



**MASTER TIMING CIRCUIT SD-25633-01**  
**METHODS OF HANDLING ALARMS**  
**NO. 1 CROSSBAR OFFICES**

**1. GENERAL**

**1.001** This addendum supplements Section 216-813-301, Issue 3. The attached pages must be inserted in the section in accordance with the filing instructions above.

**1.002** This addendum is issued to add a paper take-up alarm.

**1. GENERAL**

The following changes apply to Part 1 of the section:

- (a) 1.03 — Paper Take-Up Alarm added

- (b) 1.24 and 1.25 — renumbered 1.25 and 1.26, respectively

- (c) New 1.24 — added

**2. APPARATUS**

The following change applies to Part 2 of the section:

- (a) Table A — Alarm Procedure I added

**3. METHOD**

The following changes apply to Part 3 of the section:

- (a) 3.262 through 3.264 — added

**Attached:**

Page 1 dated April 1968, revised  
Page 2 dated April 1968, reissued  
Page 3 dated April 1968, reissued  
Page 4 dated April 1968, revised  
Page 25 dated April 1968, reissued  
Page 26 dated April 1968, revised



**MASTER TIMING CIRCUIT SD-25633-01**  
**METHODS OF HANDLING ALARMS**  
**NO. 1 CROSSBAR OFFICES**

**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 to bring it in conformity with other material in the Plant Series. In this process marginal arrows have been omitted.

**1.03** The alarms covered are:

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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 Section 216-800-302.

**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.

**Pulse Failure Alarm**

**1.07** If the master timing circuit in control for furnishing time pulses fails to furnish a pulse for stepping the master timing circuit selectors and recorder selectors every 6 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 transverter trouble indicator 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 transverter trouble indicator 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 transverter trouble indicator —  
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.

#### **End-of-Tape Failure — Long Time-Out and Auxiliary Long Time-Out**

**1.14** If the master timing circuit short time-out feature is inoperative when the master timing circuit is called upon to control the perforation of a make-busy, transfer, or window splice pattern, the master timing circuit long time-out feature checks that the functions from the start of recorder seizure to the start of splice pattern are completed within an 18- to 30-second period and that the functions from the start of splice pattern to the end of perforation are completed within a second 18- to 30-second 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** If the master timing circuit short time-out feature is inoperative when the master timing circuit is called upon to control the perforation of 3:00 a.m. end-of-tape patterns, the master timing circuit long time-out feature checks that the functions from the start or 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 transverter trouble indicator, to take a trouble record after which the master timing circuit 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 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 transverter trouble indicator 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 transverter trouble indicator. 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 the transverter trouble indicator. 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 transverter trouble indicator 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 the transverter trouble indicator.

#### **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, the

↗ PTU-, and aisle pilot lamps will light at the master timing 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.

**2. APPARATUS**

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

**TABLE A**

APPARATUS	ALARM PROCEDURE						
	A	B	C	D	E	H	I
↗ 322A (Make-Busy) Plugs, as required	✓	✓	✓	✓	✓	—	✓
KS-3008 Stop Watch, or Equivalent	—	1	1	1	—	—	—
32A (Remote Control) Test Set	—	—	—	—	1	—	—
Red Pencil (2.02)	—	—	—	—	1	—	—
↘ Tape Reader (2.03)	—	—	—	—	1	—	—
✓As required							

2.02 Red china marking pencil.

2.03 KS-14343 tape reader.

**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
SSF only	3.70
PF only	3.130
TSF and SSF or TSF, SSF, and PF or TSF and PF	3.149

**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 1 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 to 3.11 or in case of repeat trouble, 3.12 to 3.26
TO	E	3.27 to 3.36
TE	O	3.37 to 3.45
TO	O	3.46 to 3.54 or in case of repeat trouble, 3.55 to 3.69

**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, proceed as in 3.04 to 3.11, inclusive. 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 3.12 to 3.26, inclusive.

**TE Timer - Initial Failure**

- 3.04 Operate the CMBO (controller make-busy odd) and CKL (check lamp) keys.
- 3.05 Operate the MSO (master timing circuit start or stop - odd) key to the STP (stop) position, thereby stopping the TO timer.
- 3.06 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.
- 3.07 At any time except when the U8 or U9 lamp is lighted, operate the MSO key to the ST (start) position. Within 1 minute, the

TO timer will start. Then operate the MSO key to the R (run) position.

3.08 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.

3.09 Restore the CMBO key.

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

3.11 Restore the CKL key.

**TE Timer - Repeat Failure**

3.12 Operate the TT key to the O position and operate the CKL key. The OS- (out of synchronism) lamps associated with all recorders will be lighted.

3.13 If there is a make-busy plug in any recorder TN or RTN jack at the transverter trouble indicator, 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 or RTN jack to make the emergency recorder available.

3.14 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 RMB 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.

3.15 Remove the plug from the emergency recorder RMB jack.

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3.16 If the emergency recorder is available, insert a make-busy plug into the recorder TN or RTN 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 RMB jack. Momentarily operate the S key to synchronize the recorder selectors. Then remove the plug from the recorder TN or RTN or RMB jack.

3.17 Proceed as in 3.16 for each of the other recorders having lighted OS- lamps, to synchronize their selectors.

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

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

3.20 Check the TE timer as covered in Section 030-141-701.

3.21 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.

3.22 At any time except when the U8 or U9 check lamp is lighted, operate the MSE key to the ST position. Within 1 minute, the TE timer will start. Then operate the MSE key to the R position.

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

3.24 Restore the CMBE key.

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

3.26 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.

**TO Timer at Fault - TT Key in E Position**

3.27 Operate the CMBO and CKL keys.

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

3.29 Check the TO timer as covered in Section 030-141-701.

3.30 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.

3.31 At any time except when the U8 or U9 lamp is lighted, operate the MSO key to the ST position. Within 1 minute, the TO timer will start.

3.32 Operate the MSO key to the R position.

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

3.34 Restore the CMBO key.

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

3.36 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.

**TE Timer at Fault – TT Key in O Position**

- 3.37 Operate the CMBE and CKL keys.
- 3.38 Operate the MSE key to the STP position, thereby stopping the TE timer.
- 3.39 Check the TE timer as covered in Section 030-141-701.
- 3.40 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.
- 3.41 At any time except when the U8 or U9 check lamp is lighted, operate the MSE key to the ST position. Within 1 minute, the TE timer will start. Then operate the MSE key to the R position.
- 3.42 Momentarily operate the S key. The SO lamp will be lighted while the even master timing circuit selectors are stepping to the synchronized position.
- 3.43 Restore the CMBE key.
- 3.44 Momentarily operate the AR key. The TSF lamp will be extinguished.
- 3.45 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.

**TO Timer at Fault – TT Key in O Position**

- 3.46 If this is the first response to trouble on the TO timer after a comparatively long period of satisfactory operation, proceed as in 3.47 to 3.54, inclusive. 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 3.55 to 3.69, inclusive.
- 3.47 Operate the CMBE and CKL keys.
- 3.48 Operate the MSE key to the STP position, thereby stopping the TE timer.
- 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 1 minute, the TE timer will start. Then operate the MSE key to the R position.
- 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.
- 3.55 Operate the TT key to the E position and operate the CKL key. The OS- lamps associated with all recorders will be lighted.
- 3.56 If there is a make-busy plug in any recorder TN or RTN jack at the transverter trouble indicator, 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 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 or RTN jack to make the emergency recorder available.
- 3.57 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,

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insert a make-busy plug into the emergency recorder RMB 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 OS lamp.

3.58 Remove the plug from the emergency recorder RMB jack.

3.59 If the emergency recorder is available, insert a make-busy plug into the TN or RTN 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 RMB jack. Momentarily operate the S key to synchronize the recorder selectors. Then remove the plug from the recorder TN, RTN, or RMB jack.

3.60 Proceed as in 3.59 for each of the other recorders having lighted OS-lamps, to synchronize their selectors.

3.61 Operate the CMBO key.

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

3.63 Check the TO timer as covered in Section 030-141-701.

3.64 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.

3.65 At any time except when the U8 or U9 check lamp is lighted, operate the MSO key to the ST position. Within 1 minute, the TO timer will start. Then operate the MSO key to the R position.

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

3.67 Restore the CMBO key.

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

3.69 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.

**B. Selector Synchronism Failure Alarm**

3.70 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 OS- 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 RE-CORDER	ALL RE-CORDERS	ODD MASTER TIMING CIRCUIT	EVEN MASTER TIMING CIRCUIT	
✓				3.71 to 3.77
	✓			3.78 to 3.83
		✓		3.84 to 3.99
			✓	3.100 to 3.115
	✓	✓		3.116 to 3.122
	✓		✓	3.123 to 3.129

**One Recorder OS- Lamp Lighted**

3.71 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.

3.72 If there is a make-busy plug in any recorder TN or RTN jack at the transverter trouble indicator, determine whether it is satisfactory to transfer the associated trunks or the district junctor group to the regular recorder and, if so, remove this plug from the recorder TN or RTN jack to make the emergency recorder available. When the emergency recorder is available, insert a make-busy plug into the recorder TN or RTN 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 RMB jack of the recorder. If the emergency recorder selectors are out of synchronism, insert the plug into the emergency recorder RMB jack.

3.73 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.

3.74 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.

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

3.76 Restore the CKL key.

3.77 Wait until reasonably certain that the recorder selectors will remain synchronized. Then restore the recorder to service by removing the plug from the associated recorder TN, RTN, or RMB jack at the transverter trouble indicator.

**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**

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

3.79 Operate the TT key to its opposite position.

3.80 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 3.13 to 3.16, inclusive, or if the TT key is now in the E position, proceed as in 3.56 to 3.59, inclusive.

3.81 Proceed as in 3.80 for each of the other recorders having lighted OS- lamps, to synchronize their selectors.

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

3.83 Restore the CKL key.

**OSO Lamp Lighted**

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

3.85 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.

3.86 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, bear-

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ing 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.

3.87 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 time on the building master clock or other source known to be correct by using a KS-3008 stop watch. Start the stop watch precisely at the beginning of any minute and note the time in minutes. Then compare the reading on the stop watch with the check lamps for the minutes time indication to determine whether the even or the odd master timing circuit is at fault.

3.88 If any of the odd master timing circuit selectors are at fault, proceed as in 3.89 and 3.90, or if any of the even master timing circuit selectors are at fault, proceed as in 3.91 to 3.99, inclusive.

### Odd Master Timing Selectors at Fault

3.89 Operate the CMBO key.

3.90 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

3.91 If the U selector of the even master timing circuit is not stepping, momentarily operate the UH relay of the even master timing circuit to cause the recorder selectors to be out of synchronism with the controlling (even) master timing circuit. Observe that the OS- lamps for all recorders are lighted.

3.92 If the U selector of the even master timing circuit is stepping and the time indicated by the check lamps is between 00.0

and 50.0 minutes, block nonoperated for 7 or 8 seconds the UH relay of the even master timing circuit. This causes the selectors of the controlling (even) master timing circuit to lag one or two 6-second steps, thereby causing the recorder selectors to be out of synchronism. Observe that the OS- lamps for all recorders are lighted.

3.93 If the U selector of the even master timing circuit is stepping and the time indicated by the check lamps is between 50.0 and 00.0 minutes, wait until 00.1 minute is indicated on the check lamps and then block nonoperated for 7 or 8 seconds the UH relay of the even master timing circuit. Observe that the OS- lamps for all recorders are lighted.

3.94 Insert make-busy plugs into the RMB jacks for all recorders and the RMB jack for the emergency recorder. Observe the MTE and MTO lamps which light each time a make-busy pattern is applied on a recorder tape. When these lamps remain extinguished, make-busy patterns have been applied on all recorder tapes.

3.95 Operate the TT key to the O position and operate the CMBE key. Observe that the OSO lamp is extinguished and the OSE lamp is lighted.

3.96 Momentarily operate the S key to synchronize the selectors of all recorders and the selectors of the even master timing circuit. The SO lamp will be lighted while the selectors are stepping to the synchronized positions. The OSE and OS- lamps will be extinguished when the selectors are synchronized.

3.97 Remove the plugs from all recorder RMB jacks and the emergency recorder RMB jack.

3.98 If the selectors 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.

3.99 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

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

3.101 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.

3.102 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 time on the building master clock or other source known to be correct by using a KS-3008 stop watch. Start the stop watch precisely at the beginning of any minute and note the time in minutes. Then compare the reading on the stop watch with the check lamps for the minutes time indication to determine whether the even or the odd master timing circuit is at fault.

3.104 If any of the even master timing circuit selectors are at fault, proceed as in 3.105 and 3.106, or if any of the odd master timing circuit selectors are at fault, proceed as in 3.107 to 3.115, inclusive.

#### Even Master Timing Selectors at Fault

3.105 Operate the CMBE key.

3.106 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

3.107 If the U selector of the odd master timing circuit is not stepping, momentarily operate the UH relay of the odd master timing circuit to cause the recorder selectors to be out of synchronism with the controlling (odd) master timing circuit. Observe that the OS- lamps for all recorders are lighted.

3.108 If the U selector of the odd master timing circuit is stepping and the time indicated by the check lamps is between 00.0 and 50.0 minutes, block nonoperated for 7 or 8 seconds the UH relay of the odd master timing circuit. This causes the selectors of the controlling (odd) master timing circuit to lag one or two 6-second steps, thereby causing the recorder selectors to be out of synchronism. Observe that the OS- lamps for all recorders are lighted.

3.109 If the U selector of the odd master timing circuit is stepping and the time indicated by the check lamps is between 50.0 and 00.0 minutes, wait until 00.1 minute is indicated on the check lamps and then block nonoperated for 7 or 8 seconds the UH relay of the odd master timing circuit. Observe that the OS- lamps for all recorders are lighted.

3.110 Insert make-busy plugs into the RMB jacks for all recorders and RMB jack for the emergency recorder. Observe the MTE and MTO lamps which light each time a make-busy pattern is applied on a recorder tape. When these lamps remain extinguished,

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make-busy patterns have been applied on all recorder tapes.

3.111 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.

3.112 Momentarily operate the S key to synchronize the selectors of all recorders and the selectors of the odd master timing circuit. The SE lamp will be lighted while the selectors are stepping to the synchronized positions. The OSO and OS- lamps will be extinguished when the selectors are synchronized.

3.113 Remove the plugs from all recorder RMB jacks and the emergency recorder RMB jack.

3.114 If the selectors 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.

3.115 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.

### OCO Lamp and All Recorder OS- Lamps Lighted

3.116 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.

3.117 Operate the TT key to the O position. Observe that the OSO lamp and all recorder OS- lamps are extinguished and the OSE lamp is lighted.

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 Operate the CMBE key.

3.120 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.

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

3.122 Restore the CMBE and CKL keys.

### OSE Lamp and All Recorder OS- Lamps Lighted

3.123 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.

3.124 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.

3.125 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.

3.126 Operate the CMBO key.

3.127 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.

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

3.129 Restore the CMBO and CKL keys.

### C. Pulse Failure Alarm

3.130 If the PF lamp only is lighted, it is probably due to the failure of the 22-volt, 60-cycle 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 described in 3.131 to 3.133, inclusive.

### Checking for Correct Time Indication

3.131 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.

3.132 To check the time indicated by the H, T, and U selectors of the master timing circuit in control in comparison with the actual correct time, use the KS-3008 stop watch. Obtaining the time from the building master clock or other source known to be correct, start the stop watch precisely at the beginning of any minute and note the time in minutes.

3.133 If the time is correctly indicated within  $\pm 0.5$  minute (30 seconds), operate the AK key to extinguish the PF lamp and then restore the CKL key. If the time indicated is incorrect by more than 0.5 minute (30 seconds), reset the selectors as described in 3.134 to 3.148, inclusive.

### Setting Selectors to the Correct Time

3.134 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.

3.135 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.

3.136 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.

3.137 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.

3.138 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.

3.139 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

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

3.141 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.

3.142 Insert make-busy plugs into the RMB jacks for all recorders and the RMB jack for the emergency recorder. Observe the MTE and MTO lamps which light each time a make-busy pattern is applied on one of the recorder tapes. Wait until the MTE and MTO lamps remain extinguished, indicating that all make-busy patterns have been applied.

3.143 Operate the TT key to the opposite position.

3.144 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.

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

3.146 Restore the CMBE or CMBO key and then remove the plugs from the recorder RMB and emergency recorder RMB jacks.

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

3.148 Restore the CKL key.

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

3.149 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 TT KEY	PROCEED AS IN PARAGRAPHS
TE stopped	E	3.150 to 3.159
TO stopped	E	3.160 and 3.161
TE stopped	O	3.162 and 3.163
TO stopped	O	3.164 to 3.173
TE and TO stopped	E or O	3.174 to 3.177
TE and TO running	E or O	3.178 to 3.180

**TE Timer Stopped - TT Key in E Position**

3.150 If the TE timer only is stopped, the trouble is probably due to failure of the 22-volt, 60-cycle 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.

3.151 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.

3.152 Check the time indicated by the H-, T-, and U- check lamps with the stop watch as follows. Obtain the time from the building master clock or other source known to be correct and start the stop watch precisely at the beginning of any minute and note the time in minutes. Then, while holding the CLT key operated, compare the lighted H-, T-, and U- check lamps with the reading on the stop watch.

3.153 If the time is correctly indicated within  $\pm 0.5$  minute (30 seconds), proceed as in 3.154. If the time is incorrect by more than  $\pm 0.5$  minute (30 seconds), reset the selectors as in 3.135 to 3.140, inclusive, and then proceed as in 3.154.

3.154 Momentarily operate the UH relay of the even master timing circuit. This causes the selectors of all recorders to be out of synchronism with the even master timing circuit and will light the OS- lamps for all recorders.

3.155 Insert make-busy plugs into the RMB jacks for all recorders and the RMB jack for the emergency recorder. Observe the MTE and MTO lamps which light each time a make-busy pattern is applied on one of the recorder tapes. Wait until the MTE and MTO lamps remain extinguished, indicating that all make-busy patterns have been applied.

3.156 Operate the TT key to the O position.

3.157 Momentarily operate the S key to synchronize the selectors of all recorders. The SO lamp will be lighted while the selectors are stepping to the synchronized positions and the OS- lamps will be extinguished when the selectors are synchronized.

3.158 Remove the plugs from the recorder RMB jack and emergency recorder RMB jack.

3.159 If the trouble is due to failure of the 22-volt supply to the TE timer, clear the trouble and then proceed as in 3.18, 3.19, and 3.21 to 3.26, inclusive, or if the trouble is in the TE timer, proceed as in 3.18 to 3.26, inclusive.

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### TO Timer Stopped - TT Key in E Position

3.160 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-cycle supply for this timer or to mechanical difficulty in the timer itself.

3.161 If the trouble is due to failure of the 22-volt supply, operate the CMBO and CKL keys, clear the trouble and then proceed as in 3.28 and 3.30 to 3.36, inclusive, or if the trouble is in the TO timer, proceed as in 3.27 to 3.36, inclusive.

### TE Timer Stopped - TT Key in O Position

3.162 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-cycle supply for this timer or to mechanical difficulty in the timer itself.

3.163 If the trouble is due to failure of the 22-volt supply, operate the CMBE and CKL keys, clear the trouble and then proceed as in 3.38 and 3.40 to 3.45, inclusive, or if the trouble is in the TE timer, proceed as in 3.37 to 3.45, inclusive.

### TO Timer Stopped - TT Key in O Position

3.164 If the TO timer only is stopped, the trouble is probably due to failure of the 22-volt, 60-cycle 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.

3.165 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.

3.166 Check the time indicated by the H-, T-, and U- check lamps with the stop watch as follows. Obtain the time from the building master clock or other source known to be correct and start the stop watch precisely at the beginning of any minute and note the time in minutes. Then, while holding the CLT key operated, compare the lighted H-, T-, and U- check lamps with the reading on the stop watch.

3.167 If the time is correctly indicated within  $\pm 0.5$  minute (30 seconds), proceed as in 3.168. If the time is incorrect by more than  $\pm 0.5$  minute (30 seconds), reset the selectors as in 3.135 to 3.140, inclusive, and then proceed as in 3.168.

3.168 Momentarily operate the UH relay of the odd master timing circuit. This causes the selectors of all recorders to be out of synchronism with the odd master timing circuit and will light the OS- lamps for all recorders.

3.169 Insert make-busy plugs into the RMB jacks for all recorders and the RMB jack for the emergency recorder. Observe the MTE and MTO lamps which light each time a make-busy pattern is applied on one of the recorder tapes. Wait until the MTE and MTO lamps remain extinguished, indicating that all make-busy patterns have been applied.

3.170 Operate the TT key to the E position.

3.171 Momentarily operate the S key to synchronize the selectors of all recorders. The SE lamp will be lighted while the selectors are stepping to the synchronized positions and the OS- lamps will be extinguished when the selectors are synchronized.

3.172 Remove the plugs from the recorder RMB jack and emergency recorder RMB jack.

3.173 If the trouble is due to failure of the 22-volt supply to the TO timer, clear the trouble and proceed as in 3.61, 3.62, and 3.64 to 3.69, inclusive, or if the trouble is in the TO timer, proceed as in 3.61 to 3.69, inclusive.

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

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

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

3.176 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 to 3.11, inclusive. If the TT key is in the O position, proceed as in 3.47 to 3.54, inclusive.

3.177 Check for correct time indication as in 3.131 to 3.133, inclusive, and if necessary, reset the selectors to the correct time as in 3.134 to 3.148, inclusive.

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

3.178 If the TE and TO timers are both running and one of the combinations of lighted lamps listed in 3.152 is found, the trouble indication is probably due to a momentarily opened 22-volt, 60-cycle supply to one or both timers.

3.179 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 to 3.11, inclusive. If the TT key is in the O position, proceed as in 3.47 to 3.54, inclusive.

3.180 Check for correct time indication as in 3.131 to 3.133, inclusive, and if necessary, reset the selectors to the correct time as in 3.134 to 3.148, inclusive.

**E. End-of-Tape Failures**

3.181 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**

3.182 When using the transverter trouble indicator, 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**

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

**Indication 3**

3.184 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 record. 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-

TABLE G - END-OF-TAPE FAILURE INDICATIONS

		AT MASTER TIMING FRAME			AT TROUBLE INDICATOR						AT RECORDER FRAME	
TROUBLE INDICATION NUMBER	TROUBLE ANALYSIS IN PARAGRAPH	TAE 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	PROCEED AS COVERED IN PARAGRAPHS
1	3.182								✓	✓		3.191 to 3.203
2	3.183							✓	✓	✓		3.204 and 3.205
3	3.184	✓	✓	✓	✓	✓	✓		✓	✓	✓	3.206 to 3.215
4	3.185	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3.216 to 3.223
5	3.186		✓	✓	✓							3.224 and 3.225
6	3.187								✓	✓	✓	3.226 to 3.228
7	3.188										✓	3.229 to 3.237
8	3.189	✓	✓	✓	✓	✓	✓				✓	3.238 to 3.250
9	3.190					✓	✓					3.251 and 3.252

  

<p><b>Note 1:</b> These lamps have various designations as follows.</p> <p>Master Timer Display Lost</p> <p>Recorder Display Lost</p> <p>Trouble Record Request</p>	NO. 1 CROSSBAR
	DLTE or DLTO
	DLR-
	TI

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*

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

#### *Indication 5*

3.186 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*

3.187 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 the 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*

3.188 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*

3.189 This 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-

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of-tape record was placed on the tapes of these recorders.

### **Indication 9**

3.190 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**

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

3.192 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.

3.193 Make busy the trunks or district junctor units associated with the recorder in trouble.

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

If the recorder in trouble is the only recorder in its group, do not remove the associated trunks from service.

3.194 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.

3.195 After clearing the trouble, insert a make-busy plug into the RMB jack for the recorder in trouble and then insert a make-busy plug into the recorder TST or T jack for this recorder.

3.196 Insert the plug of a No. 32A test set into the R jack. Operate and release the white key button on the No. 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 TI and recorder display lost lamps at the trouble indicator.

3.197 Remove the plug from the recorder TST or T jack of the recorder and disconnect the No. 32A test set from the R jack. Remove the plug from the recorder RMB jack.

3.198 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.

3.199 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.

3.200 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 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.

3.201 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.

3.202 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.

3.203 Restore to service all district junctures or trunks served by the recorder in trouble that were removed from service.

#### Procedure for Indication 2

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

3.205 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

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

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

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

3.209 When using the transverter trouble indicator, if the trouble record indicates by an A, B, D, E, or SP indication that the type of entry was for a recorder transfer, make-busy, or window splice pattern, proceed as in 3.192 to 3.203, inclusive.

3.210 When using the transverter trouble indicator, if the trouble record indicates by an ET indication that at 3:00 a.m. end-of-tape pattern was in progress, proceed as in 3.211 to 3.229, inclusive, 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.

3.211 Check whether both the even and odd master timing circuits are in control of the perforation of end-of-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.

3.212 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.

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3.213 On the recorder indicated in the trouble record, proceed as in 3.192 to 3.203, inclusive, except that for 3.196, apply nine diamond patterns and test entries instead of two.

3.214 On one of the recorders on which the 3:00 a.m. end-of-tape record has not been perforated, proceed as in 3.195 to 3.203, inclusive, except that for 3.196, apply nine diamond patterns and test entries instead of two.

3.215 Repeat 3.214 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

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

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

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

3.219 If this alarm occurred between 3:00 a.m. and 3:30 a.m., proceed as in 3.220 to 3.223, inclusive, 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 3.192 to 3.203, inclusive.

3.220 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.

3.221 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.

3.222 On the recorder indicated by the display lost lamp, proceed as in 3.192 to 3.203, inclusive, except that for 3.196, apply nine diamond patterns and test entries instead of two.

3.223 If a 3:00 a.m. end-of-tape failure is found in examination described in 3.220, 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 3.220 and 3.221 and, if end-of-tape entries are missing, mark these tapes as in 3.214 and 3.215.

### Procedure for Indication 5

3.224 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.

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

**Procedure for Indication 6**

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

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

(a) When using the transverter trouble indicator, 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 transverter trouble indicator, 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 check. The A, B, D, E, or SP indications reflect the type of entry involved as follows.

PUNCH	TRouble TICKET POS DIGIT	TYPE OF ENTRY
A	9 1	Transfer from regular to emergency recorder in progress
B	9 0	Transfer from emergency to regular recorder in progress
D	10 0	Make-busy recorder in progress
E	10 1	Recorder returned to service from made-busy condition
SP	11 1	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.

3.228 Proceed as in 3.192 to 3.203, inclusive, to clear the trouble and mark the recorder tape.

**Procedure for Indication 7**

3.229 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.

3.230 Proceed as in 3.193 to make busy trunks or district junctor units associated with the recorder in trouble.

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

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

3.233 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.

3.234 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.

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

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3.236 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 or RTN 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 RMB jack for the recorder. Insert a make-busy plug into the recorder TST or T jack for the recorder.

3.237 Proceed as in 3.196 to 3.203, inclusive, except that in 3.197, remove the plug from the recorder RMB, RTN, or TN jack.

Procedure for Indication 8

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

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

3.240 If this alarm occurred between 3:00 a.m. and 3:30 a.m., proceed as in 3.241 to 3.244, inclusive, 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 3.245 to 3.250, inclusive.

3.241 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.

3.242 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.

3.243 On the recorder indicated by the lighted MTR lamp, proceed as in 3.192 to 3.203, inclusive, except that for 3.196, apply nine diamond patterns and test entries instead of two.

3.244 If a complete 3:00 a.m. end-of-tape pattern is not found in 3.241, 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 3.241 and 3.242 and, if necessary, mark these tapes as in 3.213 to 3.215, inclusive.

3.245 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.

3.246 Make busy the trunks or district junctor units associated with the recorder in trouble.

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

If the recorder in trouble is the only recorder in its group, do not remove the associated trunks from service.

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

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

3.249 Restore the CMBE or CMBO key.

**3.250** Proceed as in 3.195 to 3.203, inclusive.

#### Procedure for Indication 9

**3.251** 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.

**3.252** Proceed as for trouble indication 8 and as described in 3.238, 3.239, and 3.241 to 3.244, inclusive.

#### F. Fuse Alarm

**3.253** If, in response to a major alarm, lighted CMBE or CMBO lamps are found at the master timing frame and the transverter trouble indicator, and a lighted FA or 20A lamp is found at the outgoing trunk test frame jack bay or at a miscellaneous relay rack, replace the operated fuse. The FA or 20A lamp will be extinguished, the alarm will be silenced, and the ALE or ALO lamp at the master timing frame will be lighted when the operated fuse is removed.

**3.254** If the fuse operates again, find the cause of the short circuit, clear the trouble, and then replace the fuse.

**3.255** At the master timing frame, momentarily operate the AR key. Observe that the ALE and CMBE or ALO and CMBO lamps are extinguished.

#### G. Major Alarm Due To Double Make-Busy Conditions

**3.256** 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.

**3.257** 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

**3.258** When using the transverter trouble indicator, 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 the transverter trouble indicator.

**3.259** Check the trouble record to determine whether the perforator lead or leads in trouble are indicated by the MA- through MF- indications (trouble ticket positions 24 through 29).

**3.260** 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.

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

**L Paper Take-Up Alarm**

**3.262** If, in response to a major alarm, a PTU-lamp is found lighted at the master timing frame, it indicates a failure of the paper tape to be taken up properly on the associated storage reel in the perforator cabinet. The PTU-lamp indicates which perforator caused the alarm. The alarm cannot be retired until the trouble is corrected.

**3.263** At the perforator cabinet determine the trouble that has developed in the paper take-up mechanism. The trouble may be a take-up motor failure, a jammed take-up reel, or snagging of the paper tape on some part of the perforator cabinet. In some cases it may be necessary to transfer or make busy the recorder at the trouble indicator or trouble recorder frame.

**3.264** When trouble has been cleared, hand feed the paper tape onto the storage reel until tape is taut and take-up control arm is in its uppermost position. Take-up motor should stop, and audible and visual alarms should be retired.