	2
R77	5000020	362	Resistor 3.6K	2
R75	5000020	182	Resistor 1.8K	2
R94	5000020	182	Resistor 1.8K	2
R79	5000020	202	Resistor 2K	2
R104	5000020	202	Resistor 2K	2
R83	5000020	514	Resistor 510K	1
R84	5000020	624	Resistor 620K	1
R86	5000020	331	Resistor 330Ω	2
R88	5000020	331	Resistor 330Ω	2
R87	5000020	223	Resistor 22K	1
R89	5000020	512	Resistor, 5.1K	5
R91	5000020	512	Resistor, 5.1K	5
R92	5000020	512	Resistor, 5.1K	5
R93	5000020	512	Resistor, 5.1K	5
R97	5000020	512	Resistor, 5.1K	5
R90	5000020	752	Resistor 7.5K	1
R102	5000020	434	Resistor 430K	1
R103	5000020	433	Resistor 43K	1
R105	5000282	501	Potentiometer 50.0Ω (Digilog Mod. 21)	1
R106	5000020	301	Resistor 300	1
R114	5000020	101	Resistor 100	1
C1	5000219	002	Capacitor, .012μf ±5%	2
C6	5000219	002	Capacitor, .012μf ±5%	2
C2	5000099	019	Capacitor, 820pf	1
C3	5000216	062	Capacitor, .022μf 10%	1
C4	5000216	053	Capacitor, .0047μf 10%	2
C14	5000216	053	Capacitor, .0047μf 10%	2
C5	5000219	001	Capacitor .01μf ±5%	1
C7	5000341	040	Capacitor, .1μf 16V	1
C8	5000219	005	Capacitor, .022μf ±5% 1	4
C9	5000219	005	Capacitor, .022μf ±5% 1	4
C10	5000219	005	Capacitor, .022μf ±5% 1	4
C11	5000219	005	Capacitor, .022μf ±5% 1	4
C12	5000216	045	Capacitor, .001μf 10%	1
C13	5000216	031	Capacitor, .22μf 10%	2
C20	5000216	031	Capacitor, .22μf 10%	2
C15	5000216	029	Capacitor, .15μf 10%	1
C16	5000216	049	Capacitor, .0022μf 10%	1
C17	5000216	056	Capacitor, .0068μf 10%	1
C18	5000219	060	Capacitor, .02μf ±5%	1
C19	5000219	009	Capacitor, .039μf ±5%	1
C21	5000216	027	Capacitor, .1μf 10%	1
C22	5000219	022	Capacitor, .47μf ±5%	1
C23	5000088	009	Capacitor, 10μf 15V	2
C28	5000088	009	Capacitor, 10μf 15V	2
C24	5000216	064	Capacitor, .033μf 10%	1
C25	5000099	002	Capacitor, .01μf	3
C26	5000099	002	Capacitor, .01μf	3

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			MODEM BOARD (Cont)	
C27	5000099	002	Capacitor, .01µf	3
C29	5000223	001	Capacitor, .0022µf ±10% Optional	–
C29	5000223	003	Capacitor, .0033µf ±10%	–
Q1	5000067	001	Transistor 2N5088	3
Q12	5000067	001	Transistor 2N5088	3
Q13	5000067	001	Transistor 2N5088	3
Q2	5000001	001	Transistor 2N4123	23
Q3	5000001	001	Transistor 2N4123	23
Q5	5000001	001	Transistor 2N4123	23
Q8	5000001	001	Transistor 2N4123	23
Q9	5000001	001	Transistor 2N4123	23
Q10	5000001	001	Transistor 2N4123	23
Q14	5000001	001	Transistor 2N4123	23
Q15	5000001	001	Transistor 2N4123	23
Q16	5000001	001	Transistor 2N4123	23
Q20	5000001	001	Transistor 2N4123	23
Q21	5000001	001	Transistor 2N4123	23
Q22	5000001	001	Transistor 2N4123	23
Q23	5000001	001	Transistor 2N4123	23
Q24	5000001	001	Transistor 2N4123	23
Q25	5000001	001	Transistor 2N4123	23
Q26	5000001	001	Transistor 2N4123	23
Q27	5000001	001	Transistor 2N4123	23
Q30	5000001	001	Transistor 2N4123	23
Q31	5000001	001	Transistor 2N4123	23
Q32	5000001	001	Transistor 2N4123	23
Q33	5000001	001	Transistor 2N1423	23
Q34	5000001	001	Transistor 2N4123	23
Q35	5000001	001	Transistor 2N4123	23
Q4	5000002	001	Transistor 2N4125	7
Q6	5000002	001	Transistor 2N4125	7
Q7	5000002	001	Transistor 2N4125	7
Q11	5000002	001	Transistor 2N4125	7
Q18	5000002	001	Transistor 2N4125	7
Q28	5000002	001	Transistor 2N4125	7
Q29	5000002	001	Transistor 2N4125	7
Q19	5000234	001	Transistor MSPU02	1
CR1	5000007	001	Diode 1N914	28
thru				
CR28	5000007	001	Diode 1N914	28
VR1	5000165	014	Zener Diode 1N5234	3
VR2	5000165	014	Zener Diode 1N5234	3
VR5	5000165	014	Zener Diode 1N5234	3
VR3	5000191	012	Zener Diode 1N4739	2
VR4	5000191	012	Zener Diode 1N4739	2
Z1	5000252	001	Integrated Circuit (UA741C)	8
Z2	5000252	001	Integrated Circuit (UA741C)	8
Z3	5000252	001	Integrated Circuit (UA741C)	8
Z4	5000252	001	Integrated Circuit (UA741C)	8
Z5	5000252	001	Integrated Circuit (UA741C)	8

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			MODEM BOARD (Cont)	
Z6	5000252	001	Integrated Circuit (UA741C)	8
Z7	5000252	001	Integrated Circuit (UA741C)	8
Z8	5000252	001	Integrated Circuit (UA741C)	8
Z9	5000196	001	Integrated Circuit (MC836)	1
Z10	5000196	002	Integrated Circuit (MC846)	1
L1	5000284	050	Inductor, Slug Tunable 390–410 mh	3
L2	5000284	050	Inductor, Slug Tunable 390–410 mh	3
L3	5000284	050	Inductor, Slug Tunable 390–410 mh	3
L4	5000342	074	Inductor, Slug Tunable 500 mh	1
T1	5000261	001	Transformer	1

POWER SUPPLY/EIA BOARD



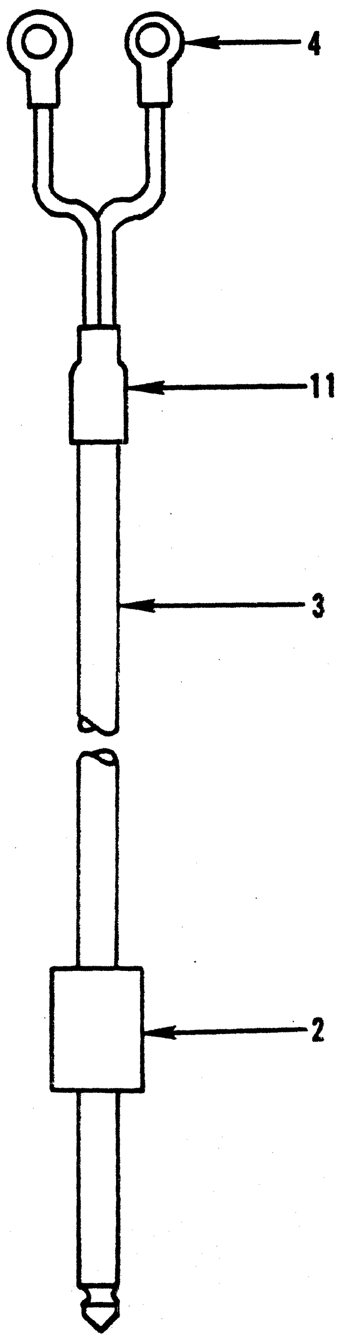
STAND ALONE MODEM ONLY

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY/EIA BOARD	
1	0000347	001	Power Supply/EIA Board, Complete	1
–	0000348	001	Printed Circuit Board, Bare	1
2	5000011	302	Screw, 4–40 x 1/8 nylon	3
3	5000349	076	#4 Washer, mica, insulating	3
4	5000309	001	Heat Sink, transistor	3
			NOTE: All resistors are 1/4W ±5% unless otherwise noted.	
R1	5000023	621	Resistor, 620Ω 1/2W ±5%	2
R5	5000023	621	Resistor, 620Ω 1/2W ±5%	2
R2	5000020	471	Resistor, 470Ω	3
R4	5000020	471	Resistor, 470Ω	3
R6	5000020	471	Resistor, 470Ω	3
R3	5000026	102	Resistor, 1K 1W ±5%	1
R7	5000020	222	Resistor, 2.2K	3
R22	5000020	222	Resistor, 2.2K	3
R30	5000020	222	Resistor, 2.2K	3
R8	5000020	332	Resistor, 3.3K	2
R9	5000020	332	Resistor, 3.3K	2
R10	5000020	512	Resistor, 5.1K	1
R11	5000020	472	Resistor, 4.7K	3
R15	5000020	472	Resistor, 4.7K	3
R23	5000020	472	Resistor, 4.7K	3
R12	5000020	122	Resistor, 1.2K	2
R31	5000020	122	Resistor, 1.2K	2
R13	5000020	223	Resistor, 22K	5
R16	5000020	223	Resistor, 22K	5
R17	5000020	223	Resistor, 22K	5
R25	5000020	223	Resistor, 22K	5
R26	5000020	223	Resistor, 22K	5
R14	5000020	682	Resistor, 6.8K	1
R18	5000020	333	Resistor, 33K	1
R19	5000020	103	Resistor, 10K	6
R20	5000020	103	Resistor, 10K	6
R24	5000020	103	Resistor, 10K	6
R27	5000020	103	Resistor, 10K	6
R28	5000020	103	Resistor, 10K	6
R32	5000020	103	Resistor, 10K	6
R21	5000020	471	Resistor, 470Ω	2
R29	5000020	471	Resistor, 470Ω	2
C1	5000099	006	Capacitor, .05μ 100V	1
C2	5000184	134	Capacitor, 250μ 50V	3
C7	5000184	134	Capacitor, 250μ 50V	3
C12	5000184	134	Capacitor, 250μ 50V	3
C3	5000099	002	Capacitor, .01μ 100V	12
C4	5000099	002	Capacitor, .01μ 100V	12
C5	5000099	002	Capacitor, .01μ 100V	12
C8	5000099	002	Capacitor, .01μ 100V	12
C9	5000099	002	Capacitor, .01μ 100V	12
C10	5000099	002	Capacitor, .01μ 100V	12

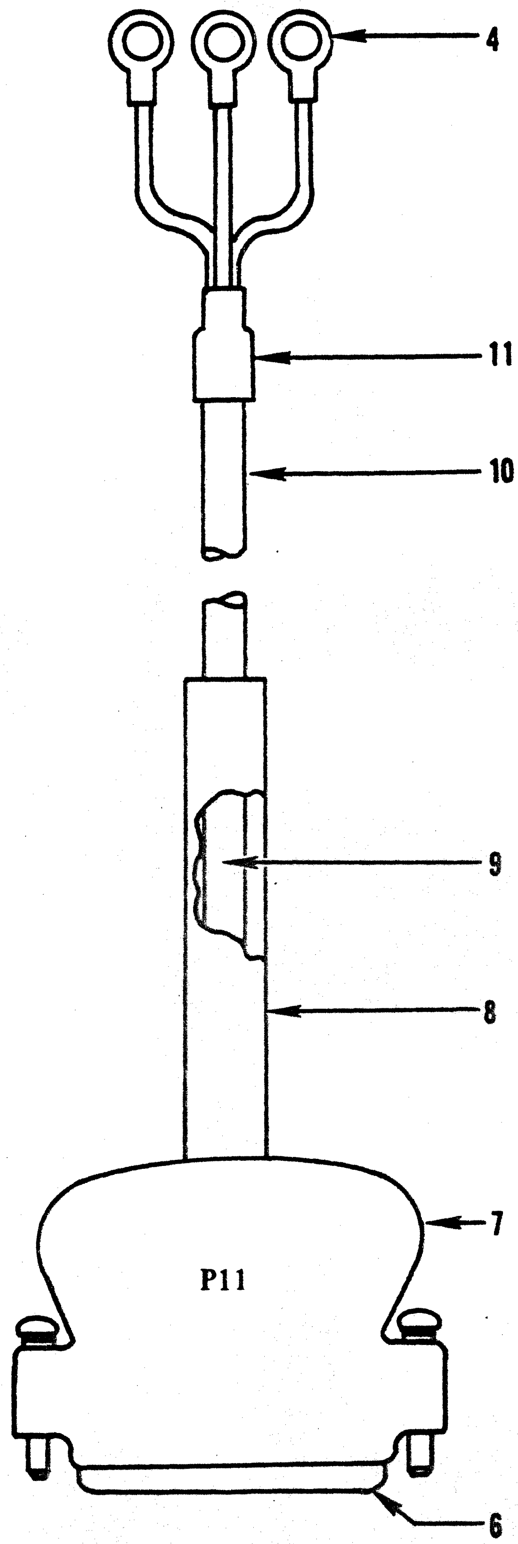
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			POWER SUPPLY/EIA BOARD (Cont)	
C13	5000099	002	Capacitor, .01µ 100V	12
C14	5000099	002	Capacitor, .01µ 100V	12
C16	5000099	002	Capacitor, .01µ 100V	12
C18	5000099	002	Capacitor, .01µ 100V	12
C19	5000099	002	Capacitor, .01µ 100V	12
C20	5000099	002	Capacitor, .01µ 100V	12
C6	5000089	111	Capacitor, 100µ 100V	3
C11	5000089	111	Capacitor, 100µ 100V	3
C15	5000089	111	Capacitor, 100µ 100V	3
C17	5000215	031	Capacitor, .22µ 50V ±5%	1
Q1	5000310	001	Transistor, MPS U52 PNP	2
Q3	5000310	001	Transistor, MPS U52 PNP	2
Q2	5000001	001	Transistor, 2N4123 NPN	11
Q4	5000001	001	Transistor, 2N4123 NPN	11
Q7	5000001	001	Transistor, 2N4123 NPN	11
Q8	5000001	001	Transistor, 2N4123 NPN	11
Q9	5000001	001	Transistor, 2N4123 NPN	11
Q10	5000001	001	Transistor, 2N4123 NPN	11
Q11	5000001	001	Transistor, 2N4123 NPN	11
Q12	5000001	001	Transistor, 2N4123 NPN	11
Q14	5000001	001	Transistor, 2N4123 NPN	11
Q15	5000001	001	Transistor, 2N4123 NPN	11
Q16	5000001	001	Transistor, 2N4123 NPN	11
Q5	5000002	001	Transistor, 2N4125 PNP	3
Q13	5000002	001	Transistor, 2N4125 PNP	3
Q17	5000002	001	Transistor, 2N4125 PNP	3
Q6	5000234	001	Transistor, MPS U02 NPN	1
CR1	5000306	003	Diode, 1N4003	4
CR2	5000306	003	Diode, 1N4003	4
CR3	5000306	003	Diode, 1N4003	4
CR4	5000306	003	Diode, 1N4003	4
CR5	5000007	001	Diode, 1N914	5
CR6	5000007	001	Diode, 1N914	5
CR7	5000007	001	Diode, 1N914	5
CR8	5000007	001	Diode, 1N914	5
CR9	5000007	001	Diode, 1N914	5
VR1	5000165	023	Diode, Zener, 1N5243A	2
VR3	5000165	023	Diode, Zener, 1N5243A	2
VR2	5000165	012	Diode, Zener, 1N5232	1
VR4	5000165	015	Diode, Zener, 1N5235	1

HARD COUPLE AND TELETYPE CABLES

1 Hard Couple Cable

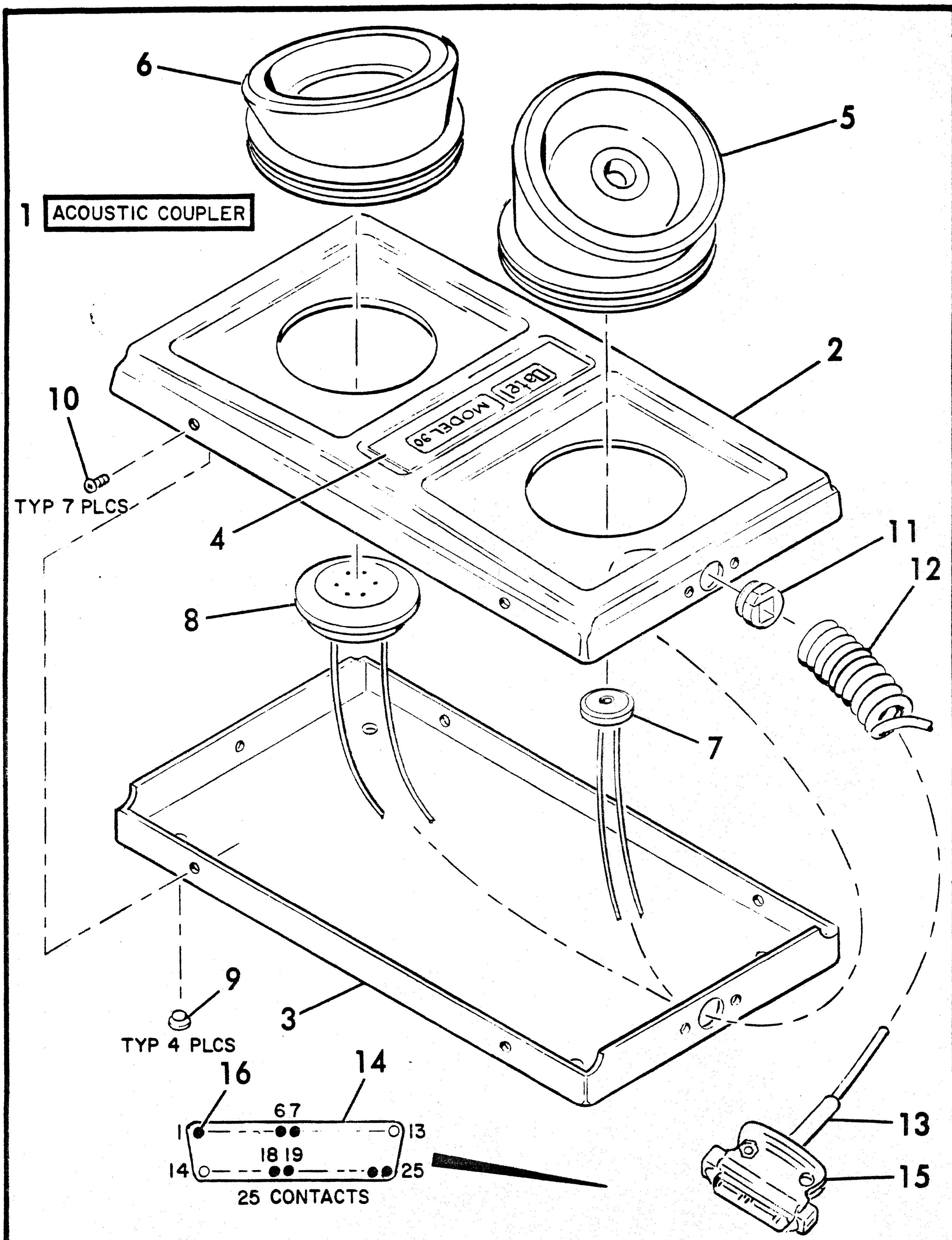


5 Teletype Cable

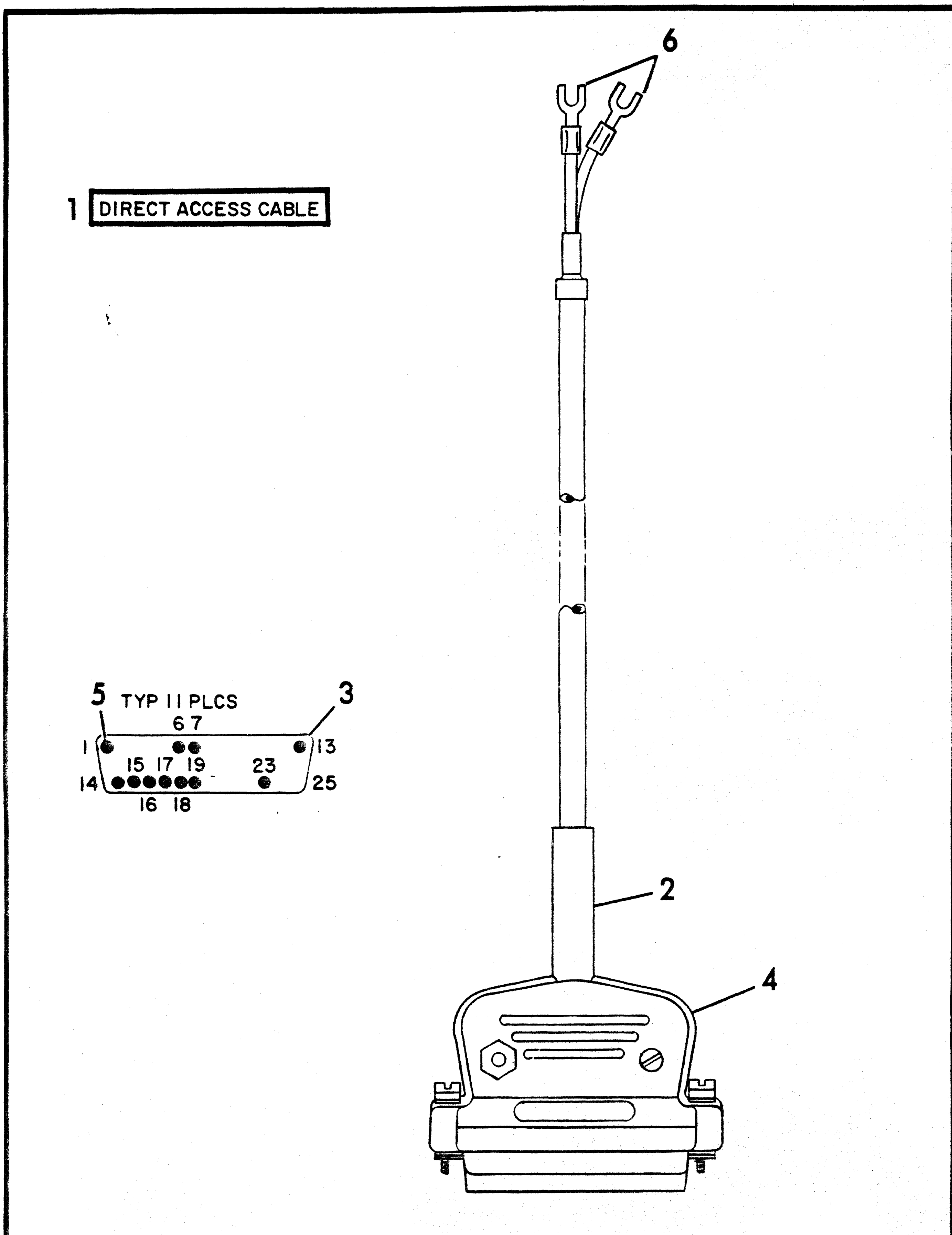


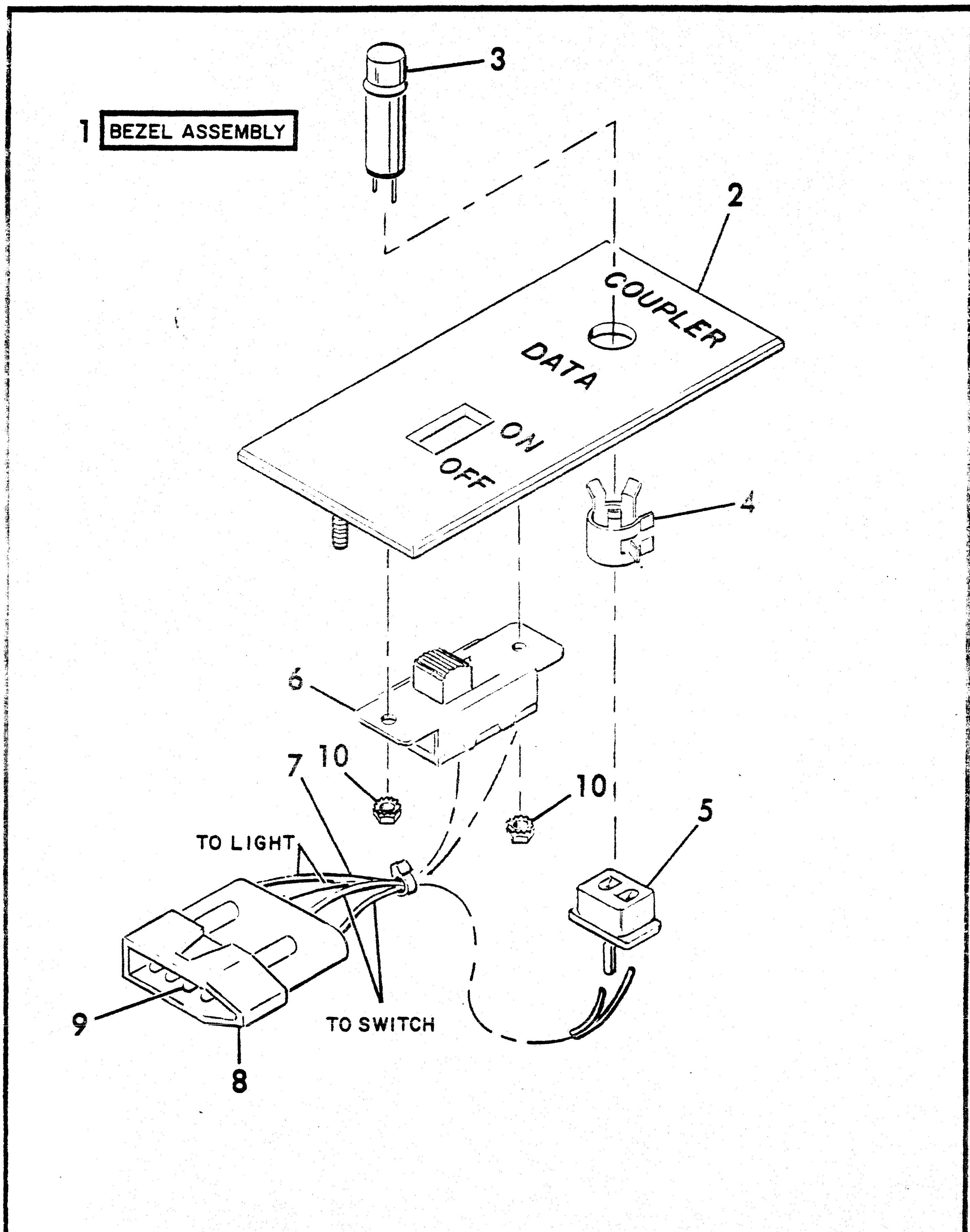
REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			HARD COUPLE AND TELETYPE CABLES	
1	0000385	001	Hard Couple Cable, Complete (72" long)	1
2	5000346	001	Phone Plug, 2 Conductor	1
3	5000312	006	Cable, Multi-conductor, twisted (specify length)	–
4	5000092	001	Terminal, ring, crimp	5
5	0000364	001	Teletype Cable, Complete (72" long)	1
6	5000209	003	Connector, plug, rack and panel	1
7	5000208	001	Contact, male, crimp type	3
8	5000343	003	Bushing, Cable	1
9	5000343	002	Bushing, Cable	1
10	5000312	014	Cable, 3 Conductor, shielded (specify length)	–
11	5000066	004	Tubing, heat shrinkable (specify length)	–
–	5000124	000	Wire, single conductor (specify length)	–

HARD COUPLE AND TELETYPE CABLES



REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			DIRECT ACCESS CABLE PARTS LISTING	
1	0000291	001	Cable, Direct Access, 77"	1
1	0000291	002	Cable, Direct Access, 113"	
1	0000291	003	Cable, Direct Access, 149"	
1	0000291	004	Cable, Direct Access, 185"	
1	0000291	005	Cable, Direct Access, 221"	
2	5000343	003	Boot, Cable	1
3	5000209	003	Connector, 25 Pin Male	1
4	5000217	002	Connector Hood	1
5	5000208	001	Contact, Male Crimp	11
6	5000163	001	Terminal Space	2
	5000066	002	Shrink Tubing	11
	5000066	004	Shrink Tubing	2


1 DIRECT ACCESS CABLE
5
TYP 11 PLCS
3
6 7
1
13
15 17 19
23
14
25
16 18
6
2
4


1 BEZEL ASSEMBLY
3
2
COUPLER
DATA
ON
OFF
4
6
7
10
10
5
TO LIGHT
TO SWITCH
9
8

REF. NO.	DATEL PART NO.	DASH NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY. PER ASSY.
			BEZEL ASSEMBLY PARTS LISTING	
1	0000293		Bezel Assembly (Complete)	1
2	0000294	001	Bezel Plate Assy., Modem Option	1
2	0000296	001	Bezel Plate Assembly, Blank	1
3	5000258	004	Lamp, Cartridge	1
4	5000035	001	Clip, Lamp Cartridge	1
5	5000034	001	Connector, Lamp Cartridge	1
6	5000288	001	Switch, Slide SPST	1
7	5000122		Wire, Black AWG #22 20"	1
8	5000285	004	Connector, 4 Pin, Nylon (Molex)	1
9	5000146	001	Pin, Connector	4
10			4—40 Hex "Kep" Nut	2

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