

MASTER TIMING CIRCUIT SD-25633-01
METHODS OF HANDLING ALARMS
WITH SIX-SECOND TIMING
NO. 5 CROSSBAR OFFICES

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1. GENERAL	
1.01 This section describes the procedures to be followed when responding to alarms associated with the master timing circuit SD-25633-01.	
1.02 This section is reissued for the following reasons:	
(a) To separate the one-second timing methods of handling alarms into a new section, 218-772-304, Issue 1,	
(b) To provide a general revision of this section, therefore, arrows normally used for changes will not be used,	
(c) To make other minor changes as required.	
This reissue does not affect the Equipment Test Lists.	
1.03 The alarms covered are:	
A. <i>Timer Synchronism Failure Alarm</i>	5
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C. <i>Pulse Failure Alarm</i>	15
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1.04 Information concerning precautions to limit stoppages at the accounting center caused by central office tape irregularities is included in the section on Central Office AMA Equipment Precautions to Limit Stoppages in No. 1 Accounting Center—No. 5 Crossbar Offices.	
Timer Synchronism Failure Alarm	
1.05 If the timers of the odd and even master timing circuits are out of synchronism with each other, the major alarm will sound and the TSF (timer synchronism failure) and aisle pilot lamps will light at the master timing frame.	
Selector Synchronism Failure Alarm	
1.06 If any of the recorder selectors or the selectors of the master timing circuit not furnishing time pulses to the recorders are out of synchronism with the selectors of the master timing circuit that are furnishing time pulses to the recorders, the major alarm will sound and the SSF (selector synchronism failure) and aisle pilot lamps will light at the master timing frame.	

NOTICE

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Pulse Failure Alarm

1.07 If the master timer circuit in control for furnishing time pulses fails to furnish a pulse for stepping the master timing circuit selectors and recorder selectors every six seconds, the major alarm will sound and the PF (pulse failure) and aisle pilot lamps will light at the master timing frame.

End-of-Tape Failure—Short Time-Out

1.08 While controlling the perforation of a make-busy, recorder transfer, window splice, or 3:00 a.m. end-of-tape pattern, the master timing circuit short time-out feature times the various functions of these end-of-tape patterns, with the exception of the splice pattern for 3:00 a.m. end-of-tape. If any of the timed functions are not completed within the 4- to 7-second time intervals, the master timing circuit seizes the trouble recorder to take a trouble record and causes the major alarm to sound.

1.09 After the trouble record is taken or if a lost record indication occurs because the trouble recorder is busy, the master timing circuit attempts to complete under local control, the perforation of the pattern that was blocked.

1.10 If perforation of the pattern under local control is successful for make-busy, transfer, window splice entries, or for 3:00 a.m. end-of-tape entries when the recorder in trouble is the last in the series, the master timing circuit is released after completion of its functions. If the recorder is not the last in the series for 3:00 a.m. end-of-tape entries, the master timing circuit advances to control the perforation of the 3:00 a.m. end-of-tape pattern on the tape of the next recorder in succession.

1.11 If perforation of the pattern under local control is not successful within the short time-out interval, the master timing circuit and the recorder are automatically made busy under control of the AR (alarm release) keys on their respective frames and each of these circuits also maintains a connection to sound the major alarm. The connection between the master timing circuit and the recorder is released and the progression of the master timing circuit for the control of the 3:00 a.m. end-of-tape entries on the tapes of the next recorders in succession is stopped.

1.12 If the master timing circuit fails to release after the trouble record is taken because of unsuccessful local control operation or for any other reason, lighted lamps indicate the circuit conditions at the following locations.

At master timing frame—

TAE or TAO (time alarm even or odd) ETFE or ETFO (end-of-tape failure even or odd)

CMBE or CMBO (controller make-busy even or odd)

Aisle pilot

At trouble recorder frame—

CMBE or CMBO (controller make-busy even or odd)

MTE or MTO (master timing even or odd—in use)

R_ or RCDR_ (recorder—in use)

At recorder frame—

MTR (master timing release)

Aisle pilot

1.13 Since the lighted lamps at the master timing frame and other frames indicate only the circuit conditions after the time-out, it will be necessary to refer to the trouble record to determine the type of entry involved, the progress of the call when blocked, and also the connecting circuits involved as an aid in determining the source of the trouble causing the time-out.

1.14 The master timing circuit short time-out feature may be inoperative when the master timer is called upon to control the perforation of a make-busy, transfer, or window splice pattern. In this case, the long time-out feature checks that the functions from the start of recorder seizure to start of splice pattern are completed within an 18- to 30-second period. The functions from the start of splice pattern to the end of perforation are also checked for completion within a second 18- to 30-seconds period. If any of these timed functions are not completed within their allowable time intervals, the master timing circuit and the recorder are automatically made busy, the major alarm sounds, and the connection between the master timing circuit and the recorder is released. Also, the lamps as described in 1.12 are lighted.

1.15 The master timing circuit short time-out feature may be inoperative when the master timing circuit is called upon to control the perforation of 3:00 a.m. end-of-tape patterns. In this case, the master timing circuit long time-out feature checks that the functions from the start of recorder seizure to the start of the splice pattern are completed within a 66- to 78-second period. After timing the length of splice pattern for a second 66- to 78-second period, the long time-out feature checks that the functions from end-of-splice pattern to the end of perforation are completed within the next 12 seconds. If any of these timed functions are not completed within their allowable time intervals, the long time-out feature calls on the short time-out feature to seize the trouble recorder to take a trouble record. The master timing circuit then attempts to complete, under local control, the perforation of the blocked pattern.

1.16 If the trouble record is taken and perforation under local control is successful, and the recorder in trouble is not the last in the series, the master timing circuit advances to start perforation of the 3:00 a.m. end-of-tape pattern on the tape of the next recorder in succession.

1.17 If the short time-out feature is also inoperative at this time, the auxiliary long time-out feature functions in 2 to 5 minutes (when E wiring option is used) to take a trouble record and attempt completion of the pattern under local control, or (when B wiring option is used) to make busy the master timing circuit and the recorder, release the connection between the master timing circuit and the recorder, and to light the lamps as described in 1.12.

1.18 When E wiring option is used and if the short time-out feature is inoperative when called upon by the auxiliary long time-out feature, the progression of the master timing circuit to control the perforation of the 3:00 a.m. end-of-tape patterns on the tapes of the next recorders in succession is blocked. The steadily lighted MTE or MTO and RCDR_ or R_ lamps not accompanied by other lighted lamps at the trouble recorder indicate this condition.

End-of-Tape Failure to Start

1.19 If a master timing circuit fails to start the perforation of the 3:00 a.m. end-of-tape patterns, the major alarm will sound, the master

timing circuit will be automatically made busy, and the ETFE and CMBE (or ETFO and CMBO) lamps and aisle pilot lamp will light at the master timing frame for the master timing circuit in trouble. The control of perforation for the 3:00 a.m. end-of-tape patterns on the tapes of the recorders normally served by the master timing circuit in trouble is transferred when this circuit is made busy; therefore, the master timing circuit not in trouble will control the perforation of the end-of-tape recordings on the tapes of all recorders. In this case, the recorders will be selected in succession starting at the highest odd-numbered recorder to the lowest odd-numbered recorder, the emergency recorder, and then the highest even-numbered recorder to the lowest even-numbered recorder.

Fuse Alarm

1.20 If a 48-volt fuse or a 130-volt fuse associated with either master timing circuit is operated, the major alarm will sound and the master timing circuit will be automatically made busy under control of the AR (alarm release) key on the master timing frame. The FA or 20A lamp will light at the fuse panel on the OGT jack bay or miscellaneous relay rack and the CMBE or CMBO lamps will light at the master timing frame and the trouble recorder frame. When the operated fuse is removed, the ALE or ALO, or FGE or FGO lamp will light at the master timing frame to serve as a guard lamp indicating that the make-busy condition has not been released after replacement of an operated fuse.

Double Make-Busy Condition

1.21 If both master timing circuit make-busy keys are operated at the same time, the major alarm will sound, the CMBE, CMBO, and aisle pilot lamps will light at the master timing frame, and the CMBE and CMBO lamps will light at trouble recorder frame. The same alarm conditions will occur if one of the master timing circuits is automatically made busy because of a trouble condition such as a grounded perforator lead, and an attempt is made to make the other master timing circuit busy by the operation of its make-busy key.

Crossed or Grounded Perforator Leads

1.22 If false battery or ground on any of the perforator leads to the recorders, or false ground on any of the perforator leads within the master timing circuit is detected by the standing test feature in the master timing circuit, the master timing circuit seizes the trouble recorder to take a trouble record.

1.23 After the trouble record is taken, or a lost record indication is registered, the master timing circuit is automatically made busy under control of the AR key at the master timing frame. The CMBE or CMBO lamps will light at the master timing frame and trouble recorder frame.

Paper Take-Up Alarm

1.24 If the paper tape in an AMA perforator cabinet fails to be taken up properly on the storage reel, the major alarm will sound and the PTU_ and aisle pilot lamps will light at the master test frame. This alarm condition cannot be retired until the trouble in the perforator cabinet has been corrected.

Silencing and Restoring Alarms

1.25 The audible portion of timer synchronism, selector synchronism, and pulse failure alarms may be silenced by momentarily operating the ACO (alarm cutoff) key at the master timing frame.

1.26 Timer synchronism, selector synchronism, and pulse failure alarms may be restored by momentarily operating the AR key at the master timing frame. The controller portion of a master timing circuit that has been automatically made busy because of a time-out, fuse alarm, or perforator lead standing test alarm may also be restored by momentarily operating the AR key.

1.27 Where the office is equipped with the paper jam detector feature and the PJD (paper

jam detector) counter is provided, the following caution must be complied with.

CAUTION: When performing maintenance on the perforator and the slack take-up arm is stored in its holder, after 100 counts of the paper jam counter:

- (1) **A major alarm will sound**
- (2) **The NP lamp at the recorder frame associated with the perforator lights**
- (3) **The recorder will be made service busy.**

In order to prevent the above, monitor the PJD counter, when the count nears 100, release the take-up arm from its holder which allows the paper take-up motor to operate, in turn resetting the PJD counter to 0.

2. APPARATUS

2.01 The apparatus required for each type of alarm is shown in Table A. The details of items indicated by the number in parentheses are covered in the following paragraphs.

2.02 KS-16751 L1 dry reed reader (used to check synchronous of TE and TO motor timers).

2.03 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one 607A tool, and one 419A tool (for use in establishing test connections to nonwire-spring-relay winding terminals from apparatus side of frame).

2.04 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one 624A tool, and one 419A tool (for use in establishing test connections to wire-spring-relay winding terminals from apparatus side of frame.)

TABLE A

APPARATUS	ALARM PROCEDURE					
	A	B	C	D	E	H
322A (Make-busy) Plugs	✓	✓	✓	✓	✓	—
KS-3008 Stopwatch or equivalent	—	1	1	1	—	—
32A (Remote Control) Test Set	—	—	—	—	1	—
Red China Marking Pencil	—	—	—	—	1	—
KS-14343 Tape Reader	—	—	—	—	1	—
KS-16751 L1 Dry Reed Reader (2.02)	1	—	—	—	—	—
Cord (2.03)	2	—	—	—	—	—
Cord (2.04)	2	—	—	—	—	—

3. METHOD

3.01 A Through D Alarms—Common

Procedure: If, in response to a major alarm, lighted TSF, SSF, or PF lamps are found at the master timing frame, momentarily operate the ACO key to silence the audible alarm. Then proceed as indicated in Table B. If the alarm occurs again in the course of clearing the trouble, momentarily operate the ACO key.

TABLE B

LAMP INDICATIONS AND ASSOCIATED PROCEDURES

LAMPS LIGHTED	PROCEED AS IN PARAGRAPH
TSF only	3.02 or 3.03
SSF only	3.87
PF only	3.148
TSF and SSF or TSF, SSF and PF or TSF and PF	3.171

A. Timer Synchronism Failure Alarm

3.02 If the TSF lamp only is lighted, the TE and TO timers are out of synchronism with each other by one second or less. To determine which timer caused the alarm, compare the position of the U selector of the even master timing circuit as shown on its indicator wheel with the position of the U selector of the odd master timing circuit. The U selector that is lagging indicates the corresponding odd or even timer at fault. If both U selectors are at the same numbered positions, observe carefully which U selector steps last. Then determine whether the TT (timer transfer) key is in the E (even) or O (odd) position and proceed as indicated in Table C.

TABLE C

**TIMER SYNCHRONISM
FAILURE PROCEDURE**

TIMER AT FAULT	POSITION OF TT KEY	PROCEED AS IN PARAGRAPHS
TE	E	3.03 through 3.14 or in case of repeat trouble, 3.15 through 3.32
TO	E	3.33 through 3.44
TE	O	3.45 through 3.56
TO	O	3.57 through 3.68 or in case of repeat trouble, 3.69 through 3.86

TE Timer at Fault—TT Key in E Position

3.03 If this is the first response to trouble on the TE timer after a comparatively long period of satisfactory operation, and timer is not out of synchronism by more than twelve seconds, proceed as in 3.04 through 3.14. However, if the trouble persists, or the alarm is due to a repeat trouble, indicating inability of the TE timer to remain in synchronism with the TO timer, proceed as in 3.15 through 3.32.

TE Timer—Initial Failure

3.04 Using a 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PE relay and the 419A tool to any lamp of the KS-16751 L1 dry reed reader. Using another 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PO relay and the 419A tool to any other lamp of the dry reed reader to 48V battery (refer to 2.02 through 2.04). Observe that the dry reed reader lamps are not lighted in unison.

3.05 Operate the CMBO (controller make-busy odd) and CKL (check lamp) keys.

3.06 Operate the MSO (master timing circuit start or stop—odd) key to the STP (stop) position, thereby stopping the TO timer.

3.07 Grasp the hub of the TO timer and manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.

3.08 At any time except when the U8 or U9 lamp is lighted, operate the MSO key to the ST (start) position. Within one minute the TO timer will start. Then operate the MSO key to the R (run) position. Observe that the dry reed reader lamps are lighted in unison or the synchronous lamps are lighted, if provided.

3.09 Momentarily operate the S (synchronize) key. The SE (synchronize to even) lamp will be lighted while the odd master timing circuit selectors are stepping to the synchronized position.

3.10 Restore the CMBO key.

3.11 Momentarily operate the AR key. The TSF lamp will be extinguished.

3.12 Restore the CKL key.

3.13 Remove cords connecting KS-16751 L1 dry reed reader to PO and PE relays.

3.14 Disconnect cord of KS-16751 L1 dry reed reader from 48V battery.

TE Timer—Repeat Failure

3.15 Operate the TT key to the O position and operate the CKL key. If the OS_ (out of synchronism) lamp associated with all recorders is lighted, continue as follows, otherwise proceed to 3.21.

3.16 If there is a make-busy plug in any recorder TN jack at the trouble recorder frame, at the master timing frame momentarily operate the S key to synchronize the selectors of the transferred recorder. The SO (synchronize to odd) lamp will be lighted while the recorder selectors are stepping to the synchronized position, followed by the extinguishing of the transferred recorder OS_ lamp. Determine whether it is satisfactory to transfer from the emergency recorder to the regular recorder and, if so, remove the plug from the recorder TN jack to make the emergency recorder available.

3.17 Whether the emergency recorder has been made available or not, it is necessary to synchronize its selectors and place the required record on the tape. To do this, insert a make-busy plug into the emergency recorder MB jack, then momentarily operate the S key. The SO lamp will be lighted while the emergency recorder selectors are stepping to the synchronized position, followed by the extinguishing of the emergency recorder OS_ lamp.

3.18 Remove the plug from the emergency recorder MB jack.

3.19 If the emergency recorder is available, insert a make-busy plug into the recorder TN jack of one of the regular recorders which has an OS_ lamp lighted. If the emergency recorder is not available, insert a make-busy plug into the recorder MB jack. Momentarily operate the S key to synchronize the recorder selectors. Then remove the plug from the recorder TN or MB jack.

3.20 Proceed as in 3.19 for each of the other recorders having lighted OS_ lamps, to synchronize their selectors.

3.21 Using a 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PE relay and the 419A tool to any lamp of the KS-16751 L1 dry reed reader. Using another 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PO relay and the 419A tool to any other lamp of the dry reed reader. Connect the cord of the dry reed reader to 48V battery (refer to 2.02 through 2.04). Observe that the dry reed reader lamps are not lighted in unison.

3.22 Operate the CMBE (controller make-busy even) key.

3.23 Operate the MSE (master timing circuit start or stop—even) key to the STP position, thereby stopping the TE timer.

3.24 Check the TE timer as covered in the sections on Timers - Requirements and Adjusting Procedures.

3.25 Grasp the hub of the TE timer and manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.

3.26 At any time except when the U8 or U9 lamp is lighted, operate the MSE key to the ST position. Within one minute, the TE timer will start. Then operate the MSE key to the R position. Observe that the dry reed reader lamps are lighted in unison.

3.27 Momentarily operate the S key. The SO lamp will be lighted while the even master timing circuit selectors are stepping to the synchronized position.

Note: In offices arranged for 6-second timing features, more than one attempt at synchronizing the timer motors may be necessary due to the critical settings of the CH cam.

3.28 Restore the CMBE key.

3.29 Momentarily operate the AR key. The TSF lamp will be extinguished.

3.30 Restore the CKL key.

Note: Do not operate the TT key to the E position, but continue to use the odd master timing circuit to furnish time pulses to the recorders until it is reasonably certain that the TE timer will remain in synchronism with the TO timer.

- 3.31 Remove cords connecting KS-16751 L1 dry reed reader to PO and PE relays.
- 3.32 Disconnect cord of KS-16751 L1 dry reed reader from 48V battery.

TO Timer at Fault—TT Key in E Position

- 3.33 Using a 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PE relay and the 419A tool to any lamp of the KS-16751 L1 dry reed reader. Using another 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PO relay of the dry reed reader. Connect the cord of the dry reed reader to 48V battery (refer to 2.02 through 2.04). Observe that the dry reed reader lamps are not lighted in unison.
- 3.34 Operate the CMBO and CKL keys.
- 3.35 Operate the MSO key to the STP position, thereby stopping the TO timer.
- 3.36 Check the TO timer as covered in the sections on Timers - Requirements and Adjusting Procedures.
- 3.37 Grasp the hub of the TO timer and manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.
- 3.38 At any time except when the U8 or U9 lamp is lighted, operate the MSO key to the ST position. Within one minute the TO timer will start. Then operate the MSO key to the R position. Observe that the dry reed reader lamps are lighted in unison.
- 3.39 Momentarily operate the S key. The SE lamp will be lighted while the odd master timing circuit selectors are stepping to the synchronized position.

Note: In offices arranged for 6-second timing features, more than one attempt at synchronizing the timer motors may be necessary due to the critical settings of the CH cam.

- 3.40 Restore the CMBO key.
- 3.41 Momentarily operate the AR key. The TSF lamp will be extinguished.
- 3.42 Restore the CKL key.

Note: Do not operate the TT key to the O position, but continue to use the even master timing circuit to furnish time pulses to the recorders until it is reasonably certain that the TO timer will remain in synchronism with the TE timer.

- 3.43 Remove cords connecting KS-16751 L1 dry reed reader to AO and PE relays.
- 3.44 Disconnect cord of KS-16751 L1 dry reed reader from 48V battery.

TE Timer at Fault—TT Key in O Position

- 3.45 Using a 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PE relay and the 419A tool to any lamp of the KS-16751 L1 dry reed reader. Using another 1W13B cord connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PO relay and the 419A tool to any other lamp of the dry reed reader. Connect the cord of the dry reed reader to 48V battery (refer to 2.02 through 2.04). Observe that the dry reed reader lamps are not lighted in unison.
- 3.46 Operate the CMBE and CKL keys.
- 3.47 Operate the MSE key to the STP position, thereby stopping the TE timer.
- 3.48 Check the TE timer as covered in the sections on Timers - Requirements and Adjusting Procedures.
- 3.49 Grasp the hub of the TE timer and manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.

3.50 At any time except when the U8 or U9 lamp is lighted, operate the MSE key to the ST position. Within one minute the TE timer will start. Then operate the MSE key to the R position. Observe that the dry reed reader lamps are lighted in unison.

3.51 Momentarily operate the S key. The SO lamp will be lighted while the even master timing circuit selectors are stepping to the synchronized position.

3.52 Restore the CMBE key.

3.53 Momentarily operate the AR key. The TSF lamp will be extinguished.

3.54 Restore the CKL key.

Note: Do not operate the TT key to the E position, but continue to use the odd master timing circuit to furnish time pulses to the recorders until it is reasonably certain that the TE timer will remain in synchronism with the TO timer.

3.55 Remove cords connecting KS-16751 L1 dry reed reader to PO and PE relays.

3.56 Disconnect cord of KS-16751 L1 dry reed reader from 48V battery.

TO Timer at Fault—TT Key in O Position

3.57 If this is the first response to trouble on the TO timer after a comparatively long period of satisfactory operation, proceed as in 3.58 through 3.68. However, if the trouble persists, or the alarm is due to a repeat trouble indicating inability of the TO timer to remain in synchronism with the TE timer, proceed as in 3.69 through 3.86.

3.58 Using a 1W13B cord, connect the 607A tool or 624A tool, as required to the upper winding terminal of the PE relay and the 419A tool to any lamp of the KS-16751 L1 dry reed reader. Using another 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PO relay and the 419A tool to any other lamp of the dry reed reader. Connect the cord of the dry reed reader to 48V battery (refer to 2.02 through 2.04). Observe that the dry reed reader lamps are not lighted in unison.

3.59 Operate the CMBE and CKL keys.

3.60 Operate the MSE key to the STP position, thereby stopping the TE timer.

3.61 Grasp the hub of the TE timer and manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.

3.62 At any time except when the U8 or U9 lamp is lighted, operate the MSE key to the ST position. Within one minute the TE timer will start. Then operate the MSE key to the R position. Observe that the dry reed reader lamps are lighted in unison.

3.63 Momentarily operate the S key. The SO lamp will be lighted while the even master timing circuit selectors are stepping to the synchronized position.

Note: In offices arranged for 6-second timing features, more than one attempt at synchronizing the timer motors may be necessary due to the critical settings of the CH cam.

3.64 Restore the CMBE key.

3.65 Momentarily operate the AR key. The TSF lamp will be extinguished.

3.66 Restore the CKL key.

3.67 Remove cords connecting KS-16751 L1 dry reed reader to PO and PE relays.

3.68 Disconnect cord of KS-16751 L1 dry reed reader from 48V battery.

TO Timer—Repeat Failure

3.69 Operate the TT key to the E position and operate the CKL key. If this OS₁ lamps associated with all recorders are lighted, continue as follows otherwise proceed to 3.75.

3.70 If there is a make-busy plug in any recorder TN jack at the trouble recorder frame, at the master timing frame, momentarily operate the S key to synchronize the selectors of the transferred recorder. The SE lamp will be lighted while the recorder selectors are stepping to the synchronized

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position, followed by the extinguishing of the transferred recorder OS₁ lamp. Determine whether it is satisfactory to transfer from the emergency recorder to the regular recorder and, if so, remove the plug from the recorder TN jack to make the emergency recorder available.

3.71 Whether the emergency recorder has been made available or not, it is necessary to synchronize its selectors and place the required record on the tape. To do this, insert a make-busy plug into the emergency recorder MB jack, then momentarily operate the S key at the master timing frame. The SE lamp will be lighted while the emergency recorder selectors are stepping to the synchronized position, followed by the extinguishing of the emergency recorder OS₁ lamp.

3.72 Remove the plug from the emergency recorder MB jack.

3.73 If the emergency recorder is available, insert a make-busy plug into the TN jack of one of the regular recorders which has an OS₁ lamp lighted. If the emergency recorder is not available, insert a make-busy plug into the recorder MB jack. Momentarily operate the S key to synchronize the recorder selectors. Then remove the plug from the recorder TN or MB jack.

3.74 Proceed as in 3.73 for each of the other recorders having lighted OS₁ lamps, to synchronize their selectors.

3.75 Using a 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PE relay and the 419A tool to any lamp of the KS-16751 L1 dry reed reader. Using another 1W13B cord, connect the 607A tool or 624A tool, as required, to the upper winding terminal of the PO relay and the 419A tool to any other lamp of the dry reed reader. Connect the cord of the dry reed reader to 48V battery (refer to 2.02 through 2.04). Observe that the dry reed reader lamps are not lighted in unison.

3.76 Operate the CMBO key.

3.77 Operate the MSO key to the STP position, thereby stopping the TO timer.

3.78 Check the TO timer as covered in the sections on Timers - Requirements and Adjusting Procedures.

3.79 Grasp the hub of the TO timer and manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.

3.80 At any time except when the U8 or U9 lamp is lighted, operate the MSO key to the ST position. Within one minute the TO timer will start. Then operate the MSO key to the R position. Observe that the dry reed reader lamps are lighted in unison.

3.81 Momentarily operate the S key. The SE lamp will be lighted while the odd master timing circuit selectors are stepping to the synchronized position.

Note: In offices arranged for 6-second timing features, more than one attempt at synchronizing the timer motors may be necessary due to the critical settings of the CH cam.

3.82 Restore the CMBO key.

3.83 Momentarily operate the AR key. The TSF lamp will be extinguished.

3.84 Restore the CKL key.

Note: Do not operate the TT key to the O position, but continue to use the even master timing circuit to furnish time pulses to the recorders until it is reasonably certain that the TO timer will remain in synchronism with the TE timer.

3.85 Remove cords connecting KS-16751 L1 dry reed reader to PO and PE relays.

3.86 Disconnect cord of KS-16751 L1 dry reed reader from 48V battery.

B. Selector Synchronism Failure Alarm

3.87 If the SSF lamp only is lighted, one or more recorder or master timing circuit selectors are out of synchronism with the controlling master timing circuit selectors. Momentarily operate the ACO key to silence the audible alarm. Operate the CKL key and observe which OS₁ lamps are lighted. Then proceed as indicated in Table D.

TABLE D
SELECTOR SYNCHRONISM
FAILURE PROCEDURE

LIGHTED OS LAMPS ASSOCIATED WITH				PROCEED AS IN PARAGRAPHS
ONE RECORDER	ALL RECORDERS	ODD MASTER TIMING CIRCUIT	EVEN MASTER TIMING CIRCUIT	
✓				3.88 through 3.94
	✓			3.95 through 3.99
		✓		3.100 through 3.116
			✓	3.117 through 3.133
	✓	✓		3.134 through 3.140
	✓		✓	3.141 through 3.147

One Recorder OS_ Lamp Lighted

3.88 If a single recorder OS_ lamp is lighted, one or more selectors associated with the recorder are out of synchronism with the controlling master timing circuit selectors. The trouble may be in the pulsing path from the master timing circuit to the recorder or may be due to selector adjustment.

3.89 If there is a make-busy plug in any recorder TN jack at the trouble recorder frame, determine whether it is satisfactory to transfer the associated trunks to the regular recorder and, if so, remove this plug from the recorder TN jack to make the emergency recorder available. When the emergency recorder is available, insert a make-busy plug into the recorder TN jack of the recorder associated with the lighted OS_ lamp. If the emergency recorder is not or cannot be made available, insert the make-busy plug into the MB jack of the recorder. If the emergency recorder

selectors are out of synchronism, insert the plug into the emergency recorder MB jack.

3.90 Momentarily operate the S key. The SE or SO lamp will be lighted while the recorder selectors are stepping to the synchronized position. The OS_ lamp associated with the recorder will be extinguished when the selectors are in synchronism.

3.91 If the recorder selectors fail to synchronize, the trouble is probably due to an improper adjustment of the recorder selector. After clearing the trouble, momentarily operate the S key.

3.92 Momentarily operate the AR key. The SSF lamp will be extinguished.

3.93 Restore the CKL key.

3.94 Wait until reasonably certain that the recorder selectors will remain synchronized. Then restore the recorder to service by removing the

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plug from the associated recorder TN, or MB jack at the trouble recorder frame.

Note: Since an out of synchronism condition for a recorder will not be indicated by the selector synchronism failure alarm while the recorder is made busy or transferred, a lighted OS_ lamp for the recorder made busy or transferred is the only indication that the recorder selectors are out of synchronism.

All Recorder OS_ Lamps Lighted

3.95 If all recorder OS_ lamps are lighted, the pulsing relays of the controlling master timing circuit are probably at fault.

3.96 Operate the TT key to its opposite position.

3.97 Transfer or make-busy, synchronize and restore to service one of the recorders whose OS_ lamp is lighted as follows. If the TT key is now in the O position, proceed as in 3.16 through 3.20, or if the TT key is now in the E position, proceed as in 3.70 through 3.74.

3.98 Momentarily operate the AR key to extinguish the SSF lamp.

3.99 Restore the CKL key.

OSO Lamp Lighted

3.100 If the OSO lamp only is lighted, one or more odd or even master timing circuit selectors are out of synchronism.

3.101 Compare the check lamp indications when the CLT (check lamp transfer) key is released and when it is operated. Repeat the CLT key operations several times if necessary to determine the selectors that are not in synchronism.

3.102 If any of the M, DT, DU, HT, or HU selectors are not in synchronism, compare the month, day, or hour lamp indications with the actual month, day, or hour to determine the selector or selectors at fault, bearing in mind that the month selector does not advance until after completion of the 3:00 a.m. end-of-tape entries following midnight of the last day of the month.

3.103 If the H, T, or U selectors of the master timing circuits are out of synchronism,

compare the time indication in minutes on the check lamps with the actual precise correct time as in 3.104 and 3.105.

3.104 Check the precise time source per local procedures. Use the KS-3008 stopwatch and start the watch precisely at the beginning of any minute and record the time.

3.105 At the master timing frame, operate the CKL key and when the U_ check lamp has just extinguished, stop timing and record the time indicated by the H_, T_, U_ or H_, T_, ST_, U_ check lamps. Check that the sum of the elapsed time on the stopwatch agrees within 12 seconds (± 0.2 minute) of the time displayed on the H_, T_, U_ or H_, T_, ST_, U_ check lamps at the instant the watch was stopped. If the time indication is incorrect by more than 12 seconds, reset the master timer as in 3.106.

3.106 If any of the odd master timing circuit selectors are at fault, proceed as in 3.107 and 3.108 or if any of the even master timing circuit selectors are at fault, proceed as in 3.109 through 3.116.

Odd Master Timing Selectors at Fault

3.107 Operate the CMBO key.

3.108 After the trouble has been cleared, momentarily operate the S key. The SE lamp will be lighted while the odd master timing circuit selectors are stepping to the synchronized position. The OSO lamp will be extinguished when the selectors are synchronized. Restore the CKL and CMBO keys. Momentarily operate the AR key to extinguish the SSF lamp.

Even Master Timing Selectors at Fault

3.109 Operate the TT key to the 0 position and operate the CMBE key. Observe that the OSO lamp is extinguished and the OSE lamp is lighted. The OS_ lamps associated with all recorders should light after the transfer to the ODD master timer.

3.110 Momentarily operate the S key to synchronize the selectors of the even master timing circuit. The SO lamp will be lighted while the selectors and counters are stepping to the synchronized

positions. The OSE lamp will be extinguished when the selectors are synchronized.

3.111 If the selectors and counters of the even master timing circuit fail to step to the synchronized positions, or fail to step with the time pulses, clear the trouble and again momentarily operate the S key to synchronize these selectors and counters.

3.112 Insert a make-busy plug into the MB jack of the emergency recorder. Observe the MTE or MTO lamps which light when the make-busy pattern is applied on a recorder tape. When these lamps remain extinguished, the make-busy pattern has been applied on the recorder tape.

3.113 Operate the S key to synchronize the recorder and master timing circuit.

3.114 Remove make-busy plug from MB jack of recorder.

3.115 Repeat 3.112 through 3.114 for each regular recorder until all recorders are in the synchronized position with respect to the master timing circuit.

Note: If a trouble is encountered on a regular recorder while it is being synchronized, transfer that recorder to the emergency recorder and clear the trouble. After the trouble has been cleared, transfer the regular recorder back into service.

3.116 Restore the CKL and CMBE keys. Momentarily operate the AR key to extinguish the SSF lamp.

Note: Do not operate the TT key to the E position until it is reasonably certain that the selectors of the even master timing circuit will remain in synchronism.

OSE Lamp Lighted

3.117 If the OSE lamp only is lighted, one or more even or odd master timing circuit selectors are out of synchronism.

3.118 Compare the check lamp indications when the CLT key is released and when it is operated. Repeat the CLT key operations several

times if necessary to determine the selectors that are not in synchronism.

3.119 If any of the M, DT, DU, HT, or HU selectors are not in synchronism, compare the month, day, or hour lamp indications with the actual month, day, or hour to determine the selector or selectors at fault, bearing in mind that the month selector does not advance until after completion of the 3:00 a.m. end-of-tape entries following midnight of the last day of the month.

3.120 If the H, T, or U, selectors of the master timing circuits are out of synchronism, compare the time indication in minutes on the check lamps with the actual precise time as in 3.126 and 3.127.

3.121 Check the precise time source per local procedures. Use the KS-3008 stopwatch and start the watch precisely at the beginning of any minute and record the time.

3.122 At the master timing frame, operate the CKL key and when the U_ check lamp has just extinguished, stop timing and record the time indicated by the H_, T_, U_ check lamps. Check that the sum of the elapsed time on the stopwatch agrees within 12 seconds (± 0.2 minute) of the time displayed on the H_, T_, U_ check lamps at the instant the watch has stopped. If the time indication is incorrect by more than 12 seconds, reset the master timer as described in the section titled "MASTER TIMING CIRCUIT - METHOD OF HANDLING ALARMS" under "PULSE FAILURE ALARM".

3.123 If any of the even master timing circuit selectors are at fault, proceed as in 3.124 and 3.125 or if any of the odd master timing circuit selectors are at fault, proceed as in 3.126 through 3.141.

Even Master Timing Selectors at Fault

3.124 Operate the CMBE key.

3.125 After the trouble has been cleared, momentarily operate the S key. The SO lamp will be lighted while the even master timing circuit selectors are stepping to the synchronized position. The OSE lamp will be extinguished when the selectors are synchronized. Restore the CKL and CMBE

keys. Momentarily operate the AR key to extinguish the SSF lamp.

Odd Master Timing Selectors at Fault

3.126 Operate the TT key to the E position and operate the CMBO key. Observe that the OSE lamp is extinguished and the OSO lamp is lighted. The OS_ lamps associated with all recorders should light after the transfer to the even master timer.

3.127 Momentarily operate the S key to synchronize the selectors and counters of the even master timing circuit. The SE lamp will be lighted while the selectors and counters are stepping to the synchronized positions. The OSO lamp will be extinguished when the selectors are synchronized.

3.128 If the selectors and counters of the odd master timing circuit fail to step to the synchronized positions, or fail to step with the time pulses, clear the trouble and again momentarily operate the S key to synchronize these selectors and counters.

3.129 Insert make-busy plug into the MB jack of the emergency recorder. Observe the MTE or MTO lamps which light each time a make-busy pattern is applied on a recorder tape. When the lamp remains extinguished, the make-busy pattern has been applied on the recorder.

3.130 Operate the S key to synchronize the recorder and master timing circuit.

3.131 Remove make-busy plug from MB jack of recorder.

3.132 Repeat 3.129 through 3.131 for each recorder until all recorders are in the synchronized position with respect to the master timing circuit.

Note: If a trouble is encountered on a regular recorder while it is being synchronized, transfer that recorder to the emergency recorder and clear the trouble. After the trouble has been cleared, transfer the regular recorder back into service.

3.133 Restore the CKL and CMBO keys. Momentarily operate the AR key to extinguish the SSF lamp.

Note: Do not operate the TT key to the O position until it is reasonably certain that the selectors of the odd master timing circuit will remain in synchronism.

OSO Lamp and All Recorder OS_ Lamps Lighted

3.134 If the OSO lamp and all recorder OS_ lamps are lighted; one or more of the even master timing circuit H, T, or U selectors are out of synchronism, due to improper adjustment of a selector or trouble in the pulsing path.

3.135 Operate the TT key to the 0 position. Observe that the OSO lamp and all recorder OS_ lamps are extinguished and the OSE lamp is lighted.

3.136 Compare the check lamp indications when the CLT key is released and when it is operated. Repeat the CLT key operations several times if necessary to determine the selectors that are not in synchronism.

3.137 Operate the CMBE key.

3.138 After clearing the trouble, momentarily operate the S key. The SO lamp will be lighted while the even master timing circuit selectors are stepping to synchronized positions. The OSE lamp will be extinguished when the selectors are synchronized.

3.139 Momentarily operate the AR key to extinguish the SSF lamp.

3.140 Restore the CMBE and CKL keys.

OSE Lamp and All Recorder OS_ Lamps Lighted

3.141 If the OSE lamp and all recorder OS_ lamps are lighted, one or more of the odd master timing circuit H, T, or U selectors are out of synchronism, due to improper adjustment of a selector or trouble in the pulsing path.

3.142 Operate the TT key to the E position. Observe that the OSE lamp and all recorder OS_ lamps are extinguished and the OSO lamp is lighted.

3.143 Compare the check lamp indications when the CLT key is released and when it is operated. Repeat the CLT key operations several

times if necessary to determine the selectors that are not in synchronism.

3.144 Operate the CMBO key.

3.145 After clearing the trouble, momentarily operate the S key. The SE lamp will be lighted while the odd master timing circuit selectors are stepping to synchronized positions. The OSO lamp will be extinguished when the selectors are synchronized.

3.146 Momentarily operate the AR key to extinguish the SSF lamp.

3.147 Restore the CMBO and CKL keys.

C. Pulse Failure Alarm

3.148 If the PF lamp only is lighted, it is probably due to the failure of the 22-volt, 60-Hz power supply to the TE and TO timers for a period of more than 6 seconds. After clearing the trouble, momentarily operate the AR key to extinguish the PF lamp. Check the time indication as in 3.149 through 3.153.

Checking for Correct Time Indication

3.149 At the master timing frame, operate the CKL key and check that the month, day, and hour are correctly indicated by the lighted M_, DT_, DU_, HT_, and HU_ check lamps.

Note: The M selector is arranged to advance after completion of the 3:00 a.m. end-of-tape entries. Therefore, when checking the positions of these selectors between midnight and 3:00 a.m., their correct positions are the same as for the previous day.

3.150 To check the H, T, and U selectors of the master timing circuit in control in comparison with the actual precise correct time, proceed as outlined in 3.151 and 3.153.

3.151 Check the precise time source per local procedures. Use the KS-3008 stopwatch and start the watch precisely at the beginning of any minute and record the time.

3.152 At the master timing frame, operate the CKL key and when the U_ check lamp has just extinguished, stop timing and record the time

indicated by the H_, T_, U_ check lamps. Check that the sum of the elapsed time on the stopwatch agrees within 12 seconds (± 0.2 minute) of the time displayed on the H_, T_, U_ check lamps at the instant the watch was stopped.

3.153 If the time is correctly indicated within ± 0.2 minute (12 seconds), operate the AR key to extinguish the PF lamp and then restore the CKL key. If the time indicated is incorrect by more than 0.2 minute (12 seconds), reset the selectors as in 3.154 through 3.170.

Setting Selectors to the Correct Time

3.154 Operate the CKL key and momentarily operate the CLT key to observe which selectors require resetting. If the TT key is in the E position, reset the selectors associated with the odd master timing circuit. If the TT key is in the O position, reset the selectors associated with the even master timing circuit. After resetting any of the selectors, the OSE or OSO and SSF lamps will light. Momentarily operate the ACO key to silence the audible alarm.

3.155 Proceed as in 3.156 through 3.170.

3.156 Observe the lighted U_ check lamp with the CLT key operated. If the time is incorrectly indicated by more than 0.1 minute (6 seconds), step the U selector by manually operating and releasing the UH relay until the lighted U_ check lamp indicates the correct time to the nearest 0.1 minute.

3.157 Observe the lighted H_ and T_ check lamps with the CLT key operated. If these lamps do not correctly indicate the minutes tens and minutes units, step the T or H selector by manually operating and releasing the TH or HH relay until the lighted H_ and T_ check lamps indicate the correct time in minutes.

3.158 Observe the lighted HT_ and HU_ check lamps with the CLT key operated. If these lamps do not correctly indicate the hour tens and the hour units, step the HU or HT selector by manually operating and releasing the HUH or HTH relay until the lighted HT_ and HU_ check lamps indicate the correct hour.

3.159 Observe the lighted M_ check lamp with the CLT key operated. If this lamp does

not correctly indicate the month, step the M selector by manually operating and releasing the MOH relay until the lighted M_ check lamp indicates the correct month.

3.160 Observe the lighted DT_ and DU_ check lamps with the CLT key operated. If these lamps do not correctly indicate the day tens and day units, step the DU or DT selector by manually operating and releasing the DH or DTH relay until the selector is in the proper position for the day as specified in Table E.

TABLE E

SETTING OF DAY SELECTORS

DAY	POSITION OF DT SELECTOR	POSITION OF DU SELECTOR
01	1	1
02	1	2
03	1	3
04	1	4
05	1	5
06	1	6
07	1	7
08	1	8
09	1	9
10	2	10
11	2	11
12	2	12
13	2	13
14	2	14
15	2	15
16	2	16
17	2	17
18	2	18
19	2	19
20	3	20
21	3	1
22	3	2
23	3	3
24	3	4
25	3	5
26	3	6
27	3	7
28	3	8
29	3	9
30	4	10
31	4	11

3.161 After making a final recheck for correct check lamp time indications with the CLT key operated, release the CLT key.

3.162 At the check lamps, check the time in minutes. If the time is between 00:0 and 50:0 minutes, block nonoperated for 7 or 8 seconds the UH relay of the master timing circuit in control, or if the time is between 50:0 and 00:0 minutes, wait until 00:1 is indicated and then block nonoperated for 7 or 8 seconds the UH relay of the master timing circuit in control. This causes the selectors of the controlling master timing circuit to lag one or two 6-second steps, thereby causing the selectors of all recorders to be out of synchronism with the selectors of the controlling master timing circuit and lighting the OSE or OSO lamp, the OS_ lamps for all recorders, and the SSF lamp.

Note: The position of the TT key (E or O) indicates the master timing circuit in control.

3.163 Insert a make-busy plug into the MB jack of the emergency recorder. Observe the MTE and MTO lamps which light when the make-busy pattern is applied on the recorder tape. When these lamps remain extinguished, the make-busy pattern has been applied on the recorder tape.

3.164 Operate the TT key to the opposite position.

3.165 If the TT key is now in the O position, operate the CMBE key or, if the TT key is now in the E position, operate the CMBO key.

3.166 Momentarily operate the S key to synchronize the selectors of the emergency recorder and the selectors of the master timing circuit that is not in control. The SO or SE lamps will be lighted while the selectors are stepping to the synchronized positions. The OSE or OSO and emergency recorder OS lamps will be extinguished when the selectors are synchronized.

3.167 Remove the make-busy plug from the MB jack of the emergency recorder and insert it into the TN or MB jack of a regular recorder. Operate the S key to synchronize the selectors of the master timer with the selectors of the recorder. Repeat this operation for each recorder until all recorder selectors are in synchronism with the master timing circuits.

- 3.168 Restore the CMBE or CMBO key and remove the make-busy plug from the MB or TN jack of last recorder synchronized.
- 3.169 Momentarily operate the AR key to extinguish the SSF lamp.
- 3.170 Restore the CKL key.

D. Combination of Timer Synchronism Failure, Selector Synchronism Failure, and Pulse Failure Alarms

- 3.171 If the TSF and SSF or the TSF, SSF, and PF, or the TSF and PF lamps are lighted in one of these combinations, proceed as indicated in Table F on the line that corresponds to the timer conditions and position of the TT key.

TABLE F

PROCEDURE FOR COMBINATIONS OF SYNCHRONISM AND PULSE FAILURE ALARMS

TIMER CONDITION	POSITION OF TTY KEY	PROCEED AS IN PARAGRAPHS
TE stopped	E	3.172 through 3.183
TO stopped	E	3.184 and 3.185
TE stopped	O	3.186 and 3.187
TO stopped	O	3.188 through 3.199
TE and TO stopped	E or O	3.200 through 3.203
TE and TO running	E or O	3.204 through 3.206

TE Timer Stopped—TT Key in E Position

3.172 If the TE timer only is stopped, the trouble is probably due to failure of the 22-volt, 60-Hz supply for this timer or to mechanical difficulty in the timer itself. With the TT key in the E position, the selectors of all recorders will be stopped because of the absence of time pulses from the even master timing circuit and it is necessary to reset the selectors of all recorders. However, before resetting the recorder selectors, it is necessary to place a make-busy pattern containing a nonsynchronous entry on the tapes of all recorders.

3.173 At the master timing frame, operate the CKL key. Operate the CLT key and hold it operated while checking that the month, day, and hour are correctly indicated by the lighted M_, DT_, DU_, HT_, and HU_ check lamps.

Note: The M selector is arranged to advance after completion of the 3:00 a.m. end-of-tape entries. Therefore, when checking the positions of this selector between midnight and 3:00 a.m., the correct position is the same as for the previous day.

3.174 If the H, T, or U selectors of the master timing circuits are out of synchronism, compare the time indication in minutes on the check lamps with the actual precise time as in 3.175 and 3.176.

3.175 Check the precise time source per local procedures. Use the KS-3008 stopwatch and start the watch precisely at the beginning of any minute and record the time.

3.176 At the master timing frame, operate the CKL key and when the U_ check lamp has just extinguished, stop timing and record the time

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indicated by the H_, T_, U_ check lamps. Check that the sum of the elapsed time on the stopwatch agrees within 12 seconds (± 0.2 minute) of the time displayed on the H_, T_, U_ check lamps at the instant the watch was stopped.

3.177 If the time is correctly indicated within ± 0.2 minute (12 seconds), proceed as in 3.178. If the time is incorrect by more than ± 0.2 minutes (12 seconds), reset the selectors as in 3.154 through 3.161 and then proceed as in 3.178.

3.178 Operate the TT key to the O position and observe that all OS_ lamps have lighted.

3.179 Operate the CMBE key.

3.180 Momentarily operate the S key to synchronize the selectors of the master timing circuits. The SO lamp will be lighted while the selectors are stepping to the synchronized positions, then restore the CMBE key.

3.181 Insert make-busy plug into the MB jack for the emergency recorder. Observe the MTE or MTO lamp which lights each time a make-busy pattern is applied on one of the recorder tapes. Wait until the MTE or MTO lamp remains extinguished and then momentarily operate the S key to synchronize the recorder with the master timing circuit. The OS_ lamp will be extinguished when the selectors are synchronized. Remove make-busy plug from recorder MB jack.

3.182 Repeat 3.181 for each remaining regular recorder, by inserting the make-busy plug into the appropriate TN or MB jack.

3.183 If the trouble is due to failure of the 22-volt supply to the TE timer or if the trouble is in the TE timer, clear the trouble and then proceed as in 3.21 through 3.32.

TO Timer Stopped—TT Key in E Position

3.184 If the TO timer is stopped and the TT key is in the E position, the trouble is probably due to failure of the 22-volt, 60-Hz supply for this timer or to mechanical difficulty in the timer.

3.185 If the trouble is due to failure of the 22-volt supply or if trouble is in TO timer, clear the trouble and then proceed as in 3.33 through 3.44.

TE Timer Stopped—TT Key in O Position

3.186 If the TE timer is stopped and the TT key is in the O position, the trouble is probably due to failure of the 22-volt, 60-Hz supply for this timer or to mechanical difficulty in the timer itself.

3.187 If the trouble is due to failure of the 22-volt supply or if the trouble is in the TE timer, clear the trouble and then proceed as in 3.45 through 3.56.

TO Timer Stopped—TT Key in O Position

3.188 If the TO timer only is stopped, the trouble is probably due to failure of the 22-volt, 60-Hz supply for this timer or to mechanical difficulty in the timer itself. With the TT key in the O position, the selectors of all recorders will be stopped because of the absence of time pulses from the odd master timing circuit and it is necessary to reset the selectors of all recorders. However, before resetting the recorder selectors, it is necessary to place a make-busy pattern containing a nonsynchronous entry on the tapes of all recorders.

3.189 At the master timing frame, operate the CKL key. Operate the CLT key and hold it operated while checking that the month, day, and hour are correctly indicated by the lighted M_, DT_, DU_, HT_, and HU_ check lamps.

Note: The M selector is arranged to advance after completion of the 3:00 a.m. end-of-tape entries. Therefore, when checking the positions of this selector between midnight and 3:00 a.m., the correct position is the same as for the previous day.

3.190 Check the time indicated by the H_, T_, and U_ check lamps with the stopwatch as in 3.176.

3.191 Check the precise time source per local procedures. Use the KS-3008 stopwatch and start the watch precisely at the beginning of any minute and record the time.

3.192 At the master timing frame, operate the CKL key and when the U_ check lamp has just extinguished, stop timing and record the time indicated by the H_, T_, U_ check lamps. Check that the sum of the elapsed time on the stopwatch agrees within 12 seconds (± 0.2 minute) of the

time displayed on the H, T, U check lamps at the instant the watch was stopped.

3.193 If the time is correctly indicated within ± 0.2 minute (12 seconds), proceed as in 3.194. If the time is incorrect by more than ± 0.2 minute (12 seconds), reset the selectors as in 3.154 through 3.161 and then proceed as in 3.194.

3.194 Operate the TT key to the E position and observe that all OS lamps have lighted.

3.195 Operate the CMBO key.

3.196 Momentarily operate the S key to synchronize the selectors of the master timing circuits. The SO lamp will be lighted while the selectors are stepping to the synchronized positions, then restore the CMBO key.

3.197 Insert make-busy plug into the MB jack for the emergency recorder. Observe the MTE or MTO lamp which lights each time a make-busy pattern is applied on one of the recorder tapes. Wait until the MTE or MTO lamp remains extinguished and then momentarily operate the S key to synchronize the recorder with the master timing circuit. The OS lamp will be extinguished when the selectors are synchronized. Remove make-busy plug from recorder MB jack.

3.198 Repeat 3.197 for each remaining regular recorder, by inserting a make-busy plug into the appropriate TN or MB jack.

3.199 If the trouble is due to failure of the 22-volt supply to the TO timer or if the trouble is in the TO timer, clear the trouble and then proceed as in 3.75 through 3.86.

TE and TO Timers Stopped—TT Key in E or O Position

3.200 If the TE and TO timers are both stopped, the trouble is probably due to failure of the 22-volt, 60-Hz power supply to these timers.

3.201 Clear the trouble and restore the 22-volt supply to the timers.

3.202 Momentarily operate the AR key. Wait several seconds and if the TSF lamp again lights, synchronize the timers as follows. If the TT key is in the E position, proceed as in 3.04

through 3.14. If the TT key is in the O position, proceed as in 3.58 through 3.68.

3.203 Check for correct time indication as in 3.149 through 3.152 and if necessary, reset the selectors to the correct time as in 3.154 through 3.170.

TE and TO Timers Running—TT Key in E or O Position

3.204 If the TE and TO timers are both running and one of the combinations of lighted lamps listed in 3.171 is found, the trouble indication is probably due to a momentarily opened 22-volt, 60-Hz supply to one or both timers.

3.205 Momentarily operate the AR key. Wait several seconds, and if the TSF lamp again lights, synchronize the timers as follows. If the TT key is in the E position, proceed as in 3.04 through 3.14. If the TT key is in the O position, proceed as in 3.58 through 3.68.

3.206 Check for correct time indication as in 3.149 through 3.152 and if necessary, reset the selectors to the correct time as in 3.154 through 3.170.

E. End-of-Tape Failures

3.207 If, in response to an alarm, lighted lamps indicating an end-of-tape failure as shown in Table G are found, proceed as the paragraphs indicate for the line corresponding to the lighted lamps.

Analysis of Trouble Indications

Indication 1

3.208 When using the trouble recorder, if the trouble record for the master timing circuit in trouble contains one of the A, B, D, E, SP, or ET indications, it indicates that the perforation of a recorder transfer, a make-busy, a window splice, or a 3:00 a.m. end-of-tape pattern was blocked. The master timing circuit then timed out after one of the short time-out intervals and the trouble record was taken. After the trouble record was taken, the perforation of the blocked pattern was completed by means of local control in the master timing circuit.

Indication 2

3.209 This trouble indication is the same as indication 1 except that the trouble record was lost.

Indication 3

3.210 This combination of lighted lamps indicates that the progression of a recorder transfer, make-busy, window splice, or 3:00 a.m. end-of-tape pattern was blocked, causing the master timing circuit after one of the short time-out intervals to time-out and call for a trouble recorder. However, after the trouble record was taken, the local control feature of the master timing circuit was unable to complete the perforation of the blocked pattern. After a second short time-out interval, the master timing circuit and the associated recorder were automatically made busy, and then the connection between these circuits was released. If the blocked call is one of the 3:00 a.m. end-of-tape patterns, the tape of the recorder indicated on the trouble card contains an incomplete or mutilated end-of-tape pattern and the tapes of all lower numbered recorders normally served by the master timing circuit in trouble have no 3:00 a.m. end-of-tape pattern applied.

Indication 4

3.211 This combination of lighted lamps indicates trouble conditions similar to indication 3 except that the trouble record was lost.

Indication 5

3.212 This combination of lighted lamps indicates that shortly before the start of 3:00 a.m. end-of-tape operations, when an automatic check was made to determine if the master timing circuits were prepared to start the perforation of the 3:00 a.m. end-of-tape patterns, one of the master timing circuits was not prepared. Each master timing circuit checks its opposite circuit to determine whether their ET, ET1, and OC relays are operated as preparation for the start of the 3:00 a.m. end-of-tape entries. The master timing circuit in trouble was automatically made busy and the control of placing the end-of-tape entries on the tapes of all recorders was taken over by the other master timing circuit.

Indication 6

3.213 This indication is similar to indication 1 except that the recorder MTR lamp is also lighted. The master timing circuit blocked and timed out probably due to an open class lead (A, B, D, E, or SP), an open RK lead or failure to seize the recorder, or to crossed class leads (A, B, D, and E) while controlling a recorder transfer, make-busy or window splice end-of-tape pattern. After a short time-out interval, a trouble record was taken and completion of the blocked pattern was made by means of local control feature in the master timing circuit. The recorder was then automatically made busy and the connection between the master timing circuit and the recorder was released.

Indication 7

3.214 If a recorder frame MTR lamp only is found lighted and no trouble record is taken associated with this trouble, it indicates that the perforation of a recorder transfer or make-busy pattern was completed on the recorder tape and no difficulty was encountered until the recorder and master timing circuit started to release. At this time, the class relay (A, B, D1, or E) failed to release due to a false ground on its associated class lead or for some other reason, causing the recorder to be automatically made busy, and in turn releasing the connection between the master timing circuit and the recorder.

Indication 8

3.215 The combination of lighted lamps indicates that an end-of-tape failure occurred while perforating a recorder transfer pattern, a make-busy pattern, a window splice pattern, or if "B" wiring option is used in the master timing circuit, a 3:00 a.m. end-of-tape pattern. It also indicates that the short time-out feature of the master timing circuit was inoperative and therefore the master timing circuit was unable to make a trouble record and attempt to complete the blocked pattern by means of local control. The master timing circuit then functioned as follows.

- (a) For a recorder transfer, make-busy or window splice pattern failure, the long time-out feature in 18 to 30 seconds caused the master timing circuit and the recorder to be automatically

made busy and the connection between these two circuits to be released.

(b) For a 3:00 a.m. end-of-tape failure when "B" wiring option is used in the master timing circuit, the auxiliary long time-out feature in 2 to 5 minutes caused the master timing circuit and the recorder to be automatically made busy and the connection between these circuits to be released. The progression of the start circuits is stopped for controlling the perforation of the 3:00 a.m. end-of-tape records for all lower numbered recorders that are next in succession, and no 3:00 a.m. end-of-tape record was placed on the tapes of these recorders.

Indication 9

3.216 This combination of lamps will be lighted only when the master timing circuit uses "E" wiring option and it indicates that a failure occurred while perforating a 3:00 a.m. end-of-tape pattern. It also indicates that the short time-out feature of the master timing circuit was inoperative and therefore the master timing circuit was unable to take a trouble record and attempt to complete the blocked pattern by means of local control. The master timing circuit and the recorder remain blocked at the stage where function could not be completed due to trouble, thereby preventing the perforation of the 3:00 a.m. end-of-tape patterns on the tapes of the lower even-numbered or lower odd-numbered recorders next in succession.

Procedure for Indication 1

3.217 Refer to the trouble record to determine the type of entry involved and the progress of the call when it was blocked.

3.218 Proceed to the perforator cabinet of the recorder involved. Raise the perforator cover and, using a red china marking pencil, draw a single line across the top of the unperforated tape where it enters the perforator tape chute.

3.219 Make busy the trunks associated with the recorder in trouble.

Caution: *The removal from service of the trunks associated with a recorder may result in a shortage of available trunks or junctions for handling service calls.*

3.220 Clear the trouble and then check that an end-of-tape pattern of the type indicated by the trouble record may be applied without causing a trouble record to be taken or a display lost indication.

3.221 After clearing the trouble, insert a make-busy plug into the MB jack for the recorder in trouble and then insert a make-busy plug into the recorder TST jack for this recorder.

3.222 Insert the plug of a 32A test set into the R jack. Operate and release the white key button on the 32A test set. Observe that the RUT (recorder under test) lamp lights while a diamond pattern and other test entries are being perforated on the tape, and is then extinguished. Again operate and release the white key button to place a second diamond pattern and test entries on the tape.

Note: The application of the diamond pattern and other test entries will sound the alarm and light the TRR and recorder display lost lamps at the trouble recorder frame.

3.223 Remove the plug from the recorder TST jack of the recorder and disconnect the 32A test set from the R jack. Remove the plug from the recorder MB jack.

3.224 At the perforator, open the cabinet door. Raise the reel clutch release arm and hook it over the catch provided for this purpose. Disengage the tape from the tape guides.

Refer to Note 1.27.

3.225 Using a red china marking pencil, mark a large X on the smooth side of the tape over the lower of the two diamond patterns, that is, the diamond pattern farthest from the perforator drum.

3.226 Find the horizontal red mark placed on the tape when the alarm was answered. If necessary, pull the reel forward away from the friction drive and pull back some slack in the tape. Examine the portion of the tape from the horizontal red mark and in the direction away from the perforator drum and note whether a series of splice entries appear approximately 2-1/2 inches from the horizontal red mark. If a series of splice entries is found, then using a red china marking

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pencil, mark a large X on the smooth side of the tape in the splice entry area. If a series of splice entries is not found, mark a large X on the smooth side of the tape so that the center of this X is 4-1/2 inches from the red mark in a direction away from the perforator drum.

3.227 Replace the tape in the tape guides. If necessary, push the reel back into the notches in the mounting plates and wind the tape back on the reel. Lower the reel clutch release arm.

3.228 Record on Form E-4104 the recorder number, the date, and the time, and a note that this tape was marked with two red X's to indicate to the accounting center that all entries between these X's should be skipped.

3.229 Restore to service all trunks served by the recorder in trouble that were removed from service.

Procedure for Indication 2

3.230 This trouble indication is similar to trouble indication 1 except that the trouble recorder was busy and therefore unable to take a record of this trouble.

3.231 Due to the absence of a trouble record, no direct action toward clearing this trouble can be taken. Make a record of the lighted display lost lamps in accordance with local instructions.

Procedure for Indication 3

3.232 At the master timing frame, momentarily operate the AR key to extinguish the CMBE, ETFE and TAE or CMBO, ETFO and TAO lamps.

3.233 At the recorder frame, momentarily operate the AR key to extinguish the MTR lamp.

3.234 Refer to the trouble record to determine the type of entry involved and the progress of the call when it was blocked.

3.235 When using the trouble recorder, if the trouble record indicates by an A, B, D, E, or SP indication; or when using the trouble ticketer, if the ticket indicates by printing of 0 or 1 in ticket position 9, or 10 or in position 11, that the type of entry was for a recorder transfer,

make-busy or window splice pattern, proceed as in 3.218 through 3.229.

3.236 When using the trouble recorder, if the trouble record indicates by an ET indication, or when using the trouble ticketer, if the ticket indicates by a printing of 1 in position 30, that at 3:00 a.m. end-of-tape pattern was in progress, proceed as in 3.237 through 3.255 which includes marking the tape of the recorder indicated by the trouble record and also the tapes of all lower odd-numbered or all lower even-numbered recorders depending upon whether the odd or the even master timing circuit is indicated on the trouble record.

3.237 Check whether both the even and odd master timing circuits are in control of the perforation of end-to-tape patterns to determine the progression of their application as follows.

(a) If either the CMBE or CMBO key is operated, the master timing circuit associated with the unoperated key is in control and the progression of the application of 3:00 a.m. end-of-tape patterns is from the highest odd-numbered recorder to the lowest odd-numbered recorder, the emergency recorder, and then the highest even-numbered recorder to the lowest even-numbered recorder.

(b) If both the CMBE and CMBO keys are released, each master timing circuit controls the application of the 3:00 a.m. end-of-tape patterns on their respective highest even-numbered or highest odd-numbered recorder to their lowest even-numbered or lowest odd-numbered recorder.

3.238 From the trouble record, determine the recorder number for the call that failed. Then determine by the position of this recorder in the progression chain which lower numbered recorders do not have 3:00 a.m. end-of-tape patterns applied for the current day.

3.239 On the recorder indicated in the trouble record, proceed as in 3.218 through 3.229 except that for 3.222 apply nine diamond patterns and test entries instead of two.

3.240 On one of the recorders on which the 3:00 a.m. end-of-tape record has not been perforated, proceed as in 3.218 through 3.229 except that for 3.222 apply nine diamond patterns and test entries instead of two.

3.241 Repeat 3.240 for each of the remaining recorders on which the 3:00 a.m. end-of-tape records have not been perforated.

Procedure for Indication 4

3.242 Make a record of the lighted display lost lamps in accordance with local instructions.

3.243 At the master timing frame, momentarily operate the AR key to extinguish the CMBE, ETFE and TAE or CMBO, ETFO, and TAO lamps.

3.244 At the recorder frame, momentarily operate the AR key to extinguish the MTR lamp and silence the alarm.

3.245 If this alarm occurred between 3:00 a.m. and 3:30 a.m., proceed as in 3.246 through 3.249 or if this alarm occurred at a time of the day that eliminates the probability of a 3:00 a.m. end-of-tape failure, proceed as in 3.218 through 3.229.

3.246 At the perforator cabinet for the recorder indicated by the lighted display lost lamp, examine the perforated part of the tape to determine whether an end-of-tape pattern 6 to 8 feet long has been placed on the tape for the 3:00 a.m. end-of-tape entry.

3.247 If the alarm is not answered before 4:00 a.m. or later, the tape might have advanced to a point where the 3:00 a.m. end-of-tape pattern is on the take-up reel. To examine the tape in a case of this kind, raise the reel clutch release arm and hook it over the catch, pull the take-up reel forward away from the friction drive and pull back some slack in the tape. Then, using the KS-14343 tape reader, locate the 281003 (3:00 a.m. hour) entry. The 3:00 a.m. end-of-tape pattern, if present, will appear on the tape adjacent to the 3:00 a.m. hour entry on the side nearest the perforator drum. Push the reel back into the notches of the mounting bars, wind the tape back on the take-up reel, and lower the reel clutch release arm.

Refer to Note 1.27.

3.248 On the recorder indicated by the display lost lamp, proceed as in 3.218 through 3.229, except that for 3.222, apply nine diamond patterns and test entries instead of two.

3.249 If a 3:00 a.m. end-of-tape failure is found in examination as in 3.246 the end-of-tape entries are probably missing on the tapes of all lower even-numbered or all lower odd-numbered recorders depending upon whether the even or the odd master timing circuit is involved. In this case, check these recorder tapes as in 3.246 and 3.247 and, if end-of-tape entries are missing, mark these tapes as in 3.240 and 3.241.

Procedure for Indication 5

3.250 Operate the CMBE or CMBO key corresponding to the lighted CMBE or CMBO lamp. Momentarily operate the AR key. Observe that the ETFE or ETFO lamp is extinguished and the alarm is silenced.

Note: Do not attempt to clear the trouble until after the 3:00 a.m. end-of-tape entries have been placed on the tapes of all recorders. This may require as much as 30 minutes.

3.251 When the trouble has been found and cleared, restore the CMBE or CMBO key.

Procedure for Indication 6

3.252 At the recorder frame, momentarily operate the AR key to extinguish the MTR lamp and silence the alarm.

3.253 Refer to the trouble record to determine the type of entry and the nature of the trouble as follows.

(a) When using the trouble recorder, if none of the A, B, D, E, or SP indications are present, the trouble is probably due to an open class lead between the recorder and the master timing circuit or to the failure of the A, B, D1, E, or SP relays to operate in the master timing circuit for any other reason. The operation of these relays by means of the corresponding class leads normally occurs during recorder transfer, recorder make-busy, or window splice operations.

(b) When using the trouble recorder, if one of the A, B, D, E, or SP indications is present and no indication appears in the A to F line, the trouble is probably due to failure to seize the recorder, or to an open RK lead between the recorder and the master timing circuit. The open RK lead fails to furnish a recorder seizure

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check. The A, B, D, E, or SP indications reflect the type of entry involved as follows.

PUNCH	TYPE OF ENTRY
A	Transfer from regular to emergency recorder in progress
B	Transfer from emergency to regular recorder in progress
D	Make-busy recorder in progress
E	Recorder returned to service from made-busy condition
SP	Window splice encountered

(c) If more than one of the A, B, D, E, or SP indications are present, the trouble is probably due to crossed class leads except when the A and D indications or the B and E indications appear at the same time. When these indications appear at the same time, the trouble may be due to the failure to seize the recorder or to an open RK lead in the second stage of a recorder transfer.

3.254 Proceed as in 3.218 through 3.229 to clear the trouble and mark the recorder tape.

Procedures for Indication 7

3.255 Proceed to the perforator cabinet of the recorder involved. Raise the perforator cover, and using a red china marking pencil, draw a single line across the top of the unperforated tape where it enters the perforator tape chute.

3.256 Proceed as in 3.219 to make busy trunk units associated with the recorder in trouble.

3.257 At the recorder frame, momentarily operate the AR key to extinguish the MTR lamp and silence the alarm.

3.258 If the recorder in trouble is an even-numbered recorder, operate the CMBE key, or if an odd-numbered recorder, operate the CMBO key.

3.259 If any of the A, B, D1, or E relays in the associated even or odd master timing circuits are found operated, they probably are the source of the trouble record.

3.260 If none of the A, B, D1, or E relays are found operated, check for the presence of a false ground on any of the class leads (A, B, D, and E) from the recorder to the master timing circuit and the connections to these leads within the recorder.

3.261 After clearing the trouble, restore the CMBE or CMBO key.

3.262 If the trouble condition was found on the AT or B lead or the A or B relay, insert a make-busy plug into the TN jack for the recorder, or if the trouble condition was found on the D or E lead or the D1 or E relay, insert a make-busy plug into the MB jack for the recorder. Insert a make-busy plug into the recorder TST jack for the recorder.

3.263 Proceed as in 3.222 through 3.229 except that in 3.223 remove the plug from the recorder MB or TN jack.

Procedure for Indication 8

3.264 At the master timing frame, momentarily operate the AR key to extinguish the CMBE, ETFE, and TAE or CMBO, ETFO, and TAO lamps.

3.265 At the recorder frame, momentarily operate the AR key to extinguish the MTR lamp and silence the alarm.

3.266 If this alarm occurred between 3:00 a.m. and 3:30 a.m., proceed as in 3.267 through 3.270 or if this alarm occurred at a time of the day that eliminates the probability of a 3:00 a.m. end-of-tape failure, proceed as in 3.271 through 3.276.

3.267 At the perforator cabinet for the recorder indicated by the lighted MTR lamp, examine the perforated part of the tape to determine whether an end-of-tape pattern 6 to 8 feet long has been placed on the tape for the 3:00 a.m. end-of-tape entry.

3.268 If the alarm is not answered before 4:00 a.m. or later, the tape might have advanced

to a point where the 3:00 a.m. end-of-tape pattern is on the take-up reel. To examine the tape in a case of this kind, raise the reel clutch release arm and hook it over the catch, pull the take-up reel forward away from the friction drive and pull back some slack in the tape. Then, using the KS-14343 tape reader, locate the 281003 (3:00 a.m. hour) entry. The 3:00 a.m. end-of-tape pattern, if present, will appear on the tape adjacent to the 3:00 a.m. hour entry on the side nearest the perforator drum. Push the reel back into the notches of the mounting bars, wind the tape back on the take-up reel and lower the reel clutch release arm.

Refer to Note 1.27

3.269 On the recorder indicated by the lighted MTR lamp, proceed as in 3.218 through 3.229 except that for 3.222 apply nine diamond patterns and test entries instead of two.

3.270 If a complete 3:00 a.m. end-of-tape pattern is not found in 3.267 the end-of-tape entries are probably missing on the tapes of all lower even-numbered or all lower odd-numbered recorders depending upon whether the even or the odd master timing circuit is involved. In this case, check these recorder tapes as in 3.267 and 3.268 and, if necessary, mark these tapes as in 3.239 through 3.241.

3.271 Proceed to the perforator cabinet for the recorder whose MTR lamp was lighted.

Raise the perforator cover, and using a red china marking pencil, draw a single line across the top of the unperforated tape where it enters the perforator tape chute.

3.272 Make busy the trunks associated with the recorder in trouble.

Caution: *The removal from service of the trunks associated with a recorder may result in a shortage of available trunks or junctors for handling service calls.*

3.273 Operate the CMBE or CMBO key for the master timing circuit in trouble.

3.274 Clear the trouble affecting the short time-out feature of the master timing circuit.

3.275 Restore the CMBE or CMBO key.

3.276 Proceed as in 3.221 through 3.229.

Procedure for Indication 9

3.277 At the master timing circuit indicated by the lighted MTE or MTO lamp, operate the TM6 relay which locks. Observe that the lamps now lighted correspond to the lighted lamps for indication 8 in Table G.

TABLE G
END-OF-TAPE FAILURE INDICATIONS

TROUBLE INDICATION NUMBER	TROUBLE ANALYSIS IN PARAGRAPH	AT MASTER TIMING FRAME					AT TROUBLE RECORDER FRAME			AT RECORDER FRAME	PROCEED AS COVERED IN PARAGRAPHS	
		ATE or TAO	ETFE or ETFO	CMBE or CMBO	CMBE or CMBO	MTE or MTO	R	MASTER TIMER DISPLAY LOST (NOTE 1)	RECORDER DISPLAY LOST (NOTE 1)	TROUBLE RECORD REQUEST (NOTE 1)		MTR
1	3.208								✓	✓		3.217 through 3.229
2	3.209							✓	✓	✓		3.230 and 3.231
3	3.210	✓	✓	✓	✓	✓	✓		✓	✓	✓	3.232 through 3.241
4	3.211	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3.242 through 3.249
5	3.212		✓	✓	✓							3.250 and 3.251
6	3.213								✓	✓	✓	3.252 through 3.254
7	3.214										✓	3.255 through 3.263
8	3.215	✓	✓	✓	✓	✓	✓				✓	3.264 through 3.276
9	3.216					✓	✓					3.277 and 3.278
Note 1: These lamps have various designations as follows. Master Timer Display Lost Recorder Display Lost Trouble Record Request									NO. 5 CROSSBAR OFFICES DL-MTE or DL MTO DLR- TRR			



3.278 Proceed as for trouble indication 8 and as in 3.264, 3.265, and 3.267 through 3.270.

F. Fuse Alarm

3.279 If, in response to a major alarm, lighted FAE and CMBE or FAO and CMBO lamps are found at the master timing frame, this indicates that a 48 volt or +130 volt fuse has operated at the master timing frame fuse panel.

3.280 When the operated fuse is removed, the FAE or FAO lamp is extinguished, the FGE or FGO lamp is lighted and the audible alarm is silenced.

3.281 Replace the operated fuse. If the fuse again operates, find the cause of the short circuit, clear the trouble, then replace the fuse.

3.282 Momentarily operate the AR key to extinguish the FGE and CMBE or FGO and CMBO lamps.

G. Major Alarm Due to Double Make-Busy Conditions

3.283 If, in response to a major alarm, both the CMBE and CMBO lamps are found lighted, it indicates an attempt to make busy both master timing circuits at the same time. This make-busy attempt may be due to the operation of both the CMBE and CMBO keys, or to the operation of one of these keys before or after the automatic make-busy of a master timing circuit as a result of a crossed or grounded perforator lead, or because of a trouble causing a long time-out in the master timing circuit.

3.284 Check the positions of the CMBE and CMBO keys and then proceed as follows.

(a) If both keys are operated, check the MBE and MBO relays, then release the key associated with the relay that is not operated. Observe that the audible alarm is silenced.

(b) If only one key is operated, other lamp indications as described under alarm E or alarm H will indicate alarms causing master timing circuit automatic make-busy conditions. Restore the operated key and proceed as described for the alarm condition indicated. The audible alarm in these cases will be under control of

the alarm features described under alarms E and H.

H. Crossed or Grounded Perforator Leads

3.285 When using the trouble recorder, if a trouble record is taken with the XPL indication recorded, it indicates that a crossed or grounded perforator lead has been detected by the standing test feature in the master timing circuit. The cross-detecting circuit causes the master timing circuit to be automatically made busy and lights the CMBE or CMBO lamps at the master timing frame and trouble recorder frame.

3.286 Check the trouble record to determine whether the perforator lead or leads in trouble are indicated by the MA_ through MF_ indications.

3.287 If the trouble record does not indicate the perforator lead or leads in trouble, determine whether a cross-detecting relay is operated in the associated master timing circuit as follows. Check the positions of the XPE and XPE1 relays or XPO and XPO1 relays in their respective even or odd master timing circuit. The XPE or XPO relay when operated indicates a false battery or false ground on one or more perforator leads between its associated master timing circuit and the associated group of even or odd recorders. The XPE1 or XPO1 relay when operated indicates a false ground on one or more perforator leads within the associated master timing circuit. However, if neither of the cross-detecting relays is found operated in the master timing circuit in trouble, the cross or ground is of a transient nature.

3.288 After clearing the trouble, momentarily operate the AR key at the master timing frame. Observe that the CMBE or CMBO lamp is extinguished.

I. Paper Take-Up and Jammed Paper Alarms

Refer to Note 1.27

3.289 If the major alarm sounds and a PTU_ (paper take-up) lamp lights at the master timing frame, the punched paper tape has probably failed to accumulate properly on the take-up reel. The lamp indicates which perforator is in trouble and the alarm cannot be retired until the trouble is corrected.

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3.290 The most frequently reported troubles have been take-up motor failures, take-up reel jams, snagging of the paper tape on the inside of the perforator cabinet, and jammed paper tape.

3.291 If in response to a major alarm, a lighted NP (no paper) lamp is observed at a recorder, it indicates that a torn paper tape, an end of a paper tape, or a jammed paper tape has been encountered. Momentarily operate the AR (alarm release) key at the recorder to retire the alarm. If the alarm is not retired after operating the AR key, a jammed paper condition may be assumed and a make-busy plug should be inserted in the R_MB jack, at the master test frame, jack, lamp, and key circuit, associated with the recorder in trouble.

3.292 Check the perforator cabinet to determine the trouble that has developed with the

paper tape, or, any part of the paper winding mechanism. Clear the trouble in the approved manner and remove the make-busy plug from the R_MB jack at the master test frame jack, lamp, and key circuit.

3.393 When the trouble has been cleared and the paper tape starts winding on the storage reel, hand feed the tape to prevent snagging or tearing the paper tape. Be sure that the movable control arm is in position to be engaged by the advancing paper tape.

3.394 As the paper tape is wound on the storage reel, the control arm is moved upward. The movement of the control arm stops the take-up motor, and the microswitch contacts on the control arm retire the audible and visual alarms.