FAST INTERLINE NONPRINTING ACTIVATE CONTROL (FINAC) MASTER STATION TRANSMITTER CONTROL ARRANGEMENT DESCRIPTION, OPERATION, AND TEST PROCEDURE

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1. GENERAL

1.01 This section gives a description, the operating principles, and test procedure for the Master Station Transmitter Control Arrangement.

2. DESCRIPTION

GENERAL OPERATION

2.01 This control circuit was designed for use at the master station of a full-duplex circuit to send transmitter start signals to a number of outlying stations.

2.02 The purpose of this arrangement is to furnish fast sequential Transmitter Start Codes (TSCs) which will neither be copied at any outlying station nor interfere with transmission on the receiving circuit.

2.03 Speed of operation may be 60, 75, or 100 wpm.

2.04 With this type of control arrangement for duplex service, the master station is the only one which transmits to outlying stations, while all transmissions from them are received by the master station only.

2.05 Transmission from all stations must be on a torn tape basis for the following reasons.

(a) Unless torn tape produces 6th pin operation at an outlying station, no new transmitter starts can be effected.

(b) Unless torn tape is used at the master station, it might result in taut tape which would prevent TSCs from being transmitted. Results of this condition are described later.

2.06 The basis of functional operation is the carriage return (CR) character which is required at the end of each line of page copy, and is also used in the End-of-Message (EOM) coding.

BLINDING FEATURES

2.07 Inasmuch as TSCs are sent during transmission of messages, a means of preventing the printing of these code characters is necessary. This nonprinting is provided in a blinding arrangement controlled by the stuntboxes of all outlying station machines. The following conditions are as follows.

(a) On receipt of every CR, any machines in the "print" condition will be blinded during the one character following.

(b) This one character after each CR will be either a valid TSC or a nonvalid BLANK signal.

2.08 This TSC or BLANK character is generated by the coding circuit in association with an eleven step selector.

2.09 Whenever a CR is transmitted on the sending line, the control circuit will automatically follow it with either a TSC character or a BLANK depending upon the "idle" or "busy" condition of the receiving circuit.

2.10 When both the sending and receiving circuits are idle, the control circuit will automatically generate both the CR and TSC character.

2.11 There are four operating conditions under which it is necessary to send valid or nonvalid TSCs to obtain transmissions on the receiving circuit without interfering with any existing transmission or causing any extraneous printing on outlying station's received copy. These four conditions are as follows.

(1) Master station transmitting (outlying station transmitting).

(2) Master station transmitting (outlying stations idle).

(3) Master station idle (outlying station transmitting).

(4) Master station idle (outlying stations idle).

2.12 Under the condition covered in 2.11(1), the TSC circuit will automatically transmit a BLANK character after each CR in the master station tape. The results are described as follows.

(a) Outlying station receiving units are blinded on receipt of the CR for the one next following character, therefore, there is no interference with any copy being received.

(b) The BLANK character being a nonvalid TSC will have no effect on any transmitters thus causing no interference with any existing outlying station transmission.

(c) The BLANK character will be transmitted after each CR until circuit operating conditions are as covered in 2.11 (2), (3), or (4).

2.13 Under the condition covered in 2.11 (1), the TSC coding circuit will now automatically transmit a new valid TSC after each CR in the master station tape. The results are as follows.

(a) The blinding feature is still effective on outlying station receiving equipment to prevent copying these TSCs, and a "tape-available" condition will result in a transmitter start when that station's TSC is received.

(b) The TSCs will continue to be sequentially transmitted after each CR until circuit operating conditions are as covered in 2.11 (1), (3) or (4).

2.14 Operation under the condition covered in 2.11 (3) requires no valid or nonvalid TSCs to be transmitted inasmuch as transmission on the receiving circuit already exists. The results are as follows.

(a) The coding circuit becomes deactivated until either the master station starts transmission or the receiving circuit becomes idle.

(b) Transmission of valid or nonvalid TSCs then resumes as covered in 2.11 (1), (2), or (4).

2.15 With both the sending and receiving circuits idle as covered in 2.11(4), the coding and control circuit will now generate a CR and a valid TSC in order to effect a transmitter start for any station with tape available. The results are as follows.

(a) Blinding features remain effective.

(b) The CR and TSC will continue to be generated and transmitted until conditions become such as covered in 2.11 (1), (2), or (3).

CODING

TSC

2.16 A TSC can be only one of the following characters: Y, B, A, X, Z, J, S, D, W, F, or E, each preceded by a CR.

2.17 TSCs are assigned and prewired in accordance with the table or drawing EA-12616-ED and no change in the sequence should be attempted without referring to the

equipment design group. The assignment of TSCs as shown on the table assures maximum efficiency and distribution.

2.18 The number of TSC codes assigned limit outlying sending stations to eleven, but a lesser number may be employed by assigning multiple codes to some stations. All eleven codes must be assigned.

2.19 For economic reasons it is not feasible to operate less than four sending stations on a circuit.

2.20 No TSC is required for the master station as it is the only transmitting station on the send circuit and transmits at will.

CDC

2.21 Outlying station receiving units are connected by a Code Directing Character (CDC) inserted in the master station tapes to effect normal stuntbox operation.

2.22 Any station's CDC is restricted to one two-letter combination. This one CDC limitation precludes the use of broadcast or group codes.

2.23 Any number of additional, outlying and receiving only stations may be employed.

End-of-Address (Lock-out)

2.24 LF is the End-of-Address (EOA) Code. It prevents all nonselected stations from printing, and conditions all stuntboxes so that fortuitous combinations of CDC characters in text will not connect any unselected station.

End-of-Message (Disconnect)

2.25 FIGS H CR is the disconnect code. It disconnects all stations previously connected until a new CDC is sent and restores all stuntboxes to select "nonprint" in preparation for receipt of subsequent CDCs.

STATION EQUIPMENT

2.26 The FINAC circuit is designed for use with 28-type equipment. The station's equipment consists of the following.

MASTER STATION

1 — 28 ASR (For tape perforation, transmission, and transmission monitoring.)

1 — 28 RO (For the receiving circuit.)

OUTLYING STATION

1 — 28 ASR
28 ROs are optional

2.27 Control circuit equipment is mounted inside the 28 ASR cabinet and consists of the following.

1 — KS-16201, L1 Selector

1 — KS-15898 Rectifier

1 — 376B Vacuum Tube

1 — Jones Socket

20 — Wire Spring Relays, associated resistors and capacitors.

3. THEORY OF OPERATION

OPERATION WITH NO OUTGOING TRAFFIC

3.01 In case there is no outgoing traffic from the master station and the receiving RD relay in Fig. 1 of EA-12615-SD is on its marking contact due to no incoming traffic, the RX trigger tube will fire after its associated condenser is charged to a sufficient difference of potential to trigger-off this gas tube.

3.02 The discharge of this tube is through the No. 6 break contact of the BK relay and its winding to battery, so that it operates and locks up through its No. 6 make contact, the BK resistance, and over the No. 8 lead to Fig. 2, and then through break contact No. 8 of the KZ relay back over the No. 2 lead to Fig. 1 and ground through break contact No. 10 of the Z relay.

3.03 The BK relay operated, discharges the timing RX condenser of the RX trigger tube to ground through its No. 1 make contact, connects to ground top winding of the CX break contacts No. 6 of the MJ relay and break contacts No. 6 of the CX relay.

3.04 The CX relay operates and locks up through its bottom winding, break contact No. 10 of the EC relay, and make contacts No. 6 of the CX relay. As long as the CX relay is operated, there is no possibility of the MJ relay being operated, since the ground that would be used for that purpose has been disconnected by means of the No. 6 break contact on the CX relay.

3.05 The operation of the CX relay also connects ground through its No. 1 make contacts, the No. 3 break contacts of the EC relay to the winding of the KB relay which operates. This action shorts out 1-4 of the receiving relay over L1, and L4 leads by making contacts No. 11 of this relay so that the monitoring printer does not copy the TSC.

3.06 Distributor contacts S1 to S5 inclusive shown on Fig. 3 are connected through break contacts on the DC relay in Fig. 1, the break contacts of the Z relay, the break contacts of the B relay, the break contacts of the KR relay, and then to Fig. 3 over R1 to R5 leads inclusive to the transmitter contacts.

3.07 The DS relay in Fig. 1 has now lost the ground on its winding by means of the No. 8 break contact on the CX relay so that it releases. With the release of the DS relay, a short is presented to the BB and DC leads through break contacts No. 2 of the DS relay, make contacts 3 of the CX relay, break contacts 3 of the EX relay. These two BB and DC leads go to Fig. 3, and the short across these two leads energizes the distributor clutch magnet.

3.08 The operation of this distributor magnet permits the teletypewriter sending equipment to transmit the carriage return teletypewriter character to the line since the sending contacts S1 to S5 inclusive are now connected through the make contacts of the KR relay, which was operated through No. 3 break contacts of the EC relay and the No. 1 make contacts of the CX relay to the air through the break contacts of the KZ relay with the exception of the S-4 contact which goes to ground.

3.09 This ground is fed back over the KB lead to the sending SD relay so that only the No. 4 unit is marking. This connection permits the distributor to send a CR teletypewriter character to the line.

3.10 During the transmission of this teletypewriter character, the distributor auxiliary contact closes and connects ground over the DX lead from Fig. 3 to Fig. 1 and then through make contact No. 9 of the CX relay, break contact No. 10 of the DS relay and over the No. 16 lead to Fig. 2 through break contact No. 12 of the KZ relay to the winding of the KO relay causing it to operate.

3.11 As soon as the CR character has been transmitted to the line, the auxiliary contact opens up and permits the operation of the KZ relay in series with the KO relay so that S1 to S5 leads are connected to the SE selector with the exception of the S1 lead which has a permanent ground on it.

3.12 The code transmitted to the line is therefore dependent upon the strappings on the SE selector and also upon what step this selector may be at that particular time. During the transmission of this character, the auxiliary contact which is closed during this transmission connects ground through the top make contacts of the KZ relay over lead 17 to Fig. 1 to the winding of the EX relay through break contacts No. 12 of the EC relay so that the EX relay operates.

3.13 As soon as this EX relay operates, it breaks the distributor magnet circuit by its No. 3 break contacts. When this transmitter-distributor start signal character has been transmitted to the line, the distributor auxiliary contact on opening up will permit the EC relay to operate, which locks up through the VP varistor and ground through the No. 6 make contact on the CX relay.

3.14 It also locks up over lead 9 to ground through the No. 12 make contact of the KO relay in Fig. 2. It will be noticed that the locking circuits of the CX, KZ, and KO relays are broken by the operation of the EC relay.

3.15 The reason for the VP varistor is so that a locking ground for the EC relay coming back from a number of relays in this system will not inadvertently operate the CX relay.

3.16 The locking circuit of the BK relay is broken by the operation of the KZ relay, so that it is released. The CX released, places

ground by means of its No. 8 break contacts on the winding of the DS relay so that it operates and removes ground from the magnet of the distributor.

3.17 As soon as the CX relay is released, a ground is placed on the operating winding of the SD relay through No. 4 break contacts of the CX relay and the No. 8 break contacts of the MJ relay. This is to hold the outgoing circuit closed.

3.18 Since it is desirable to step the SE selector every time an attempt is made to start a transmitter-distributor, a ground is applied through make contact No. 10 of the KZ relay, the break contact of the SE selector to the winding of the coil, thus permitting the selector to operate and hold through the SE resistance.

3.19 This selector will step upon the release of the KZ relay. This means that the system will send a different start code for every position of the SE selector including the No. 11 step.

3.20 Sending SD relay is kept on marking by a ground through break contact No. 11 of the SP relay and make contacts No. 12 of the DS relay until the DS relay releases.

OPERATION WITH BOTH INCOMING AND OUTGOING TRAFFIC

3.21 In case incoming traffic is being handled, the intermittent ground applied, to the timing circuit of the RX tube by the RD relay will not permit the tube to time out, so that the BK relay will remain in its released position.

3.22 The transmitter contacts are connected over the R1 to R5 leads inclusive and back to the distributor contacts over the S1 to S5 leads inclusive through the break contacts of DC, Z, B, and KR relays.

3.23 In order to start sending from the master station, it is necessary to place tape in the gate of the transmitter-distributor and also to operate the manual switch. The operation of the manual switch operates the MS relay in Fig. 1, so that the tape in the gate will hold the sixth pin closed and operate the SP relay through the No. 4 make contacts on the MS relay. The SP relay on operating locks through its contacts No. 9 to the sixth pin contact in the transmitter-distributor so that if the manual switch was opened by means of tight tape, the SP relay would not fall down and release the circuit.

3.24 The MJ relay now operates since ground is connected through No. 6 break contacts of the CX relay, No. 6 break contact of the MJ relay and the No. 10 make contact of the SP relay to the primary winding of the MJ relay. This relay operates and locks up by means of its bottom winding through the No. 8 make contacts of the SP relay, the No. 6 make contacts of the MJ relay and the No. 6 break contacts of the CX relay to ground.

3.25 The operation of the MJ relay, by means of its break contact No. 2, releases the ST relay. Rectifier voltage is now applied to the winding of the transmitter clutch magnet. The circuit for energizing the transmitter clutch magnet comes over the TC lead through make contact No. 12 of the SP relay, make contact No. 1 of the MS relay, break contact No. 2 of the Z1 relay, break contact No. 2 of the B1 relay, break contact No. 2 of the ST relay and back to the rectifier over the BB lead.

3.26 Traffic is now handled in the normal manner until the end of the line, when a CR character is transmitted over the system from the master station. At this time, the CR relay operates to its No. 4 contact due to its associated resistance reading circuit which is connected to the five leads between the transmitter contacts and the distributor contacts.

3.27 This relay operated, places ground on the QA relay which operates, and by means of its No. 10 make contact completes a circuit so that the battery is now applied through break contacts No. 6 through the X relay, through contact No. 6 of the BL relay, No. 10 make contacts of the QA relay to the winding of the BL relay which operates and locks up by means of its bottom winding through the break contacts No. 8 of the EC relay, the No. 6 make contact of the BL relay and the No. 6 break contact of the X relay to ground.

3.28 As soon as the auxiliary contact of the distributor closes, ground is connected over the DX lead through No. 8 make contact to the QA relay, the No. 9 make contact of the BL relay, No. 12 break contact of the B relay, the No. 2 break contact of the X relay to the winding of the B1 relay which operates.

3.29 The operation of the B1 relay opens the transmitter magnet circuit by means of its No. 2 break contacts so that the transmitter sets up one more teletypewriter character and then comes to rest.

3.30 The distributor continues to send the CR, teletypewriter character to the line and at its completion when the distributor auxiliary contacts open up, the B relay operates in series with the B1 relay so that the distributor contacts are now connected through the make contacts of the B1 relay to the air. Since there is nothing connected to these make contacts, the BLANK teletypewriter character will be sent to the line. The BLANK character is not included as a station start code so no station will be started.

3.31 Since the 28F multicontact transmitter-distributor has set up a teletypewriter character that has not been transmitted to the line, it is desirable that the sending equipment take care of this character before the transmitter magnet is closed. In order to do this, DC and DX relays are provided, and during the transmission of the BLANK teletypewriter character, the auxiliary contact connects its ground through make contacts 11 of the BL relay, make contact 11 of the B relay, break contacts 12 of the DC relay to the winding of the DX relay.

3.32 Relay DX operates and remains in that condition during the transmission of the BLANK teletypewriter signal.

3.33 At the end of this character, it will be noted that the DC relay operates in series with the DX relay connecting transmission S1 to S5 leads directly to transmission R1 to R5 leads inclusive so that on its next trip around, the distributor sends the character that was set up by the machinery but never transmitted to the line.

3.34 During the transmission of this last teletypewriter character, the ground from the auxiliary contact continues through make contact 12 of the DC relay, break contact 12 of the EC relay to the winding of the EX relay which operates. At this time the transmitter magnet is again closed by make contact 9 of this EX relay.

3.35 With the EX relay operated, the distributor magnet circuit is opened up by break contacts No. 3 on this relay, so that when it completes this operation it will come to a halt.

3.36 At the conclusion of the transmission of this character, however, the EC relay operates in series with the EX relay so that the locking grounds of all relays with the exception of the EC and EX relays are opened.

3.37 These relays release, and on their release, the locking circuit of the EC and EX relays are opened so they release and the circuit is normal. The transmitter-distributor now operates normally.

3.38 The locking path of the EC and EX relays to the BL relay is through the VQ varistor. This diode is in the circuit so that BL relay will not be operated from some other ground such as make contacts No. 12 on the Z1 relay.

OPERATION WITH OUTGOING TRAFFIC—RECEIVING CIRCUIT IDLE

3.39 In case outgoing traffic is being handled, and the receiving circuit remains in the "marking" condition, the RX trigger tube will time out and fire, thus operating the BK relay which operates and locks up as mentioned previously. Under this condition, when the CR is transmitted by the multicontact transmitter-distributor, the QA relay operates from the CR relay which is activated by the CR character.

3.40 However, this time the X relay is operated as soon as the BK relay comes up since path from the primary winding of the X relay is continuous now through the No. 8 break contact of the ST relay, make contact No. 11 of the BK relay, break contact No. 6 of the BL relay to ground through No. 6 break contact of the X relay.

3.41 This X relay operates and locks up by means of its bottom winding through the break contact 11 of the EC relay, break contact No. 10 of the CX relay to ground through the No. 6 make contacts of the X relay.

3.42 Under this set of conditions, the closure of the distributor auxiliary contact connects ground through the No. 8 make contact of the QA relay, the No. 9 make contact of the X relay, the No. 12 break contact of the Z relay, No. 2 break contact of the BL relay to the winding of the Z1 relay which operates.

3.43 As soon as the CR character has been transmitted, the ground from the auxiliary contacts of the distributor is lost and the Z relay operates in series with the Z1 relay, so that all of the leads from the distributor side of the transmitter-distributor are connected to the SE selector with the exception of S1 which goes to a permanent ground. The start character transmitted is therefore dependent upon this permanent ground and also the strappings on the SE selector.

3.44 At the conclusion of the transmission of this start signal, the operation is the same as described when a BLANK teletypewriter signal was transmitted to the line except that the DX lead is connected to the winding of the DX relay through make contacts 11 of the X relay, make contacts 11 of the Z relay and break contacts 12 of the DC relay.

3.45 The monitor machine does not copy the TSC since L1 and L4 leads to the receiving relay are shorted through make contacts 6 of the Z relay, and break contacts 11 of the DC relay.

4. TESTS

GENERAL TEST INFORMATION

4.01 To make tests on master station equipment, a release of the complete service should be obtained as normal operation will be interrupted.

4.02 Co-ordination is required with the Serving Test Center (STC) for most of the tests.

4.03 Before making tests, the STC should remove the master station SENDING and RECEIVING loops and terminate them in separate dummy circuits.

4.04 When perforating torn tape, it is advisable to include seven to ten LTRS characters at both the beginning and end of the tape. This provides easier latching at the start and insures that the complete message will be transmitted before 6th pin operation deactivates the transmitter.

EQUIPMENT TESTS

Receiving (28 RO)

4.05 The 28 RO is online at all times and requires no selection. It is not equipped with a LINE-TEST key. Orientation limits may be checked by having the STC transmit the automatic fox test in accordance with standard instructions.

Sending (28 ASR)

4.06 The transmitter and typing unit of the 28 ASR are normally online. There is no provision for selective connection by a CDC or transmitter start by TSC. A LINE-TEST key is provided.

Transmitter

4.07 The following conditions are required for tests of the transmitter.

(a) LINE-TEST key in LINE position and power ON.

(b) Open RECEIVE loop to simulate a "busy" receiving circuit condition which will prevent the control circuit from transmitting valid TSCs.

(c) Place a test tape in the transmitter, lock tape lid, and operate START-STOP switch to the RUN position (right).

(d) The STC should now receive the transmitted signals and make a telegraph transmission measurement.

(e) The transmitter should be deactivated after the tape has fed through and operated the 6th pin.

(f) Assuming the STC to be using a monitor which prints all functions, the received copy should read exactly as sent including FIGS, LTRS, CR, LF, and BLANK.

Note: This BLANK character will have been transmitted by the control circuit after each CR in the tape.

(g) The station ASR should have copied only the text of the message, but performed all functional operations while disregarding the BLANK which has no useful purpose.

Control Circuit

4.08 To test signals from the TSC control circuit proceed as follows.

(a) Have both SENDING and RECEIVING loops closed and idle.

(b) Tape lid latched down.

(c) START-STOP switch in RUN position.

(d) No tape in transmitter.

(e) The Control circuit should now operate and transmit the TSC sequence of CR Y, CR B, CR A, CR X, CR Z, CR J, CR S, CR D, CR W, CR F, and CR E.

(f) These TSCs should be generated at one-second intervals, and the complete cycle should be repeated as long as both loops are closed and idle.

(g) Telegraph transmission measurements should be made by the STC.

Keyboard

4.09 To test keyboard signals, proceed as follows.

(a) Open RECEIVING loop.

(b) Tape-lid position is immaterial.

(c) START-STOP switch in STOP (LOAD, left) position.

(d) K-KT-T switch in K (keyboard) position.

(e) Signals may now be typed directly to the SENDING loop for measurement by the STC, and a check of home copy.

Typing Unit

4.10 To test orientation limits of typing unit per standard instructions, proceed as follows.

(a) Have RECEIVING loop open.

(b) No tape in transmitter.

(c) START-STOP switch in STOP (left) position.

(d) Have STC transmit automatic fox test on SENDING loop.

(e) Make orientation tests.

Line-Test Key

4.11 If it is desired to make tests on the 28 ASR locally, it can be placed in the "test" condition by operating the LINE-TEST key to TEST. Proceed as follows.

(a) When in the "line" condition, the ASR is arranged as follows.

(1) The transmitter is connected to the SEND loop.

(2) The typing unit is connected to the SEND loop.

(3) The keyboard is connected to the SEND loop when the K-KT-T switch is in either the K or KT positions.

(4) The TSC generator circuit is connected to the SEND loop.

(b) When in the TEST position, the ASR in its entirety, and the TSC generator, are removed from the SEND loop and placed in a local battery circuit. A short is placed on the SEND loop to keep that circuit closed.

Transmitter Start Code Generator Circuit

4.12 The TSC generator circuit should be checked for proper operation under varying sending and receiving circuit, "idle" and "busy" conditions are as follows.

(a) Sending and receiving circuits idle, proceed as follows.

(1) Automatically generate a CR and the second character of a TSC in sequence.

(2) Pause for one second to allow time for the outlying station transmitter to start.

(3) Automatically repeat Steps 1 and 2, sending a different second character according to the "polling" sequence.

(4) Automatically and continuously generate the "polling" sequence with a one-second pause between each CR (TSC) as long as the receiving circuit remains idle.

(5) Stop "polling" if the receiving circuit is made busy, and automatically resume if an "idle" condition again prevails.

(b) Sending and receiving circuits busy, proceed as follows.

(1) Make the receiving circuit busy by having the STC transmit the automatic fox.

(2) Make the sending circuit busy by transmitting a long tape made up of short test sentences.

(3) After each CR sent by the station transmitter from the test tape, the TSC generator should send a BLANK character.

(4) The BLANK character should continue to be sent after each CR in the test tape as long as the receiving circuit is kept busy.

(5) Removal of the fox on the receiving circuit should cause the TSC circuit now to generate a valid TSC character after each CR sent from the station transmitter.

(c) Sending circuit busy, receiving circuit idle, proceed as follows.

(1) Make the sending circuit busy by transmitting short test sentences.

(2) After each CR sent from the transmitter, the TSC generator should send a new valid TSC character.

(3) These TSC characters should continue to be sent after each CR as long as the receiving circuit is idle.

(4) It should be noted that inasmuch as it takes one second to generate a new TSC character, too rapid transmission of CRs in the test tape will not result in an equal number of TSCs.

(5) To insure generation of a TSC, the CR character should not appear in the tape closer than every tenth character which is equivalent to approximately one second.

(d) Send circuit idle, receiving circuit busy, proceed as follows.

(1) Have the STC transmit the automatic fox on the receiving circuit.

(2) With a "no-tape" condition at the master station, no TSCs should be generated.

(3) If the fox is removed and the receiving circuit remains idle for one second or more, valid TSCs will then be generated and transmitted on a-one-a second basis.

Line "Hold" Feature

4.13 The line "hold" feature is provided to permit tape servicing in case of taut, tangled or torn tape during transmission.

(a) The TSC generator is prevented from sending TSCs while the transmitter is stopped. This prevents overlining, and extraneous characters from being printed, during text at outlying stations that have been selected.

(b) Test of the "hold" feature is made with the sending circuit busy and the receiving circuit idle as shown in Table A.

TABLE A — LINE HOLD FEATURE TEST (See 4.13)

STEP	ACTION	RESULTS
1	Master station transmits tape.	Signal received at STC.
2	During transmission, operate the START-STOP switch of the transmitter to the STOP position (left).	Transmission halted. No signals received at STC.
3	Remove tape from transmitter.	No signals received at STC. No TSCs transmitted.
4	Reinsert tape in transmitter. START-STOP switch in LATCH (center) position.	No response.
5	Operate START-STOP switch to RUN (right) position.	Transmitter restarts. Signals received at STC.

TROUBLE CLEARING

4.14 If trouble is suspected in the relay circuit of the master station transmitting and TSC coding arrangement, the tests outlined in Table B should indicate which relays, if any, are

involved. Before proceeding to the test, the following should be observed.

(1) No loop connections are required.

(2) Lift black ground strap from terminal C88 in the 28 ASR cabinet.

(3) Operate the LINE-TEST key to TEST.

(4) Turn power switch ON.

(5) Observe that DS and ST relays are operated.

4.15 The tests should be made for each feature or condition over at least a ten-minute period to insure proper operation.

4.16 In the event of finding and clearing any troubles, all tests should be repeated, and special attention given the faulty feature to prevent a recurrence.

5. REFERENCES

5.01 The following are Bell System Practices and a EA drawing related to this section.

E12.762 — 28 ASR Teletypewriter — Full Duplex Outlying Station Arranged for FINAC — Office Responsibilities, Operating, and Testing Procedures

581-803-901 LL — Fast Interline Nonprinting Activate Control (FINAC) — EA-12616 Outlying Station Control Circuit — Description, Operation, and Test Procedure

EA-12616-SD — 28 ASR Teletypewriter — Full Duplex Outlying Station Arranged for FINAC

Note: For information on basic 28-type teletypewriter apparatus, refer to standard instructions covering the particular component needed.

TABLE B — MASTER STATION TRANSMITTER CONTROL ARRANGEMENT RELAY CIRCUIT TEST (See 4.14)

STEP	ACTION	RESULT	STEP	ACTION	RESULT
1	Hold armature of RD relay to right until RX tube fires.	BK, CX, and KR relays operate. D8 relay releases. Distributor shaft rotates.	9	Repeat Step 8.	EX and EC relays operate and release B, B1, DX, DC, and BL relays release.
2	Ground terminal C87 once only. Release the ground.	KO relay operates. KZ relay operates. BK relay releases. SE magnet pulls up.	10	Prepare a test tape containing the sequence CR LF fifteen SPACES repeated ten or twelve times. Insulate the M10 contact of QA relay. Insert test tape in gate.	SP and MJ relays operate. ST relay releases. Transmitter starts.
3	Repeat Step 2.	EX and EC relays operate and release. CX, KR, KO, and KZ relays release. D8 relay operates. SE selector steps.			
4	Operate STOP-RUN lever to RUN.	MS relay operates.	11	Hold armature of RD relay to right until RX tube fires.	BK and X relays operate.
5	Prepare a test tape containing the sequence CR SPACE SPACE SPACE repeated 20 or 30 times. Insert in gate and close lid to depress 6th pin.	SP and MJ relays operate. ST relay releases. Tape feeds through transmitter.	12	Ground terminal C87 until the Z1 relay operates. Release the ground.	Transmitter stops. Z relay operates. BK relay releases. SE magnet pulls up.
6	Note transmission of CR from tape.	CR and QA relays operate and release. BL relay operates.	13	Operate STOP-RUN tape lever to STOP. Momentarily ground terminal C87 again.	DX and DC relays operate.
7	Ground terminal C87 until the B1 relay operates. Release the ground.	Transmitter stops. B relay operates.	14	Repeat Step 13.	EX and EC relays operate and release. Z, Z1, DX, DC, and X relays release. SE selector steps.
8	Operate STOP-RUN tape lever to STOP. Momentarily ground terminal C87 again.	DX and DC relays operate.			