

SECURE MODEL 28 TELETYPEWRITER STATION  
FOR TWX (C8M) SERVICE  
TEST PROCEDURE

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1. GENERAL

1.01 This section provides an operation test program for each TWX (C8M) station arrangement used in the Secure and Encrypted Bell System Teletypewriter Service. Using this test program, the installer or repairman has sufficient information to connect external test equipment and to assure that the station teletypewriter operates correctly with respect to the station arrangement illustration for half-duplex transmission line operation.

1.02 After the TWX (C8M) Secure and Encrypted Teletypewriter Station is installed, the local telephone company is required to operationally test the teletypewriter and the associated station facilities in accordance with the applicable test procedure in this section. Each test program is designed to verify that the teletypewriter signal and clutch step control circuits are correctly wired to operate as shown in either of the station operating arrangement illus-

trations. Two test methods, a line test switch on the teletypewriter and the encryption bypass feature in the interface box, are provided for in each station arrangement. These test methods are designed to provide a basic routine procedure, which can be used to localize and trace transmission or receiving trouble to either the teletypewriter or station facilities in a relatively short amount of service call time. Both test methods are briefly described in the following paragraphs.

1.03 The teletypewriter LINE-TEST switch is an on-line and off-line operation control for the teletypewriter set only. Operation of the switch to TEST position disconnects the teletypewriter from the transmission facilities and interconnects the transmit components of the set to its receive components; internal battery voltage is also applied to the step pulse input to enable the keyboard and transmitter distributor clutches to operate. Using this feature and the test program provided in this section, the customer can also utilize the off-line test arrangement. Off-line operation tests do not require the service of a telephone company repairman. Ordinarily, this feature is used only after a telephone company maintenance interval or by the station operator prior to a request for service if it is suspected that one of the teletypewriter component units is causing errors during station operation. If the service of a repairman is required, the customer should be able to accurately report the difficulty when service is requested. For example: printer message garbles when on-line, but works well in test position. When given an accurate trouble report, the telephone company repair personnel can determine that the problem is caused by the associated government cryptographic equipment or station transmission facilities. Using the standard telephone company test arrangement and the interface box bypass feature, the authorized phone company repair personnel will repair and restore the station for on-line operation in a relatively short amount of time. Normal on-line teletypewriter operation

is restored when the LINE-TEST key is returned to LINE position.

1.04 Bypass testing is an arrangement which disconnects the government cryptographic equipment from the teletypewriter station. This arrangement is a necessary feature for this type of cryptographic communication terminal so that the standard methods of telephone company maintenance, automatic test line (ATL), teletypewriter test boards, and the 911 type test generator or equivalent can be used for periodic maintenance and if necessary, trouble analysis of the station terminal equipment. Since auxiliary test equipment is connected to the EIA input-output terminals provided within the interface box, this test arrangement must be performed only by trained telephone company repair personnel. Bypass of the government crypto equipment is accomplished by means of a connector plug arrangement in the interface box. Cross connecting the plugs will bypass the crypto equipment, Figure 4. Safeguards are included in the station so that the bypass test can only be done when the interface box rear access cover is removed. With the cover removed, a switch closes and a warning lamp on the front of the station set lights. This lamp warns the operator that classified messages are not to be transmitted. After the bypass test is performed, the teletypewriter RED signal cable and the signal converter BLACK cable connectors must be reconnected to the government cryptographic equipment before the interface box cover is replaced. The teletypewriter set must be conditioned for on-line operation during bypass testing.

1.05 During the normal maintenance interval or station repair service call, it might, in some instances be necessary to replace one or more of the circuit pack assemblies or radio frequency interference shielded assemblies used

in the teletypewriter set. Should it be necessary for a part replacement to restore operation, it is highly recommended that field repair (ie, transistor or diode requires replacement, etc,) not be done. Instead of repair, the entire assembly or circuit pack assembly should be replaced with a good part which has undergone and met the required standards of the radio frequency interference test. The defective part should be taken to an authorized repair service center for the necessary part repair. The repair service center must have equipment capable of simulating normal operating conditions and for performing radio frequency interference (rfi) testing. When the defective part is repaired, it must be subjected to an rfi test since failures of this requirement are not necessarily recognized by monitoring a typical communication operational test.

## 2. TELETYPEWRITER TESTING

2.01 The test programs in the following paragraphs include on-line and off-line operation procedures for checking the teletypewriter circuits. When the teletypewriter keyboard selector switch is positioned as required by the test instruction, the teletypewriter must respond as stated in the "Response" column. Perform the standard test procedure given in 2.02 and select one of the test programs applicable to the teletypewriter station arrangement.

### STANDARD TEST PROCEDURE

2.02 This paragraph includes a standard test procedure for checking the power and control circuit wiring for all of the teletypewriter sets used in the secure and encrypted TWX (C8M). Since these requirements are applicable to each set, this test paragraph must be used in addition to the test programs given on the subsequent pages.

## STANDARD TEST

ACTION REQUIRED	TEST RESPONSE
Remove the TP333530 interface box cover.	The interface box switch must actuate and cause the teletypewriter warning lamp to light.
<p>Open the page printer paper access lid on the cabinet and operate the copy lamp power switch on the left inside of the cabinet dome.</p> <p><u>Note:</u> Operate the switch to NORMAL ON when the test sequence is completed and turn the main power switch to ON position.</p>	<p><u>NORMAL ON</u>, all copy lamps light (with the exception of a single lamp which serves as an end-of-line indicator in "T" position or as a margin indicator lamp when the keyboard switch is in K or KT position) and go off with operation of the set ac power switch.</p> <p><u>MAINT ON</u>, all copy lamps light even though the set power switch is in OFF position.</p> <p><u>OFF (CENTER)</u>, all lamps are off.</p>
The ASR Set is equipped with a magnet controlled power backspace option — depress TAPE B. SP. key.	The paper in the keyboard perforator must back up one character for each operation of the key.

A. Test Program "A" for the 28N, 28R, 28S, and 28U Automatic Send-Receive (ASR) Set.

2.03 This test is applicable only to wiring option 1 listed on the 8801WD. Wiring option 1 (Figure 1) is used for half-duplex tele-

typewriter operation. The signal line wiring connections for operating arrangement option 1 are listed on sheet 4 of 8801WD. The step pulse control wiring connections for controlling the teletypewriter clutch circuitry are given on sheet 2 of the wiring diagram.

## TEST A

ACTION REQUIRED	TEST RESPONSE
Operate the teletypewriter LINE-TEST switch to TEST position (signal electrical service assembly (ESA) relays R3, R4, and clutch ESA relay R15 operate).	
Operate the keyboard selector switch to K position (relays R1 and R12 operate).	
Manually depress each keyboard keytop in consecutive operations until all keys have been operated.	Check that the proper character is printed or proper function is performed on the ASR Set page printer.
Depress the keyboard LOC LF key momentarily.	Paper should feed out from the page printer at approximately three times the speed obtained when the LINE-FEED and REPT keys are depressed.
Depress the keyboard REC key momentarily.	The operation of the keyboard signal generator is not affected and the REC key remains depressed.
Depress the keyboard SEND key momentarily.	The REC keytop returns to its normal unoperated position.

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## TEST A (continued)

ACTION REQUIRED	TEST RESPONSE
Depress the keyboard REPT keytop together with any other keytop with exception of the local function keys.	The selected keytop character or symbol will repeat transmission of the associated code combination.
Depress the keyboard LOC CR (local carriage return) keytop momentarily.	The page printer printing carriage must return to the extreme left hand margin of the paper.
Depress the keyboard BLANK keytop alternately with any other keytop with the exception of the local function keys.	The REC keytop on the keyboard must not operate. The ASR Set page printer must print the proper character code combination.
Depress the keyboard BLANK key twice in succession.	The keyboard REC keytop must automatically operate to the down position.
Depress the keyboard FIGS keytop momentarily and then depress the BELL keytop.	The bell in the teletypewriter set must ring clearly on single or repeated operation.
Place a message tape containing a known test message into the transmitter distributor and move the bat handle control lever from STOP to RUN position.	The transmitter distributor must not operate.
Return the transmitter distributor bat handle control lever to STOP (center position).	
Operate the keyboard selector switch to KT position (signal ESA relay R2 and clutch ESA relays R13 and R14 operate).	
Manually depress each keyboard keytop in consecutive operations until all keys have been operated.	Check that the correct character is printed on the ASR Set page printer and perforated in the tape in the keyboard perforator.
Depress the keyboard BLANK and REPT keytops simultaneously. Release the keys after noting results.	The keyboard perforator must feed out blank tape without interruption.
Depress the keyboard E and REPT keytop simultaneously.	The character counter on the keyboard must count without missing and the margin indicator lamp must light at its preset count.
Release the E and REPT keytops and depress the CAR RET (carriage return) keytop momentarily.	The character counter must return to zero and the margin indicator lamp must extinguish.
Depress the E keytop once.	The character counter must count one character.
Test the accuracy of transmission from the transmitter distributor by sending the message on the prepared test tape. Operate the RUN-STOP control lever to RUN position.	The transmitter starts; check that the test tape message is received accurately on the ASR Set page printer.

## TEST A (continued)

ACTION REQUIRED	TEST RESPONSE
Operate RUN-STOP control lever to STOP position.	The transmitter stops.
Operate the keyboard selector switch to T (tape) position (signal ESA relay R1 and clutch ESA relay R11 operate).	
Depress the keyboard E and REPT keys simultaneously.	The keyboard character counter must count without missing and the end-of-line indicator lamp must light at its preset count.
Release the keyboard E and REPT keys and depress CAR RET (carriage return) key.	The character counter must return to zero position and the end-of-line indicator lamp must extinguish.
Depress the E keytop once.	The character counter must count one character.
Depress the keyboard BLANK and REPT keys simultaneously.	The keyboard perforator must feed out blank tape at high speed without interruption.
Test the accuracy of transmission from the transmitter distributor by sending the message from the prepared test tape. Operate the transmitter RUN-STOP control lever to RUN position.	The transmitter starts operation. The ASR Set page printer must print the test message accurately.
Operate RUN-STOP control lever to STOP position.	The transmitter stops.
Operate the teletypewriter LINE-TEST switch to LINE position.	In all positions of the keyboard selector switch, the page printer receives all incoming message signals to the teletypewriter.
Operate the keyboard selection switch to K (keyboard) position (signal ESA relay R1 and clutch ESA relay R12 operate).	<p>The teletypewriter signal output is connected to the SEND LOOP. The KW STEP CONTROL is connected only with the keyboard clutch magnet driver for controlling the keyboard operation.</p> <p>The keyboard is operative and transmits on the SEND LOOP providing that the external KW step control voltage is a positive 6 volts. The transmitter distributor is not operative.</p> <p>The teletypewriter output signal is not directly connected to the page printer selector magnet driver. This connection is normally made by the associated government furnished equipment at the normal signal input lines or by the TP333530 interface box at the auxiliary input lines when the government crypto equipment is bypassed.</p>

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## TEST A (continued)

ACTION REQUIRED	TEST RESPONSE
<p>Operate the keyboard selector switch to KT position (signal ESA relay R2 and clutch ESA relays R13 and R14 operate).</p>	<p>The teletypewriter signal output is disconnected from the sending signal line.</p> <p>The KW STEP CONTROL is disconnected from the ASR Set step input circuit. Internal step battery voltage is connected to the keyboard and transmitter distributor clutch magnet drivers.</p> <p>Both the keyboard and the transmitter distributor are operative and their internal signal output is connected to the selector magnet driver of the ASR Set page printer. The keyboard is mechanically linked to the keyboard perforator.</p>
<p>Operate the keyboard selector switch to T (tape) position (signal ESA relay R1 and clutch ESA relay R11 operate).</p>	<p>The teletypewriter signal output is connected with the sending transmission line.</p> <p>The external KW STEP CONTROL voltage is connected to the clutch magnet driver of the transmitter distributor only.</p> <p>The transmitter distributor signal generator is operative for transmission of message signals but the keyboard signal generator is not operative.</p> <p>The keyboard is mechanically linked to the perforator for the off-line tape preparation in the blind.</p> <p>The teletypewriter signal output is not directly connected to the selector magnet driver of the page printer. This connection is normally made by the associated government furnished equipment at the normal signal input lines, or by the TP333530 interface box at the auxiliary input lines when the government crypto equipment is bypassed.</p>

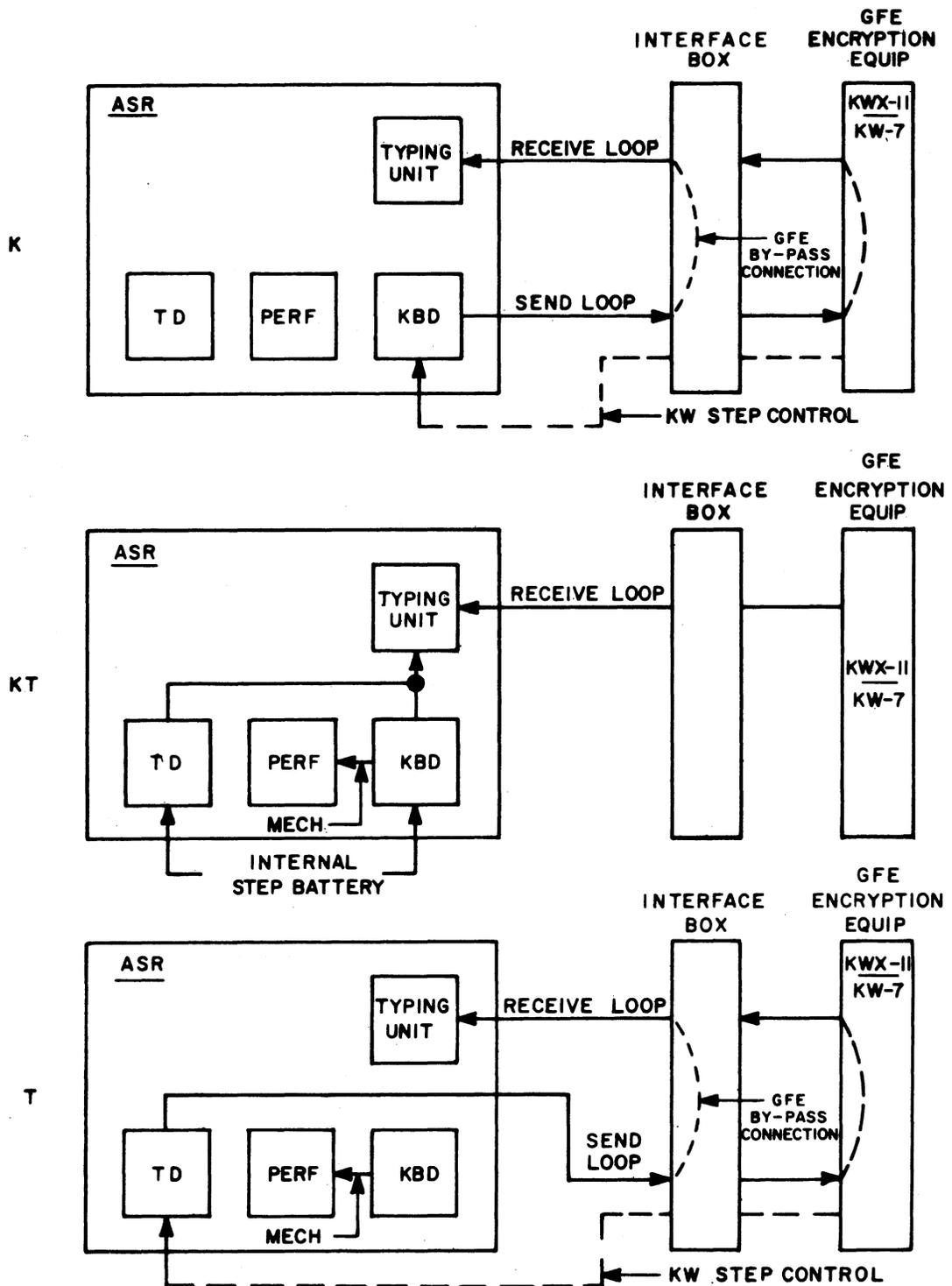


Figure 1 - Model 28 ASR for Half-Duplex Operation -  
Wiring Option 1, 8801WD

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B. Test Program "B" for the 28W, 28AA, 28AH, and 28AK Automatic Send-Receive (ASR) Set Equipped with Auxiliary Receive-Only Typing Reperforator (ROTR).

2.04 This test program is applicable to wiring option 3 given on the 8808WD. Wiring option 3 (Figure 2) is used for the ASR Set with

auxiliary ROTR equipped for half-duplex signal line operation. The teletypewriter signal line connections are as shown on sheet 4. The clutch circuitry control step pulse wiring connections are as shown on sheet 3 of 8808WD. The ACTION REQUIRED column specifies the test instructions and the right column lists the expected teletypewriter TEST RESPONSE.

TEST B

ACTION REQUIRED	TEST RESPONSE
Operate the teletypewriter LINE-TEST switch to TEST position (signal ESA relays R3, R4, and clutch ESA relay R15 operate).	
Operate the keyboard selector switch to K position (relays R1 and R12 operate).	
Manually depress each keyboard keytop in consecutive operations until all keys have been operated.	Check that the proper character is printed or the proper function is performed on the ASR page printer and auxiliary ROTR. The ASR Set page printer must receive in either the SEND or REC position as indicated by the printer control switch.
Depress the keyboard LOC LF (local line feed) key momentarily.	Paper must feed out from the page printer at approximately three times the speed obtained when the LF (line feed) and REPT (repeat) keys are depressed.
Depress the keyboard REC (receive) key momentarily.	The REC key must remain depressed and operation of the keyboard signal generator must not be affected.
Depress the SEND key momentarily.	The REC key must return to its up (normal) position.
Depress the keyboard REPT (repeat) key together with any other key with the exception of local function keys.	The selected keytop character or symbol must repeat transmission of the associated code combination.
Depress the keyboard LOC CR (local carriage return) key momentarily.	The page printer carriage must return to the extreme left hand margin of the paper.
Depress the keyboard BLANK keytop alternately with any other keytop with the exception of local function keys.	The keyboard REC key must not operate.
Depress the keyboard BLANK key twice in succession.	The keyboard REC keytop must automatically operate to down position.
Depress the FIGS (figures) keytop and then depress the BELL keytop.	The bell in the set must ring clearly on single or repeat operation.

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## TEST B (continued)

ACTION REQUIRED	TEST RESPONSE
Place a message tape which contains a known message beneath the tape gate on the transmitter distributor. Move the RUN-STOP lever to RUN position.	The transmitter distributor must not operate.
Return the RUN-STOP lever to STOP position and operate the keyboard switch to KT (keyboard-tape) position; ESA relays R13 and R14 operate.	
Manually depress each keyboard keytop in consecutive operations until all keys have been operated.	<p>Check that the ASR Set page printer (see note) prints the correct character and that the correct code combination is perforated in the tape from the keyboard perforator.</p> <p>Note: The page printer will receive the keyboard transmission only when it is connected to the SEND line as indicated by the printer control switch position. In REC (receive) position, the ASR Set page printer must not respond to keyboard transmission.</p>
Depress the keyboard BLANK and REPT (repeat) keytops simultaneously. Release the keys after noting results.	The keyboard perforator must feed out blank tape without interruption.
Depress the keyboard E and REPT keys simultaneously.	The keyboard character counter on the keyboard must count without missing and the margin indicator lamp must light at its preset count.
Release the E and REPT keys and depress the CAR RET (carriage return) keytop momentarily.	The character counter must return to zero and the margin indicator lamp must extinguish.
Depress the E keytop once.	The character counter must count one character.
Test the accuracy of transmission from the transmitter distributor by sending the message from the prepared test tape. Operate the RUN-STOP switch to RUN position.	The transmitter starts transmission to the ASR Set page printer; the aux ROTR does not respond. The page printer receives the test message only when the printer control switch is positioned to the SEND line.
Operate the RUN-STOP control lever to STOP position.	The transmitter stops.
Operate the keyboard selector switch to T (tape) position; ESA relays R1 and R11 are operated.	

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## TEST B (continued)

ACTION REQUIRED	TEST RESPONSE
Depress the keyboard E and REPT keys simultaneously.	The keyboard character counter must count without missing and the end-of-line indicator lamp must light at its preset count.
Release the keyboard E and REPT keys and depress the CAR RET (carriage return) key.	The character counter must return to zero position and the end-of-line indicator lamp must extinguish.
Depress the E keytop once.	The character counter must count one character.
Depress the keyboard BLANK and REPT keys simultaneously.	The keyboard punch must feed out blank tape without interruption.
Test the accuracy of transmission from the transmitter distributor by sending the message on the prepared test tape. Operate the transmitter RUN-STOP switch control lever to RUN position.	The transmitter distributor starts operation and the ASR Set page printer and auxiliary ROTR receive the prepared tape message. The ASR Set page printer must receive the message with the printer control switch in either the SEND or REC positions.
Operate the RUN-STOP control lever to STOP position.	The transmitter stops.
Operate the teletypewriter LINE-TEST switch to LINE position (ESA relay R3, R4, and R15 are not operated).	
In all positions of the keyboard K-KT-T switch, the teletypewriter must operate as indicated.	The signal line input to the teletypewriter is connected to the auxiliary ROTR. The signal line input to the teletypewriter is also connected to the selector magnet driver of the ASR Set page printer on a manual selective basis as indicated by an illuminated printer control switch mounted in the ASR control panel. Switch light ON (relay R2 operated) indicates that the ASR page printer responsive to signal input on the receiving line. Switch light OFF (relay R2 not operated) indicates that the page printer is responsive to the signal output on the sending line.
Operate the keyboard selector switch to K (keyboard) position, relays R1 and R12 operated.	The teletypewriter signal output from the keyboard is connected to the SEND LOOP. The external KW STEP CONTROL voltage is connected only with the keyboard clutch magnet driver for controlling the keyboard operation only.

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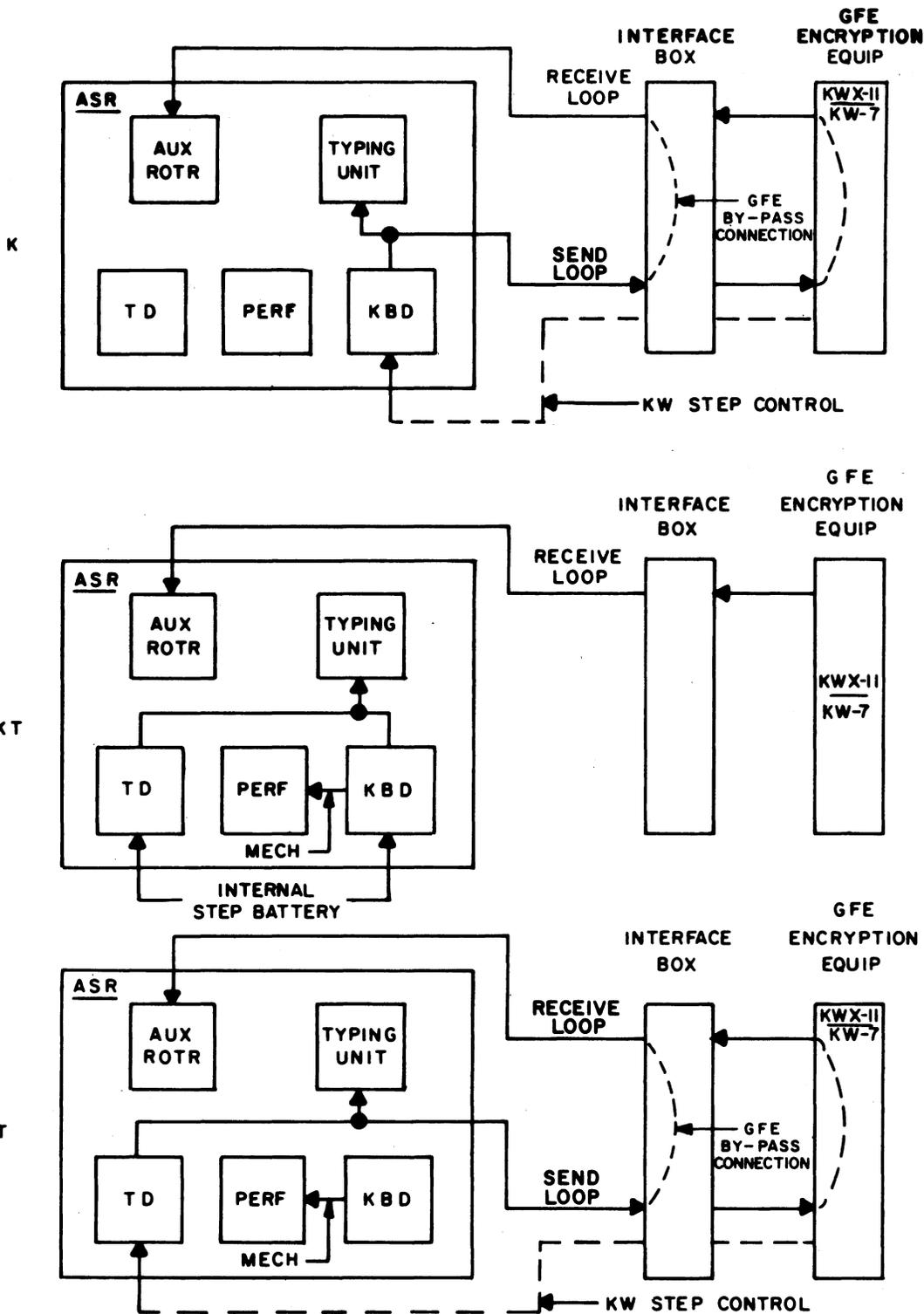
## TEST B (continued)

ACTION REQUIRED	TEST RESPONSE
<p>Operate the keyboard selector switch to K (keyboard) position, relays R1 and R12 operated.</p>	<p>The keyboard must be operative and transmit on the SEND LOOP when operated. (The KW STEP CONTROL voltage must be positive 6 volts dc for "step"; a negative 6 volts dc is not step.)</p> <p>The transmitter distributor is not operative when the control lever is moved to RUN position. The teletypewriter signal output is connected to the selector magnet driver of the ASR Set page printer on a manual selective basis as indicated by the printer control switch.</p> <p>The teletypewriter signal output is normally not connected to the auxiliary reperforator selector magnet driver. This connection is made, however, by the associated government furnished equipment at the normal signal input lines or by the TP333530 interface box at the auxiliary signal input lines when the government furnished equipment is bypassed.</p>
<p>Operate the keyboard selector switch to KT (keyboard-tape) position; ESA relays R13 and R14 are operated.</p>	<p>The teletypewriter signal output is disconnected from the SEND LOOP. External KW STEP CONTROL is disconnected from the teletypewriter. Internal step battery voltage is connected to the keyboard and transmitter distributor clutch magnet drivers.</p> <p>The keyboard and transmitter distributor are operative. The teletypewriter internal signal output is connected to the ASR Set page printer selector magnet driver only on a manual selective basis as indicated by the "printer control" switch.</p> <p>The keyboard is mechanically linked to the keyboard perforator.</p>
<p>Operate the keyboard selector switch to T (tape) position; ESA relays R1 and R11 are operated.</p>	<p>The teletypewriter signal output is connected to the SEND LOOP. The KW external step control is connected to the clutch magnet driver of the transmitter distributor only.</p> <p>The transmitter signal generator is operable, but the keyboard signal generator is not.</p> <p>The teletypewriter signal output is connected to the selector magnet driver of the ASR page printer on a manual selective basis as indicated by the printer control switch.</p> <p>The keyboard is mechanically connected to its perforator for off-line tape preparation in the blind.</p>

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TEST B (continued)

ACTION REQUIRED	TEST RESPONSE
Operate the keyboard selector switch to T (tape) position; ESA relays R1 and R11 are operated.	The teletypewriter signal output is normally not connected to the selector magnet driver of the auxiliary reperforator. This connection is made, however, by the associated government furnished equipment at the normal signal input lines or by the TP333530 interface box at the auxiliary signal input lines when the government furnished equipment is bypassed.



Note: Typing unit may be connected to receive loop on a manual selective basis as indicated by an illuminated switch on ASR control panel.

Figure 2 - Model 28 ASR for Half-Duplex Operation - Wiring Option 3, 8808WD

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C. Test Program "C" for the 28BD, 28BH, 28BK, and 28BP Keyboard Send-Receive (KSR) Set.

2.05 This test is applicable to wiring option 1 listed on the 8816WD. Wiring option 1 (Figure 3) is for half-duplex signal line oper-

ation. All signal line input and output connections for the teletypewriter are shown on sheet 3 of 8816WD. The clutch circuitry step pulse connections are shown on sheet 2 of 8816WD. The ACTION REQUIRED column specifies the test instruction and the right column lists the expected teletypewriter TEST RESPONSE.

TEST C

ACTION REQUIRED	TEST RESPONSE
Operate the teletypewriter LINE-TEST switch to TEST position (ESA relays R1, R2, and R11 are operated).	The KSR is disconnected from all external circuitry. The teletypewriter internal signal input is connected to the internal signal output, and internal step battery voltage is connected to the normal step pulse input.
Manually depress each keyboard keytop in consecutive operations until all keys have been operated.	Check that the proper character is printed or the proper function is performed on the KSR Set page printer.
Depress the keyboard LOC LF key momentarily.	Paper should feed out from the page printer at approximately three times the speed obtained when the LINE-FEED and REPT keys are depressed.
Depress the KBD LOCK (keyboard lock) key and release.	All other keyboard keys, except local line feed, carriage return, and keyboard unlock are prevented from operating. The KBD LOCK key must remain depressed.
Depress the keyboard unlock key.	All keyboard keys must unlock (operative).
Depress the keyboard REPT keytop together with any other key with the exception of local function keys.	The selected keytop character or symbol will repeat transmission of the associated code combination.
Depress the keyboard LOC CR (local carriage return) key momentarily.	The page printer printing carriage must return to the extreme left hand margin of the paper.
Depress the keyboard BLANK keytop alternately with any other keytop with exception of any of the local function keys.	The KBD LOCK (keyboard lock) key must not operate.
Depress the keyboard BLANK key twice in succession.	The keyboard REC keytop must automatically operate to the down position.
Depress the KBD UNLOCK (keyboard unlock) key. Depress the FIGS keytop momentarily and then depress the BELL key.	The bell in the teletypewriter set must ring clearly on single or repeated operation.

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TEST C (continued)

ACTION REQUIRED	TEST RESPONSE
Operate the teletypewriter LINE-TEST switch to LINE position.	The external KW step control is connected to the clutch magnet driver of the keyboard. The keyboard signal output is connected to the SEND LOOP. The signal output is not directly connected to the selector magnet driver of the page printer. This connection is normally made by the government furnished equipment at the normal signal lines or by the TP333530 interface box at the auxiliary signal input lines when the government equipment is bypassed.
<p>Check that the KSR terminal has the following operational capabilities:</p> <p>When Sending</p>	
When Receiving	<p>The input signal to the teletypewriter is connected to the selector magnet driver of the page printer.</p> <p>The keyboard is operationally disabled by means of the external KW step control voltage.</p>

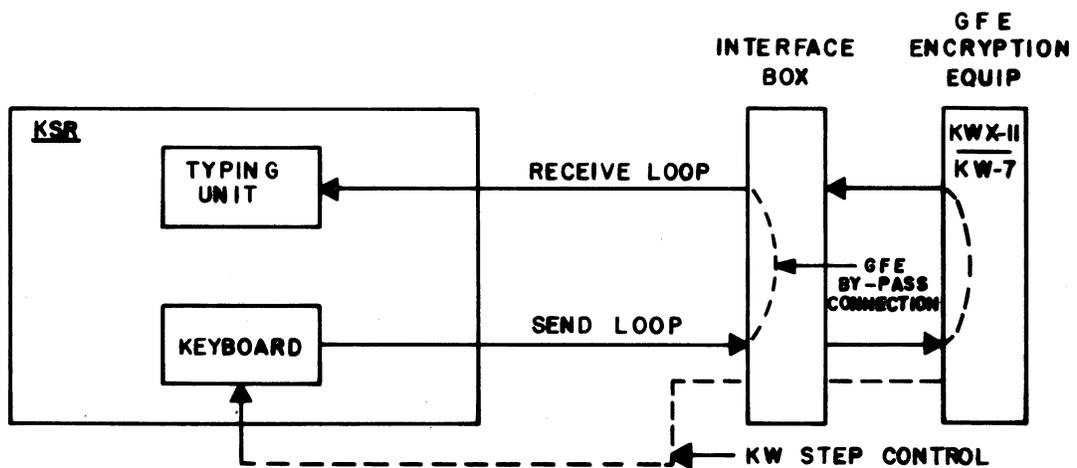
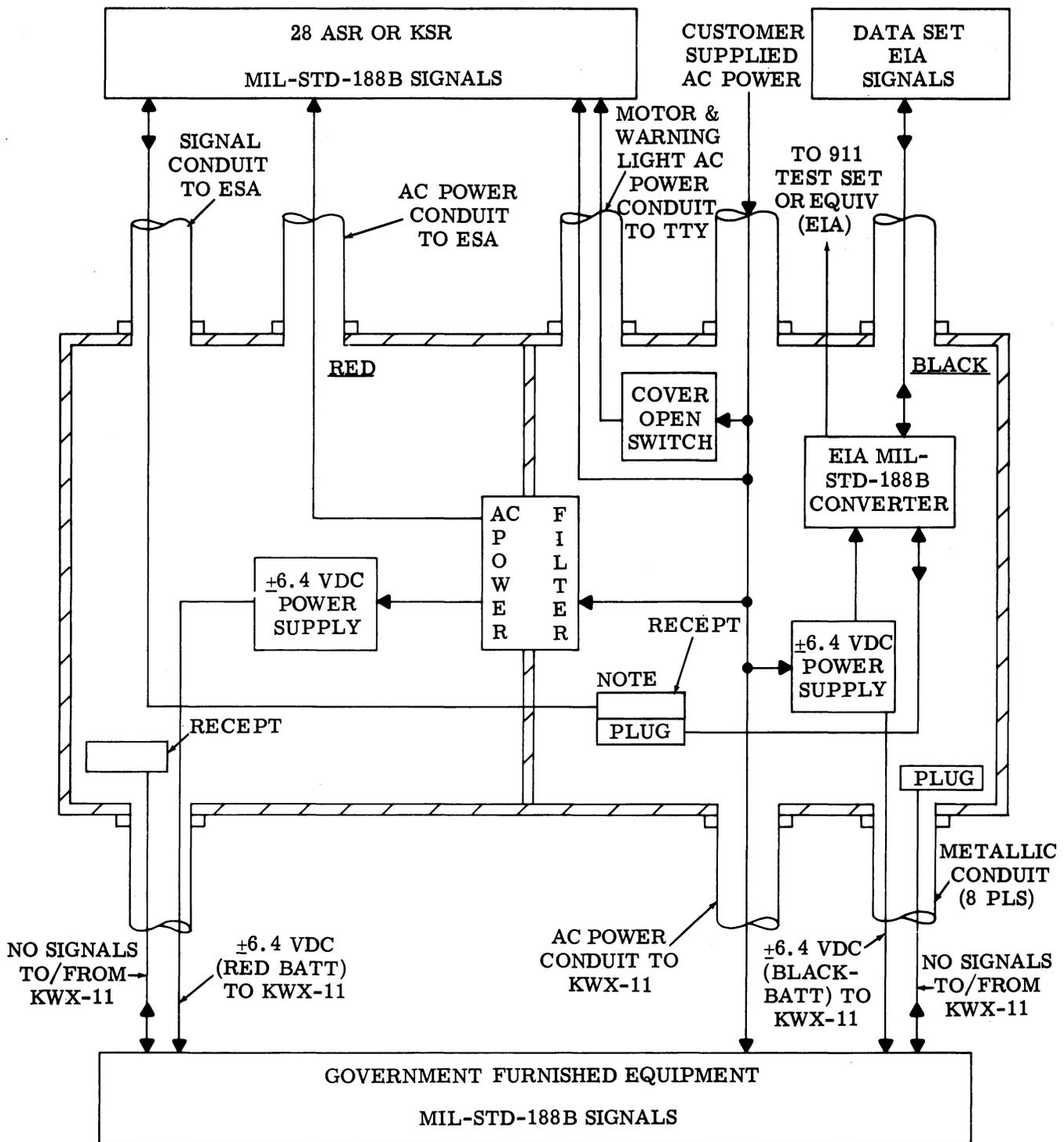


Figure 3 - Model 28 KSR Half-Duplex Operation



Note: Cover on interface box must be removed to make this bypass connection. The cover open switch operates a warning light on the teletypewriter when the interface box is opened.

Figure 4 - Interface Box Test (KW Bypass) Arrangement for TWX (C8M) Teletypewriter Stations