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TECHNICAL MANUAL

for

TELEPRINTER SETS AN/UGC-38 and AN/UGC-40 and TELETYPEWRITER SET AN/UGC-41

Manufactured by
MITE Corporation
New Haven, Connecticut

DEPARTMENT OF THE NAVY
NAVAL ELECTRONIC SYSTEMS COMMAND

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LIST OF EFFECTIVE PAGES

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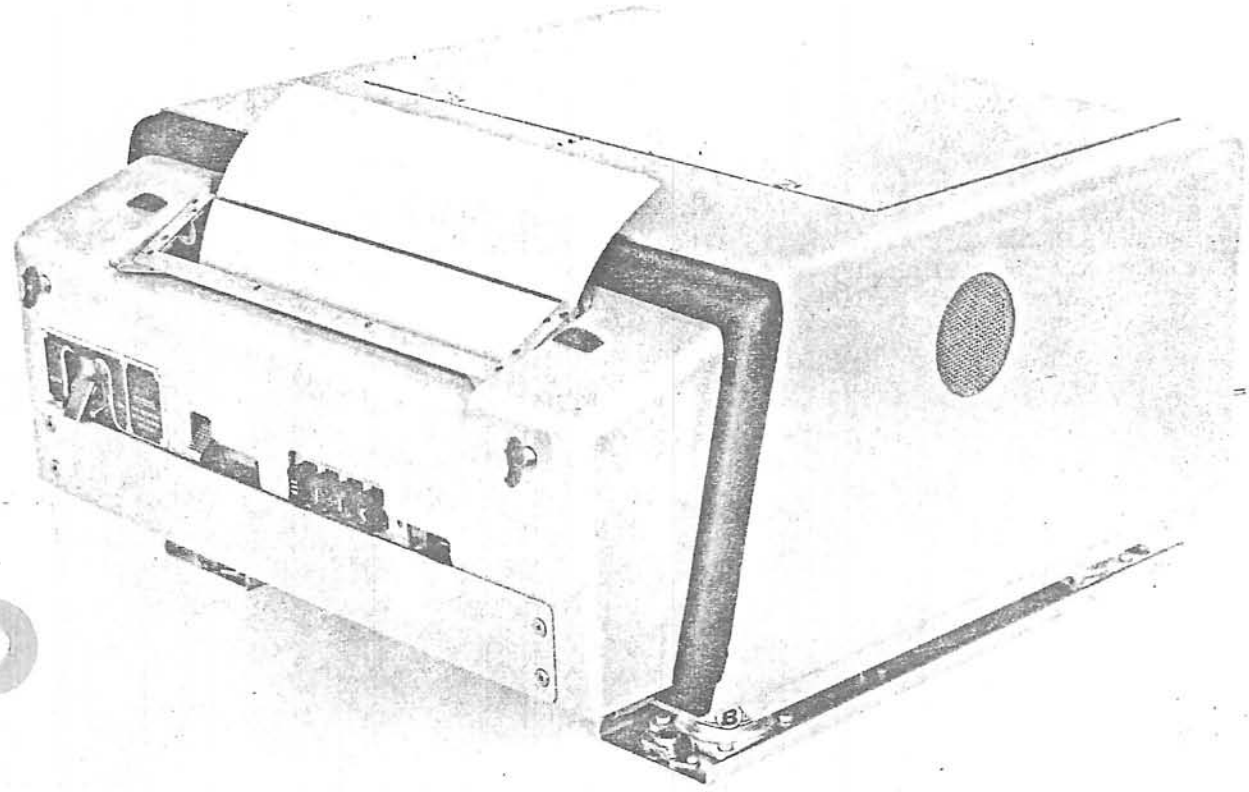
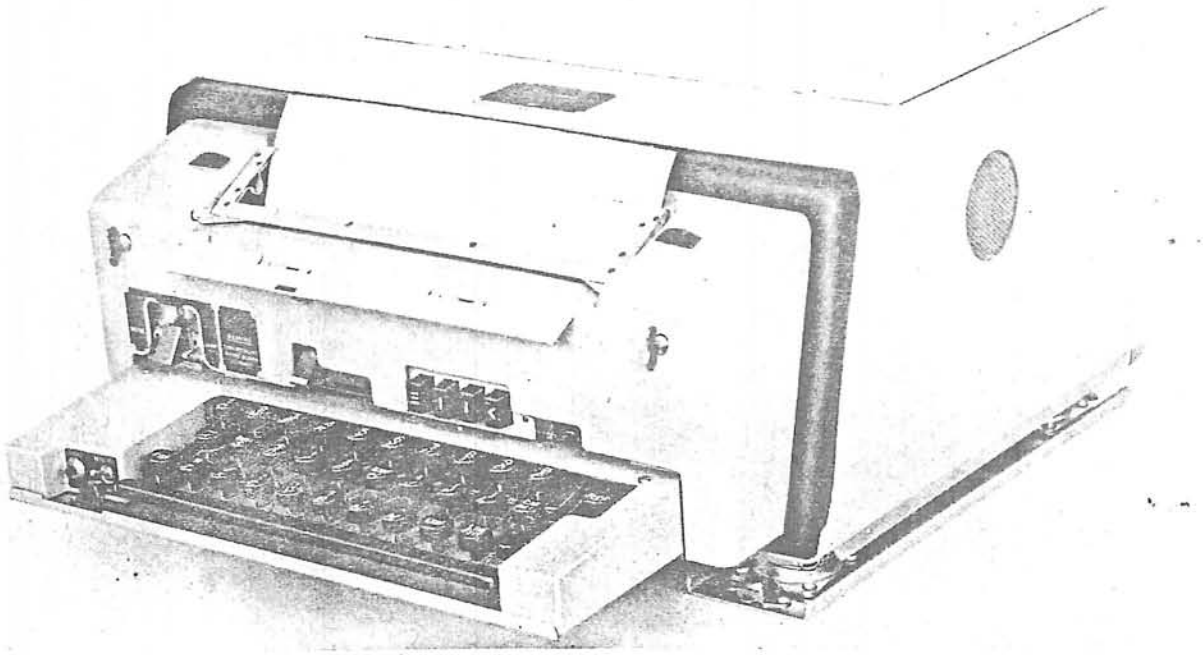


A. Teleprinters AN/UGC-38 and AN/UGC-40



B. Teletypewriter Set AN/UGC-41

Figure 1-1. Teleprinters AN/UGC-38 and AN/UGC-40, and Teletypewriter Set AN/UGC-41

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SECTION 5 - MAINTENANCE (Cont)

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SECTION 1

GENERAL INFORMATION

1-1. GENERAL.

This Technical Manual contains installation, operation, theory, troubleshooting, and maintenance instructions for Teletypewriter Set AN/UGC-41 (Send and Receive Communications Page Printer), Teleprinter AN/UGC-40 (Receive Communications Page Printer), Teleprinter AN/UGC-40 (Receive Only Communications Page Printer), and Teleprinter AN/UGC-38 (Receive Only Weather Page Printer). The teletypewriter set and teleprinters are manufactured by MITE Corporation, New Haven, Connecticut. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

1-2. PURPOSE AND DESCRIPTION OF EQUIPMENT.

a. PURPOSE. - Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38 are ruggedized, lightweight, miniature, alphanumeric or alpha-weather printing telegraph equipments. They may be used for general service under a wide range of operating conditions. These sets are fully compatible with commercial and military teletypewriter equipments employing the standard Baudot code and can be integrated into existing land-line and radio-link communications systems. By appropriate switching the equipment can be operated in full-duplex on-line, or off-line circuits. Local operation (off-line) as an electric typewriter is used for local testing. Since Teleprinter Sets AN/UGC-38 and AN/UGC-40 do not have keyboards, an external source for keying the units is required for local testing. As Figure 1-1 illustrates, the units are furnished in non-tactical cases for use in fixed-station, shipboard, mobile, and aircraft installations.

b. DESCRIPTION.

(1) OPERATING OPTIONS. - Teletypewriter Set AN/UGC-41 consists of a keyboard, a printer, an electrical chassis, an electronic module, and a case. The electronic module contains a dual range line sensor, a line sensor power supply, and a time delay motor stop. Teleprinter Sets AN/UGC-38 and AN/UGC-40 are essentially the same as Teletypewriter Set AN/UGC-41 except that they will not accept a keyboard. A 115-volt, 60 cycles per second, hysteresis-synchronous, alternating current, motor is provided for operation in each equipment. Case CY-6063/UG, equipped with shock-mounts, houses each of these units making them suitable for installations which may be subjected to severe shock or vibration. The versatility of these units is further enhanced by a simple switching option which permits operation in Hi- or Lo-level full-duplex, or off-line (local) modes. Speed change gears, allowing variations in operational speed, are supplied for 60, 66, and 100 words-per-minute operation.

(2) PRINCIPLES OF OPERATION. - Teletypewriter Set AN/UGC-41 is a send/receive unit. Teleprinter Sets AN/UGC-38 and AN/UGC-40 are receive-only units. Only that portion of the text relative to the receipt of coded signals is applicable to Teleprinter Sets AN/UGC-38 and AN/UGC-40. Teletypewriter Set AN/UGC-41 provides the means of transmitting and receiving printed intelligence comprising the 26 letters of the alphabet, the digits Ø through 9, and a basic group of punctuation signs and other symbols. (Teleprinter Set AN/UGC-38 is a receive-only printer with standard weather code print-out.)

In addition to the printing of these characters, certain necessary mechanical operations are provided; spacing between words, letters-figures shifting, line feed, and carriage return. Other operating features include a bell function; an automatic line feed upon receipt of signalled carriage return; a repeat key, which when depressed causes the last transmitted character to be continuously repeated until the key is released; an automatic time delay motor stop; and a keyboard interlock mechanism. When in use, the keyboard interlock mechanism enables the operator to depress any of the keyboard levers without actually transmitting the intended character. Upon receipt of a synchronous pulse, the keyboard clutch is released and the intelligence stored in the keyboard is transmitted, clearing the keyboard for depression of the next key lever.

At the other end of the line, the train of pulses (generated upon release of the keyboard clutch) is received and decoded by the line sensor in a remote teletypewriter set. The decoded train of pulses is then translated into the required mechanical action by the printer, resulting in either the printing of a character or the performance of a mechanical operation. For reception, the roles of the local and remote teletypewriter set are simply reversed. For off-line (local) operation the keyboard, line sensor power supply, line sensor, and printer of a teletypewriter set are connected in a closed loop. Teleprinter Sets AN/UGC-40 and AN/UGC-38 require a keying device for test purposes and to make those adjustments which require power. The signal code developed by the keyboard is the standard five-level 7.42 unit Baudot serial teletypewriter code. In this code, each keyboard function is represented by a discrete combination of mark (current) bits and space (no-current) bits. Each bit group contains five of these intelligence bits. The letter J, for example, is represented by mark-mark-space-mark-space. In addition to the five intelligence bits, each bit group begins with a start (spacing) bit and ends with a stop (marking) bit. The stop bit is 1.42 times as long as any of the other six bits, each of which may be considered as one time-unit long. The entire bit group consisting of a start bit, five

intelligence bits, and a stop bit is therefore 7.42 units in length. The actual time duration of a bit group is dependent upon operational speed. At 60 words per minute, each bit is 22 milliseconds in length (7.42 times 22 milliseconds or 0.163 seconds per letter or function). The complete Baudot code is illustrated in Figure 1-2.

Although the keyboard operates on a 7.42 unit basis, the receiving printer operates on a 6.7 unit basis. This feature increases both the reliability and versatility of the teletypewriter set, allowing it to correct for slight variations in speed between machines.

(3) OPERATING FEATURES. - Teletyewriter Set AN/UGC-41 employs a standard teletypewriter keyboard which, when the set is to be shipped, is stowed in a recess in the electrical chassis beneath the printer. The keyboard can be illuminated by opening the hinged front cover reflector, which when opened, reflects light from the copy lamps on to the keyboard. The keyboard can thus be illuminated without having to illuminate the surrounding area. Intensity of the copy lights can be controlled by placing the copylight switch (see Figure 3-1 for all keyboard controls) in the BRIGHT, DIM, or OFF position. Figure 1-3 shows the equipment with the keyboard extended to, and secured in, the operating position. The 32 keys are arranged in three rows which are banked for operator comfort. Each of the keys on the keyboard (except FIGS, LTRS, LINE FEED, CAR RET, blank, and the space bar, which normally do not cause printing) serves a dual purpose. When the teletypewriter set is in the Figures condition the symbol shown on the upper portion of the depressed key will be printed. When the teletypewriter set is in the Letters condition the letter shown on the lower portion of the depressed key will be printed. The blank key at the lower right is one of the 32 available characters, but normally does not cause printing to take place. The keyboard is equipped with a guard to negate the possibility of damaging the space bar.

The four buttons located below the copy window (part of the chassis assembly), control the mechanically operated off-line functions of line feed, figures shift, letters shift, and carriage return. These are local functions and have no effect on the signal line.

The operating controls are grouped at the lower left side of the keyboard. The line feed shift arm, used to shift to single or double space copy, extends through the front cover just above the key lever for letter P. A PAPER pressure release button extends through the printer front cover just over the key lever for the letter W.

Each equipment is supplied with an electronic time delay motor stop which turns off the motor leaving the line sensor in a standby condition when no mark-to-space transition has been received for approximately two minutes. Receipt of the first mark-to-space transition automatically restarts the motor.

All three equipments, Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38, use standard single- or multi-ply rolls of copy paper 8-1/2 inches wide and of any diameter up to 5 inches with a 1-inch hollow core. The paper roll is stored in the electrical chassis (Figure 1-4). The three equipments are also capable of using fan-fold, sprocket feed, multi-ply copypaper, stored externally and fed into a slot in the rear of Non-Tactical Case CY-6063/UG.

The electrical chassis (Figure 1-5) accommodates the printer and the copypaper. The printer prints six lines to the inch, when set for single line-feed, and three lines to the inch, when set for double line-feed. Automatic carriage return and line-feed occur when either 72 or 76 characters (depending on the adjustment of the automatic carriage return mechanism) have been printed on a line and a carriage return signal has not been received. In addition, the unit also contains a device which, when enabled, provides automatic line-feed on signalled carriage return, preventing overprint of the previous line.

During operation of the printer, the copypaper feeds in front of an eight-sided print cylinder which contains 64 characters. This print cylinder is positioned so that the selected character is correctly located behind the paper. The print hammer then strikes the paper through a standard 1/2-inch Underwood-type inked ribbon, causing the character to be printed. Since the print cylinder never touches the ribbon, little cleaning of the print cylinder is required. Ribbon reversal is automatic.

The electronic module consists of the time delay motor stop, line sensor power supply and line sensor.

AN/UGC-38 WEATHER CODE		AN/UGC-40 AN/UGC-41 COMMUNICATIONS CODE		7.42 UNITS CODE SIGNALS							
									1 UNIT	1.42 UNITS
LET.	FIG.	LET.	FIG.	START	1	2	3	4	5	STOP
A	4	A	–							
B	⊕	B	?							
C	○	C	:							
D	5	D	$							
E	3	E	3							
F	→	F	!							
G	6	G	&							
H	↑	H	③							
I	8	I	8							
J	7	J	'							
K	←	K	(							
L	9	L	)							
M	•	M	•							
N	⊕	N	,							
O	9	O	9							
P	0	P	0							
Q	1	Q	1							
R	4	R	4							
S	•	S	①①							
T	5	T	5							
U	7	U	7							
V	⊕	V	;							
W	2	W	2							
X	/	X	/							
Y	6	Y	6							
Z	+	Z	"							
BLANK ①	–③	BLANK ①								
SPACE ②		SPACE ②								
CAR. RET. ①		CAR. RET. ①								
LINE FEED ①		LINE FEED ①								
FIGURES ①		FIGURES ①								
LETTERS ①		LETTERS ①								

① NON-PRINTING ; NON-ADVANCING
② NON-PRINTING ; ADVANCING
③ PRINTING ; ADVANCING

Figure 1-2. Five Level Baudot Code

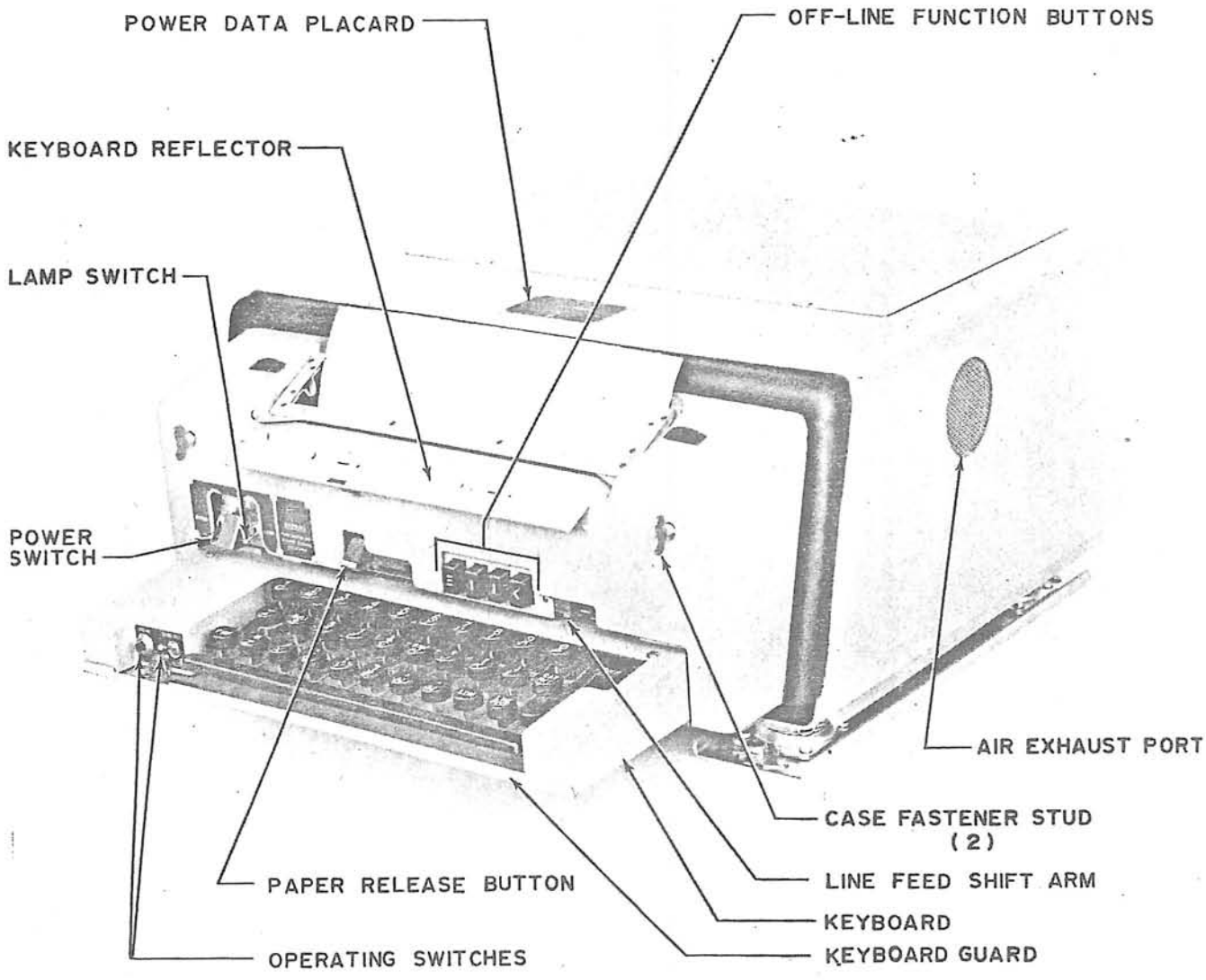


Figure 1-3. Teletypewriter Set Ready for Operation

It is a plug-in printed circuit board mounted on the left-rear side of the electrical chassis. The rear of the chassis (Figure 1-4) houses two fuse holders for the (1. 5 ampere) primary power line fuses. Figure 1-4 also shows the location of the two service cable receptacles through which all power, signal line, and ground connections are made. The bench test primary power and signal service cables (not supplied as part of the unit) are shown in Figure 1-6. A plug-in type transformer, located in the right rear of the electrical chassis (see Figure 1-5), supplies operating voltages for the line sensor power supply and copy lamps.

The metal case, shown in Figures 1-1 and 1-4, may be opened from the top for replacement of paper and fuses without removing the printer from the case. The running spares kit is attached to the rear of the chassis.

Inlet and exhaust ventilation ports are provided. A slot at the rear of the case is used for admitting the externally stored fan-fold, sprocket feed copypaper.

1-3. REFERENCE DATA.

a. NOMENCLATURE. - Teletypewriter Set AN/UGC-41; Teleprinter Sets AN/UGC-40 and AN/UGC-38.

b. SPECIAL FEATURES.

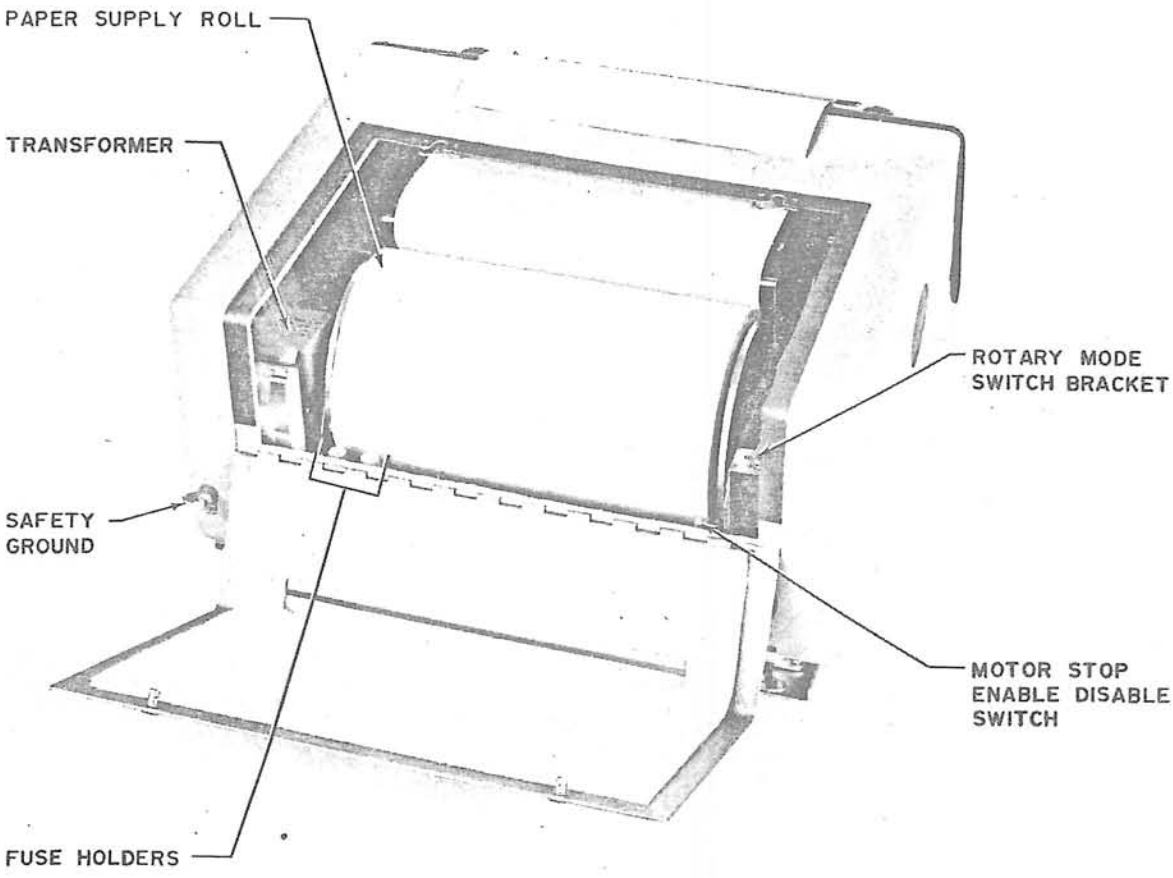
1. Self-contained electronic module containing: Time delay motor stop, line sensor power supply, and line sensor.

2. Automatic carriage return and line feed (after 72 or 76 characters).

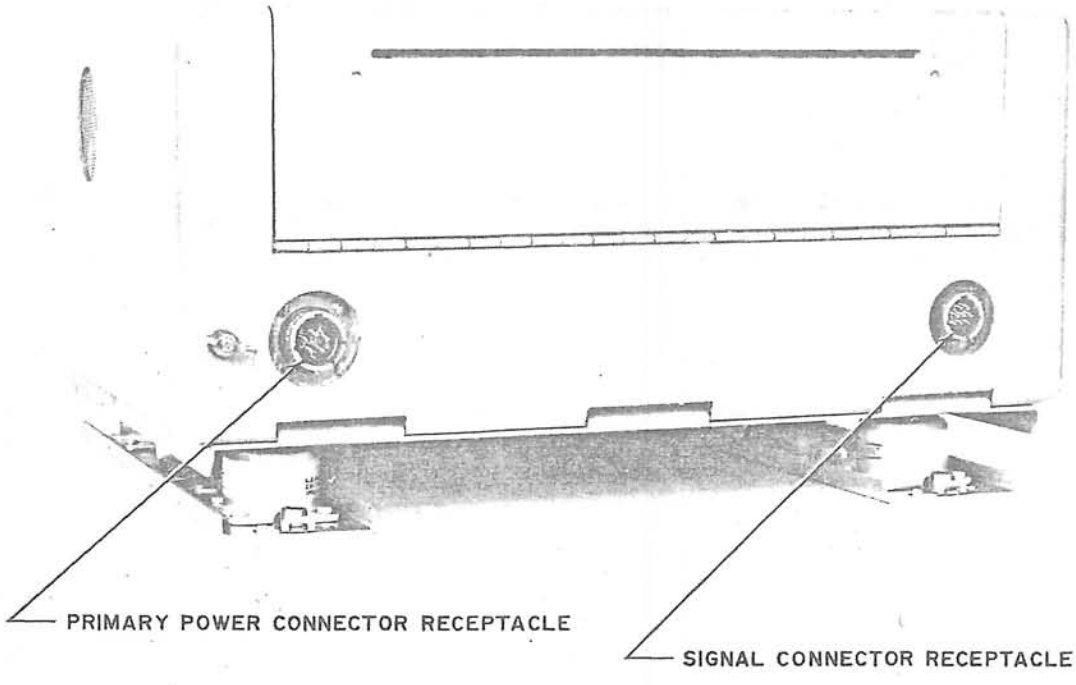
3. Automatic line feed upon receipt of signalled carriage return.

4. Input signal line not polarity sensitive.

5. Provision for high and low current range operation.



A. Teletypewriter Set



B. Teletypewriter Set

Figure 1-4. Teletypewriter Set, Rear View

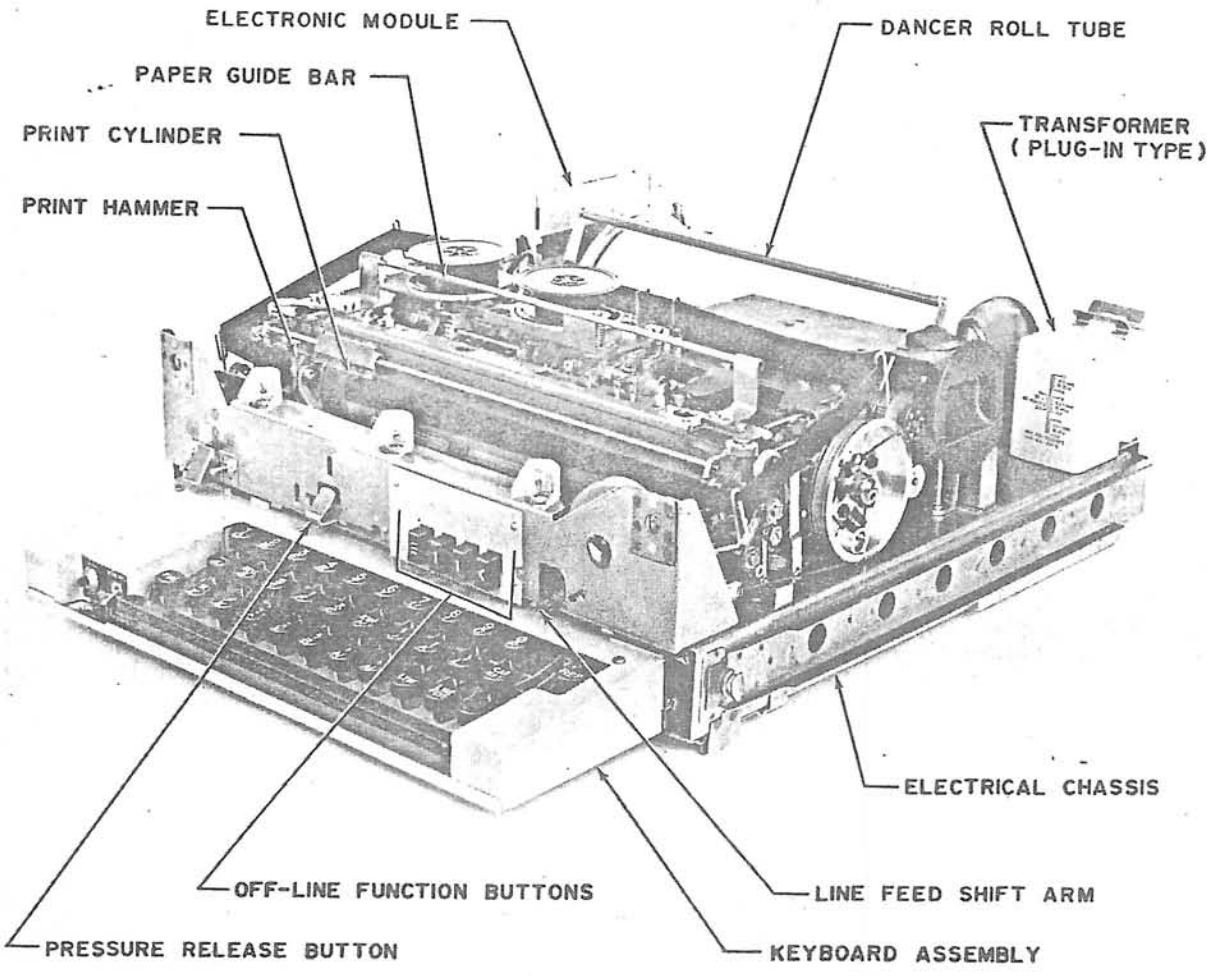


Figure 1-5. Teletypewriter Set, Case and Cover Removed

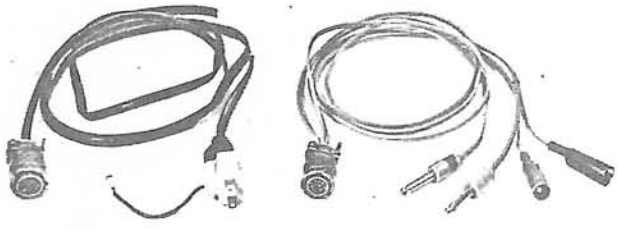


Figure 1-6. Primary Power and Signal Service Cables

6. May be installed into signal line of 20 to 80 milliamperes without internal adjustment.

7. Offers a resistive load to signal line.

8. Units do not print or space on non-printing functions (Letters, Figures, Line Feed, Carriage Return, and Blank, AN/UGC-38 prints (-) on Figures-Blank.

9. Internal paper supply for single- or multi-ply paper rolls (8-1/2-inches wide by 5-inches in diameter with a 1-inch hollow core) or exnally stored fan-fold, sprocket feed, multiply copy paper (up to 6-ply).

10. Keyboard interlock prevents transmission if remote station is not ready to receive (AN/UGC-41 only).

c. POWER REQUIREMENTS. - 115 volts alternating current, 60 cycles per second, single-phase, 112 watts.

d. TYPE OF INSTALLATION. - Non-tactical, airborne, and fixed station.

e. OPERATING SPEED. - Gears for 60, 66, or 100 words-per-minute.

f. SIGNAL CODE TYPE. - Direct-current pulse, five-level, 7.42 unit, Baudot serial, neutral line.

g. KEYBOARD. - Standard communications (supplies with AN/UGC-41 only).
h. TYPE OF CHARACTERS. - English (weather code with AN/UGC-38 only).
i. TYPE FACE. - Gothic, 12-point.
j. PRINTER LINE SPACING.

1. Single line feed - Six lines per inch.

2. Double line feed - Three lines per inch.

k. CHARACTERS PER LINE. - Adjustable for either 72 or 76.
l. INPUT IMPEDANCE.

1. High current range (20 to 80 milliamperes) - Approximately 185 ohms, resistive, at 60 milliamperes.

2. Low current range (2.5 to 10 milliamperes) - Approximately 1500 ohms, resistive, at 5 milliamperes.

m. ALARM DEVICE. - Signal activated bell.
n. COPY PAPER. - All three units use maximum 5-inch diameter roll, (single- or multi-ply), 8-1/2-inch wide, with 1-inch hollow core or fan-fold, sprocket feed, multi-ply paper (up to 6-ply).

1-4. EQUIPMENT SUPPLIED.

The equipment supplied as Teletypewriter Set AN UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38 is listed in Table 1-1.

1-5. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED.

Refer to Table 1-2 for the list of equipment and publications required but not supplied with the teletypewriter sets.

1-6. FACTORY AND FIELD CHANGES.

There are no factory or field changes in existence. Table 1-3 is provided for future use.

1-7. EQUIPMENT SIMILARITIES.

Refer to Table 1-4 for a comparison between Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38.

1-8. PREPARATION FOR RESHIPMENT.

The teletypewriter sets require no special preparation other than placing the keyboard in the stowed position for reshipment. The equipment may be shipped to another operating site or depot by repacking the complete teletypewriter set in the original shipping container in accordance with packing specification MIL-P-17555E. A teletypewriter set may also be shipped partially disassembled. Refer to Table 1-5 for the sizes and weights of the shipping containers. Advise the packing and packaging facility as to the type of equipment and whether preparation shall be for domestic shipment-immediate use, domestic shipment and storage, or for overseas shipment. If the technical manual is to be included, advise the facility to mark the shipping container, TECHNICAL MANUAL INSIDE.

TABLE 1-1. EQUIPMENT SUPPLIED

QTY	NOMENCLATURE		UNIT NO.	OVERALL DIMENSIONS (INCHES)			VOLUME (CUBIC FEET)	WEIGHT (POUNDS)
	NAME	DESIGNATION		HEIGHT	WIDTH	DEPTH		
	Teletypewriter Set includes:	AN/UGC-41	1	7-7/8	15	* 17-3/16 ** 20-1/16	-	37.9
1	Teleprinter	TT-531/UGC-41	1A2	4-1/2	12-3/4	9	0.30	13.9
1	Keyboard-Transmitter Teletypewriter	TT-332/UG	1A4	1-1/2	12	8-1/4	0.09	3.9
1	Chassis Electrical Equipment	CH-561/UG	1A1	5-1/2	13-1/8	14-1/8	0.60	7.4
1	Cover Teletypewriter	CW-896/UG	1 Amp	5-1/2	15	4-1/8	0.20	1.5
1	Case Teletypewriter	CY-6063/UG	1A5	7-7/8	15	14-1/2	1.0	9.5

*Keyboard in stowed position.
**Keyboard in operating position.

TABLE 1-1. EQUIPMENT SUPPLIED (Cont)

QTY	NOMENCLATURE		UNIT NO.	OVERALL DIMENSIONS (INCHES)			VOLUME (CUBIC FEET)	WEIGHT (POUNDS)
	NAME	DESIGNATION		HEIGHT	WIDTH	DEPTH		
	Teleprinter Set includes:	AN/UGC-40	1	7-7/8	15	17-3/16	-	33.9
1	Teleprinter	TT-530/UGC-40	1A2	4-1/2	12-3/4	9	0.30	13.9
1	Chassis Electrical Equipment	CH-561/UG	1A1	5-1/2	13-1/8	14-1/8	0.60	7.4
1	Cover Teleprinter	CW-895/UG	1 Amp	5-1/2	15	4-1/8	0.20	1.5
1	Case Teletypewriter	CY-6063/UG	1A5	7-7/8	15	14-1/2	1.0	9.5
	Teleprinter Set includes:	AN/UGC-38	1	7-7/8	15	17-3/16	-	33.9
1	Teleprinter	TT-529/UGC-38	1A2	4-1/2	12-3/4	9	0.30	13.9
1	Chassis Electrical Equipment	CH-561/UG	1A1	5-1/2	13-1/8	14-1/8	0.60	7.4
1	Cover Teleprinter	CW-895/UG	1 Amp	5-1/2	15	4-1/8	0.20	1.5
1	Case Teletypewriter	CY-6063	1A5	7-7/8	15	14-1/2	1.0	9.5

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QTY	NOMENCLATURE		REQUIRED USE
	NAME	DESIGNATION	
1	Multimeter	AN/PSM-4	Check resistance, current, and voltage.
1	Oscilloscope	AN/USM-105	Observe waveforms.
1	Electronic Multimeter	TS-505/U	Check voltages.
1	Teletypewriter Tool Kit	TK-122/U, TK-188/U	Make adjustments.
1	Maintenance Fixture required for AN/UGC-41 only	MITE P/N 37200	Performing power-on adjustments.

TABLE 1-3. FACTORY OR FIELD CHANGES

CHANGE NUMBER	TITLE AND PURPOSE	SERIAL NO. AFFECTED	INDICATION OF ACCOMPLISHMENT

TABLE 1-4. EQUIPMENT SIMILARITY

	AN/UGC-41	AN/UGC-40	AN/UGC-38
Primary Power Supply	115 vac 60 cps single phase	Same as AN/UGC-41	Same as AN/UGC-41
Signal Code	Sends and receives 7.42 unit Baudot code at speeds of 60, 66, and 100 wpm.	Receives 7.42 unit Baudot code (no send capability).	Same as AN/UGC-41
Switching Options	Operates in full-duplex on-line, or in off-line (local) modes.	Same as AN/UGC-41	Same as AN/UGC-41
Line Length	Normally prints 76 characters per line; can be adjusted for 72 characters.	Same as AN/UGC-41	Same as AN/UGC-41
Paper Feed Mechanism	Uses pressure feed paper stored within case or sprocket feed paper stored externally and admitted through slot in rear of non-tactical case.	Same as AN/UGC-41	Same as AN/UGC-41
Motor Stop Mechanism	Uses time delay motor stop; turns off motor, leaving the Teletypewriter Set in standby condition if no mark-to-space transition is received for 60 seconds; receipt of first mark-to-space transition automatically restarts motor.	Same as AN/UGC-41	Same as AN/UGC-41
Keyboard	Transmits 7.42 unit Baudot code.	No keyboard	No keyboard
Case	Supplied in Non-Tactical Case CY-6063/UG (shock mounted).	Same as AN/UGC-41	Same as AN/UGC-41

TABLE 1-5. CRATED SIZES AND WEIGHTS

NOMENCLATURE		UNIT	OVERALL DIMENSIONS (INCHES)			*VOLUME (CUBIC	*WEIGHT	FEDERAL STOCK
NAME	DESIGNATION	NO.	HEIGHT	WIDTH	DEPTH	FEET)	(POUNDS)	NUMBER
Teletypewriter Set	AN/UGC-41		12-1/2	19-3/4	22-3/4	4.9	55	–
Teleprinter Set	AN/UGC-40		12-1/2	19-3/4	22-3/4	4.9	51	–
Teleprinter Set	AN/UGC-38		12-1/2	19-3/4	22-3/4	4.9	51	–

*Equipment crated and ready for shipment.

SECTION 2

INSTALLATION

2-1. INTRODUCTION.

This section contains installation instructions for Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38. These instructions include information on site selection, unpacking, mating connector wiring (signal and power), performance check, adjustments, and final preparation for use. Reference is made to the left, right, front, or back of the unit as viewed from the operating position.

2-2. UNPACKING AND HANDLING.

NOTE

Retain the shipping container in which the teletypewriter set or teleprinter set is received for use in reshipment.

a. UNPACKING.

(1) GENERAL. - The equipments are packed in accordance with packing specification MIL-P-17555E. Sizes and weights of the various containers are listed in Table 1-5.

(2) TELETYPEWRITER SET AN/UGC-41 OR TELEPRINTER SETS AN/UGC-40 AND AN/UGC-38. - The teletypewriter sets (a keyboard, a printer, and an electrical chassis) and teleprinter sets (a printer and an electrical chassis) are shipped in a single container already mounted in Non-Tactical Case CY-6063/UG. Examine the shipping container for signs of external damage and carefully open the container. Remove the equipment and inspect as detailed in Paragraph 2-2b.

b. INSPECTION AND KEYBOARD INSTALLATION. - Inspect the unpacked equipment as follows:

NOTE

Keyboard installation procedures apply only to Teletypewriter Set AN/UGC-41.

Step 1. Remove unwired primary power and signal line connectors from plastic bag in shipping container.

Step 2. Place unit in operating position on clean working surface.

Step 3. Disengage two fastener studs (Figure 1-3) on front cover by turning them 1/4-turn counterclockwise.

CAUTION

WHEN THE FRONT COVER IS REMOVED, THE ELECTRICAL CHASSIS LOCKING DEVICE IS RELEASED AND THE CHASSIS IS FREE TO SLIDE OUT OF THE CASE.

Step 4. Carefully pull top of front cover out toward front of machine (approximately 1/2 inch) and lift cover up.

Step 5. Carefully slide printer and electrical chassis forward and out of case.

CAUTION

WHEN PLACING PRINTER AND ELECTRICAL CHASSIS ASSEMBLY ON WORK SURFACE, DO NOT REST IT IN ANY POSITION WHICH MAY DAMAGE THE MOTOR AND LAMP SWITCHES OR OTHER PROTRUDING PARTS.

Step 6. Inspect printer and chassis to ensure that no damage was incurred during shipment.

NOTE

For Teletypewriter Set AN/UGC-41 proceed with Steps 7 through 15. For Teleprinter Sets AN/UGC-40 and AN/UGC-38 proceed with Step 16.

Step 7. Loosen two printer attaching screws (18, Figure 2-1).

Step 8. Disengage two printer slide locks (1).

Step 9. Remove selector connector plug (5) from its electrical chassis connector.

Step 10. Remove motor connector plug (17) from its electrical chassis connector.

Step 11. Remove printer from electrical chassis (20) and stand on its backplate.

NOTE

Lift printer off chassis by grasping locknut on speed change gear (located on right side) and range dial knob (located on left side).

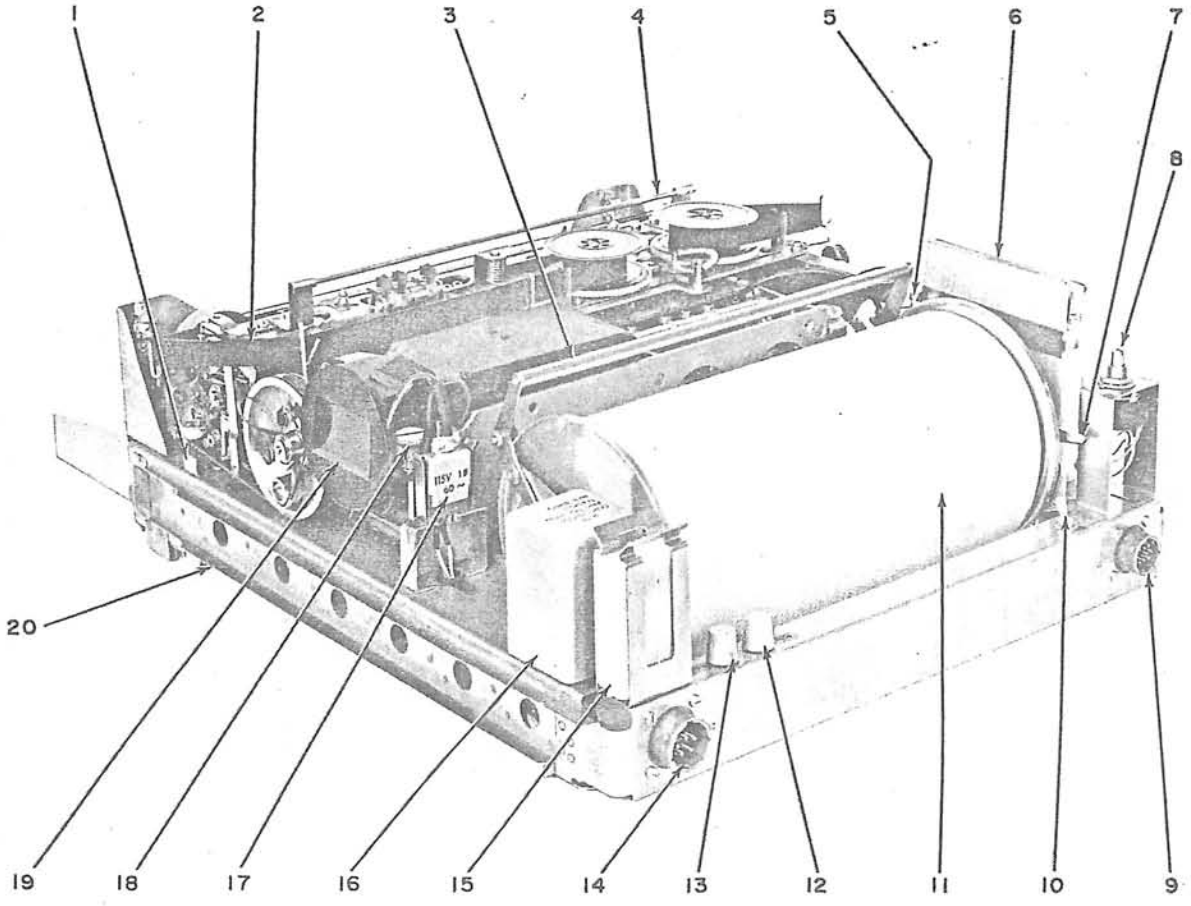
Step 12. Remove two screws which secure keyboard in stowage position within electrical chassis (Figure 2-2).

NOTE

Screws are located just behind printer slide locks in notched position of chassis stiffener (printer rests on stiffener when in operating position).

Step 13. Slide keyboard forward until two threaded holes in keyboard rails are aligned with forward holes in electrical chassis.

Step 14. Secure keyboard in operating position with two screws removed in Step 12. Screws are inserted through forward holes in chassis stiffener notches (see Figure 2-2).



KEY	ITEM	KEY	ITEM
1	Printer slide locks (one on each side)	11	Paper roll
2	Ribbon	12	Primary power fuse (F2)
3	Dancer roll tube (part of pager brake)	13	Primary power fuse (F1)
4	Paper guide	14	Primary power connector
5	Selector connector plug	15	Spare parts kit
6	Electronic module (printed circuit board)	16	Transformer
7	Paper roll lock arm	17	Motor connector plug
8	Rotary mode switch	18	Printer attaching (rear lock) screws (one on each side)
9	Signal line connector	19	Cooling outlet
10	Motor stop enable-disable switch	20	Electrical chassis

Figure 2-1. Printer and Electrical Chassis Parts Location

Step 15. Replace printer on electrical chassis by reversing Steps 7 through 11.

Step 16. Check mechanical operation of printer by manually turning mainshaft and observing for possible binding and free operation of all clutches.

Step 18. Inspect felt oil wicks for adequate oil supply and ascertain that all clutches and cam followers have been lubricated as detailed in Section 5.

2-3. POWER REQUIREMENTS AND DISTRIBUTION.

a. POWER REQUIREMENTS. - Refer to Table 2-1 for primary power requirements.

b. POWER DISTRIBUTION - Primary power distribution for the alternating current configuration is shown in Figure 4-6.

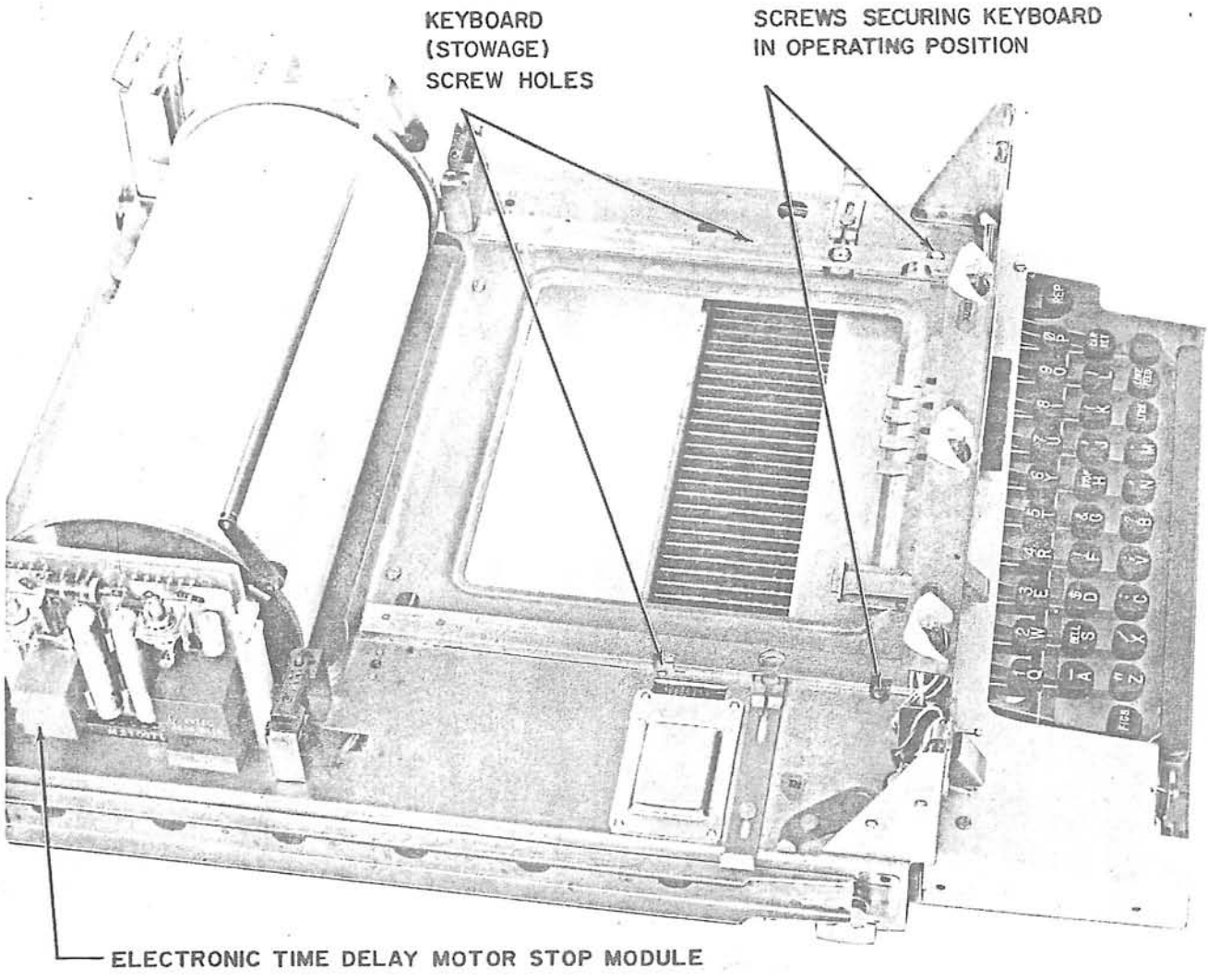


Figure 2-2. Left Side View of Chassis Electrical Equipment CH-561/UG

TABLE 2-1. PRIMARY POWER SOURCE REQUIREMENTS

PRIMARY POWER SOURCE	COMPONENTS REQUIRED	NOMENCLATURE	MITE PART NO.	POWER REQUIREMENTS (WATTS)
115 ±10% vac	Teletypewriter Set	AN/UGC-41	37502	112
60 ±5% cps	Teleprinter Set	AN/UGC-40	37500	112
	Teleprinter Set	AN/UGC-38	37501	112

2-4. SITE SELECTION.

The primary considerations in selecting an installation site are the availability of a primary power, signal line, and adequate facilities for making a good ground connection. If possible, select a site close enough to the primary power source and signal line to allow direct connection. Determine the exact nature of the primary power source to be certain it is compatible with the equipment. Refer to Figure 2-3 for space requirements for installation of Non-Tactical Case CY-6063/UG.

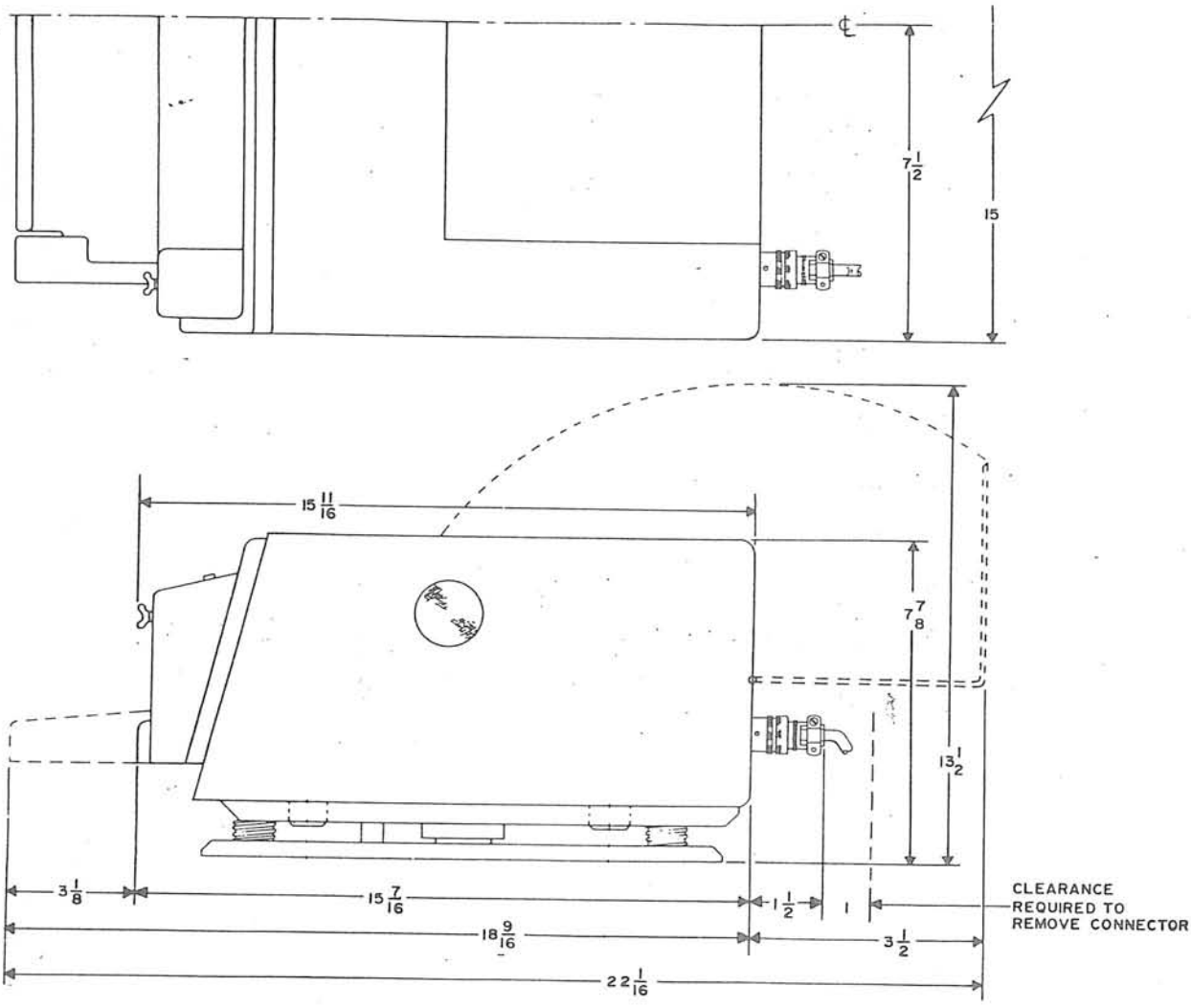


Figure 2-3. Non-Tactical Case CY-6063/UG (AN/UGC-41) Overall Dimensions

2-5. INSTALLATION OF SHOCK MOUNTED CASE CY-6063/UG.

CAUTION

WHEN INSTALLING A SINGLE TELETYPEWRITER OR TELEPRINTER, A MINIMUM CLEARANCE OF 2-INCHES FOR COOLING AND SWAY SPACE MUST BE PROVIDED.

WHEN INSTALLING TWO (2) OR MORE UNITS SIDE BY SIDE (IN-LINE), ESTABLISH A MINIMUM CLEARANCE OF 6-INCHES BETWEEN UNITS TO PREVENT HOT AIR EXHAUST FROM ONE UNIT ENTERING THE NEIGHBORING UNIT AND ALSO TO ALLOW ADEQUATE SWAY SPACE. FAILURE TO MEET THIS REQUIREMENT WILL RESULT IN DRYING OF LUBRICANTS, FAILURE OF CIRCUIT COMPONENTS, AND EXCESSIVE WEAR ON MOVING PARTS. WHERE IT IS NOT POSSIBLE TO SATISFY THE MINIMUM CLEARANCE REQUIREMENTS OF 6-INCHES FOR MULTI-UNIT INSTALLATIONS, A DEFLECTION PLATE MOUNTED MIDWAY BETWEEN UNITS, ADHERING TO THE SINGLE UNIT INSTALLATION CRITERIA OF 2- INCHES, MUST BE PROVIDED. THESE DEFLECTION PLATES CAN BE FABRICATED LOCALLY BY THE INSTALLING ACTIVITY.

All three equipments are shipped with shock mounts. Perform the installation of Case CY-6063/UG as follows:

Step 1. Drill eight 5/16-inch holes through mounting surface for the 1/4-28 mounting screws. Space holes as shown in Figure 2-4.

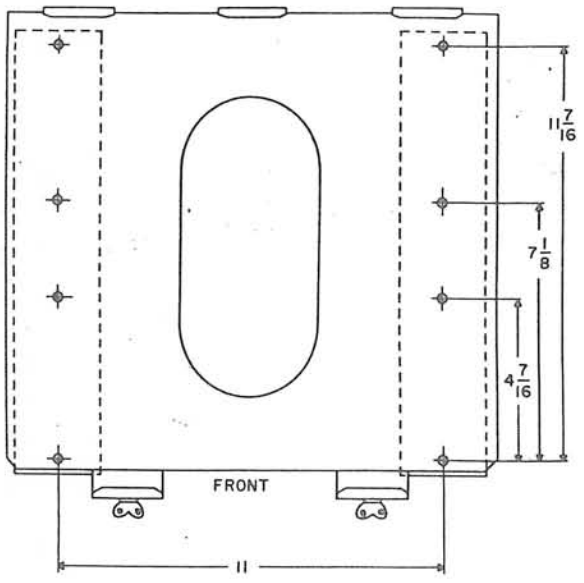


Figure 2-4. Case CY-6063/UG Shock-Mounted Installation Mounting Holes Location

NOTE

If for any reason it is desired to separate the case from the shock mount, loosen the two thumb screws on the front of the shock mount far enough to release the case and then lift the case off the mount. Conversely, the case is placed on the shock mount with the three prongs on the back of the mount engaged with the three slots in the back of the case and secured by tightening the two thumb screws.

Step 2. Position case and shock mounts over drilled holes. Insert the 1/4-28 screws through mounting surface and thread into captive nuts in shock mount.

Step 3. Use washers between screw head and bottom of mounting surface as shims to ensure that mounting screw does not protrude far enough to hinder motion of shock mount (approximately two threads should show).

2-6. MATING CONNECTOR WIRING TECHNIQUE (For service cables).

Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN UGC-40 and AN/UGC-38 are supplied with two unwired mating connectors: the power connector, for primary power and ground (MITE Corporation Part No. 5511-188); and the signal connector, for send, receive, and auxiliary circuits (MITE Corporation Part No. 5511-190). Wiring of mating connectors is performed by the using facility as instructed in Paragraphs 2-6a and 2-6b.

a. PRIMARY POWER CONNECTOR (Five pin, MITE Corporation Part No. 5511-188). - Wiring of the primary power connector (Figure 2-5) is performed as follows.

Step 1. Strip outer cable jacket to expose approximately 3/4-inch of leads. Strip 3 16-inch of leads to bare wire.

NOTE

Leads should be tinned before soldering into connector insert cups to prevent loose strands and to permit ease of entry.

Step 2. Unscrew insert (1, Figure 2-5) from insert retainer and clamp assembly (5) by turning insert (1) counterclockwise.

Step 3. Loosen two clamp screws in insert retainer and clamp assembly (5). Remove clamp insulation (6).

Step 4. Remove rubber gland (3) from cups on insert assembly (1).

Step 5. Remove shell (4) from insert (1).

Step 6. Fill solder cups with solder. (Refer to Figure 2-5.)

Step 7. Slide following parts onto cable (8) in this order: clamp insulation (7), insert retainer and clamp assembly (5), shell (4), and rubber gland (3).

NOTE

Cable leads are inserted through holes in rubber gland (3). Refer to rear view of insert (1) to position leads in proper gland (3) holes for alignment with insert cups (2).

Step 8. Solder service cable leads to insert cups (2). Refer to Table 2-2 for lead designation.

Step 9. Slide rubber gland (3) over soldered leads and insert cups (2).

Step 10. Screw insert retainer and clamp assembly (5) onto insert assembly (1).

Step 11. Align clamp insulation (7) under two clamp leaves (6) and tighten clamp screws.

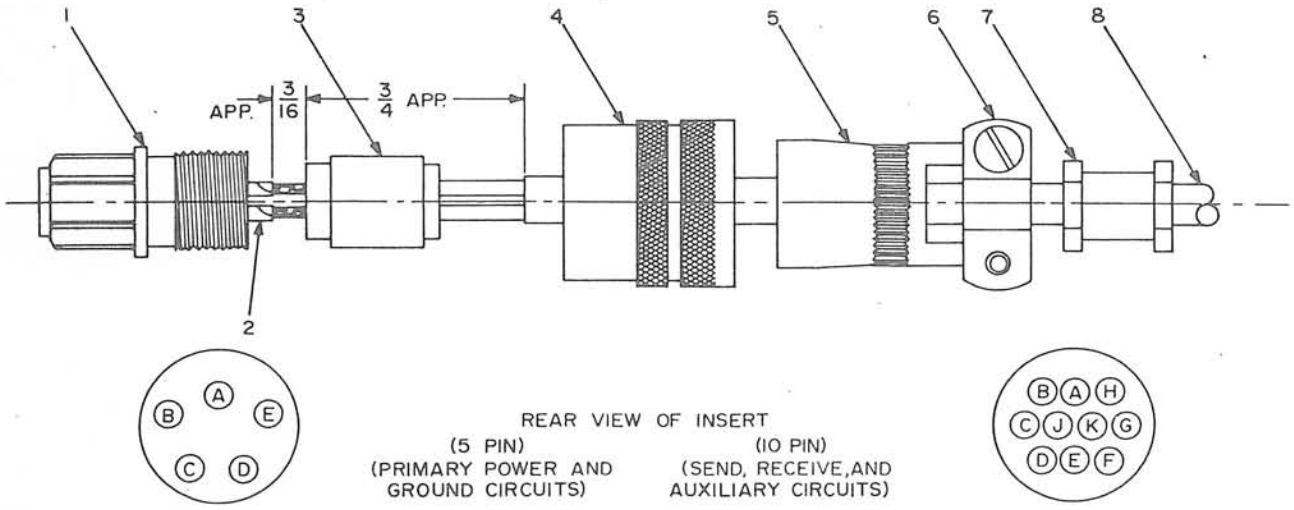
NOTE

Insulation should be positioned so that clamp leaves are between insulation hubs.

b. SIGNAL CONNECTOR (Ten pin, MITE Corporation Part No. 5511-190). - Refer to Paragraphs 2-6a and 2-9d for the disassembly and reassembly technique and to the chart provided in Figure 2-5 for determining the signal cable lead connections.

2-7. PREPARATION FOR INITIAL PERFORMANCE CHECK AND ADJUSTMENTS.

a. SWITCHING FOR OFF-LINE (LOCAL MODE) TEST. - All three equipments are shipped from the factory with the rotary mode switch (8, Figure 2-1) in the on-line (high range) mode. This prevents damage to the line sensor by inadvertent connection to a high level current signal loop. Therefore, it is necessary to position the rotary mode switch to the off-line mode for test purposes. Use a coin or screwdriver to position the rotary mode switch notch so that it points to number 1 (off-line) on the switch bracket.



KEY	ITEM	KEY	ITEM
1	Insert	5	Insert retainer and clamp assembly
2	Insert cups	6	Clamp leaves
3	Rubber gland	7	Clamp insulation
4	Shell	8	Cable

UNWIRED SIGNAL MATING CONNECTOR (Ten Pin, MITE Corporation Part No. 5511-190)					
INSERT CUP	FUNCTION	VOLTS	AMPERES	COLOR	AWG
	TELETYPEWRITER SET AN/UGC-41				
A	Keyboard-transmitter on-line data output	150	2.5-80 ma	Wht/Blk/Yel	22
B	Keyboard-transmitter on-line data output	150	2.5-80 ma	Wht/Brn/Grn	22
C	Teleprinter on-line data input	150	2.5-80 ma	Wht/Blk/Orn	22
D	Teleprinter on-line data input	150	2.5-80 ma	Wht/Red/Gy	22
E	Transmitter control			Wht/Blk/Gy	22
F	Transmitter control			Wht/Blk/Grn	22
G	Remote keyboard-transmitter SYNC pulse			Wht/Blk/Blu	22
H	Remote keyboard-transmitter SYNC pulse			Wht/Blk/Vio	22
J, K	Spares	-	-	-	-
	TELEPRINTER SETS AN/UGC-38 and AN/UGC-40				
A	Remote keyboard-transmitter off-line data input	13	8.7 ma	Wht/Blk/Yel	22
B	Remote keyboard-transmitter off-line data input	13	8.7 ma	Wht/Blk/Grn	22
C	Teleprinter on-line data input	150	2.5-80 ma	Wht/Blk/Orn	22
D	Teleprinter on-line data input	150	2.5-80 ma	Wht/Red/Gy	22
E, F, G, H, J, K	Spares	-	-	-	-
	POWER CONNECTOR (Five Pin, MITE Corporation Part No. 5511-188)				
A	115 v ±10%, 60 cps ±5%, 1 Ø	115	1.0	Blk	20
B	Ground	0	0	Grn	20
C	115 v ±10%, 60 cps ±5%, 1 Ø (system ground)	115	1.0	Wht	20
D, E	Spares	-	-	-	-

Figure 2-5. Exploded View of Connector (Typical)

b. FUSE INSTALLATION. - All equipments are shipped with 1.5 ampere primary power line fuses installed in the fuse holders (12, 13, Figure 2-1). Turn the fuse holder caps counterclockwise to remove. Check for presence of 1.5 ampere fuses in each fuse holder. If fuses are not in the holders, remove spare fuses from the spare parts kit and install.

c. RIBBON INSTALLATION. - Install the ribbon in accordance with instructions in Paragraph 3-4a(2).

NOTE

It is recommended that only nylon ribbons, MITE Corporation Part No. 05048-0001 (FSN 1N5815-975-9676), be used since lint from cotton ribbons could fall into the printer assembly. This could create a need for increased cleaning and maintenance.

d. PAPER INSTALLATION. - Install paper in accordance with the instructions in Paragraph 3-4a(3).

2-8. INITIAL PERFORMANCE CHECK AND ADJUSTMENTS.

a. GENERAL. - Teletypewriter Set AN UGC-41 will be used to describe initial performance check procedures (Paragraph 2-8d). Teleprinter Sets AN UGC-40 and AN/UGC-38, which are receive-only units, require an external keying device in order to perform initial performance procedures.

NOTE

The teletypewriter set should be removed from its case (refer to Paragraph 2-2b, Steps 3, 4, and 5) prior to performing service cable connection during preliminary check and adjustments.

b. SERVICE CABLE CONNECTION. - The following procedure can be used for connecting both cables. Since the primary power connector (five pin) is smaller than the signal connector (ten pin), there should be no difficulty in distinguishing between the two connectors. Connect both service cable connectors to their receptacles in rear of chassis as follows:

CAUTION

BE CERTAIN THAT SIGNAL LINE CURRENT IS KNOWN AND THAT MODE SWITCH IS IN CORRECT POSITION PRIOR TO CONNECTING THE SIGNAL CONNECTOR. LO POSITION IS FOR OPERATION WITH 2.5 TO 10 MA. HI POSITION IS FOR OPERATION WITH 20 TO 80 MA.

Step 1. Set POWER and LAMP switches to OFF position.

CAUTION

DO NOT APPLY EXTERNAL SIGNAL LINE BATTERY TO PINS A AND B OF THE SIGNAL CONNECTOR OF TELEPRINTER SETS AN/UGC-38 AND AN/UGC-40 WHILE IN THE OFF-LINE MODE OR SERIOUS DAMAGE TO THE LINE SENSOR POWER SUPPLY MAY BE INCURRED.

NOTE

Placing the POWER switch in the OFF position does not prevent signal line current from entering the unit.

Step 2. Inspect service cable receptacles (Figure 2-1) to ensure that no foreign matter is present.

CAUTION

IF ANY INTERFERENCE OR BINDING IS ENCOUNTERED WHILE PERFORMING THE FOLLOWING STEPS, IMMEDIATELY REMOVE THE CONNECTOR PLUG FROM THE RECEPTACLE AND DETERMINE THE CAUSE OF THE INTERFERENCE.

Step 3. Align key of service cable connector plug with its respective keyway service cable receptacle.

Step 4. Carefully insert service cable connector plug into its respective service cable receptacle. Turn sleeve of connector plug 1 4-turn clockwise to secure it.

CAUTION

ALWAYS GROUND THE (PRIMARY POWER) SERVICE CABLE BY USING A GROUNDED RECEPTACLE.

Step 5. Before applying power, make certain that equipment is switched to the off-line mode (Paragraph 2-7a).

NOTE

The in-coming signal line is open when mode switch 1A1S3 is in the off-line position.

c. INITIAL TURN-ON PROCEDURE. - Set the MOTOR and LAMP switches to the ON position. Copy lamps should illuminate paper. Motor should start as evidenced by an audible hum.

d. INITIAL PERFORMANCE CHECK. - Teletypewriter Set AN/UGC-41 is shipped from the factory with both keyboard interlock and line feed on carriage return mechanisms disabled. To perform initial performance check it is not essential to enable these mechanisms. The keyboard interlock is required only during secured operation and should remain disabled during all other operation. Instructions for enabling and disabling the keyboard interlock mechanism are contained in Section 5.

Perform initial performance check as follows:

NOTE

A check of both keyboard interlock and line feed mechanisms is required only when use of these mechanisms is anticipated.

Step 1. Check to ensure that all instructions in Paragraph 2-7 have been performed.

Step 2. Set keyboard SEND. REC/REC switch to SEND. REC position. Refer to Figure 3-1 for location of operating controls.

Step 3. Depress each alphanumeric key three times to ensure that each character is satisfactorily printed.

Step 4. Depress LTRS key and then A key; letter A should print. Depress FIGS key and then A key; a hyphen (-) should print. Repeat this sequence several times.

NOTE

Check that no print or space occurs when LTRS or FIGS key is depressed.

Step 5. Depress any alphanumeric key and REP key simultaneously. Maintain pressure on REP key and release alphanumeric key. Character for key depressed should be repeated until REP key is released.

Step 6. Depress space bar and REP key simultaneously. Release space bar and allow printer to operate through several lines. Automatic carriage return and line feed must function at end of each line.

Step 7. Depress FIGS key and then S key. Bell must ring each time S key is depressed.

Step 8. Depress A key and REP key simultaneously. Release A key. Allow several characters to be printed. Quickly depress and release off-line letters ( ) button; observe that a series of A's is printed. Quickly depress and release off-line figures ( ) button and observe that a series of hyphens is printed. Repeat previous sequence several times while maintaining constant pressure on REP key to ensure that off-line letter and figures shift satisfactorily operates.

NOTE

Advance is prevented if any off-line button is depressed. This condition applies whether printer is receiving traffic or in an idle condition. With the exception of the off-line letters function, each of the off-line functions can be accomplished while the unit is idle (motor running; no receipt or transmission of intelligence). If printer is already in position selected by the off-line button, printer will not shift but advance will be prevented while button is depressed.

Step 9. Depress off-line carriage return (<) button and observe that carriage return occurs. Type approximately a half line of characters and then depress off-line carriage return button. Observe that carriage return occurs.

Step 10. Depress off-line, line feed button (≡). Observe that line feed occurs.

Step 11. Allow unit to remain idle and note that motor shuts off after interval of 60 to 120 seconds. Momentarily depress BREAK button and observe that motor starts. Repeat this sequence several times.

NOTE

Motor will stop when there are no mark-to-space transitions for 60 to 120 seconds. An electronic time delay motor stop automatically turns motor off and places line sensor in standby condition.

e. ADJUSTMENTS. - The following adjustments should be performed prior to final preparation for use (Paragraph 2-9).

(1) LOCAL RANGE ADJUSTMENT. - Refer to Figures 2-6 and 2-7 and proceed as follows:

Step 1. Check that rotary mode switch notch is positioned for off-line mode (local loop).

Step 2. While typing a test message, unlock range dial by pulling out range finder knob; turn knob clockwise to point where message starts to garble.

Step 3. Record number indicated on range dial.

Step 4. Continue to type test message and turn knob counterclockwise past point of optimum operation until message again starts to garble.

Step 5. Record number indicated on range dial.

Step 6. Calculate point of optimum operation as follows:

$$\frac{\text{High} + \text{Low}}{2} = \text{Point of Optimum Operation}$$

Example: $\frac{100 + 20}{2} = 60$ (Optimum Setting)

Step 7. Calculate points of range as follows:

High - Low = Points of Range

Example: 100 - 20 = 80 (Points of Range)

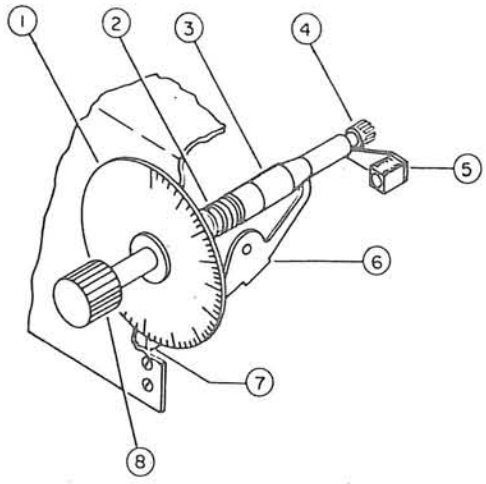
Step 8. Turn knob so that pointer is directly over number established as point of optimum operation.

Step 9. Push knob against printer to ensure that mechanism is adequately locked.

NOTE

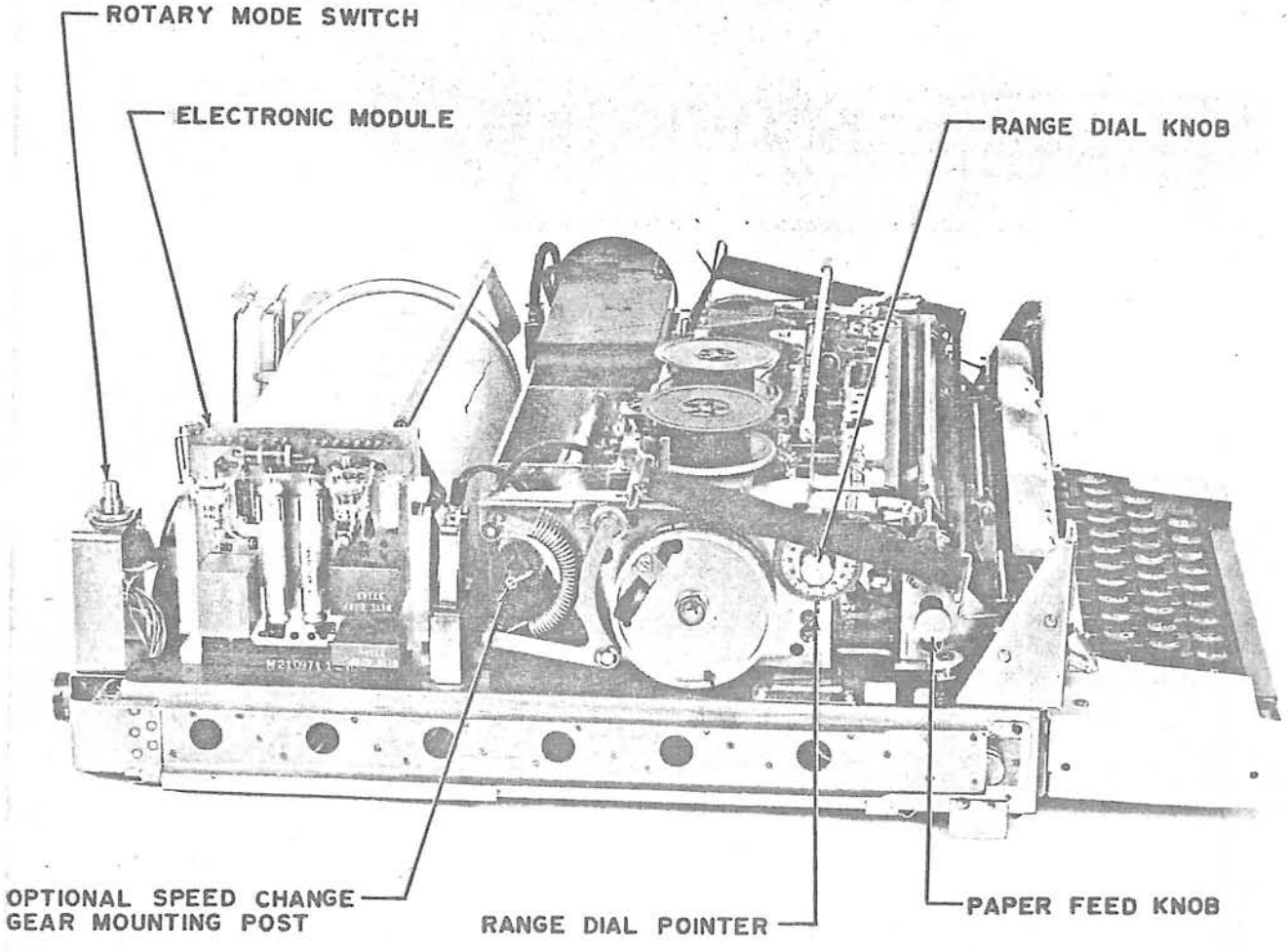
If uncalibrated portion of range dial falls under pointer, proceed with Steps 10 through 14.

Step 10. Unlock range dial by pulling knob out as far as possible and turn knob to its clockwise limit. Push knob in toward printer, locking it in this position.



KEY	ITEM
1	Range dial
2	Range finder lock helical spring
3	Conical range finder slide lock
4	Range pinion
5	Retaining lever
6	Range finder lock lever
7	Range dial pointer
8	Range finder knob

Figure 2-6. Range Dial Adjustment, Part Location



KEY	ITEM
1	Rotary mode switch
2	Electronic module
3	Optional speed change gears
4	Range dial
5	Paper feed knob
6	Range dial pointer

Figure 2-7. Printer and Electrical Chassis, Left-Side View

Step 11. Unlock retaining lever. Pull complete assembly out until range pinion is no longer engaged with range adjustment gear segment.

Step 12. Rotate knob until pointer is centered in uncalibrated portion of scale.

Step 13. Push knob toward printer, rotating slightly back and forth, until gears mesh and retaining lever locks range dial.

Step 14. Repeat Steps 2 to 9 of local range adjustment (Paragraph 2-8e(1)).

(2) OUTSIDE LOOP RANGE ADJUSTMENT. - Preferred method of ranging printer is performed using outside loop to which printer will ultimately be connected. Select on-line (outside loop) mode of operation as instructed in Paragraph 2-9b or 2-9c and request that a test message be sent from a remote station. The actual calibration procedure is same as local range adjustment procedure.

2-9. MODE OPTIONS.

Mode options described in this paragraph are referred to as Modes 1 through 3 and are applicable to land line connections when converters are not in use. Refer to Paragraph 2-10 for information on converter connections. These mode numbers correspond to those identified on the side of the mode switch (8, Figure 2-1). Modes discussed in this paragraph are applicable to all three units. However, both receive-only units (AN/UGC-40 and AN/UGC-38) require a transmitting device, if transmission over a signal loop is desired. Operating mode options are as follows:

Mode 1	Off-Line (Local)
Mode 2	On-Line, Low Level
Mode 3	On-Line, High Level

NOTE

Provisions have been made in Teleprinter Sets AN/UGC-38 and AN/UGC-40 for input of external dry-contact keying from a TD or keyboard to pins A and B of the signal connector when in the off-line mode. If no external dry contacts are supplied, or if pins A and B are not shorted, the equipment will run open.

CAUTION

DO NOT APPLY EXTERNAL SIGNAL LINE BATTERY TO PINS A AND B OF THE SIGNAL CONNECTOR OF TELEPRINTER SETS AN/UGC-38 AND AN/UGC-40 WHILE IN THE OFF-LINE MODE OR SERIOUS DAMAGE TO THE LINE SENSOR POWER SUPPLY MAY BE INCURRED.

a. MODE 1 - OFF-LINE (local mode). - In the off-line mode (see Figure 2-8) the unit functions as an electric typewriter with signal line (2.5 to 10 ma internal loop) supplied internally. Position the rotary mode switch (8, Figure 2-1) so that the notch is pointing toward number 1 (extreme counterclockwise).

NOTE

Off-line (local mode) is used primarily for test purposes.

b. MODE 2 - ON-LOW (On-line, low level mode). - On-line (low level) mode is full-duplex operation (see Figure 2-9) and means that communications can be carried on between two points in both directions simultaneously. Low level signal loop current (2.5 to 10 ma) is to be supplied externally for both send and receive signal lines. Position the mode switch (8, Figure 2-1) so that the notch is pointing toward number 2 (center position).

c. MODE 3 - ON-HIGH (On-line, high level mode). - On-line (high level) mode of operation is full-duplex, (see Figure 2-9) meaning that communications can be carried on between two points in both directions simultaneously. High level signal loop current (20 to 80 ma) is to be supplied externally for both send and receive signal lines. Position the mode switch (8, Figure 2-1) so that the notch is pointing toward number 3 (extreme clockwise position).

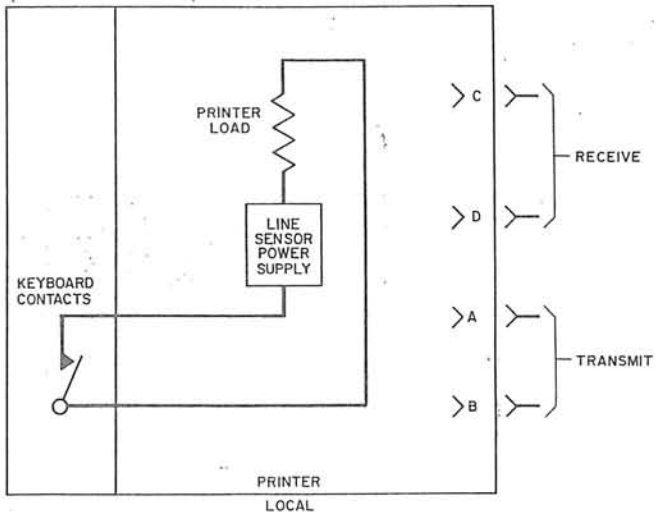


Figure 2-8. Off-Line, Mode 1 (Local)

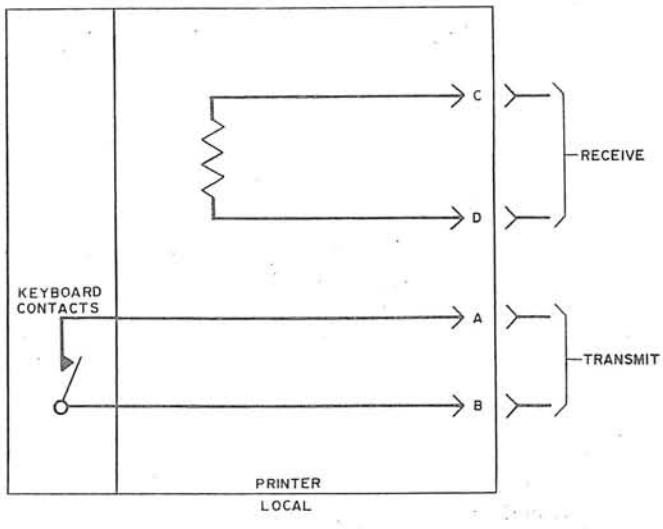


Figure 2-9. On-Line (Low level, Mode 2) (High level, Mode 3)

d. HALF-DUPLEX MODE. - Half-duplex operation can be accomplished with Teletypewriter Set AN/UGC-41 in one of two manners: the unit can be patched externally on the ships patching panel by connecting the signal lines to pins A and D and externally shorting pins B and C of the signal connector, or when it is anticipated that half-duplex mode will be utilized on a continuing basis, the signal lines can be brought in on pins A and D and a shorting strap soldered across pins B and C of the signal connector. When patched in this manner, it is still necessary to correctly position the rotary mode switch for HIGH or LOW current operation as defined in Paragraphs 2-9b and 2-9c.

2-10. EQUIPMENT CONNECTION TO CONVERTORS AND/OR RADIO TRANSMITTERS.

Since all three equipments are supplied with mating connectors, the mating connector wiring technique (Paragraph 2-6) should be followed to wire them to convertors and/or radio transmitters. Teletypewriter Set AN/UGC-41 is capable of keying a transmitter through use of the circuit connected to the SEND. REC/REC switch on the keyboard. However, it is necessary to complete the transmitter control circuit through Pins E and F when wiring mating send, receive, and auxiliary circuit connector, if keying of a remote transmitter is desired.

2-11. SPEED CHANGE GEAR REPLACEMENT.

The teletypewriter set and teleprinter sets are supplied with a choice of three speed-change gears. Establish the operating speed and install the correct color-coded gear. The 60 word-per-minute (45.45 Baud) gear is coded blue; the 66 word-per-minute (50 Baud) gear is coded yellow; and the 100 word-per-minute gear is coded white. Refer to Figure 2-7 for location of optional speed change gears. To replace a speed change gear (Figure 2-10), turn off equipment and proceed as follows:

Step 1. Loosen and remove speed change gear lock knob.

Step 2. Loosen idler gear locknut and allow idler gear and locknut to swing away from speed change gear.

Step 3. Remove speed change gear.

Step 4. Select desired replacement speed change gear and install so that its slot engages pin on post.

Step 5. Ensure that speed change gear is properly seated and install speed change gear lock knob on shaft.

Step 6. Swing idler gear up and against speed change gear to mesh gears, taking care not to exert excessive pressure. Allow minimum backlash (distance between the gears).

Step 7. Tighten idler gear locknut while holding speed change gear and idler gear in mesh with the other hand. Adjust backlash to approximately 0.002 inch.

Step 8. Run motor. If excessive gear noise indicates too much or too little backlash, stop motor and readjust backlash. Repeat this procedure for minimum gear noise.

Step 9. Store replaced speed change gear on optional speed change gear mounting post (Figure 2-7).

2-12. FINAL PREPARATION FOR USE.

Upon completion of adjustments and tests necessary to ascertain that teletypewriter set is functioning properly, re-install set into case as follows:

Step 1. Set POWER and LAMP switches to OFF position.

Step 2. Remove both connector plugs from electrical chassis by carefully turning sleeve 1/4-turn counterclockwise and pulling out.

Step 3. Align electrical chassis groove with slides in case and insert assembly into case.

NOTE

The half-circle locks on each side of the electrical chassis have now come in contact with the half-circle locks in the case. These matching half circles are locked together by a fork located in the front cover.

Step 4. Secure electrical chassis in case by engaging locking fork in front cover. Press bottom of front cover down and then push top in toward case.

Step 5. Secure front cover by engaging two quick-disconnect fastener studs with 1/4-turn clockwise.

Step 6. Connect both cable connector plugs as instructed in Paragraph 2-8b.

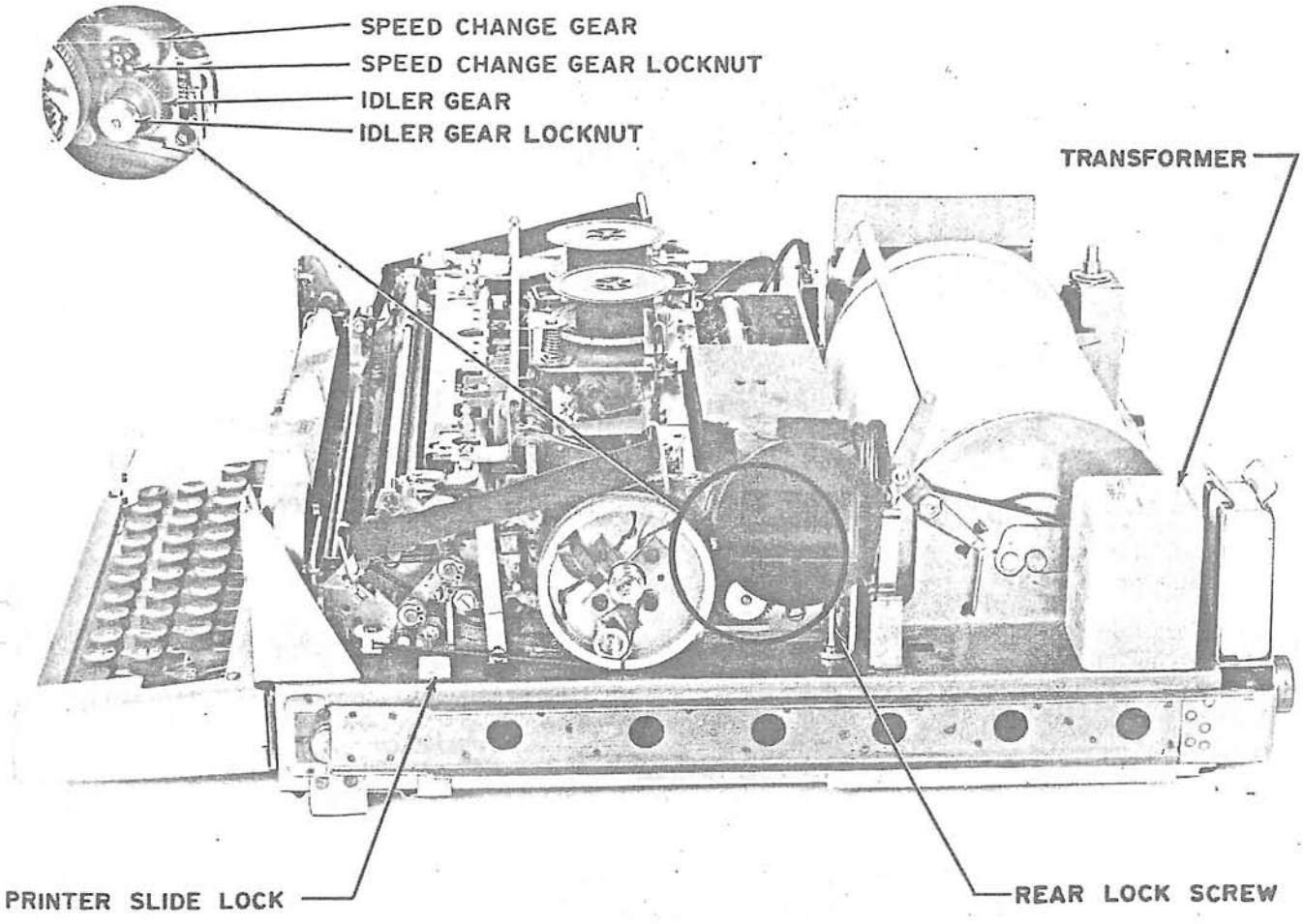


Figure 2-10. Right Side View of Teletypewriter Set AN/UGC-41, Case Removed

SECTION 3

OPERATION

3-1. GENERAL.

This section contains instructions for Teleprinter Sets AN/UGC-40 and AN/UGC-38 and Teletypewriter Set AN UGC-41. This section is written on the premise that the teletypewriter and/or teleprinter sets have been installed and completely checked in accordance with the instructions in Section 2. The following discussion is directed toward Teletypewriter Set AN UGC-41, in that the AN/UGC-38 and AN/UGC-40 are not equipped with a keyboard.

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES VOLTAGES WHICH ARE DANGEROUS TO LIFE. DO NOT SERVICE OR ADJUST THE TELETYPEWRITER SET WHILE IT IS RUNNING UNLESS EXTREME CAUTION IS USED.

3-2. FUNCTIONAL OPERATION.

a. PURPOSE OF EQUIPMENT. - The teletypewriter set provides a means of exchanging typewritten page messages between two or more stations which are similarly equipped and connected by suitable transmission media. Teleprinter sets AN/UGC-40 and AN UGC-38, which are receive-only units, provide a means of obtaining typewritten page messages from remote stations.

b. CAPABILITIES AND LIMITATIONS.

(1) PRIMARY POWER SOURCE. - The teletypewriter set is adaptable for use with 115 volts alternating current, 60 cycles per second primary power.

(2) OPERATING SPEED OPTIONS. - All three units may be adapted to operate at speeds of 60, 66, and 100 words per minute by changing speed change gears provided with the equipment. Additional gears for other operating speeds may be obtained from the manufacturer as required. Instructions for changing the gears are contained in Paragraph 2-11.

(3) OPERATING MODE OPTIONS. - The teletypewriter or teleprinter sets can be switched from off-line (local mode) to on-line (full duplex) operation by positioning the rotary mode switch located on the left-rear corner of the electrical chassis. Refer to Paragraph 2-9 for complete instructions for switching the mode of operation.

c. BASIC PRINCIPLES OF OPERATION. - The teletypewriter set provides a means of transmitting and receiving printed intelligence by exchanging series of coded pulses with similar equipment. The local teletypewriter set (AN/UGC-41) generates a standard five-level 7.42-unit, Baudot serial teletypewriter code which is sent over a transmission medium to a remote teletypewriter set. At the remote station the teletypewriter set receives, decodes, and prints the transmitted intelligence.

The AN/UGC-41 Teletypewriter Set is equipped with a keyboard interlock system. This system is enabled only when pulsed keyboard operation is required in conjunction with secure communications systems utilizing pulsed keyboard input. When the interlock system is enabled, it is necessary to disable the keyboard repeat key to negate erroneous transmissions. Instructions for this procedure are contained in Section 5 of this manual.

NOTE

When the keyboard interlock mechanism is enabled, the operator can depress any key lever. This action positions the code bars, stores the intelligence in the keyboard, and locks out all the remaining key levers. Upon receipt of a synchronous pulse, the keyboard clutch is released, and the intelligence stored in the keyboard is transmitted, and the keyboard is cleared for depression of the next key lever. When operating with the keyboard interlock mechanism enabled, do not, under any circumstances, depress the BREAK button. Depression of the BREAK button will open the signal line and enter erroneous data into the receiving station.

3-3. CONTROLS AND INDICATORS.

a. DESCRIPTION OF CONTROLS. - Refer to Table 3-1 for a listing of all operator's controls and functions. All index numbers referred to in Table 3-1 are shown in Figure 3-1.

b. DESCRIPTION OF INDICATORS. - The teletypewriter set is equipped with an audible signal bell used by the remote operator to alert the local operator to a forthcoming message. The bell is operated by striking the FIGS key and then the S key. If the keyboard interlock is disabled, the local operator can follow the same procedure (ring the signal bell at remote station) to notify the remote station that a message is forthcoming. In addition, a BREAK button is provided on the front of the keyboard to permit the local operator to open the signal line and notify the remote operator to stop sending.

3-4. OPERATING PROCEDURES.

a. SEQUENCE OF OPERATION. - To operate the teletypewriter set, perform the following procedures in accordance with the instructions given in the indicated subparagraphs:

Preliminary Starting Procedures - Subparagraph (1)
Installation of Ribbon - Subparagraph (2).

Installation of Paper - Subparagraph (3).
Starting Procedure - Subparagraph (4).
Operating Procedure and checks - Subparagraph (5).
Stopping Procedure - Subparagraph (6).

(1) PRELIMINARY STARTING PROCEDURE.

Step 1. Check that primary power and signal cables are connected to receptacles on set.

Step 2. Check ribbon; if it is damaged or dried out, replace it as instructed in Paragraph 3-4a(2).

Step 3. Check copy paper; if supply is low (indicated by red or purple line along edge of paper), install new supply as instructed in Paragraph 3-4a(3).

Step 4. Set LINE FEED control arm (located in notch in front cover, 9, Figure 3-1) for single or double spacing of lines.

(2) INSTALLATION OF RIBBON (See Figure 3-2).

NOTE

It is recommended that only nylon ribbons, MITE Corporation Part No. 05048 (FSN 1N5815-975-9676) be used since lint from cotton ribbons drops into printer mechanism and necessitates more frequent cleaning and servicing. If standard Underwood-type teletypewriter ribbons are not available, 1/2-inch typewriter ribbon is usable, provided that Underwood-type spools are used. If ribbon does not have eyelets, knot ribbon a few inches from each end and engage knots with the reversing arms in the manner used for reversing eyelets.

Step 1. Remove front cover by disengaging fastener studs with a counterclockwise turn and pulling top of cover approximately 1/2-inch forward; lift cover up and away from set.

Step 2. Remove both cables from teletypewriter set by turning the connector plugs counterclockwise and pulling them straight out.

Step 3. Carefully slide printer and electrical chassis out of case and place on a clean work surface.

Step 4. Remove paper from printer.

NOTE

Do not remove the ribbon feed assembly to replace the ribbon.

Step 5. Remove old ribbon, if installed, and retain one empty spool.

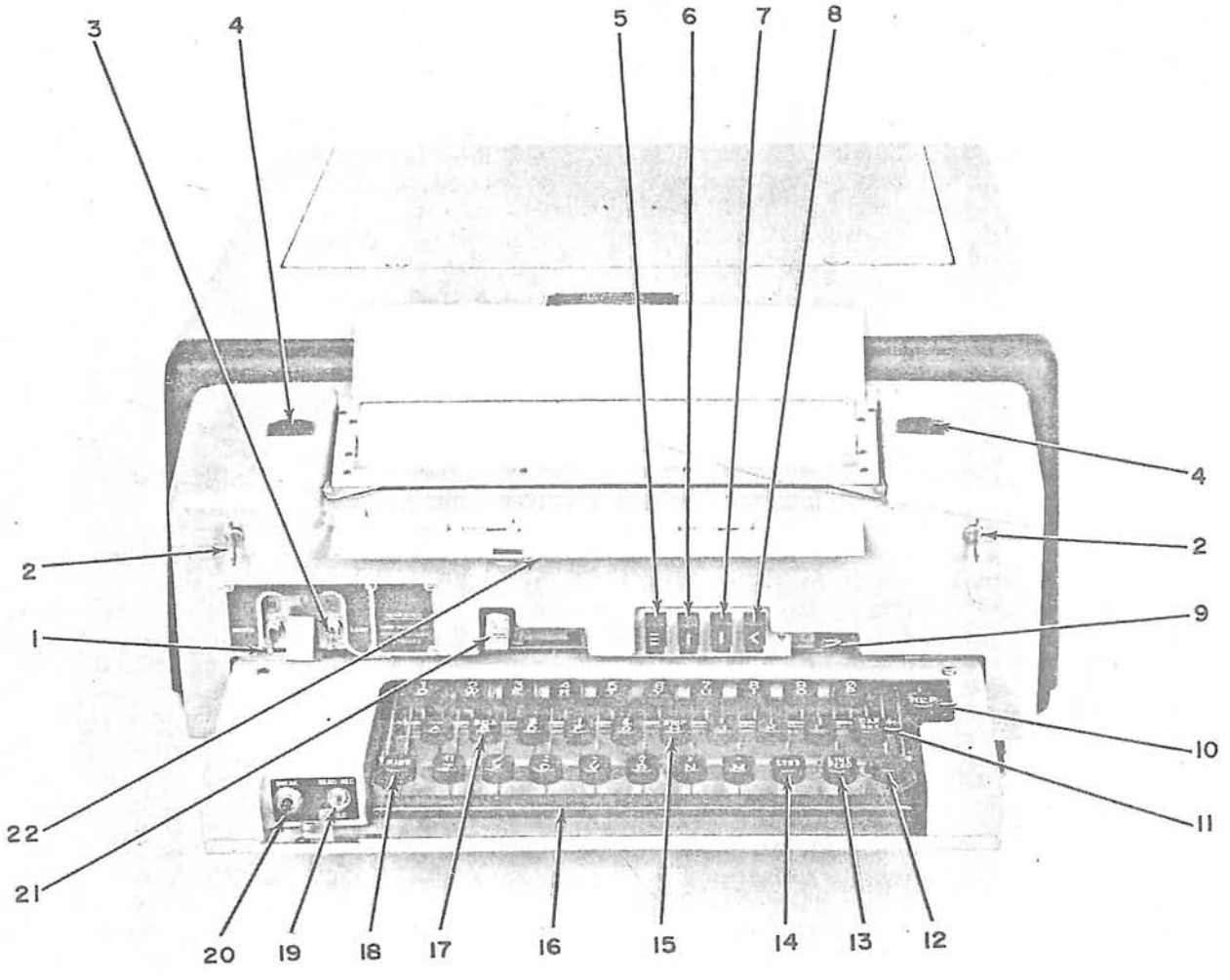


Figure 3-1. Operator's Controls

TABLE 3-1. OPERATOR'S CONTROLS

CONTROL	FIGURE 3-1 LEGEND	LOCATION	FUNCTION
POWER switch	1	Left side of printer, above keyboard	ON position turns on all primary power OFF position turns off all primary power
Fastener studs	2	Both sides of front cover	Locks front cover in place and secures teletypewriter in case
LAMP switch	3	Left side of printer, above keyboard	ON position lights the copy lamp OFF position extinguishes the copy lamp DIM position reduces the light intensity to approximately 1/2
Copy window release	4	Levers are located at top right and top left of front cover	Unlocks copy window when slid toward outside
Off-line line feed button (≡)	5	Button on right side of front cover	Feeds copy paper on local unit
Off-line figures button (↟)	6	Button on right side of front cover	Moves print cylinder of local teletypewriter set to figures position (no signal transmitted)
Off-line letters button (↡)	7	Button on right side of front cover	Moves print cylinder of local teletypewriter set to letters position (will not operate unless an incoming signal or signals are being received)
Off-line carriage return button (<)	8	Button on right side of front cover	Returns local teletypewriter set print cylinder to extreme left margin of paper (no signal transmitted)
Line feed shift arm	9	Notch in front cover	In the left position, causes paper feed rubber roll to move one line; in the right position, causes the paper feed rubber roll to move two lines
REP key	10	Top row, extreme right-hand end of keyboard	REP key must be disabled when keyboard interlock is enabled. When keyboard interlock is disabled, REP key is operable, and will repeat the last character or function sent from the keyboard, for as long as the key is depressed

TABLE 3-1. OPERATOR'S CONTROLS (Cont)

CONTROL	FIGURE 3-1 LEGEND	LOCATION	FUNCTION
CAR RET key	11	Middle row, extreme right-hand end of keyboard	Returns print cylinder to extreme left margin of paper. Also, supplies line feed when line feed on carriage return mechanism is operable.
Blank key	12	Bottom row, extreme right-hand of keyboard	Transmits blank code group NOTE Printing suppressed on AN/UGC-41 and AN/UGC-40, AN/UGC-38 prints (-) when in figures condition
LINE FEED KEY	13	Bottom row, second from right-hand end of keyboard	Moves paper up one or two line spaces on paper feed rubber roll depending on position of LINE FEED shift arm
LTRS key	14	Bottom row, third from right-hand end of keyboard	Shifts teletypewriter set to letters condition, enabling all letters to be typed
STOP key	15	Middle row, fifth from right-hand end of keyboard	AN UGC-41 and AN UGC-40 will print symbol (#), and AN UGC-38 will print (♮) symbol upon receipt of figures H. If teletypewriter set equipped with figures H motor stop in the loop, its motor will shut off upon receipt of figures H
Space bar	16	Bottom of keyboard	Causes hammer to move to the right without printing
BELL key (FIGS S)	17	Middle row, second from left-hand end of keyboard	Rings the signal bell, if struck after FIGS key, not after LTRS key
FIGS key	18	Bottom row, extreme left-hand end of keyboard	Shifts teletypewriter set to figures condition, enabling punctuation and other symbols to be typed
SEND. REC/REC switch	19	Left side of keyboard cover	REC position allows only reception, but not transmission; SEND. REC position allows both keyboard transmission, printing reception and keying of a remote radio transmitter or teleprinter
BREAK push button switch	20	Left side of keyboard cover	Opens signal line; used to start motors when turned off by time delay mechanism NOTE Do not use BREAK button when keyboard interlock mechanism is enabled.

TABLE 3-1. OPERATOR'S CONTROLS (Cont)

CONTROL	FIGURE 3-1 LEGEND	LOCATION	FUNCTION
Paper lock pressure release lever	21	Notch in front cover	Push serrated tab in and down to lock in place. This lifts the pressure rollers away from feed roller enabling the paper to be moved in center of feed mechanism. Lift serrated tab to re-engage pressure roller
Keyboard Reflector	22	Front cover	Illuminates keyboard with light reflected from copy lamps
Alphanumeric keys		Keyboard	Causes printing of letter or symbol, displayed on keytop by AN/UGC-41 and AN/UGC-40. Weather symbols rather than standard punctuation symbol are printed by AN/UGC-38
Paper feed knob	Not Shown	Under front cover on left side of printer	Feeds the paper through the paper feed rubber roll to facilitate paper installation
Time delay MOTOR STOP switch	(10, Figure 2-1)	On left rear of electrical chassis	Enables or disables time delay motor stop feature

Step 6. Place ribbon and spool (3. Figure 3-2) on left-hand ribbon spindle (4).

Step 7. Thread ribbon through reverse bar (2) and left-hand ribbon guide (1).

Step 8. Thread ribbon through front plate ribbon guide (14) across front of printer, threading it through hammer ribbon guide (13 and 11) and in front of hammer face (12).

Step 9. Thread ribbon through right-front plate ribbon guide (10), right-rear ribbon guide (9) and right-hand ribbon guide (8).

Step 10. Thread ribbon through fork in reverse bar (2).

Step 11. Engage end of ribbon with ribbon spool (6) and wind new ribbon onto spool until reversing eyelet (7) is on spool (6).

NOTE

Ensure that ribbon eyelet (7) is left of the right yoke in reverse bar (2) and on the ribbon spool (6). If it is not, ribbon will not reverse.

Step 12. Test operation of ribbon feed mechanism by starting printer motor; depress REPEAT key and then actuate (push right and left) reversing bar (2) several times.

NOTE

The start clutch must be turning for ribbon feed mechanism to operate.

Step 13. Install paper as instructed in Paragraph 3-4a(3).

(3) INSTALLATION OF PAPER.

(a) ROLL PAPER SUPPLY INSTALLATION.

Step 1. Remove front cover by loosening two fastener studs. Pull top of cover approximately 1/2-inch forward; lift entire cover up and away from teletypewriter set.

Step 2. Remove both cables from teletypewriter set by turning connector plug 1/4-turn counterclockwise and pulling straight out.

Step 3. Carefully slide printer and electrical chassis out of case and place on a clean work surface

Step 4. Raise two paper support and brake drum assembly lock levers (Figure 2-1); lift paper support and brake drum assembly out of electrical chassis.

Step 5. Grasp knurled discs (3, Figure 3-3) on both ends of paper support and brake drum assembly and turn one end counterclockwise with respect to the other.

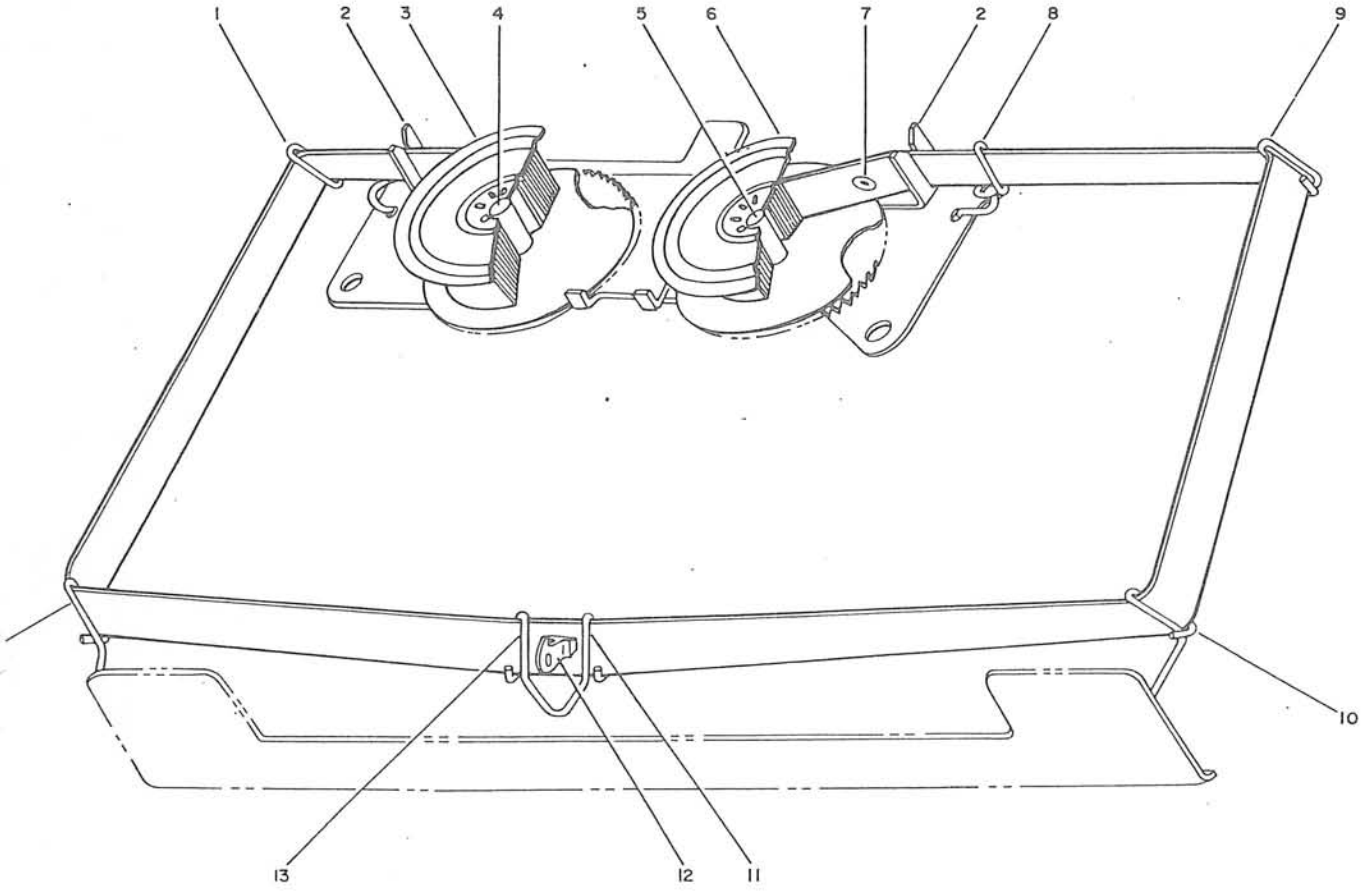
Step 6. Remove brake drum (4) from paper support shaft (2).

Step 7. Remove metal caps (if installed) that protect core of paper roll.

Step 8. Insert paper support shaft (2) through core of paper supply roll (1). Install brake drum (4) by turning knurled discs (3) on brake drums clockwise with respect to each other.

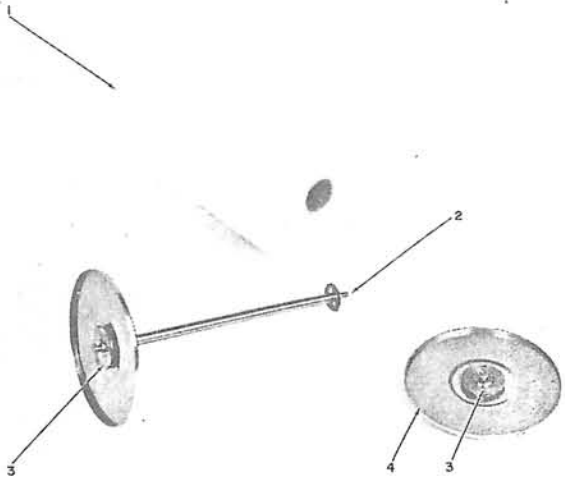
Step 9. Position paper roll so that paper feeds from underside toward operator.

Step 10. Insert paper support and brake drum assembly into paper spool bearing receptacles of electrical chassis. Lock into position by moving paper support and brake drum assembly lock levers back and down.



KEY	ITEM	KEY	ITEM
1	Left-hand ribbon guide	8	Right-hand ribbon guide
2	Reversing bar	9	Right-rear ribbon guide
3	Ribbon and spool	10	Front plate ribbon guide (right-hand)
4	Ribbon spindle (left-hand)	11	Hammer ribbon guide
5	Ribbon spindle (right-hand)	12	Hammer face
6	Ribbon and spool	13	Hammer ribbon guide
7	Eyelet	14	Front plate ribbon guide (left-hand)

Figure 3-2. Ribbon Threading Diagram



KEY	ITEM
1	Paper supply roll
2	Paper support shaft assembly
3	Brake drum knurled hub
4	Brake drum

Figure 3-3. Paper Spool Assembly

Step 11. Thread paper behind and over dancer roll tube and then over paper guide.

Step 12. Fold back approximately three inches of paper (to provide a straight edge) and insert paper down and behind return (red) cable and print cylinder.

Step 13. Gently press paper down and against paper feed rubber roll and pressure roll; rotate paper feed knob (Figure 2-8) counterclockwise until paper emerges at top of printer.

Step 14. If paper is not straight in printer depress paper release button, align edges, and lock paper by pushing up on paper release button.

Step 15. Align electrical chassis slide with track in case and carefully slide into case.

Step 16. If front cover is to be reinstalled, thread paper through opening.

Step 17. Install front cover by pressing bottom of cover into position, to lock electrical chassis in place, and swinging top of cover into closed position; then, engage two fasteners studs by pushing in and turning both clockwise.

Step 18. Install power and signal cable connector plugs into respective receptacles by aligning key of connector plug with keyway of receptacle, gently pushing in, and turning connector plug 1 4-turn clockwise.

(b) SPROCKET FEED PAPER SUPPLY INSTALLATION.

NOTE

In order to change from roll paper supply operation to sprocket feed paper operation it is necessary to perform the sprocket feed paper adjustment in Section 5 of this manual.

Step 1. Remove front cover by loosening two fastener studs, pulling top of cover approximately 1 2-inch forward, and then lifting cover up and away from teletypewriter set.

Step 2. Slide chassis out of case and remove plastic box located behind transformer (right-rear corner).

Step 3. Remove the eight sprocket teeth and hex wrench; install four sprocket teeth into threaded holes in each end of paper feed roll.

Step 4. Return wrench into plastic box and place box into clip on chassis.

Step 5. Disconnect two captive fasteners on hinged cover by turning them counterclockwise and lift cover.

Step 6. Fill front paper receptacle (Figure 3-4) with supply of fan-fold paper, being careful to position it so that master sheet faces bottom of teletypewriter.

Step 7. Carefully tear off one corner (or staple front edge) of paper to facilitate installation into equipment.

Step 8. Grasp end of paper, being careful to have carbon paper facing in correct direction, and feed paper through slot in rear of hinged cover.

Step 9. Slide chassis approximately halfway into case.

Step 10. Draw paper over paper guide and out through opening in front of case.

Step 11. Slide chassis all the way into case.

Step 12. Depress paper release button. Feed paper down between return (red) cable and print cylinder.

Step 13. Gently press paper down and against paper feed rubber roll and pressure roll; then rotate paper feed knob counterclockwise until paper emerges at top of printer.

NOTE

Ensure that sprocket teeth are properly engaged with the feed holes in the paper. Also, make certain that the paper release button remains in the RELEASE position.

Step 14. Open window on front cover and thread paper through cover. Install front cover by pressing bottom of cover into position to lock electrical chassis in place and swinging top cover into closed position.

Step 15. Engage two fastener studs by turning them counterclockwise.

Step 16. Close lid and secure with 1 4-turn fasteners.

Step 17. When operation has begun, check that copy paper feeds into rear paper receptacle as shown in Figure 3-4.

(4) STARTING PROCEDURE.

Step 1. Set MOTOR switch to ON position.

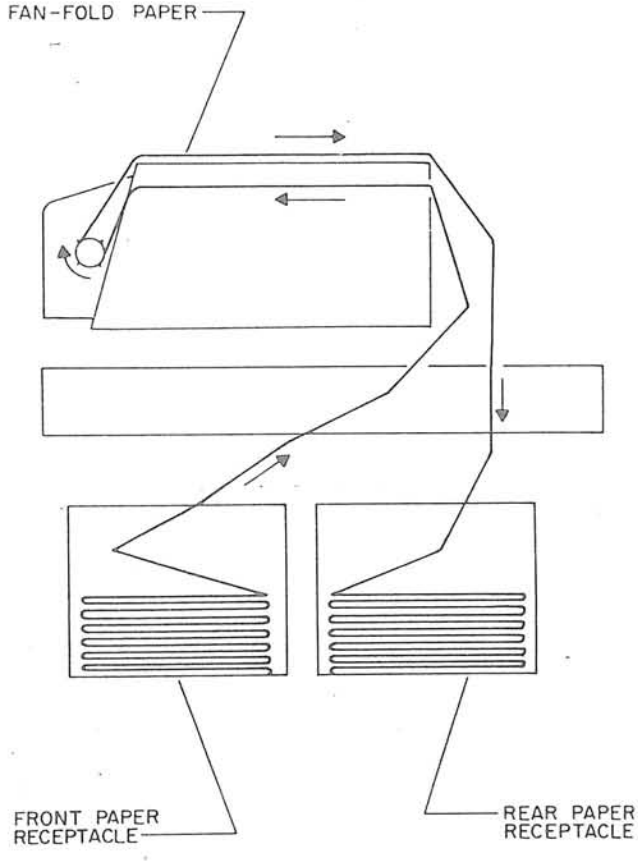


Figure 3-4. Sprocket Feed Paper Installation Diagram

Step 2. Set SEND. REC/REC switch to SEND. REC position for full duplex operation or to REC position for receive-only operation.

Step 3. Set LAMP switch to ON position.

NOTE

To start motor after it has been shut down by time delay motor stop, check that MOTOR switch is still in ON position and then depress BREAK button.

(5) OPERATING PROCEDURE AND CHECKS. - Perform the following operating checks prior to commencing operation:

Step 1. Check that automatic line feed and carriage return occur after 76th or 72nd character is printed and carriage return occurs when carriage return code impulse is received.

Step 2. Observe action of ribbon while printing. Ribbon spool must advance each time character is printed.

Step 3. Check space bar, FIGS key, and LTRS key to see that they function properly.

Step 4. Depress FIGS key and then depress A key. Observe that hyphen (-) prints. Depress REP key and momentarily depress letters off-line button protruding through front cover. Print cylinder should return to letters position as indicated by a series of A's.

Step 5. Space print cylinder toward center of page. Depress carriage return off-line button protruding through front cover. Print cylinder and hammer should return to left margin.

Step 6. Depress LTRS key and then depress figures off-line button protruding through front cover. Print cylinder should return to figure position.

Step 7. Depress off-line feed button (≡) protruding through front cover. Paper should continue to advance as long as button is depressed.

Step 8. Check signal bell by depressing FIGS key then S key; signal bell should ring.

Step 9. After a waiting interval (non-operation) of 60 to 120 seconds, observe that motor shuts off.

NOTE

When enabled, the time delay motor stop will shut off the motor when there are no mark to space transitions to 120 seconds.

Step 10. Depress BREAK button; motor should start.

Step 11. Depress any alphanumeric key and then depress REP key. Maintain pressure on repeat key and release alphanumeric key. Character will continue to be typed until REP key is released.

Step 12. Commence sending or receiving operations.

Step 13. If received message is garbled, perform applicable range calibration check as instructed in Paragraph 2-8e.

(6) STOPPING PROCEDURE.

Step 1. During operation, an operator at any sending station can stop motors of all teletypewriter sets, equipped with figure H motor stop feature, by depressing FIGS key and then H key. On teletypewriter and teleprinter sets equipped with the time delay motor stop feature, motor will shut off 60 to 120 seconds from receipt of last space-to-mark transition.

Step 2. Stop teletypewriter set and close it to traffic by setting MOTOR and LAMP switches to OFF position.

3-5. SUMMARY OF OPERATING PROCEDURES.

Refer to Table 3-2 for a summary of operating procedures.

3-6. OPERATOR'S MAINTENANCE.

Operator's maintenance consists of replacing ribbons, paper, fuses, and copy lamps. In addition, operator must check range calibration as described in Paragraph 3-6b. These procedures require no special tools or test equipment.

a. REPLACEMENT PROCEDURES.

(1) RIBBON REPLACEMENT. - Replace ribbon, when required, as instructed in Paragraph 3-4a(2).

(2) PAPER REPLACEMENT. - Replace paper, when required, as instructed in Paragraph 3-4a(3).

(3) FUSE REPLACEMENT. - To replace a defective fuse proceed as follows:

Step 1. Loosen two 1/4-turn fasteners on top hinged cover of case. Then open and swing hinged cover back.

Step 2. To replace defective fuse, turn fuse holder caps (12 and 13, Figure 2-1) counterclockwise and remove.

NOTE

Fuses are 1.5 amperes.

Step 3. Insert new fuse into holder and install fuse holder caps by turning them clockwise.

Step 4. Close hinged cover and secure by engaging two 1/4-turn fasteners with a clockwise turn.

(4) COPY LAMP REPLACEMENT.

CAUTION

THE ELECTRICAL CHASSIS IS FREE TO SLIDE OUT OF THE CASE UPON REMOVAL OF THE FRONT COVER.

Step 1. To remove front cover, loosen two fastener studs, pull top toward front approximately 1/2-inch, and then pull entire assembly up and away from case.

Step 2. Compress plastic lamp diffusers to disengage diffuser tabs from electrical chassis cutouts. Remove lamp diffusers.

Step 3. Depress defective copy lamp, turn counterclockwise, and remove from socket.

Step 4. Insert new lamp in socket, depress and turn clockwise 1/4-turn.

Step 5. To permit insertion of diffuser tabs in electrical chassis cutouts, compress plastic lamp diffusers.

Step 6. To install front cover, engage electrical chassis locking device, press down, push top into position, and then engage two fastener studs with a 1/4-turn clockwise.

b. OPERATING CHECK AND ADJUSTMENTS. - Operating checks and adjustments are those which must be made during normal operations in order to maintain overall efficiency of the teletypewriter set.

(1) RANGE CALIBRATION CHECK AND ADJUSTMENT. - Due to variations in signal line distortion, it may be necessary to check range calibration several times during any given day. Check range according to Paragraph 2-8d(2). Adjust range, if necessary.

c. PREVENTIVE MAINTENANCE. - If an Organizational Maintenance Program is in effect, refer to operator's checkoff list for preventive maintenance routine check.

TABLE 3-2. SUMMARY OF OPERATING PROCEDURES

STEP NO.	OPERATION	ACTION
1	Prepare for operation.	Ascertain that equipment has been correctly installed and is ready for operation.
2	Start equipment	Set MOTOR and LAMP switches to ON.
3	Check operating adjustments.	Refer to Paragraph 3-6b for adjustment procedures; perform adjustments if required.
4	Select operating condition.	Set SEND.REC/REC switch to proper position (up for both send and receive; down for receive only).
5	Perform following on-line (both send and receive) functions as required:	NOTE On-line functions are performed upon receipt of a signalled input as opposed to off-line functions which are performed on the local unit only without the benefit of a signalled input.
	a. Print numbers and punctuation marks when selected key is depressed.	Depress FIGS key.
	b. Print letters when selected key is depressed.	Depress LTRS key.
	c. Advance paper.	Depress LINE FEED key.
	d. Return print cylinder and hammer to left side.	Depress CAR RET key (automatic line feed should also be activated).
	e. Repeat last transmitted character.	Depress REP key. (When keyboard interlock is operable the REP key is disabled and it is necessary to repeatedly depress same key.
	f. Obtain space between characters.	Depress space bar.
	g. Interrupt transmission from remote station.	Push BREAK push button switch.
	h. Ring bell at both local and remote stations.	Depress FIGS key and then S key.
	i. Stop motor at remote stations having FIGS H motor stop.	Depress FIGS key and then H key.
	NOTE Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38 are provided with electronic time delay motor stops that automatically shut off the equipment after 60 to 120 seconds if signal line remains in steady mark condition	

TABLE 3-2. SUMMARY OF OPERATING PROCEDURES (Cont)

STEP NO.	OPERATION	ACTION
	j. Restart motor at both local and remote stations.	Push BREAK button switch.
6	Perform following off-line functions, as required:	NOTE Off-line functions are performed on the local unit only without the benefit of an incoming signal as opposed to On-line functions which are performed upon receipt of a signalled input.
	a. Provide shift to letters on local printer.	Depress off-line letter button ( ) while receiving intelligence. (Off-line letters button will not operate unless intelligence is being received by printer.)
	b. Provide shift to figures on local printer.	Depress off-line figures button ( ).
	c. Provide carriage return on local printer.	Depress off-line carriage return button (<).
	d. Provide line feed.	Depress off-line feed button (≡).
7	Change line feed rate.	Move LINE FEED shift arm to single (six lines per inch) or double (three lines per inch) position, as required.
8	Stop equipment.	Set MOTOR and LAMP switches to OFF.

SECTION 4

THEORY OF OPERATION

4-1. INTRODUCTION.

This section contains principles of operation for Teletypewriter Set AN/UGC-41, and Teleprinter Sets AN/UGC-38 and AN/UGC-40. Paragraph 4-2 describes the overall functioning of the equipment in the two modes of operation: off-line local mode, and on-line mode. Paragraph 4-3 describes the electrical and mechanical theory of each functional section of the teletypewriter set.

NOTE

The AN/UGC-41 is a send-receive equipment, and the AN/UGC-38 and AN/UGC-40 are receive only units. Discussion will be keyed to the AN/UGC-41 to illustrate the send function.

4-2. OVERALL FUNCTIONAL DESCRIPTION.

a. GENERAL. - Figure 4-1 is a simplified block diagram showing the functional arrangement of the major assemblies of the teletypewriter set. Module board 1A3 consists of a dual range line sensor, line sensor power supply, and electronic time delay motor stop.

b. OVERALL OPERATION. - Electrical chassis 1A1 routes the incoming and outgoing signals and distributes primary power to the appropriate assemblies. The ac line sensor power supply furnishes a dc signal line current source for off-line (local mode) operation. The dc signal line is floating in respect to the chassis.

Keyboard TT-532/UG(1A4) functions as a switching device for the generation of intelligence pulses. Depressing a key or the space bar establishes a code bar position which represents the pulse train to be transmitted to the remote printer or the local printer. The coded pulse train shown in Figure 4-2 represents the letter D, which has a signal code combination of space (no current) pulses on start, 2, 3, and 5 and mark (current) pulses on 1, 4, and stop. For further information on the signal code combinations, refer to Figure 1-2.

Upon receipt of a sequential signal, the line sensor functions as an electronic switch and switches the start pulse, the five intelligence pulses, and the stop pulse to a magnetic selector in the printer. The magnetic selector converts the intelligence pulses to mechanical functions which operate a system of clutch release fingers to release the clutches on the printer mainshaft. These clutches operate cams and linkages which perform all mechanical and printing functions to reproduce the received intelligence pulses.

When the pulse train ceases, a steady mark pulse will remain while the signal is applied to the equipment and the signal loop remains closed. Under this steady mark condition, the printer does not perform any mechanical functions and operates in a closed-loop condition.

During this mark condition, the electronic time delay motor stop is energized and will shut the motor off within 120 seconds after receipt of the mark pulse, if there has been no space pulse introduced and the time-delay-motor-stop switch is in the ENABLE position. If, however, the space pulse is introduced and a steady space condition exists, the printer will be in open-loop state and printer motor will continue to run.

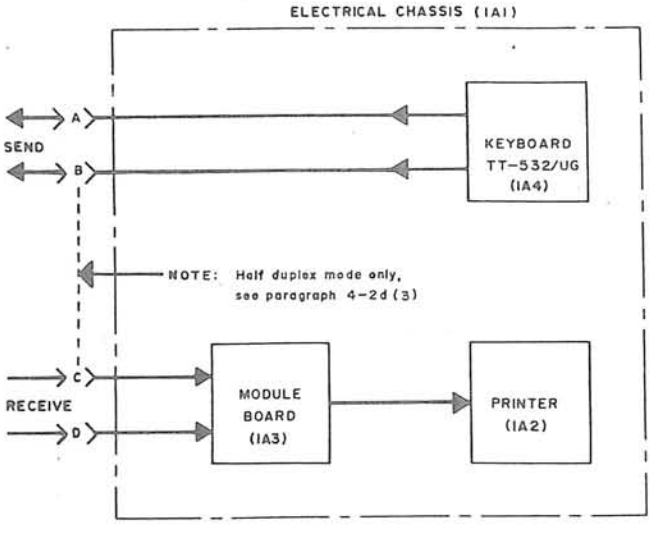


Figure 4-1. Teletypewriter, Simplified Block Diagram (On-line, full duplex)

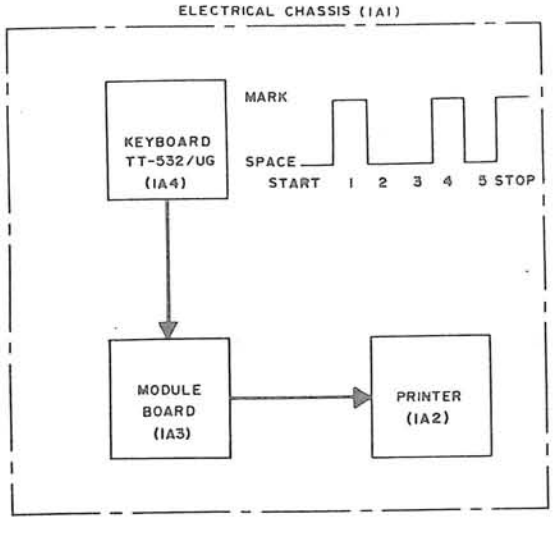


Figure 4-2. Off-Line Local Mode, Block Diagram

c. OFF-LINE LOCAL MODE (See Figure 4-2). - The teletypewriter functions as an electric typewriter in the off-line local mode, requiring only connection to a 115vac, 60 cycle, single phase primary power supply. While in this mode, d-c current for the signal loop is supplied by the line sensor power supply.

NOTE

The discussion of Full-Duplex and Half-Duplex modes is applicable to Teletypewriter Set AN/UGC-41 only. Teleprinter Sets AN/UGC-38 and AN/UGC-40 are capable of receive only operation in that they have no transmitting capability.

d. ON-LINE MODES (full duplex). - On-line mode operation (Figure 4-1) requires a send and a receive signal loop, permitting simultaneous sending and receiving operations. Signal line current must be supplied externally in these modes.

(1) ON-LOW MODE. - The ON-LOW mode is a full-duplex mode for operating signal line currents of 2.5 to 10MA.

(2) ON-HIGH MODE. - The ON-HIGH mode is a full-duplex mode for operating signal line current of 20 to 80 MA.

(3) HALF-DUPLEX MODE. - Half-duplex operation, which provides (monitoring) home copy, can be accomplished in one of two manners: the unit can be patched externally on the ships patching panel by connecting the signal lines to pins A and D and shorting pins B and C of the signal connector (1A1J1), or when it is anticipated that half-duplex mode will be utilized on a continuing basis, the signal lines can be brought in on pins A and D and a shorting strap soldered across pins B and C of the signal connector (1A1J1). When patched in this manner, it is still necessary to correctly position the rotary mode switch for HIGH or LOW current operation, defined in Paragraphs 4-2d(1) and 4-2d(2).

4-3. FUNCTIONAL DESCRIPTION BY SECTION.

a. INTRODUCTION. - The operation of the individual functional sections forming the teletypewriter set is described in the following paragraphs. The arrangement of these descriptions approximates the signal path through the equipment: power supply, keyboard, dual range line sensor, and printer. Each assembly is described independently for ease of reference.

b. LINE SENSOR POWER SUPPLY. - The line sensor power supply (See Figure 4-3) functions as a source of voltage and current for proper internal operation of the line sensor module only. The power supply is capable of supplying 13 vdc at 100 ma. The power supply is electrically isolated from the chassis so that the output of the supply is above ground (floating ground). The input to the power supply is 115 vac, 60 cycles, single phase. Power transformer 1A1T1 has multiple windings consisting of one winding which supplies power to the line sensor (14 vac), a second winding to supply power to the copy lamps (6 vac), and a third winding, although not used now, could be used to supply current for an internal signal line power supply. The 14 vac output of the secondary winding is fed to a signal orientation bridge comprised of diodes CR1 through CR4. The rectified voltage is then filtered by resistor capacitor filter networks consisting of R1, R4, C1; R2, R5, and C2. The load resistor R3 serves as a stabilizer to adjust for any variations in load and tends to maintain a constant d-c output of 13 vdc. Resistor R3 also functions as a discharge path for energy stored in capacitors C1 and C2 when input power is removed or power supply output is disconnected.

c. DUAL RANGE LINE SENSOR. - The dual range line sensor (see Figure 4-4) consists of a signal orientation bridge to orient the polarity of the incoming signal from the on-line terminals when mode switch 1A1S3 is in the on-line position. Transistor Q1 functions as a switch to actuate either mark driver (amplifier) Q2, or the space driver (amplifier) Q3 to drive the respective mark and space coils of the magnetic selector.

The signal orientation bridge receives d-c pulses (of either positive or negative polarity) from the signal source and orients the pulse polarity so that only negative pulses appear at the base of transistor Q1. Transistor Q1 functions as a switch to control

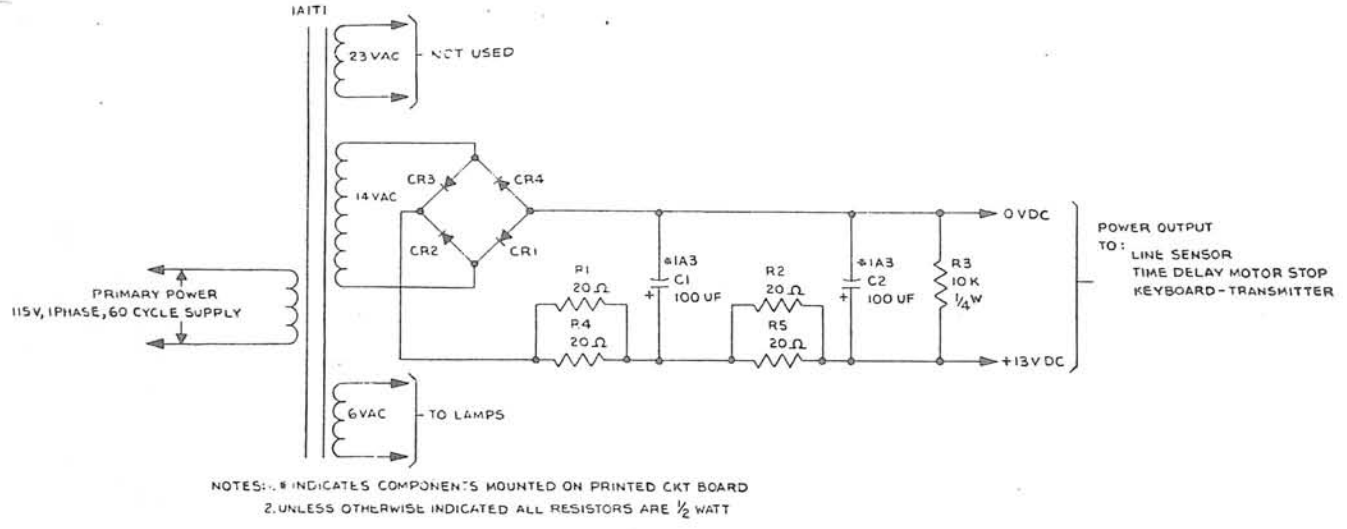


Figure 4-3. Line Sensor Power Supply (1A3A2), Schematic Diagram

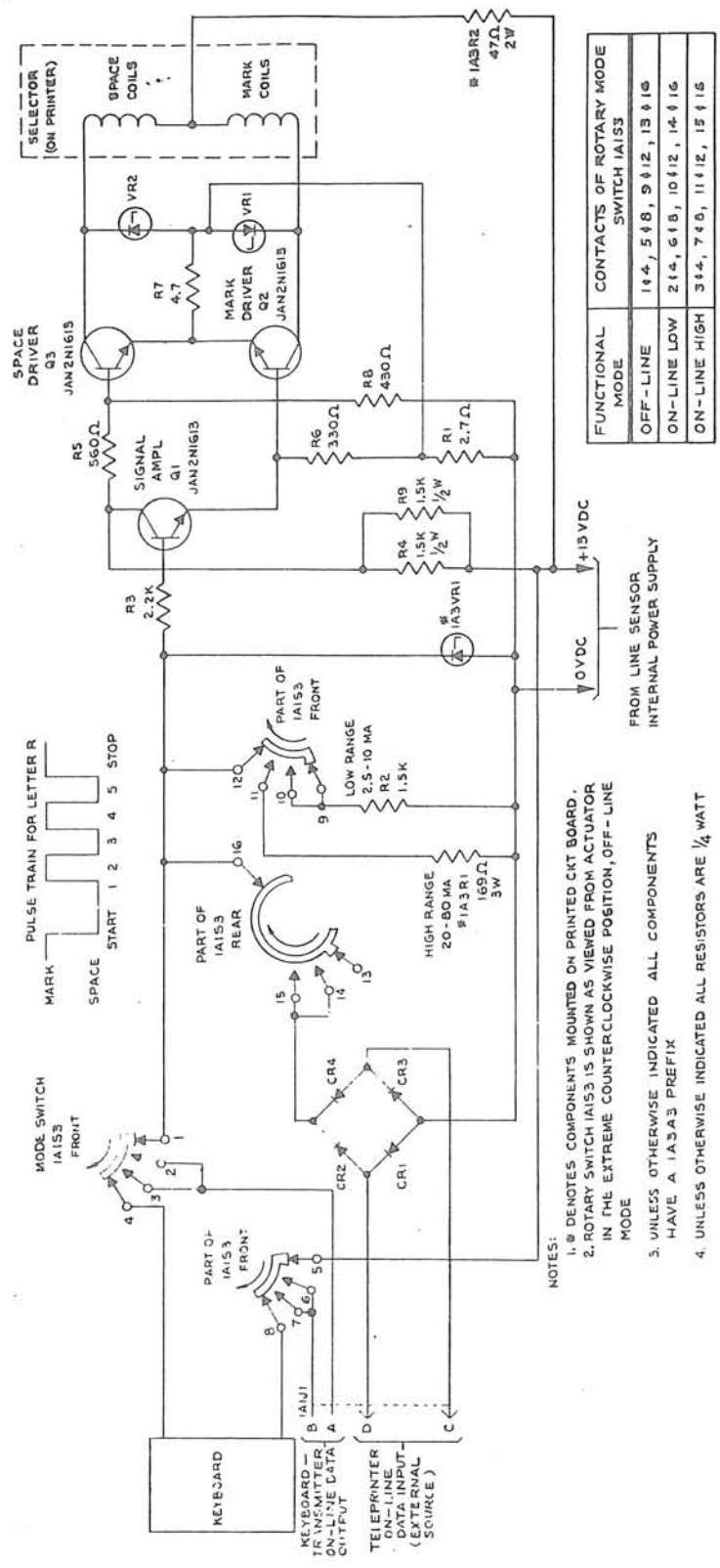


Figure 4-4. Dual Range Line Sensor (1A3A2), Schematic Diagram

current to mark and space drivers. In the space condition (no signal current), the space driver Q3, conducts and causes the space coil in the magnetic selector to be energized. The magnetic selector is located in the printer and serves to convert the electrical impulses from the signal line to mechanical movements for selecting the various printing and non-printing functions. A detailed discussion of the line sensor follows, commencing with a mark signal (current) at the input.

The mark signal appears across the input of the signal orientation bridge at the junction of CR1 and CR2, and CR3 and CR4. If the signal current is present, a voltage drop is developed across input resistor 1A3R1 for the 20-80 ma range (high range) or 1A3R2 for the 2.5-10 ma range (low range). This voltage is applied as forward bias to the base-emitter junction of Q1, turning it on. Emitter of Q1 is tied directly to the base of Q2 whose emitter-base junction is normally back-biased through resistors R1 and R7. When Q1 is turned on, it forward biases Q2 which turns it on, allowing current to flow through the mark coil in the magnetic selector. During this period Q3 is being reverse biased through resistors R1 and R7 (emitter is less positive than its base) and Q3 is off, allowing no current to flow to the space coil in the magnetic selector. Zener 1A3VR1 protects transients or spikes that may appear on the signal line in the form of interference. Zener diodes VR1 and VR2 are placed at the collectors of Q2 and Q3 respectively to prevent inductively produced spikes or pulses at the selector coils exceeding 24 volts from appearing on the collectors of drivers Q2 and Q3.

In the space condition (no current) there is no voltage drop across the input and the base of Q1 is at 0 volts. The emitter of Q1 is biased to approximately 0.27 volts resulting in a reverse biased-emitter junction causing Q1 to be turned off. At this point, Q2 is also reverse biased because its base is less positive than its emitter, causing Q2 to be turned off. Q3 however, has its emitter common with the Q2 emitter, and the base-emitter junction is forward biased so that Q3 is turned on, energizing the space coils.

d. KEYBOARD TT532/UG(1A4) for AN/UGC-41 ONLY.

(1) MECHANICAL FUNCTIONS. - Keyboard TT532/UG(1A4) (Figure 4-5) consists of a keyboard drive gear (coupled to the printer motor), a drive shaft which rotates continuously as long as the motive power is applied, a clutch mechanism coupled to a set of five code pulsing cams, code pulsing contacts, master pulsing cam, contacts, and a set of five code bars which set up the mechanical code appropriate to the selected character of function.

The clutch, which is mounted on the drive shaft (Figure 4-5) consists of two housings, a cage, four rollers, two bias compression springs, and two spacers. The housings and the cage are connected by four rivets and two spacers so that the housings are rigidly connected and the cage is free to rotate approximately 10 degrees around the drive shaft in relation to the housings. Bias compression springs, between the cage and the spacers separating the

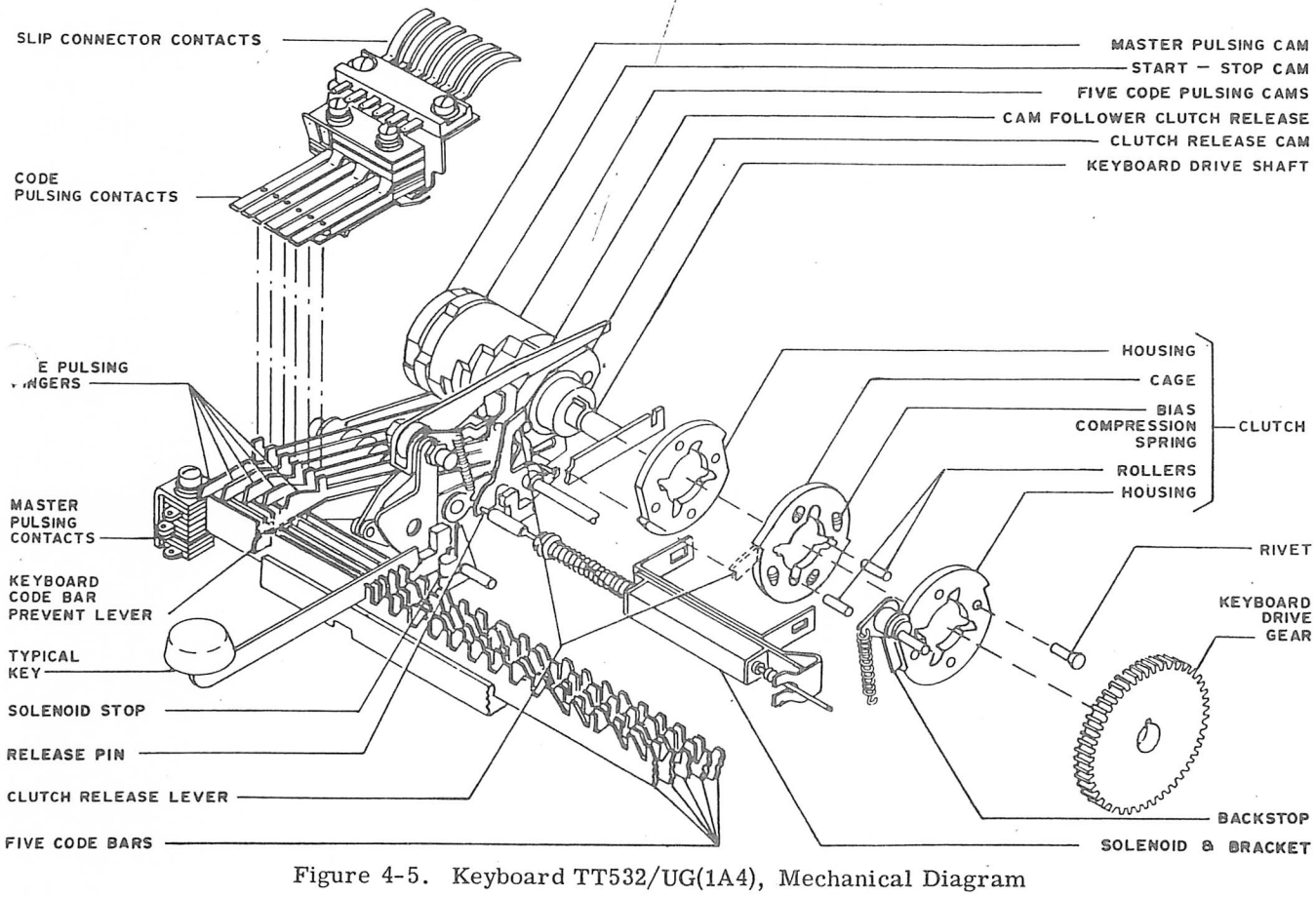


Figure 4-5. Keyboard TT532/UG(1A4), Mechanical Diagram

housings, bias the cage in the direction of clutch rotation. The four rollers pass through the four slots in the cage and both housings. The slots in the cage fit around the rollers and permit the rollers to travel the length of the slots. The ends of the slots in the housings contain close-fitting sloped surfaces which, when the clutch is engaged, restrict the motion of the rollers in such a manner as to force the rollers against the drive shaft.

When the clutch release disengages the stop tab on the cage, the cage is moved forward by the bias compression springs. This motion cams the rollers down on the drive shaft and the clutch rotates with the drive shaft. This initial camming action is reinforced by the jamming action exerted on the rollers by the sloped surfaces in the housing. The clutch will rotate 180 degrees until one of the two cage stop tabs engages the clutch release. At this point, the forward motion of the cage will be stopped and the camming and jamming action of the rollers against the drive shaft will cease, resulting in the clutch being disengaged.

At the instant the cage is halted by the clutch release, the bias compression springs will tend to push the housings backward, thus reestablishing the camming effect. If unrestrained, this backward motion will result in the clutch chattering. Consequently, backstops are provided to prevent any backward motion of the clutch.

Depression of any key, positions the keyboard code bars, storing the intelligence for that key depressed and mechanically locks out all other keys. Upon receipt of a synchronous pulse, the interlock solenoid actuates the clutch release lever, releasing the keyboard clutch. The stored intelligence is then transmitted and the keyboard code bars are released, enabling the next character to be set up. Prior to receipt of this pulse, a spring loaded release pin remains positioned under the clutch release lever, preventing the release of keyboard clutch and cam assembly. Key depression is not possible because the prevent lever has locked the code bars, preventing any movement until receipt of the next pulse. The pulse energizes the interlock solenoid and retracts release pin. The clutch release lever assembly pivots release keyboard clutch and cam assembly which allows the last intelligence set up on the code bars to be transmitted. During transmission time, motive power is also applied to the five code pulsing cams, the stop-start cam, and the master pulsing cam. Depression of a key releases the code bar lock lever, which falls into one of two adjacent slots in each code bar, locking the code bars in place during the character or function generating cycle. The five-level code set up by the code bars is converted into a pulse train by five code pulsing cams, five cam followers, and five sets of code pulsing contacts. The stop-start cam actuating another set of pulsing contacts through a cam follower, signals the beginning and end of the character transmitting cycle.

Depression of any key moves the clutch bail downward, pulling the clutch release cam follower, actuate lever, release lever link, and release lever assembly to the front of the printer. Release lever assembly clears tab on prevent lever, releasing the prevent lever so that it can ride on the cam. This movement permits sufficient pivoting of the clutch release lever to allow release of clutch when the next synchronous pulse is received. Receipt of a pulse allows the transmission of intelligence through keyboard operation and the lack of a pulse to the keyboard effectively locks out the local equipment from the signal loop.

The code pulsing contacts are connected in series with the signal loop through the keyboard slip contacts. When the stop-start cam follower moves downward, the associated stop-start pulsing contacts are closed resulting in a steady mark condition. Rotation of the stop-start cam at the beginning of the character cycle causes the stop-start cam follower to open the code pulsing contacts and transmit a start or space pulse. Rotation of the five code pulsing cams acts on the associated cam followers which actuate the five code pulsing contacts. Some of the code bars extend under the cam follower extensions and may stop the extension from dropping, depending upon the positioning of a code bar under the cam follower. When a code bar does not restrict the downward motion of a cam follower, the associated set of code pulsing contacts is closed and transmits a mark pulse. The blocking of a cam follower by a code bar holds the set of code pulsing contacts open, causing a space pulse to be transmitted. The cam follower normally holds the pulsing contacts open except when the cam follower drops into the cam for a mark pulse. The master pulsing contacts comprise a single-pole, double-throw switch which is alternately switched from one side to the other by the master pulsing cam follower and master pulsing cam. When the switch is in the first position, the code pulsing contacts used for transmitting the stop-start, 2, and 4 pulses are connected in the circuit; in the other switch position, the pulsing contacts used for transmitting pulses 1, 3, and 5 are switched into the circuit. The gap through which the master pulsing contacts oscillate is adjusted to obtain the effect of simultaneously switching one circuit out and the other circuit in. In this manner, the six individual code pulsing contacts handle a minimum amount of current with the master pulsing contacts switching the greater amount, since the six individual pulse contacts close early and open late. The effect of this arrangement is to have six code pulsing contacts determine the presence or absence of a code pulse while the master pulsing contacts oscillate between the stop-start, 2, and 4 circuit and the 1, 3, and 5 circuit, accurately timing the duration of pulses in each circuit.

As the 180 degrees of clutch rotation ends, the code bar lock lever is moved out of the code bar slots by the clutch release lever cam and the clutch is disengaged by the stop tab on the cage engaging the clutch release. If the REP (repeat) key is depressed when the synchronous pulse solenoid is disabled, the clutch release will be held back from engaging the cage by the action of the repeat key lever shaft. As a result, the clutch will remain engaged and apply motive power to the code pulsing cams, retransmitting the last code combination set up on the code bars. This cycle will be repeated continuously as long as the repeat key is held down.

(2) ELECTRICAL FUNCTIONS. (See Figure 4-6)- The keyboard circuit is shown, the keyboard slip contacts and the chassis-mounted signal line shorting contacts separated. The keyboard slip contacts (shown in Figure 4-6 as part of 1A1E8) and the automatic signal line shorting contacts are so constructed as to close the signal loop when the keyboard is not

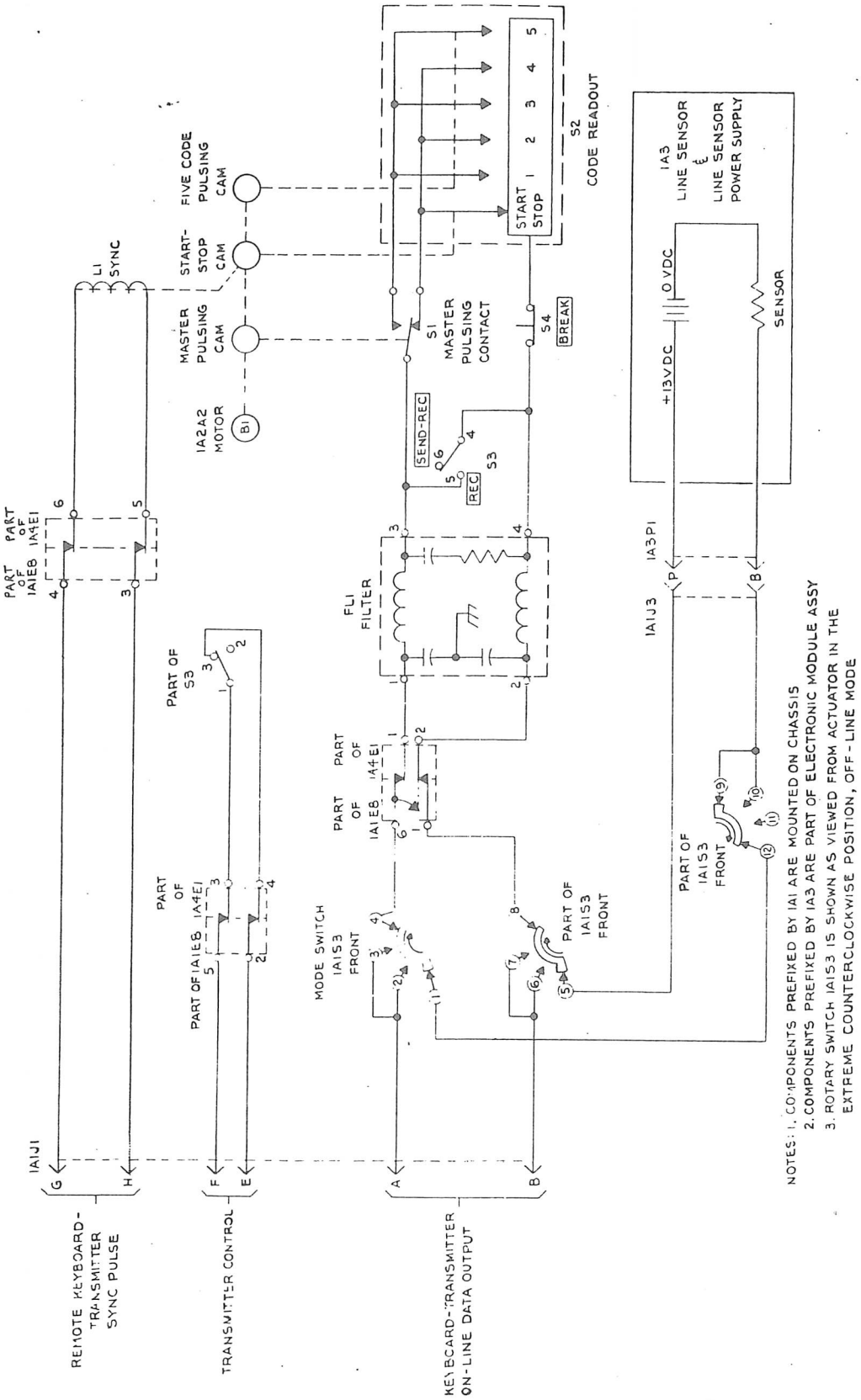


Figure 4-6. Keyboard TT532/UG(1A4), Simplified Schematic Diagram

in the operating position, thus preventing the loop from remaining open.

In this circuit, the signal loop is completed from the negative side of the signal line power supply (in off-line condition only) through the signal line shorting contact, keyboard slip contact, filter FL1, master pulsing contacts S1, code readout S2, BREAK switch S4, keyboard slip contact, signal line shorting contact (B), and through the input resistance of the line or load device back to the signal line power supply.

The contact filter is used to suppress arcing across the switching contacts and to minimize interference with nearby radio equipment. The master pulsing contacts are used to switch current between the set of pulsing contacts that develops stop-start, 2, and 4 pulses, and the set of contacts for 1, 3, and 5 pulses. The BREAK switch is connected in series with the switching circuit and if depressed will open the signal loop, interrupting transmission. The SEND-REC/REC switch is connected across the master pulsing contacts, code pulsing contacts, and the BREAK switch. When this switch is in the SEND/REC position, the operator may either send or receive, since the code pulsing contacts are in the circuit to be used as required. In the REC position, the pulsing contacts and the BREAK switch are shorted out, resulting in a closed signal loop, effectively shorting out the output of the keyboard.

e. MOTOR STOP (See Figure 4-7). - When the signal loop is not active, a steady mark (current) signal line condition exists, and the line sensor remains in the mark condition. Current flows through the mark driver (amplifier) Q2 in the line sensor, and does not flow through the space driver (amplifier) Q3, of the line sensor. The collector of Q2 is at a potential of approximately + 7.5 volts with respect to the 0 vdc reference. Because of the current flow through a common resistor leg, the cathode of CR1 will be at + 7.5 vdc. Since one end of R7 is connected to the anode of CR1 and the other end to the +13 vdc buss, CR1 will be forward biased and the junction of CR1, R7, and CR4 will be at approximately +8 vdc. This +8 vdc is enough to forward bias CR4, CR8, and the base-emitter junction of Q2 and Q3. As a result of this forward biased condition, Q2 and Q3 will be turned on. The emitter of Q3 is biased through three diodes, CR2, CR5, CR6, and the resistor R4 to approximately +2.4 vdc. When Q2 and Q3 are turned on, their common collector will be at a potential of approximately +3.5 vdc (approximately 1 volt drop appearing across the collector to emitter junction of Q3). This +3.5 vdc is also applied to the negative terminal of C3, and C3 will begin to charge to +13 vdc through R1 and R6. At a voltage (charge level) of approximately +9 volts at the junction of R6, R1, and the base of 1A3Q1 the emitter break-over voltage of Q1 (a unijunction transistor) is accomplished and Q1 will begin to conduct. The emitter to the b_1 junction of Q1 is representative of a negative resistance, and as current through it increases, the resistance decreases. The decreasing resistance now offers a low impedance path through which capacitor 1A3C3 may discharge. Transistor 1A3Q1 acts as an amplifier and merely amplifies the current that flows to the uni-junction transistor Q1. Using the transistor 1A3Q1 as an amplifier permits the use of R1 in a larger value. When current flows through junction b_1 of Q1, a portion of the current will be diverted through R3, and another portion to the gate of 1A3Q2, a silicon controlled rectifier (SCR). The current through R3 produces a voltage drop across it, and this voltage is applied between the gate and cathode of the SCR. The combination of this voltage between the gate and cathode of the SCR and the current flowing in the gate, turns the SCR on. Current now flows through the SCR energizing the motor stop relay 1A1K1, which in turn removes primary power from the motor by opening contacts 3 and 5 of relay 1A1K1. When capacitor C3 discharges to a level of approximately 5 volts through the base-emitter junction of 1A3Q1 and the emitter-b_1 junction of 1A3Q2, the emitter-b_1 junction will once again assume the blocking state and as long as Q2 and Q3 are turned on, C3 will once again start to charge to the breakover voltage level. By the nature of its operation, the SCR will stay on and 1A1K1 will remain energized until either the anode or the cathode circuit of the SCR is opened. Once turned on, the gate no longer has any control over the SCR.

If Q2 and Q3 are left in the conducting state for a long period of time, Q1 will continue to fire periodically, however, its operation will have no effect on the SCR since this device is latched in the on position

When the signal line is open, (a space condition) Q2 of the line sensor shuts off, and Q3 of the line sensor turns on. The collector of Q3 is at a potential of approximately +1.1 volts; therefore, the cathode of CR1 will be at +1.1 volts. CR1 will again be forward biased through R7, however, the junction of CR1, CR7, and CR4 will be held at approximately +1.7 volts. Since the emitter of Q3 is at approximately +2.4 vdc, this voltage is not enough to forward bias CR4, CR8, and the emitter-base junction of Q2 and Q3, therefore, they will not conduct (turn off), effectively opening the cathode circuit of the SCR. With SCR cathode open, it shuts off, and current will no longer flow through the SCR anode and the coil of 1A1K1.

In subsequent operation, every time a mark signal is transmitted, Q2 and Q3 of the motor stop are on, and C3 begins to charge. Capacitor C3 will only charge to the break-over point provided the mark signal is sustained for approximately 60 to 120 seconds.

f. PRINTER 1A2. - A magnetic selector incorporated in the printer receives d-c current impulses from the dual range line sensor (space and mark pulses) and converts these pulses into the mechanical motions required to couple various clutches to a continuously rotating mainshaft. The magnetic selector starts the character printing cycle and all other functions with the start pulse and then translates each of the five intelligence pulses to start all mechanical functions in the printer. Upon receipt of the stop pulse, the magnetic selector holds the stop-start clutch in the stop condition until receipt of next space (start) pulse. Figure 4-8 provides a general concept of how all mechanical functions in the printer are selected. These functions will first be discussed on a block diagram basis, and then each functional system will be described in detail.

(1) BLOCK DIAGRAM DISCUSSION. (See Figure 4-8) - The magnetic selector first receives a d-c impulse representing start (space). This pulse energizes a set of solenoid coils which attract the armature that the start clutch release arm releases the

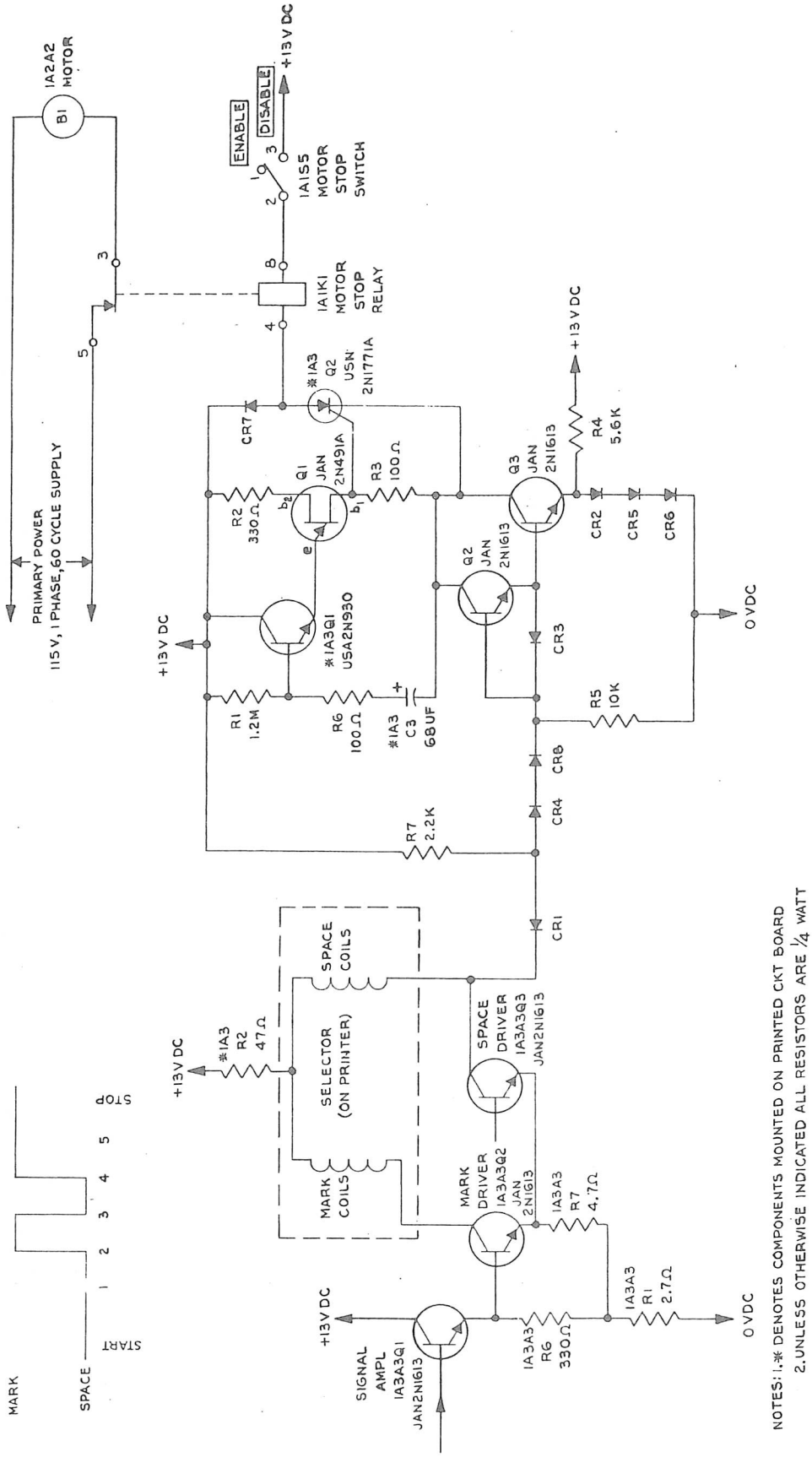


Figure 4-7. Electronic Time Delay Motor Stop (1A3A1), Simplified Schematic Diagram

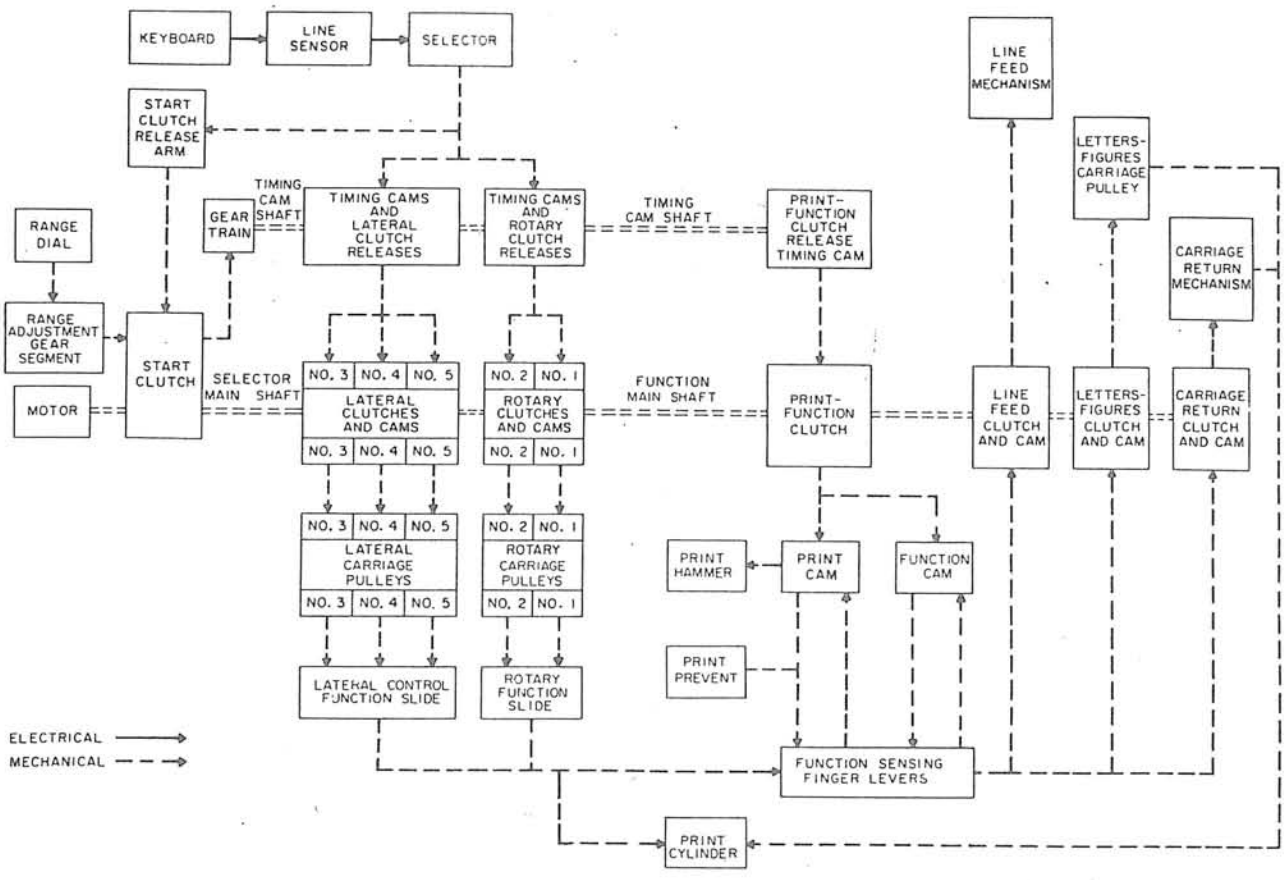


Figure 4-8. Printer (1A2), Functional Block Diagram

start clutch mounted on the printer mainshaft. The mainshaft consists of two sections; a selector mainshaft and a function mainshaft. The two shaft sections are coupled together and rotate as one shaft. All mechanical functions begin on the selector mainshaft. When released by the start clutch release arm, the start clutch engages the selector mainshaft for 180 degrees rotation. The clutch disengages the selector mainshaft when the cage stop tab is blocked by the start clutch release latch. With a steady mark signal (stop pulse), operation of the start clutch release arm is blocked by the magnetic selector armature and the start clutch is held stationary by the start clutch and subsequent sampling of the intelligence pulses is manually adjusted by a range dial geared to the start clutch. The start clutch is also gear-coupled to a timing camshaft assembly which times the magnetic selector clutch release functions in relation to the pulse train. A set of timing cams on the timing camshaft time the operation of the clutch release fingers which release rotary and lateral clutches on the selector mainshaft. The magnetic selector samples the five intelligence pulses and by energizing space or mark solenoid coil sets, mechanically locks or unlocks the clutch release fingers that release (engage) the rotary and lateral clutches. The release fingers are only permitted to release their associated clutches when their timing cams are not positioned in accordance with the start clutch function. The timing function is required to set up the individual clutches as their respective pulse is received.

During rotation of the timing camshaft (which rotates 360 degrees to every 180 degrees of the mainshaft rotation) one finger of each pair of clutch release fingers is free to operate and correctly position its respective clutch and cam assembly. Prior to completion of the clutch and cam assembly positioning cycle, the print cam (which is attached to the function cam) is released, regardless of the combination of pulses received.

The selector mainshaft accommodates a start clutch, two rotary clutches and three lateral clutches, numbered in accordance with the intelligence pulse that controls its position. Number one and number two intelligence pulses have the effect of positioning the rotary clutches in one of two 180-degree positions as determined by mark or space pulses. These clutches position pulley carriages which, by means of mechanical linkage, position the type cylinder in one of four 45-degree positions, or on one of four rows of type. A letters-figures pulley carriage is used to rotate the type cylinder to any one of two 180-degree positions representing letters or figures. The rotary pulley carriages also position a rotary slide in the function selector.

Lateral clutches 3, 4, and 5 (operated from intelligence pulses 3, 4, and 5), operating in conjunction with the three lateral pulley carriages, also position the lateral slide in the function selector. The two slides, which move laterally with respect to one another, select mechanical functions such as blank, space, line feed, figures, bell, letters, and carriage return. Each slide has various slots arranged so

hat the proper combination of pulses will align a air of slots in both rotary and lateral slides and ermit a sensing finger to fall into the slots and perorm the selected mechanical function.

The function selector can be considered as a poitioning servo operating in a closed loop. It reeives mechanical positioning information from the otary and lateral pulley carriages and senses the nformation with function selector sensing fingers. f the information is appropriate for the particular nechanical function, such as either letters or figures, it releases a letters-figures clutch on the unction mainshaft. Release of the letters-figures lutch positions a letters-figures pulley carriage. Movement of the letters-figures pulley carriage letermines in which 180-degree position (letters or igures) the type cylinder will be positioned. In ddition to moving the type cylinder laterally to elect any character in a row of eight characters, he lateral pulley carriages are also used in conunction with the lateral slide and the function sensing ingers to release the line feed and the carriage return clutches when these functions are selected.

elease of the function-print clutch rotates a unction cam and print cam. The function cam follower, when on the high part of the cam, allows the ensing fingers to determine when two slots are in lignment on the rotary and lateral slides and then elect the function to be performed. On the downward motion of the function cam follower, all sensing ingers are deflected and cammed away from the unction slides by the function bar, thus freeing the lides to move to the next position during the subsequent cycle. If a function selection is accomplished y the sensing fingers, the printing which would normally follow is prevented. When the print cam is ree to act on the print hammer, printing is accomplished. The print hammer is moved in a lateral irection across the copy paper and in front of the ype cylinder through action of the carriage return, akeup drum, and advance drum systems.

(2) MAGNETIC SELECTOR MECHANISM. (See Figure 4-9) - The magnetic selector mechanism, nounted at the back of the printer, receives pulse nformation from the dual range sensor. The magc selector consists of two armature and solenoid oil sets facing in opposite directions. Each armature set contains four solenoid coils connected so hat like magnetic poles are diagonally opposite. The elector operates in polar fashion, using two sets of eries coils for space and two sets for series coils or mark. In this manner, recovery time is reduced nd the armature sets are mechanically divided so hat the right armature set is controlled by stoptart, 2, and 4 pulses, and the left armature set is ontrolled by pulses 1, 3, and 5. Energizing either he space or mark coils positions the armature so hat it blocks the inward motion of either the space r mark paddle.

Figure 4-10 shows a section of the magnetic selector with a pair of clutch release fingers bearing n the mark and space paddles. There are six clutch ssemblies on the selector mainshaft of the printer, ach controlled by its respective pulse (Figure 4-8).

In operation, the clutch release fingers (Figure 4-10) press down on the paddles or latches under pring pressure greater than that required to pull the

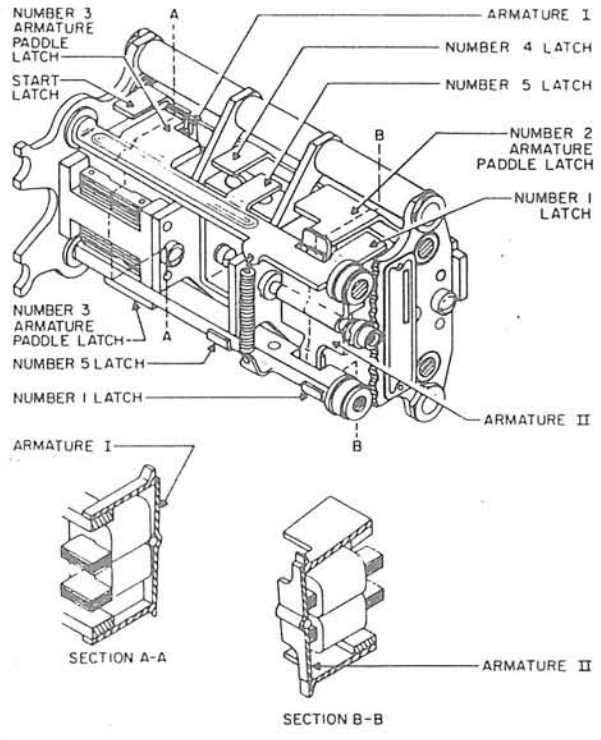


Figure 4-9. Magnetic Selector Mechanism

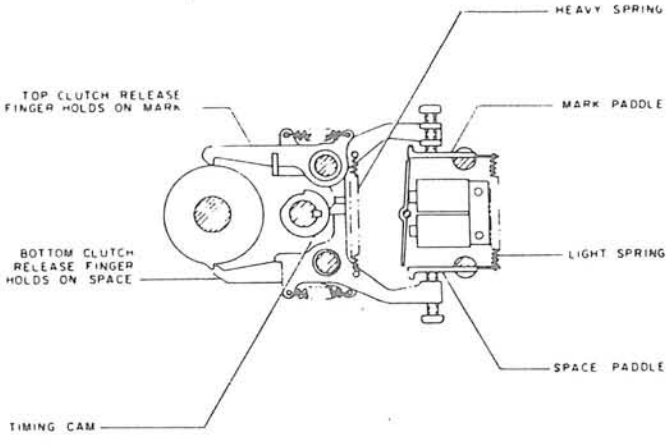


Figure 4-10. Magnetic Selector Clutch Release Mechanism

paddles away from the armature. The release fingers are free to press on the latches or paddles by the simultaneous positioning of the timing cam and the receipt of the appropriate intelligence pulse. If a clutch release finger is not blocked by the timing cam or armature, it will press downward on a latch or paddle. The top clutch release finger holds on a mark pulse and the bottom clutch release finger holds on a space pulse. When a space pulse arrives, the armature is pulled in toward the space solenoid and permits the mark paddle to be pressed downward

by the top clutch release finger adjustment screw, thereby releasing the clutch on the mark side. When energized, the mark solenoid pulls the armature in at the top and releases the bottom clutch release finger (space side). Release of a clutch on either side allows the clutch to engage the selector mainshaft and rotate 180 degrees where it is stopped by the opposite clutch release finger.

(3) START CLUTCH RELEASE SYSTEM. (See Figure 4-11) - During receipt of a steady mark signal (stop pulse), the start latch, mounted on the same shaft as paddle 2, locks the start clutch release arm in the stop position. When locked, the start clutch release arm holds the clutch release latch against the clutch stop tab and the backstop lever rests in the cut-out in the start clutch restoring cam. When a start pulse is received, the spring-loaded start clutch release arm moves down, pulling the clutch releases latch away from the clutch stop tab and thus releases the clutch for 180-degrees rotation. As the rotation of the clutch cams the backstop lever out, the clutch release latch is moved back down to the stop position and the release arm is simultaneously moved out and away from the magnetic selector. As the clutch stop tab moves around to complete its 180-degrees rotation, it is engaged by the release latch and backstop lever and held in position until the next start pulse is received. The backstop lever, which is adjustable to prevent clutch chatter, then drops into the start clutch restoring cam cut-out. To permit manual adjustment of the timing cycle or the time relationship between the start of the timing camshaft and sampling of the intelligence pulses, a range dial is provided. Adjusting this dial orients the timing cam shaft in the most favorable position in relation to the incoming pulse train. Timing dots are incorporated to ensure proper relationship of start clutch to timing camshaft during reassembly of printer.

(4) PRINTER MAINSHAFT CLUTCH AND CAM ASSEMBLY. (See Figure 4-12) - The printer mainshaft consists of the selector mainshaft on the left side of the printer (facing the front) and the function mainshaft on the right side. Mainshaft power is supplied by the printer motor through gear (19, Figure 4-12) on the function mainshaft. The keyboard mechanism receives motive power from gear (3) on the selector mainshaft; the timing camshaft receives motive power from gear (6), which is attached to the start clutch.

The selector mainshaft contains, from left to right, keyboard drive gear (3), range gear sector (2), bearing retainer (4), start clutch cam backstop (1), start clutch release adjustment screw (5), timing camshaft and ribbon feed drive gear (6), number 3 lateral clutch and B cam (7), number 4 lateral clutch and C cam (8), number 5 lateral clutch and D cam (9), number 2 rotary clutch and E cam (11), and number 1 rotary clutch and F cam (12). The clutch and cam assemblies are identified by a stamped capital letter.

The function mainshaft (see Figure 4-12), from left to right, contains function-print clutch and G and H cam (14), line-feed clutch and I cam (15), letters-figures clutch and J cam, carriage return clutch and K cam (17), and third reduction gear (19) The cams of these clutches also have capital letters stamped on them for identification. These clutches are not released directly through the action of the magnetic selector as are the selector mainshaft clutches, but are released when a particular function is selected by the function selector. The function-print clutch and cam assembly consists of a clutch which may be rotated to one of two positions (representing function or print) and two cams designated as a function cam and a print cam. The clutch is released by a function-print clutch release timing cam mounted on the timing cam shaft (Figure 4-8). The

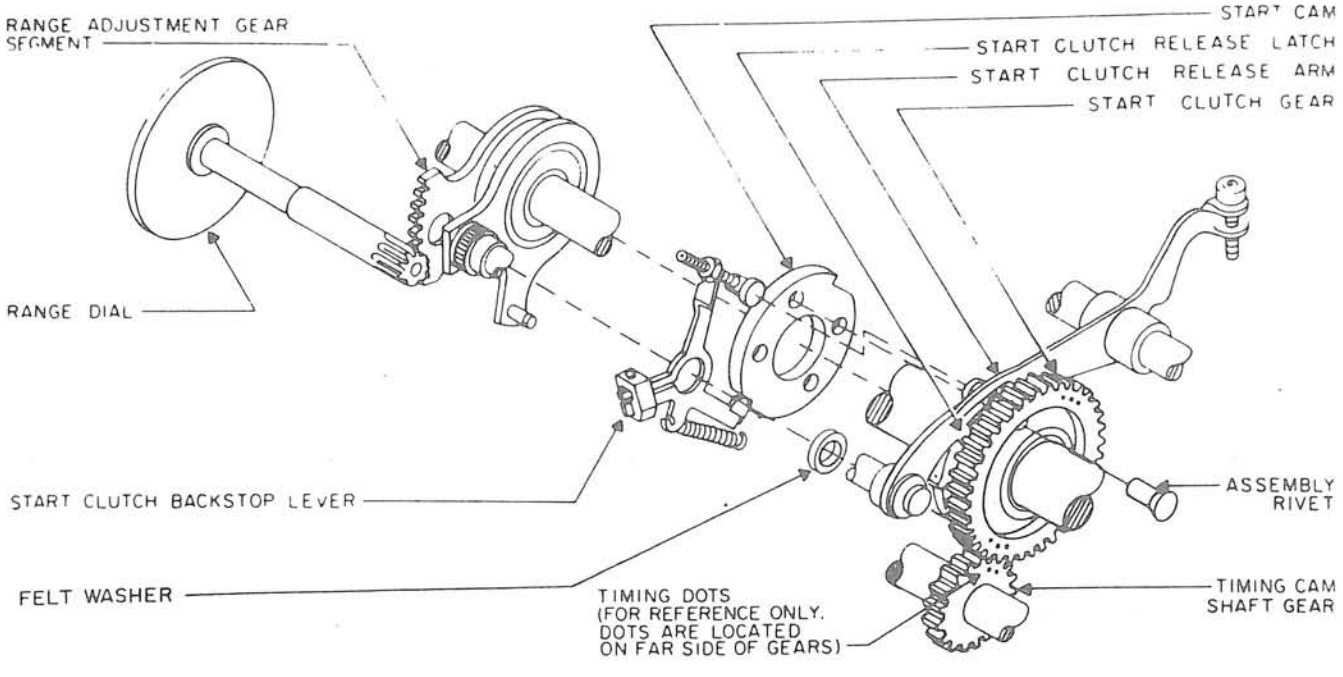
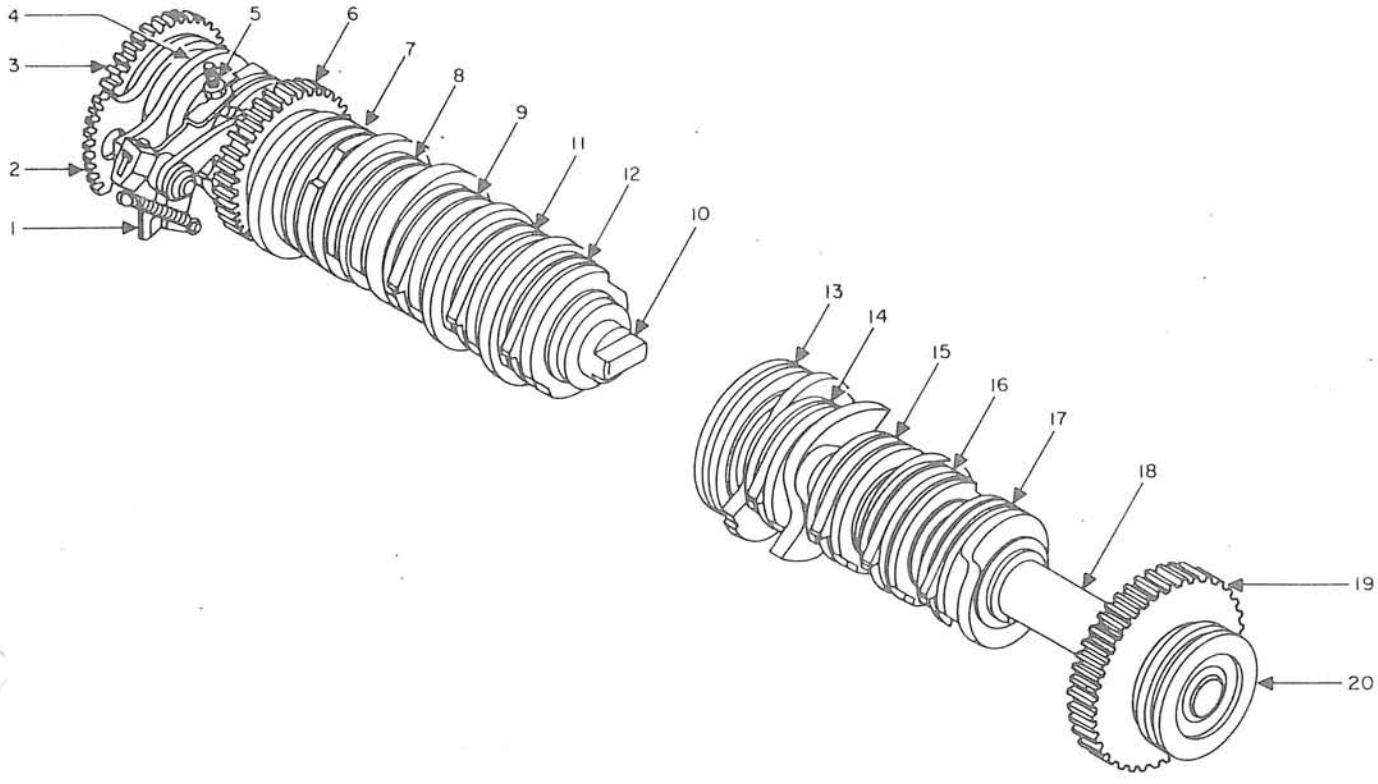


Figure 4-11. Start Clutch Release Mechanism



KEY	ITEM	KEY	ITEM
1	Start Clutch Cam Backstop	10	Selector Mainshaft Assembly
2	Range Gear Sector	11	No. 2 Rotary Clutch and E Cam
3	Keyboard Drive Gear	12	No. 1 Rotary Clutch and F Cam
4	Bearing Retainer	13	Bearing
5	Start Clutch Release Adjustment Screw	14	Function-Print Clutch and G and H Cam
6	Timing Camshaft Drive Gear and Ribbon Feed Drive Gear	15	Line Feed Clutch and I Cam
7	No. 3 Lateral Clutch and B Cam	16	Letters-Figures Clutch and J Cam
8	No. 4 Lateral Clutch and C Cam	17	Carriage Return Clutch and K Cam
9	No. 5 Lateral Clutch and D Cam	18	Function Mainshaft Assembly
		19	Third Reduction Gear
		20	Bearing

Figure 4-12. Printer (1A2) Mainshaft Assembly

function cam starts the mechanical function selection cycle and the print cam operates the print hammer. The line feed clutch and cam assembly operates the line feed mechanism when line feed is commanded. The letters-figures clutch and cam assembly moves a cam follower and pulley carriage to position the type cylinder in one of two 180-degree positions, representing either letters or figures. The carriage return clutch and cam assembly is used to return the type cylinder and print hammer to the left margin.

(5) TYPE CYLINDER POSITIONING SYSTEM. (See Figure 4-13) - The coding of the incoming signal, as interpreted by the magnetic selector mechanism, determines the position of the five type cylinder positioning cams and their corresponding cam followers. Each cam follower can be left in one of two positions by its positioning cam as follows:

Number 1 Pulse Cam: High side for Mark/Low for Space

Number 2 Pulse Cam: High side for Mark/Low for Space

Number 3 Pulse Cam: Low side for Mark/High for Space

Number 4 Pulse Cam: Low side for Mark/High for Space

Number 5 Pulse Cam: Low side for Mark/High for Space

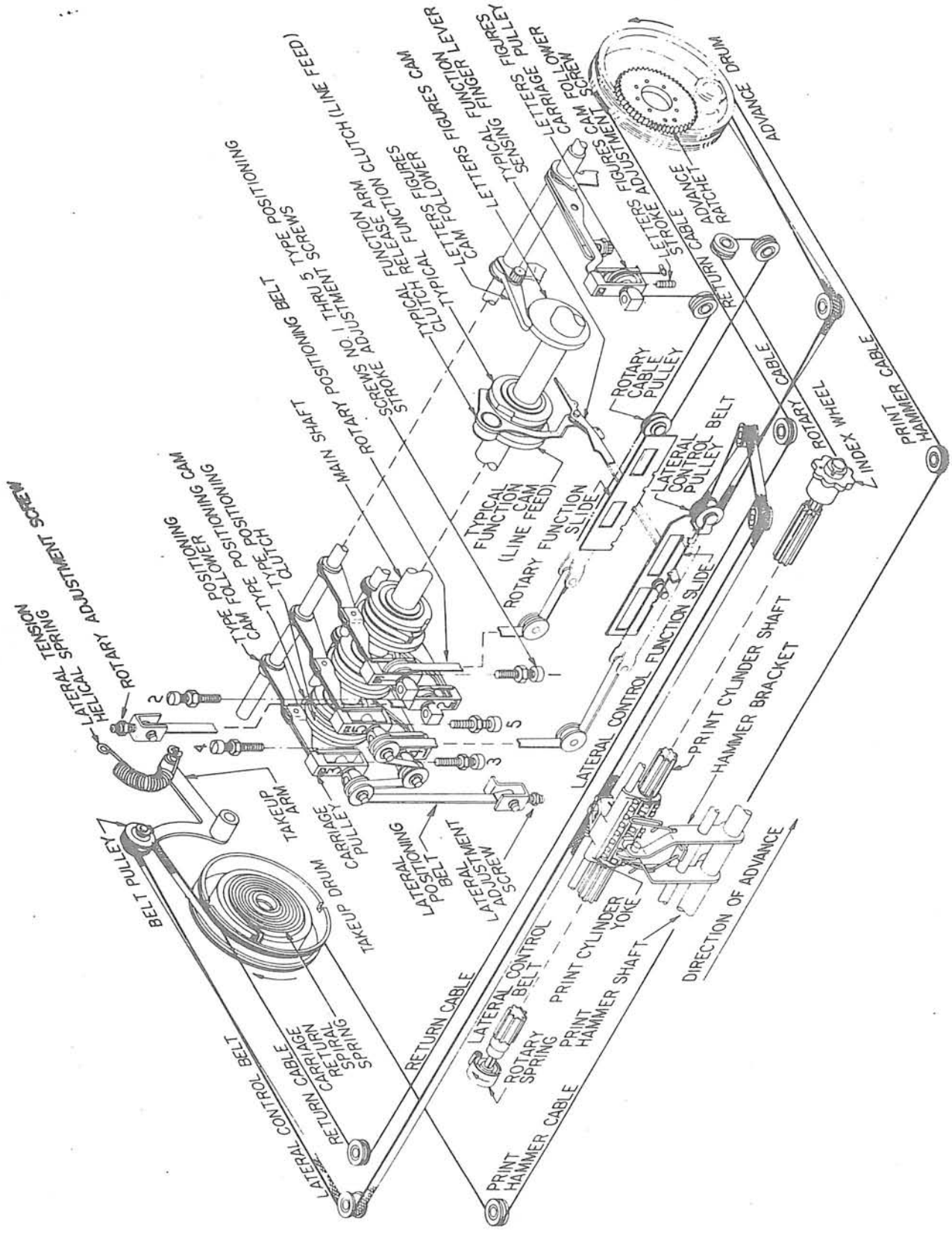


Figure 4-13. Type Cylinder and Print Hammer Positioning System

When the letter A is commanded (mark pulse on 1 and 2, and space on 3, 4, and 5) all of the cam followers will be positioned on the high portions of their respective cams. Upon command of the letter M (space on 1 and 2, and mark on 3, 4, and 5). all of the cam followers will be on the low portions of their respective cams. Since each of the cam followers is connected to a pulley carriage (Figure 4-13) the high and low positioning of the cam followers positions the pulley carriages. The positioning belts that pass through the pulley carriages, therefore, are effectively lengthened and shortened by the motion of the cam followers. In practice, carriages number 1 and 2 control motion of the rotary positioning belt and carriages 3, 4, and 5 control motion of the lateral positioning belt.

In both the rotary and lateral systems, the various cam followers move different preset distances, allowing four possible combinations in the rotary system and eight combinations in the lateral system. Figure 4-14 illustrates the units of travel accomplished by each pulley carriage and how the various combinations can be established.

(a) ROTARY MOTIONS OF TYPE CYLINDER. - As shown in Figure 4-13, the effect of the combination of number 1 and 2 pulses is transmitted through the rotary positioning belt, rotary slide, and rotary cable to the end of the shaft to which the type cylinder is keyed. The cylinder shaft is turned in one direction by the rotary spring and in the other by the rotary cable pulling against the spring. The stroke of pulley carriage number 1 is 3/32 inch and the stroke of pulley carriage number 2 is 3/64 inch. The stroke of the number 2 pulley is exactly half that of number 1 pulley, so that four evenly spaced rotary positions are possible as follows:

ROTARY POSITION	CAM FOLLOWER POSITION 1	CAM FOLLOWER POSITION 2	EFFECTIVE LENGTH OF ROTARY CABLE RELATIVE TO FIRST POSITION IN INCHES
I	High	High	First position
II	High	Low	3/16 longer
III	Low	High	3/8 longer
IV	Low	Low	3/16 longer

The developed view of the type cylinder (Figure 4-15) shows the eight vertical (rotary) type cylinder positions. Four of the eight rotary positions correspond to letters; the other four correspond to figures. The letters-figures cam follower and pulley system, as the pulley is moved to the high position for letters and low for figures, determines within which group of four rows the subsequent rotary positioning will take place. The stroke of the pulley, through which the rotary cable passes, positions the type cylinder so that the subsequent selection will be within one of the two 180-degree segments of the cylinder.

(b) LATERAL MOTIONS OF TYPE CYLINDER. - The lateral motions of the type cylinder are similarly transmitted from the lateral positioning belt (Figure 4-13) through the connecting shaft, lateral slide, and the lateral belt to the type cylinder yoke. The actual strokes of the pulley carriages are as follows:

Pulley Carriage Number 3 — 3/16 inch
Pulley Carriage Number 4 — 3/32 inch
Pulley Carriage Number 5 — 3/64 inch

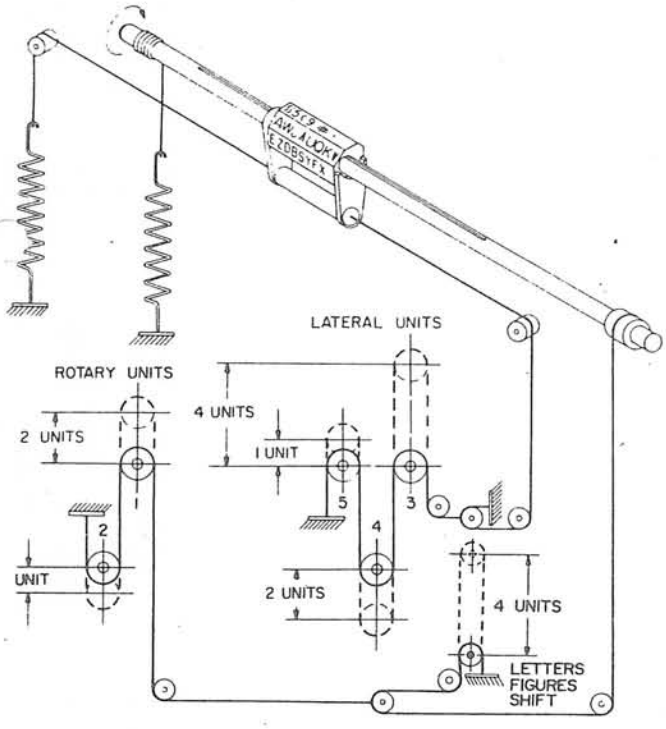


Figure 4-14. Type Cylinder Positioning Mechanism

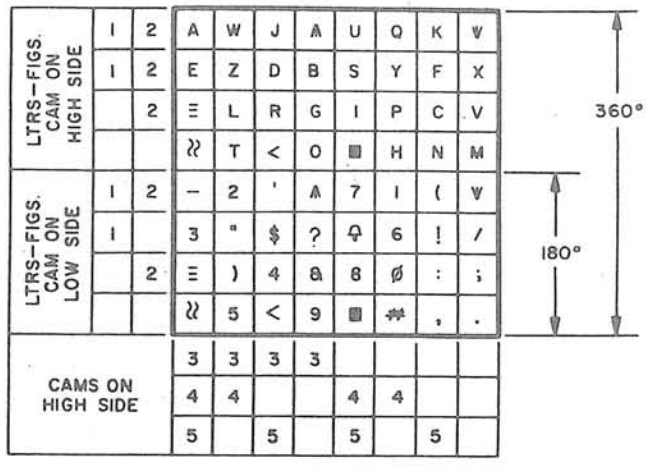


Figure 4-15. Type Cylinder, Developed View

Here again, the stroke for number 4 is twice that of number 5 and the stroke for number 3 is twice that of number 4 so that eight lateral positions are possible as follows:

LATERAL POSITION	CAM FOLLOWER POSITION 3	4	5	EFFECTIVE LENGTH OF LATERAL CABLE RELATIVE TO FIRST POSITION IN INCHES
I	High	High	High	First position
II	High	High	Low	3/16 longer
III	High	Low	High	3/8 longer
IV	High	Low	Low	9/16 longer
V	Low	High	High	3/4 longer
VI	Low	High	Low	15/16 longer
VII	Low	Low	High	1-1/8 longer
VIII	Low	Low	Low	1-5/16 longer

(c) CHARACTER ADVANCE AND CARRIAGE RETURN. - Character advance is achieved by moving the type cylinder and print hammer space-by-space across the page. When the end of the line is reached, the type cylinder and hammer are returned to the left side of the page.

As shown in Figure 4-13, the lateral belt, hammer cable, and return cable originate in the advance drum. The advance drum is rotated by the action of a pawl on the advance ratchet. As the advance drum rotates counterclockwise, the hammer cable and lateral belt advance the hammer and type cylinder toward the right side of the page, tightening the spring in the takeup drum. This advance continues across the page until, at a preset point, the advance ratchet and pawl system releases the advance drum and the spring-loaded takeup drum returns the type cylinder and hammer to the left side of the page. The return cable serves to counteract the effects of inertia during carriage return by combining the rapid clockwise motion of the advance drum with corresponding counterclockwise motion of the takeup drum.

(d) ISOLATION OF TYPE CYLINDER MOTIONS. - In the lateral direction, the type cylinder (paralleled by the print hammer) is subject to simultaneous motions consisting of character advance (step-by-step) motions and type positioning motions. In addition, the type cylinder is subjected to two distinct rotary motions: the letters-figures selection motions and the discrete type positioning motions. Since simultaneous lateral or simultaneous rotary motions may be occurring, some method of isolation between these motions must be employed.

The lateral selection motions of the type cylinder are completely isolated from the step-by-step advance and carriage return motions by interposing the lateral transfer pulley (Figure 4-13) between the advance drum and the type cylinder to introduce lateral selection motion, and by interposing the takeup arm pulley between the type cylinder and the takeup drum to bias the lateral selection motion of the type cylinder.

The rotary motions (letters-figures and type positioning) of the type cylinder are completely isolated by interposing the rotary transfer pulley (Figure 4-13) between the letters-figures cam follower and the type cylinder shaft, and the use of a rotary spring on the end of the type cylinder shaft.

(e) OPERATION OF TYPE CYLINDER POSITIONING CAMS. - The magnetic selector interprets the sequence in which each of the five intelligence pulses is received and converts this series of electrical signals into mechanical motion. This is done by controlling the release of the type cylinder positioning cam clutches. Figure 4-16 illustrates the system of clutch release fingers, clutches, and cams controlled by the magnetic selector.

The system consists of a driven mainshaft to which each of the type cylinder positioning cam clutches and the start clutch are capable of being coupled. The pair of release fingers straddling each clutch are capable of controlling the coupling of that clutch to the mainshaft, and consequently of positioning the clutch in one of two 180-degree positions, corresponding to a marking or spacing pulse.

Each clutch is held in its mark or space position by one of the two release fingers straddling it. Consequently, if in successive character cycles a given intelligence pulse is the same as in the previous cycle, the corresponding clutch remains stationary. For example, in a repeated RY combination, all clutches turn 180 degrees with each new character cycle because the mark and space combinations are exactly opposite for R and Y. In an RQ combination, however, the number 2 clutch will remain motionless because in both R and Q the number 2 is a marking pulse while all other clutches alternate between mark and space in changing from R to Q. (R has marking pulses on 2 and 4. Q has marking pulses on 1, 2, 3, and 5; Y has marking pulses on 1, 3, and 5).

As described in Paragraph 4-3f(2), more than one pair of clutch release fingers can be affected by the selector at one time. This would permit the wrong clutch to react to a specific pulse and would be completely incompatible with the time base concept of a sequential code. Therefore, the individual pairs of clutch release fingers are freed to respond to the selector and release their clutches only during the period when their timing cams permit them to move outwards from the clutch. The timing cams are angularly displaced on a shaft which is gear-coupled to the mainshaft through the start clutch. The first break in the neutral circuit (start pulse) through the selector releases the start clutch for 180 degrees rotation which, through the two-to-one gear ratio, drives the timing camshaft 360 degrees. During this 360-degree turn of the timing camshaft, each pair of clutch release fingers is in turn freed to operate for a period of time corresponding to the time interval of the incoming signal pulses at the appropriate operating speed. The function-print clutch release finger is then freed to operate as the last action of the timing camshaft.

The angular relationship between the timing cams and the stop position of the timing camshaft (the time relationship between the start of the timing camshaft

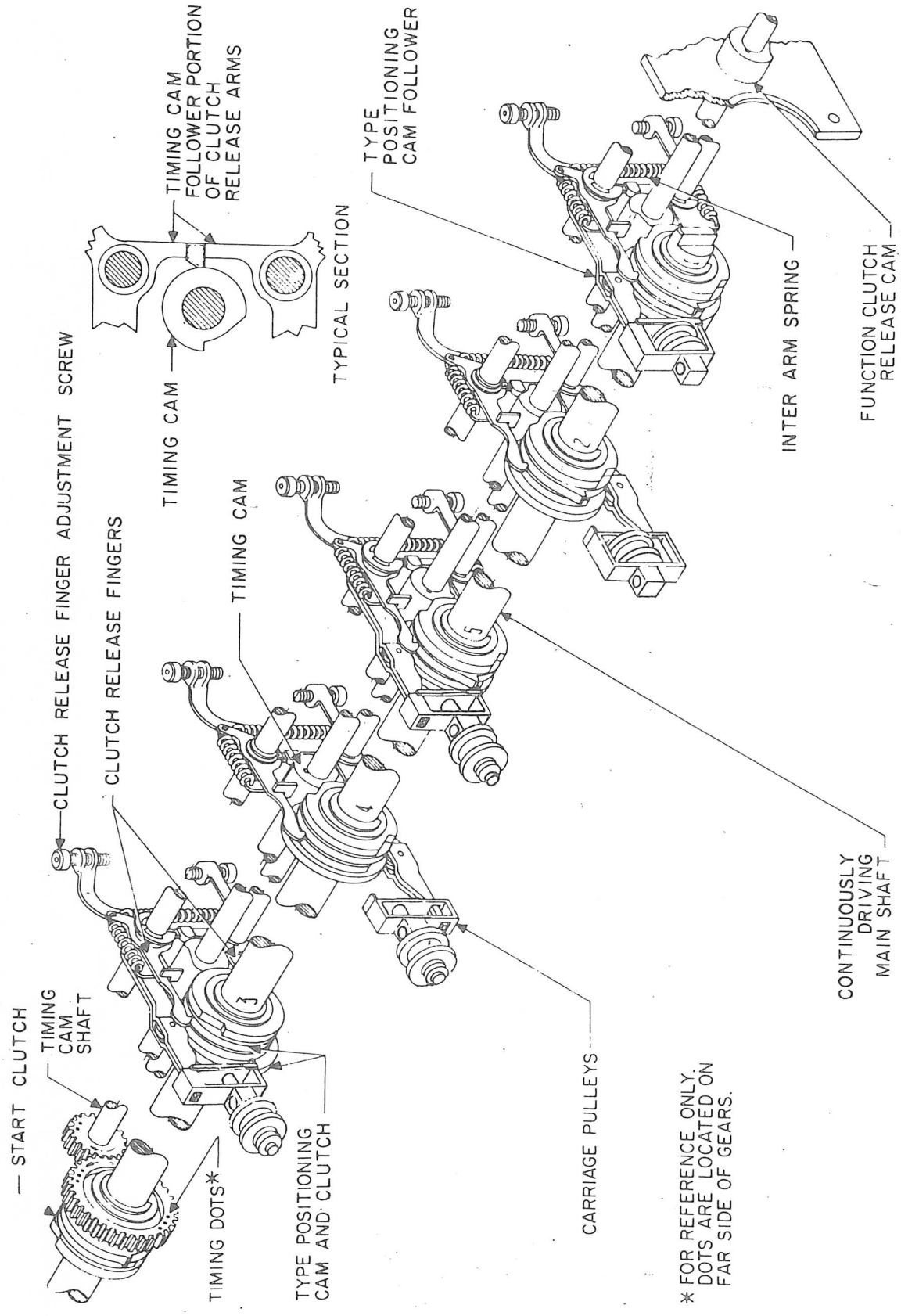


Figure 4-16. Type Cylinder Positioning Clutch Release System

and the sampling of the intelligence pulses) is adjusted by the range dial in order to orient the selector in the best possible position in relation to the condition of the incoming signal. If a distorted signal is received, this mechanism searches for the usable portion of signal. An exploratory check is made for the leading and trailing edges of the usable signal; then the unit is set to the midpoint.

(6) FUNCTION SELECTOR. - As shown in Figure 4-13, the rotary and lateral positioning belts terminate at slotted plates. These plates, which are called rotary and lateral function slides, are used to select mechanical functions as distinguished from the normal printing of a character. The slides are part of the function selector mechanism which serves to sense various mechanical functions and select the particular function to be performed. Through movement of the five pulley carriages (Paragraph 4-3f(5)), various combinations of marking and spacing pulses will cause the slides to move in lateral directions in relation to each other.

In figure 4-17, the slots in the rotary and lateral slides are arranged so that a particular combination of pulses will align a pair of slots in the two slides at a point directly opposite a function sensing finger and permit the sensing finger (Figure 4-13) to engage the slots. A sensing finger will engage the two slots only momentarily to sense the mechanical function requested and will then be pushed back and out. A separate function sensing finger is provided for sensing each of the mechanical functions shown in Figure 4-17. After sensing the mechanical function established by positioning the rotary and lateral slides, the function selector engages the appropriate clutch on the function mainshaft to perform the function. The particular combination of incoming pulses required for different functions and the mechanical results are listed in Table 4-1.

The function sensing fingers (Figure 4-18) are spring biased against the slides and consequently will fall into a pair of properly aligned slots if not otherwise prevented. The function bar is supported by two arms and pivots on the function shaft, describing an arc tangent to the edge of the function sensing fingers. The function shaft to which the lifter arm is clamped also supports the function cam follower; therefore, the function spring tends to hold the function cam follower against the function cam.

(a) START OF FUNCTION CYCLE. - In Figure 4-18, the function-print clutch has two cams: a print cam and a function cam. The function-print clutch (on the function mainshaft) is released or engaged at the same time as the number 5 clutch on the selector mainshaft (during every character translating cycle, regardless of the pulse arrangement received). The function-print clutch is released by a clutch release finger operated by the function-print timing cam, which is located on the same timing camshaft as the magnetic selector timing cams.

When the function-print clutch is in the stop position (disengaged from the function mainshaft), the function cam follower is positioned approximately one-third of its movable distance upward on the function cam. Upon its release simultaneously with receiving the number 5 pulse, the function-print clutch and cam combination rotates, moving the function cam follower toward a higher position. This movement rotates the function shaft and raises the function bar lifter arm which in turn raises the function bar beyond the tops of the function sensing fingers, permitting the fingers to fall into any pair of slots (in the rotary and lateral slides) that are aligned by a particular combination of received pulses. During the time the function cam follower is rising on the function cam, positioning of the slides has been completed and the slides are stationary. After a function

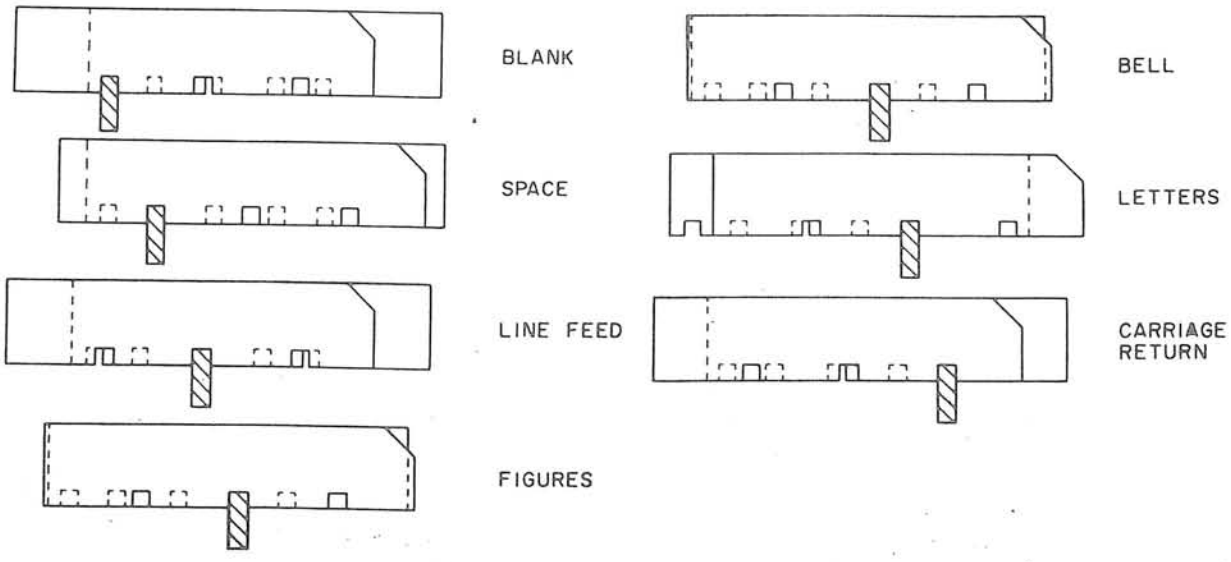


Figure 4-17. Rotary and Lateral Slides, Function Positions

TABLE 4-1. FUNCTION AND PULSE DATA

FUNCTION	MARKING PULSES 1	2	3	4	5	RESULTS
Blank						Suppresses printing and character advance. AN/UGC-38 prints and advances in figures Blank
Space			X			Suppresses printing only.
Line Feed		X				Suppresses printing and character advance. Engage line feed clutch to function mainshaft.
Figures	X	X		X	X	Suppresses printing and character advance. Engages letters-figures clutch to function mainshaft and rotates to figures position if it was previously held in letters position.
Bell	X		X			Suppresses printing and character advance. Moves bell clapper. Operates only when in figures shift.
Letters	X	X	X	X	X	Suppresses printing and character advance. Engages letters-figures clutch to function mainshaft and rotates to letters position if it was previously held in figures position.
Carriage Return				X		Suppresses printing and character advance. Engages carriage return clutch to function mainshaft.

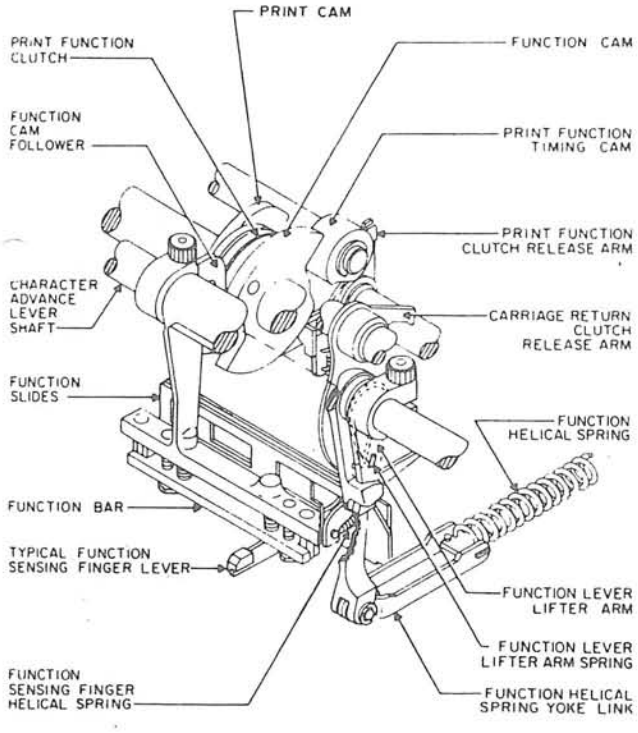


Figure 4-18. Function Selector, Start of Function Cycle

sensing finger has been permitted to fall into a pair of slots, the function cam follower drops off the high side of the function cam to the low side and allows the function spring to pull the function bar downward, clearing the function sensing fingers. The relationship of the function bar to the function sensing fingers is such that the bar will hit the top of any sensing finger already in a pair of slots but will deflect outward toward the bottom of the printer any sensing fingers which have not fallen into the slots. Only the one function which has been commanded by the incoming pulse train can be selected.

(b) COMPLETION OF FUNCTION CYCLE. (See Figure 4-19) - Any finger which has been selected to perform a function will be driven toward the rear of the printer by the function bar. This motion of the finger moves the U bar (function clutch release finger), to which it is pivoted, and introduces its individual function. The motion of the function bar continues beyond the point at which the function is performed. This additional function bar motion pushes the inner surface of the sensing finger against a rod, camming the sensing finger outward until it slips out from under the bar and is returned by its spring to the original sensing position, providing clearance between sensing edge of sensing fingers and the edge of function slides. The function bar, after reaching its low point, is raised again about one-third by the function cam follower, at which time the function-print clutch reaches its stop point and the cycle is

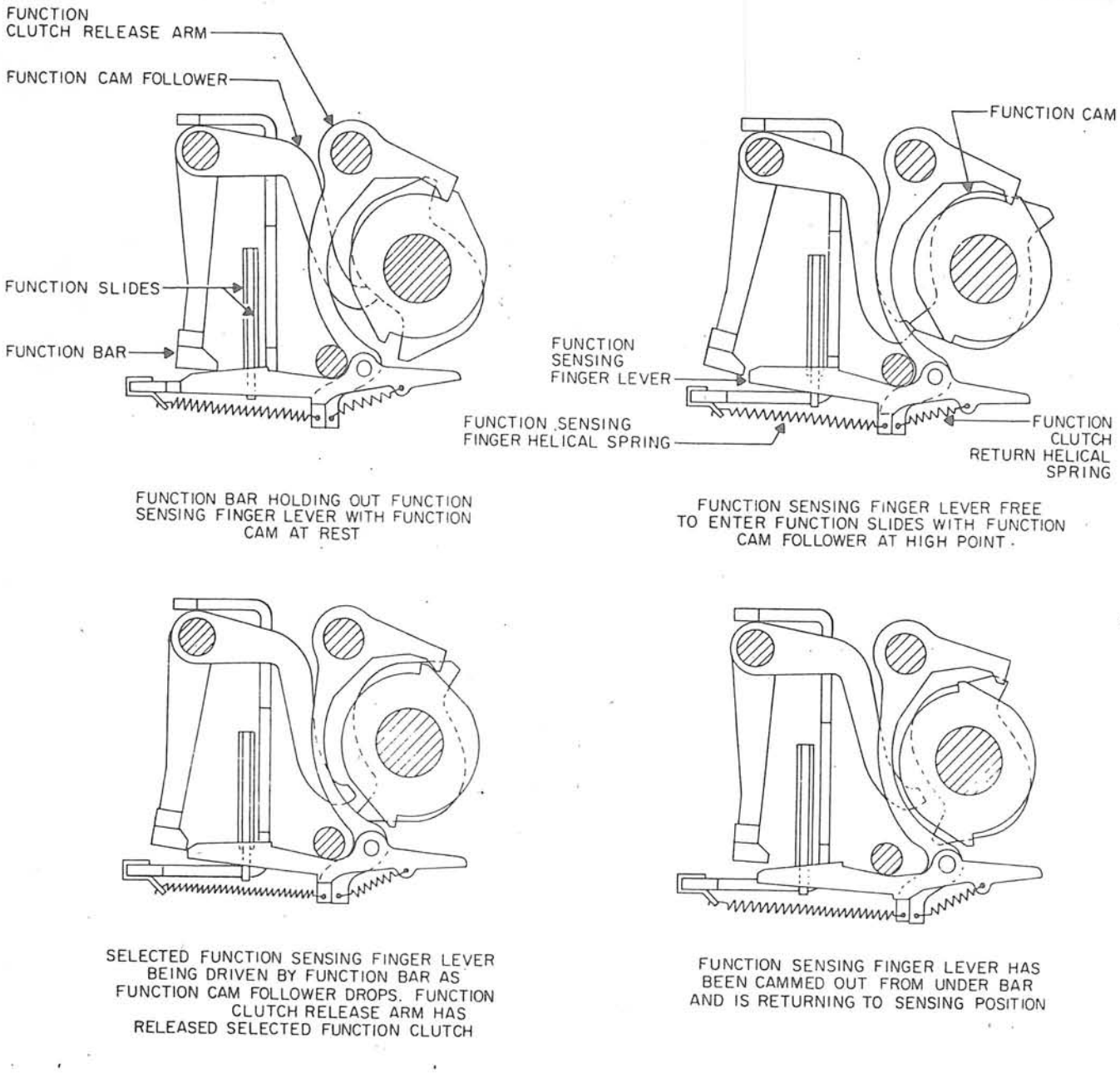


Figure 4-19. Function Selector, Operating Cycle

completed. When no function is selected, the function bar rises, falls, and deflects all sensing fingers slightly outward, and then rises part way again on the character cycle. However, when a function is selected, one particular finger will fall under the function bar, be pushed to the rear of the printer to engage its clutch or otherwise perform its function, and then be cammed out to return to the sensing position.

(c) BLANK FUNCTION LINKAGE. (See Figure 4-20) - A blank function results in a combination of printing suppression and character advance suppression. The spring action of the blank sensing finger falling into aligned slots in the function slides moves the lower end of the sensing finger outward, moving the spring-loaded print prevent bail with it. The stroke of the sensing finger, caused by the function bar, pivots the U bar to which the finger is attached upward, pushing up the advance prevent bail; therefore, no printing or advancing will take place.

NOTE

The AN/UGC-38 is equipped with a mechanical linkage which allows the printing of a dash (-) in figures blank.

(d) SPACE FUNCTION LINKAGE. (See Figure 4-21) - The space function initiates print suppression, but allows character advance to be performed. The space sensing finger falls into slots of the slides and moves the print prevent bail. Print suppression is performed by moving print prevent bail down, blocking the print cam follower.

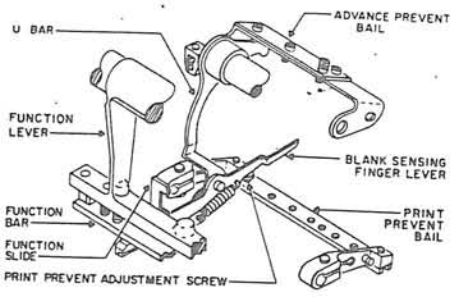


Figure 4-20. Function Selector, Blank Linkage

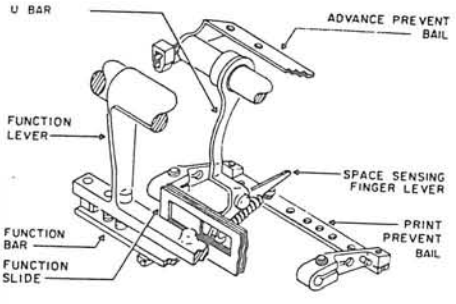


Figure 4-21. Function Selector, Space Linkage

(e) BELL FUNCTION LINKAGE. (See Figure 4-22) - Unlike other non-printing functions, bell can be selected only when the machine has been put in figures position. The bell prevent lever tab is affixed to the letters-figures cam follower so that it prevents the bell sensing finger from falling into the function slides when the machine is in letters position. Operation of the bell sensing finger prevents printing and advance in the same manner as the other functions. The U bar in this case does not release a clutch, but terminates in an arm to which the clapper connecting rod is attached. When the U bar moves, it pulls the clapper connecting rod, causing the clapper to move away from the bell. The bell sensing finger is cammed out, and the U bar returns to its rest position permitting the clapper to move rapidly towards the bell. As a result of its overtravel, the clapper then strikes the bell.

(f) LETTERS-FIGURES FUNCTION LINKAGE. (See Figure 4-23) - Letters and figures operate a common clutch, each capable of releasing the clutch for a 180-degree rotation. Print and advance prevention take place for either letters or figures as described for the blank function (see Paragraph 4-3f(6)(c)) with the U bars serving as clutch releases

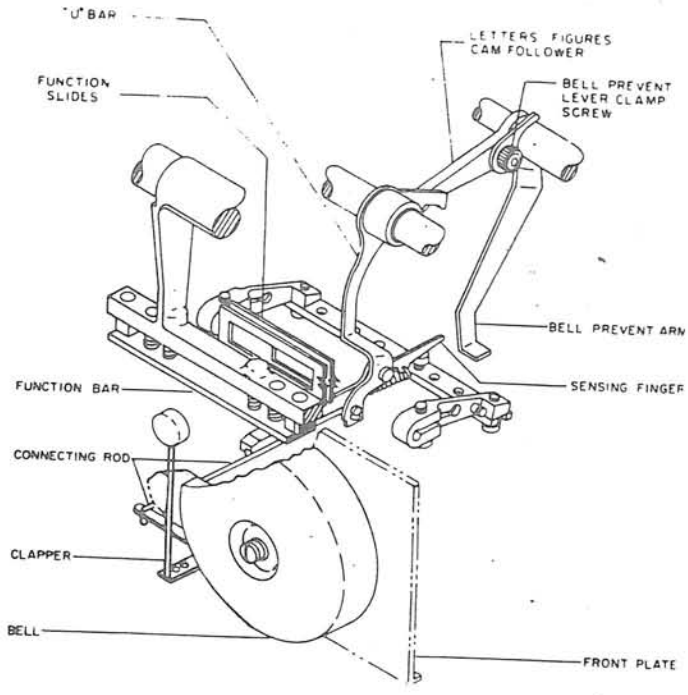


Figure 4-22. Function Selector, Bell Linkage

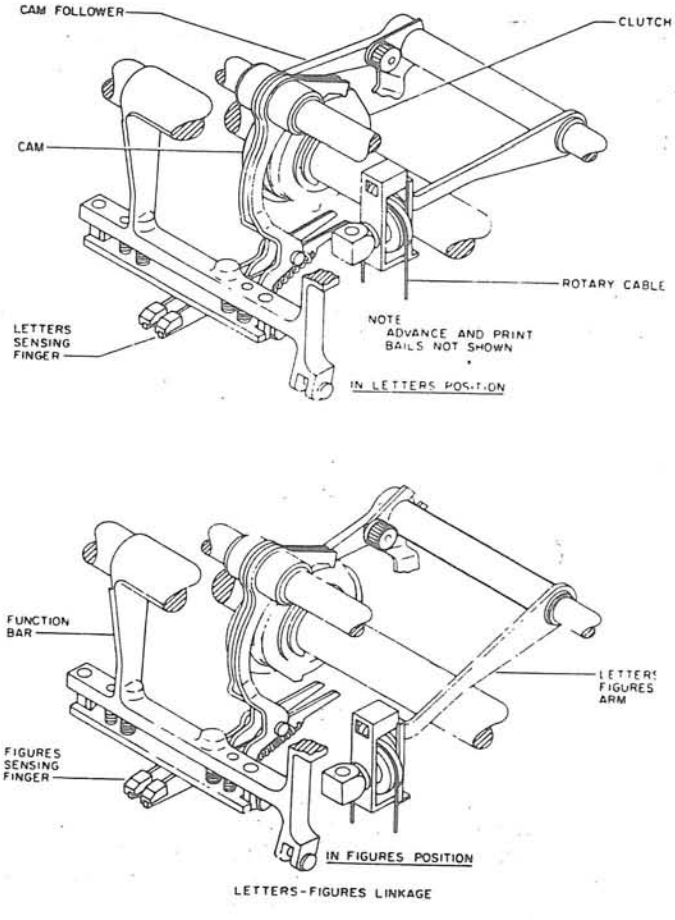


Figure 4-23. Function Selector, Letters - Figures Linkage

for the common clutch. Therefore, if the clutch is resting in letters position, repeated letters selection will not release it, while a figures selection will permit a 180-degree rotation. The letters-figures cam follower transmits its motions through a torque tube to its arm and pulley carriage. The motion of the cam follower positions the letters-figures pulley in one of two positions, thereby effectively shortening or lengthening the rotary cable the equivalent of 180 degrees on the type cylinder. In practice, the letters position has the cam follower on the high side and the cable is effectively shortened.

(g) LINE FEED FUNCTION LINKAGE. (See Figure 4-24) - Line feed consists of print and advance suppression as well as a positive mechanical action. In this case, print and advance suppression are as described for the blank function (see Paragraph 4-3f(6)(c)). In addition, the U bar used for advance suppression becomes a clutch release finger which allows a 180-degree rotation of the line feed clutch and the cam affixed to it. The line feed cam follower transfers its motion through a torque shaft to the line feed pawl which moves the line feed detent ratchet.

The change from double to single line feed is accomplished by positioning the line feed shift arm. Setting the line feed shift arm for single space moves the arm closer to the pawl teeth and holds the line feed pawl away from the ratchet so that only the second tooth engages.

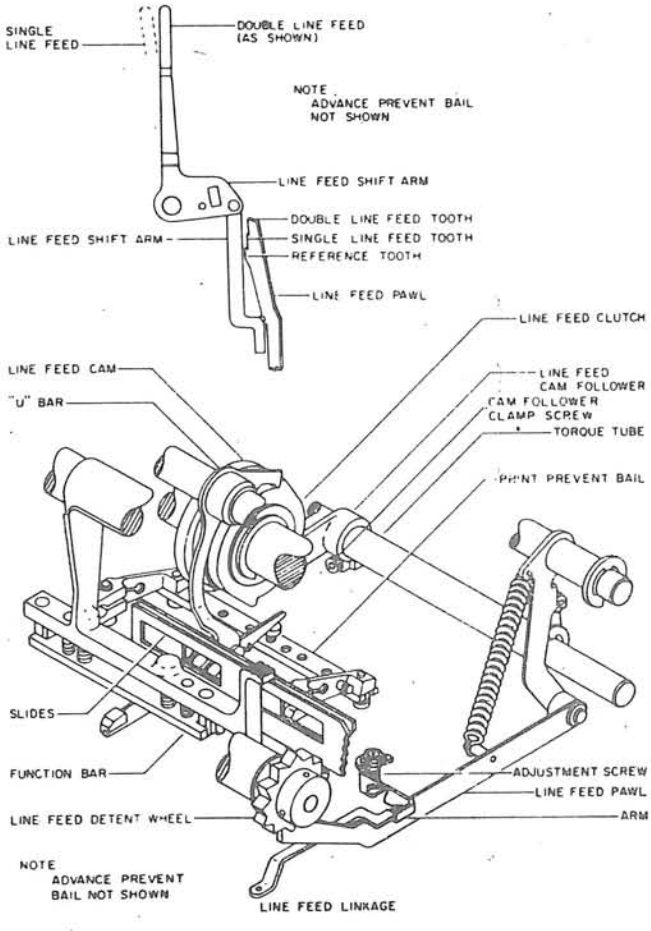


Figure 4-24. Function Selector, Line Feed Linkage

(h) PRINTING ACTION. (See Figure 4-25) - The print cam is affixed to the same clutch as the function cam. This clutch is released once every character cycle, regardless of the combination of pulses received. The release of the clutch turns the print cam and moves the cam follower, which is spring-loaded against the cam by the print spring arm. The spring arm is attached to the print shaft.

When printing is to be performed, the print cam follower will fall off the high portion of the cam (shortly after the function cam follower falls), rotating the print shaft and moving the terminal lever. This motion is transmitted to the hammer shaft assembly and thence to the hammer. Toward the end of its motion, the hammer disconnect link is moved with the terminal lever, forcing the hammer shaft link away from the terminal lever just before hammer impact. The inertia of the hammer, however, is sufficient to complete the printing stroke although the driving force has been released.

(i) PRINT PREVENTION. (See Figure 4-26) - When a non-printing function is selected, the sensing finger pushes out the spring-loaded print prevent bail. The pivoting action of the bail moves the print prevent bail lever under the print prevent arm, which just clears it when the print cam follower is on the high portion of the cam. There is a small step in the print cam, from which the print cam follower drops just prior to the fall of the function cam. This slight step serves to lock the print prevent bail lever under the print prevent arm. The function bar action precedes the final drop in the print cam in order to store the print or no-print action until the print cam follower drops.

The positioning of the print prevent bail lever beneath the print prevent arm blocks the final drop of the print cam follower, thereby preventing printing. The rising of the print cam follower on the next character cycle frees the print prevent bail lever. The bail will then be spring-returned to its sensing position. If desired, printing cam be permitted on functions by disabling the print prevention linkage; the various function symbols shown in Figure 1-2 will then be printed.

(j) CHARACTER ADVANCE PREVENTION. (See Figure 4-27) - Advance prevention takes place for all functions except space (and figures blank, AN/UGC-38 only). The U bars move the advance prevention bail, which is affixed to the carriage return cam follower, slightly upwards. This motion is equivalent to about one-half the upward motion that is induced by the carriage return cam. This motion is transmitted through the carriage return shaft to the carriage return lever, whose motion is sufficient to withdraw the advance feed pawl and engage it on the advance prevention catch but is not sufficient to release the advance check pawl. Consequently, advancing is prevented without permitting carriage return. If desired, character advance on functions may be allowed by removing adjustment screws.

(k) CARRIAGE RETURN FUNCTION LINKAGE. (See Figure 4-28) - Carriage return combines print prevention and simultaneous action by the U bar to engage the carriage return clutch and cam. The rising motion of the carriage return cam moves its follower away until the carriage return lock lever intersects the notch in the carriage return cam

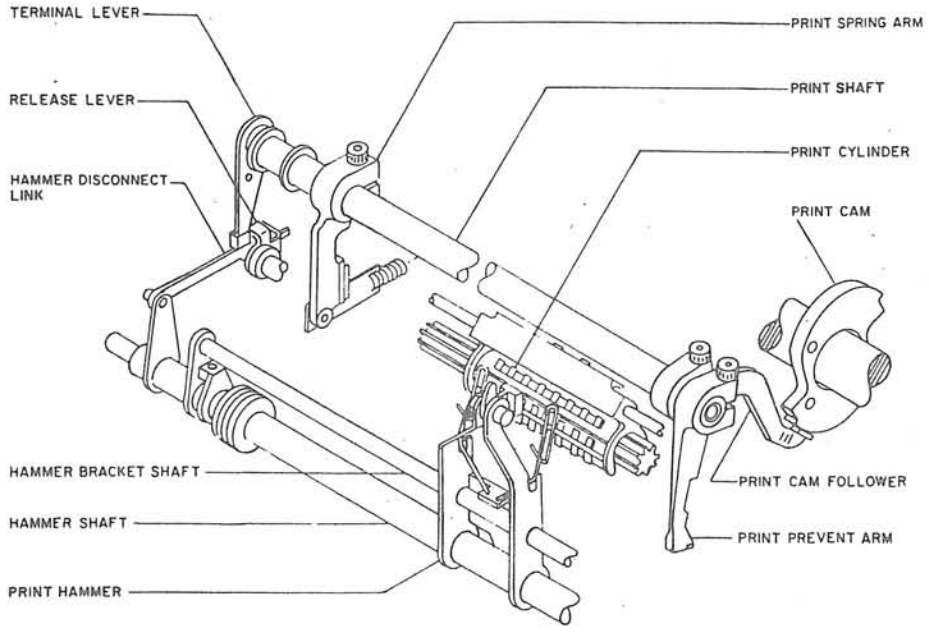


Figure 4-25. Function Selector, Character Printing Linkage

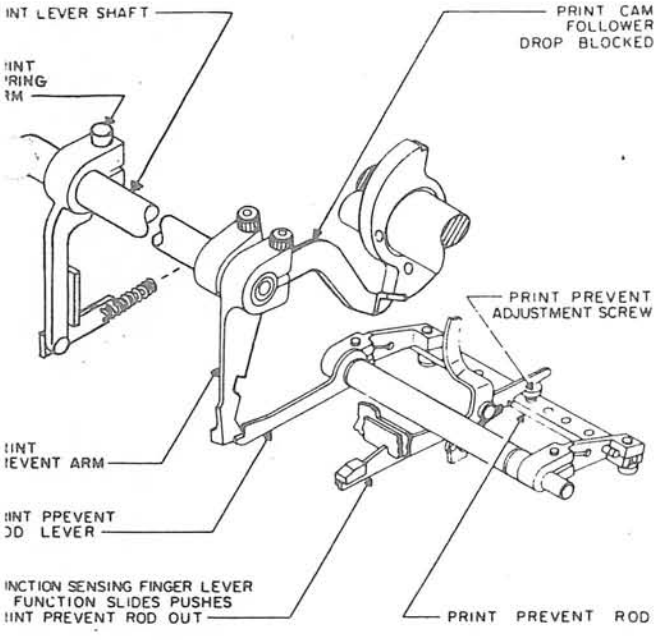


Figure 4-26. Function Selector, Print Prevention Linkage

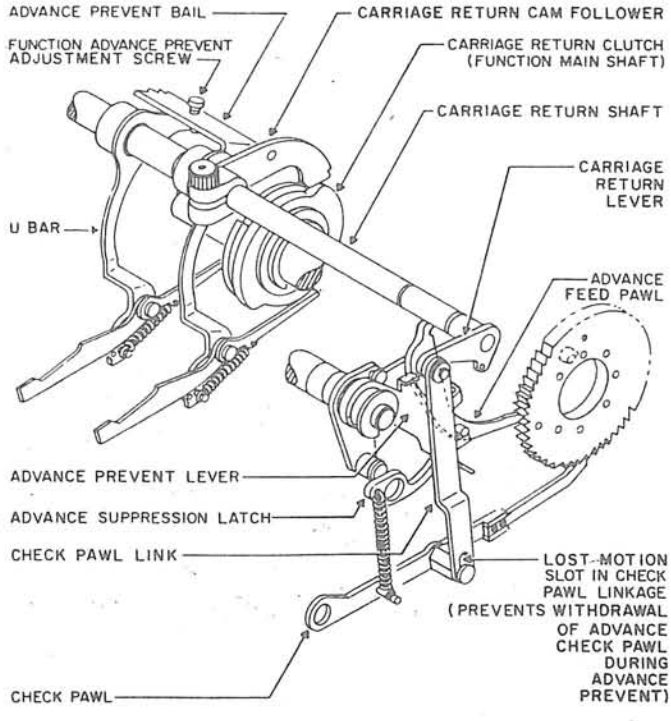


Figure 4-27. Function Selector, Character Advance Prevent Linkage

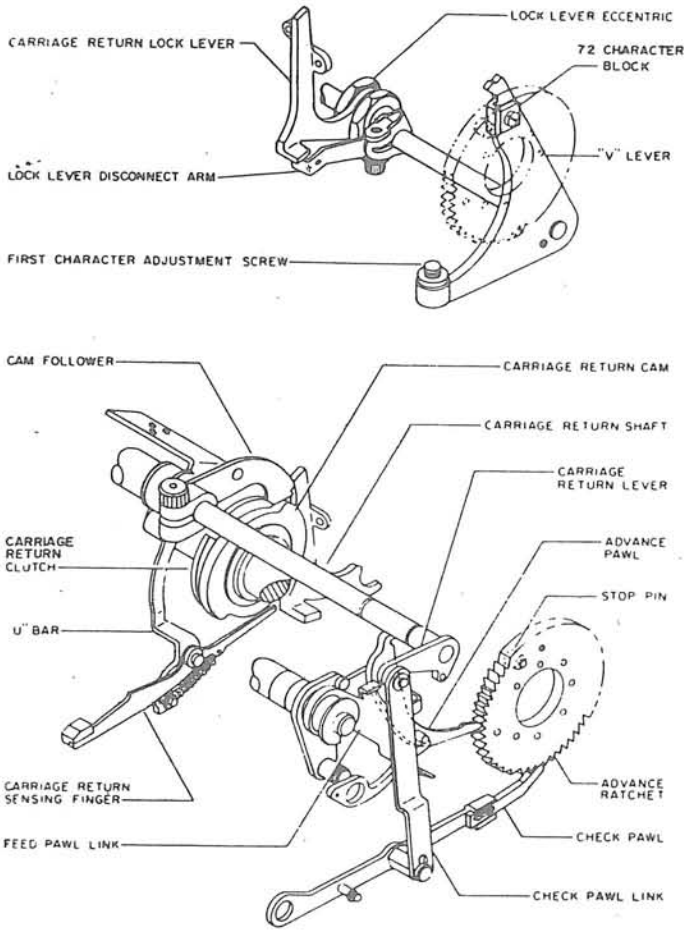


Figure 4-28. Function Selector, Carriage Return Linkage

follower. Movement of the cam follower rotates the carriage return shaft and lever, resulting in a downward motion of the check pawl link and advance prevention lever. This motion disengages the advance check pawl and advance feed pawl from the advance ratchet until carriage return is completed. As the carriage return cycle is completed, the stop pin on the inner face of the advance ratchet strikes the V lever, which in turn rotates the lock lever disconnect arm, disengaging the lock lever from the notch in the carriage return cam follower.

(l) AUTOMATIC CARRIAGE RETURN AND LINE FEED. (See Figure 4-29) - Automatic carriage return and line feed are provided at the end of any line if carriage return has not been signalled to the machine. Function fingers similar to the other function sensing fingers are provided for these two functions. However, these fingers do not actually sense the slide alignment but are spring loaded such that they tend to fall beneath the function bar regardless of the position of the slides. This action is prevented, however, by the automatic carriage return and line feed actuator assembly which is affixed to the V lever shaft. The actuator assembly and shaft are spring loaded against the automatic carriage return and line feed fingers in such a manner that the bias springs urging the fingers beneath the function bar are overcome. When the advance drum reaches the end of the line with no carriage return signal, the stop pin mounted on the drum pushes against the V lever, overcoming the shaft spring and turning the shaft, thus relieving the pressure on the two function fingers. These fingers fall beneath the function bar on its next stroke, releasing the carriage return and line feed clutches.

(m) OFF-LINE FUNCTION INTRODUCTION. (See Figure 4-30) - Off-line function controls are provided on the printer cover to introduce, through appropriate linkage, off-line functions of line feed, figures, letters, and carriage return into the printer. These functions, while operating only on the local printer, do not electrically affect the signal line or the magnetic selector, and thus can be introduced while receiving copy. With the exception of letters, the off-line function controls operate levers which push the U bars in and release the appropriate clutches. Since the sensing fingers do not fall into slides in off-line function selection, there is no print prevention motion; however, the motion of the U bar does prevent character advance.

In the case of letters, there is a theoretical possibility that the release of the letters clutch at the wrong time may jam the machine. Therefore the manual introduction of letters is accomplished differently. The letters off-line function control moves a slide inward, camming a leaf spring against a finger similar to a function sensing finger. This finger is urged against the function bar, beneath which it falls when the bar is at its high point. The finger falls under the function bar without interfering with the slide and is driven downward by the bar, pivoting the U bar and releasing the letters clutch. In this manner, the off-line introduction of letters is timed to the normal stroke of the function bar.

(n) AUTOMATIC LINE FEED ON CARRIAGE RETURN. (See Figure 4-31) - When enabled, the automatic line feed on carriage return mechanism negates the possibility of overprinting one or more lines of material, even if the generator fails to send the line feed signal at the end of the line. Upon receipt of the carriage return signal, the function bar strikes the carriage return sensing finger lever driving it to the rear, the extension of carriage return clutch release arm (2, Figure 4-31) engages latch assembly (11). Latch assembly (11) activates carriage return lever (9) and line feed lever assembly (12). Line feed lever assembly (12) strikes the extension of the line feed clutch release arm (1), releasing the line feed clutch.

When the carriage return sensing finger is deflected from under the function bar, its bias spring restores it to the standby condition. Spring (6) attached to the carriage return lever and cancellation lever assembly (7), returns the automatic line feed linkage to a standby condition.

The off-line functions, line feed, and carriage return, may still be independently selected by depressing their respective off-line function controls on the front cover. When the off-line carriage return control is activated, an adjustable slide (3) engages an extension of the cancellation lever (7). The cancellation lever rotates in a counterclockwise direction and a tab on the lever engages and withdraws the latch from under carriage return clutch release arm (2). This allows activation of carriage return without line feed. Line feed may be selected by depressing the

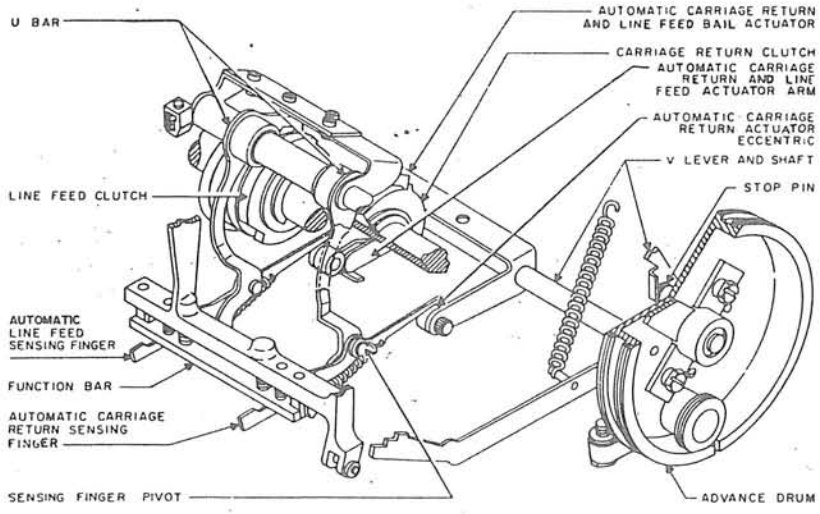


Figure 4-29. Automatic Carriage Return and Line Feed Linkage

off-line control on the front cover. The off-line function ...her which rides under the line feed lever assembly ...tivates only the line feed clutch release arm (1).

(7) RIBBON FEED MECHANISM. (See Figure 4-32) The ribbon feed mechanism automatically advances and reverses the direction of the ribbon. Motive power is received from the start clutch gear which rotates the ribbon drive gear shaft (9, Figure 4-32) when the start clutch is engaged. The cam (8) on ribbon drive gear shaft (9) engages power lever (7) causing it to pivot to the rear. The drive pawl assembly (4) is pushed to the rear by the motion of power lever (7). The check pawl tab (3) and drive pawl tab (4) assemblies are spring loaded causing them to return to the rest position. On the backstroke of power lever (7) drive pawl tab (4) engages a tooth on ribbon spool spindle (5) causing it to rotate. While ribbon spool spindle (5) is being rotated, check pawl tab (3) falls into a tooth on ribbon spool spindle (5). Automatic ribbon reversal is accomplished when ribbon eyelet pulls reversal bar (6) causing one of the drive pawl reversing tabs (11) to be blocked by tabs (12) on reversal bar (6). This causes check pawl tab (3) and drive pawl tab (4) to be pivoted in the opposite direction during the next cycle of operation.

(8) PRINTER MOTOR. - The motor supplied with the teletypewriter set requires 115-vac, 60 cps, single phase primary power. The motor is the hysteresis-synchronous type, and requires a 5.0 UF capacitor in series with a stator winding to provide phase shift for directional starting and running.

Motor pinion gear speed should be 3600 rpm. Frequency can vary ±5% (57 to 63 cycles per second); however, distortion is greatly increased with any change in frequency.

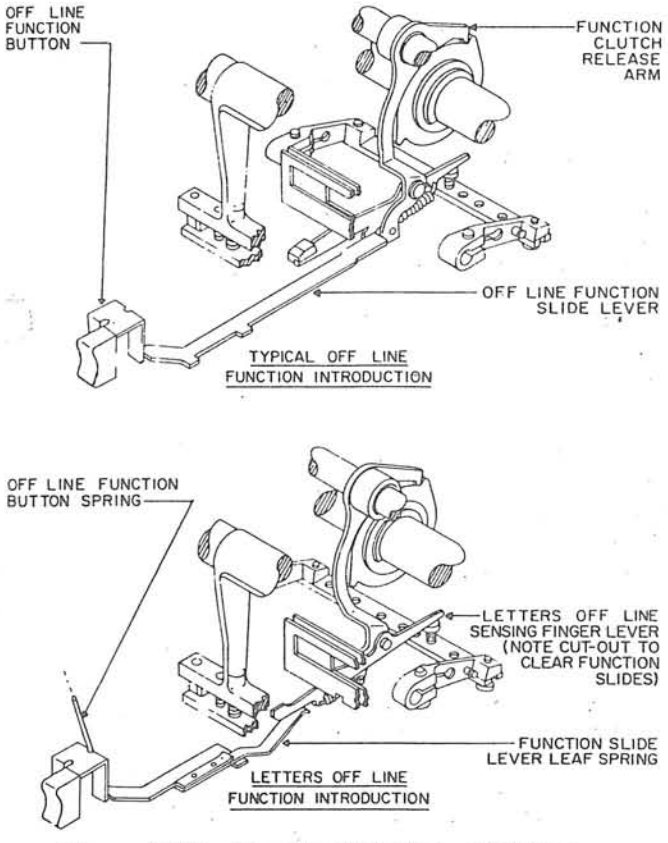


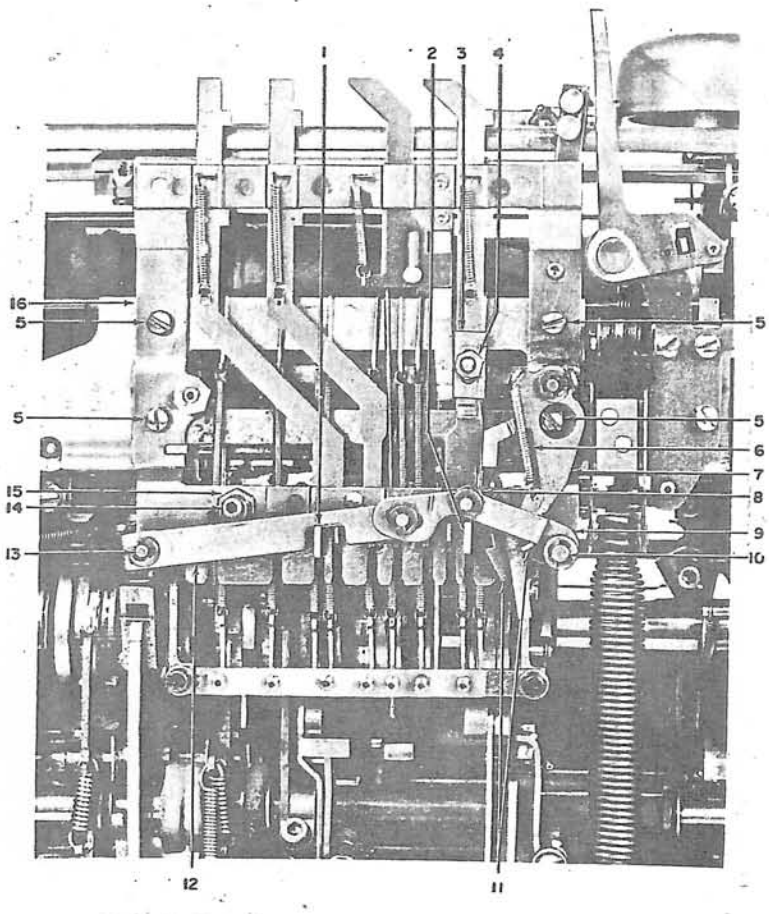
Figure 4-30. Function Selector, Off-Line Function Control Linkage

4-4. SIGNAL DISTORTION.

Teletypewriter signals, as well as all d-c signals, are subject to distortion. This distortion may be caused by the line facilities, natural or man-made electrical disturbances, cross-fire, or sporadic changes of operating speed at either the local or remote station. Distortion of a start-stop teletypewriter signal is the shifting of the transition points of the signal pulses from their proper positions relative to the beginning of the start pulse. Figure 4-33 illustrates the various types of distortion in relation to a perfect signal and mechanical functions of the printer.

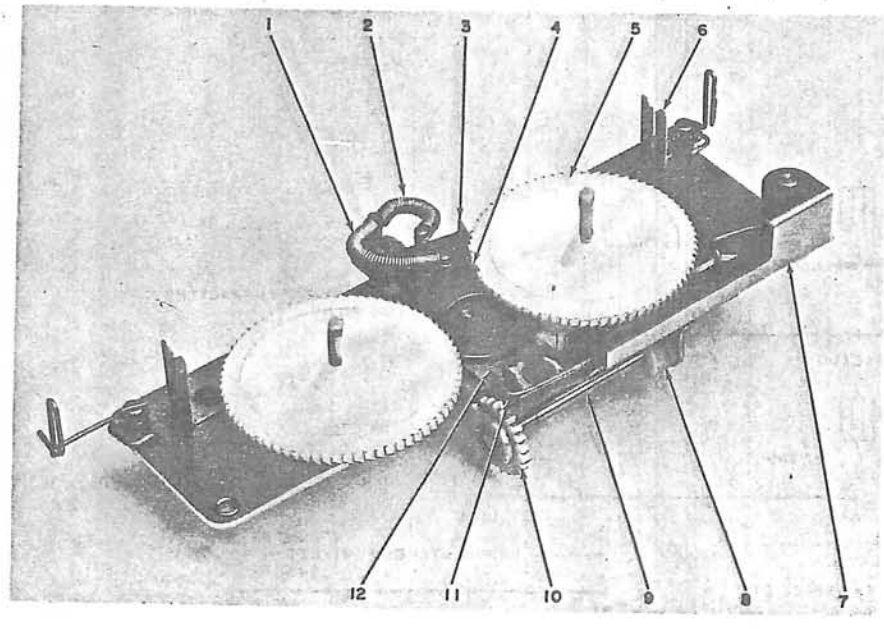
a. BIAS DISTORTION. - Bias distortion or bias of start-stop teletypewriter signals is the uniform shifting of the beginning of all marking pulses from their proper positions in relation to the beginning of the start pulse.

b. END DISTORTION. - End distortion of the start-stop teletypewriter signals is the shifting of the



KEY	ITEM
1	Line Feed Clutch Release Arm (Extension)
2	Carriage Return Clutch Release Arm (Extension)
3	Adjustable Slide
4	Hex-nut
5	Slotted Head Screws
6	Cancellation Spring (in Disable Position)
7	Cancellation Lever
8	Latch Spring
9	Carriage Return Lever
10	Carriage Return Lever Post (Mounted on Slide Assembly)
11	Latch
12	Line Feed Lever
13	Line Feed Lever Post (Mounted on Slide Assembly)
14	Socket Head Cap Screw
15	Eccentric
16	Manual Function Slide Assembly

Figure 4-31. Automatic Line Feed on Carriage Return Mechanism



KEY	ITEM
1	Drive Pawl
2	Check Pawl Spring
3	Check Pawl Tab
4	Drive Pawl Tab
5	Ribbon Spool Spindle
6	Reversal Bar
7	Power Lever
8	Cam
9	Ribbon Drive Gear Shaft
10	Ribbon Drive Gear
11	Drive Pawl Reversing Tabs
12	Reversal Bar Tab

Figure 4-32. Ribbon Feed Mechanism

end of all marking pulses from their proper positions in relation to the beginning of the start pulse.

c. FORTUITOUS DISTORTION. - Fortuitous distortion of telegraph signals is the random departure from the average of the position of the transition points of a signal pulse. This type of distortion can be caused by cold solder joints, contact bounce, dirty contact brushes, intermittent opens in the signal line and other related causes.

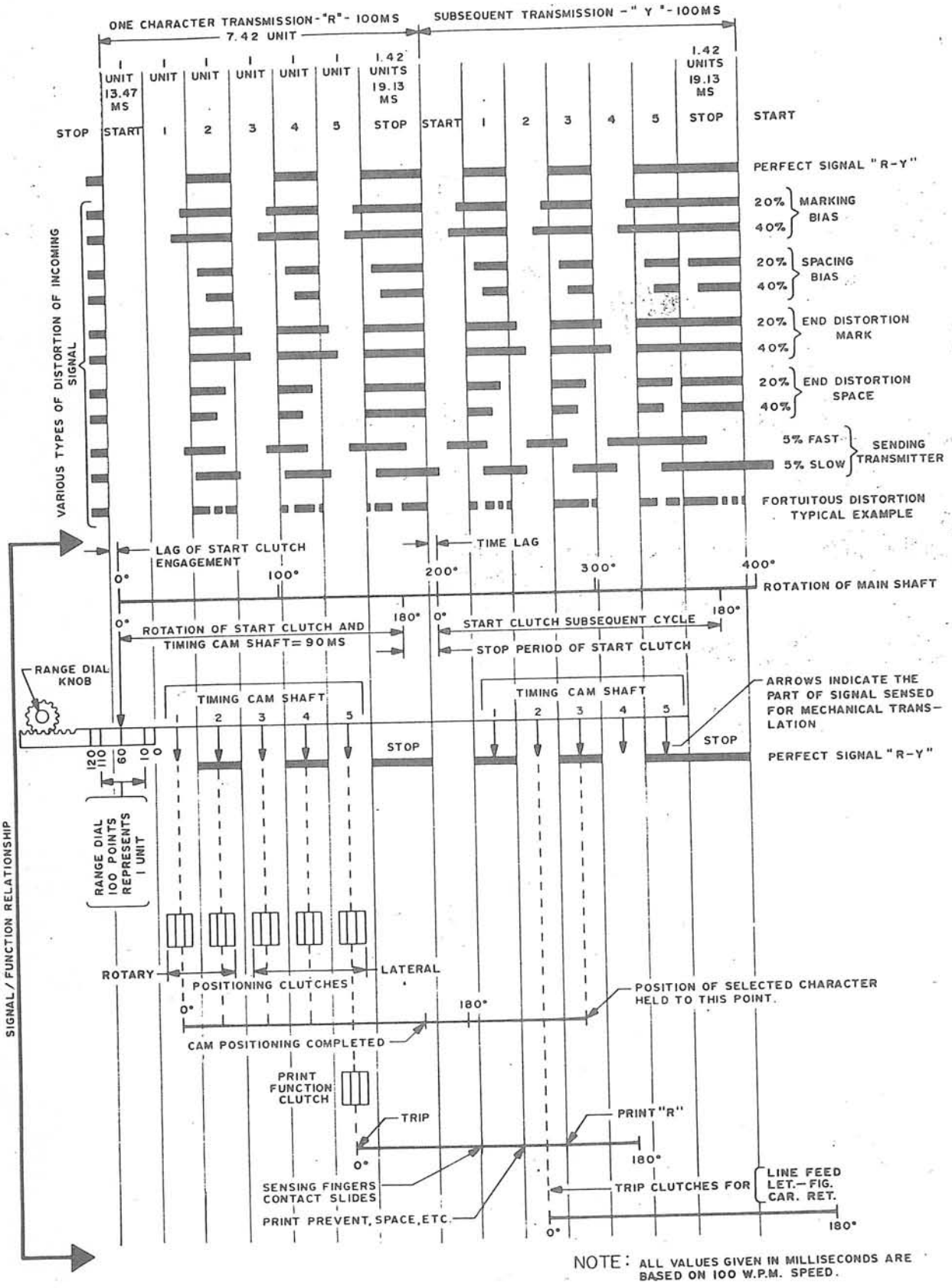


Figure 4-33. Signal Distortion and Timing Chart

ORIGINAL

SECTION 5

MAINTENANCE

5-1. INTRODUCTION

This section, divided into three subsections, contains preventive maintenance, trouble-shooting, and repair information for Teleprinter Sets AN/UGC-38 and AN/UGC-40, and Teletypewriter Set AN/UGC-41.

The Preventive Maintenance subsection contains tabular test procedures to be performed by operating and maintenance personnel at specified intervals to detect indications of abnormal performance. The maintenance standards portion of this subsection contains maintenance standards which will establish overall performance criteria for the teletypewriter or teleprinter sets.

The preventive maintenance procedures also provide a systematic and efficient method for checking and performing routine preventive maintenance intended to avert impending equipment malfunction.

The trouble-shooting subsection contains overall, functional and electrical component trouble-shooting procedures in tabular form. Trouble-shooting should be confined (in the field) to that work which can be accomplished without complete disassembly, or with partial disassembly of the equipment, and not requiring the use of any tools or test equipment other than those found in the field maintenance shop.

The repair subsection contains information required to test, repair, adjust, and lubricate the equipment.

NOTE

All references to direction in this section are based upon viewing the equipment as seen from the operator's position.

5-2. TEST EQUIPMENT.

Table 5-1 lists the recommended test equipment and tools to service and repair Teletypewriter Set AN/UGC-41 and Teleprinter Sets AN/UGC-40 and AN/UGC-38.

TABLE 5-1. RECOMMENDED TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT AND TOOLS	PREVENTIVE MAINTENANCE	MAINTENANCE STANDARDS	REPAIR
Multimeter AN/PSM-4	X	X	
Electronic Multimeter TS-505/U			X
Oscilloscope AN/USM-24 or AN/USM-105			X
*Teletypewriter Tool Kit TK-188/UG			X
Signal Generator AN/UGM-6(V)	X	X	X
Maintenance Fixture, MITE Part Number 37200	X	X	X
Primary Power Service Cable, MITE Part Number 38557	X	X	X
Signal Service Cable, MITE Part Number 38558	X	X	X
Materials			
Oil, Non-fluid MITE Part No. 34304 1-pint plastic bottle 1N 5815-869-9148	X	X	X
Grease MITE Part No. 05041-0001 8 ounce tube	X	X	X

*This tool kit contains all required special tools and gages.

5-3. PREVENTIVE MAINTENANCE.

GENERAL. - This section is divided into six parts: Operator's Checkoff Lists, Technician's Checkoff Lists, Maintenance Standards, Lubrication, Scheduled Maintenance, and Isolation of Printer Malfunctions. When properly adhered to, these checks and procedures indicate the performance of individual electrical circuits and mechanical systems, and also provide for systematic preventive maintenance of the overall unit.

The preventive maintenance tables establish a calendar inspection system. If, however, 500 hours operation time is accrued prior to the calendar due date, follow the inspection requirements established in Tables 5-4 through 5-7.

A list of operating conditions (which apply to the entire table unless otherwise noted in a given step) is provided at the beginning of action column of each checkoff list. Where illustrations are supplied, the step numbers of the procedures will correspond to the step numbers on accompanying illustrations. Arrows leading from a given step number on an illustration graphically present certain basic information given in the associated step of the procedure table. This basic information includes the point where the test equipment is to be connected to the teletypewriter set and similar information.

Prior to performing the scheduled preventive maintenance procedures, the teletypewriter set should be checked to ensure that the equipment is operating within its design capabilities. The maintenance standards given in Paragraph 5-3c should be performed to ascertain that the equipment is operating normally.

Comparison of test results with the given maintenance standards will reveal any significant change in the operation of the teletypewriter sets. It is expected that the test results will occasionally show nominal variances, which does not necessarily mean that the equipment is operating improperly. If, however, a particular step produces an indication which varies each time the check is made, improper operation or impending failure are indicated and corrective measures should be taken.

a. OPERATOR'S CHECKOFF LISTS. - The following checks (Tables 5-2 and 5-3) are included for use by Operating Personnel. All of the conditions under which these checks are to be accomplished, are included at the beginning of action required column of each table.

TABLE 5-2. OPERATOR'S DAILY CHECK-OFF LIST

STEP NO.	ACTION REQUIRED	PROCEDURE
	Operating conditions and control settings: MOTOR and LAMP switches: ON. SEND.REC/REC switch: SEND-REC. Equipment switched for off-line local mode (refer to Paragraph 2-9). Refer to Section 3 for operating instructions.	
1	Test overall operation of teletypewriter set with keyboard. (AN/UGC-41) [Teleprinters AN/UGC-38 and AN/UGC-40 will require keying devices or Signal Generator AN/UGM-6(V).]	A. Depress LTRS key and type out test message. Observe that machine prints clearly with no garbles. B. Observe that motor stops after 60 seconds of inactivity with time delay MOTOR STOP switch in ENABLE position. C. Depress BREAK button (observe that motor starts). D. Type out a complete row of characters and observe that automatic carriage return and line feed take place after 72 or 76 characters have been printed. E. Test all off line function buttons on the printer front cover for proper operation. F. Move rotary mode switch to local mode, place SEND.REC/REC to SEND.REC position and type a test message. Check printed message. Switch to REC position to ensure that printer does not receive from keyboard.

TABLE 5-3. OPERATOR'S WEEKLY CHECK-OFF LIST

STEP NO.	ACTION REQUIRED	PROCEDURE
	Operating conditions and control settings: Primary power removed. Teletypewriter Set removed from case.	
1	Inspect components	Inspect cables and lateral control belt for wear. Inspect ribbon for dryness.
2	Clean mechanical parts.	Using a soft lint-free cloth, clean print hammer shaft and print cylinder and yoke shafts.
3	Inspect all mechanical parts for security.	Inspect ribbon feed mechanism and all other mechanical parts for binding or damage.
4	Inspect electrical cables.	Inspect service cable wiring and connectors for secure connections.
5	Inspect electrical chassis rear panel.	Inspect rotary mode switch for proper mode of operation. Inspect fuse caps for security and damage.

b. TECHNICIAN'S CHECK-OFF LISTS. - The technician's check-off lists (Tables 5-4 through 5-7) comprise daily, weekly, 3 week, and 6 week checks. Each of these tables contains a step number, the items to be checked, and a reference to the maintenance standard (satisfactory operating condition). If while performing the various checks a specified maintenance standard cannot be obtained, refer to (Paragraph 5-3f) ISOLATION OF PRINTER MALFUNCTIONS in an effort to isolate the problem area. Refer to LOGICAL TROUBLE SHOOTING, Paragraph 5-4, if unable to diagnose malfunction using isolation of printer malfunction information. If the problem area has been isolated, do not perform the adjustment sequence without first double-checking to ensure that your diagnosis is correct. If it is found that the adjustment is not correct, perform the adjustment sequence as instructed in Paragraph 5-5e.

TABLE 5-4. TECHNICIAN'S DAILY CHECK-OFF

STEP NO.	ACTION REQUIRED	MAINTENANCE STANDARD REFERENCE (Refer to Table 5-8)
	Operating conditions and control settings: Primary power removed. Teletypewriter Set removed from case.	
1	Check paper supply.	
2	Check ribbon for sufficient ink by observing darkness of print.	See CAUTION after Maintenance Standard A10.

TABLE 5-5. TECHNICIAN'S WEEKLY CHECK-OFF

STEP NO.	ACTION REQUIRED	MAINTENANCE STANDARD REFERENCE NUMBER (Refer to Table 5-8)
	Operating conditions and control settings: Teletypewriter set removed from case (Refer to Paragraph 5-5b(3)). Equipment switched for off-line (Refer to Paragraph 2-9).	

TABLE 5-5. TECHNICIAN'S WEEKLY CHECK-OFF (Cont)

STEP NO.	ACTION REQUIRED	MAINTENANCE STANDARD REFERENCE NUMBER (Refer to Table 5-8)
	Primary power removed (Steps 1 and 2) Primary power connected (Steps 3 through 8, and 13)	
1	Clean printer unit.	A9
2	Lubricate unit.	A12
3	Slide alignment and takeup arm adjustment.	A1 - A2
4	Check selection of functions.	A17
5	Check range.	A8
6	Rotary detent pawl pin clearance.	A3
7	Hammer alignment	A4
8	Inspect printer unit.	A10
9	Selector adjustment screws.	A23
10	Function bar adjustment.	A25
11	Advance mechanism.	A26
12	Ribbon feed mechanism.	A27
13	Running adjustment checks.	A28, a, b, c, and d

TABLE 5-6. TECHNICIAN'S 3 WEEK CHECK-OFF

STEP NO.	ACTION REQUIRED	MAINTENANCE STANDARD REFERENCE NUMBER (Refer to Table 5-8)
	Operating conditions and control settings: Teletypewriter set removed from case (Refer to Paragraph 5-5b(3)). Equipment switched for off-line (Refer to Paragraph 2-9). Primary power removed (Steps 2, 4, 5, and 6). Primary power connected (Steps 1, 3, and 5).	
1	Motor Stop Check	
	Time Delay	A7
2	Check stroke	A5 - A6
3	Clean and lubricate unit (Table 5-9)	A9 - A19
4	Inspect and check chassis.	A20
5	Master pulsing contacts.	A18
6	Check function timing cam.	A24

TABLE 5-7. TECHNICIAN'S 6 WEEK CHECK-OFF

STEP NO.	ACTION REQUIRED	MAINTENANCE STANDARD REFERENCE NUMBER (Refer to Table 5-8)
	Operating conditions and control settings: Teletypewriter set removed from case (Refer to Paragraph 5-5b(3)). Equipment switched for off-line (Refer to Paragraph 2-9). Primary power removed (Steps 1, 2, 4, and 5). Primary power connected (Step 3).	
1	Clean selector assembly.	A14
2	Clean motor assembly.	A15
3	Adjustment checks.	A16
4	Shock mounts.	A22

c. MAINTENANCE STANDARDS. - This section is comprised of a group of standards (operating and adjustment) which must be met to ensure optimum performance of the equipment. These standards are to be used as a guide when performing preventive maintenance and trouble isolation procedures. If the standards cannot be met, the related adjustment procedure required to obtain the standard appears next to the standard.

When using the MAINTENANCE STANDARDS (Table 5-8), the left column contains a reference number for referral to this section from other sections, the middle column contains the standard, and the right column contains a reference to the paragraph in which the related adjustment is contained.

TABLE 5-8. MAINTENANCE STANDARDS

REFERENCE NO.	MAINTENANCE STANDARDS	ADJUSTMENT PARAGRAPH NO.
	NOTE The following maintenance standards are keyed to the Technician's Check-off Lists, Tables 5-4 through 5-7, and to the related adjustment procedures. CAUTION DO NOT PERFORM ANY ADJUSTMENT SEQUENCE WITHOUT FIRST CHECKING THE DIAGNOSIS TO ENSURE THAT THE SUSPECT ADJUSTMENT WILL CORRECT THE MALFUNCTION.	
A1	SLIDE ADJUSTMENT Position the printer in letter A with the function clutch in the stop position. Check for proper alignment of rotary and lateral slide index mark on the function selector frame.	 5-5d(6) 5-5e(3)(b) 5-5e(4)(b)
A2	TAKEUP ARM PULLEY AND TAKEUP DRUM Check for approximately 1/16-inch clearance between the O.D.'s of the takeup arm pulley and the takeup drum (in letter A).	5-5e(4)(a)

TABLE 5-8. MAINTENANCE STANDARDS (Cont)

REFERENCE NO.	MAINTENANCE STANDARDS	ADJUSTMENT PARAGRAPH NO.
A3	ROTARY DETENT PAWL PIN CLEARANCE Check that the detent pin clears the points of the index wheel by at least 0.010-inch when print function clutch is in stopped position.	5-5e(7)
A4	HAMMER ALIGNMENT WITH "I" Position printer in letter "I". Check alignment of hammer with "I" halfway across the line. NOTE Stroke adjustment should have been completed (or checked) if the letter "I" is to be used for hammer alignment.	5-5e(18)(a) and (b)
A5	ROTARY STROKE Check for rotary motion of print cylinder to the type strips containing the letters A, E, L, and T.	5-5e(18)(a)
A6	LATERAL STROKE Check for lateral alignment of printed characters AM, OU, and RY.	5-5e(18)(b)
A7	MOTOR STOP Check motor stop for shut-down within 120 seconds.	Table 5-14
A8	RANGE OF PRINTER: If a signal generator is available: Check for capability of unit to receive 30% marking or spacing bias or 30% marking or spacing end bias. If at existing setting of range dial the unit does not receive and print correctly an RY signal, adjust the range dial until the RY is received and printed correctly. If a signal generator is not available: Check for minimum of 70 point of range at 100 wpm. Hi - Low = points of range. To find the points of range subtract the lowest point on the range dial where the signal can be accepted without errors from the highest point on the range dial where the signal can be accepted without errors. (Minimum points of range at 100 wpm should be 70 points.)	5-5e(2)(b) 5-5e(2)(b)
A9	CLEAN PRINTER UNIT CAUTION ENSURE THAT SPRINGS AND ADJUSTABLE PARTS ARE NOT DISTURBED. Using a soft lint-free cloth, clean the cylinder yoke, and hammer shafts. If exceptionally dirty apply a few drops of oil to the shaft while running and then wipe completely dry. Wipe off all dust, lint and paper shavings. Special attention should be paid to the keyways in the print cylinder shaft.	

TABLE 5-8. MAINTENANCE STANDARDS (Cont)

REFERENCE NO.	MAINTENANCE STANDARDS	ADJUSTMENT PARAGRAPH NO.
A10	INSPECT PRINTER UNIT CAUTION NEVER INCREASE TENSION ON PRINT HAMMER FOR DARKER COPY. REPLACE RIBBON IF DARKER COPY IS DESIRED. Inspect ribbon for wear and frayed edges. Inspect cables for fraying, wear, or cuts. Check print hammer disconnect adjustment if ribbon replacement does not provide darker copy.	5-5e(15)
A11	CHECK PAPER SUPPLY Ensure that sufficient paper is on roll and that it is properly installed.	3-3c(3)
A12	LUBRICATION CAUTION NEVER LUBRICATE THE CYLINDER, HAMMER OR YOKE SHAFTS. (REFER TO LUBRICATION SCHEDULE.)	Refer to Table 5-9
A13	DISASSEMBLE AND INSPECT PRINTER UNIT Use only low pressure air to clean unit. Ensure that springs are not disengaged or lost. Disassemble printer unit into four major assemblies. Inspect for loose, broken, or worn parts. Clean off all excessive oil and grease. (Make a diagram of timing mark alignment, before removing mainshaft from frame. Refer to Figure 4-11 for location of timing marks.)	5-5(g) 5-5(g)
A13a	INSPECT MAINSHAFT Clean off all excessive grease and oil from clutches and the area between the clutches. Check to ensure that all cages move freely, and relubricate with oil.	
A13b	REASSEMBLE PRINTER UNIT Replace all worn, broken, or missing parts as required. Check for proper alignment of timing marks on mainshaft and timing shaft when reassembling front and rear halves of printer. (Refer to timing mark diagram prepared during disassembly.)	
A14	SELECTOR MECHANISM Remove the selector and clean in residue free solvent. Check that no foreign matter remains on poles or armatures. Relubricate bearings and felts with oil, place one drop of oil on carbide surfaces. Replace selector in printer.	
A15	MOTOR ASSEMBLY Remove motor and inspect first reduction gear and pinion gear for wear or damage. Lubricate gears with grease prior to reassembly.	5-5(g)(2)(a) and (b)

TABLE 5-8. MAINTENANCE STANDARDS (Cont)

REFERENCE NO.	MAINTENANCE STANDARDS	ADJUSTMENT PARAGRAPH NO.
A16	CHECK ADJUSTMENTS The following adjustments should be checked and readjusted if necessary. a. Function Slide Alignment b. Start Clutch Release c. Selector d. Rotary and Lateral Stroke e. First Character f. Character Advance g. Automatic CR & LF	 5-5e(3)(b) and 5-5e(4)(b) 5-5e(5) 5-5e(17) 5-5e(18)(a) and (b) 5-5e(23) 5-5e(8) 5-5e(9)(b)
A17	CHECK FOR PROPER OPERATION OF FUNCTIONS NOTE If functions do not operate, check slide and stroke adjustments prior to checking individual function clutches and linkages. Blank Space Line Feed Figures Bell Letters Carriage Return	 5-5e(3)(b) 5-5e(4)(b) 5-5e(18)(a) 5-5e(18)(b)
A18	MASTER PULSING CONTACTS Continuously transmit the letter "R". This checks the upper contact screw adjustment. Continuously transmit the letter "Y". This checks the lower contact screw adjustment.	 5-5e(24)(i) or 5-5e(26)(b)
A19	KEYBOARD INSPECTION Inspect the keyboard for worn, broken or loose parts. Check for accumulation of dirt and grease. Clean keyboard with a lint-free cloth and relubricate using oil on all linkages and grease on keyboard drive gear..	
A20	INSPECT CHASSIS Inspect the chassis for loose components and frayed or damaged wiring. Check for proper fuses and proper patching for mode of operation required. Wipe off all excess oil and grease on the chassis.	
A21	SHOCK MOUNT Inspect shock mount for security. Check that no foreign matter is interfering with operation of the shock mount.	
A22	MEASURE PRIMARY POWER SOURCE Set Multimeter AN/PSM-4 to measure a-c voltage of 0 to 250 volts; connect leads across primary power source and check for correct primary power.	

TABLE 5-8. MAINTENANCE STANDARDS (Cont)

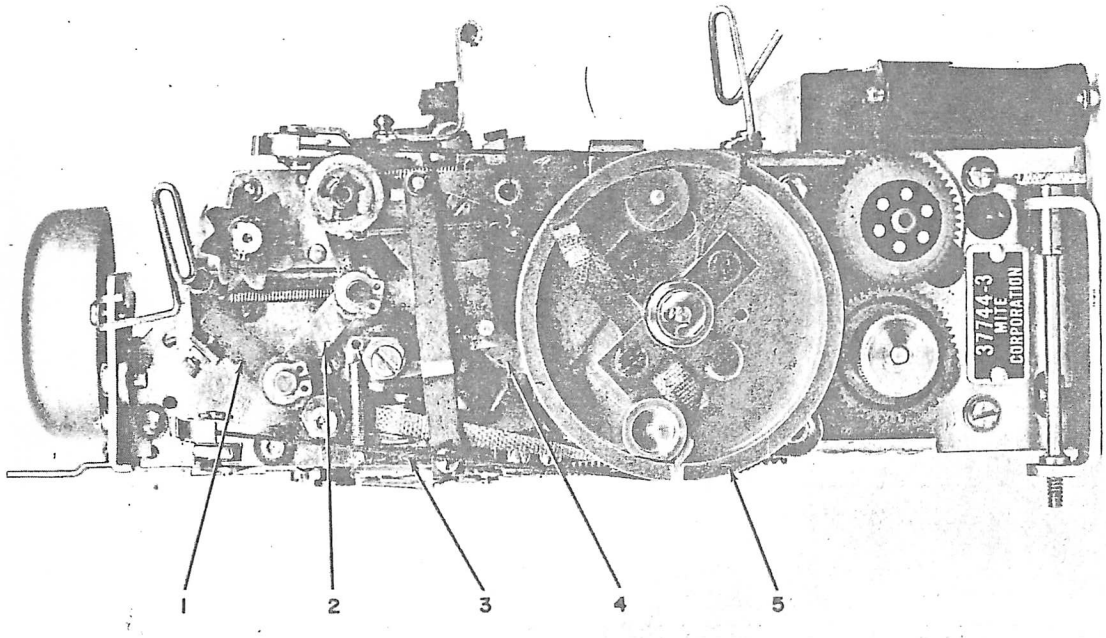
REFERENCE NO.	MAINTENANCE STANDARDS	ADJUSTMENT PARAGRAPH NO.
A23	SELECTOR ADJUSTMENT SCREWS Inspect the eleven (11) selector adjustment screws to see that they are locked tight by their locknuts.	
A24	FUNCTION TIMING CAM Inspect function timing cam for wear.	
A25	FUNCTION BAR ADJUSTMENT Inspect to see that there is 1/32" clearance between function bar and sensing finger, when function cam follower is on high cam position.	
A26	ADVANCE MECHANISM Inspect advance pawl, check pawl and ratchet for signs of wear and proper adjustment.	
A27	RIBBON FEED MECHANISM Inspect to see that ribbon reverses properly and is threaded correctly.	
A28	RUNNING ADJUSTMENT CHECKS (using external signal source) a. 1st character spacing. b. Rotary detent for index wheel bounce. c. Print and advance prevent; that no print or advance occurs during functions. d. Auto. CR & LF: that CR and LF occur after 72 or 76 characters.	

d. SCHEDULED MAINTENANCE. - The following schedules should be followed when checking for wear of parts at the end of 3 week, 6 week, and 9 week intervals of operation. The parts should be replaced if there is any indication that they may become unserviceable during the next 3 weeks of operation. Refer to the appropriate disassembly, or replacement procedure.

SCHEDULED MAINTENANCE

3 WEEK CYCLE

PART NAME	3 WEEK AREA TO CHECK	INDICATION THAT REPLACEMENT PROCEDURE IS NECESSARY
Character advance pawl (4, Figure 5-1)	Tip (where pawl engages the advance ratchet).	Rounded tip, improper spacing across the line, overprinting of characters.
Check pawl (3, Figure 5-1)	Tip (where pawl engages advance ratchet).	Rounded tip, improper spacing across the line, overprinting of characters.
Advance drum and advance ratchet (5, Figure 5-1)	Advance drum inner cable groove and advance ratchet.	Damage to inner cable groove in drum, worn or chipped advance ratchet teeth.

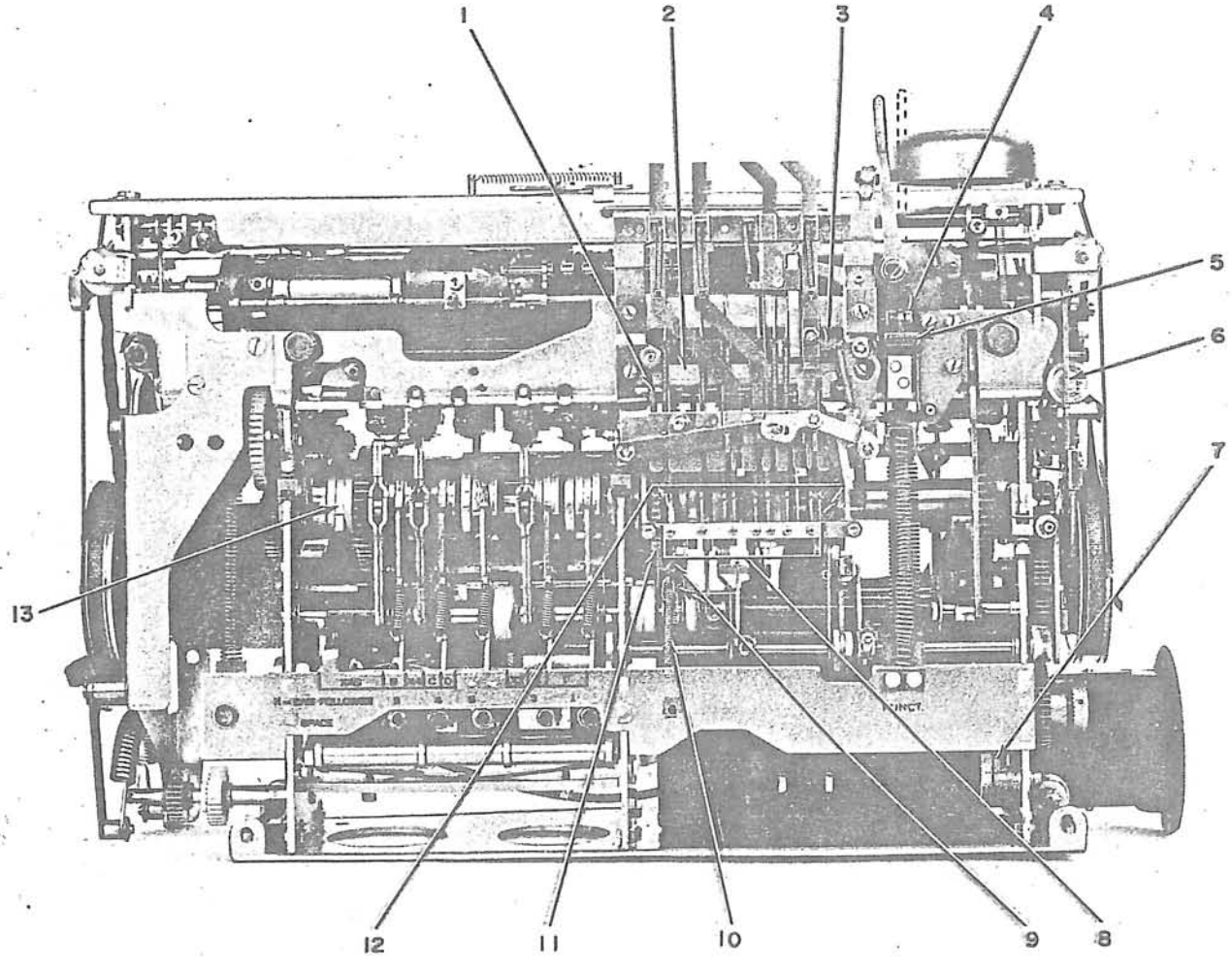


KEY	ITEM
1	Rotary Detent Actuator
2	Index Link
3	Hammer Cable (Green)
4	Advance Feed Pawl
5	Advance Drum

Figure 5-1. Scheduled Maintenance (Right Side View of Printer)

SCHEDULED MAINTENANCE (Cont)

PART NAME	3 WEEK AREA TO CHECK	INDICATION THAT REPLACEMENT PROCEDURE IS NECESSARY
Motor pinion and first reduction gear (7, Figure 5-2)(located within housing)	Teeth of pinion and first Reduction Gear, where they engage.	Excessively worn teeth resulting in abnormal noise when operating.
Hammer face (7, Figure 5-3)	Bond between hammer face and hammer assembly.	Separation of rubber between hammer face and hammer assembly.
Index link (2, Figure 5-1)	Index Link bearings.	Worn index link bearings are indicated by excessive movement of the index link or inability to maintain 0.010 inch clearance between the rotary detent pin and the tips of index wheel.
Rotary detent actuator (1, Figure 5-1)	Actuator bearing.	Check bearing for wear, indicated by excessive side movement or end play of the actuator.
Contact block assembly	Contact points in contact block (located in chassis).	Check contacts for wear. Check self-shorting contact for continuity when keyboard is removed. Check continuity on leads wired to the contact.
Master pulsing contacts	Contacts located in keyboard actuated by master pulsing cam follower.	Contacts worn or bent to a point where keyboard output is not accepted by the printer and range is less than 70 points, when keyboard is checked with a printer of known range capability.
Keyboard pulsing contacts	Contacts located in keyboard actuated by pulsing cam followers.	Gap between contacts cannot be maintained due to metal fatigue in contact leaves.
Lateral and Rotary Positioning. Lateral belts, hammer, rotary, and return cables. Ribbon feed drive shaft bearing.	Check near pulleys and clamping areas. Ribbon Feed Drive Shaft Bracket.	Worn, frayed or cut sections of belts or cables. Worn or loose.
All screws, springs and retaining rings.	Screw heads and threads; spring loops and main body; retaining rings.	Check screws for damaged threads and heads, spring loops and main body for damage or distortion; retaining rings for secure positioning.
6 WEEK CYCLE		
	6 WEEK AREA TO CHECK	
Special function bar screws (Delrin)(3, Figure 5-2)	Screw Heads (white) holding function bar to function section.	Replace every 1500 hours.
Function clutch release spring (10, Figure 5-2)	Spring loops and/or main spring body.	Functions are repeated. Inability to select functions. Check for distortion of spring loops and/or main spring body.

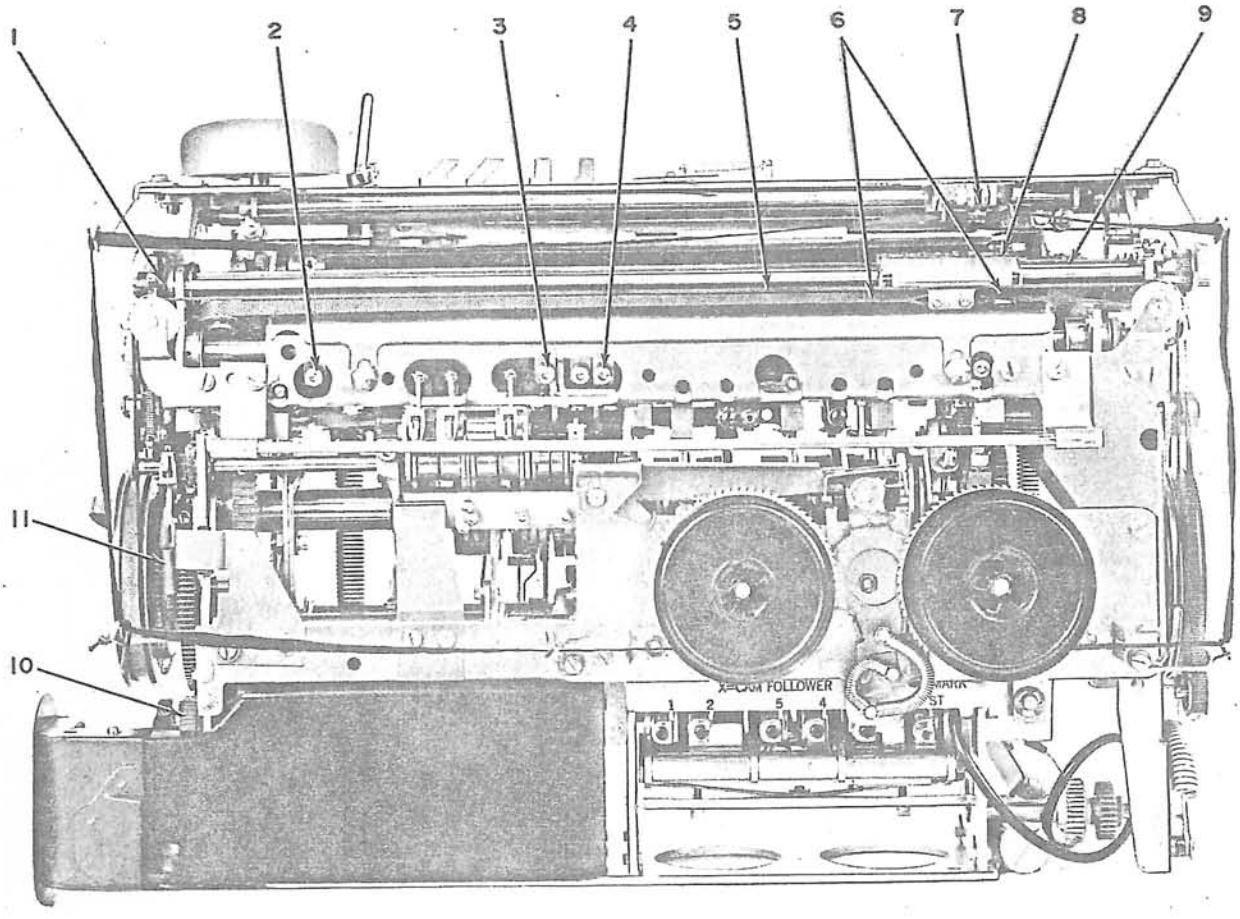


KEY	ITEM
1	Print Prevent Arm
2	Sensing Finger Stop Strip
3	Function Bar
4	Function Lever Assembly
5	Spring Yoke and Retaining Plate
6	Check Pawl
7	Motor Pinion First Reduction Gear Housing
8	Print Prevent Bail Screws
9	Function Timing Cam and Cam Follower
10	Function Clutch Release Spring
11	Print Function Clutch
12	Function Sensing Fingers
13	Start Clutch

Figure 5-2. Scheduled Maintenance (Bottom View of Printer)

SCHEDULED MAINTENANCE (Cont)

PART NAME	6 WEEK AREA TO CHECK	INDICATION THAT REPLACEMENT PROCEDURE IS NECESSARY
Check pawl (6, Figure 5-2)	Tip (where pawl engages ratchet).	Rounded tip, check pawl does not hold ratchet when advanced by feed pawl. Motor shut-down time excessive.
Function timing cam and cam follower (9, Figure 5-2)	Check cam surface (point of cam drop off) and tip of cam follower.	Worn cam surface (at drop off point) or cam follower tip. Functions or characters are selected more than once or not selected at all.
Spring yoke (print and function spring) (5, Figure 5-2)	Rubber pad on spring yoke and yoke bearings.	Separation of rubber pad on bottom of yoke from yoke main body, worn bearings, and loose fitting clevis pins resulting in excessive vibration during operation.
Print prevent arm (1, Figure 5-2)	Tip (point of contact with the step in the print prevent bail).	Rounded tip, no print prevent (intermittent printing of functions) during function selection.
Print prevent bail screws (8, Figure 5-2)	Check bail screws on the print prevent bail.	Check for stripped bail screws, will not retain correct adjustment, printing is not prevented during function selection.
Print cylinder and print cylinder shaft, (8, 9, Figure 5-3)	End plugs of print cylinder, surface of print cylinder shaft, and individual strips.	Worn print cylinder end plugs, resulting in excessive end play and poor rotary positioning. Worn or damaged print cylinder shaft resulting in poor carriage return or lateral positioning (printed copy). Damaged print strap results in poor printed copy.
Lateral and Rotary Positioning. Lateral belts, hammer rotary and return cables.	Check near pulleys and clamping areas.	Worn, frayed or cut sections of belts and cables.
All screws, springs and retaining rings.	Screw heads and threads; spring loops and main body; retaining rings.	Check screws for damaged threads and heads, spring loops and main body for damage or distortion; retaining rings for secure positioning.
9 WEEK CYCLE		
	9 WEEK AREA TO CHECK	
Speed change gear (10, Figure 5-3)	Teeth of speed change gear.	Check for worn or damaged teeth.
Start clutch (13, Figure 5-2)	Cam surface, carbide inserts (above jamming rollers).	Cam surface worn, carbide inserts dislodged from clutch housing, start clutch will not rotate (release).
Print-function clutch (11, Figure 5-2)	Print-function clutch cams, carbide inserts.	Cam surfaces worn, carbide inserts dislodged from clutch housing, clutch jammed, rotates continuously or will not engage.



KEY	ITEM
1	Rotary Cable
2	Lifter Arm Clamp Screw
3	Function Cam Follower Clamp Screw
4	Print Cam Follower Clamp Screw
5	Return Cable
6	Lateral Belt
7	Hammer Face
8	Print Cylinder
9	Print Cylinder Shaft
10	Speed Change Gear
11	Bounce Prevent Lever

Figure 5-3. Scheduled Maintenance (Top View of Printer)

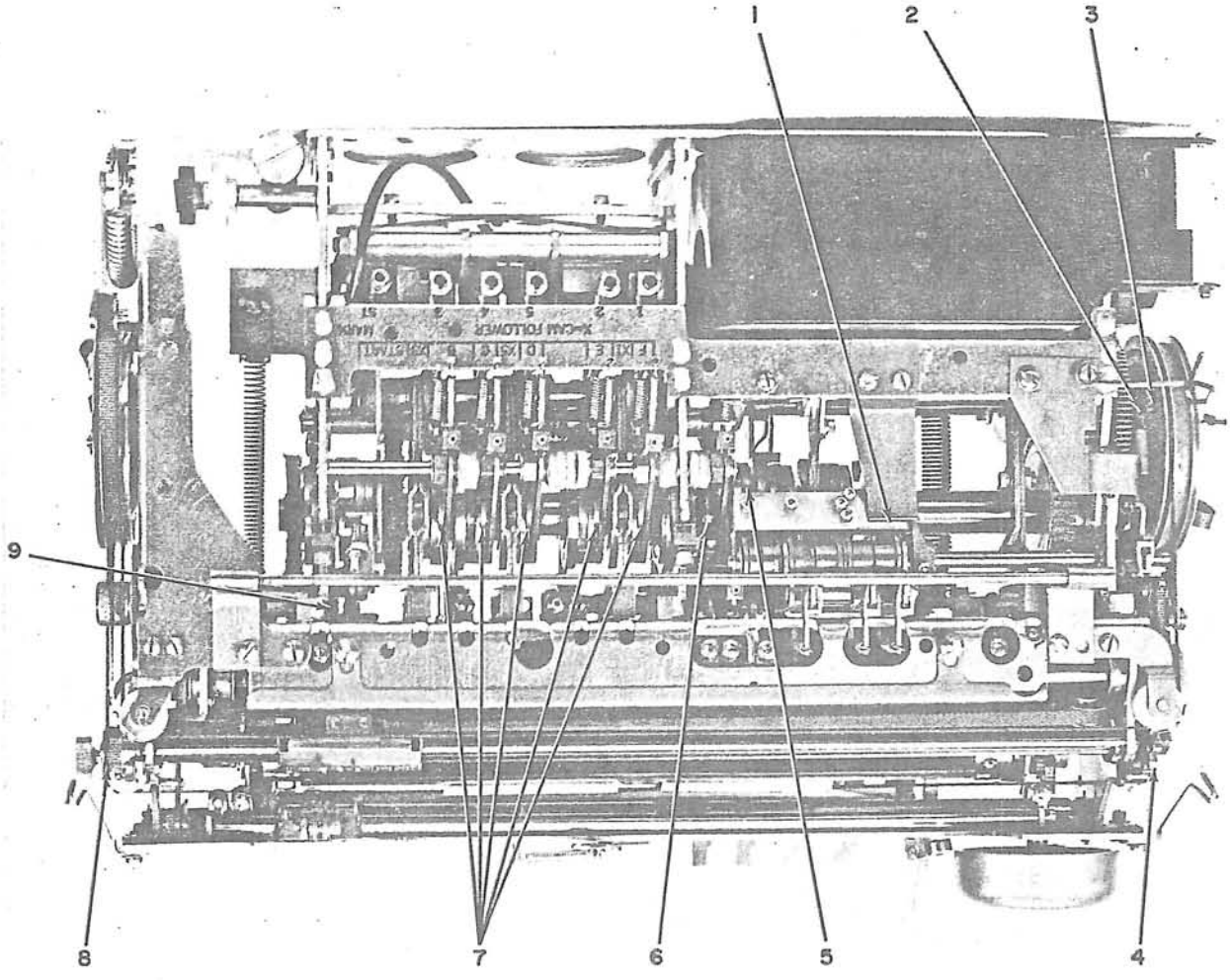
SCHEDULED MAINTENANCE (Cont)

PART NAME	9 WEEK AREA TO CHECK	INDICATION THAT REPLACEMENT PROCEDURE IS NECESSARY
Print and function cam followers (4, 3, Figure 5-3)	Check carbide cam follower tips at point of contact with their respective cams.	Check for excessive wear on cam followers and their respective cams. Normally when a cam follower is replaced the clutch on which it rides should also be replaced.
Function bar (3, Figure 5-2)	Leading edge of function bar, fit of function bar guide pins.	Worn leading edge on function bar, loose fit of function bar on guide pins.
Function lever assembly (4, Figure 5-2)	Oilite bearings and pins in function lever assembly.	Worn Oilite bearings and guide pins in function lever assembly. The function bar will usually show signs of wear when above conditions are present.
Lifter arm (2, Figure 5-3)	Lifter arm clamp and point of contact (tip of lifter arm) with slot in function lever assembly.	Lifter arm clamp does not hold function shaft, no function selection. Worn tip of lifter arm permits excessive lateral movement of the function lever assembly.
Bounce prevent lever (11, Figure 5-3)	Check first tooth and clamp of bounce lever.	Worn first tooth and/or clamp on bounce lever results in continuous automatic carriage return and line feed after printing a few characters on the line.
Lateral belts; hammer, rotary, and return cables (6, 1, 5, Figure 5-3)	Check belt and cables near pulleys.	Worn, frayed, or cut sections of belt or cables.
Sensing finger stop strip (2, Figure 5-2)	Check inner surface of stop strip (top).	Grooves worn in inner surface of stop strip or stop strip bent from jammed sensing fingers.
U Bars and sensing fingers (12, Figure 5-2)	Pin holding sensing finger to U bar.	Pin holding sensing finger to U bar is worn resulting in excess play and non-selection of functions.
All screws, springs and retaining rings.	Screw heads and threads; spring loop main spring body, and retaining rings.	Check screw heads for damage, threads for distortion, spring loops and main spring body for damage or distortion, retaining rings for security.

e. LUBRICATION. - The normal lubrication interval for Teleprinter Sets AN/UGC-38 and AN/UGC-40 and Teletypewriter Set AN/UGC-41 is 500 hours (3 weeks). If, however, a unit is operated under high temperature and high humidity conditions, the lubrication interval should be shortened to 250 hours (approximately 1-1/2 weeks). Non-fluid Oil (FSN 5815-869-9148), MITE Corporation Part Number 34304, is used on all parts except the gear train and the tips of the cam followers. The gear train and cam follower tips are lubricated with grease, (MITE Corporation Part Number 5041-1) MIL-G-3278A. Refer to Table 5-9, and Figures 5-4 through 5-10, Lubrication Instructions, for the teletypewriter and teleprinter sets.

TABLE 5-9. LUBRICATION INSTRUCTIONS

FIGURE & INDEX NO.	LUBRICATION POINT	SPECIAL INTERVAL	PERIODIC INTERVALS		
		ANY REASSEMBLY	EVERY WEEK	EVERY 3 WEEKS	EVERY 6 WEEKS
	O = Oil, Non-fluid, MITE P/N 34304, 1N 5815-869-9148 G = Grease, MITE P/N 05041-0001				
	PRINTER ASSEMBLY				
4, Figure 5-4	Index wheel	G	G		
3, Figure 5-4	Advance ratchet	O		O	
5, Figure 5-5	Advance suppression latch (where character advance pawl contacts)	O	O		
7, Figure 5-5	Advance suppression latch eccentric bushing	O	O		
5, Figure 5-5	Advance prevent lever tab (where character advance pawl contacts)	O		O	
4, Figure 5-5	Carriage return lever and advance prevent lever tab (point of contact)	O		O	
1, Figure 5-5	Rotary detent pawl eccentric bushing	O	O		
8, 2, Figure 5-5	Bushings and pivots on link between rotary detent pawl and function shaft terminal lever	O	O		
9, Figure 5-5	Rotary detent pawl adjustment screw tip	O	O		
6, Figure 5-5	Check pawl tip	O	O		
3, Figure 5-5	Character advance pawl bushing	O	O		
2, Figure 5-4	V lever tab which meets pin in advance drum	O			O
7, 3, Figure 5-6	Bushings at both ends of V lever shaft	O			O
2, Figure 5-6	First character adjustment screw (contact point)	O		O	
	Right-hand and left-hand bearings	O		O	
8, Figure 5-4	Rotary motion spring retainer grip ring	O		O	
9, Figure 5-4	Range adjustment gear segment (on start clutch assembly)	O			O

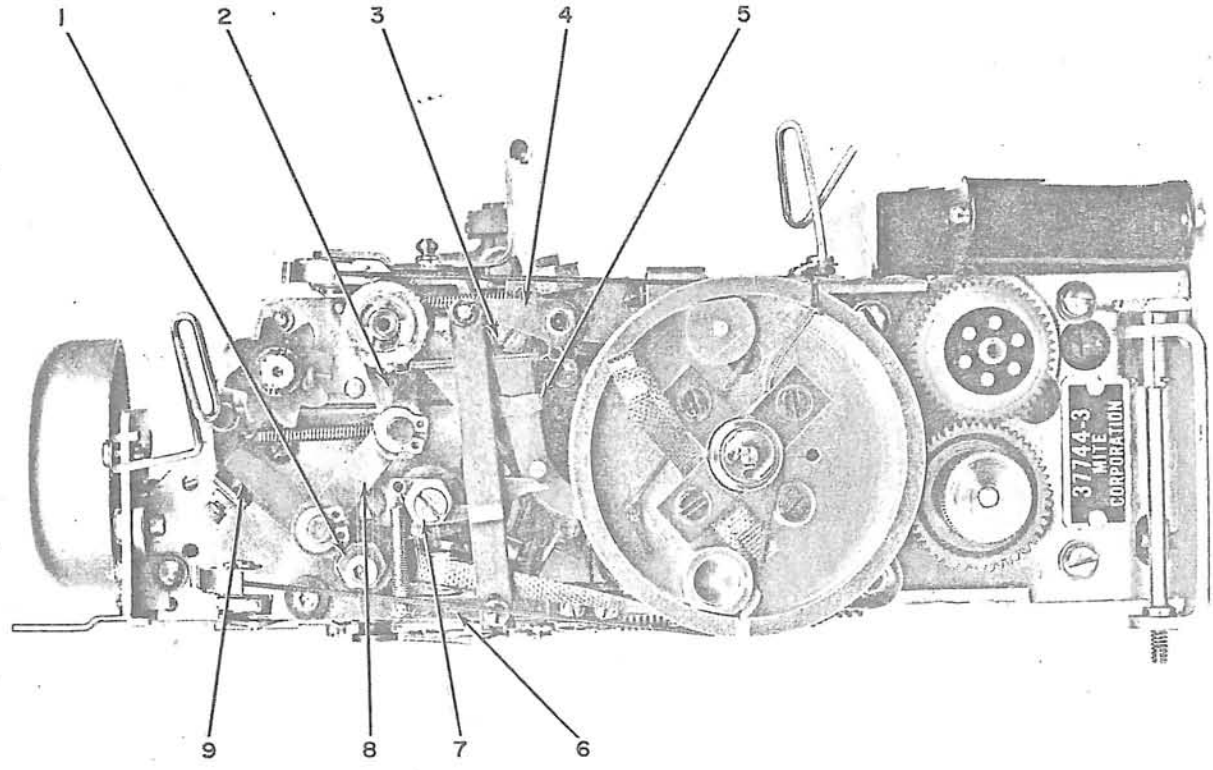


KEY	ITEM
1	Advance Prevent Stop Spring (point of contact with advance prevent bail)
2	V Lever Tab
3	Advance Ratchet
4	Index Wheel
5	Function Cam Follower
6	Print Cam Follower Tip
7	Clutch Release Finger and Cam Follower Surfaces
8	Rotary Motion Spring Retainer
9	Range Adjustment Gear Segment

Figure 5-4. Lubrication (Top View of Printer, Ribbon Assembly Removed)

TABLE 5-9. LUBRICATION INSTRUCTIONS (Cont)

FIGURE & INDEX NO.	LUBRICATION POINT	SPECIAL INTERVAL	PERIODIC INTERVALS		
		ANY REASSEMBLY	EVERY WEEK	EVERY 3 WEEKS	EVERY 6 WEEKS
	PRINTER ASSEMBLY (Cont)				
6, Figure 5-7	Print hammer actuator link guide bracket	G			G
3, Figure 5-7	Print hammer actuator link pivot	O	O		
5, Figure 5-7	Print shaft terminal lever (where it meets print hammer actuator link and print hammer release)	G	G		
4, Figure 5-7	Print hammer release bushing	O		O	
2, Figure 5-7	Takeup arm bushing	O	O		
6, Figure 5-6	Function clutch release arm bushings	O		O	
	All gears in equipment (except where noted)	G	G		
	All spring loops in equipment	O			O
1, Figure 5-7	Carriage return spiral spring	O			
7, Figure 5-7	Rotary motion spring	O			O
1, Figure 5-4	Advance prevent stop spring (where it engages bail)	O			O
1, Figure 5-6	Off-line function slide levers	O			O
6, Figure 5-4	Print cam follower tip	G			O
5, Figure 5-4	Function cam follower tip	G			O
7, Figure 5-4	Clutch release finger and cam follower surfaces	O			O
5, Figure 5-6	Lock lever eccentric bushing	O		O	
4, Figure 5-6	Lock lever tip	G			G
	KEYBOARD				
1, Figure 5-8	Keyboard cam wick	O		O	

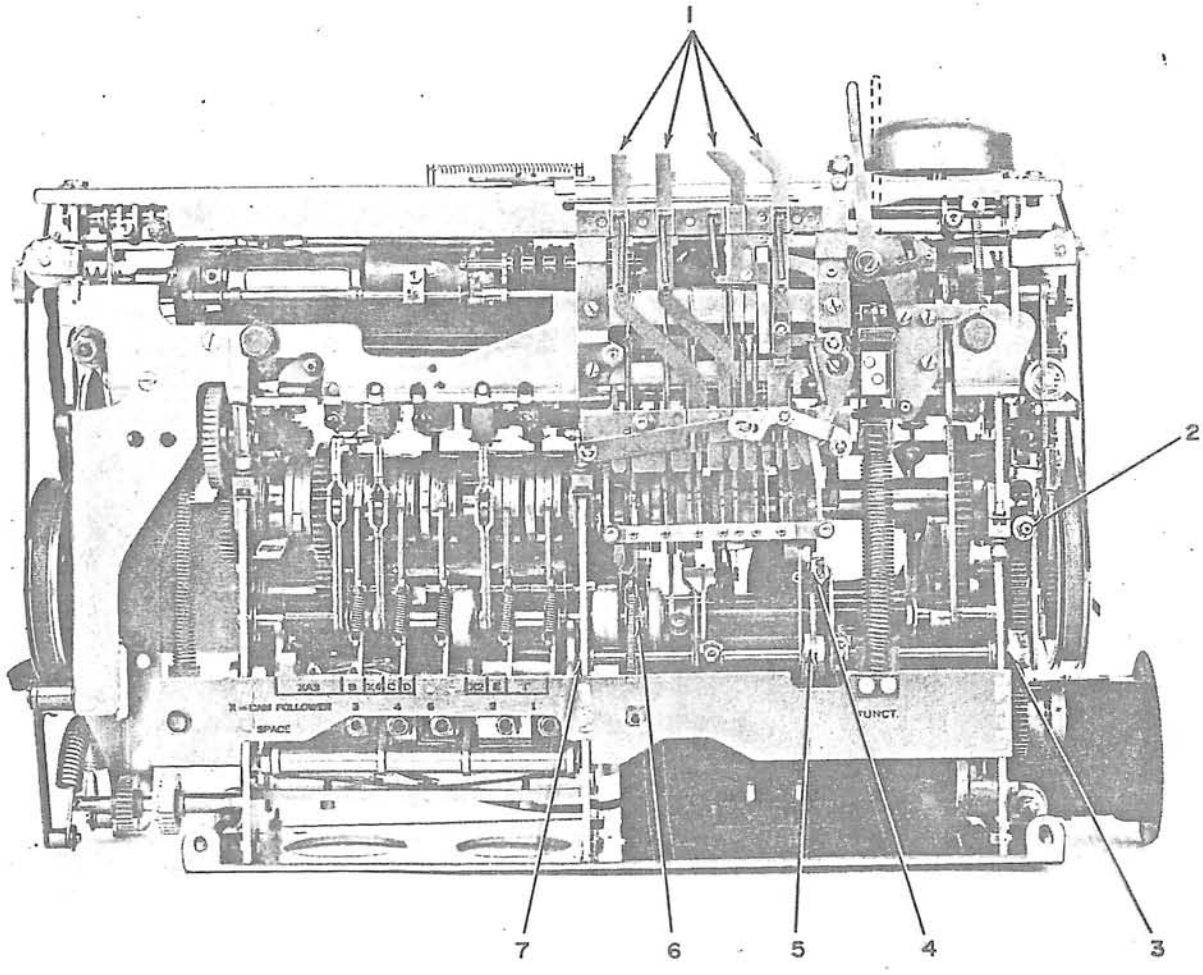


KEY	ITEM
1	Rotary Detent Pawl Eccentric Bushing
2	Function Shaft Terminal Lever
3	Character Advance Pawl Bushing
4	Carriage Return Lever and Advance Prevent Lever Tab (point of contact)
5	Advance Suppression Latch (where character advance pawl contacts)
6	Check Pawl Tip
7	Advance Suppression Latch Eccentric Bushing
8	Bushings and Pivots
9	Rotary Detent Pawl Adjustment Screw Tip

Figure 5-5. Lubrication (Right Side View of Printer)

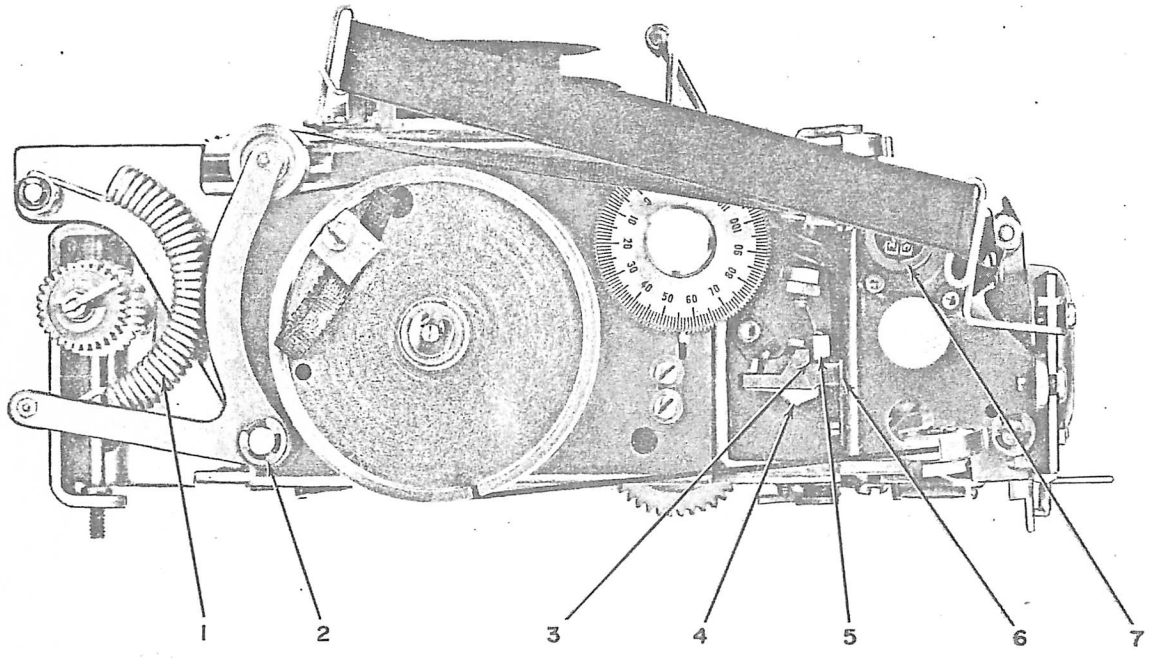
TABLE 5-9. LUBRICATION INSTRUCTIONS (Cont)

FIGURE & INDEX NO.	LUBRICATION POINT	SPECIAL INTERVAL	PERIODIC INTERVALS		
		ANY REASSEMBLY	EVERY WEEK	EVERY 3 WEEKS	EVERY 6 WEEKS
	KEYBOARD (Cont)				
4, Figure 5-8	Clutch rollers (within clutch)	O		O	
5, Figure 5-8	Clutch backstop surface	O		O	
2, Figure 5-8	Keyboard code bar prevent lever cam	O		O	
3, Figure 5-8	Clutch release cam	O		O	
7, Figure 5-8	Clutch release cam follower eccentric	O		O	
6, Figure 5-8	Clutch backstop bushing	O		O	
4, Figure 5-9	Pulsing finger bushings	O		O	
2, Figure 5-9	Key lever leaf springs (where they contact key levers)	O			O
5, Figure 5-9	Clutch release bail bearings	O		O	
1, 3, Figure 5-9	Repeat key shaft ends	O			O
5, Figure 5-8	Clutch backstop surfaces	O			O
	RIBBON FEED MECHANISM				
3, Figure 5-10	Check pawl pivot	O	O		
4, Figure 5-10	Feed pawl pivot	O	O		
6, Figure 5-10	Drive lever pivot	O	O		
5, Figure 5-10	Drive lever spring	O	O		
2, Figure 5-10	Check pawl spring loops	O	O		
1, Figure 5-10	Feed pawl spring loops	O	O		
8, Figure 5-10	Drive shaft bearings	O	O		
7, Figure 5-10	Feed cam	O	O		



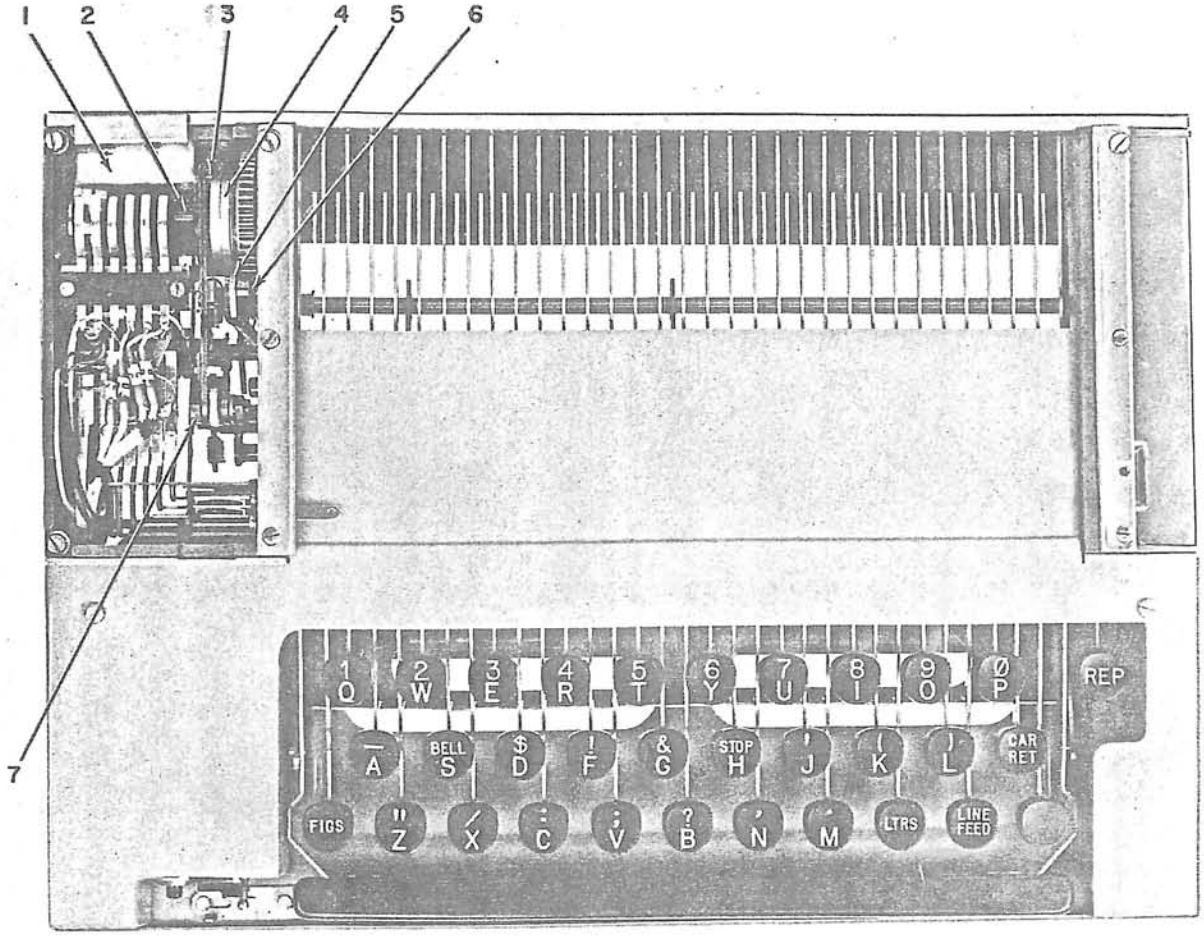
KEY	ITEM
1	Off-Line Function Slide Levers
2	First Character Adjustment Screw (contact point)
3	Bushings (at both ends of V Lever Shaft)
4	Lock Lever Tip
5	Lock Lever Eccentric Bushing
6	Function Clutch Release Arm Bushings
7	Bushings (at both ends of V Lever Shaft)

Figure 5-6. Lubrication (Bottom View of Printer)



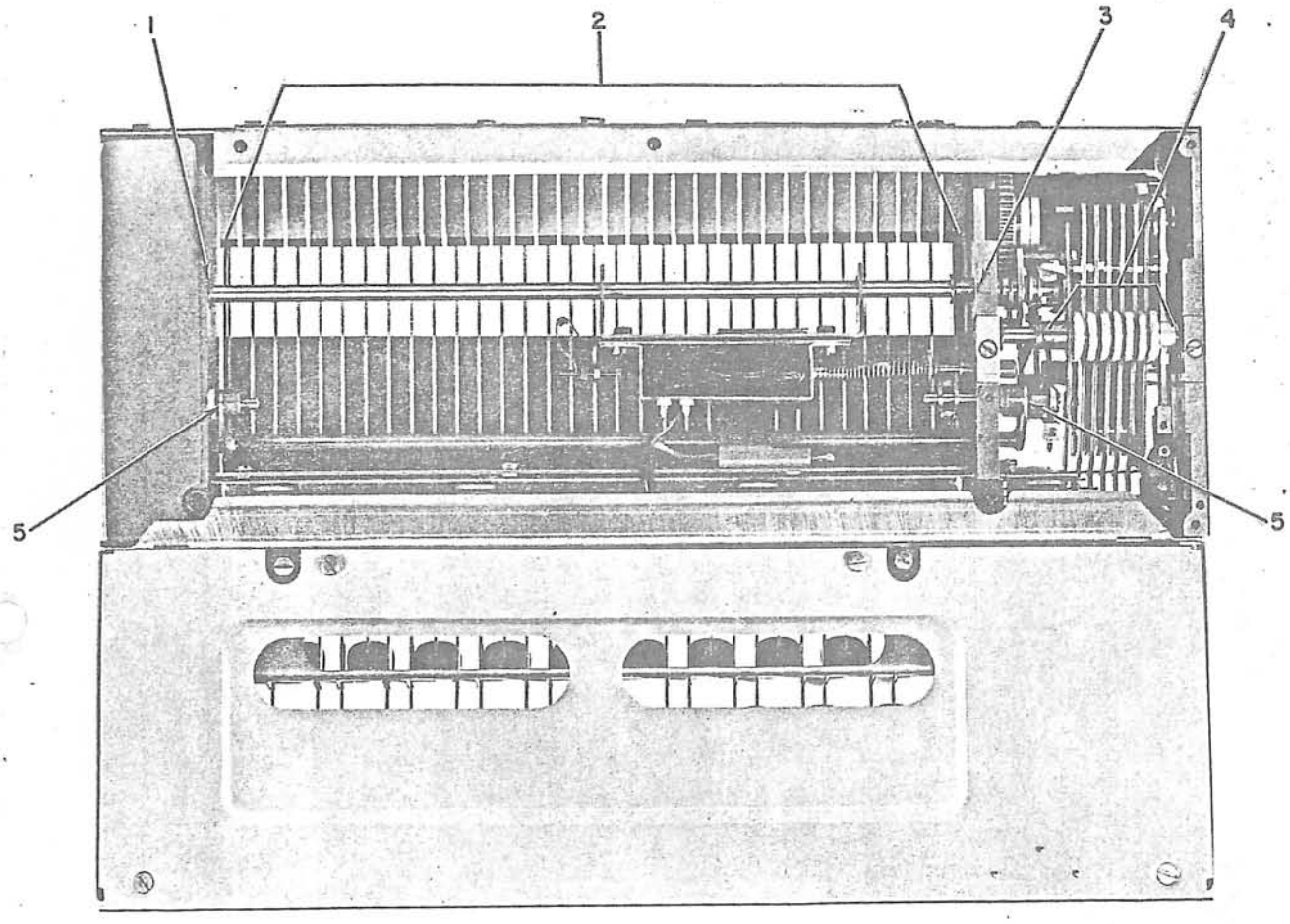
KEY	ITEM
1	Carriage Return Spiral Spring
2	Takeup Arm Bushing
3	Actuator Link Pivot
4	Release Bushing
5	Print Shaft Terminal Lever
6	Actuator Link Guide Bracket
7	Rotary Motion Spring

Figure 5-7. Lubrication (Left Side View of Printer)



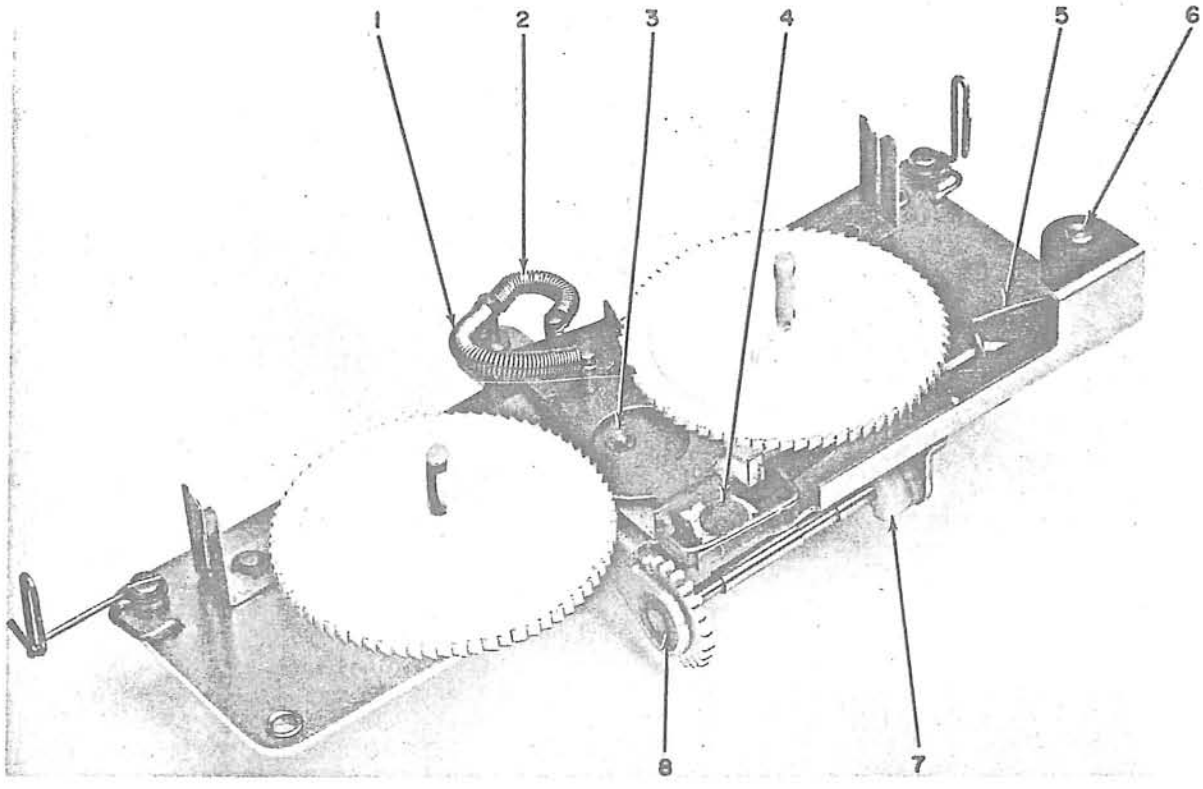
KEY	ITEM
1	Keyboard Cam Wick
2	Keyboard Code Bar Prevent Lever Cam
3	Clutch Release Cam
4	Clutch Cage (rollers inside)
5	Clutch Backstop Surface
6	Clutch Backstop Bushing
7	Clutch Release Cam Follower Eccentric Bushing

Figure 5-8. Lubrication (Top View of Keyboard)



KEY	ITEM
1	Repeat Key Shaft End
2	Key Lever Leaf Spring (where they contact key lever)
3	Repeat Key Shaft End
4	Pulsing Finger Bushings
5	Clutch Release Bail Bearing

Figure 5-9. Lubrication (Bottom View of Keyboard)



KEY	ITEM
1	Feed Pawl Spring Loops
2	Check Pawl Spring Loops
3	Check Pawl Pivot
4	Feed Pawl Pivot
5	Drive Lever Spring
6	Drive Lever Pivot
7	Feed Cam
8	Drive Shaft Bearings

Figure 5-10. Lubrication (Ribbon Feed Assembly)

f. ISOLATION OF PRINTER MALFUNCTIONS. - his section contains samples of printed copy from ·inters with known malfunctions. If your printer is arting to garble, type a series of "AM's", "RY's",)U's", and the message, "NOW IS THE TIME FOR LL GOOD MEN TO COME TO THE AID OF THEIR)UNTRY." Compare this typed material with the .mples that follow, noting exactly which one of the .mples corresponds to the material just typed. hen the correct sample is selected, follow the in- ructions given to correct the malfunction.

Each of these samples will have a series of notes, ch as; "only half a character appears to be printed". ıy particular attention to these notes as they will rve as a guide in recognizing the cause of printing alfunctions.

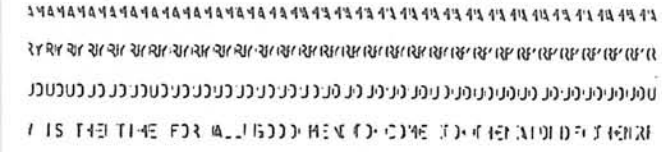
NOTE

A check of slide alignment in letters A should always be the first step in diagnosing printer malfunctions.

(1) HAMMER NOT ALIGNED PROPERLY. - Half nted character appears, but character spacing good. If hammer is misaligned, there will be no inting on functions; if there is printing on functions, fer to Paragraph 5-4f(2).

SAMPLE 1

HAMMER MISALIGNMENT



CAUSE: Hammer slipping on hammer cable.

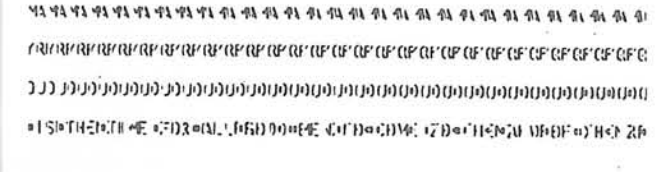
CORRECTION:

Step 1. Put the printer in letter "A" and check ımer alignment with the letter "A".
Step 2. With the printer in letter "A", loosen ımer cable on the advance drum.
ep 3. Reloop hammer cable around the tabs on ımer in the form of a figure eight, maintaining ımer alignment with the letter "A".
Step 4. Replace hammer cable under its clamp advance drum and tighten cable clamp.

(2) LATERAL SLIDE NOT ALIGNED PROPERLY LATERAL BELT STRETCHED. - Half characters appear to print over one another. When slide alignment is extreme, function characters will ıt with alpha-numeric characters.

SAMPLE 2

LATERAL SLIDE MISALIGNED OR LATERAL BELT STRETCHED



(a) LATERAL SLIDE

CAUSE: Lateral slide misaligned.

CORRECTION: Place the printer in the letters A, and realign the slides.

NOTE

If stroke is correct, but functions are being printed, check the rotary slide adjustment.

(b) LATERAL BELT

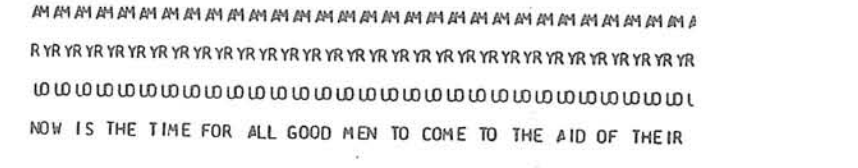
CAUSE: Lateral belt stretching.

CORRECTION: Perform the lateral function slide alignment and realign the hammer to the letter A.

(3) STROKE NOT ADJUSTED PROPERLY OR LATERAL BELT STRETCHED. - Uneven spacing between certain characters.

SAMPLE 3

LATERAL STROKE NOT ADJUSTED PROPERLY OR LATERAL BELT STRETCHED



(a) LATERAL STROKE

CAUSE: Lateral stroke screws loose or improperly adjusted.

CORRECTION: Check slide alignment in letters A. Perform lateral stroke adjustment.

(b) LATERAL BELT

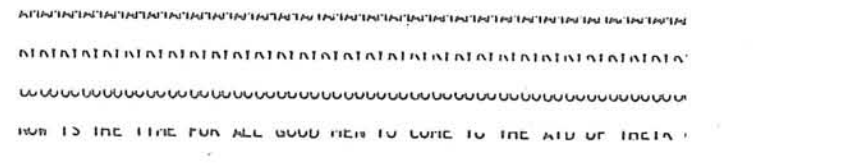
CAUSE: Lateral belt stretching.

CORRECTION: Check slide alignment in letters A, realign slides if necessary. Check lateral belt adjustments.

(4) HAMMER FACE NOT PROPERLY ALIGNED WITH CHARACTER STRIPS; ROTARY CABLE OR ROTARY DETENT PAWL IMPROPERLY ADJUSTED. - The upper or lower portion of the character may appear light or does not print.

SAMPLE 4

HAMMER FACE NOT PROPERLY ALIGNED



(a) HAMMER FACE

CAUSE: Hammer face on the hammer assembly not properly aligned to the cylinder or rotary cable not adjusted properly or distorted ribbon guide.

CORRECTION: Readjust hammer face, rotary cable, or form ribbon guide parallel to hammer face (should not hit paper guide).

(b) ROTARY CABLE

CAUSE: Rotary cable stretching.

CORRECTION: Check rotary cable adjustments.

(c) ROTARY DETENT PAWL

CAUSE: No index wheel clearance.

CORRECTION: Check rotary detent pawl adjustment.

5-4. LOGICAL TROUBLE SHOOTING.

The overall trouble shooting tables group the equipment as follows: Equipment Already In Use; Equipment of Unknown Condition; and Newly Installed Equipment. The technician chooses the category into which the defective equipment belongs and follows the step-by-step procedures of the applicable table. If the preliminary procedures as outlined do not isolate the malfunction, the technician is instructed to proceed to the System Trouble Shooting Chart which lists the most often encountered symptoms of trouble, together with probable causes and corrective actions.

The functional section trouble shooting tables list the most often encountered symptoms, their probable causes, and corrective actions. The corrective actions provide detailed directions to perform adjustments, make voltage and continuity checks, check for obvious damage, or check for incorrect switch settings.

To further assist in isolating malfunctions, both overall and detailed functional descriptions are provided, supported by functional block diagrams, servicing block diagrams, and simplified schematic diagrams.

Test points and significant waveforms are provided on both servicing block diagrams and parts location drawings for use with functional section trouble shooting tables.

The most rapid method of correcting a malfunction and getting the equipment back into operation is to replace entire defective units (keyboard, electronic module or transformer) with known good replacement units and then to perform the trouble shooting procedures on the defective unit. In this manner, the operating equipment will be subjected to minimum down time.

a. OVERALL TROUBLE SHOOTING.

WARNING

Voltages dangerous to life exist in the teletypewriter set. Use extreme caution when servicing this equipment.

(1) GENERAL. - The teletypewriter sets considered in this section have been grouped as follows: Equipment Already In Use; Equipment of Unknown Condition; and Newly Installed Equipment.

(a) EQUIPMENT ALREADY IN USE. - Equipment already in use comprises equipment that has previously performed satisfactorily and is now malfunctioning. Refer to Table 5-10 for preliminary checks and trouble-shooting instructions.

TABLE 5-10. PRELIMINARY CHECKS FOR EQUIPMENT ALREADY IN USE

STEP NO.	ACTION	PROCEDURE OR REFERENCE
1	Check for presence of primary power.	Remove service cable from primary power source; using Multimeter AN/PSM-4, check power source for correct primary power.
2	Check for presence of fuses; using Multimeter AN/PSM-4, check fuses for continuity.	Refer to Figure 2-1; replace defective fuses.
3	Check that option switching arrangement for operating mode being used is correct.	Refer to Paragraph 2-9.
4	Ensure that motor and selector cable connectors are secure in their chassis receptacles.	Tighten or repair loose or damaged connections.
5	Check keyboard and electrical chassis slip contacts for continuity and correct operation.	Tighten loose connections.

TABLE 5-10. PRELIMINARY CHECKS FOR EQUIPMENT ALREADY IN USE (Cont)

STEP NO.	ACTION	PROCEDURE OR REFERENCE
6	Check signal line current. (externally supplied)	Using Multimeter AN/PSM-4, check incoming signal line current: On Line, High Range 20 to 80 ma On Line, Low Range 2.5 to 10 ma
7	Check signal line distortion.	Check for minimum of 70 points of range, using range dial. Refer to Section 4 for a description of the types of distortion which may be encountered.
8	Proceed to Table 5-11 for trouble shooting procedures.	

(b) EQUIPMENT OF UNKNOWN CONDITION. - Equipment of unknown condition is not usable due to an undetermined fault. Refer to Table 5-11 for the trouble shooting procedure.

(c) NEWLY INSTALLED EQUIPMENT. - Newly installed equipment comprises equipment which has been installed but never operated. Perform all tests and adjustments in Section 2 and then proceed with the trouble shooting procedure in Table 5-12.

(2) TEST SETUP AND PRELIMINARY CHECKS. - Operate the machine by hand through any single operation. Check for broken or binding parts. If trouble is not apparent, proceed as follows:

Step 1. Switch the equipment for off-line local mode (Paragraph 2-9).

CAUTION

DO NOT CONNECT THE EQUIPMENT TO THE PRIMARY POWER SOURCE WITHOUT FIRST DETERMINING THAT THE TELETYPEWRITER SET IS COMPATIBLE WITH THE POWER SOURCE. REFER TO PARAGRAPH 2-6 FOR VERIFICATION INSTRUCTIONS.

Step 2. Connect signal and primary power cables to the electrical chassis receptacles.

Step 3. Set the SEND.REC/REC switch to the SEND.REC position.

Step 4. Set MOTOR and LAMP switches to ON position. Observe that copy lamps glow and motor runs; if either or both fail to energize, refer to Table 5-11 for trouble shooting instructions.

Step 5. Set the SEND.REC-REC switch to the REC position. If the machine runs open, trouble is in the keyboard. Deenergize the equipment, remove the keyboard and trouble shoot keyboard. (Refer to Table 5-13.)

Step 6. Disconnect the motor connector and depress the line shorting contacts while observing the motion of the armatures on the magnetic selector. If the armatures do not move, check for any mechanical blocking or binding. If there are no mechanical defects, the trouble is electrical; refer to Table 5-11 for further instructions.

A trouble shooting flow chart, Figure 5-11, is provided for quickly isolating troubles in a systematic manner. Choose one of the symptoms in the top row and follow the indicated procedure. If trouble persists, refer to Table 5-11 for further procedures.

(3) SYSTEM TROUBLE SHOOTING PROCEDURE.- Table 5-12 provides the trouble shooting procedure for isolating the particular functional section (send, receive, or power supply and distribution) at fault. Refer to Figure 5-12 for the primary power distribution diagram. Refer to Section 5 for overall wiring, schematic, and block diagrams; for removal, disassembly, adjustment, or reassembly procedures; and for parts location information.

TABLE 5-11. PRELIMINARY CHECKS FOR EQUIPMENT OF UNKNOWN CONDITION

STEP NO.	ACTION	PROCEDURE OR REFERENCE
1	Perform thorough visual inspection; check for missing or damaged components and security of all connectors. Check belt and cables for wear and proper threading.	Refer to Section 1 for general overall illustrations of the complete equipment. Refer to Section 5 for belt and cable threading instructions.
2	Determine the type of primary power required and connect the teletypewriter set to the applicable primary power source.	Refer to Paragraph 2-8b.
3	Perform all checks of Table 5-10.	

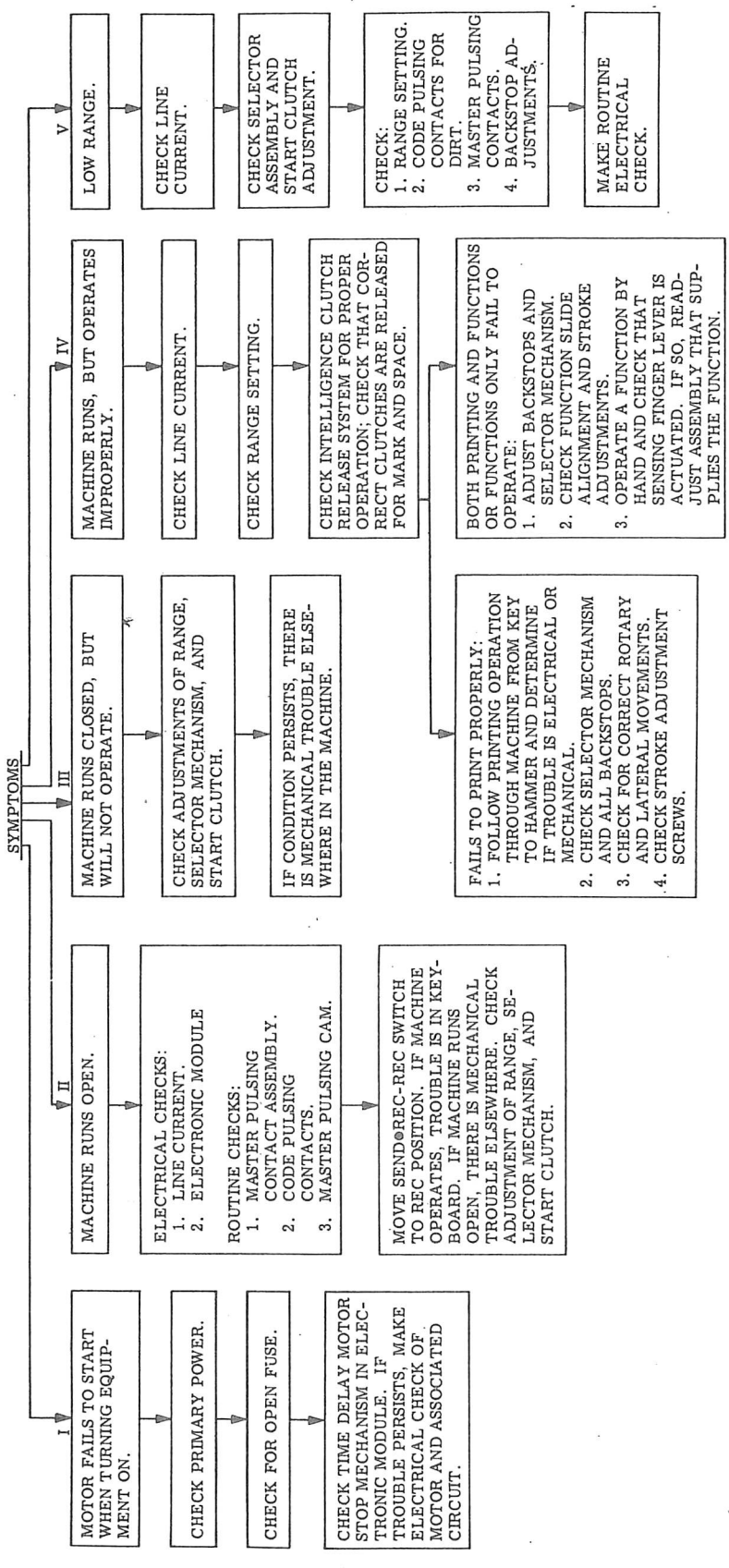


Figure 5-11. Trouble Shooting Flow Chart

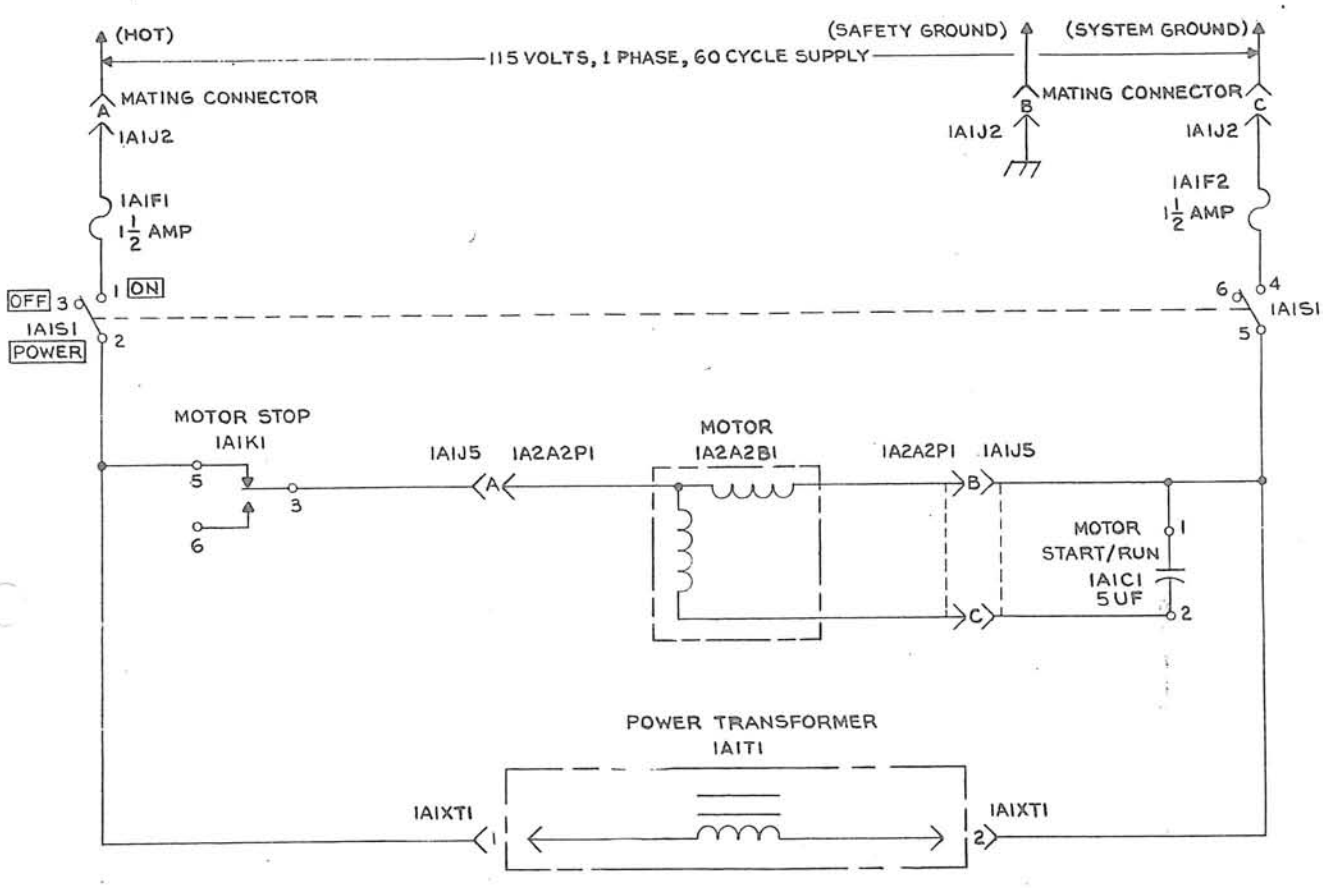


Figure 5-12. Alternating Current Primary Power Distribution, Simplified Diagram

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Prior to using this chart, perform the test setup of Paragraph 5-4a(2)	
1. Both motor and copy lights inoperative	Defective main fuse, 1A1F1 or 1A1F2	Replace fuse or fuses.
	Defective MOTOR switch	Replace switch.
	Open or shorted wire(s)	Perform continuity check using Figure 5-12 and Multimeter AN/PSM-4 or equivalent. Replace or solder broken or shorted wire.
2. Motor inoperative (copy lights operative)	Broken or bent connector pin	Replace connector assembly.
	Faulty motor	Replace motor. Perform continuity check between power leads and chassis. See Figure 5-2. Replace or solder broken or shorted wire(s).

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Motor inoperative; slight movement of gears when MOTOR switch is turned on	Faulty starting capacitator 1A1C1 (one side open or shorted)	Test for shorted or open condition. Replace if defective
		Motor stop relay 1A1K1 continuously energized due to defective time delay motor stop, line sensor, or switch 1A1S5	Repair or replace defective parts; refer to Table 5-14 for line sensor trouble shooting procedures
		Defective motor stop circuit in line sensor	Refer to Table 5-14
3.	Copy lights inoperative	Faulty LAMP switch 1A1S2	Replace switch
		Faulty bulb(s)	Replace bulb(s)
		Open wire or connection	Perform continuity checks
		Transformer 1A1T1 defective	Replace transformer
4.	Motor will not stop after 60 seconds inactivity (no mark to space transition)	Time delay motor stop defective	Refer to Table 5-14
		Defective MOTOR STOP ENABLE-DISABLE switch	Refer to Table 5-14
		Defective motor stop relay 1A1K1	Replace relay (45, Figure 5-104)
		Defective line sensor in electronic module	Refer to Table 5-14 for line sensor trouble shooting
		Open wire or connection	Perform continuity checks in motor stop circuit
5.	Motor speed fluctuates	Input power (voltage or frequency) variations	Check primary power
		Binding component in printer	Check clutches, gears, cams, and linkages for free movement; if necessary lubricate parts according to Table 5-9
6.	Printer runs open	Defective line sensor in electronic module	Refer to Table 5-14
		Faulty start clutch or clutch release finger adjustment	Adjust according to Paragraph 5-5e(5)
		No mark signal being transmitted	Check for signal line current and/or remote operator
		Signal loop open	Rotary mode switch not correctly positioned for operating mode. Position correctly as instructed in Paragraph 2-9

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Faulty contact on contact block 1A1E8	Replace contact block
	Defective line sensor in electronic module	Refer to Table 5-14
	Open wire(s)	Perform continuity check on signal line
	Open signal line in service cable	Perform continuity checks on service cable
7. Printer runs closed but does not print	Printer improperly switched for mode of operation	Refer to mode switching instructions in Paragraph 2-9
	Poor solder connections on patch cords	Resolder patch cords
	Defective line sensor in electronic module	Refer to Table 5-14
	Start clutch not releasing	Adjust start clutch as instructed in Paragraph 5-5e(5)
	Selector improperly adjusted or faulty	Adjust selector as instructed in Paragraph 5-5e(17) or replace selector
8. Teletypewriter set prints garbled message	Range dial out of adjustment	Adjust as instructed in Paragraph 2-8e(2)
	Incorrect speed gear installed	Install correct speed gear as instructed in Paragraph 2-11
	Line current at improper value or distorted	Readjust; trace source of distortion
	Selector improperly adjusted	Adjust selector as instructed in Paragraph 5-5e(17)
	Defective line sensor in electronic module	Refer to Table 5-14
	Start clutch improperly adjusted	Adjust as instructed in Paragraph 5-5e(5)
	Loose selector bar (5, Figure 5-89, Appendix)	Tighten selector bar screws
	Defective clutch	Check all clutches for operation by sending RYRY (all clutches should release) Replace defective clutch
	Timing marks on timing cam shaft gear and start clutch gear (Figure 4-11)	Align three dots on start clutch gear with two dots on timing cam shaft gear (∴). Refer to reassembly procedure Paragraph 5-5ab

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Dirty print cylinder shaft	Clean print cylinder shaft
	Function slides out of adjustment and random functions are selected	Perform function slide and stroke adjustments (Paragraph 5-5e(3)b, 5-5e(4)b, 5-5(18)a and b.
	Rotary spring broken	Replace spring (Figure 5-33)
9. Depressing any key does not produce output signal	SEND.REC-REC switch in REC position	Place switch in SEND.REC position
	Printer not seated correctly on electrical chassis	Position printer correctly
	Master pulsing contacts out of adjustment	Readjust on local mode (Paragraph 5-5e(24)(j)
	Keyboard slip connector contactor-contact 1A9E1 defective	Repair or replace contact
	Keyboard not in right operating position	Pull keyboard out to correct position
	Keyboard clutch release finger does not clear tab (Figure 4-5)	Adjust according to Paragraph 5-5e(24)b
	Keyboard drive gear stripped	Replace gear
	Incorrect rotary mode switch position	Set rotary mode switch to position for mode of operation desired
	Defective keyboard	Refer to Table 5-12
10. Printer prints copy received from remote station but not from local keyboard	SEND.REC-REC switch 1A4S3 defective or in REC position	Replace switch or set to SEND.REC position
	Keyboard filter 1A4FL1 open or shorted	Replace filter
	Incorrect mode switch position	Switch to off line operation in order to print (Paragraph 2-9)
	Open wire of connection	Perform continuity check
	Contact block 1A1E8 (AN/UGC-41, only)	Replace contact block
	Keyboard clutch not engaged	Engage clutch
	Master pulsing contacts out of adjustment	Readjust contacts (Paragraph 5-5e(24)(j)

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
11. No printing; selection taking place	Print and function clutch not operating correctly	Check clutch for correct operation; repair or replace if necessary
	Print prevent adjustment incorrect	Adjust according to Paragraph 5-5e(19)
	Print hammer actuating adjustment incorrect	Adjust according to Paragraph 5-5e(15 and 16)
	Defective print hammer actuator link helical spring (32, Figure 5-95, Appendix)	Replace spring
	Defective print helical spring (18, Figure 5-92, Appendix)	Replace spring
	Defective print cam follower (35, Figure 5-93, Appendix)	Adjust, repair or replace
12. No function selection; printing taking place	Broken function lever lifter arm screw or function cam follower screw (54 and 85, Figure 5-97, Appendix)	Drill out broken portion and replace with stainless steel screw
	Function bar is not set high enough to clear sensing finger levers on high side of function cam	Adjust function lever lifter arm or entire function section (Paragraph 5-5e(b)(c)
13. Printing on function	Print prevent adjustment screws improperly adjusted (45, Figure 5-99, Appendix)	Adjust according to Paragraph 5-5e(19)
	Print prevent rod lever worn (48, Figure 5-99, Appendix)	Replace with stellite-tipped part
	Print prevent arm worn or out of adjustment (34, Figure 5-93, Appendix)	Adjust arm or replace if defective (Paragraph 5-5e(19)
	Defective print prevent rod actuator arm bias spring (38, Figure 5-99, Appendix)	Replace spring
	Incorrect stroke adjustment	Adjust according to Paragraph 5-5e(18)
14. Printing on space	Function slides out of adjustment (59, Figure 5-99, Appendix)	Adjust according to Paragraphs 5-5e(3)(b) and 5-5e(4)(b)
	Function bar out of adjustment (83, Figure 5-97, Appendix)	Adjust according to Paragraph 5-5e(6)(b)
	Broken function backstop clutch release arm return helical spring (12, Figure 5-99, Appendix)	Replace spring
	Space print prevent adjustment screw incorrectly adjusted (45, Figure 5-99, Appendix)	Adjust according to Paragraph 5-5e(19)

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
15. Functions during printing	Function bar adjustment incorrect	Adjust according to Paragraph 5-5e(6)(b)
	Function slides out of adjustment	Adjust according to Paragraphs 5-5e(3)(b) and 5-5e(4)(b)
16. Occasional misprint	Range dial out of adjustment	Adjust according to Paragraph 2-8d(2)
	Signal line distortion	Check for maximum of 30 per cent distortion.
	Defective rotary detent pawl (49, Figure 5-97, Appendix)	Repair or replace pawl
	One or more type positioning clutches not functioning correctly	Check for correct
	Start clutch release adjustment incorrect	Adjust according to Paragraph 5-5e(5)
	Selector adjustment incorrect	Adjust according to Paragraph 5-5e(17)
	Selector armatures binding on pole pieces (Figure 5-89, Appendix)	Check and remove cause of binding.
	Incorrect externally supplied signal line current	Using Multimeter AN/PSM-4, check for 60 ma on high range or 5 ma on low range.
	Defective electronic module	Refer to Table 5-14
	Dirty print cylinder shaft (Figure 5-95, Appendix)	Clean shaft
	Defective clutch release finger	Repair or replace finger
17. Printing too lightly	Defective or twisted ribbon	If defective, replace ribbon according to Paragraph 3-3e(2). If twisting or folding correct by repositioning the ribbon guides to follow the ribbon action.
	Print hammer face pad damaged (20, Figure 5-95, Appendix)	Replace pad
18. Uneven spacing between characters	Dirty print cylinder shaft (17, Figure 5-95, Appendix)	Clean shaft
	Incorrect stroke adjustment	Adjust according to Paragraph 5-5e(18)(a) and (b)
	Loose frame clamps (1, 2, and 9, Figure 5-83, Appendix) (1, 4, and 9, Figure 5-84, Appendix)	Tighten all loose frame clamps

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
19. Print hammer hitting only half of character	Function slides out of adjustment	Adjust according to Paragraphs 5-5e(3)(b) and 5-5e(4)(b)
	Print hammer and print cylinder out of alignment	Adjust according to Paragraph 5-5e(14)
	Cables and belt not running on their pulleys	Check that cables and belt are installed as shown in Figure 4-13
20. Printing only top or bottom of characters	Rotary function slide out of adjustment	Adjust according to Paragraph 5-5e(3)(b)
	Rotary adjustment incorrect	Perform all rotary adjustments in Paragraph 5-5e(3)
	Clearance between rotary detent pawl pin and index wheel incorrect (Figure 5-44)	Adjust according to Paragraph 5-5e(7)
	Broken rotary detent pawl spring on detent arm (56, Figure 5-97, Appendix)	Replace spring
	Print cylinder shaft binding	Check and remove cause of binding
	Defective print hammer face pad	Replace pad
21. No carriage advance	Check pawl out of adjustment	Adjust according to Paragraph 5-5e(8)
	Carriage return lock lever not dropping out of carriage return cam follower	Adjust according to Paragraph 5-5e(9)(a)
	Random advance prevention function selected	Adjust function slides according to Paragraphs 5-5e(3)(b) and 5-5e(4)(b)
	Broken or damaged character advance pawl or check pawl springs (35 and 57, Figure 5-97, Appendix)	Check springs and replace defective units
	Character advance pawl, check pawl, or advance ratchet worn (32, 60, and 8, Figure 5-97, Appendix)	Check for wear and replace if necessary
22. No line feed	Refer to first two entries of Symptom 15	Refer to Symptom 15
	Line feed actuator cam follower arm out of adjustment (44, Figure 5-91, Appendix)	Readjust according to Paragraph 5-5e(13)
	Paper pressure release lever in RELEASE position	Move lever to forward LOCK position
	Paper supply roll not rotating freely on electrical chassis	Check installation of paper supply roll and tension on dancer roll tube

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Function shaft out of adjustment	Adjust according to Paragraph 5-5e(6)(c)
	Pressure roll not clamping paper (12 and 15, Figure 5-96, Appendix)	Check for damaged pressure roll springs or binding pressure roll shaft
	Dirty paper feed rubber roll	Clean roll
	Line feed clutch not operating (9, Figure 5-86, Appendix)	Check for defect and repair or replace
23. No carriage return	Refer to first two entries of Symptom 15	Refer to Symptom 15
	Check pawl does not clear advance ratchet	Adjust according to Paragraph 5-5e(9)
	Carriage return spiral spring broken or disengaged (8, Figure 5-93, Appendix)	Replace or engage spring
24. No blank function	Refer to Symptom 15, and/or check blank print prevent adjustment screw	Refer to Symptom 15
25. No space function	Same as no carriage advance (Symptom 21)	Refer to Symptom 21
	Refer to first two entries of Symptom 15	Refer to Symptom 15
26. No letters function	Figures sensing finger lever stuck in function slide	Release lever
	Letters figures clutch not operating	Check clutch for proper operation
	Incorrect stroke adjustment	Adjust according to Paragraph 5-5e(18)(a) and (b)
	Rotary spring broken (28, Figure 5-95, Appendix)	Replace spring
27. No figures function	Letters sensing finger lever stuck in function slide (Symptom 26)	Refer to Symptom 26
28. No bell function	Refer to first two entries of Symptom 15 and 26	Refer to Symptoms 15 and 26
29. No lateral movement (Refer to Figure 4-13)	Jammed function slides	Release function slides
	Defective lateral tension helical spring	Replace spring
	Cables or belt not functioning	Inspect for fault and correct
30. No rotary movement	Defective rotary spring (28, Figure 5-95, Appendix)	Replace rotary spring
	Defective rotary cable	Replace rotary cable 5-5c(3)

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Rotary detent pawl adjustment incorrect	Adjust according to Paragraph 5-5e(7)
	Defective clutch	Check clutches for correct operation
31. No automatic carriage return and line feed	Incorrect adjustment	Adjust according to Paragraph 5-5e(9)(b)
32. Automatic carriage return but no line feed	Incorrect alignment of automatic carriage return and line feed sensing finger levers	Adjust automatic carriage return actuator eccentric and actuator arm according to Paragraph 5-5e(9)(b)
33. Carriage return after 4 or 5 characters from left side margin	Incorrect automatic carriage return adjustment	Adjust according to Paragraph 5-5e(9)(b)
	Bounce prevent lever not seating in teeth of V lever assembly	Adjust bounce prevent lever (Paragraph 5-5e(22)) or first character adjustment screw (Paragraph 5-5e(22))
34. Slow carriage return (Refer to Figure 4-19)	Dirty print cylinder shaft	Clean shaft
	Print hammer binding	Clean and remove cause of binding
	Cables may be tight (return cable) or damaged	Loosen or replace cables
	Number of turns on take-up drum insufficient; carriage return spiral eyelet (8, Figure 5-93, Appendix) not engaging tab on carriage return spring mounting cup (10)	Detach cables and lateral control belt; turn takeup drum counterclockwise two turns; install cables and belt; bend end of spiral spring to ensure that eyelet engages tab of cup
35. Advancing on advance prevent functions	Incorrect slide adjustment (will be printing and advancing on functions)	Adjust according to Paragraphs 5-5e(3)(b) and 5-5e(4)(b)
	Function advance prevent adjustment screws on advance prevent bail carriage return bar out of adjustment	Adjust according to Paragraph 5-5e(21)
36. Double line feed every time	Shift linkage on line feed (35, Figure 5-98, Appendix) not functioning	Locate and correct malfunction
	Carriage return too slow	Check for dirt on shafts
	Line feed adjustment incorrect	Adjust according to Paragraph 5-5e(13); make certain that the reference tooth (not the first tooth) on the line feed pawl is used when making this adjustment
	Cable adjustments incorrect	Adjust according to Paragraph 5-5e(3)(c)

TABLE 5-12. TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Incorrect number of turns on carriage return spiral spring (8, Figure 5-93, Appendix)	Takeup drum (carriage return spiral spring) should be loaded two or three turns counterclockwise prior to cable and belt replacement
37. No ribbon reversal	No eyelets in ribbon	Replace ribbon, or tie knots in ribbon on either end, Paragraph 3-3c(2)
	Ribbon improperly threaded	Install ribbon according to Paragraph 3-3c(2)
38. Unusual noise	Clutch backstops out of adjustment	Adjust backstops according to Paragraph 5-5e(1)
	Interference between motor fan and outlet duct assembly	Reposition motor to eliminate interference
	Binding component	Locate and correct
	Incorrect idler gear adjustment	Refer to Paragraph 2-11.
	Defective clutch backstop spring	Replace spring
	Gears require lubrication	Refer to Table 5-9
	Defective gear	Check all gears for damage; replace defective gears.
	Defective bearings on gears	Check and replace defective bearings
39. Teletypewriter Set is polarity sensitive	Defective bridge diode in line sensor in electronic module	Refer to Table 5-14, for line sensor trouble shooting
40. Continuous line feed	Automatic carriage return mechanism is jammed	Lift up printer, free line feed on carriage return mechanism and check springs
41. No automatic line feed on carriage return	Latch assembly not positioning under carriage return arm eccentric not adjusted properly	Readjust the line feed on carriage return mechanism and check springs. Refer to Paragraph 5-5e(10)
42. Occasional line feed on carriage return	Same as Symptom 41	Same as Symptom 41
43. Line feed is supplied when off-line carriage return control is actuated	Adjustable slide is not pivoting the cancellation lever and latch assembly out of the way of carriage return arm	Readjust the adjustable slide. Refer to Paragraph 5-5e(10)
44. No automatic line feed on carriage return	Jammed assembly, assembly spring hooked to disable post, or defective spring	Free assembly, reposition and/or replace spring

TABLE 5-12. SYSTEM TROUBLE SHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
45. Keyboard does not operate properly, when pulse is being received	Faulty interlock adjustment	Readjust. Refer to Paragraph 5-5e(24)(b)
	Solenoid dirty or defective	Clean or replace
	Solenoid release pin does not clear clutch release lever when solenoid is actuated. Words per minute is not synchronized with pulse rate.	Check leaf spring adjustment
	Insufficient pulse strength	Check pulse current. Pins G and H.
46. Keyboard does not operate	No synchronous pulse received	Check for pulse at pins G and H. Notify pulse source.
47. Keyboard interlock mechanism sticks in disable position	Defective or dirty solenoid	Clean and/or replace solenoid assembly
	Keyboard interlock mechanism incorrectly adjusted	Perform adjustment sequence. Refer to 5-5e(24)(b)
	Interlock disabled by interlock stop arm	Move stop arm to correct position. Refer to Paragraph 5-5e(24)(c)
	Release pin jammed	Check release pin and its seat for burrs or other foreign matter. Clean and/or replace as necessary. Refer to Figure 5-73.
47. Copy lights operate in "ON" position. No copy lights in "DIM" position.	R1 defective	Replace. Refer to Figure 5-107 or 5-114
	Copy light switch (S2) defective	Replace

b. FUNCTIONAL SECTION TROUBLE SHOOTING.- The teletypewriter sets consist of three functional sections; send, receive, and power supply and distribution.

(1) PRELIMINARY PROCEDURES.

Step 1. Perform any applicable preliminary checks in Table 5-9.

Step 2. Refer to Paragraph 5-5 for any required removal, disassembly, adjustment, or reassembly procedures and for parts location information.

(2) TEST SET-UP.

Step 1. Position rotary mode switch for off-line local mode (Paragraph 2-9).

Step 2. Connect signal and primary power cables to the electrical chassis receptacles (Paragraph 2-8b).

Step 3. Set the SEND.REC/REC switch to the SEND.REC position.

Step 4. Set the MOTOR switch to the ON position.

(3) TEST POINTS. - Test points for use in signal tracing and voltage and continuity tests are shown on the trouble-shooting tables and illustrations. The test points are divided into three categories: major, secondary, and minor.

Major test points for isolating the cause of a malfunction to a functional section are identified by an encircled Arabic number enclosed in a star; for example, major test point 1 is shown as

Secondary test points for isolating the cause of a malfunction to a specific circuit are identified by an encircled capital letter; for example, secondary test point A is shown as

Minor test points for isolating the cause of a malfunction to a specific part are identified by an encircled capital letter and a subscript Arabic numeral; for example, minor test point A_1 is shown as

(4) KEYBOARD 1A4, TROUBLE SHOOTING. (Refer to Table 5-13.)

(5) ELECTRONIC MODULE 1A3, TROUBLE SHOOTING. (Refer to Table 5-14.)

(6) PRINTER 1A2, TROUBLE SHOOTING. (Refer to Table 5-15.)
(7) ELECTRICAL CHASSIS 1A1, TROUBLE SHOOTING. (Refer to Table 5-16.)
(8) TRANSMITTER CONTROL CIRCUITRY TROUBLE SHOOTING. (Refer to Table 5-17.)

TABLE 5-13. KEYBOARD 1A4, TROUBLE SHOOTING CHART

TEST POINT	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Figure 5-13			
A	1. Teletypewriter set runs open	Keyboard slip connector or contact block not making correct contact	Check for defective contacts; repair or replace defective contacts
A_1 A_2 A_3		Defective filter FL1; defective code pulsing contacts; defective master pulsing contacts; or defective BREAK switch	Remove keyboard; connect multimeter across A; if reading is not 5 ohms, connect multimeter across A_1 and then across A_2. If either reading is not 2.5 ohms, replace filter FL1. If readings at A_1 and A_2 are both 2.5 ohms, connect multimeter across A_3. If no continuity is obtained across A_3, replace BREAK switch. Adjust or repair code pulsing or master pulsing contacts for reading of 5 ohms across A.
NONE	2. Teletypewriter set runs closed with keyboard in operating position	SEND.REC-REC switch in wrong position or defective	Set SEND.REC-REC switch in correct position or replace switch
		Master pulsing contacts or code pulsing contacts defective or out of adjustment	Adjust according to paragraph 5-5e(24)(j) or replace contacts
		Defective pulsing finger	Replace pulsing finger
		Defective filter FL1	Refer to Symptom 1 for procedure
NONE	3. Incorrectly transmitted character	Incorrect range adjustment	Adjust according to paragraph 2-8e(1)
		Master pulsing contacts defective or out of adjustment	Adjust according to paragraphs 5-5e(24)(j) and 5-5e(26)(b) or replace contacts
NONE	4. Depressing BREAK switch does not open signal line	Defective BREAK switch	Refer to Symptom 1 for procedure

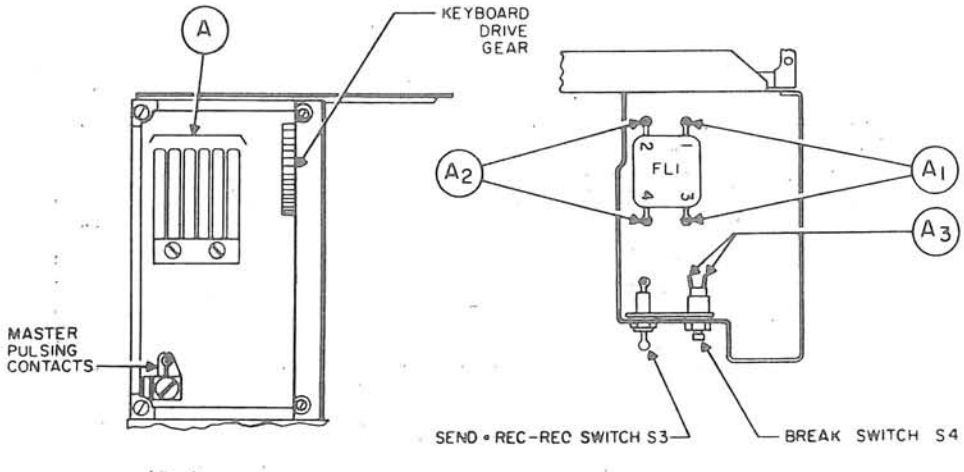


Figure 5-13. Keyboard 1A4, Location of Test Points

TABLE 5-14. ELECTRONIC MODULE 1A3, TROUBLE SHOOTING CHART

Conditions for testing electronic module:

Step 1. Place rotary mode switch 1A1S3 in OFF LINE position.
Step 2. Turn main power switch 1A1S1 to ON position.

NOTE

All readings are taken between TP3 (reference 0 vdc) and the test points shown in this chart except when otherwise indicated.

TEST POINTS	VOLTAGES (Nominal Values)		EXPLANATION
Figure 5-14	MARK CONDITION	SPACE CONDITION	
TP1 to TP2	CAUTION LINE BATTERY IS PRESENT ON TP1 AND TP2 IN THE OFF LINE MODE OF OPERATION.		Can be used for check of externally supplied signal line voltage only. Insert probe inside sleeve tubing to obtain multimeter reading.
Cathode of VR1	+11.2	0 vdc	Signal input to A3.
TP3	0 vdc Reference	0 vdc Reference	0 vdc line of power supply.
TP4	11.2 vdc	13.12 vdc	Output of A2 (TP4 is positive with respect to TP3).
TP5	-	-	Not used.
TP6	-	-	Not used.
TP7	6.9 vdc	1.044 vdc	Output of A3 to mark and space coils of selector.
TP8	.424 vdc	8.02 vdc	Output of A3 to mark and space coils of selector.
TP9	11.2 vdc (Before motor stop relay energizes) 4.03 vdc (After motor stop is energized)	13.12 vdc In space condition motor stop relay is deenergized	Output of A1.
TP10 to TP11	16.2 vdc	17.2 vdc	Output of Transformer T1, located on electrical chassis.
TP12	-	-	Not used.
TP13	-	-	Not used.
TP B (See Figure 5-14)	6.844 vdc	8.02 vdc	Check to ensure that 1A3R2 is not open.

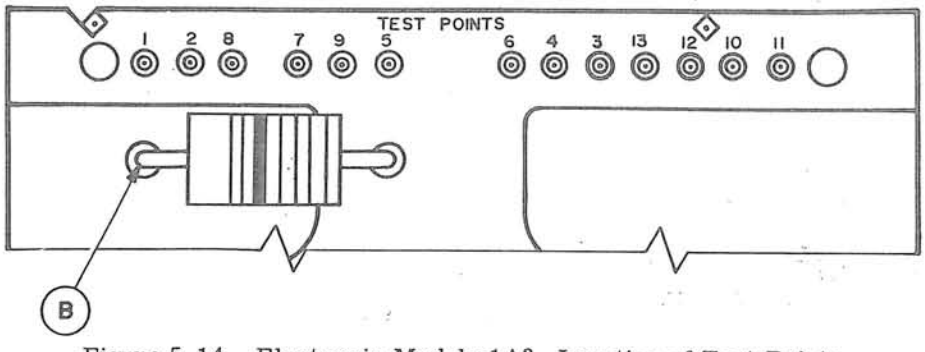


Figure 5-14. Electronic Module 1A3, Location of Test Points

TABLE 5-15. PRINTER 1A2, TROUBLE SHOOTING CHART

TEST POINT	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Figure 5-15			
①	1. Motor does not operate	Absence of input power	Turn equipment off. Gain access to motor. Remove connector from jack 1A1J5 (test point #1) and turn equipment on. Connect a-c multimeter between 1AJ5-A and 1AJ5-B and read 115 vac. If reading is incorrect, refer to Table 5 (Appendix). If readings are correct, continue with Symptom 2.
B	2. Motor does not operate; input power present	Defective motor or faulty connections	Turn equipment off. Connect multimeter (ohms) between A2P1-B and A2P1-A (47 ohms) and between A2P1-B and A2P1-D (140 ohms). If readings are incorrect, check for faulty connections or replace defective motor.
C	3. Printer runs open	Magnetic selector not plugged in or defective	Make certain that magnetic selector connector is secure in jack 1A3J1. If trouble persists, turn equipment off, remove connector, and connect multimeter (ohms) between A1P1-B and A1P1-D; meter should read 65 ohms ±10%. Check between A1P1-C and A1P1-D for same reading. If reading is incorrect, check for broken connection or replace magnetic selector.
	4. Printer runs closed	Same as Symptom 3	Same as Symptom 3.
	5. Motor will not stop with time delay motor function	Defective stop switch 1A2S1	Turn equipment off. Connect multimeter (ohms) between 1A2P1-F and 1A2P1-H; actuate stop switch and check for continuity reading. If no continuity, replace stop switch.
	6. Refer to Table 5-12 for other symptoms of trouble in printer		

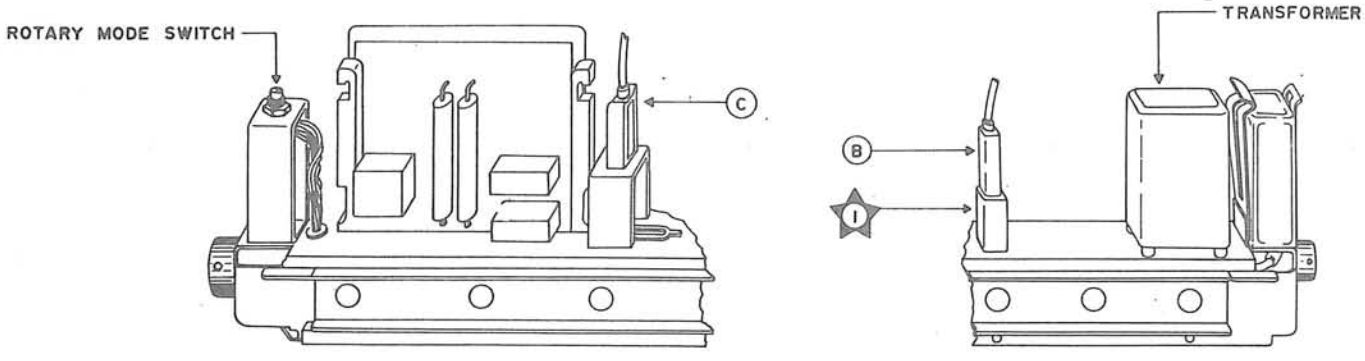


Figure 5-15. Printer 1A2, Location of Test Points

TABLE 5-16. ELECTRICAL CHASSIS 1A1, TROUBLE SHOOTING CHART

TEST POINT	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Figure 5-16			
4	1. Printer motor, line sensor, or line sensor power supply inoperative due to loss of input primary power	Defective parts in primary power circuit	Connect multimeter across #4 connector (pins A and C) and check for 115 vac. Check fuses F1 and F2 and MOTOR switch S1 if readings are incorrect. If components are not defective, check power inputs at #6, #7, and service cable connections.
I	2. Motor will not stop with time delay motor stop function	Defective coil on motor stop relay K1	With power off, connect multimeter (ohms) across I; if meter reads very high resistance (1 megohm or above), replace relay.
J K	3. Printer motor inoperative	Defective capacitor C1	With power off, connect multimeter between J and K; meter should read very high (1 megohm or above) or infinite resistance. If not, replace C1. To check for an open capacitor C1, replace with a known good capacitor. Check F2, and replace if defective.
L		Defective fuse F1 or F2	Replace fuse or fuses
5	4. No keying of send line	Defective keyboard, or incorrect option switching	Refer to table for keyboard trouble shooting. Check for correct option switching (Paragraph 2-9).
	5. Line sensor in electronic module inoperative	Loss of input signal	Check for presence of input signal at #5. If signal is missing, or check for correct option patching (Paragraph 2-9).

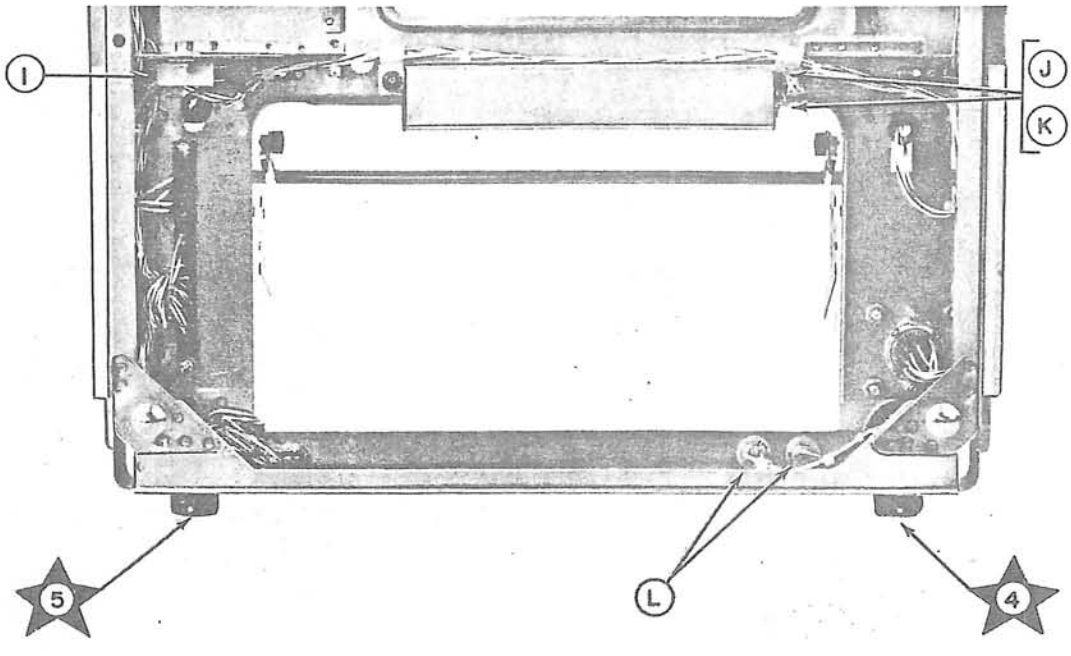


Figure 5-16. Electrical Chassis, Location of Test Points

TABLE 5-17. TRANSMITTER CONTROL CIRCUITRY TROUBLE SHOOTING (AN/UGC-41 only)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
1. Remote Transmitter not being keyed when SEND. REC-REC switch of keyboard set in the SEND. REC position and keyboard in the operating position.	Step 1. Malfunction or faulty wiring between transmitter control chassis terminals and remote transmitter.	Remove external signal connector and short pins E and F of mating connector together. If transmitter does not key, trouble is either loose connection or no source of battery to key relay. If the transmitter keys, go to Step 2.
	Step 2. Faulty wiring between terminals of chassis connector and SEND. REC-REC switch of Teletypewriter Set.	Place SEND. REC-REC switch in SEND. REC position and check for continuity across pins E and F in chassis connector 1A1J1. If continuity is not obtained proceed to Step 3.
	Step 3. Faulty chassis connector 1A1J1.	Set SEND. REC-REC switch in SEND. REC position and check for continuity across pins E and F of chassis 1A1J1. If no reading is obtained check for loose wiring or defective connector. If wiring and connector check out, proceed to Step 4.
	Step 4. Loose wire between contacts 2 and 5 of contact block of chassis and/or E and F of connector 1A1J1.	Remove keyboard from chassis. Check for continuity between pin E of chassis connector and contact 2 of contact block, and pin F of chassis connector and contact 5 of contact block. If continuity is not obtained in either reading, check for loose connection or cold solder joint. If continuity is obtained proceed to Step 5.
	Step 5. Faulty contacts in SEND. REC-REC switch (1A4S3) or loose wire between switch and slip contacts of the keyboard.	Check for continuity across transient contacts 3 and 4 of keyboard with SEND. REC-REC switch in SEND. REC position. If continuity is not obtained, check across terminals of switch. If reading is not obtained, replace the switch. If reading is obtained, check for loose wiring between switch and slip contacts.
	Step 6. Faulty contact blocks.	Set SEND. REC-REC switch in SEND. REC position. Check for continuity across pins E and F of chassis connector 1A1J1. If no reading is obtained check contact block 1A1E8 and keyboard slip connector contacts 1A4E1. Bend keyboard slip connector contacts 3 and 4 slightly upward and recheck for continuity across pins E and F of chassis connector. Replace contact block (1A1E8 if necessary.

5-5. REPAIR

The following paragraphs contain instructions for repairing and adjusting the teletypewriter sets. Parts location illustrations are provided throughout the text or in the Appendix as required. Overall schematic and wiring diagrams are provided in the Appendix.

a. FAILURE REPORTS. - Failure reports are not required. (See Paragraph 5-1, NAVSHIPS Handbook 94500).

b. REMOVAL AND INSTALLATION PROCEDURES. - The following procedures establish the manner in which the teletypewriter sets are to be dismantled to their component levels for adjustment or further disassembly. Specific disassembly and assembly instructions are contained in Paragraphs 5-5f through 5-5g.

(1) CABLE REMOVAL. - Set all switches in the OFF position, turn the connector plug one quarter turn counterclockwise and pull straight out.

(2) CABLE INSTALLATION

Step 1. Set all switches in the off position.

Step 2. Inspect the cable receptacles in the rear of the electrical chassis to insure that no foreign matter is present.

CAUTION

IF INTERFERENCE OR BINDING IS ENCOUNTERED WHILE PERFORMING THE FOLLOWING STEPS, IMMEDIATELY REMOVE THE CONNECTOR-PLUG FROM THE RECEPTACLE AND DETERMINE THE CAUSE OF INTERFERENCE.

Step 3. Align the key of the cable connector-plugs with the keyway of the cable receptacles.

Step 4. Carefully insert the cable connector-plugs into the cable receptacles and then turn the connector-plugs a quarter turn clockwise to secure them.

CAUTION

BE SURE THAT THE PRIMARY CABLE IS GROUNDED AT THE PRIMARY POWER SOURCE.

(3) PRINTER FRONT COVER AND ELECTRICAL CHASSIS REMOVAL.

NOTE

Remove the cable connector-plugs (Paragraph 5-5b(1) prior to performing the following steps.

Step 1. Disengage the two captive fasteners on the printer front cover by turning them 1/4 turn counterclockwise.

Step 2. Carefully pull the top of the front cover toward the front of machine (approximately 1/2-inch) and lift up.

CAUTION

WHEN THE FRONT COVER IS REMOVED, THE ELECTRICAL CHASSIS LOCKING DEVICE IS RELEASED AND THE CHASSIS IS FREE TO SLIDE OUT OF THE PRINTER.

Step 3. Slide the chassis out of the case.

CAUTION

CHECK TIGHTNESS OF TWO GROUND STRAPS CONNECTED TO CASE BY SLIDE BRACKETS AND VIBRATION INSULATION ASSEMBLY SCREWS. THIS ASSURES A SAFETY GROUND IF PIN IN PRIMARY POWER CONNECTOR IS DEFECTIVE.

(4) PRINT COVER AND ELECTRICAL CHASSIS INSTALLATION. The printer front cover and electrical chassis are replaced in the case by reversing the removal procedure.

(5) PRINTER REMOVAL FROM ELECTRICAL CHASSIS.

Step 1. Remove the front cover and chassis assembly in accordance with Paragraph 5-5b(3).

Step 2. Disconnect the motor and selector connector-plugs by depressing connector leaf springs.

Step 3. Depress lock pins in cooling housing and slide cooling outlet to the right.

NOTE

This permits access to right lock screw through hole in cooling housing.

Step 4. Disengage the printer slide locks and the two rear lock screws.

Step 5. Lift the printer assembly away from the electrical chassis by lifting up and to the rear to prevent damage to the off-line function slides.

NOTE

Lift printer by range dial (located on left side of printer) and speed change gear locknut (located on right side of printer).

(6) PRINTER INSTALLATION ON ELECTRICAL CHASSIS.

Step 1. Rotate printer front support counterclockwise to loaded (retracted) position.

Step 2. Position the printer on the electrical chassis and engage the two printer slide locks and two printer attaching screws.

Step 3. Depress lock pins and slide cooling outlet to the left until lock pins reengage in cooling outlet holes.

Step 4. Connect the magnetic selector plug to the receptacle provided in the line sensor. Connect the motor plug to the receptacle provided in the line sensor. Connect the motor plug to the receptacle just forward of the signal line power supply.

Step 5. Reinstall the front cover and chassis assembly.

(7) KEYBOARD REMOVAL.

CAUTION

INSURE THAT THE PRINTER MOTOR HAS BEEN TURNED OFF PRIOR TO ATTEMPTING KEYBOARD REMOVAL.

NOTE

The keyboard cannot be removed without first removing the front cover and electrical chassis from case.

Step 1. Remove the front cover and electrical chassis as instructed in Paragraph 5-5b(3).

Step 2. Remove printer from chassis as instructed in Paragraph 5-5b(4).

Step 3. Remove two screws which secure keyboard within the electrical chassis and slide the keyboard forward and out of chassis.

(8) KEYBOARD INSTALLATION. - The keyboard is replaced in the electrical chassis by reversing the steps in the keyboard removal procedure.

(9) ELECTRONIC MODULE REMOVAL FROM ELECTRICAL CHASSIS.

Step 1. Remove the front cover and chassis assembly as instructed in Paragraph 5-5b(3).

Step 2. Pivot spring clip retainer to rear to free printed circuit board (electronic module).

Step 3. Grasp the printed circuit board (electronic module) by its sides and pull upward until it clears guides on both sides.

NOTE

Insulation board should be left in chassis guides.

(10) ELECTRONIC MODULE INSTALLATION IN ELECTRICAL CHASSIS. - Reverse the electronic module removal procedure to replace the electronic module in the electrical chassis.

CAUTION

WHEN INSERTING PRINTED CIRCUIT BOARD (ELECTRONIC MODULE IN ITS RECEPTACLE) IN CHASSIS, BE CAREFUL NOT TO DAMAGE PRINTED CIRCUIT BOARD BY USING EXCESSIVE PRESSURE. BE SURE TO REINSERT INSULATION BOARD IN BACK OF PRINTED CIRCUIT BOARD IF INADVERTENTLY REMOVED.

(11) TRANSFORMER REMOVAL.

Step 1. Remove the front cover and electrical chassis assembly as instructed in Paragraph 5-5b(3).

Step 2. Turn chassis upright and pull the transformer directly upward out of its socket in chassis.

(12) TRANSFORMER INSTALLATION.

Step 1. Align the prongs of transformer with the socket holes in chassis.

Step 2. Insert transformer in its socket in chassis.

Step 3. Reverse Steps 1 through 3 of transformer removal procedure (Paragraph 5-5b(11)) to complete installation of the transformer in the electrical chassis.

c. REPLACEMENT PROCEDURES. - The replacement of cables, lateral belt, advance drum ratchet, and master pulsing contacts described in the paragraphs that follow require only minor disassembly. Adjustments which are effected by a replacement procedure are indicated in the replacement procedure. In most instances all that is required is that a check of the indicated adjustments be made before returning the equipment to service. The replacement of worn or defective mechanical parts requires disassembly of the equipment as far as necessary to gain access to parts. Replace the part with the correct replacement part listed in appropriate Illustrated Parts List.

(1) ELECTRONIC COMPONENT REPLACEMENT.- The replacement of defective electronic components is accomplished using standard hand tools and soldering techniques. Replace all defective electronic parts with the correct replacement part.

CAUTION

BE SURE TO USE AN ADEQUATE HEAT SINK WHEN SOLDERING TRANSISTORS OR OTHER HEAT SENSITIVE COMPONENTS.

(2) TWO PIECE LATERAL CONTROL BELT EPLACEMENT.

Step 1. Place printer in letters "A".

Step 2. Depress carriage return off-line function lide, and rotate mainshaft until carriage return ccurs.

Step 3. Loosen lateral control belt clamp on ad- ance drum (Figure 5-17).

Step 4. Remove lateral control belt from under ts clamp.

Step 5. Loosen lateral control belt clamp screw n takeup drum.

Step 6. Remove lateral control belt from the akeup drum, the tension pulley, and the lateral ulley (located on the left corner of the printer).

Step 7. Remove print cylinder yoke shaft "E" ing located outside of the printer right frame wall.

Step 8. Slide print cylinder yoke shaft to the eft to disengage shaft from hole in right frame wall.

Step 9. Slide print cylinder yoke shaft to the ight and remove shaft completely from print cylinder oke and printer frame.

CAUTION

EXERCISE CARE NOT TO KINK BELT DURING THE INSTALLATION PROCEDURE, AS KINKING WILL FRACTURE THE MATERIAL.

Step 10. Remove both old belts from anchor posts n print cylinder yoke.

Step 11. Staple flat end of new lateral belt to loop nd of old belt (belt to the right of print cylinder yoke).

NOTE

When stapling the overlapped ends of the belts together, be sure that there are no twists in the old or new belts.

Step 12. Gradually pull right end of old lateral elt (portion outside of the printer) to the right until ew belt comes out of the printer right side.

Step 13. Slide loops of new belts over anchor posts n print cylinder yoke.

Step 14. Slide print cylinder yoke shaft from right eft into print cylinder yoke.

Step 15. Slide print cylinder yoke shaft into hole n left frame wall and then to the right into hole in ight frame wall.

Step 16. Insert yoke shaft "E" ring into its notch utside of the right frame wall.

Step 17. Separate the old belt from new fiber- las belt at the point where they are stapled together.

Step 18. Twist the fiberglas belt 1/4 turn clock- ise and then pass the belt around the pulley on the ight side of the frame just outside the hole in the rame wall.

Step 19. Make a 1/4 clockwise turn in the lateral elt and then one full counterclockwise turn with the elt around the advance drum; then insert the lateral elt through the notch in the advance drum.

Step 20. Place the lateral belt under lateral belt lamp on the advance drum (there should be approxi- ately 2 inches of excess belt).

Step 21. Loop the excess belt, insert belt end under lateral belt clamp and tighten the lateral belt clamp screw.

Step 22. Check to be sure that lateral belt remains under the clamp when the clamp screw is tightened.

Step 23. Thread new left lateral belt around lateral belt pulley on left corner of the printer.

NOTE

It is not necessary to staple the left lateral belt (belt to the left of print cylinder yoke) as threading of belt through left side of printer is easily accessible.

Step 24. Loop lateral belt over the top of lateral belt tension pulley and then under the tension pulley.

NOTE

If the takeup drum spring tension has been released, preload the takeup drum by turning it two or three complete turns counterclockwise. Then insert a hex wrench or similar object into the hole in the takeup drum and the takeup bracket to prevent the takeup drum from unwinding.

Step 25. Make two full clockwise turns (as viewed from the left side of printer) around takeup drum and insert belt through notch in the takeup drum.

Step 26. Pull left end of the lateral belt until the outside diameter of the lateral tension pulley is approximately 1/8 inch away from the outside diameter of the takeup drum.

Step 27. Insert the lateral belt under its clamp on the takeup drum.

Step 28. Loop the excess belt, insert the belt end under the clamp and tighten the lateral belt clamp screw; remove hex wrench inserted in Step 24 (NOTE).

Step 29. Check to be sure that lateral belt remains under the clamp when the clamp screw is tightened.

Step 30. Advance the print cylinder all the way across its shaft by turning the advance drum counterclockwise until two clicks are heard or felt, indicating that the end of the line has been reached.

Step 31. Check for 1/2 inch clearance between the right end of the print cylinder yoke and print cylinder shaft bearing in the printer right frame wall (1/2 inch for 72 character line and 1/16 inch for a 76 character line format).

Step 32. If the clearance is not as specified in Step 31 loosen the lateral belt clamp on the advance drum and let out or takeup as required, until 1/2 or 1/16 inch clearance is established between the print cylinder yoke and print cylinder shaft bearing.

Step 33. Readjust for 1/8 inch clearance as explained in Step 26.

Step 34. Depress the off-line carriage return slide while rotating the mainshaft until carriage return occurs.

Step 35. Advance the print cylinder half-way across its shaft by rotating the advance drum counterclockwise.

Step 36. Loosen the hammer cable clamp screw on advance drum.

Step 37. Loosen hammer cable around hammer bracket lugs and align the hammer to the letter A.

Step 38. Tighten the hammer cable on the hammer bracket lugs when the alignment of the hammer and the letter A is correct.

Step 39. Tighten hammer cable under its clamp on advance drum when hammer face is properly aligned with the letter A.

Step 40. Check to insure that there is no hammer cable overlap on the takeup drum when the printer is in the full carriage return position.

Step 41. Turn the advance drum counterclockwise until the print cylinder has advanced half-way across the line.

Step 42. Depress the carriage return lever and observe return action (movement of the print cylinder to the lefthand margin).

NOTE

Carriage return should be rapid. If carriage return is slow (print cylinder moves slowly or hesitates), proceed with Step 43. If the carriage return is satisfactory the lateral belt adjustment is completed.

Step 43. Loosen the hammer cable slightly until carriage return speed is satisfactory.

NOTE

There must be no cable overlap on the take-up drum upon completion of this adjustment.

Step 44. Check lateral slide alignment Paragraph 5-5e(4)(b).

NOTE

A check of lateral slide alignment is recommended after 24 to 48 hours of operation.

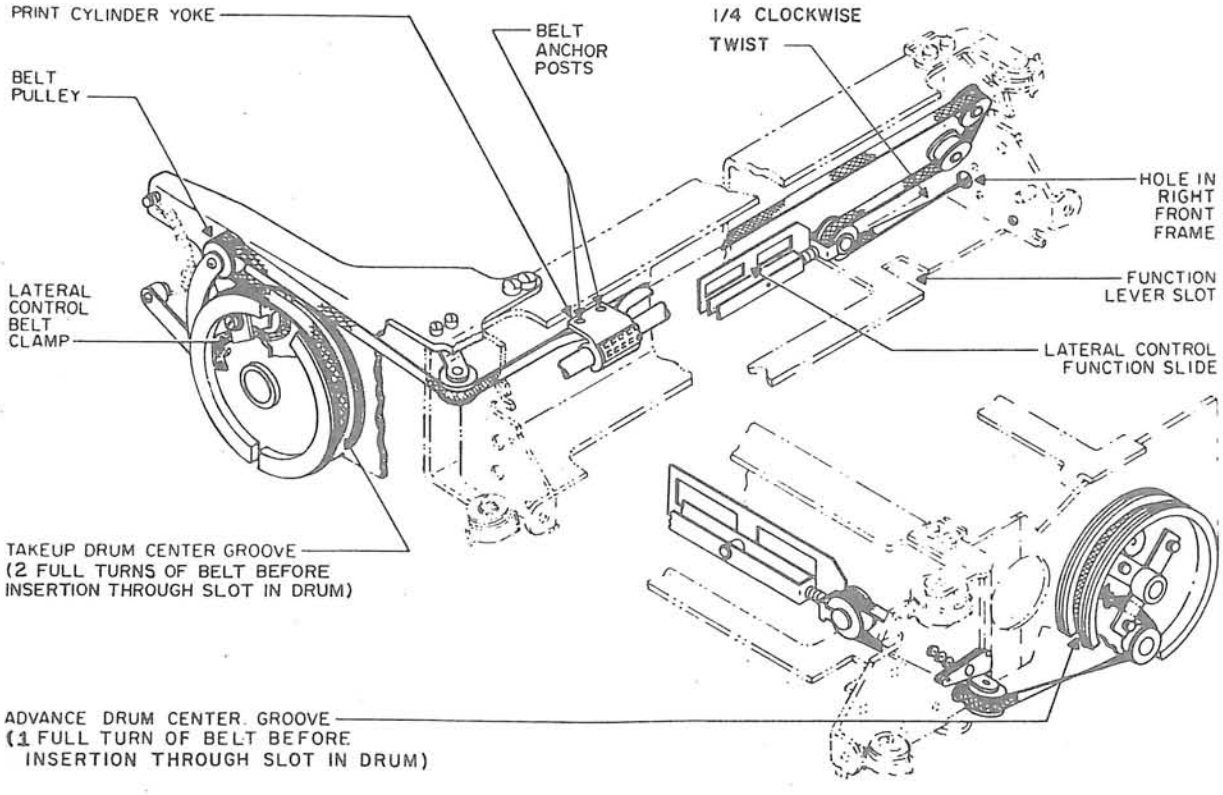


Figure 5-17. Two Piece Lateral Control Belt Replacement, Belt Threading Diagram

(3) ROTARY CABLE REPLACEMENT.

NOTE

Do not remove the old rotary cable as it will be used to thread the new rotary cable through the printer pulley system.

Step 1. Place the printer in letters "A"

CAUTION

IN THE NEXT STEP, RAPID UNWINDING OF THE ROTARY MOTION SPRING WILL SERIOUSLY DAMAGE THE SPRING. IF THE ROTARY MOTION SPRING RETAINER IS RELEASED SUDDENLY, OR THE ROTARY CABLE HAS BROKEN, REMOVE THE GRIP RING AND TWO WASHERS AND INSURE THAT THE SPRING (FIGURE 5-18) HAS NOT BEEN DAMAGED.

Step 2. While holding the rotary motion spring iner, loosen the print cylinder shaft bearing etainer screws and allow the spring retainer to nwind slowly until the spring tension is released.

Step 3. Place the printer on its backplate and urn the rotary cable adjustment screw (Figure 5-19) ntil the rotary cable adjustment bracket reaches he center of its travel.

Step 4. Cut a length of cable (or use replacement able of exact length) approximately 15 inches long, not one end tightly and then fuse the knotted end of he cable with a match.

CAUTION

BE SURE THAT THE SPRING TENSION HAS BEEN RELEASED AS DIRECTED IN STEP 2, BEFORE PERFORMING STEP 5.

Step 5. If the old rotary cable is still threaded through the rotary pulley system, cut off the knotted ends of the cable. (The end knotted against the index wheel and the end knotted against the rotary cable adjustment bracket) and proceed with Step 8. If the old rotary cable has been removed from the printer proceed with Step 6.

Step 6. Thread the new cable through the hole in the rotary cable adjustment bracket (Figure 5-20).

Step 7. Thread the free end of the rotary cable over the top of the letters-figures pulley (Figure 5-19) under the next idler pulley, over and around the pulley on the rotary strip, through the hole in the right frame, under the idler pulley up and over the upper idler pulley and then under and over the front of the index wheel. Skip Step 8 and proceed with Step 9.

Step 8. Thread the new cable through hole in the unknotted end of the new rotary cable to the end of the old cable and pull on old rotary cable near the index wheel until the new cable is drawn out of the printer.

Step 9. Release the print function clutch and rotate the mainshaft until the function cam follower falls to the low of its cam; then rotate the index wheel counterclockwise so that the index mark is two notches away from the detent pawl. (See Figure 5-20).

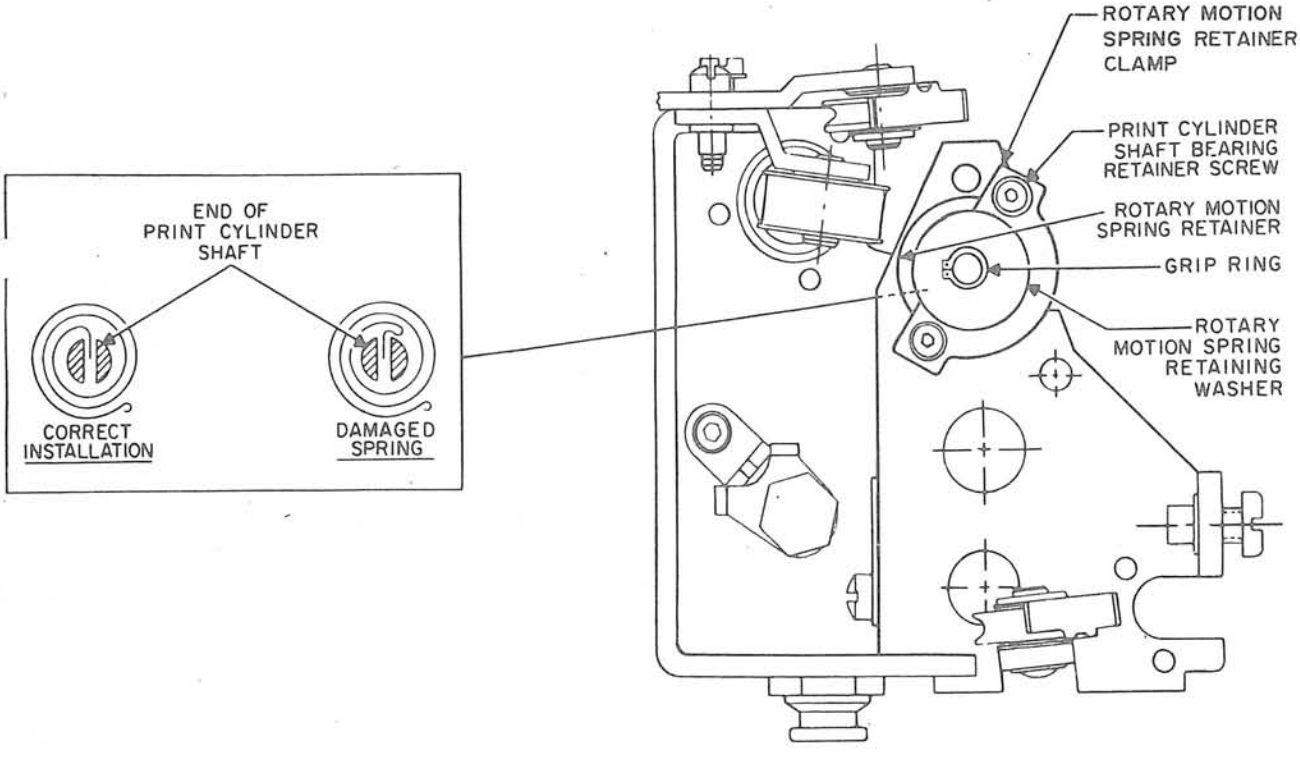


Figure 5-18. Rotary Cable Replacement, Left Side View of Printer