35 KEYBOARD SEND-RECEIVE TELETYPEWRITER SET

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 schematic and circuit area that is causing the trouble in the equipment.

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

1.03 The functional schematic wiring diagrams referenced will be found in the appropriate section covering the functional diagrams and connecting information for the keyboard send-receive set (KSR).

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.

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-milliampere meter for checking voltages, current, resistance (continuity) and capacitors.

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, then determine what specific mechanism or electrical part is faulty.

3.02 Failures of the equipment can be traced functionally by means of the 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 to 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 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. References 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.

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(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 the 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 the 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 functional schematics referenced in the chart. If the 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 line or power connections, improperly set switches, erratic motor speed, or improper rangefinder setting.

3.04 Arrange the equipment to operate on a test circuit and perform the procedures normally followed after the installation of a KSR set, to sectionalize the trouble. These procedures are primarily performed after initial installation of new or repaired equipment 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 wires), and chassis ground contacts. Electrical circuits in the teletypewriter set have terminal connections at the points where test must be made. Do not disturb the wiring more than necessary when testing or inspecting. Maintenance personnel must be thoroughly familiar with the schematic and 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, AC circuits, and DC circuits in turn before making other tests. These checks will, of necessity, include normal operation of the parts in these circuits and the requirements of all adjustments which would 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 Capacitor 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 the other 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, transformer windings, motor windings, fixed resistors and inductors. In making resistance checks, follow the same general procedures as those described for continuity checks.

(c) Capacitor: 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 volt AC power supply by checking the power cord connections on the terminal board at the rear of the call control unit.

(b) Check fuses located on the call control unit and in the auxiliary ROTR cabinet. If open, rotate the associated motor 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, selector magnets, the copy light transformer, or the power transformer in the call control unit.

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 related data found in the detailed adjustment procedures 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 the 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.

TROUBLE SHOOTING CHART FOR KSR SETS

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
1.	LCL key depressed; LCL lamp lights; cabinet lamps light; keyboard motor starts.	Motor does not start.	Check power line connections.	FS22 B-5
			Check fuses.	FS22 A-3
			Check motor thermal cut-off switch.	-
		Synchronous motor (on sets so equipped) runs at incorrect speed.	Check power line frequency.	-
		Governed motor (on sets so equipped) runs at incorrect speed.	Check 117 VAC line.	-
			Check motor and governor brushes.	-
			Check governor adjustments.	-
		Governed motor speed uncontrollable.	Check governor resistor and capacitor.	-
			Check for sticking governor contacts.	-
		No cabinet illumination.	Check copy light receptacle.	FS22 B-7
			Check copy light transformer.	FS22 B-7
		Some cabinet copy lamps not illuminated.	Check bulbs and sockets.	FS22 C-7
		LCL lamp does not light.	Check circuit continuity or bulb.	FS21 1-F
2.	Typing unit runs closed on idle signal; operates on signal impulse from keyboard.	Typing unit runs open on idle signal.	Check output from data set.	FS11 F-6
			Check output of selector magnet driver card.	FS11 C-6
			Check for open selector coils.	FS11 D-6
			Check for signal line continuity.	FS11
			Check selector adjustments.	-

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
		Typing unit runs closed during signal impulse from keyboard.	Check output from data set.	FS11 F-6
			Check keyboard signal generator for shorting or mechanical failure.	FS11 C-2
			Check keyboard timing contacts.	FS11 B-2
			Check selector adjustments.	-
			Check for open signal line to the data set.	-
3.	Transmit from keyboard to typing unit. Error free copy will be printed on the typing unit.	Selector receiving margin short.	Check data set input.	FS11
			Check keyboard timing contact adjustment.	FS11 B-2
			Check data set output. Signal line ground to connector PIN D9.	FS11 E-5
			Check current output from selector magnet driver 500 MA.	FS11 C-6
			Check selector magnets.	FS11 D-6
			Check selector adjustments.	-
			Check motor speed.	-
		Intermittent errors or garbling.	Check data set input.	FS11
			Check range finder (may be at marginal setting).	-
			Check current output from selector magnet driver. 500 MA.	FS11 C-6
			Check selector magnets.	FS11 D-6
			Check selector adjustments.	-
			Check motor speed.	-

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
4.	Depressing the HERE IS key will cause the answer back mechanism to operate and the message will be printed on the typing unit. If HERE IS key is held depressed, answer back will not repeat.	Answer back mechanism does not operate.	Check answer back circuit continuity.	FS12 D-4
			Check HERE IS contacts No. 5 and 6 for open condition.	FS12 C-4
		Answer back mechanism repeats as long as HERE IS key is depressed.	Check ABR relay, should remain energized until HERE IS key is released.	FS12 B-4
5.	When the typing unit carriage advances across the platen, the end-of-line (EOL) indicator lamp will turn on at about the 70th character.	End-of-line indicator lamp does not light.	Check EOL bulb.	FS22 D-7
			Check EOL circuits for continuity.	FS22 E-7
			Check for open margin indicator switch.	FS22 F-7
		End-of-line indicator lamp lights, but not at about 70 characters.	Check mechanical adjustments of end-of-line indicator.	-
6.	Depressing the CTRL and Bell keys simultaneously will ring the bell and the printer will not type.	Bell does not ring.	Check bell stunt box contacts for open condition.	FS22 D-7
			Check bell circuit continuity.	FS22 C-7
			Check stunt box function bar coding.	-
7.	(Sprocket feed printer)depress the CTRL and either the FORM TAB or V-TAB keys simultaneously. The printer will perform the selected function but will not print.	Printer does not perform the selected function.	Check stunt box contacts for open condition.	FS17 E-4
			Check appropriate function circuit continuity.	FS17
			Check appropriate stunt box function bar coding.	-
8.	Depression of the CLR key will release the LCL key and stop the motor.	The motor does not stop.	Check the MCR relay, it should be de-energized upon release of the LCL key.	FS17 C-6

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
			Check for closed condition across LCL key contacts No. 29 and 30.	FS17 E-1
9.	Depression of the HERE IS key while the motor is off, will not trip the answer back.	The answer back trips.	Check the CON relay in the data set. It should be de-energized.	FS12 F-7
10.	With the set in the local mode, depress the HERE IS key, then immediately depress the CLR key. The answer back mechanism will finish its operation before the motor begins to slow down.	The answer back does not finish its operation before the motor slows down.	Check for open condition in the AB motor hold contacts when the answer back is operating.	FS17 D-5
11.	(Sprocket feed printer) depression of the CTRL key and either the FORM key or the TAB key and immediately thereafter depressing the CLR key will not slow down the motor until after the function operation is completed.	The motor slows down before the function operation is completed.	Check for open condition in the V TAB and H TAB contacts or check for open condition in the FORM OUT contacts.	FS17 E-4
12.	Depression of the ORIG key will light the ORIG lamp, start the motor and turn on the speaker. Dial tone will be heard over the speaker, and the volume can be controlled by the volume control knob.	ORIG lamp does not light.	Check to see that the OR relay in the data set has operated.	FS5 D-5
			Check ORIG bulb.	FS5 F-7
			Check circuit continuity associated with the ORIG lamp.	FS5 D-6
		Motor does not start.	Check for open condition in the OR relay No. 6 contacts.	FS17 E-6
		Dial tone is not heard over the speaker.	Check for proper telephone line connections.	FS19 E-5
			Check amplifier card.	FS9
			Check circuit continuity.	FS9
			Check speaker.	FS9 F-8

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
		Dial tone volume is not controlled by the volume control knob.	Check for short across potentiometer R1.	FS9 F-7
13.	Dial number of automatic test line.	No break in dial tone or wrong number dialed consistently.	Check circuit of dial mechanism being used.	See index page of set schematics.
			Check associated KSR circuitry for continuity.	FS8 FS10
14.	Call connection made; depress TEST key; receive message from test center.	Local message garbled or not received.	Check for data set output.	FS11
		Test center does not receive message.	Check circuit continuity in area of TEST key.	FS1 C-3
15.	Depress the CLR key and call will be disconnected.	Call does not disconnect.	Check motor control relay (MCR). Should not be operated.	FS17 C-7
16.	When the paper supply on the friction feed printer runs low, the buzzer will buzz and the BUZ-RLS lamp will light.	Buzzer does not buzz.	Check buzzer connections.	FS20 C-3
			Check for open in buzzer coils.	FS20 C-3
		Buzzer does not buzz and BUZ-RLS lamp does not light.	Check for open in buzzer circuit.	FS20
			Check for open condition across low paper switch.	FS20 D-5
		BUZ-RLS lamp does not light.	Check BUZ-RLS bulb.	FS20 C-3
			Check BUZ-RLS lamp socket connections.	FS20 C-3
17.	A notched form is fed through the sprocket feed printer, the buzzer will buzz and BUZ-RLS lamp will light when the notch passes the low paper alarm actuator.	Buzzer does not buzz.	Check buzzer connections.	FS20 C-3
			Check for open in buzzer coils.	FS20 C-3

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
		Buzzer does not buzz and BUZ-RLS lamp does not light.	Check for open in buzzer circuit.	FS20
			Check for open condition across the low paper switch.	FS20 D-5
		BUZ-RLS lamp does not light.	Check BUZ-RLS bulb.	FS20 C-3
			Check BUZ-RLS lamp socket connections.	FS20 C-3
18.	Depressing the BUZ-RLS key will release the LCL key, the buzzing will stop and the BUZ-RLS lamp will remain lit.	Buzzer does not stop buzzing.	Check for closed condition between BUZ-RLS contacts No. 31 and 32.	FS20 D-3
		BUZ-RLS lamp does not remain lit.	Check for open condition between BUZ-RLS contacts No. 31 and 33.	FS20 D-3
19.	When in a low paper condition, the automatic answer circuit will be disabled to calls from another station. The set can answer manually by depressing the ANS key while the BUZ-RLS key is depressed.	The automatic answer circuit does not disable.	Check for a closed condition in the low paper switch.	FS20 D-5
		The set cannot answer manually.	Check for an open condition in the ANS key.	FS6 D-7
20.	When the last form is fed out of the sprocket feed printer, the set will automatically disconnect.	Set does not automatically disconnect.	Check paper out switch for open circuit condition.	FS14 D-3
21.	When the out of service switch is in the locking position, the out of service lamp will light and the ringer and automatic answer circuit will be disabled.	Out of service lamp does not light.	Check bulb.	FS18 B-3
			Check out of service switch contacts 7 and 8.	FS18 B-2
		Set automatically answers incoming call.	Check out of service switch contacts No. 9 and 10.	FS20 E-7
		Ringer rings on incoming call.	Check out of service switch contacts 5 and 6.	FS19 D-3
22.	When the out of service switch is turned to the restore (non-locking) position, the ORIG lamp will light and dial tone will be audible from the speaker.	Dial tone is not heard.	Check out of service switch contacts 3 and 4.	FS19 D-6

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
23.	When a set is wired with the make-busy option, steps No. 19 and 21 will result in a busy signal rather than a no answer condition.	Busy signal is not received.	Check for open condition in make busy circuitry (option A).	FS19 D-4
24.	Depression of the BREAK key when the set is connected to another station will cause the BRK-RLS lamp to light and the keyboard to become blinded.	BRK-RLS lamp does not light.	Check RB relay and appropriate S relay contacts in data set.	FS3 E-2
			Check bulb.	FS3 E-3
			Check circuit continuity.	FS3
		KYBD is not blinded.	Check the break detector relay (RB) in the data set.	FS11 E-1
25.	Depression of the BRK-RLS key will cause the BRK-RLS lamp to extinguish and the keyboard to become unblinded.	BRK-RLS lamp does not extinguish and KYBD remains blinded.	Check to see that the RB relay in the data set has de-energized.	FS3 E-1
26.	Receiving an EOT code combination from another station will cause the set to disconnect.	Set does not disconnect.	Check the EOT stunt box contacts for an open condition.	FS15 F-3
			Check the EOT circuit for continuity.	FS15
			Check the S relay in the data set for operation.	FS15 F-6
27.	The answer back will operate upon connection with another station and will also operate in response to a received WRU code combination.	Answer back mechanism does not trip upon connection with another station. (ANS lamp does not light.)	Check AN relay in data set (should be operated).	FS20 B-5
			Check M relay in data set (should be operated).	FS12 F-5
			Check CON relay contacts in data set (should be closed).	FS12 F-5
			Check automatic answer circuit for proper continuity.	FS12 B-5

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
			Check the low paper contacts on the printer and the low tape switch on the ROTR (if applicable). Set will not answer automatically if these contacts are operated.	FS20 C-7 D-5
		Answer back does not operate in response to a received WRU code combination.	Check for closed condition in the NCT relay contacts No. 8.	FS12 C-5
			Check for continuity through the answer back clutch trip magnet circuit.	FS12 B-5
28.	Depression of the CTRL and WRU keys simultaneously will not print on the typing unit or trip the local answer back.	Local answer back operates.	Check NCT 8 contacts for open condition.	FS12 C-5
29.	When connected to another station, depression of the CTRL and FORM keys simultaneously will cause the sprocket feed printer to feed a form out. After the form feed is finished, depression of the CLR key will not cause a form feed operation on the disconnect.	Depression of the CLR key causes a form feed operation on the disconnect.	Check for closed condition in the form out off normal contacts.	FS13 B-4
30.	When reconnected to another station and the LF key operated several times, depression of the CTRL and EOT simultaneously will cause the sprocket feed printer to feed a form out to the end of the form.	Form does not feed out.	Check for open condition in the form out off normal contacts.	FS13 B-4
31.	Connect to a 60 wpm, 5 level D-TWX station if available. Send by operating the REPT key with some printing character. The REST lamp will light after a few characters and subsequently the BRK-RLS lamp will light and the output of the keyboard will be blinded.	RESTRAINT lamp does not light and printer continually monitors keyboard transmission.	Check RS relay. Relay should be operated.	-
			Check RS contacts.	FS3 F-1

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
32.	Depression of the BRK-RLS key will extinguish the BRK-RLS lamp and the keyboard will become unblinded.	BRK-RLS lamp does not extinguish and KYBD remains blinded.	Check to see that RB relay in data set has de-energized.	FS3 E-1
33.	KSR equipped with an auxiliary ROTR. ROTR cabinet does not contain a TATC card. The ROTR, after being turned on, will perforate tape during both incoming and outgoing traffic.	ROTR does not perforate tape.	Check RCR relay for operation.	FS21 C-2
			Check RCR No. 10 contacts for open condition.	FS21 B-3
34.	KSR equipped with an auxiliary ROTR. ROTR cabinet contains a turn around traffic control card. The ROTR will perforate tape only during incoming traffic.	ROTR perforates tape during outgoing traffic.	Check output of turn around traffic control card in ROTR cabinet.	FS21 D-5
			Check circuit continuity of TATC.	FS21
35.	KSR equipped with an auxiliary ROTR. Depressing the CTRL and TAPE keys simultaneously when the KSR set is connected to another station will result in the ROTR remaining blinded.	ROTR unblinds.	Check for operation of the RCR relay.	FS21 C-2
			Check for closed condition in the NCT 10 contacts.	FS21 E-2
36.	KSR equipped with an auxiliary ROTR. Operation of the CTRL and TAPE key from the distant station shall unblind the ROTR to subsequent traffic.	ROTR remains blinded.	Check for open condition in the NCT 10 contacts.	FS21 E-2
			Check circuit continuity.	FS21
37.	KSR equipped with an auxiliary ROTR. With the ROTR unblinded, depression of the CTRL and TAPE keys simultaneously shall blind the ROTR and feed out tape.	ROTR remains unblinded.	Check RCR relay. The relay should be de-energized.	FS21 C-2
			Check ~~TAPE~~ stunt box contacts for closed condition.	FS21 E-3
		ROTR does not feed out tape.	Check to see if TFR relay contacts No. 1 have an open condition.	FS21 B-3
			Check circuit continuity.	FS21
			Check tape feed magnet.	FS21 B-2
			Check mechanical linkages.	-

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	CHECK	FUNCTIONAL SCHEMATIC REFERENCE
38.	KSR equipped with an auxiliary ROTR. Depression of the BREAK key when the ROTR is unblinded will cause the ROTR to be blinded and tape fed out.	ROTR remains unblinded and tape is not fed out.	Check for operation of the RB relay in the data set.	FS21 F-2
39.	KSR equipped with an auxiliary ROTR and the ALL TRAFFIC SWITCH in the operated position. The ROTR will normally be unblinded on break or disconnect, the ROTR will feed out tape.	The ROTR is not normally unblinded.	Check wiring and circuit continuity in conjunction with the ALL TRAFFIC SWITCH.	FS21 D-2