MHG-17

TM 11-5815-200-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

TELETYPEWRITER SETS AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X, AND TELEPRINTER TT-259/FG

This copy is a reprint which includes current pages from Changes 1 through 4. Title was changed by Change 4 as shown above.

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1966

WARNING

This equipment contains selenium rectifiers which immediately release poisonous fumes when they burn out. The fumes are very toxic and have a strong, unpleasant odor resembling the smell of rotten eggs. Whenever this odor is detected, IMMEDIATELY disconnect power and thoroughly ventilate the area. Do not handle the burned-out rectifier until it cools. PERMANENT INJURY OR DETAH MAY RESULT FROM PROLONGED BREATHING OF THE FUMES.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when replacing paper. The power supply contains 95- to 250-volt circuits. Serious injury or death may result from contact with these circuits.

DON'T TAKE CHANCES

TECHNICAL MANUAL
No. 11-5815-200-12
TECHNICAL ORDER
No. 31W4-2FGC20-31

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON, DC, *14 February 1966*

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

TELETYPEWRITER SETS

AN/FGC-20 (NSN 5815-00-503-2652), AN/FGC-20X (NSN 5815-00-392-7743), AN/FGC-21 (NSN 5815-00-503-2653), AN/FGC-66 (NSN 5815-00-817-9277), AN/FGC-159 AND AN/FGC-159X (NSN 5815-00-561-7964), AN/FGC-160 (NSN 5815-00-025-9036), AN/FGC-177 (NSN 5815-01-017-3780), AN/UGC-4 (NSN 5815-00-557-5970), AN/UGC-29 (NSN 5815-00-082-4199), AN/UGC-29X (NSN 5815-00-082-4200); AND TELEPRINTER TT-259/FG (NSN 5815-00-688-8761)

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NOTE

All references to Teletypewriter Set AN/FGC-64, AN/FGC-67, and AN/FGC-67X in this manual are deleted. The AN/FGC-64 has been classified as obsolete. The AN/FGC-67 and AN/FGC-67X were never type classified in the US Army inventory.

***This manual supersedes TM 11-5815-200-10, 8 July 1958, including C 1, 4 February 1960, C 2, 3 October 1960, C 3, 14 November 1960, C 4, 11 September 1961, C 6, 1 July 1963; TM 11-5815-200-20P, 15 November 1961; and together with TM 11-5815-200-35, 14 February 1966, supersedes TM 11-5815-200-35, 30 June 1959, including C 1, 11 May 1960, C 2, 30 March 1961, C 3, 18 September 1961, C 4, 5 June 1963, and C 5, 15 January 1964.**





Figure 1-1. Teletypewriter Set AN/FGC-20, less running spares and technical manuals.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes Teletypewriter Sets AN/FGC-20 (fig. 1-1), AN/FGC-20X, AN/FGC-21, AN/FGC-64, AN/FGC-66, AN/FGC-67, AN/FGC-67X, AN/UGC-4, AN/UGC-29, AN/UGC-29X and Teleprinter TT-259/FG. It includes operation and operator's maintenance of the equipment.

b. Official nomenclature followed by (*) is used to indicate all models of the equipment item covered in this manual. Thus, Teletypewriter TT-98(*)/FG represents Teletypewriters TT-98/FG, TT-98A/FG, and TT-98B/FG, and Teletypewriter TT-100(*)/FG represents Teletypewriters TT-100/FG and TT-100B/FG.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DAM Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Maintenance Forms, Records and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (TAMMS). Air Force personnel will use AFM 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

1-3.1. Reporting Errors and Recommending Improvements

a. You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

b. For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, section VI, T.O. 00-5-1. Forward direct to prime ALC/MST.

c. In either case, a reply will be furnished direct to you.

1-3.2. Reporting Equipment Improvement Recommendations (EIR's)

a. If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

b. Air Force personnel are encouraged to submit EIR's in accordance with AFM 900-4.

1-3.3. Administrative Storage

For procedures, forms, and records, and inspections required during administrative storage of this equipment, refer to TM 740-90-1.

1-3.4. Destruction of Electronic Materiel

Demolition and destruction of electronic equipment will be under the direction of the commander and in accordance with TM 750-244-2.

Section II. DESCRIPTION AND DATA

1-4. Purpose and Use

a. The teletypewriter sets provide a means of communication with a typewritten record of the communique. The teletypewriter sets are used to transmit, monitor, and receive messages over direct current (dc) wire lines (fig. 1-2) carrier, or radio systems. Either neutral or polar signals can be applied to the selector magnets without the use of relays or other signal conversion equipment. Any of the equipments may be modified for *receive-only* operation (fig. 1-3) by removing the keyboard and making minor wiring changes.

b. Teleprinter TT-259/FG (fig. 1-4) is used only to monitor or receive messages. The same type signals and signal lines as described in *a* above can be used.

1-5. Technical Characteristics (AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-64, AN/FGC-66, AN/UGC-4, AN/UGC-29, and AN/UGC-29X)

Type of installation	Fixed-station, send and receive by direct wire, carrier, or radio-teletype.
Keyboard and typebar symbols:	
Standard	AN/FGC-20, AN/FGC-20X, AN/FGC-66, AN/UGC-4, AN/UGC-29, and AN/UGC-29X.
Weather	AN/FGC-21 and AN/FGC-64.
Type of characters	English.
Characters per line	Standard, 72; weather, 76.
Type of paper feed	Friction or sprocket.

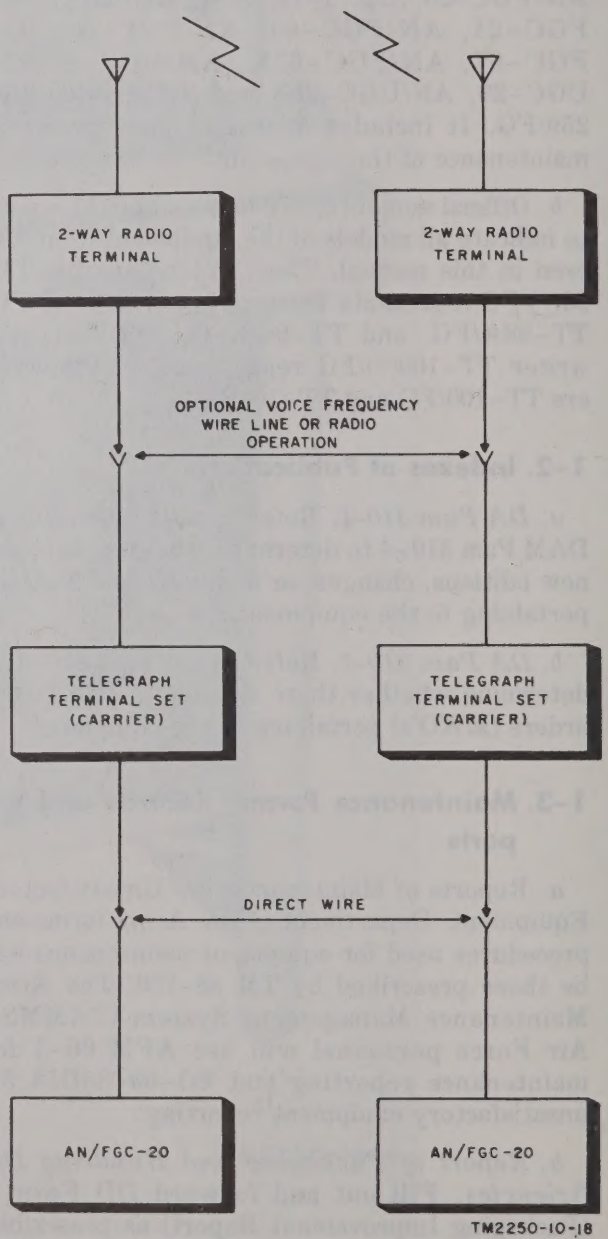


Figure 1-2. System application, block diagram.

Signaling:	
Transmission:	
AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, and AN/UGC-4.	7.42, start-stop, 5-unit code.
AN/FGC-64, AN/UGC-29 and AN/FGC-29X.	8.00, start-stop, 5-unit code (includes 2 stop impulses).
Reception	All models receive 7.00, 7.42, and 8.00 start-stop, 5-unit code impulses within acceptable range limits when appropriate gearset is installed to match baud rate in use on signal line.
Type of signals	Neutral (20 or 60 ma); polar (20 or 30 ma).
Operational speeds:	
45.5-baud rate (368.1-opm gearset installed[1]).	61.5 wpm with 7.42-unit code; 56.9 wpm with 8.00-unit code.
50-baud rate (404-opm gearset installed[2]).	67.7 wpm with 7.42-unit code; 62.4 wpm with 8.00-unit code.
56.8-baud rate (460-opm gearset installed[3]).	75 wpm with 7.42-unit code; 70 wpm with 8.00-unit code.
75-baud rate (600-opm gearset installed[4]).	100 wpm with 7.42-unit code; 93.6 wpm with 8.00-unit code.

Code impulse lengths:	
45.5-baud rate	22 milliseconds.
50-baud rate	20 milliseconds.
56.8-baud rate	17.6 milliseconds.
75-baud rate	13.5 milliseconds.
Power requirements:	
AN/FGC-20X, AN/FGC-64, AN/FGC-66, AN/UGC-4 and AN/UGC-29X.	Approx 180 watts: 95-125 v, 190-250 v, 50-60 cps, ac.
AN/FGC-20, AN/FGC-21 and AN/UGC-29.	Approx 150 watts: 95-125 v, 190-250 v, 60 cps, regulated ac.
TT-259/FG	Approx 120 watts: 95-125v, 60 cps regulated ac.
Motor type	See paragraph 1-14.
Motor speed	3,600 revolutions per minute.
Motor voltage requirements:	
Series-governed	105- to 125-volt, regulated or unregulated, ac.
Synchronous	105- to 125-volt, 60 cps single phase, ac.

See footnotes on page 1-3.

Paper capacity	Adjustable to accommodate standard 1- through 6-copy, roll, fanfold paper, or sprocket-fed forms, 8½ in. wide.
Signal bias tolerances:	
Transmitted signals	5% maximum.
Received signals (tolerance), 7.42, 5-unit code:	
368.1 or 404 opm	40% marking or spacing bias.
600 opm	35% marking or spacing bias.
End distortion tolerance (received signals), 7.42, 5-unit code:	
368.1 or 404 opm	35% marking or spacing and distortion.
600 opm	30% marking or spacing end distortion.
Range adjustment	Scale calibrated 0 to 120; 100 scale units equal width of 1 unit signal pulse (22 milliseconds at 368.1 opm).
Suppression of interference with radio reception.	Teletypewriter does not interfere with radio reception at frequencies between .35 and 150 mc when located 1 ft or more from radio antenna.
Safety shielding	Points at which potentials of 30 volts or more exist are shielded against accidental contact by personnel.
Surrounding temperature limits:	
Equipment in use	32° F. (0° C.) to 132° F. (55.6° C.)
Equipment in storage	—80° F. (—62.2° C.) to 160° F. (71.1° C.).
Minimum barometric pressure (operating).	16.88 inches of mercury (equivalent to approx. 15,000-ft altitude).
Miscellaneous	Equipment withstands high humidity and moisture as encountered in tropics; is fungiproofed and resistant to corrosion.

[1] Furnished as part of all models except AN/FGC-64.
[2] Furnished as part of AN/FGC-64 only.
[3] Must be requisitioned separately. Not furnished as part of any model of equipment.
[4] Furnished as part of all models.

1-6. Technical Characteristics (TT-259/FG)

Type of installation	Fixed-station; receive, by direct wire, carrier, or radio-teletype.
Type bar symbols	Standard.
Type of characters	English.
Characters per line	72.
Type of paper feed	Friction or sprocket.
Signaling code	Five-unit, start-stop.
Type of signals	Neutral (20 or 60 ma); polar (20 or 30 ma).

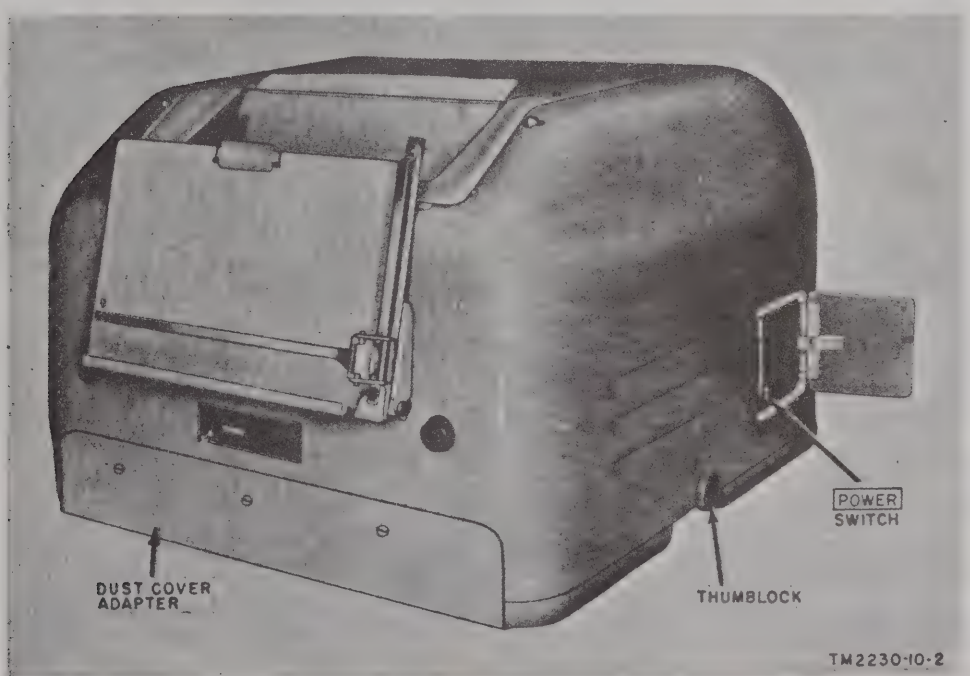


Figure 1-3. Teletypewriter TT-98/FG, keyboard removed.



Figure 1–4. Teleprinter TT–259/FG.

Speed:	368.1, 404, 460, or 600 opm.
Operations per minute.	
Words per minute	60, 66, 75, or 100 wpm.
Power requirements	Approx 120 watts.
Motor type	Synchronous.
Motor speed	3,600 rpm.
Motor voltage requirements.	105- to 125-volt, 60-cps, single phase, ac.
Paper capacity	Adjustable to accommodate standard 1- through 6-copy, roll, fanfold paper, or sprocket-fed forms, 8½ in. wide.
Total weight of installed equipment with full roll of paper.	Approx 48 lb.

Note. All other technical characteristics are identical with those listed in paragraph 1–5.

1–7. Common Names

Common names have been assigned to the items listed below.

Item	Common name
Teletypewriter Set AN/FGC–20, AN/FGC–20X, AN/FGC–21, AN/FGC–64, AN/FGC–66, AN/FGC–67, AN/FGC–67X, AN/UGC–4, AN/UGC–29, and AN/UGC–29X.	Teletypewriter set.
Teletypewriter TT–98/FG, TT–98A/FG, TT–98B/FG, TT–98C/FG, TT–99/FG, TT–100/FG, TT–100B/FG, TT–293/FG, TT–300/FG, TT–482/UGC, and TT–483/UGC.	Teletypewriter.
Power Supply PP–978/FG	Power supply.
Teletypewriter Table FN–59/FG.	Table.
Keyboard transmitter	Keyboard.
Inking ribbon	Ribbon.
Recording paper	Paper.
Rangefinder dial assembly	Rangefinder.

1-8. Components Data

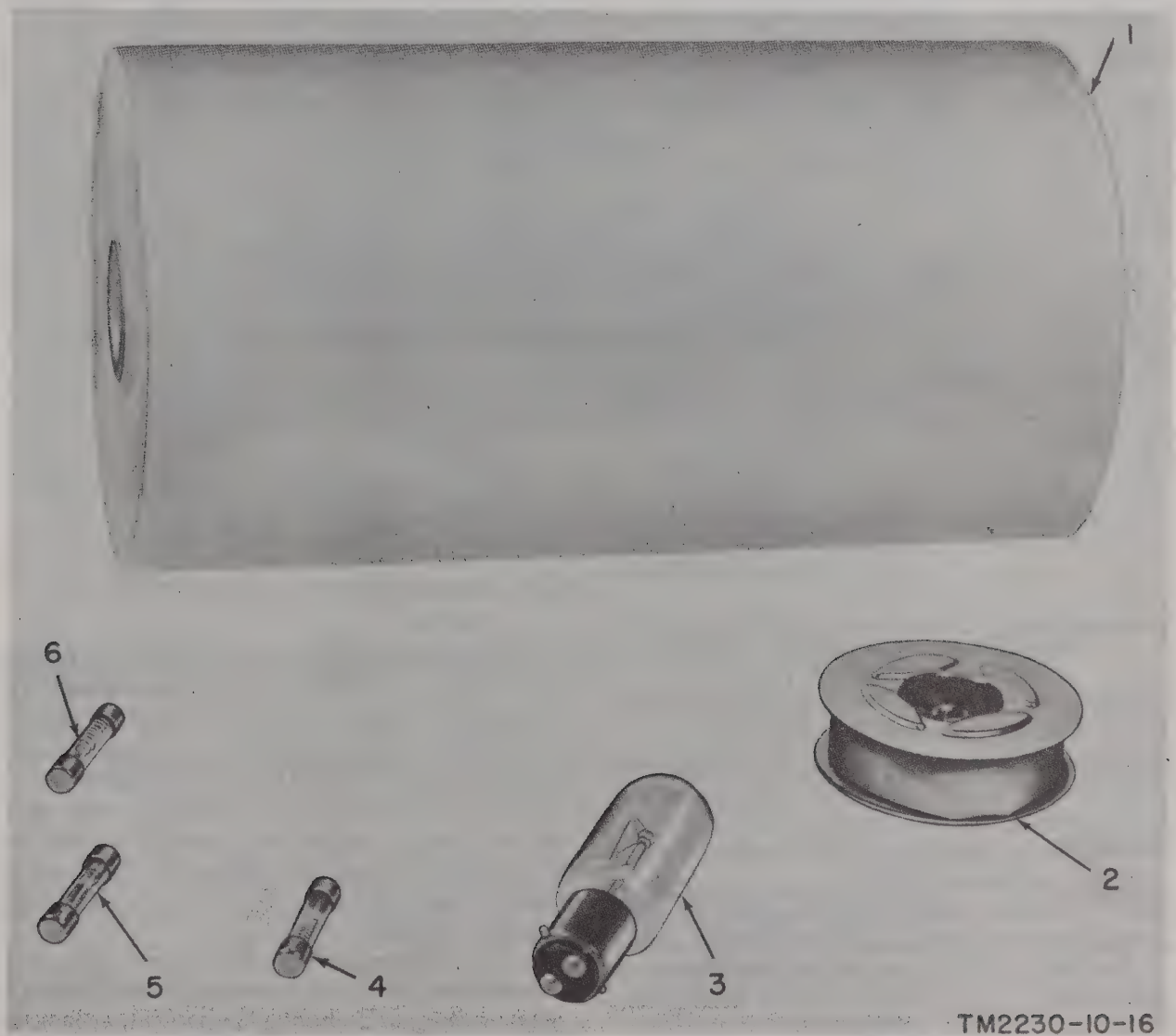
a. Components and Dimensions. The following chart lists the dimensions and weight of the major components.

Item	*Height (in.)*	*Depth (in.)*	*Width (in.)*	*Unit weight (lb.)*
Teletypewriter	11¼	20 9/16	17⅛	54
Power supply	4	4	9	7
Table	27	22¼	18¾	22
TT-259/FG	11¼	16¾	17⅛	44

b. Running Spares. The running spares are illustrated in figure 1-5.

1-8.1 Items Comprising an Operable Equipment

FSN	*Qty*	*Nomenclature, part No., and mfr code*
		NOTE The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency, etc.
5815-00-503-2652		TELETYPEWRITER AN/FGC-20



1 Recording paper
2 Inking ribbon and spool
3 Lamp, incandescent
4 Fuse, ¼-ampere, 250-volt
5 Fuse, 1/10-ampere, 250-volt
6 Fuse, 2-ampere, 250-volt

Figure 1-5. Running spares.

FSN	Qty	Nomenclature, part No., and mfr code
5815-500-4384	1	Power Supply PP-978/FG: (mounted in TT-100/FG).
5815-503-2621	1	Table, Teletypewriter FN-59/FG.
5815-503-2763	1	Teletypewriter TT-100/FG; TT-100-B/FG
5815-00-392-7743		TELETYPEWRITER SET AN/FGC-20X
		AND
5815-00-557-5970		TELETYPEWRITER SET AN/UGC-4
5815-500-4384	1	Power Supply PP-978/FG: (mounted in TT-98/FG).
5815-503-2621	1	Table, Teletypewriter FN-59/FG. (not part of AN/UGC-4)
5815-503-2764	1	Teletypewriter TT-98/FG, TT-98A, B, C/FG.
7530-281-2694	1	Paper, Recording: type 1, class 1, grade A, UU-P-547d; 81348.
7510-00-082-2648	1	Ribbon, Printing, Teletypewriter: type 1, class 1, DDD-R-311d; 81348.
5815-00-503-2653		TELETYPEWRITER SET AN/FGC-21
5815-500-4384	1	Power Supply PP-978/FG: (mounted in TT-99/FG).
5815-503-2621	1	Table, Teletypewriter FN-59/FG.
5815-503-2765	1	Teletypewriter TT-99/FG.
5815-00-817-9277		TELETYPEWRITER SET AN/FGC-66
5815-500-4384	1	Power Supply PP-978/FG: (mounted in TT-300/FG).
5815-816-6303	1	Teletypewriter TT-300/FG.
5815-00-688-8761		TELEPRINTER TT-259/FG
		NOTE
		The following items are used with AN/FGC-20, AN/FGC-20X, AN/UGC-4, AN/FGC-21, AN/FGC-66, and TT-259/FG.
7510-00-082-2648	1	Ribbon, Printing, Teletypewriter: type 1, class 1, DDD-R-311d; 81348.
5815-356-3371	1	Shaft, Assembly: Kleinschmidt part 50605A (installed in equip).
5815-356-3227	1	Spool, Printing, Ribbon: Kleinschmidt p/n 10900 (installed in equip).
5815-663-3066	1	Crank, Hand: Kleinschmidt p/n 54960A.
5815-203-1678	1	Gear Worm: (60 wpm) (installed in equip), SC-B-69681; 80063.
5815-203-1327	1	Gear Worm: (100 wpm) (mounted in equip), SC-B-70482; 80063.
5815-378-5593	1	Gear, Worm Wheel: (60 wpm) (installed in equip), SC-B-70492; 80063.
5815-351-7944	1	Gear, Worm Wheel: (100 wpm) SC-B-70478; 80063.
7530-281-2694	1	Paper, Recording: type 1, class 1, grade A UU-P-547d; 81348.

1-8.2. Expendable Consumable Items

A list of expendable consumable items required for operation appears in table 1-1.

1-9. Description of Teletypewriter Set (fig. 1-1)

a. The teletypewriter set includes a page printer, a keyboard transmitter, and a power supply. In addition, AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-64

are supplied with a table.

b. A dust cover is placed over the teletypewriter to protect the operating mechanism from dust or dirt. The dust cover, table, and exterior portions of the set are painted gray.

c. The supplies and material listed in this table are required for operation of this equipment and are authorized to be requisitioned by CTA 50-970. The FSN for the applicable unit of issue required can be found in appropriate supply catalogs. The FSCM is used as an element in item identification to designate manufacturer, distributor, or Government agency; etc., and is identified in SB 708-42.

Table 1-1. Expendable Consumable Supplies and Material

Item	Description	Ref No. and FSCM	FSC
1	Paper, Recording, Teletypewriter: Type 1, class 1, grade A	UU-P-547d 81348	7530
2	Ribbon, Printing, Teletypewriter: type 1, class 1	DDD-R-311d 81348	7510

1-10. Description of Teletypewriter (fig. 1-6)

a. A keyboard is mounted in front of and below the dust cover. The TT-98(*)/FG, TT-100/FG, TT-300/FG, TT-482/UGC, and TT-483/UGC have a standard communications keyboard with square, gray keytops; the TT-99/FG and TT-293/FG have a weather communications keyboard with black round keytops. A keyboard guard is mounted around the front of the keyboard. Four control switches are mounted in the keyboard guard, two on each side of the guard.

b. The teletypewriter dust cover has three access doors that make it possible to replenish the paper supply and change the ribbon, adjust the range, and operate the POWER switch. Two pushbuttons protrude through the front of the dust cover. A copyholder, mounted on the front of the

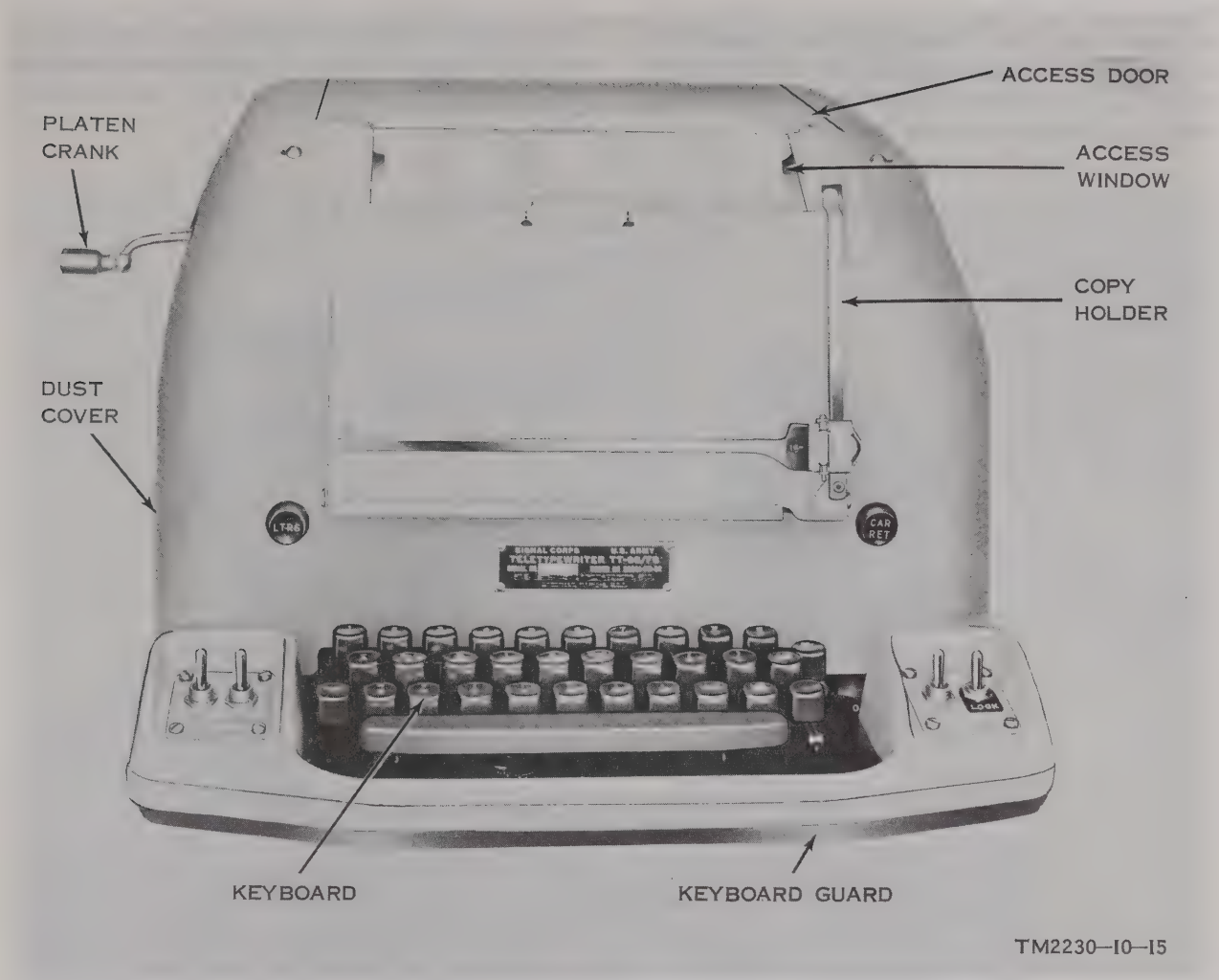


Figure 1—6. Teletypewriter TT—98(*)/FG.

dust cover, holds the copy in line for easy vision of the operator.

1—11. Description of TT—259/FG

(Fig. 1—4.)

a. The TT—259/FG is a *receive only* teletypewriter. It is equipped with standard communication symbols and a synchronous motor. The only control is a power switch located on the front of the unit.

b. The dust cover has three access doors that make it possible to replenish the paper supply and change the ribbon, adjust the range, and replace the two input fuses. Two pushbuttons protrude through the front of the dust cover.

1—12. Description of Power Supply

(Fig. 1—7.)

The power supply, located at the rear of the teletypewriter, is a plug-in, full-wave rectifier that provides a source of dc for the signal line and local test circuits, and adjusted alternating current (ac) for the ac circuits. Plug-in taps are provided in the primary winding of the input transformer that permit operation with input voltages of 95- to 125- and 190- to 250-volt, 60-cycle ac. Plug-in taps also permit coarse and fine adjustment in the secondary winding.

1—13. Description of Table

(Fig. 1—8.)

a. The table is constructed so that the teletype-

writer can be mounted at a height convenient to the seated operator. Except for the composition top, it is of metallic construction. Two spring-located guide pins are mounted in the table top to locate the teletypewriter on the table.

b. A fanfold form rack is provided in the table. Fanfold forms are placed in the rack, and the top form is threaded through the guide chute and slot provided in the table top and into the teletype-writer.

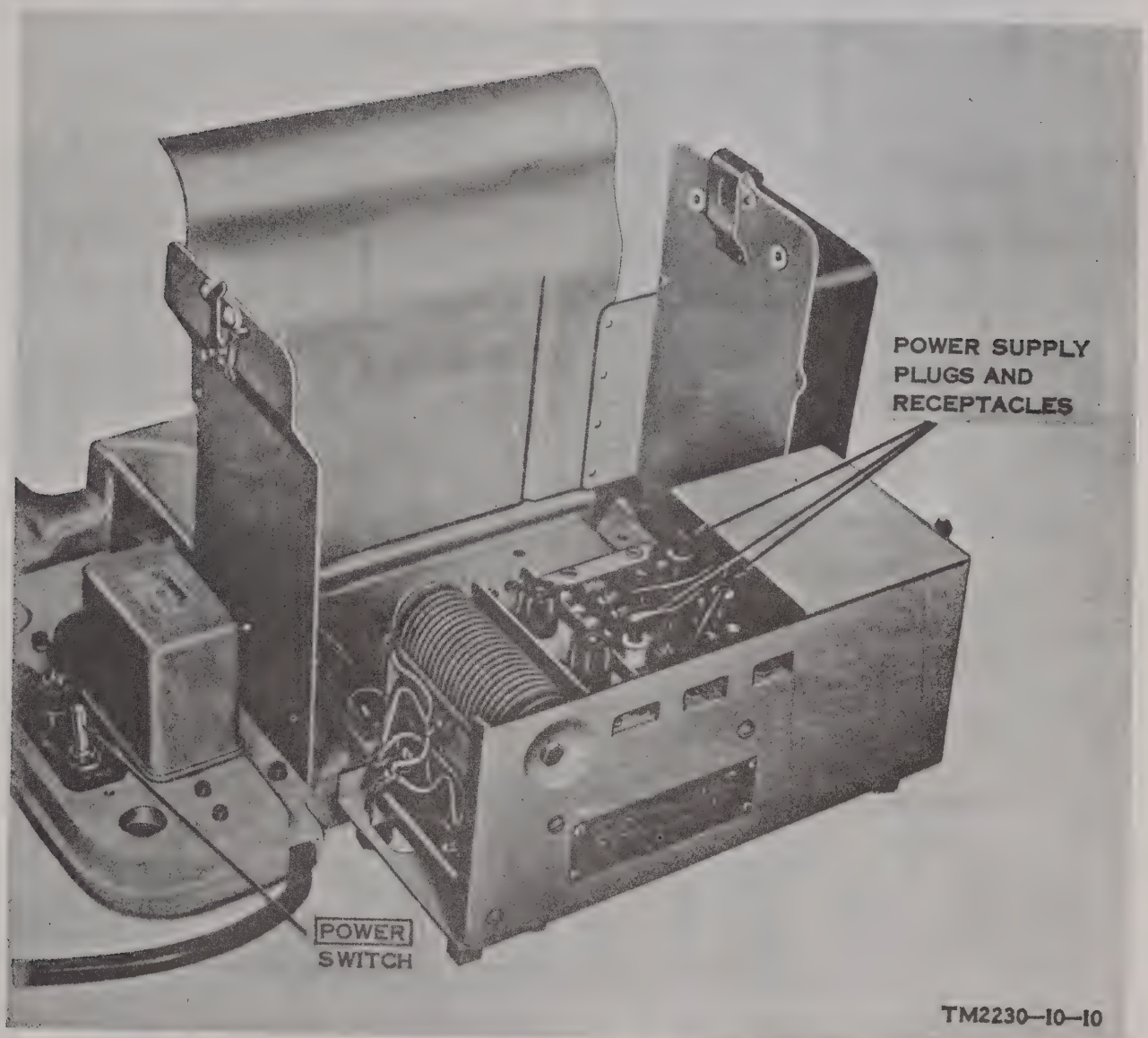


Figure 1–7. Power Supply PP–978/FG.



Figure 1–8. Teletypewriter Table FN–59/FG.

1–14. Differences in Models

The major functional differences between models of the basic equipment are covered in the following chart.

Teletypewriter set	Major components			Major features			
	Teletypewriter	Power supply	Table	Motor type	Code transmitted	Type of symbols	Capsule description of set
AN/FGC-20	TT-100(*)/FG	PP-978/FG	FN-59/FG	Synchronous	7.42	Standard	Basic teletypewriter for use with regulated power sources.
AN/FGC-20X	TT-98(*)/FG	PP-978/FG	FN-59/FG	Series-governed	7.42	Standard	Basic teletypewriter for use with unregulated power sources.
AN/FGC-21	TT-99/FG	PP-978/FG	FN-59/FG	Synchronous	7.42	Weather	Identical to AN/FGC-20 except for type of symbols.
AN/FGC-64	TT-293/FG	PP-978/FG	FN-59/FG	Series-governed	8.00	Weather	Identical with AN/FGC-21 except for motor type and 8.00 unit code.
AN/FGC-66	TT-300/FG	PP-978/FG		Series-governed	7.42	Standard	Identical to AN/UGC-4 except for a readily removable type basket.
AN/FGC-67	TT-482/UGC	PP-978/FG	FN-59/FG	Synchronous	8.00	Standard	Identical to AN/FGC-64 except for type of symbols and motor.
AN/FGC-67X	TT-483/UGC	PP-978/FG	FN-59/FG	Series-governed	8.00	Standard	Identical to AN/FGC-64 except for type of symbols.
AN/UGC-4	TT-98(*)/FG	PP-978/FG		Series-governed	7.42	Standard	Identical to AN/FGC-20X but less the table.
AN/UGC-29	TT-482/UGC	PP-978/FG		Synchronous	8.00	Standard	Identical to AN/FGC-67 but less the table.
AN/UGC-29X	TT-483/UGC	PP-978/FG		Series-governed	8.00	Standard	Identical to AN/FGC-67X but less the table.
	TT-259/FG			Synchronous		Standard	Receive only page printer.
AN/FGC-159	TT-664(*)/FG	PP-978/FG	FN-59/FG	Synchronous	7.42	Standard	Identical with AN/FGC-20 except for conversion to low-level signaling operation.
AN/FGC-159X	TT-688(*)/FG	PP-978/FG	FN-59/FG	Series-governed	7.42	Standard	Identical with AN/FGC-20X except for conversion to low-level signaling operation.
AN/FGC-160	TT-665/FG	PP-978/FG	FN-59/FG	Synchronous	8.00	Standard	Identical with AN/FGC-67 except for conversion to low-level signaling operation.
AN/FGC-177	TT-688(*)/FG	PP-978/FG		Series-governed	7.42	Standard	Identical with AN/UGC-4 except for conversion to low-level signaling operation.

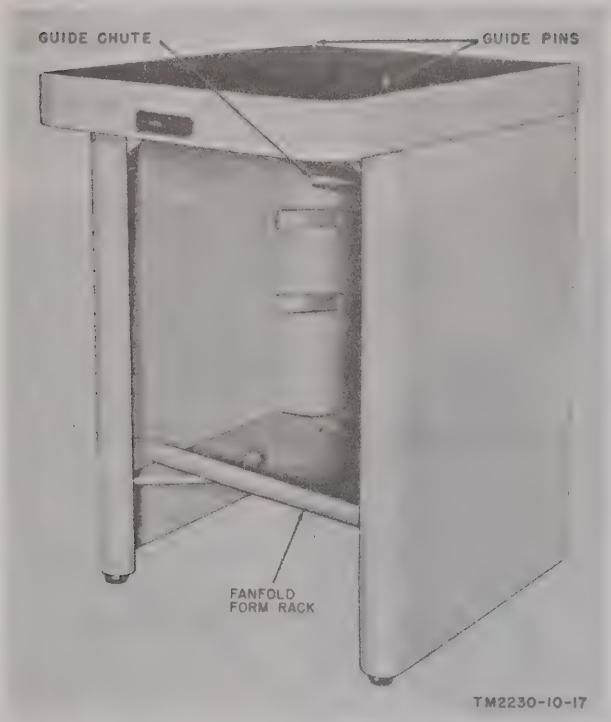


Figure 1-8. Teletypewriter Table FN-59/FG.

1-14. Differences in Models

The major functional differences between models of the basic equipment are covered in the following chart.

Teletypewriter set	Major components			Major features			
	Teletypewriter	Power supply	Table	Motor type	Code transmitted	Type of symbols	Capsule description of set
AN/FGC-20	TT-100(*)/FG	PP-978/FG	FN-59/FG	Synchronous	7.42	Standard	Basic teletypewriter for use with regulated power sources.
AN/FGC-20X	TT-98(*)/FG	PP-978/FG	FN-59/FG	Series-governed	7.42	Standard	Basic teletypewriter for use with unregulated power sources.
AN/FGC-21	TT-99/FG	PP-978/FG	FN-59/FG	Synchronous	7.42	Weather	Identical to AN/FGC-20 except for type of symbols.
AN/FGC-64	TT-293/FG	PP-978/FG	FN-59/FG	Series-governed	8.00	Weather	Identical with AN/FGC-21 except for motor type and 8.00 unit code.
AN/FGC-66	TT-300/FG	PP-978/FG		Series-governed	7.42	Standard	Identical to AN/UGC-4 except for a readily removable type basket.
AN/FGC-67	TT-482/UGC	PP-978/FG	FN-59/FG	Synchronous	8.00	Standard	Identical to AN/FGC-64 except for type of symbols and motor.
AN/FGC-67X	TT-483/UGC	PP-978/FG	FN-59/FG	Series-governed	8.00	Standard	Identical to AN/FGC-64 except for type of symbols.
AN/UGC-4	TT-98(*)/FG	PP-978/FG		Series-governed	7.42	Standard	Identical to AN/FGC-20X but less the table.
AN/UGC-29	TT-482/UGC	PP-978/FG		Synchronous	8.00	Standard	Identical to AN/FGC-67 but less the table.
AN/UGC-29X	TT-483/UGC	PP-978/FG		Series-governed	8.00	Standard	Identical to AN/FGC-67X but less the table.
	TT-259/FG			Synchronous		Standard	Receive only page printer.
AN/FGC-159	TT-664(*)/FG	PP-978/FG	FN-59/FG	Synchronous	7.42	Standard	Identical with AN/FGC-20 except for conversion to low-level signaling operation.
AN/FGC-159X	TT-688(*)/FG	PP-978/FG	FN-59/FG	Series-governed	7.42	Standard	Identical with AN/FGC-20X except for conversion to low-level signaling operation.
AN/FGC-160	TT-665/FG	PP-978/FG	FN-59/FG	Synchronous	8.00	Standard	Identical with AN/FGC-67 except for conversion to low-level signaling operation.
AN/FGC-177	TT-688(*)/FG	PP-978/FG		Series-governed	7.42	Standard	Identical with AN/UGC-4 except for conversion to low-level signaling operation.

1-15. Description and Data, AN/FGC-159 and AN/FGC-160

a. Purpose and Use. The AN/FGC-159 and AN/FGC-160 are used only at low-level polar signaling installations to permit manual keyboard transmission and page printer reception and monitoring of teletypewriter messages.

b. Technical Characteristics. Technical characteristics of the AN/FGC-159 and AN/FGC-160 are the same as the AN/FGC-20 and AN/FGC-67, respectively (para 1-5), except as follows:

Type of signals ..... Polar
Current delivered to teletypewriter contacts in mark condition ..... 60± microamperes
Voltage across teletypewriter contacts in space condition ..... 1± 0.5 volt
Signal bias tolerances ..... Not applicable
End distortion tolerances ..... Not applicable

1-16. Items Comprising an Operable AN/FGC-159 and AN/FGC-160

The following items comprise an operable AN/FGC-159 (FSN 5815-041-3382) and an AN/FGC-160 (FSN 5815-025-9036):

FSN	*Qty*	*Nomenclature*
5815-500-4384	1	Power Supply PP-978/FG (mounted under teletypewriter cover).
5815-503-2021	1	Table, Teletypewriter FN-59/FG.
5815-033-6217	1	Teletypewriter TT-664(*)/FG[a]
5815-097-0061	1	Teletypewriter TT-665/FG[b]

[a]Part of AN/FGC-159.
[b]Part of AN/FGC-160.

LOW-LEVEL UNIT NOTES

1. The terminal box in low-level units does not include a DC POWER switch; therefore, references to this switch do not apply to low-level units.
2. The selector magnets of low-level units do not include bias windings; therefore, the references to the bias circuitry (bias fuse check in paragraph 2-5 and bias current adjustment in paragraph 2-13) do not apply to low-level units.
3. Low-level units do not include a LINE SELECTOR switch for establishing a local test condition. To interconnect the transmitter output of a low-level unit to the receiver of the unit, use jumpers to connect terminal 4 to terminal 9 and terminal 5 to terminal 10 on terminal board TB1 which is mounted on the terminal box to the left of the power supply.
4. In view of the above differences, a separate section (sect. IV) has been provided to cover installation and line-up of the low-level units.

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

2-1. Unpacking

a. Packaging Data.

(1) When packed for export shipment, each teletypewriter set is packed into two wooden boxes. Pertinent data is given in the following table.

Box No.	Dimensions	Volume (cu ft)	Weight (lb)	Contents
1	19 x 24¾ x 32	8. 2	119	Teletypewriter.
2	30 x 20½ x 24½	8. 7	79	Table.

(2) When packed for domestic shipment, each teletypewriter set is packed into two corrugated cartons. Pertinent data is given in the following table.

Box No.	Dimensions	Volume (cu ft)	Weight (lb)	Contents
1	16½ x 23 x 29	6. 4	61	Teletypewriter.
2	28¾ x 20 x 23⅜	7. 6	22	Table.

b. Unpacking Table, Export Packaging (fig. 2-1).

***Caution:* Be careful when unpacking equipment. Do not thrust tools into the interior of the shipping container; this procedure may damage the equipment.**

(1) Remove the nails from the box cover and remove the cover.

(2) Carefully lift the carton from the wooden box.

(3) Open the carton by slitting three of the edges to permit the fourth edge to act as a hinge.

(4) Remove the liners, the filler, and the table; remove the sealed accessory carton from the kneehole of the table.

c. Unpacking Teletypewriter, Export Packaging (fig. 2-2).

(1) Observe the instructions in the *Caution* notice (*b* above).

(2) Carefully remove the nails from the wooden box cover; *the teletypewriter is attached (upside down) to the wooden box cover.*

(3) Carefully lift the wooden box cover straight up; be careful not to damage the teletypewriter.

(4) Set the wooden box cover and teletypewriter on a suitable working surface.

(5) Carefully cut around the base of the sealed barrier. Remove the sealed barrier.

(6) Remove the dust cover of the teletypewriter by loosening the locking knobs on each side of the base and then lifting the cover straight up.

(7) Remove the hexagonal nut, lock washer, and flat washer (fig. 2-2) from each of the four shock mounts.

(8) Remove the platen crank and the power cord from the power supply of the teletypewriter and replace the dust cover on the teletypewriter. Tighten the locking knobs.

(9) Lift the teletypewriter completely from the shock mounts and place it in position on the table.

d. Unpacking Table, Domestic Packaging.

(1) Observe the instructions in the *Caution* notice (*b* above.)

(2) Open the carton by slitting three of the edges to permit the fourth edge to act as a hinge.

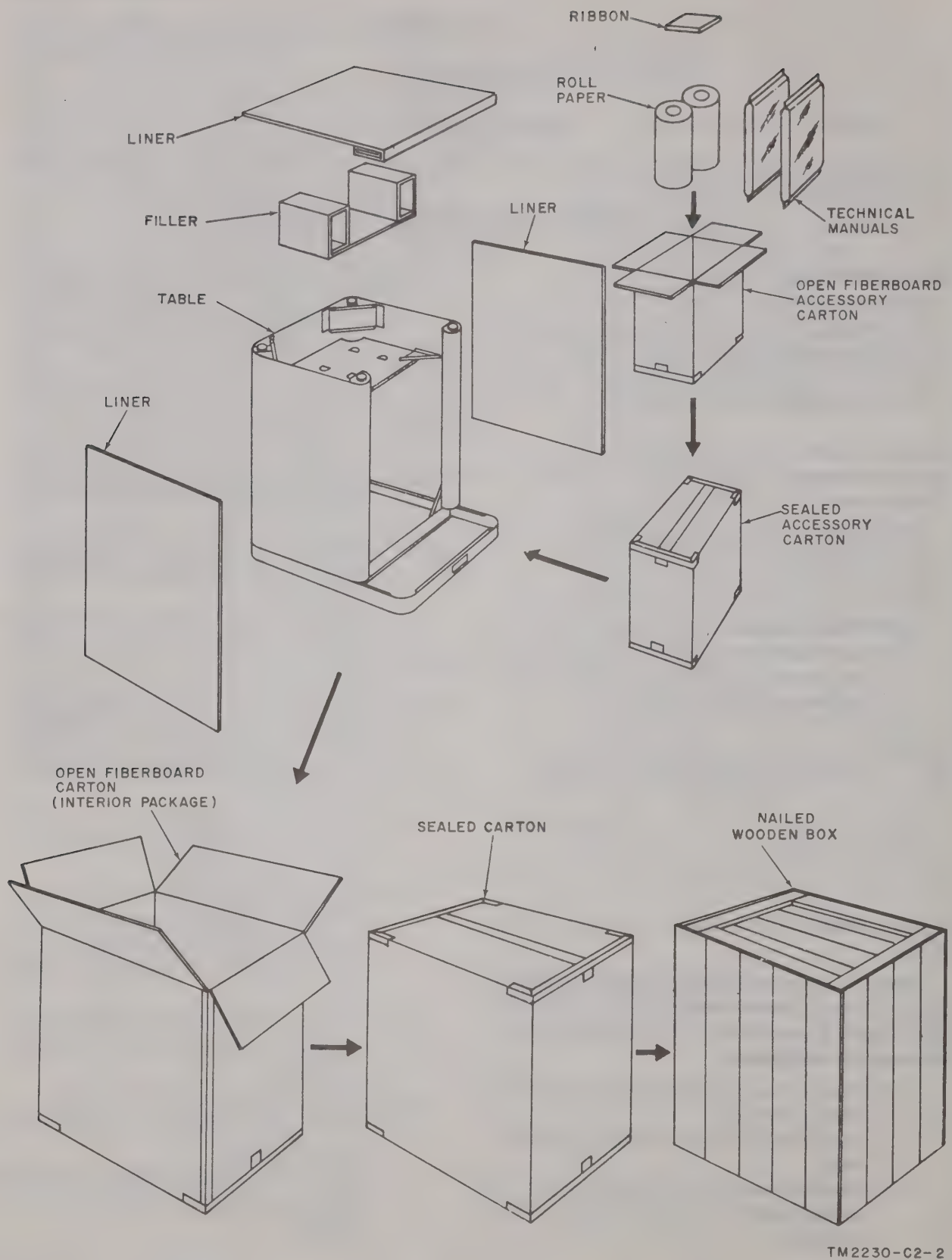


Figure 2-1. Teletypewriter Table FN-59/FG packaged for export shipment.

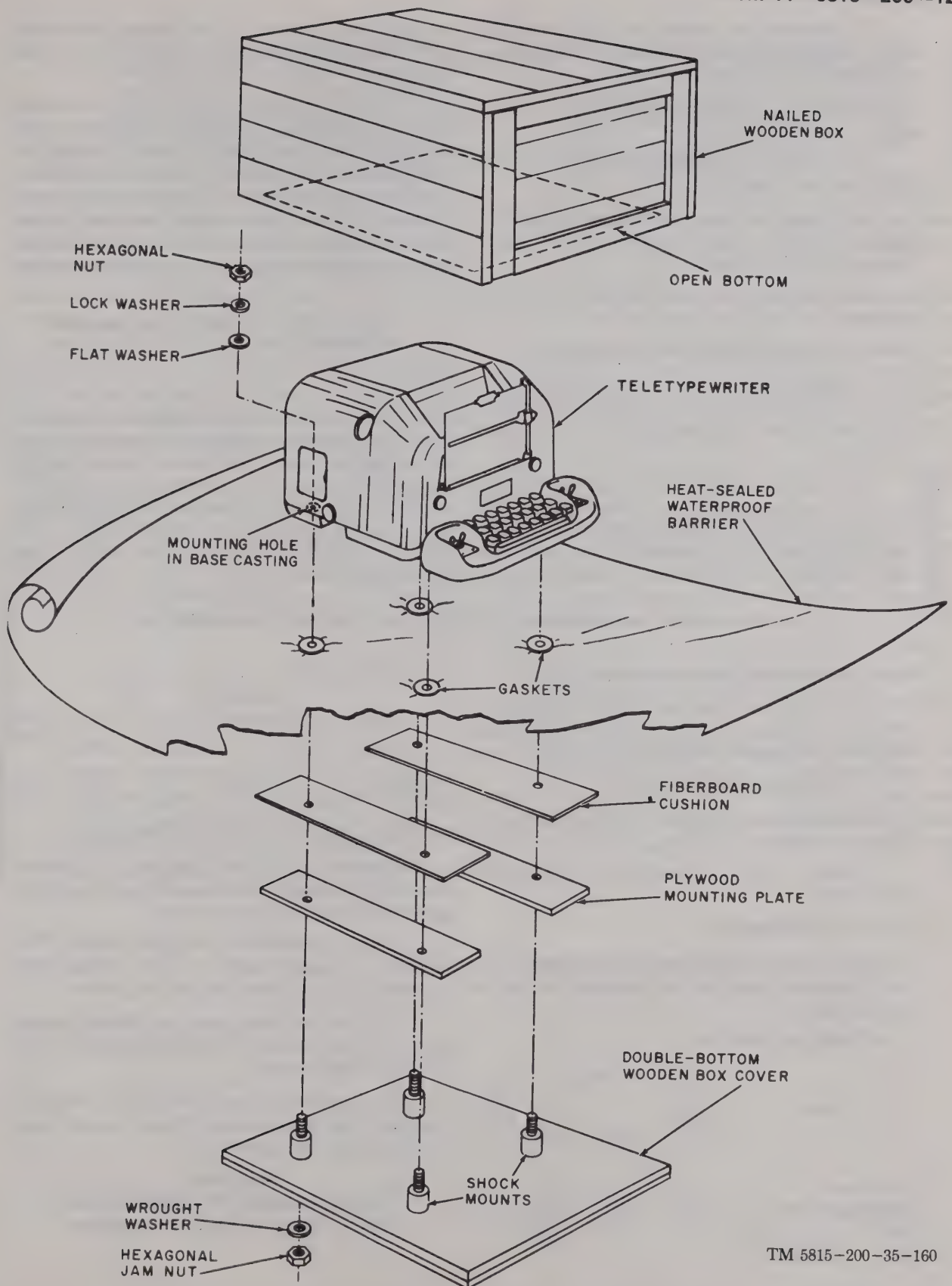


Figure 2–2. Teletypewriter T–98B/FG packaged for export shipment.

(3) Remove the liners, the filler, and the table; remove the sealed accessory carton from the kneehole of the table.

e. Unpacking Teletypewriter, Domestic Packaging.

(1) Observe the instructions in the *CAUTION* notice (*b* above).

(2) Open the carton by slitting three of the edges to permit the fourth edge to act as a hinge. Remove the teletypewriter.

(3) Carefully cut and remove the sealed barrier.

2—2. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1—3).

b. See that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against paragraph 1—8.1. Report all discrepancies in accordance with TM 38—750. Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, see whether it has been changed by modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see whether the MWO number (if any) and appropriate notations concerning the modification have been entered in the equipment manual.

NOTE

Current MWO's applicable to the equipment are listed in DA Pam 310—7.

2—3. Siting

A suitable location must provide for accessibility for equipment maintenance, convenience of operating personnel, illumination needs, the flow of message traffic in the communication center, and free access to the back of the teletypewriter set. Select a location which provides 95- to 125-volt or 190- to 250-volt, 60-cycle single phase alternating current (ac).

Section II. PRELIMINARY INSTALLATION PROCEDURES

2—4. Tools and Lubricants Required

The following items are required for installation and initial lubrication of the teletypewriter set but they are not furnished with the teletypewriter set:

a. Tool Equipment TE—50—B.

b. Oil, lubricating (OAI), (1 quart can), FSN 9150—223—4129.

c. Grease (GH), (1 pound can), FSN 9150—223—4003.

2—5. Fuse Check

Check all fuses before power is connected to the set. Pertinent fuse data is provided in the following table:

a. Teletypewriter Set.

Circuit	Fuse symbol	Fuse rating		Figure reference
		Amps	Volts	
Power input	F1	2.0	250	2—3
Power supply output	F2	1/4	250	2—5
Bias	F4	1/16	250	2—9

b. TT—259/FG.

Circuit	Fuse symbol	Fuse rating		Figure reference
		Amps	Volts	
Power input	F1 and F2	2.0	250	2—4
Bias	F4	1/16	250	2—9

2—6. Ground and Power Connections

a. Ground Connection. Connect the braided wire lead attached to the power input cord to a grounded portion of the ac outlet.

b. Power Connections (not applicable to TT—259/FG). Connect power to the teletypewriter set and adjust the rectifier taps as follows:

(1) Place the teletypewriter POWER switch (fig. 2—3) and the DC POWER switch (fig. 2—9) in their OFF positions.

(2) Use Multimeter TS—297/U to check the voltage of the power source. This will be the input voltage to the teletypewriter.

CAUTION

Power Supply PP—978/FG must be in place on the teletypewriter

frame whenever the power input plug is connected to a source of power above 125 volts. The power supply may be removed when the plug is connected to a power supply of less than 125 volts.

(3) Open the door to the power supply (fig. 2-5). Insert the plug of the primary winding lead (center lead) into the numbered jack corresponding, as close as possible, to the input voltage. If the input voltage is not exactly as indicated on the terminal board, insert the plug of the primary winding lead into the next higher numbered jack.

(4) Insert the plug of the secondary winding coarse lead into the M jack of high-level units or the L jack of low-level units. Insert the plug of the secondary winding fine lead into the No. 3 jack of high-level units or into the No. 1 jack of low-level units.

(5) Insert the power input plug into the ac power outlet.

(6) Place the teletypewriter POWER switch (fig. 2-3) and the DC POWER switch (fig. 2-9) to the ON position. Proceed to (8) below for low-level units, otherwise, perform (17) below.

WARNING

Power Supply PP-798/FG contains selenium rectifiers which immediately release poisonous fumes when they burn out. The fumes are toxic and have a strong, unpleasant odor resembling the smell of rotten eggs. Whenever this oder is detected, IMMEDIATELY disconnect power and thoroughly ventilate the area. PERMANENT INJURY OR DEATH MAY RESULT FROM PROLONGED BREATHING OF THE FUMES. Do not handle the burned-out rectifier until it cools.

(7) Use Multimeter TS-297/U to check the dc output voltage of the power supply at the test jacks of the terminal and switch box; the output voltage should be 120 volts dc.

(a) If the output voltage is greater than 120 volts, insert the plug of the secondary winding lead into one of the lower numbered jacks (1 or 2). If the output voltage is still too high, insert the plug of the secondary winding coarse lead into the L jack and insert the plug of the secondary winding fine lead into the numbered jack (1 through 5) that will give the required output voltage.

(b) If the output voltage is less than 120 volts, insert the plug of the secondary winding fine lead into one of the higher numbered jacks (4 or 5). If the output voltage is still too low, insert the plug of the secondary winding coarse lead into the H jack and insert the the plug of the secondary winding fine lead into the numbered jack (1 through 5) that will give the required output voltage.

(8) On low-level units, use a multimeter to check the dc output voltage of the power supply at test terminals E11 (–) and E12 (+), which are located on motherboard A1 A1 in the terminal box. The meter should indicate between +80 and +105 volts.



Figure 2-3. Power input fuse and power switch location (not applicable to TT-259/FG).

c. Power Connection (TT-259/FG).

(1) Set the power switch (fig. 2-4) to OFF.

(2) Connect the power input plug to a source of 105- to 125-volt, 60-cps, single-phase power.

2-7. Preinstallation Checks (T T-259/FG)

a. Disengage the platen and carriage locks and reposition the blocking plate (para 2-8). Install a roll of paper and spool of ribbon (paras 3-6 and 3-7).

b. Check the friction clutches for lubrication (para 2-8). Lubricate, if necessary.

c. Check the speed-control gears; change gears, if necessary (para 2-11).

d. Set the power switch to ON, check the bias current (para 2-13) and, if necessary, adjust the bias resistor.

e. Disconnect the shorting bar from signal line terminals 2 and 3 (fig. 2-9).

f. If a local source of teletypewriter test signals is not available, connect the incoming signal lines and make the final adjustments (para 2-19).

g. If a local source of 60-ma neutral teletypewriter test signals is available:

(1) Set the LINE SELECTOR switch (fig. 2-9) to TEST.

(2) Set the DC POWER switch on the terminal and switch box to ON.

(3) Insert several thicknesses of rubber tape (or other suitable insulating material) between the E contacts of jack J4B (14, fig. 2-67, TM 11-5815-200-35).

(4) Loosen the locknut on the LINE CURRENT rheostat (fig. 2-9) and turn the rheostat fully *counterclockwise*. Do not tighten the locknut.

(5) Connect the two leads from the source of local test signals to signal line terminals.

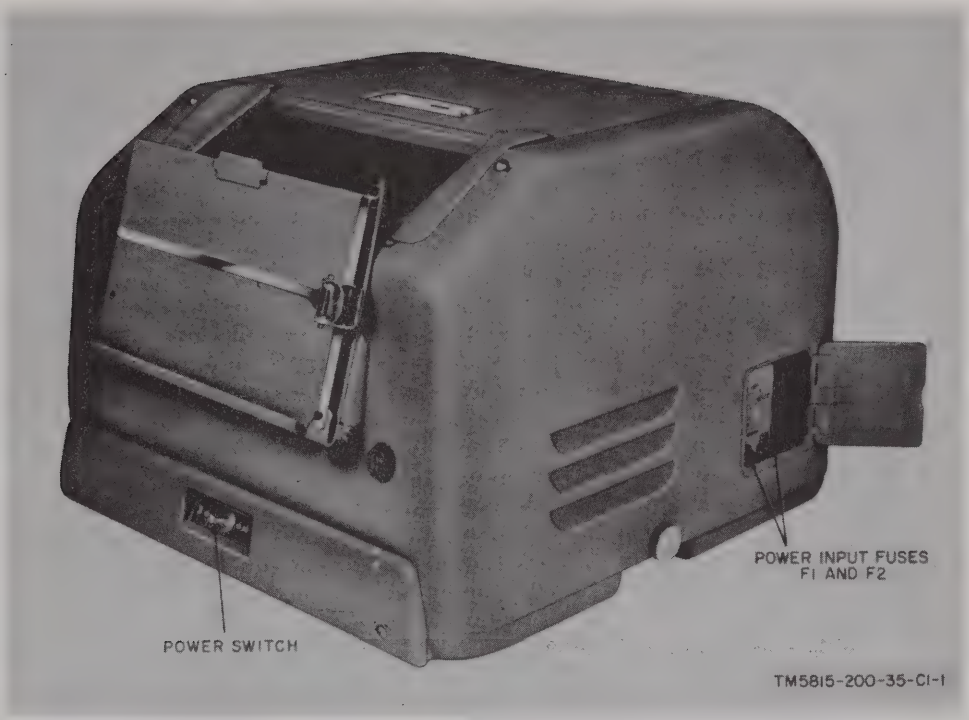


Figure 2-4. Location of power input fuse and power switch (TT-259/FG).

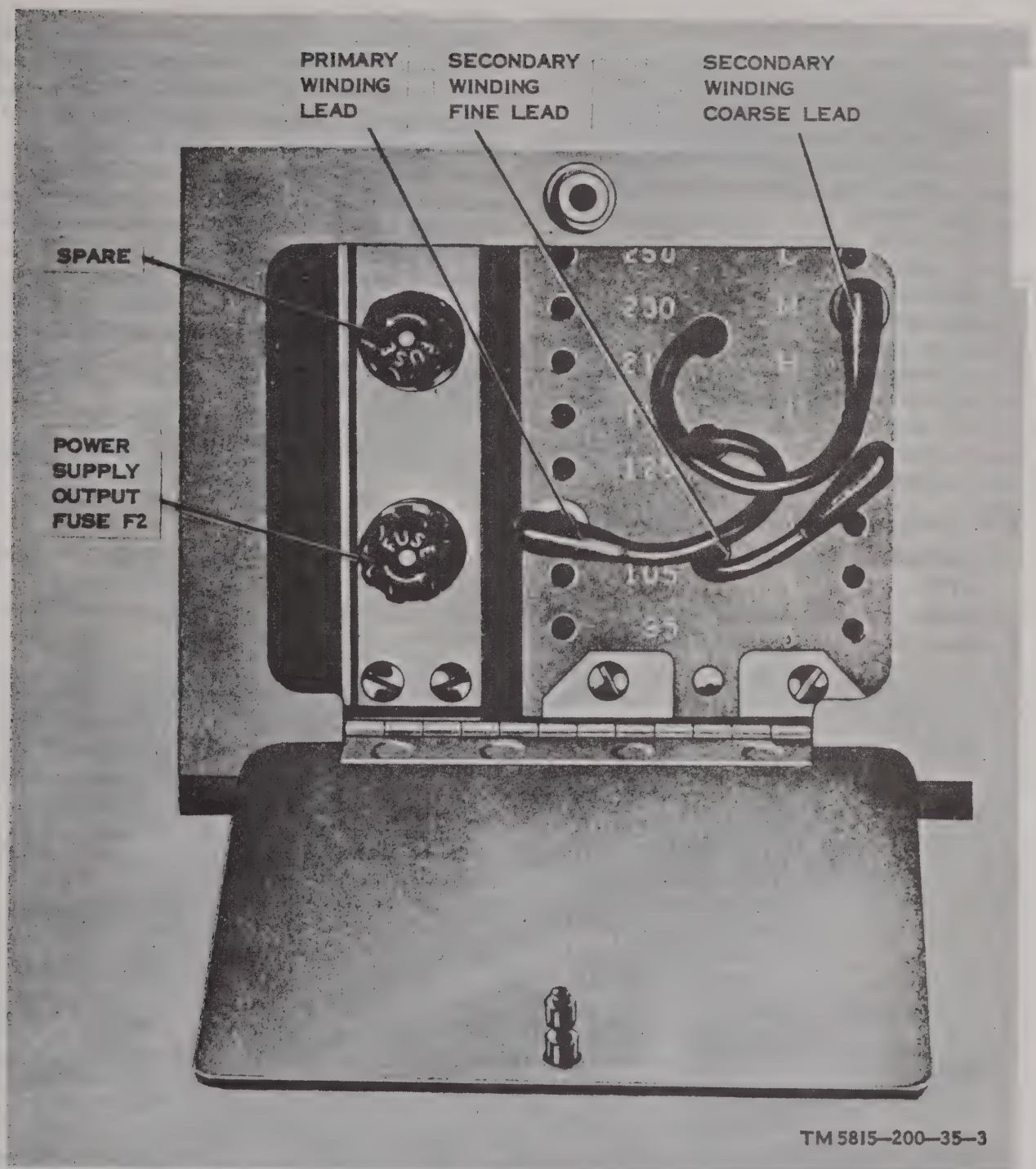


Figure 2–5. Power supply panel (not applicable to TT–259/FG).

2 and 5 (positive polarity lead to terminal 2).

Note. The source of local test signals should include a series-connected dc millammeter.

(6) Slowly turn the LINE CURRENT rheostat clockwise until the milliammeter indicates 60 ma. Tighten the locknut on the rheostat.

(7) Set the power switch to ON to start the motor. Check and, if necessary, adjust the motor speed (para 2–10).

(8) Arrange to have test signals transmitted to the teletypewriter. Adjust the rangefinder (para 2–14).

(9) Set the power switch to OFF.

(10) Connect the incoming signal lines and make the final installation adjustments (para 2–19).

2–8. Preliminary Operating Checks and Adjustments (Not applicable to TT–259/FG).

a. Check platen and carriage locks (fig. 2–6). The locks must be disengaged from the locking studs; loosen the wingnuts to shift the locks. Some teletypewriters are equipped with a blocking plate that is used to secure the carriage return driving gear during shipment (A, fig. 2–7). In this case, remove the two hexagonal nuts to reposition the blocking plate (B, fig. 2–7).

b. Check the friction clutches. If the teletypewriter has been out of service for a long period of time, the friction clutches may have dried out and will require lubrication (paras 2–8—2–12, TM 11–5815–200–35) and readjustment (paras 2–95, 2–127, 2–174, 2–175, and 2–182 in TM 11–5815–200–35). Adjust the motor speed (para 2–10) and the rangefinder dial (para 2–14) before lubricating or adjusting friction clutches.

c. Check switch adjustments (para 2–9).

d. Check motor speed; adjust if necessary (para 2–10).

e. Check the speed-control gears; change gears if necessary (para 2–11).

f. Check the bias current adjustment (para 2–13).

g. Check the rangefinder adjustment (para 2–14).

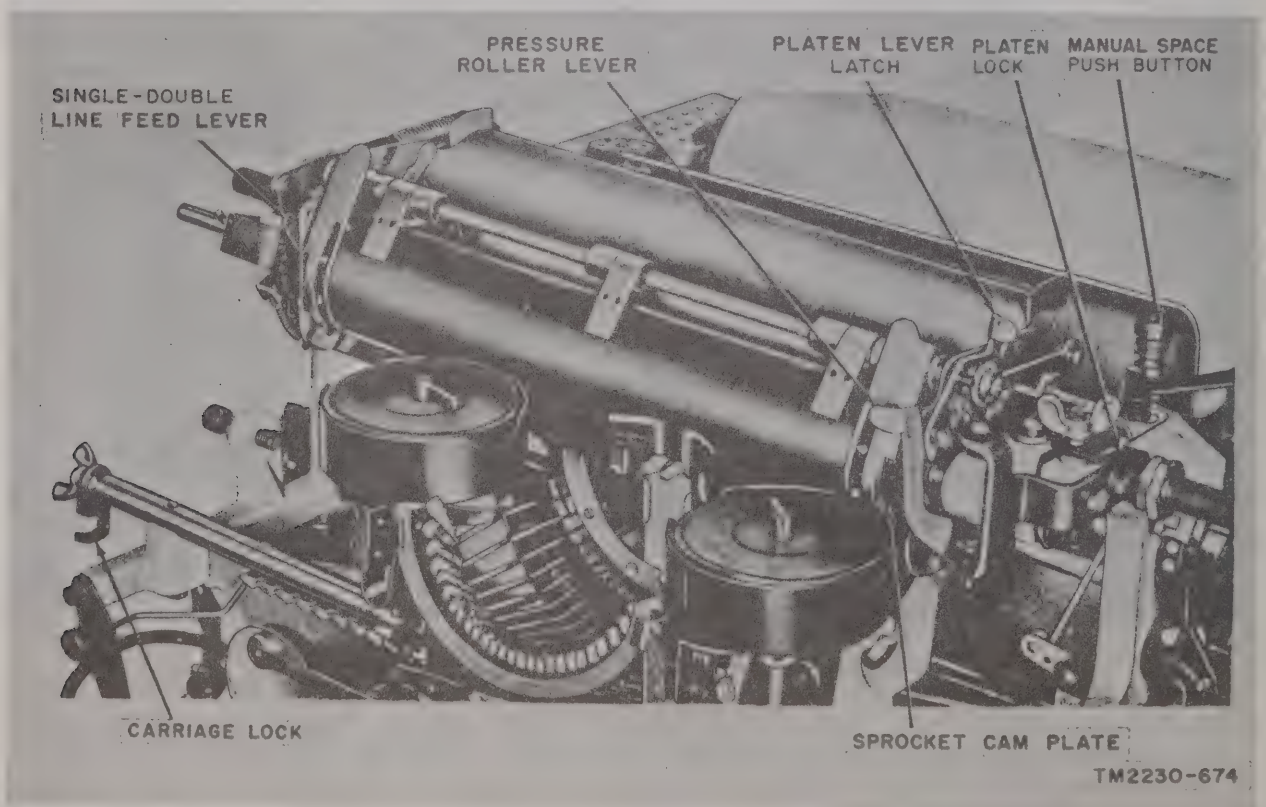


Figure 2–6. Teletypewriter, dust cover removed, showing platen and carriage locks.

2-8.1. Preliminary Operating Checks and Adjustments (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

a. Check platen and carriage locks (fig. 2-6). The locks must be disengaged from the locking studs; loosen the wingnuts to shift the locks. Some teletypewriters are equipped with a blocking plate that is used to secure the carriage return driving gear during shipment (A, fig. 2-7). In this case, remove the two hexagonal nuts to reposition the blocking plate (B, fig. 2-7).

b. Check the friction clutches. If the teletypewriter has been out of service for a long period of time, the friction clutches may have dried out and will require lubircation as described in TM 11-5815-200-35. Adjust the motor speed (para 2-10) rangefinder dial (para 2-14) before lubricating or adjusting friction clutches.

NOTE

Before performing the instructions in *c* below, normal operational checks (such as ribbon supply, paper supply, etc.) should be accomplished.

c. Adjust the contact assembly as follows:

(1) On terminal box A1, connect an oscilloscope (isolated from ground) to terminal board TB1, terminals 4 and 5, and set the oscilloscope controls to measure a waveshape with an amplitude of 12 volts and a wavelength of 26 milliseconds.

(2) Remove the transmitter contact cover; and on the newly installed contact assembly, locate the adjustable hexagonal nut which is mounted on the shaft of the pushrod lifter.

(3) Place the SEND/LOCK switch in SEND, MOTOR switch to ON, and press and hold the REPEAT button and the "R" character button.

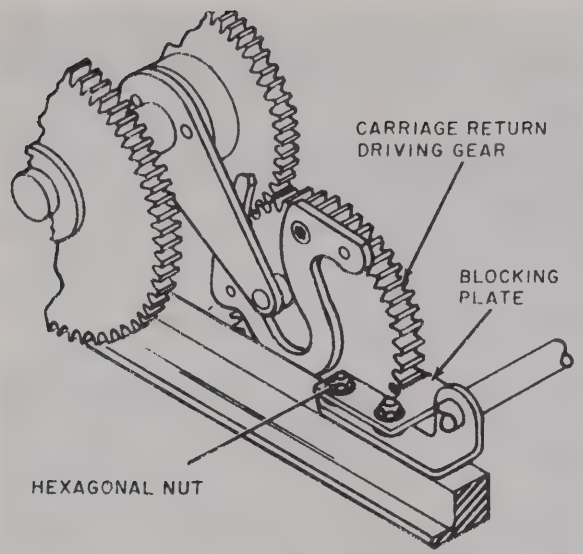
(4) Observe the oscilloscope and adjust the hexagonal nut located in (2) above until a waveshape appears with negative and positive transitions (bits) of equal time duration.

(5) Release the keyboard buttons, disconnect the oscilloscope, place the ac POWER and MOTOR switches in the OFF position, and secure transmitter contact cover.

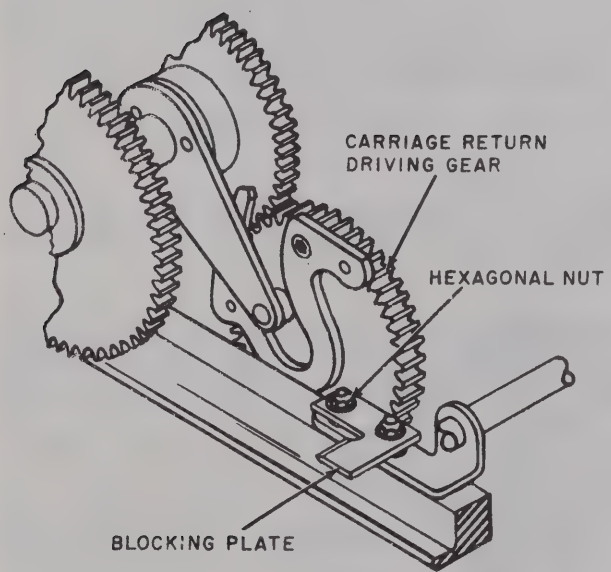
d. Check motor speed; adjust if necessary (para 2-10).

e. Check the speed-control gears; change gears if necessary (para 2-11).

f. Check the rangefinder adjustment (para 2-14).



A. BLOCKING PLATE IN SHIPPING POSITION



B. BLOCKING PLATE IN OPERATING POSITION

TM5815-200-35-4

Figure 2–7. Carriage return driving gear blocking plate.

2–9. Switch Settings (Not applicable to TT–259/FG)

a. Set the LINE SELECTOR switch, on the terminal and switch box (fig. 2–9), to the TEST position.

b. Set the DC POWER switch to OFF.

c. Set the SEND-LOCK switch, on the keyboard, to the SEND position.

2–10. Motor Speed Adjustment

Adjust the motor speed as follows:

a. Turn the MOTOR switch to ON.

b. Strike a 180 vibrations-per-second (vps) tuning fork gently against the hand to make it vibrate.

c. View the spots on the (rotating) target wheel through the vibrating shutters on the end of the tuning fork. If the spots are stationary, no adjustment is necessary. If the spots are moving clockwise, pull the end of the adjusting worm outward, and hold it out until the clockwise motion of the target spots has stopped. If the spots are moving counterclockwise, push the end of the adjusting worm inward and hold it in until the motion of the target spots has stopped. The motor now is set at its operating speed of 3,600 revolutions per minute (rpm).

2–11. Changing Operating Speed of Teletypewriter

(fig. 2–8)

a. The teletypewriter is shipped by the manufacturer with the 60-word-per-minute (wpm) (368.1-operation-per-minute (opm)) gears installed and the 100-wpm (600 opm) gears supplied as accessory equipment. The accessory gears are mounted on the main shaft drive gear cover plate on the right rear side of the teletypewriter. The speed in operations per minute is stamped on the sides of the main shaft drive gear and on the shank of the motor worm gear.

Note. The AN/FGC–64 includes 45.5-baud rate (368.1 opm) gears which are installed. Fifty-baud rate (404 opm) and 75-baud rate (600 opm) gears are supplied as accessory gears.

b. To change the operating speed of the teletypewriter:

(1) Disconnect the motor plug from the receptacle in the base.

(2) Remove the four socket head screws and lockwashers that secure the gear cover to the frame.

(3) Remove the screws and lockwashers that fasten the motor to the casting and remove the motor.

(4) Remove the screw and lockwasher that secure the motor worm gear to the armature shaft and remove the motor worm gear.
(5) Remove the screw and lockwasher that secure the worm gear to the main shaft and remove the worm gear.
(6) Install the new gears and replace the motor and gear cover.
(7) Check the motor speed (para 2–10) and friction clutch adjustments (paras 2–95, 2–127, 2–174, 2–175, and 2–182, TM 11–5815–200–35).

c. To operate the teletypewriter with British equipment which has an operating speed of 66 wpm, it is necessary to install a new gear set and to readjust the margin bell to ring on the 63d space from the left-hand margin and the right-hand margin stop bar shift stop to permit the printing of 69 characters per line. Obtain a gear set which is designed for 404 opm and install it as described in *b* above. Refer to paragraphs 2–206 and 2–212 (TM 11–5815–200–35) for margin bell and stop bar shift stop adjustment procedures.

2–12. Changing Type Basket of Teletypewriter TT–300/FG

a. Remove the inking ribbon from the ribbon guide.

b. Remove the two screws and lockwashers that secure the ribbon feed mechanism to the carriage frame.

c. Loosen the screws (3) and lift the type basket upward and outward from the carriage frame.

d. Install the alternate type basket by reversing the procedure described in *a* through *c* above.

2–13. Bias Current Adjustment
(fig. 2–9)

Check the setting of the bias resistor which is located near the rangefinder dial. Two BIAS TEST terminals, connected with a shorting bar, are provided on the terminal and switch box for the convenience of checking the bias circuit current. Remove the shorting bar and connect a milliammeter between the two BIAS TEST terminals. Check the current in the bias circuit. The milliammeter should read 12.25 milliamperes (ma) if the LINE SELECTOR switch is in the 60 position or 8.75 ma if the LINE SELECTOR switch is in the 20 position. If the reading does not conform to these values, adjust the resistor.

2–14. Rangefinder Adjustment
(fig. 2–9)

Note. The rangefinder dial should be moved only when signals are being received in the selector magnet and the selector camshaft is rotating.

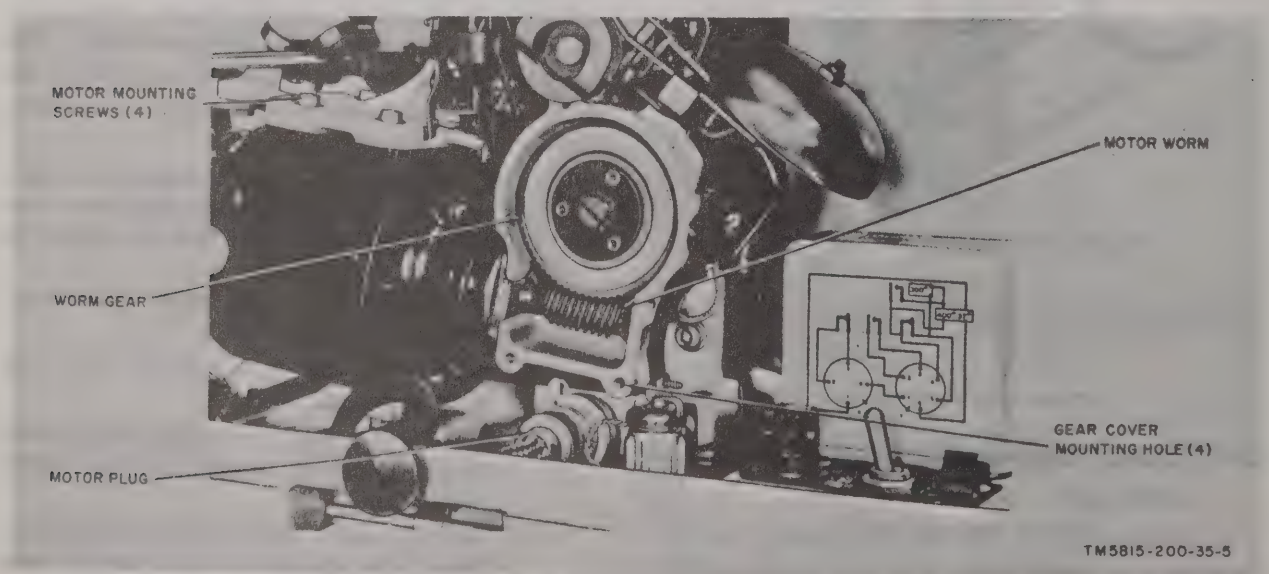


Figure 2–8. Teletypewriter motor and drive gears.

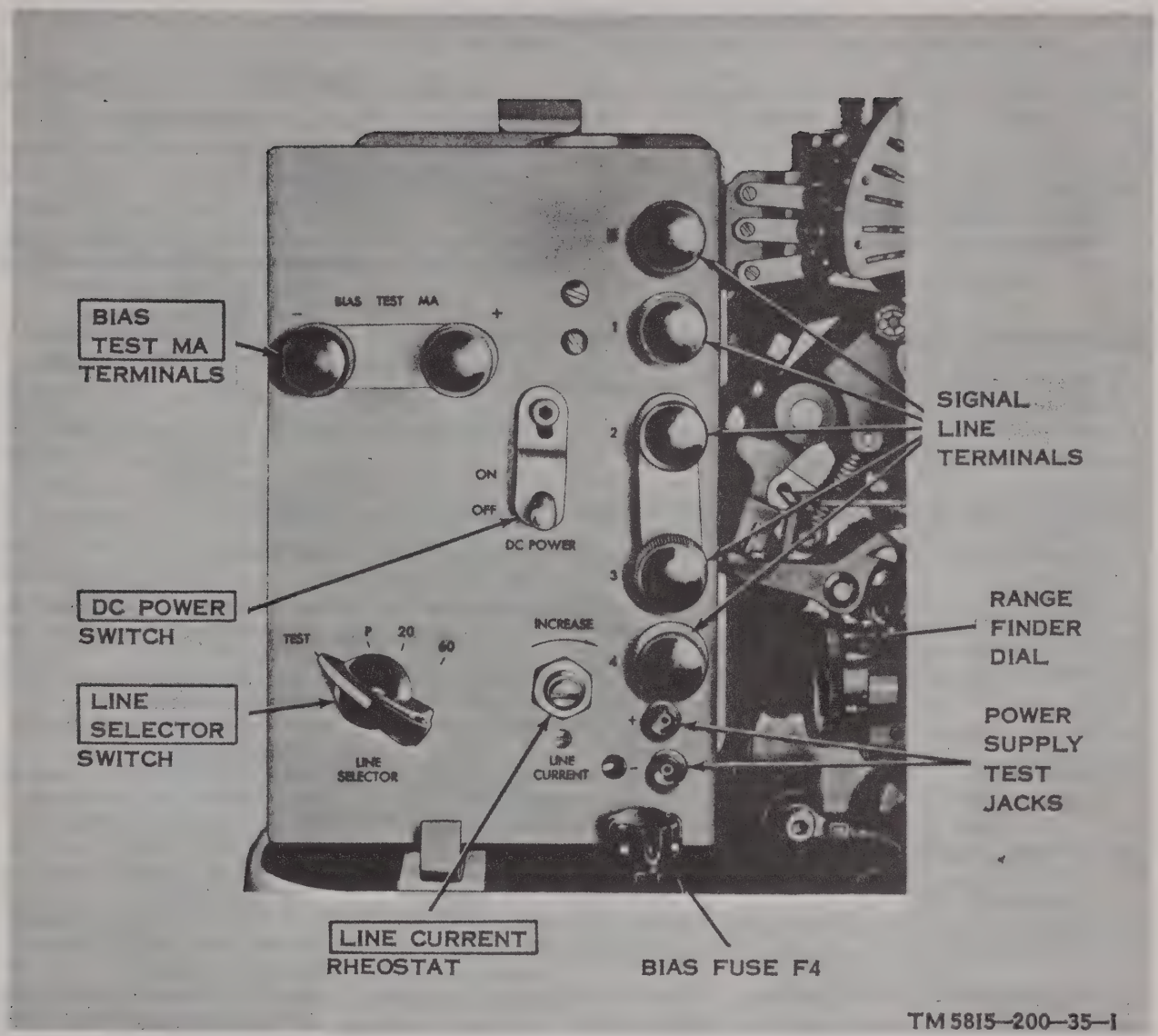


Figure 2-9. Terminal and switch box and rangefinder dial.

a. Adjust the rangefinder mechanism immediately after adjusting the BIAS resistor (para 2-13).

b. While receiving continuous R and Y signals from the keyboard, turn the rangefinder dial to the maximum and minimum good copy positions.

c. Set the rangefinder dial at the midpoint between the dial settings.

2-15. Operational Checks

a. Check the condition of the ribbon; if the printing is very light, or if the ribbon is worn, torn, or frayed, replace the ribbon (para 3-7).

b. Check the paper supply; if it is nearly depleted, install a new roll of paper (para 3-6*a*).

c. Check the operation of the sprocket feed pins (para 3-6*b*(3)).

2-16. Equipment Performance Checklist

Check the operation of the teletypewriter in the sequence listed in the chart below.

Note. Items 1, 2, 3, 5, 7, 8, and 16 through 19 do not apply to the TT-259/FG. To check items 12 through 14, arrange to have test signals transmitted to the TT-259/FG. Set the LINE SELECTOR switch (fig. 2-9)

to TEST if signals are to be obtained from a local, 60-ma., neutral test circuit; set it to P, 20, or 60, as appropriate, if the signals are to be obtained from the distant station.

Item No.	Item	Action or condition	Normal indications	Corrective measures
1	POWER switch	Operate to ON	None	None.
2	LIGHT switch	Operate to ON	Copy light should light	Check lamp and switch.
3	MOTOR switch	Operate to ON	Motor starts	Check fuse F1; check power source connection. Examine motor commutator for cleanliness. Check brushes.
4	Power switch (TT–259/FG).	Operate to ON	Copy lights should light; motor should start.	Check lamps, power switch, and power input fuses F1 and F2.
5	LINE SELECTOR switch.	Operate to TEST	Teletypewriter runs closed	Check switch.
6	DC POWER switch.	Operate to OFF (ON for TT–259/FG).	None	None.
7	SEND-LOCK switch.	Operate to SEND	Transmission possible from keyboard.	Check switch.
8	LINE-BREAK switch.	Operate to BREAK	Teletypewriter runs open	Check switch.
9	CAR RET button.	Press button	Carriage should return to left margin.	Check carriage return: button link; trip pawl; horizontal carriage return link.
10	LTRS button	Press button	Carriage should return to letters position.	Check manual unshift: push button link; lever link.
11	Manual space button.	Press button	Carriage should move from left to right.	Check manual space push button carriage feed link.
12	Automatic carriage return and line feed control.	Move carriage to right-hand margin.	Carriage should: (1) return to left-hand margin and (2) line feed automatically.	Check right hand margin trip plate, stop bar shift link, carriage return linkage, and line feed linkage.
13	Ribbon feed mechanism.	Send test message	Ribbon should feed as every other character is typed.	Check ribbon in guides and ribbon feed pawl action.
14	Ribbon lifter mechanism.	Send test message	Ribbon should rise and fall as every character is typed.	Check ribbon guide; ribbon vibrator bell crank; ribbon vibrator lever and bracket.
15	End-of-line signal bell.	Send test message	Bell should ring on 66th character	Check carriage return latch tripping arm and margin bell clapper and pawl.
16	SEND-LOCK switch.	Operate to LOCK	No transmission possible from keyboard.	Check switch.
17	MOTOR switch	Turn to OFF	Motor should stop	Check switch.
18	LIGHT switch	Turn to OFF	Light should be extinguished	Check switch.
19	POWER switch	Turn to OFF	None	Check switch.
20	Power switch (TT–259/FG).	Operate to OFF	Motor should stop; lights should be extinguished.	Check switch.

Section III. INSTALLATION AND LINE-UP

2–17. Equipment Applications

The teletypewriter set may be installed to meet several operational requirements. This is done by varying the connections of the signal lines to the teletypewriter (paras 2–18 and 2–20).

2–18. Signal Line Connections (Not applicable to TT–259/FG)

(figs. 2–9 and 2–10)

a. Set the POWER, LIGHT, MOTOR, and DC POWER switches to their OFF positions.

b. Refer to paragraph 2–6 for power and ground connection instructions.

c. Set the LINE CURRENT rheostat (fig. 2–9) to the extreme counterclockwise (maximum resistance) position and set the LINE SELECTOR switch to the position that corresponds to the type of signals to be used. Connect the teletypewriter as instructed in the applicable subparagraph below.

(1) *Neutral, half-duplex operation* (A, fig. 2–10).

(*a*) Strap terminals 2 and 3 of the terminal and switch box with the strap provided.

(*b*) For local supply of signal current, set the DC POWER switch to the ON position. Leave it in the OFF position for distant current supply.

(*c*) Connect the signal lines to terminals 1 and 4 of the terminal and switch box. If the distant station is to supply signal current, connect the positive signal line to terminal 1 and the negative signal line to terminal 4. This polarity arrangement also applies if both stations supply series-aiding battery (para 2–21 *e*(7) (*d*)).

(2) *Neutral or polar, receive-only operation* (B, fig. 2–10).

(*a*) Disconnect the strap between terminals 2 and 3 of the terminal and switch box.

(*b*) Connect the positive signal line to terminal 3 and the negative signal line to terminal 4.

(*c*) Line current normally is supplied and adjusted at the sending station. The only resistance in the receive circuit at the receive station is the resistance of the selector magnets. Refer to paragraph 2–20 for additional information covering receive-only operation.

(3) *Neutral full-duplex operation* (C, fig. 2–10).

(*a*) *Send circuit.* Disconnect the strap between terminals 2 and 3 of the terminal and switch box and connect the send signal lines to terminals 1 and 2. Set the DC POWER switch to the ON position to supply power for the send circuit. Send current is adjusted with the LINE CURRENT rheostat (para 2–21*e*).

(*b*) *Receive circuit.* Connect the positive signal line to terminal 3 and the negative signal line to terminal 4 of the terminal and switch box. When full-duplex operation is used, each station normally supplies and controls the line current in the send circuit.

2–19. Signal Line Connections and Final Adjustments (TT–259/FG)

Note. Before making the signal line connections perform the preinstallation checks (para 2–7 *a–c*)

a. Set the LINE SELECTOR switch (fig. 2–9) to P if the incoming signals are to be polar; set it to either 20 or 60, as appropriate, if the incoming signals are to be neutral.

b. Connect the incoming signal lines to signal line terminals 3 and 4 (positive polarity to terminal 3).

c. Arrange to have the distant station add or remove resistance to set the signal line current to the proper level (30 ma for polar operation; either 20 or 60 ma, as appropriate, for neutral operation).

d. Set the power switch to ON and have the distant station send alternate R and Y test signals. While receiving test signals, determine the high and low operating limits with the rangefinder dial and set the dial midway between the high and low readings.

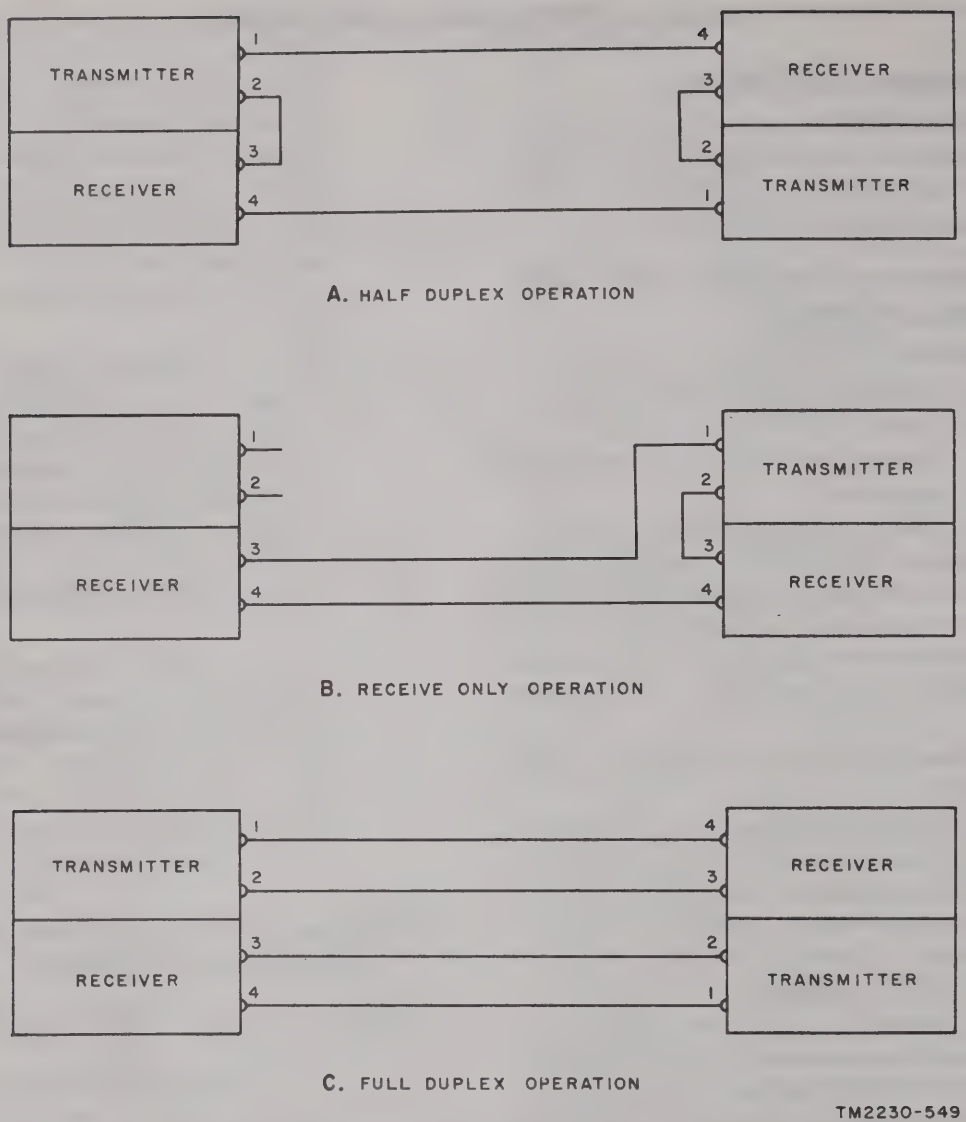


Figure 2–10. Signal line connections (Not applicable to TT–259/FG).

2–20. Equipment Modifications for Receive-only Operation (Not applicable to TT–259/FG)

(fig. 2–11)

When the teletypewriter is to be used for receive-only operation, proceed as follows:

a. Remove the keyboard guard (para 2–79, TM 11–5815–200–35) and its associated switches (S2, S3, S5, and S6) and wiring (para 2–84, TM 11–5815–200–35). Move the lead from terminal 1 of terminal board TB2 to terminal 3 (A, fig. 2–11, TM 11–5815–200–35).

(1) For receive-only operation without the motor stop feature and with the copy light controlled by the POWER switch, move the leads of TB1 (B, fig. 2–11) as follows:

(*a*) a BLK lead from terminal 5 to terminal 2;

(*b*) a WHT–RED lead from terminal 1 to terminal 2.

(2) For receive-only operation with the motor stop feature and with the copy light controlled by the motor stop feature, move the leads of TB1 (C, fig. 2–11) as follows:

(*a*) a BLK lead from terminal 5 to terminal 3;
(*b*) a WHT–RED lead from terminal 1 to terminal 2.

(3) For receive-only operation with the motor stop feature and with the copy light controlled by the POWER switch, move the leads of TB1 (D, fig. 2–11) as follows:
(*a*) a BLK lead from terminal 5 to terminal 3;
(*b*) a WHT–RED lead from terminal 1 to terminal 3.

b. Remove the keyboard plug from the keyboard jack and remove the keyboard transmitter (para 2–18, TM 11–5815–200–35).

c. Remove the two machine screws and lockwashers from the keyboard transmitter drive shaft bearing cap (fig. 2–62, TM 11–5815–200–35). Remove the two machine screws and lockwashers from the transmitter drive shaft mounting bracket, and remove the keyboard transmitter drive shaft from the teletypewriter. Replace the bearing cap with the two machine screws and lockwashers.

d. Install the receive-only dust cover adapter on the dust cover.

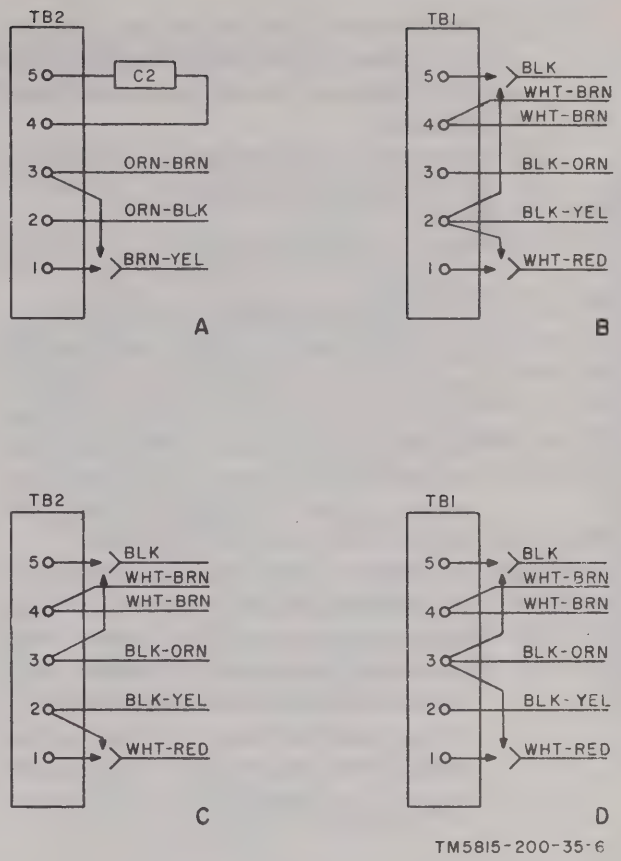


Figure 2–11. Wiring changes for receive-only operation.

2–21. Circuit Line-up (Not applicable to TT–259/FG)

a. For best operation, adjust the teletypewriter to meet the conditions of the signal line. Circuit lineup for these teletypewriters normally includes adjusting the line current and rangefinder dial for the equipment at both ends of the circuit, followed by an exchange of test copy.

b. The station from which the circuit lineup is directed is called the control station. Generally, the station of higher authority is the control station. Lineup of a circuit between stations of equal authority normally is directed by the station that has the lowest numerical designation.

c. Line current for any particular signal line in a teletypewriter system usually is supplied by the station in the network that has the transmitting device on that signal line. If two or more stations have transmitting devices on the signal line, the station of highest authority usually supplies the line current. Two or more stations may supply current when necessary because of excessive line leakage or other line factors.

d. Polar or neutral signals can be received by the teletypewriter but only neutral signals can be sent from the keyboard transmitter. Polar signals must be 30 ma and neutral signals may be either 20 or 60 ma.

e. Line current normally is adjusted as follows:
(1) Turn the POWER switch to the ON position.
(2) If the teletypewriter is to supply signal line current, set the DC POWER switch to the ON position.
(3) The control station turns its LINE CURRENT rheostat to the maximum counterclockwise (maximum resistance) position.
(4) The noncontrol station turns its LINE CURRENT rheostat to the maximum clockwise (minimum resistance) position.
(5) The control station gradually decreases resistance until the current reaches 75 ma for 60-ma circuits or 30 ma for 20-ma circuits.

(6) The noncontrol station then adds resistance gradually to bring the signal line current down to the predetermined level (*d* above).

(7) If enough current cannot be supplied to the signal line in this manner, proceed as follows:

(*a*) Turn the POWER switch to the OFF position.

(*b*) Disconnect the signal line from terminal 1 of the terminal and switch box and reconnect it to terminal 5 of the terminal and switch box. This decreases the internal resistance of the teletypewriter by 1,000 ohms and allows more current to flow through the circuit.

(*c*) Repeat (3) through (6) above.

(*d*) If sufficient current cannot be obtained on the signal line in this manner, another teletypewriter in the circuit will have to supply power on a series-aiding basis. This can be accomplished by having another teletypewriter in the circuit turn the LINE CURRENT rheostat counterclockwise to its maximum desistance position, turn the DC POWER switch to the ON position, and then adjust the LINE CURRENT rheostat to decrease the resistance until the proper signal line current is obtained.

(*e*) If the current decreases instead of increasing, reverse the signal line connections.

f. Adjust the rangefinder dial (fig. 2–9) as follows:

(1) Noncontrol stations transmit repeated R and Y signal code groups. The control station turns its rangefinder dial to the maximum and minimum good copy positions. Determine the midway point between the two settings and set the rangefinder dial at this point. When the setting is complete, the control station signals the noncontrol stations with two 5-second break signals.

(2) The control station now transmits repeated R and Y signal code groups and the noncontrol stations adjust the rangefinder dials in the same manner.

Section IV. INSTALLATION AND LINE-UP OF LOW-LEVEL SETS

2-22. Equipment Applications

The teletypewriter set may be installed to meet different operational requirements. This is done by varying the connections of the signal lines to the teletypewriter (para 2-23).

2-23. Signal Line Connections and Final Adjustments

(fig. 2-12)

a. Set the POWER, LIGHT, and MOTOR switches to OFF.

b. Refer to paragraph 2-6 for power and ground connection instructions.

c. Connect the teletypewriter as instructed in the applicable subparagraph below.

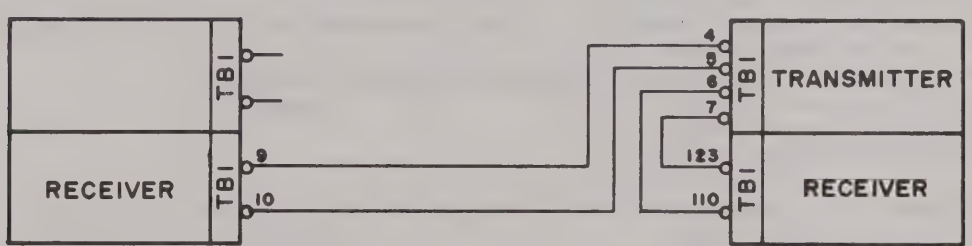
(1) Polar, receive-only operation (A, fig. 2-12).

(a) Jumper terminals 6 to 11 and 7 to 12 on terminal board TB1 at sending station.

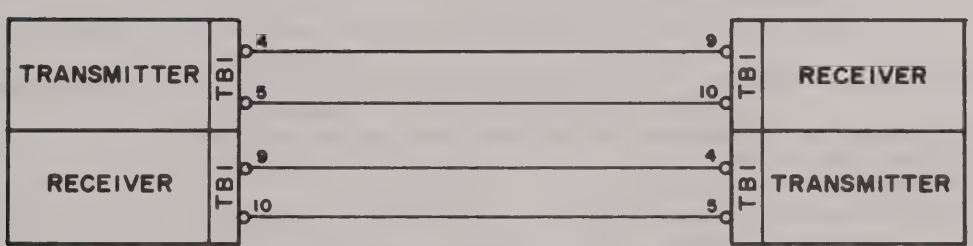
(b) Connect respectively from terminals 4 and 5 of terminal board TB 1 at sending end to terminals 9 and 10 at receiving end.

(2) Polar, full duplex operation (B, fig. 2-12). At each end, connect the sending signal line to terminals 4 and 5 of terminal board TB1 and the receiving signal line to terminals 9 and 10. The system connections should have terminals 4 and 5 at one end connected respectively to terminals 9 and 10 at the other end.

d. Set the POWER and MOTOR switches to ON and have the distant station send alternate R and Y test signals. While receiving test signals, determine the high and low operating limits with the rangefinder dial and set the dial midway between the high and low readings.



A. RECEIVE ONLY OPERATION



B. FULL DUPLEX OPERATION

TM5815-200-12-C2-2

Figure 2-12. Signal line connections (TT-664(*)/FG and TT-665/FG).

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

3-1. Controls and Their Uses (Except TT-259/FG)

a. Keyboard Controls (figs. 3-1 and 3-2).

Control	Location	Function
MOTOR switch	Left side of keyboard guard	ON position turns motor on. OFF position turns motor off.
LIGHT switch	Left side of keyboard guard	ON position lights the copy light. OFF position extinguishes the copy light.
SEND-LOCK switch	Right side of keyboard guard	LOCK position prevents keyboard transmission. SEND position allows keyboard transmission.
LINE-BREAK switch	Right side of keyboard guard	Opens signal line; used to start motors when turned off by STOP key.
FIGS key	Bottom row, extreme left hand end of keyboard.	Shifts platen to upper-case position to allow typing of numerals (or weather symbols on AN/FGC-21 or AN/FGC-64), punctuation marks, and other characters, or performance of functions.
LTRS key	Bottom row, third from right hand end of keyboard.	Returns platen to lower case position to allow typing of letters. Has no effect except when struck after FIGS has been struck.
LINE FEED key	Bottom row, second from right hand end of keyboard.	Moves paper up one or two line spaces on platen depending on position of single-double line feed lever.
CAR RET key	Middle row, extreme right hand end of keyboard.	Returns carriage (type basket) to extreme left margin of paper.
BELL key (upper case S)	Middle row, second from left hand end of keyboard.	Rings the signal bell.
STOP key (upper case H)	Middle row, fifth from right hand end of keyboard.	Turns off motor to place machine on standby basis.
REPEAT key	Top row, extreme right hand end of keyboard.	Repeats the last character or function sent from the machine (except CAR RET), for as long as the two keys are held depressed.
Alphabet keys	Keyboard	Causes the printing of the letter, or symbol, as shown on the key top.
Blank key	Bottom row, extreme right hand end of keyboard.	Transmits blank code group. Used as part of motor stop operation in weather communications machines; prints hyphen when in upper case.
Space bar	Bottom of keyboard	Causes carriage to move to the right without printing.

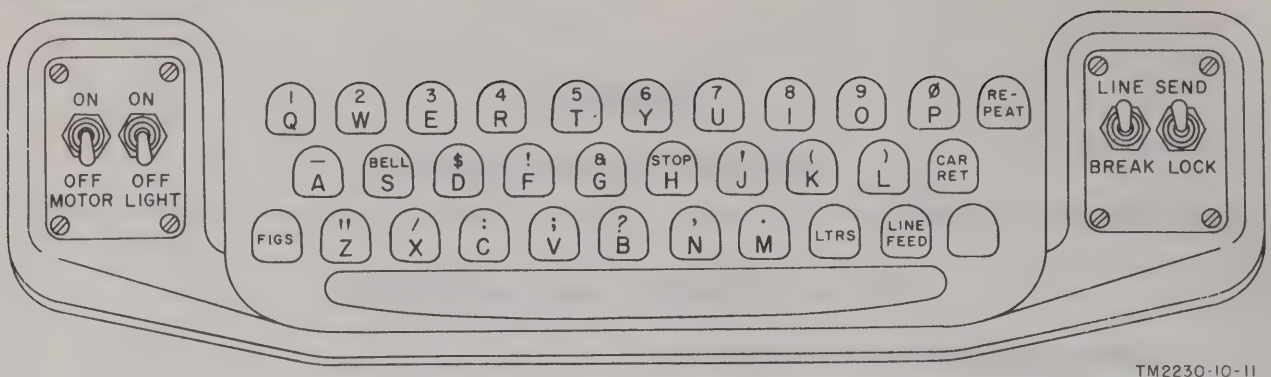


Figure 3-1. Standard communications keyboard.

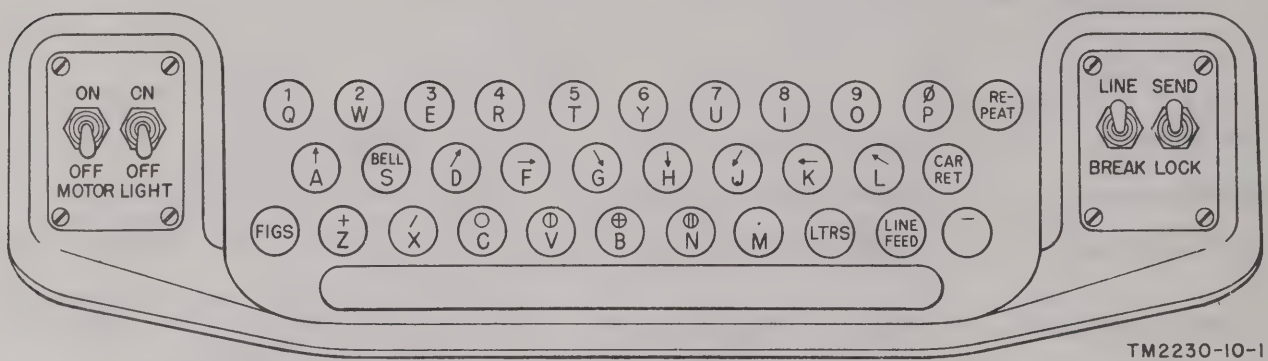


Figure 3-2. Weather communications keyboard.

b. Teletypewriter Controls (figs. 1-3, 1-6, and 3-3).

Control	Location	Function
POWER switch	Right-hand side, rear, of teletypewriter or on the front dust cover of the TT-259/FG.	ON position connects ac input to the teletypewriter. OFF position disconnects ac input to the teletypewriter.
Manual CAR RET button	On the front of the teletypewriter, right-hand side.	Returns carriage (type basket) to extreme left margin of paper.
Manual LTRS button	On the front of the teletypewriter, left-hand side.	Returns platen to lower-case position. Has no effect except when pressed after FIGS has been struck.
Platen crank	Left-hand side of teletypewriter	Rolls the paper from the platen so the message can be torn off.
Single double line feed lever	Left-hand side of platen	In the forward position, causes the platen to move one space. In the rear position, causes the platen to move two spaces.
Sprocket cam plate	Left-and right-hand side of platen	Feeds out the sprocket feed pins for use with sprocket-fed forms.
Pressure roller lever	Right-hand side of platen	When pulled forward, releases pressure on the paper. In the rear position, holds paper tightly against the platen.
Platen lever latch	Right-hand side of platen	Locks the pressure roller lever in either the applied or released position.
Manual space push button	Right-hand side of platen	When pressed, causes the carriage to move from the left to the right.

3-1.1. Types of Operation (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

Teletypewriter sets may be operated on either full duplex or receive-only operation. The type of operation is determined prior to installation and is accomplished by wiring connections at the time of installation.

a. Full-Duplex Operation. In full-duplex operation, both machines may send at the same time; however, the sending machine does not record the message it is sending.

b. Receive-Only Operation. In receive-only operation, the keyboard is disabled by the SEND-LOCK switch, and the machine can receive only.

c. Preparation for Operation. To operate the equipment for any particular type of operation, perform the following:

(1) Preliminary starting procedure (para 3-5).

(2) Installation of paper (para 3-6) and ribbon (para 3-7).

(3) Starting procedure (para 3-8.1).

(4) Operating procedure (para 3-9).

(5) Stopping procedure (para 3-12).

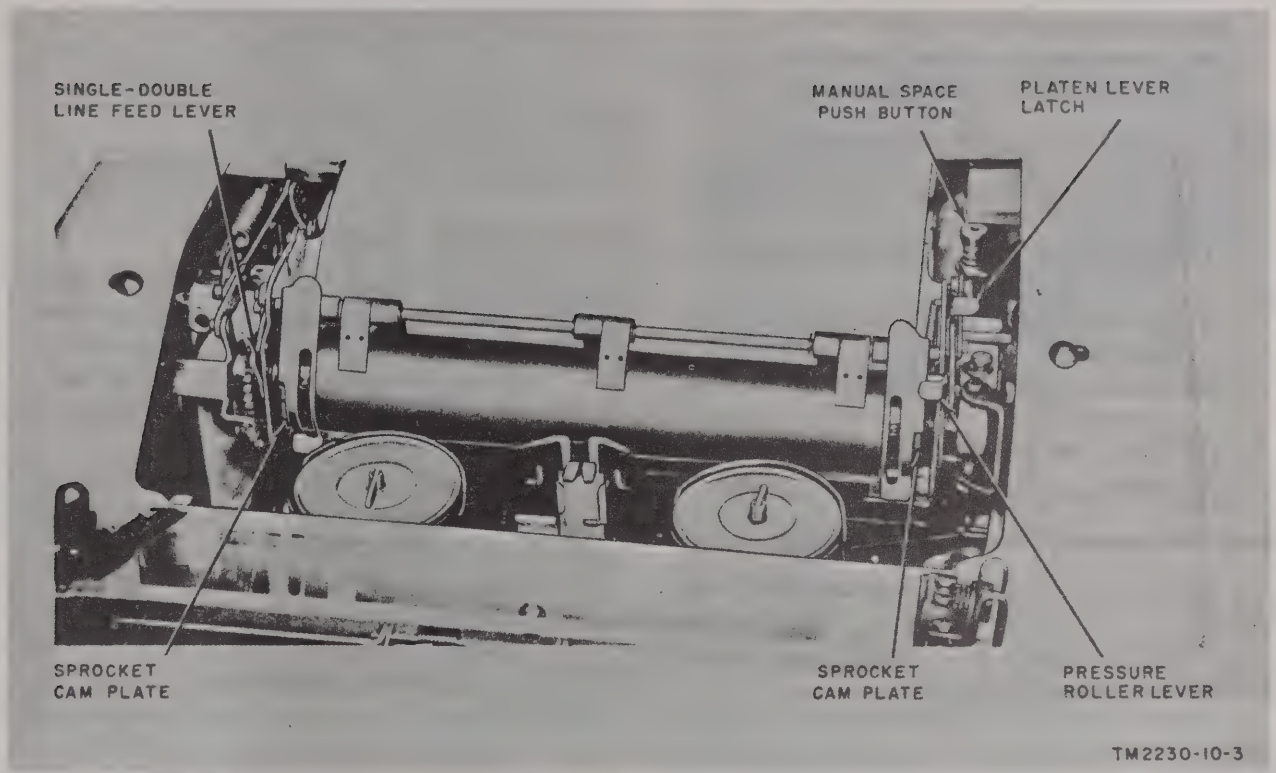


Figure 3–3. Platen controls and manual space push button.

3–2. Indicators and Their Uses

Control	Location	Function
Margin bell	Under teletypewriter cover	Rings on 66th character to warn operator that end of line is near. (Not applicable to the TT–259/FG.)
Signal bell	Under teletypewriter cover	Used to signal distant operator.

Section II. OPERATION

3–3. Types of Operation (Except TT–259/FG)

Teletypewriter sets may be operated on either half-duplex, full-duplex, or receive-only operation. The type of operation is determined prior to installation and is accomplished by wiring connections at the time of installation.

a. Half-Duplex Operation. In half-duplex operation, the message typed on the keyboard will be recorded on all teletypewriters, including the originating teletypewriter. Only one teletypewriter may send at a time.

b. Full-Duplex Operation. In full-duplex operation, both machines may send at the same time; however, the sending machine does not record the message it is sending.

c. Receive-Only Operation. In receive-only operation, the keyboard is removed or disabled by the SEND-LOCK switch, and the machine can receive only.

d. Preparation for Operation. To operate the equipment for any particular type of operation, perform the following:

(1) Preliminary starting procedure (para 3–5).

(2) Installation of paper (para 3–6) and ribbon (para 3–7).

(3) Starting procedure (para 3-8).
(4) Operating procedure (para 3-9).
(5) Stopping procedure (para 3-10).

3-4. Starting Procedure, TT-259/FG

a. The TT-259/FG is used for *receive-only* operation.

b. To operate the TT-259/FG, proceed as follows:

(1) Perform the preliminary starting procedure (para 3-5).
(2) Install paper (para 3-6) and ribbon (para 3-7).
(3) Place the power switch in the ON position.

3-5. Preliminary Starting Procedure

a. Be sure the power cord is inserted in the power outlet.

b. Check the paper; if the supply is low, install a new roll of paper (para 3-6).

c. Check the ribbon; if it is torn or badly frayed, replace it (para 3-7).

d. Set the single-double line feed lever (para 3-1*b*) for either single or double spacing of lines.

e. Set the sprocket cam plate for friction or sprocket feeding of paper (para 3-6*b*(3)).

f. Set the pressure roller lever in the rear position to hold the paper tightly against the platen.

3-6. Installing Paper

a. Roll Paper (fig. 3-4). When the end of the paper is near, a red stripe will appear at the center or side of the paper. This marking allows enough time to finish the message being received and a new supply of paper to be obtained. Install a new roll of paper as follows:

(1) Unlatch the copy holder from the dust cover by pulling the top edge of the copy holder away from the dust cover.
(2) Move the latch buttons (on both sides of the dust cover window) away from each other to release the dust cover window.
(3) Open the top access door.
(4) Remove the paper roller shaft from its mounting slots in the paper roller stand

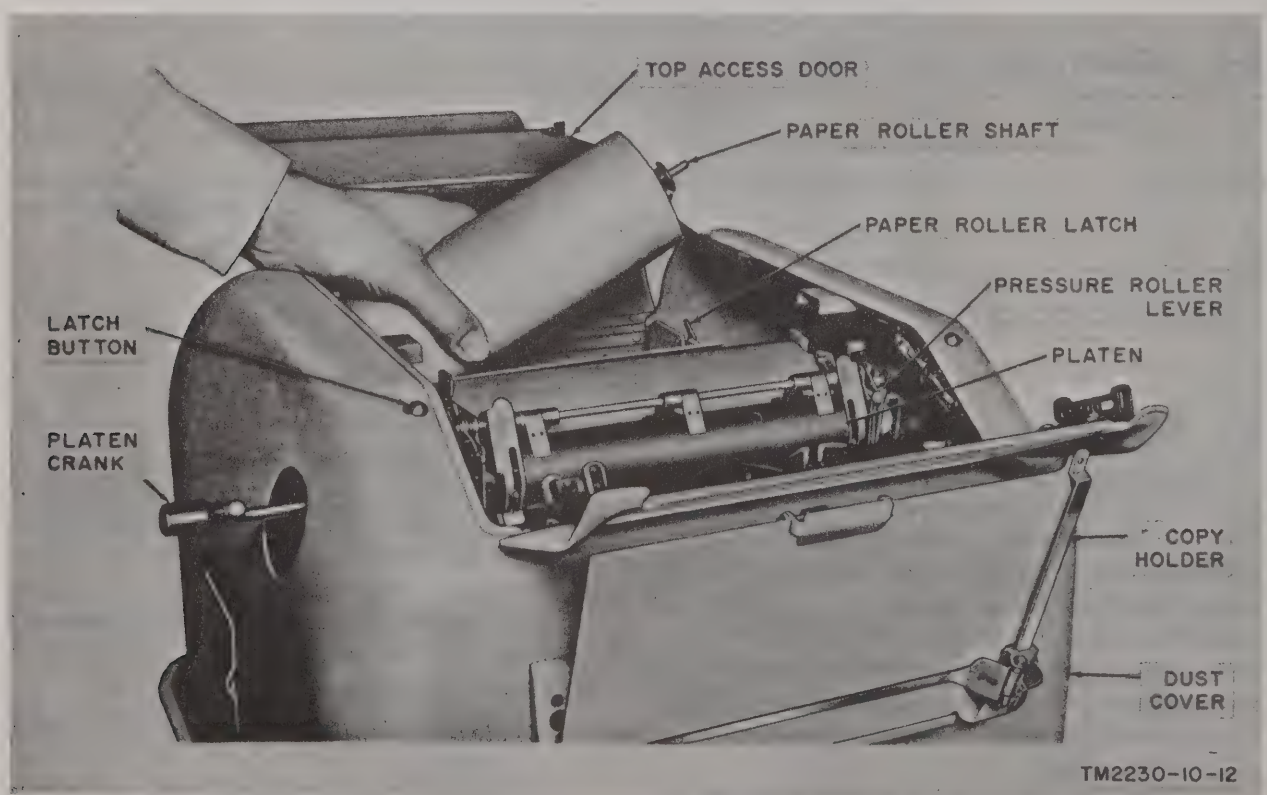


Figure 3-4. Installing paper roll.

by pressing down on the paper roller latch and pulling the paper roller shaft upward.

(5) Insert the shaft into a new paper roll.

(6) Replace the paper roller shaft in the paper roller stand so that the paper feeds from the bottom of the roll.

(7) Feed the paper into the rear of the platen assembly, between the platen and the platen pressure roller. Turn the platen crank counterclockwise until several inches of paper stand up, almost vertically, in front.

(8) Pull the pressure roller lever forward and center the paper on the platen; make sure the paper is feeding straight and is free from creases, twists, or wrinkles.

(9) Close the top access door and the dust cover window. Allow the paper to extend out over the top of the top access door. Latch the copyholder.

b. Fanfold Paper (figs. 3–3, 3–5, and 3–6). The dust cover need not be removed when loading or unloading fanfold paper. Install fanfold paper as follows:

(1) Open the top access door and the dust cover window (*a*(1) and (2) above).

(2) Remove the paper roller shaft (*a*(4) above).

(3) Insert a screw driver or like object into a slot in the sprocket cam plate (fig. 3–3) and turn the sprocket cam plate to extend the sprocket feed pins (fig. 3–5).

(4) Release the pressure roller lever.

(5) Place a box of fanfold paper on the fanfold form rack (fig. 3–6), located under the table top directly in front of the operator.

(6) Thread the loose ends of the paper at the top of the box through the guide chute in the table.

(7) Bring the paper over the top of the teletypewriter and thread it into the rear of the platen assembly, between the platen and the platen pressure roller. Straighten the paper and make sure the sprocket feed pins mesh properly with the perforations at the edges of the paper (fig. 3–5). Turn the platen crank counterclockwise until several inches of paper stand up, almost vertically, in front.

(8) Close the top access door and the dust cover window. Allow the paper to extend out over the top of the top access door. Latch the copyholder.

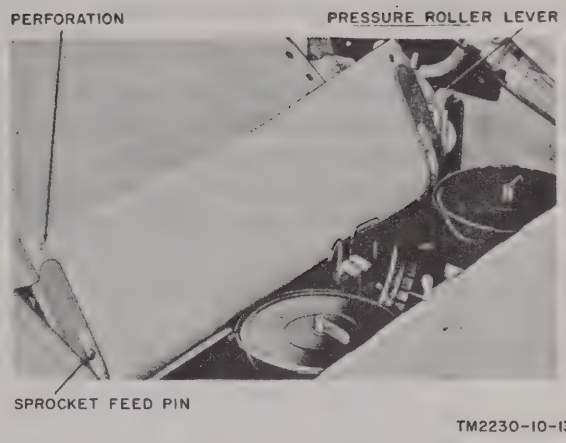


Figure 3–5. Fanfold paper threaded into platen.

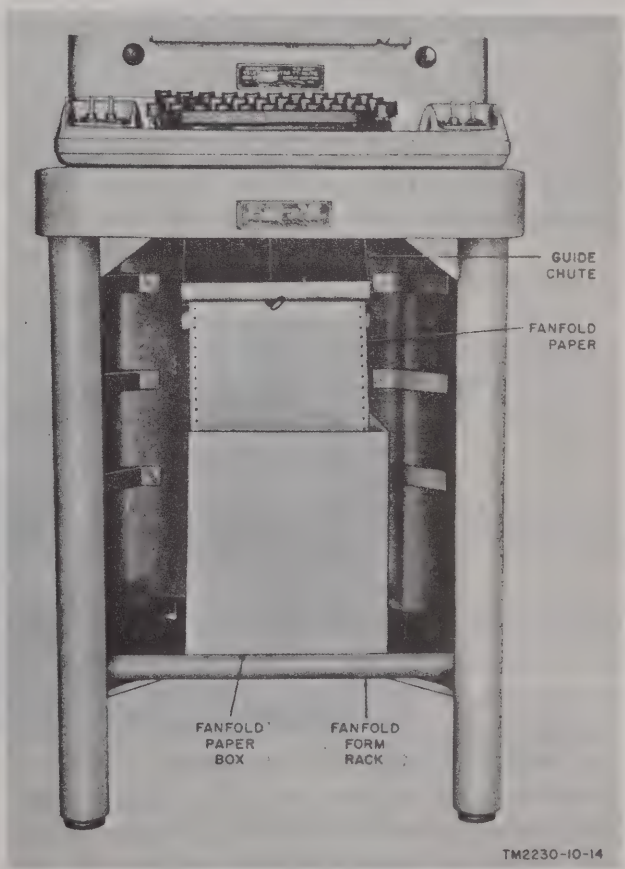


Figure 3–6. Fanfold paper placed in table.

3–7. Installing or Changing Ribbon
(fig. 3–7)

Open the top access door and window and space the carriage to the center of the opening by depressing the manual space push button.

a. To remove the old ribbon—
- (1) Wind the ribbon completely on one spool by hand.
- (2) Remove the old ribbon from the slots in the ribbon guide.
- (3) Turn the ribbon spool locks to the upright (unlocked) position.
- (4) Depress the ribbon sensing lever associated with the empty ribbon spool. Lift out the empty ribbon spool and detach the end of the ribbon. Save the empty spool for winding the new ribbon.
- (5) Depress the ribbon sensing lever associated with the full ribbon spool. Lift out the full ribbon spool and discard it and the worn ribbon.

b. Install a new ribbon as follows:
- (1) If the new ribbon must be turned counterclockwise to be unwound (when viewed from the top), place it in the right hand ribbon drive mounting cup. If it must be turned clockwise to be unwound (when viewed from the top), place it in the left hand ribbon drive mounting cup. Aline the two holes in the ribbon spool with the lugs on the ribbon spool driven shaft collar.
- (2) Pull about 12 inches of ribbon through the slotted opening at the rear of the ribbon drive mounting cup and fasten the loose end of the ribbon to the empty ribbon spool.
- (3) Insert the ribbon in the slots in the ribbon guide; make sure that it is flat and free from twists. The ribbon should pass in front of the stop plate.
- (4) Turn the ribbon spool locks to the horizontal (locked) position.
- (5) Tighten the ribbon manually by turning one ribbon spool with one hand while holding the other ribbon spool rigid.

c. After each ribbon installation, and at reasonable intervals thereafter, make the following ribbon checks:
- (1) The ribbon must be taut and free from twists, wrinkles, creases, holes, and tears. It must lie flat in the slots on the backs of the ribbon drive mountings and in the ribbon guide.

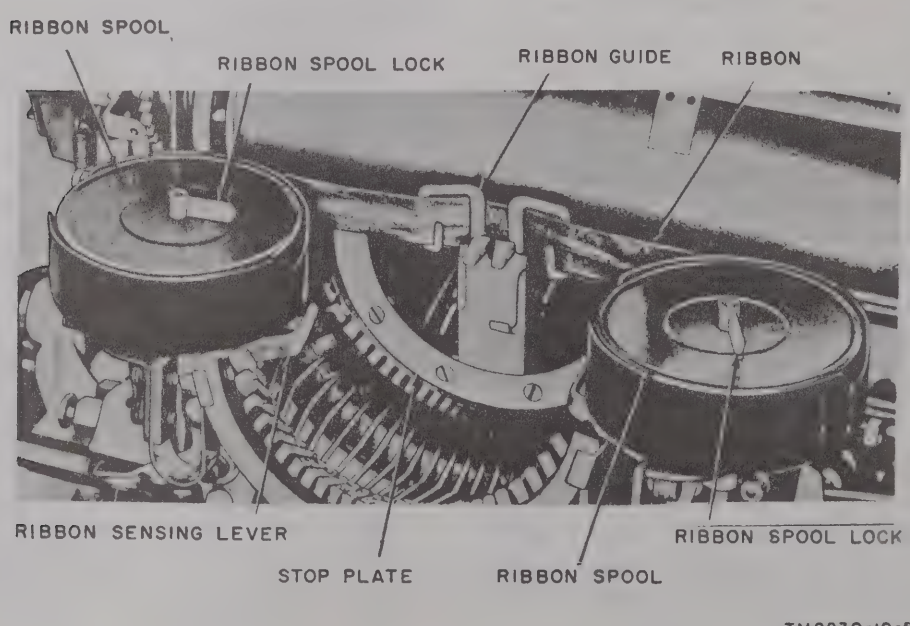


Figure 3–7. Ribbon mechanism.

(2) Both ribbon spools must turn in the same direction while the teletypewriter is typing.

(3) Both ribbon spools must be seated horizontally in the ribbon drive mountings, and the ribbon spool locks must be set horizontally.

(4) Both ribbon spools must reverse direction when a ribbon spool is emptied.

3-8. Starting Procedure for Teletypewriter Sets (Not applicable to TT-664(*)/FG and TT-665/FG, and TT-688(*)/FG)

a. To start the teletypewriter set after it has been closed down for an extended period of time —

(1) Place the POWER switch in the ON position.

(2) Place the SEND-LOCK switch in the SEND position for half-duplex or full-duplex operation, or in the LOCK position for receive-only operation.

(3) Place the LIGHT switch in the ON position.

(4) Place the MOTOR switch in the ON position.

b. To start the motor after it has been shut down by the motor stop function, proceed as follows:

(1) Check to see that the MOTOR switch is in the ON position.

(2) Operate the LINE-BREAK switch to the BREAK position for approximately 5 seconds; then restore it to the LINE position.

3-8.1. Starting Procedure for Teletypewriter Sets TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG

To start the teletypewriter set after it has been closed down for an extended period of time, perform the following:

a. Place the POWER switch in the ON position.

b. Place the SEND-LOCK switch in the SEND position for full-duplex operation, or in the LOCK position for receive-only

c. Place the LIGHT switch in the ON position.

d. Place the MOTOR switch in the ON position.

3-9. Operating Checks for Teletypewriter Sets

NOTE

Subparagraphs *g* and *h* below are not applicable to the TT-664(*)/FG and TT-665/FG.

Operate the teletypewriter and check for the following:

a. The margin signal bell should ring when the 66th character is printed. The automatic line feed and carriage return should operate after the 72d character (76th character on weather machines) is printed. Carriage return should take place when the carriage return code impulse is received.

b. Observe the action of the ribbon feed mechanism while printing. The ribbon must be lifted and fed each time a character is typed.

c. Check the space bar, FIGS key, and LTRS key to see that they function properly.

d. With the platen in the figures (raised) position, press the LTRS button protruding through the teletypewriter dust cover. The platen should return to the letters position.

e. Space the carriage toward the center of the platen. Press the CAR RET button protruding through the teletypewriter dust cover. The carriage should return to the left margin.

f. Check the signal bell. Strike the FIGS key, then the BELL key (uppercase S). The signal bell should ring.

g. Check the motor stop function. Strike the FIGS key, then the STOP (uppercase H) key for standard communication keyboards or strike the FIGS key, the BLANK key, and then the STOP (uppercase H) key for weather communication keyboards. The motor should stop.

h. Operate the LINE-BREAK switch (para 18*b*(2)). The motor should start.

i. Operate the REPEAT key, together with any character or function key except CAR RET. The character or function selected should be repeated until the REPEAT key is released.

3-10. Stopping Procedure for Teletypewriter Sets (Not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG

a. During operation, a teletypewriter operator at any sending station can stop the motors of all teletypewriters equipped with the motor stop feature in the circuit by striking the FIGS key, placing all machines in the figures position, and then the STOP key on standard communication keyboards, or the BLANK key and then the STOP key on weather communication keyboards. The motors of all page printers in the circuit will be

stopped and will remain in standby condition.

b. Stop the teletypewriter and close it to traffic by placing the MOTOR, LIGHT, and POWER switches in the OFF positions.

3-11. Stopping Procedure, T T-259/FG

Stop the TT-259/FG and close it to traffic by placing the power switch in the OFF position.

3-12. Stopping Procedure, TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG

Stop the TT-664(*)/FG or TT-665/FG and close it to traffic by placing the MOTOR, LIGHT, and POWER switches in the OFF position.

NOTE

The externally controlled motor stop features (upper case H key, para 3-1*a*) is not included as an operational capability of the TT-664(*)/FG and TT-665/FG.

CHAPTER 4
MAINTENANCE INSTRUCTIONS

4-1. Scope of Maintenance

The maintenance duties assigned to the operator of the teletypewriter set are stated in *a* below. The maintenance duties assigned to the organizational maintenance personnel are stated in *b* below.

a. Operator. Operator's maintenance consists of the preventive maintenance checks and services defined in paragraph 4-4.

b. Organizational. Organizational maintenance consists of the preventive maintenance checks and services defined in paragraph 4-5.

4-2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is in serviceable condition. To assist in maintaining serviceability, the charts indicate what to check, how to check, and what the normal conditions are. If the defect cannot be remedied, higher category maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

a. Operator's Preventive Maintenance. The procedures given in paragraph 4-4 cover routing systematic care essential for proper upkeep and operation of the equipment.

b. Organizational Preventive Maintenance. The procedures given in paragraph 4-5 cover functions to be performed at specific intervals. These checks and services maintain the equipment in good general (physical) condition and in good operating condition.

4-3. Preventive Maintenance Checks and Service Periods

a. General.

(1) To be sure that your teletypewriter set is ready for your mission, you must do scheduled preventive maintenance checks and services (PMCS).

(2) BEFORE OPERATION, perform your (B) PMCS to be sure that your equipment is ready to go.

(3) DURING OPERATION, perform your (D) PMCS. This should help you spot small troubles before they become problems.

(4) AFTER OPERATION, perform your (A) PMCS. This should help keep your equipment in top shape.

(5) WEEKLY (W), MONTHLY (M), and QUARTERLY (Q) PMCS are important checks you make to keep serious problems from happening.

(6) Routine checks like equipment inventory, cleaning, dusting, washing, checking for frayed cables, stowing items not in use, covering unused receptacles and checking for loose nuts and bolts are not listed as PMCS checks. These are things that you should do anytime you see they must be done. If you find a routine check like one of those listed in your PMCS, it was listed because other operators reported problems with this item. When you are doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS.

(7) If your equipment fails to operate, troubleshoot with proper equipment. If the defect cannot be repaired, get higher category maintenance to do the necessary work.

(8) If your equipment must be kept in continuous operation, check and service those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

(9) Use the Item No. column in your PMCS table as a source of numbers for the TM Item NO. column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) in recording results of PMCS.

b. Cleaning.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

(1) Use a dry, clean, lint-free cloth or brush to remove dust or dirt. If necessary, moisten the cloth or brush with trichlorotrifluoroethane. After cleaning, wipe dry with a clean cloth.

4-4. Operator's Preventive Maintenance Checks and Services Chart

NOTE

Perform weekly as well as before PMCS if:

You are the assigned operator and have not operated the item since the last weekly.

You are operating the item for the first time.

NOTE

The checks in the "Interval" column are to be performed in the order listed.

B—Before **D**—During **W**—Weekly

Item No.	Interval			Items to be inspected	Procedures Check and have repaired or adjusted as necessary	Equipment is not ready/available if:
	B	D	W			
1	*			Inking Ribbon	Examine the inking ribbon; look for holes, tears, missing eyelets or fraying. If necessary, replace ribbon.	
2	*			Paper Supply	Check installation and threading of a paper in the teletypewriter. If fanfold paper is being used, see that sprocket feed pins are extended and are meshed with holes in the paper. Replenish paper if supply is nearly exhausted.	
3	*			Copy Light	Be sure that copy light (where applicable) lights when LIGHT switch is turned ON, or POWER switch is turned on. Replace if necessary.	
4		*		Switches	Operate switches within keyboard guard and POWER switch. Observe that mechanical action of each switch is smooth and free of external or internal binding.	Switches do not operate properly causing equipment to be nonoperational or impair equipment operation.
5		*		Platen Crank	Check operation of platen crank (where applicable) to advance paper. Paper should advance when platen crank is turned.	Paper does not advance when platen crank is turned.

B—Before D—During W—Weekly

Item No.	Interval B	Interval D	Interval W	Items to be inspected	Procedures Check and have repaired or adjusted as necessary	Equipment is not ready/available if:
				NOTE "BEFORE" checks indicated below are prior to deployment or when initially installed. They do not have to be performed on a daily basis.		
6	*		*	Operational Check	Perform an operational check of equipment. Printed copy should be legible and letters evenly spaced.	Equipment does not meet minimum performance standards.
				NOTE This is a general operator's test and some steps may not apply depending upon the model of the equipment.		
				POWER switch	Operate to ON.	
				LIGHT switch	Operate to ON; copy light should light.	
				MOTOR switch	Operate to ON; motor starts.	Motor does not start.
				NOTE On certain models, the POWER switch controls both the LIGHT and MOTOR.		
				LINE SELECTOR switch	Operate to TEST; teletypewriter runs closed.	Teletypewriter does not run closed.
				DC POWER switch (depending upon model).	Operate to OFF.	
				SEND-LOCK switch	Operate to SEND; transmission should be possible from keyboard.	Transmission is not possible from keyboard.
				LINE-BREAK switch	Operate to BREAK; teletypewriter runs open.	Teletypewriter does not run open.
				CAR RET button	Press button; carriage should return to left margin.	Carriage does not return to left margin.
				LTRS button	Press button; carriage should return to letters position.	Carriage does not return to letters position.
				Manual Space button	Press button; carriage should move from left to right.	Carriage does not move from left to right.
				Automatic carriage return and line.	Move carriage to right-hand margin. Carriage should: (1) Return to left-hand margin and (2) Line feed automatically.	Carriage does not perform properly.

B—Before D—During W—Weekly

Item No.	Interval			Items to be inspected	—Procedures Check and have repaired or adjusted as necessary	Equipment is not ready/available if:
	B	D	W			
				Ribbon feed mechanism	Send test message. Ribbon should feed as every other character is typed.	Ribbon does not feed properly.
				Ribbon lifter mechanism	Send test message. Ribbon should rise and fall as every character is typed.	Ribbon lifter mechanism does not operate properly.
				End-of-line signal bell	Send test message. Bell should ring on 66th character.	
				SEND-LOCK switch	Operate to LOCK. No transmission possible from keyboard.	Transmission is possible.
				MOTOR switch	Turn to OFF; motor should stop.	Motor does not stop.
				LIGHT switch	Turn to OFF; light should extinguish.	
				POWER switch	Turn to OFF.	Power does not turn off.
				NOTE On certain models, the POWER switch controls both the LIGHT and MOTOR.		

4-5. Organizational Preventive Maintenance Checks and Services

NOTE

The checks in the "INTERVAL" column are to be performed in the order listed.

M—Monthly Q—Quarterly

Item No.	Interval		Item to be inspected	Procedures
	M	Q		
			NOTE The steps below are general and some items may not apply depending upon the model of the equipment.	
1	*		Equipment	Be sure the operator's PMCS's have been performed on a periodic basis as indicated. If not, perform these checks and services at least monthly. Repair any deficiencies which can be corrected or are reported by an operator, or contact a higher category of maintenance if deficiency cannot be corrected.
2	*		Motor speed	Check motor speed and adjust if necessary.
3	*		Bias current (if applicable)	Check the bias current. Adjust if necessary.

M—Monthly Q—Quarterly

Item No.	Interval M	Interval Q	Item to be inspected	Procedures
4	*		Lubrication	Check the lubrication of the equipment, and have lubricated if necessary.
5	*		Spare parts	Check all spare parts for general condition. Replace if defective or replenish if missing.
6	*		Range of teletypewriter (if applicable)	Perform range of teletypewriter test to determine if equipment is operating properly. Check the range of the teletypewriter set as follows and set the rangefinder dial at the mid-point between the minimum and maximum good copy points. *CAUTION* The rangefinder dial should be moved only when signals are being received in the selector magnet and the selector camshaft is rotating. *a.* While receiving RY or test message, rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit. *b.* Rotate the rangefinder dial slowly, toward the lower limits of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the lower range limit. *c.* Subtract the figure recorded in *b* above from the figure recorded in *a* above to obtain the range of the teletypewriter. Divide the range by 2, and then add this figure to the low limit or subtract it from the upper limit and set the rangefinder dial at this point. *d.* The range should be not less than: (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation.
			Motor speed adjustment	Adjust the motor speed as follows: *a.* Turn the motor switch to ON. *b.* Strike a 180 vibrations-per-second (VPS) tuning fork gently against the hand to make it vibrate. *c.* View the spots on the (rotating) target wheel through the vibrating shutters on the end of the tuning fork. If the spots are moving clockwise, pull the end of the adjusting worm outward, and hold it out until the clockwise motion of the target spots has stopped. If the spots are moving counterclockwise, push the end of the adjusting worm inward and hold it in until the motion of the target spots has stopped. The motor now is set at its operating speed of 3,600 revolutions per minute (rpm).

M—Monthly Q—Quarterly

Item No.	Interval M	Interval Q	Item to be inspected	Procedures
			Bias current adjustment	Check the setting of the bias resistor which is located near the rangefinder dial. Two Bias Test terminals, connected with a shorting bar, are provided on the terminal and switch box for the convenience of checking the bias circuit current. Remove the shorting bar and connect a milliammeter between the two Bias Test terminals. Check the current in the bias circuit. The milliammeter should read 12.25 milliamperes (ma) if the Line Selector switch is in the 60 position or 8.75 ma if the Line Selector switch is in the 20 position. If the reading does not conform to these values, adjust the resistor.
			Lubrication	Lubrication will be performed by a higher category of maintenance.
7	*		Modification work orders	Determine whether MWO's are required (see DA Pam 310-7). Check equipment to see if applicable MWO's are applied and MWO number is stamped as required.
8	*		Publications	Check to see that publications are available and in useable condition. Maintenance and parts manuals are available and in useable condition. All changes to publications for maintenance and parts manuals are available and in useable condition.
9	*		Gasket and cover assemblies	Check all gaskets and cover assembly for tight fit and evidence of damage. All gaskets and cover assemblies fit tightly and show no signs of damage.
10	*		Chassis parts	Inspect wiring, wiring harness, and parts for looseness, burns, blistering, swelling, or other signs of deterioration or overheating. Wiring, wiring harness, and parts should be free of evidence of looseness, burns, blistering, swelling, or other signs of deterioration or overheating.

APPENDIX I
REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX III
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

1. General

This appendix provides a summary of the maintenance operations for Teletypewriter Sets AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X and Teleprinter TT-259/FG. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) consid-

ered in classifying Army equipments/components.

3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of task-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C—Operator/Crew

O—Organizational

F—Direct Support

H—General Support

D—Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

4. Tool and Test Equipment Requirements (Sec III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. Natural/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. The column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

5. Remarks (Sec IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X and TT-259/FG

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
00	TELETYPEWRITER SET	Inspect		0.2					
		Test		0.5					A
		Test			1.0			1,2,3	
		Service			1.0			4	
		Adjust		0.5				3,4	B
		Repair		0.5				3,4	C
		Overhaul					32.0	1,2,3, 4,5	
01	TELETYPEWRITER TT-98( )/FG, TT-99/FG, TT-100( )/FG, TT-259/FG, TT-300/FG, TT-482/UGC, TT-483/UGC, TT-664( )/FG, TT-665/FG, TT-688( )/FG	Inspect		0.1					
		Test		0.5					
		Test			0.8			1,2,3	
		Adjust		0.5				3,4	
		Replace		1.5				4	C
		Repair			2.5			1,2,3, 4,5	
		Overhaul					32.0	1,2,3, 4,5	
0101	COVER ASSEMBLY	Inspect		0.1					
		Repair			1.0			4,5	
0102	MOTOR	Test			0.5				
		Replace			1.0				
		Repair				6.0		4,5	
0103	KEYBOARD ASSEMBLY	Test			0.5				
		Repair			1.5			3,4,5	
010301	TRANSMITTER CONTACT ASSEMBLY	Replace			0.7				
		Repair			0.9			3,4,5	
0104	PLATEN ASSEMBLY	Repair			0.7			3,4,5	
0105	CARRIAGE ASSEMBLY	Repair			0.8			4,5	
0106	MAINFRAME ASSEMBLY	Repair			0.8			4,5	
0107	TERMINAL BOX ASSEMBLY	Test			0.3				
		Repair			0.7			3,4,5	
010701	TRANSMITTER MODULE	Replace			0.5				
		Repair					1.8	3,4,5	
010702	RECEIVER MODULE	Replace			0.5				
		Repair					1.6	3,4,5	
010703	SELECTOR MAGNET MODULE	Replace			0.5				
		Repair					1.6	3,4,5	
0108	BASE ASSEMBLY	Repair			1.2			4,5	
02	POWER SUPPLY PP-978/FG	Replace			0.5				
		Repair			1.2			3,4,5	
03	TABLE, TELETYPEWRITER FN-59/FG	Replace			0.3				
		Repair			1.0			4,5	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X and TT-259/FG

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	F, H, D	TEST SET TTY AN/UGM-1	6625-00-965-0195	
2	F, H, D	TELETYPEWRITER TEST SET AN/GGM-1	6625-00-897-5505	
3	O, F, H, D	MULTIMETER AN/USM-223	6625-00-999-7465	
4	O, F, H, D	TOOL EQUIPMENT TE-50B	5180-00-356-4602	
5	F, H, D	TOOL EQUIPMENT TE-111	5180-00-408-1877	

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	OPERATIONAL TEST
B	ADJUSTMENT LIMITED TO MOTOR SPEED, BIAS CURRENT, AND RANGE OF TELETYPEWRITER
C	CAPS, FUSES, LAMPS

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NG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 320–50.

* U.S. GOVERNMENT PRINTING OFFICE: 1983 - 661-604/37