

35 AUTOMATIC SEND-RECEIVE TELETYPEWRITER SET

DATA COMMUNICATIONS

SERVICE MAINTENANCE

(TROUBLE SHOOTING)

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1. GENERAL

1.01 The trouble shooting information presented in this section consists of operational and electrical checks designed to lead maintenance personnel to the functional mechanism or circuit area causing trouble in 35 Automatic Send-Receive Teletypewriter equipment (ASR).

1.02 Equipment covered in this section is used in data communications service as well as private wire and switched network circuits. Two basic sets covered as distinguishable by the fact that one has only one tape reader, and the other has two, one for program control and one for data feed. There are also keyboard and typebox or typewheel differences (the single reader unit with language accent symbols on some keys) and are available with friction feed or sprocket feed typing units. Trouble shooting procedures for the two basic units are identical except as noted below.

1.03 A thorough knowledge of the sequence of operation for each functioning mechanism is of fundamental importance. Refer to the appropriate section to clarify the operation and function of all teletypewriter parts.

1.04 Where equipment failures are due to mechanical maladjustments, the technician should refer to the adjustment section for

the component in question to determine the correct procedure and adjustment tolerances.

1.05 Lubrication failures will seldom occur when normal periodic maintenance procedures are followed. See the lubrication section of the component to determine maintenance schedules.

2. TOOLS AND TEST EQUIPMENT

2.01 Standard set of tools (wire gages, spring scales, spring hooks, wrenches, etc.) as required for component adjustments.

2.02 A volt-ohm-milliamperemeter for checking voltages, current, resistance (continuity) and capacitance.

2.03 An eight-level signal distortion test set to perform signal distortion tests on the signal generator and timing contacts.

2.04 A signal analyzer, also required to perform signal distortion tests on the set.

3. TROUBLE SHOOTING

3.01 Since teletypewriter sets are an assemblage of components, the first step in trouble shooting, if the trouble is not obvious, is to sectionalize the trouble to a particular component, and then to determine what specific mechanism or electrical part is faulty.

3.02 Failures of the equipment can be traced functionally by means of a trouble shooting chart. A step-by-step analysis of the behavior of the equipment in response to the tabulated checks will indicate the area of trouble in which apply remedial measures outlined below and referenced in the chart. Since, in most cases, each check step is conditioned by the procedure in preceding steps, examine the condition of all controls, and in

particular the mode switches, before rechecking any step or otherwise performing any trouble shooting check out of sequence.

- (a) Comprehensive electrical analysis of the equipment is not generally required in trouble shooting. Reference to an open condition is to a circuit through which current will not flow, due either to a break, a poor connection or a poor or dirty contact mechanism. Reference to a closed condition is to a normally or intermittently open-circuit through which current will flow, either due to a short or to a sticky, dirty or poorly adjusted contact mechanism.
- (b) Running Open is a condition created by an open signal circuit, resulting in operation of typing and printing mechanisms because of the absence of a stop signal to latch function clutches.
- (c) Running Closed is a condition created by a closed signal circuit, resulting in failure of typing and printing mechanisms to respond to a signal, due to the absence of the start and spacing elements in the signal, or to mechanical failure.
- (d) Garbling is a condition in which the response of typing and printing mechanisms does not correspond to the mechanical or signal input.
- (e) Blind is a condition in which a unit is turned off or otherwise disconnected to assure non-response to various signal inputs.

**Note:** If trouble shooting checks indicate abnormal electrical conditions, refer to the actual wiring diagram referenced in the trouble shooting chart. If trouble appears to be mechanical, isolate the unit, and refer to the associated adjustment section for the unit isolated.

#### PROCEDURE

- 3.03 Make a visual inspection of the equipment to determine if the trouble is caused by loose signal or power connections, poor ground, improperly positioned switches, erratic motor speed, or improper range finder setting. Check connectors on cabling between components of the set for proper mating and good fit.
- 3.04 Arrange the equipment to operate on a test circuit and perform the off-line and on-line checks with PROGRAM CONTROL both

"ON" and "OFF," as specified in the installation section covering this equipment. These procedures are primarily performed after initial installation but may be used to assist in locating troubles when they occur.

3.05 **Localizing Electrical Troubles:** Most electrical troubles are found at the various contacts in the equipment, which include switch contacts, plug-in connector and pin contacts, wiring field terminals, soldered contacts (including spliced wire), and chassis ground contacts. Electrical circuits in the teletypewriter set have terminal connections at the points where tests must be made. Do not disturb the wiring more than necessary when testing or inspecting. Maintenance personnel must be thoroughly familiar with the actual and schematic wiring diagrams and use them while making point-to-point checks of the circuits. Schematic wiring diagrams of external equipment to which the teletypewriter set is connected furnish information helpful for testing and localizing trouble.

3.06 **Power Supply Checks:** To be sure that proper operating conditions exist, check the input power, a.c. circuits and d.c. circuits in turn before making other tests. These checks will, of necessity, include normal operation of the parts in these circuits and would require all adjustments which might affect the indicated trouble as related to the parts. When check of an adjustment is indicated, care should be exercised not to disturb the adjustment or related adjustments.

#### 3.07 Continuity, Resistance, and Capacitance Checks

- (a) **Continuity:** The continuity check is used to locate suspected open circuits. In making continuity checks, be sure that parallel current paths are disconnected. Make the tests by checking the continuity through the circuit suspected to be faulty by connecting the test leads so that the current can go only through the suspected circuit. Be sure no other part of the circuit is shunting the circuit being tested. If necessary, disconnect certain leads. Check all likely circuits in this manner. If, after checking all possible causes, the fault cannot be located, make a continuity test of the entire circuit. If continuity is indicated, test half of the circuit. Continue sub-dividing the circuit until the open point is definitely located.

(b) **Resistance:** The resistance check is used to locate suspected open or shorted coil windings, fixed resistors and inductors, transformer windings and motor windings. In making resistance checks, follow the same general procedures as those described for continuity checks.

(c) **Capacitance:** The capacitor check is used to locate shorted or leaking elements. To test, discharge the suspected capacitor with an insulated shorting jumper. Then disconnect one lead, and connect the capacitor to an ohmmeter. Use the highest reading scale. A good capacitor will be indicated by the ohmmeter pointer first moving up the scale rapidly, then returning more slowly to the infinity mark. A capacitor which is open will give a reading of infinite ohms. A shorted capacitor will give a reading of constant value between zero and infinity, depending upon the resistance of the short.

**WARNING: BE EXTREMELY CAREFUL WHEN HANDLING CHARGED CAPACITORS. A SEVERE ELECTRICAL SHOCK MAY BE RECEIVED FROM THE CAPACITOR OR LEADS CONNECTED TO A POWER SUPPLY IN OPERATION.**

### 3.08 Electrical Checks

(a) Check for external interruptions to the 115 V a.c. power supply by checking the power cord connections on the terminal board at the rear of the set.

(b) Check fuses located on the electrical service unit. If open, rotate the associated motors by hand and check for excessive mechanical load before replacing the fuse. If a replaced fuse burns out immediately upon installation, check for shorted wiring in the motor, or copylight transformer. Check the red thermal overload reset button on the synchronous motors. If

tripped, allow the motor to cool for five minutes with the cabinet cover open before resetting by depressing the button.

### 3.09 Localizing Mechanical Troubles

(a) Although mechanical troubles can occur in teletypewriter sets, no difficulty should be experienced in locating the fault if the sequence of operation is checked through its various steps. When a mechanical function fails to operate, or operates in a faulty manner, the trouble may be in a particular adjustment, or series of adjustments, or it may be in a particular assembly. One method for checking troubles involves checking the individual requirement for all adjustments in the faulty subassembly or mechanism. Use the procedures found in the appropriate adjustment section to determine the sequence to be followed.

(b) A second method involves setting up by hand the selecting mechanism and completing the operation by manually rotating the motor, shaft, gear, or cam that normally drives the assembly. This second method is usually quicker when only one adjustment is faulty and the remainder of the mechanism is in good condition. In such cases, only related adjustments need be checked.

(c) In some instances, faulty operation may be observed only when the mechanism is power driven. The experience of the maintenance personnel and the over-all condition of the equipment will indicate which method is the better approach to a particular trouble. In either mechanical or electrical troubles, additional aid in isolating the difficulty may be secured from records of previous troubles and adjustments.

3.10 Refer to the following trouble shooting charts for a more complete tabulation of possible troubles.

TABLE 1. TROUBLE SHOOTING (SHEET 1 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
1.	Rotary power switch OFF. Motors and copylights off. Typing unit and reperforator selectors energized.	a. Motors and copylights on.	Rotary switch wiring.	6380 WD
		b. Motor on (one or both).	Wiring between motor and electrical service unit.	6454 WD 6901 WD 4348 WD
2.	Power switch in LOC position. Motors and copylights on. Typing unit and reperforator selectors energized.	a. Motors and copylights off, selectors de-energized.	Power line connections.	6901 WD
			Rotary switch wiring.	6380 WD
		b. Motors off.	Wiring between motor and electrical service unit.	6901 WD 6454 WD 4348 WD
			Motor thermal cut-off switch reset button (keyboard motor only).	2900 WD
		c. Motors run at incorrect speed.	Power line frequency (60 cps).	
		d. No cabinet illumination.	Copylight wiring continuity.	
			Transformer.	6901 WD
		e. Some copylights not illuminated.	Bulb and socket wiring.	
		f. Page printer selector de-energized.	Signal line continuity.	6901 WD 6909 WD 4790 WD
			Output of local power supply.	6909 WD
			Output of selector magnet driver(500 milliamperes).	
			Selector coils and selector magnet driver continuity.	6901 WD
			Selector coils (7 ohms resistance per coil).	
Selector armature spring and selector range finder adjustments.				
g. Reperforator selector de-energized.	Signal line continuity.	6901 WD 6909 WD 4790 WD		

TABLE 1. TROUBLE SHOOTING (SHEET 2 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
2.	(continued)		Output of local power supply.	6909 WD
			Output of selector magnet driver (500 milliamperes).	
			Selector coils and selector magnet driver continuity.	6901 WD
			Selector coils (7 ohms resistance per coil).	
			Selector armature spring and selector range finder adjustment.	
3.	Tape in tape reader (Use rear reader on sets so equipped.) START switch depressed. Lamp on. Reader operates.	a. Tape reader does not run.	Wiring of trip magnet circuit.	6901 WD 6909 WD 6391 WD 6397 WD
4.	All printing characters transmitted from keyboard (or from rear tape reader, on sets so equipped) transmitted to typing unit. Typing unit properly types each character.	a. Typing unit runs closed.	Signal line for presence of space-mark pulses	4790 WD 6901 WD 6909 WD
			Keyboard auxiliary contacts.	
			Typing unit selector magnet drive for blind across input leads.	
			Reader auxiliary contacts.	
			Output of selector magnet driver for space-mark transition.	
			Receive break contact switch in keyboard—unoperated.	
			Selector adjustments.	
		b. Typing unit receiving margin short.	Output of selector magnet driver (500 milliamperes).	

TABLE 1. TROUBLE SHOOTING (SHEET 3 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
4.	(continued)		Dirt or oil between selector armature and magnets.	
			Selector adjustments.	
			Motor speed.	
			Distributor output for extremely high signal bias or end distortion.	
		c. Typing unit making errors or garbling.	Selector range finder (may be at marginal setting).	
			Output of selector magnet driver (500 milliamperes).	
			Dirt or oil between selector armature and magnets.	
			Selector adjustments.	
			Motor speed.	
			Code reading contact adjustment.	
5.	Type box advances to about 72nd character. Margin indicator lamp lights.	a. Lamp lights, but not at 72nd character.	Typing unit margin indicator switch adjustment.	
		b. Lamp does not light.	Check bulb and socket.	
			Switch and lamp wiring.	6901 WD 6380 WD
			Typing unit margin indicator switch adjustment.	
			Switch, for open contacts when operated.	
6.	Reperforator on. Each transmitted character is properly punched and tape is correctly printed.	a. Reperforator runs closed.	Output of selector magnet driver for space-mark transition.	
			Selector adjustments.	
		b. Receiving margin short.	Dirt or oil between selector armature and magnets.	

TABLE 1. TROUBLE SHOOTING (SHEET 4 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
6.	(continued)		Selector adjustments.	
			Selector magnets (7 ohms resistance per coil).	
			Output of selector magnet driver (500 milliamperes).	
		c. Punching or typing errors or garbling.	Selector range finder (may be at marginal setting).	
			Output of selector magnet driver (500 milliamperes).	
			Selector adjustments.	
			Dirt or oil between selector armature and magnets.	
7.	(Sets with two tape readers only.) Transmit BELL code from keyboard. Bell rings. Typing unit does not type.	a. Bell does not ring.	Typing unit selector for proper code selection.	
			Bell circuit and function box contacts.	6901 WD 6397 WD
			Typing unit function box function bar for proper coding and operation.	
		b. Typing unit types character.	Typing unit type box clutch adjustments.	
8.	(Sets with one tape reader, only.) Transmit graphic foreign language accent characters from keyboard. Typing unit types but does not space.	a. Spacing is not suppressed.	Typing unit function box function bar for proper operation.	
			Typing unit spacing clutch adjustments.	
9.	LF transmitted from keyboard. Typing unit feeds paper or forms one or two lines. No printing. (Optional CR feature. See step 10.)	a. Paper or forms are not fed out.	Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
			Typing unit line feed mechanism adjustments.	

TABLE 1. TROUBLE SHOOTING (SHEET 5 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
10.	CR transmitted from keyboard. Typing unit type box returns to left margin. (Optional LF feature. See step 9.) No printing.	a. Carriage does not return.	Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
			Typing unit carriage return mechanism adjustments.	
		b. (On units so equipped.) Paper or forms are not advanced one or two lines.	Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
			Typing unit line feed and carriage return mechanisms adjustments.	
11.	LOC LF key operated. Typing unit feeds out paper or forms one or two lines at a time, in continuous feed while key is depressed.	a. Paper or forms do not feed out.	Keyboard and typing unit mechanical linkage adjustment.	
			Typing unit line feed mechanism adjustments.	
12.	LOC S LF key operated. Paper or forms step one or two lines.	a. Paper or forms do not feed out.	Keyboard and typing unit mechanical linkage adjustment.	
			Typing unit line feed mechanism adjustments.	
13.	LOC CR key operated. Type box returns to left margin.	a. Carriage does not return.	Keyboard and typing unit mechanical linkage adjustment.	
			Typing unit carriage return mechanism adjustments.	
14.	TAB transmitted from keyboard. Typing unit tabs horizontally. No printing.	a. Typing unit does not tab horizontally.	Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	

TABLE 1. TROUBLE SHOOTING (SHEET 6 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
14.	(continued)		Typing unit horizontal tab mechanism adjustments.	
15.	VT transmitted from keyboard. Typing unit tabs vertically. No printing. (CR optional.)	a. Typing unit does not tab vertically.	Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
			Typing unit vertical tab mechanism adjustments.	
		b. (On units so equipped.) Carriage does not return.	Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
			Typing unit carriage return mechanism adjustments.	
16.	FORM transmitted from keyboard. Typing unit feeds out a form. (Applicable only to units so equipped.) CR optional.	a. Forms do not feed out.	Paper jam at typing unit.	
			Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
		b. (On units so equipped.) Carriage does not return.	Typing unit form-out mechanism adjustments.	
			Typing unit selector for proper code selection.	
			Typing unit function box function bar for proper coding and operation.	
17.	Steps 14-16 repeated, transmitting from tape. In addition to normal indications, tape reader stops while function is occurring in typing unit.	a. Tape reader does not stop transmission.	Tape reader clutch magnet circuit wiring.	6901 WD 6909 WD 6391 WD 6397 WD
			Typing unit tab or form-out contact adjustment.	

TABLE 1. TROUBLE SHOOTING (SHEET 7 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
17.	(continued)	b. Tape reader transmits information beyond the control code before stopping.	Hold circuit.	6909 WD
18.	LOC B SP key operated. Reperforator back spaces tape one position. Typing unit type box backspaces tape one position. No typing.	a. Reperforator does not backspace.	Open switch when backspace key is operated.	
			Backspace switch and magnet circuit.	6901 WD 6454 WD
		b. Typing unit does not backspace.	Keyboard and typing unit mechanical linkage and adjustments.	
19.	BREAK switch operated. Signal line open, typing unit runs open, distributor output is shunted, tape reader is disabled, and BREAK lamp lights.	a. Signal line is not open.	BREAK circuit.	6380 WD
			Break contacts adjustments.	
		b. Distributor output is not shunted.	"Receive break" circuit.	6901 WD 6454 WD 6909 WD
			Continuity across "receive break" circuit involved.	
			Keyboard "receive break" switch.	
			Typing unit, for mechanical output on single and double BLANK.	
			Keyboard and typing unit "receive break" mechanism adjustments.	
		c. Tape reader is not disabled.	"Receive break" circuit.	6901 WD 6454 WD
			Operation of applicable "receive break" contacts.	
		d. BREAK lamp does not light.	Check bulb and socket.	
Lamp circuit and "receive break" circuits.	6901 WD 6454 WD 6380 WD			

TABLE 1. TROUBLE SHOOTING (SHEET 8 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
19.	(continued)		Operation of applicable "receive break" contacts.	
20.	BRK RLS key on keyboard depressed. BREAK lamp extinguished, shunt removed from distributor, and tape reader enabled.	a. BREAK lamp lit, distributor shunted, or tape reader disabled.	Mechanical (keyboard) adjustments between BRK RLS key and "receive break" switch.	
21.	Tape in reader. Depress "STEP" button. Reader reads one character only.	a. More than one character read.	STEP switch contact cleaning and adjustments.	
			Reader auxiliary contacts adjustments.	
			Limit relay contacts.	
			Dirt or oil between armature and trip magnets.	
22.	Rotary power switch in LOC position. PROGRAM CONTROL in ON position. Selection of control codes induces appropriate function in set. Internal codes are not distributed.	a. No response to codes.	Tape reader tape-out switch.	
			PROGRAM CONTROL switch.	
			"Receive break" switch contacts.	
		b. No response to particular control code.	"B" relay operation for correct code.	
			Code reading contacts.	
			Control circuit.	6909 WD
		c. Internal codes are sent to typing unit and reperforator.	Tape reader tape-out switch.	
			PROGRAM CONTROL switch.	
			"Receive break" switch contacts.	

TABLE 1. TROUBLE SHOOTING (SHEET 9 OF 9)

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	ACTUAL WIRING DIAGRAM
23.	Depress DATA BY-PASS button. Tape reader will start, but output is suppressed.	a. No response.	Tape reader tape-out switch.	
			PROGRAM CONTROL switch.	
			"Receive break" switch contacts.	
24.	Depress PRINT SUPPRESS switch. Tape reader will start. Reperforator operates. Typing unit blinded.	a. No response.	Tape reader tape-out switch.	
			PROGRAM CONTROL switch.	
			"Receive break" switch contacts.	