NO. 4A TRAFFIC USAGE RECORDER (TUR) SD-95738-01

PERFORMANCE TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section provides a set of tests for a quick verification that all circuits are functioning properly. These tests cover general applications of the TUR and applications with Engineering and Administrative Data Acquisition System Individual Circuit Usage Recorder (EADAS ICUR) and Force Administration Data System (FADS). These tests should be used to verify the operation of both new and old features and options of the 4A TUR. The TUR should be verified for proper operation before any modifications are attempted. Upon completion of the modification, verify that the TUR functions in its proper mode. This section also provides a method of verifying crossbar switch operation and specifies a revised contact closure limitation.

1.02 This section is reissued to revise Tests M and N. Revision arrows are used to emphasize the more significant changes. Equipment Test Lists are not affected.

1.03 The following tests are covered:

4A TUR Performance Tests for General Application

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4A TUR Performance Tests for EADAS ICUR Application

4A TUR Performance Tests for FADS Application

1.04 These test results will not indicate the degree of accuracy of the data being collected, but will indicate that the TUR is functioning properly, both electrically and mechanically. Input and output verification of the TUR should be performed to check for data accuracy. Refer to Section 252-122-502 for TUR lead verification.

1.05 Test S requires reference to Sections 030-720-701 and 030-720-801.

1.06 Refer to either Fig. 1, 2, or 3 for sequence to be followed in performing any tests of this section.

Note: Test S is not a part of any testing sequence since this routine check can be performed at any time when warranted.

1.07 If any trouble is encountered while performing these tests, release ON relay and block operated, then hold operated the CT relay until CT1 relay operates. When CT releases, the TUR is ready for testing.

1.08 Local instructions should be followed with reference to recording any register operations caused by performing these tests.

1.09 References to drawing sheet number and location grids in the VERIFICATION column of this section refer to SD-95738-01.

1.10 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Parts 3 through 7 of this section indicates an action which may or may not be required depending on local conditions. The conditions under which a lettered step or series of lettered steps should be made are given in the ACTION column, and all steps governed by the same condition are designated by the same letter within the test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 14- or 15-type mechanical registers. Two required for general and FADS applications, three required for EADAS ICUR application.

2.02 185A network to be used with each mechanical register.

2.03 Pulse checking test set SD-96362-01 (J94723A). Calibrate and operate in accordance with Section 100-234-101.

2.04 TEKTRONIX* 453 oscilloscope (or equivalent) for use with EADAS ICUR applications only.

Note: The oscilloscope is a laboratory grade precision instrument. Follow the instructions in the operator's manual carefully, and handle the instrument with care.

2.05 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord). Six required for general and FADS applications, 12 required for EADAS ICUR application.

2.06 KS-6278 connecting clips for use with 1W13B cords. Two required per each 1W13B cord.

2.07 Blocking and insulating tools, as required. Use tools and apply as covered in Section 069-020-801.

*Registered trademark of Tektronix, Inc.

3. PREPARATION

STEP	ACTION	VERIFICATION
	Tests A, B, and C—4A TUR General Quick Test Setup	
1	At master TUR of TUR lineup— Insulate 1B and 2B of STP relay.	
2	At lineup of TURs being tested— Block nonoperated all SC relays of TURs except TUR under test.	
3a	If TUR being tested is equipped with an ASA relay— Block ASA relay nonoperated.	

STEP	ACTION	VERIFICATION
4b	If TUR being tested is equipped with an AS relay— When first TUR of pair is being tested— Block AS relay nonoperated. When second TUR of pair is being tested— Block AS relay operated.	
5	Record all nonstandard conditions of TUR (blocked or insulated relays).	
6	At TUR control panel— Record position of all keys and switches.	
7	Position all keys to center-off position.	
8	Connect jumper wires between following LP relay contacts: **From** — **To** 1B — 2B 3B — 4B 5B — 6B 7B — 8B 9B — 10B 11B — 12B	
9	Verify detector tube filaments are extinguished.	Detector tube filaments extinguished (filaments not lighted). ***CORRECTIVE ACTION*** Should tube filaments be lighted— Verify that FC relay is not wired to be permanently operated. Verify that 3T and 4T of IS relay are not jumpered. (Refer to sheet B-5, location E-3.)

Tests G, H, I, J, and K—4A TUR EADAS ICUR Quick Test Setup

Note: Corrective Action information has been provided throughout this section to furnish information on items to be checked should the proper verification not be obtained. Additional information has been included in Table A at the end of this procedure, covering common troubles which have occurred with ICUR. Reference to Table A should be made when Corrective Action information fails to clear the problem.

STEP	ACTION	VERIFICATION
1	At master TUR of TUR lineup— Insulate 1B and 2B of STP relay.	
2	At lineup of TURs being tested— Block nonoperated all SC relays of TURs except TUR under test.	
3a	If TUR being tested is equipped with an ASA relay— Block ASA relay nonoperated.	
4b	If TUR being tested is equipped with an AS relay— When first TUR of pair is being tested— Block AS relay nonoperated. When second TUR of pair is being tested— Block AS relay operated.	
5	Record all nonstandard conditions of TUR (blocked or insulated relays) and remove such conditions.	
6	At TUR control panel— Record position of all keys and switches.	
7	Position all keys to center-off position.	
8	Connect jumper wires between following LP relay contacts:	
9	Connect jumper wire from 7B of XTA relay to -48V.	
10	Connect jumper wire from 13B of TBL relay to -48V (ZF option).	
11	Connect jumper wire from 7T of AR relay to 4T of DOK relay.	
12	At EADAS traffic data converter— Operate remote/local switches to local position.	
13	Block ON relay nonoperated.	

From	To
1B	2B
3B	4B
5B	6B
7B	8B
9B	10B
11B	12B

STEP	ACTION	VERIFICATION
14	Verify detector tube filaments are extinguished.	Detector tube filaments extinguished (filaments not lighted). ***CORRECTIVE ACTION*** Should tube filaments be lighted— Verify that FC relay is not wired to be permanently operated. Verify that 3T and 4T of IS relay are not jumpered. (Refer to sheet B-5, location E-3.)

Tests O, P, and Q—4A TUR FADS Quick Test Setup

1 At master TUR of TUR lineup—
Insulate 1B and 2B of STP relay.

2 Connect jumper wires between following LP relay contacts:

From	To
1B	2B
3B	4B
5B	6B
7B	8B
9B	10B
11B	12B

3 Block ON relay nonoperated.

4	Verify detector tube filaments are extinguished.	Detector tube filaments extinguished (filaments not lighted). ***CORRECTIVE ACTION*** Should tube filaments be lighted— Verify that FC relay is not wired to be permanently operated. Verify that 3T and 4T of IS relay are not jumpered. (Refer to sheet B-5, location E-3.)

4. 4A TUR PERFORMANCE TESTS FOR GENERAL APPLICATION

STEP	ACTION	VERIFICATION
A. TUR Turn-On and Warm-Up Cycle		
10c	If TUR control box is provided— Operate register grouping keys on.	
11	At master TUR frame— Block ON relay operated.	IS and DC relays operated.

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should IS and DC relays not operate— Cease testing until problem corrected. (Refer to sheet B-2, location G-3 and B-9, for relay locations.)
		CT relay nonoperated.
		CORRECTIVE ACTION Should CT relay be operated— Verify that 1B and 2B of STP relay are insulated. Verify wiring of CT relay. (Refer to sheet B-1, location C-2.)
12	Manually hold operated CT relay until CT1 relay operates.	In approximately 6 seconds— CT1 relay operated. CT relay locked operated for 94 seconds and then released.
		CORRECTIVE ACTION Should CT1 relay fail to operate in approximately 6 seconds— Check CS timer and CTC relay for wiring problems. Check CS timer for defective Micro Switch. (Refer to sheet B-1, location E-7 and D-2.)
13	Block ADV relay operated.	
14	Using J94723A test set, connect B lead to -48 volt battery supply.	
15	Connect G lead to ground.	
16	Connect P lead to contact 2T of ADV relay.	
17	Manually hold operated CT relay until CT1 relay operates.	
18	Record pulses-per-second (PPS) and percent break (%) of TUR PG pulser.	Limits: PPS = 6.8 - 7.2 % Break = 35 - 45%
		CORRECTIVE ACTION Should PPS reading be out of limit, either high or low, remove or add strap or straps on RJ resistor to bring PG pulser back into specification. (Refer to sheet B-3A, location C-1.)
		Should percent break be out of limits, replace PG pulser.

STEP	ACTION	VERIFICATION
19	Disconnect J94723A test set.	
20	Unblock ADV relay.	
21	Momentarily release ON relay then block operated.	
22	Manually hold operated CT relay until CT1 relay operates.	
23	When CT relay releases— Manually hold operated CT relay until it locks operated.	
24	Block SS8 relay nonoperated.	TUR now operating. CT relay released.
25	When CT relay releases— Momentarily operate MSC relay.	TBL relay operated. Central office alarm activated.
26	Momentarily operate AR key.	AR relay operated. TBL relay released. Central office alarm silenced. An AGR lamp lighted. ***CORRECTIVE ACTION*** Should any verifications not be obtained— Check wiring of TBL relay. (Refer to sheet B-3A, location F-H, 0-3.) ***Note:*** ZF option should be used and recommended. ZE option is rated Mfr Disc.
27	Block XT relay operated.	XT1, XT2, XTT1, XTT2 relays operated. End of scan detector test performed.
28	Block TBL relay nonoperated.	
29	Block DTA relay operated.	
30	Force down AR relay.	All detector tubes operated. D (0-5) lamps lighted. Alarm sounded.
31	Unblock TBL relay.	
32	Operate AR key.	TBL relay released. XV relay already operated. XV lamp lighted. Alarm silenced.

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should any verification not be obtained— Check wiring of XV relay. (Refer to sheet B-9, location F-3.)
33	Unblock ON, SS8, XT, and DTA relays.	
B. Detector Failure Circuits and Alarms		
10	At TUR being tested— Remove detector tubes 0 and 1.	
11	Block ON relay operated.	
12	Block CT relay operated.	In approximately 200 seconds— TBL lamp lighted. DF lamp lighted. Office alarm activated. ***CORRECTIVE ACTION*** Should no alarm be present 200 seconds after start— Check wiring of RO-5 relays. (Refer to sheet B-9.) Check for proper options of TUR setup. (ZF option and Apparatus Figure 48 are preferred.) Check wiring of DOK relay. (Refer to FS-16 and associated wiring on sheet B-3A, location E-2.)
13	Operate AR key.	TBL lamp extinguished. Office alarm silenced.
14	Unblock ON and CT relays.	
15	Replace detector tubes 0 and 1.	
C. TUR Scan and Sequence		
10	Block ON relay operated.	
11	Manually hold operated CT relay until CT1 relay operates. ***Note:*** Allow TUR to go through a warm-up cycle.	When CT relay releases— TUR is ready to begin scanning.
12	Connect a mechanical register equipped with a 185-type contact protection network between terminal 2B of EC1 relay and a -48 volt source.	

STEP	ACTION	VERIFICATION
13	Record register reading.	
14	Connect another mechanical register equipped with a 185-type contact protection network between terminal 7T of MSC relay and a -48 volt source.	
15	Record register reading.	
16	At TUR control box— Operate MSC/TST key to TST. ***Note:*** This places the TUR into a detector test mode.	
17	Block CT relay operated.	TUR begins scanning. ***CORRECTIVE ACTION*** Refer to Section 252-122-501.
18	While TUR is scanning— Observe operation of scan and register switches. Note any unusual operations.	DO-5 lamps lighted during scanning. At end of scan detector test, only even or odd tubes fire and corresponding lamps light. ***CORRECTIVE ACTION*** Replace detector tube and/or corresponding R_ relay. Check for defective lamp. CE and CO relays operate alternately. (May be 3 cycles before they begin.) ***CORRECTIVE ACTION*** (Refer to FS-15 of SD-95738-01.) Check A and B relays. (Refer to sheet B-1, location C-6.)
19	When TUR begins eighteenth cycle— After CT1 relay operates— Unblock CT relay.	At end of scan interval— EC, EC1 relays operated. XT, XT1, XTT1, XTT2, and DOK relays operated. ***CORRECTIVE ACTION*** Refer to appropriate sequence charts of SD-95738-01. Refer to CD-95738-01. Refer to Section 252-122-501.
20	When TUR stops scanning— Record register readings.	

STEP	ACTION	VERIFICATION
21	Using J94723A test set, connect B leads to -48 volt battery supply.	
22	Connect G lead to ground.	
23	Connect P lead to contact 2T of ADV relay.	
24	Record pulses per second (PPS) and percent break (%) of TUR PG pulser.	Limits: PPS = 6.8 - 7.2 % Break = ◗35◖ - 45% ***CORRECTIVE ACTION*** Should limits be exceeded— Replace PG resistor and recheck pulser.
25	Remove all blocking tools.	
26	Calculate difference of before and after readings of registers. Reading of register connected to 2B of EC1 relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— —— Reading of register connected to 7T of MSC relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— ——	
27	Divide results of one by results of the other.	Quotient equals 660. (TUR has scanned correct number of crosspoints.) ***CORRECTIVE ACTION*** Should results be higher, TUR has repeated scanning of crosspoints. Should results be low, TUR has skipped contacts. In either case, relay contacts of steering and control relays should be cleaned.

D. ASA Relay Test

1	Block ASA relay nonoperated.	At master TUR— W and Z relays released. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
2	Unblock ASA relay.	

STEP	ACTION	VERIFICATION
3	Momentarily operate W relay.	ASA relay remains released. W relay locked operated. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
4	Momentarily operate Z relay.	ASA relay operated. Z relay locked operated. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
5	Manually release W relay.	ASA relay remains operated. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
6	Manually release Z relay.	ASA relay released. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
7	Remove all blocking tools.	

E. AS Relay Test

1	Block ON relay operated.	
2	Ensure AS relay is in normal/released condition.	***CORRECTIVE ACTION*** Remove any blocking tools from AS relay. Should trouble of any type be encountered while testing AS relay and contacts, refer to sheet B-10, FS-18.
3	At first TUR of pair— Momentarily operate EC relay.	AS relay operated.
4	Force down EC relay on first frame of pair.	AS relay remains operated.
5	Momentarily operate EC relay on second TUR frame of pair.	AS relay released.
6	Force down EC relay on second frame of pair.	AS relay remains released.
7	Momentarily operate EC relay on first frame of pair.	AS relay operated.

STEP	ACTION	VERIFICATION
8	At TURs— Block both IS relays released.	AS relay released. ***CORRECTIVE ACTION*** Should AS relay fail to release— ZE option is in and should be removed and ZF option installed. (Refer to sheet B-6, location A-2.)
9	Remove blocking tools from all relays.	
F. TUR Restoration and Detector Test		
1	Remove all blocking tools from relays.	
2	Remove all jumper wires associated with LP relay.	
3	Disconnect all test equipment.	
4	At TUR control panel— Restore keys and switches to their original positions.	
5	Using TUR control panel facilities, perform a detector test on TUR.	
6	When detector test is completed— Restore TUR to off condition.	ON and IS relays released.

5. 4A TUR PERFORMANCE TESTS FOR EADAS ICUR APPLICATION

STEP	ACTION	VERIFICATION
G. TUR Turn-On and Warm-Up Cycle		
15	At master TUR frame— Block ON relay operated.	IS and DC relays operated. ***CORRECTIVE ACTION*** Should IS and DC relays not operate— Cease testing until problem is corrected. (Refer to sheet B-2, location G-3 and B-9 for relay location.) CT relay nonoperated. ***CORRECTIVE ACTION*** Should CT relay be operated— Verify that 1B and 2B of STP relay are insulated. Verify wiring of CT relay. (Refer to sheet B-1, location C-2.)

STEP	ACTION	VERIFICATION
16	Manually hold CT relay operated until CT1 relay operates.	In approximately 6 seconds— CT1 relay operated. CT relay locked operated for 94 seconds and then released. ***CORRECTIVE ACTIVE*** Should CT1 relay fail to operate in approximately 6 seconds— Check CS timer and CTC relay for wiring problems. Check CS timer for defective Micro Switch. (Refer to sheet B-1, location E-7 and D-2.)
17	Block ADV relay operated.	
18	Using J94723A test set, connect B lead to -48 volt battery supply.	
19	Connect G lead to ground.	
20	Connect P lead to contact 2T of ADV relay.	
21	Manually hold CT relay operated until CT1 relay operates.	
22	Record pulses per second (PPS) and percent break (%) of TUR PG pulser.	Limits: PPS = 6.8 - 7.2 % Break = 35 - 45% ***CORRECTIVE ACTION*** Should PPS reading be out of limit, either high or low, remove or add strap or straps on RJ resistor to bring PG pulser back into specification. (Refer to sheet B-3A, location C-1.) Should percent break be out of limits, replace PG pulser.
23	Disconnect J94723A test set.	
24	Unblock ADV relay.	
25	Momentarily release ON relay then block operated.	
26	Manually hold CT relay operated until CT1 relay operates.	
27	When CT relay releases— Manually hold CT relay operated until it locks operated.	

STEP	ACTION	VERIFICATION
28	Block SS8 relay nonoperated.	TUR now operating.
29	When CT relay releases— Momentarily operate MSC relay.	TBL relay operated. Central office alarm activated.
30	Momentarily operate AR key.	AR relay operated. TBL relay released. Central office alarm silenced. An ARG lamp lighted. ***CORRECTIVE ACTION*** Should any verifications not be obtained— Check wiring of TBL relay. (Refer to sheet B-3A, location F-H, 0-3.) ***Note:*** ZF option should be used and recommended. ZE option is rated Mfr Disc.
31	Block XT relay operated.	XT1, XT2, XTT1, XTT2 relays operated. End of scan detector test performed.
32	Block TBL relay nonoperated.	
33	Block DTA relay operated.	
34	Force down AR relay.	All detector tubes operated. (D0-5 lamps lighted.)
35	Unblock TBL relay.	TBL relay operated. Alarm sounded.
36	Operate AR key.	TBL relay released. XV relay already operated. XV lamp lighted. Alarm silenced. ***CORRECTIVE ACTION*** Should any verification not be obtained— Check wiring of XV relay. (Refer to sheet B-9, location F-3.)
37	Unblock SS8, XT, ON, and DTA relays.	
38	Manually release ON relay.	

H. Detector Failure Circuits and Alarms

15	At TUR being tested— Remove detector tubes 0 and 1.	
16	Block ON relay operated.	

STEP	ACTION	VERIFICATION
17	Block CT and DTA relays operated.	In approximately 200 seconds— TBL lamp lighted. DF lamp lighted. Office alarm activated. ***CORRECTIVE ACTION*** Should no alarm be present 200 seconds after start— Check wiring of RO-5 relays. (Refer to sheet B-9.) Check for proper options of TUR setup. (ZF option and Apparatus Figure 48 are preferred.) Check wiring of DOK relay. (Refer to FS-16 and associated wiring on sheet B-3A, location E-2.)
18	Operate AR key.	TBL lamp extinguished. Office alarm silenced.
19	Unblock ON relay.	
20	Manually release ON relay.	
21	Block ON relay operated.	
22	Unblock CT and DTA relays.	
23	Replace detector tubes 0 and 1	
I. TUR Scan and Sequence		
15	Block ON relay operated.	
16	Manually hold CT relay operated until CT1 relay operates. ***Note:*** Allow TUR to go through a warm-up cycle.	TUR ready to start scan cycle.
17	Connect a mechanical register equipped with a 185-type contact protection network between terminal 2B of EC1 relay and a -48 volt source.	
18	Record register reading.	
19	Connect another mechanical register equipped with a 185-type contact protection network between terminal 7T of MSC relay and a -48 volt source.	
20	Record register reading.	

STEP	ACTION	VERIFICATION
21	Connect another mechanical register equipped with a 185-type contact protection network between terminal 1T of LP relay and a -48 volt source.	
22	Record register reading.	
23	At EADAS traffic data converter— Place TUR in a detector test mode.	At TUR— DTA relay operated. ***CORRECTIVE ACTION*** Should DTA relay fail to operate— Check wiring of DTA relay. (Refer to sheet B-5, location F-1.)
24	Block CT relay operated.	TUR begins scanning.
25	While TUR is scanning— Observe operation of scan and register switches. Note any unusual operations.	DO-5 lamps lighted during scanning. At end of scan detector test, only even or odd tubes fire and corresponding lamps light. ***CORRECTIVE ACTION*** Replace detector tube and/or corresponding R_ relay. Check for defective lamp. CE and CO relays operate alternately. (May be 3 cycles before they begin.) ***CORRECTIVE ACTION*** Check associated wiring of CE and CO relay. (Refer to FS-15 of SD-95738-01.) Check A and B relays. (Refer to sheet B-1, location C-6.)
26	When TUR begins eighteenth cycle— After CT1 relay operates— Unblock CT relay.	
27	When TUR stops scanning— Record register readings.	
28	Using J94723A test set, connect B lead to -48 volt battery supply.	
29	Connect G lead to ground.	
30	Connect P lead to contact 2T of ADV relay.	
31	Record pulses per second (PPS) and percent break (%) of TUR PG pulser.	Limits: PPS = 6.8 - 7.2 % Break = 35 - 45%

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should limits be exceeded— Replace PG resistor and recheck pulser.
32	Remove all blocking tools.	
33	Calculate difference of before and after readings of registers. Reading of register connected to 2B of EC1 relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— —— Reading of register connected to 7T of MSC relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— ——	
34	Divide results of one by results of the other.	Quotient equals 660. (TUR has scanned correct number of crosspoints.) ***CORRECTIVE ACTION*** Should results be higher, TUR has repeated scanning of crosspoints. Should results be low, TUR has skipped contacts. In either case, relay contacts of steering and control relays should be cleaned.
35	Calculate difference of before and after readings of register connected to 1T of LP relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— ——	
36	Divide these results by results obtained from register connected to MSC relay.	Quotient equals 601. ***CORRECTIVE ACTION*** Should results be higher or lower, off normal contacts of crossbar switches should be readjusted and cleaned.
J. ASA Relay Test		
15	Block ASA relay nonoperated.	At master TUR— W and Z relays released. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
16	Unblock ASA relay.	

STEP	ACTION	VERIFICATION
17	Momentarily operate W relay.	ASA relay remains released. W relay locked operated. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
18	Momentarily operate Z relay.	ASA relay operated. Z relay locked operated. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
19	Manually release W relay.	ASA relay remains operated. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
20	Manually release Z relay.	ASA relay released. ***CORRECTIVE ACTION*** Check relay wiring. (Refer to sheet B-1.)
21	Remove all blocking tools.	
K. AS Relay Test		
15	Block ON relay operated.	
16	Ensure AS relay is in normal/released condition.	***CORRECTIVE ACTION*** Remove any blocking tools from AS relay. Should trouble of any type be encountered while testing AS relay and contacts, refer to sheet B-10, FS-18.
17	At first TUR of pair— Momentarily operate EC relay.	AS relay operated.
18	Manually release EC relay on first frame of pair.	AS relay remains operated.
19	Momentarily operate EC relay on second TUR frame of pair.	AS relay released.
20	Manually release EC relay on second frame of pair.	AS relay remains released.
21	Momentarily operate EC relay on first frame of pair.	AS relay operated.

STEP	ACTION	VERIFICATION
22	At both TURs— Block IS relays released.	AS relay released. ***CORRECTIVE ACTION*** Should AS relay fail to release— ZE option is in and should be removed and ZF option installed. (Refer to sheet B-6, location A-2.)

L. TUR Restoration and Detector Test

1	Remove all blocking tools from relays.	
2	Remove all jumper wires associated with LP relay.	
3	Disconnect all test equipment.	
4	Obtain release of EADAS TDC from personnel at EADAS CCU.	
5	At ETDC— Set A0-A3 switches to positions 0-0-0-0, respectively.	
6	Operate LT1 switch to LCL.	
7	Operate LT2 switch to LCL.	EADAS TDC removed from control of central control unit (CCU).
8	Set A0-A3 switches to positions 1-0-1-0, respectively. (Clear usage command.)	
9	Momentarily operate TST switch.	At 4A TUR— Verify ON, CT, DTA, and DTB relays released.
10	Wait 100 seconds— Set A0-A3 switches to 0-0-0-1, respectively. (Restore command.)	
11	Momentarily operate TST switch.	
12	Set A0-A3 switches to 1-1-0-0, respectively. (Detector test command.)	
13	Momentarily operate TST switch.	At 4A TUR— DT relay operated. When provided with an auxiliary scanner unit— DTB relay operated. When provided with more than one TUR

STEP	ACTION	VERIFICATION
		(option XM)— DTS relay also operates.
14	Set A0-A3 switches to 1-0-0-0, respectively. ▶(Power ON command.)◀	
15	Momentarily operate TST switch.	At 4A TUR— ON relay operated. Detector tubes begin to warm up.
16	Set A0-A3 switches to 0-1-0-0, respectively. ▶(TUR scan command.)◀	
17	Momentarily operate TST switch.	At 4A TUR— TUR does not scan ▶in warm-up cycle.◀
18	After approximately 2 minutes— Momentarily operate TST switch.	At 4A TUR— TUR starts scanning.

Single frame TUR 100-second scanning rate will complete one scan only and then stop. When there is more than one TUR, they will all scan together and stop. No further scanning will take place unless a second scan command is sent.

Note: Also applies to the dual scanning 7200 input ICUR TUR-A scan.

Single Frame 200-second "B" scanning rate will begin scanning after the A scan has been completed. No further scanning will take place unless a second scan command is sent.

Note: Also applies to the dual scanning 7200 input ICUR TUR-B scan.

Single frame TUR 200-second scanning rate will complete one scan then stop. If more than one TUR, all will scan together, then stop. If a second scan command is sent, no scanning will take place on any TUR frame. TUR frames are on alternate cycles in which no scanning takes place.

Single frame TUR 100-second scan with auxiliary scanner will scan one complete cycle and then stop. The auxiliary scanner will perform its detector test during the TURs detector test. The test will begin when crossbar switch 4 is reached and end when crossbar switch 5 is

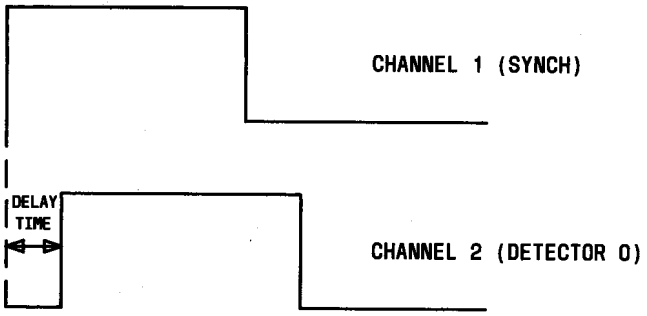
STEP	ACTION	VERIFICATION
		reached. If a second scan command is sent, the above sequence will repeat.
		Single frame TUR 200-second scan rate with auxiliary scanner will function as follows. The TUR will complete its scan and, upon completion, restart its control circuitry to drive the auxiliary scanner. When the TUR control circuits have reached crossbar switch level 4, the auxiliary scanner will perform its detector test and be complete when crossbar switch 5 is reached. At this time, the TUR will stop, and no further scanning will occur. A second scan command will restart the above sequence again.
		Paired frame TUR 200-second scan TUR 0 will scan first. Upon completing its scan, a path is completed through the "AS" and "DTS" relay contacts to the "CT" relay to restart the CS timer and TUR 1 scanning. When TUR 1 completes its scan, no further scanning will occur. A second scan command will repeat the above sequence again.
		Paired frame TUR 200-second scan with auxiliary scanner will function as follows. TUR 0 will scan first. Upon completing its scan, a path is completed through contacts of the "AS" and "DTS" relay to restart the "CT" relay and CS timer. This will cause TUR 1 to scan and the control circuitry of TUR 0 to also scan. This is to drive the auxiliary scanner so it can perform its detector test. When TUR 1 finishes, no further scanning will take place. A second scan command will repeat the above sequence.
19	Set A0-A3 switches to 1-0-1-0, respectively. ◗(Clear usage command.)◖	
20	Momentarily operate TST switch.	At 4A TUR— ON, CT, DTA, DTB relays released.
21	At 4A TUR— Set A0-A3 switches to 0-0-0-0, respectively.	
22	Operate LT2 switch to RMT.	
23	Operate LT1 switch to RMT.	EADAS TDC returned to CCU.

STEP	ACTION	VERIFICATION
M. Detector Check of Dual Scanning 7200 Input		
1	Obtain release of ETDC from personnel at EADAS CCU.	
2	At ETDC— ▶Set A0-A3 switches to 0-0-0-0, respectively.◀	
3	Operate LT1 switch to LCL.	
4	Operate LT2 switch to LCL.	ETDC removed from control of EADAS CCU.
5	At TUR— Connect jumper wires between the following LP relay contacts: **From** **To** 1B 2B 3B 4B 5B 6B 7B 8B 9B 10B 11B 12B	
6	Block operated LP1 relay.	
7	At EDTC— ▶Set A0-A3 switches to 1-0-1-0, respectively. (Clear usage command.)◀	
8	Momentarily operate TST key.	Clear usage command, TUR should be off.
9	Wait 100 seconds after Step 8, then set ▶A0-A3 switches to 0-0-0-1, respectively. (Restore command.)◀	
10	Momentarily operate TST key.	
11	▶Set A0-A3 switches to 1-1-0-0, respectively. (Detector test command.)◀	
12	Momentarily operate TST key.	TUR in detector test mode.
13	▶Set A0-A3 switches to 1-0-0-0, respectively. (TUR on command.)◀	
14	Momentarily operate TST key.	TUR ON relay operated.
15	▶Set A0-A3 switches to 0-1-0-0, respectively. (TUR scan command.)◀	TUR in warm-up cycle.

STEP	ACTION	VERIFICATION
16	Wait 100 seconds after Step 15— Momentarily operate TST key.	Observe that all 12 detector lamps fire when TUR steps to each crosspoint location. At end of scan—only even or odd lamps should light. (If trouble is encountered, see SD-95738-01.)
17	Remove all added jumper leads, and release all blocked relays.	
18	At ETDC— ▶Set A0-A3 switches to 1-0-1-0, respectively. (Clear usage command.)◀	
19	Momentarily operate TST key.	
20	▶Set A0-A3 switches to 0-0-0-0, respectively.◀	
21	Operate LT2 switch to RMT.	
22	Operate LT1 switch to RMT.	ETDC back in control of EADAS CCU.

N. EADAS ICUR Detector Timing Test

1	Obtain release of EADAS TDC from personnel at EADAS CCU.	
2	At ETDC— ▶Set A0-A3 switches to 0-0-0-0, respectively.◀	
3	Operate LT1 switch to LCL.	
4	Operate LT2 switch to LCL.	EADAS TDC removed from control of central control unit (CCU).
5	▶Set A0-A3 switches to 1-0-1-0, respectively. (Clear usage command.)◀	
6	Momentarily operate TST key.	At 4A TUR— Verify ON, CT, DTA, and DTB relays released.
7	In approximately 100 seconds after operating TST key— ▶Set A0-A3 switches to 0-0-0-1, respectively. (Restore command.)◀	
8	Momentarily operate TST key.	
9	▶Set A0-A3 switches to 1-1-0-0, respectively. (Detector test command.)◀	
10	Momentarily operate TST key.	TUR in detector test mode.

STEP	ACTION	VERIFICATION
11	◗Set A0-A3 switches to 1-0-0-0, respectively. (TUR on command.)◖	
12	Momentarily operate TST key.	TUR now turned on.
13	◗Set A0-A3 switches to 0-1-0-0, respectively. (TUR scan command.)◖	
14	Momentarily operate TST key.	TUR in warm-up cycle; wait 100 seconds.
15	Using a dual-trace oscilloscope, connect channel 1 to ICUR sync lead of TUR being checked.	
16	Arrange oscilloscope to trigger on channel 1 and display both channels.	
17	Connect channel 2 to ICUR detector 0 lead output.	
18	Momentarily operate TST key.	TUR starts to scan.
19	With TUR scanning in a detector test mode—Adjust oscilloscope for a steady waveform as follows: 	
20	Connect channel 2 to each detector output lead. The specified time delay which should exist between the sync pulse and each detector is shown below:	

Detector	Time Delay ±1 ms
◗0 or 0'	10 ms
1 or 1'	11.5 ms
2 or 2'	13 ms
3 or 3'	17 ms
4 or 4'	18.5 ms
5 or 5'◖	20 ms

STEP	ACTION	VERIFICATION
	Note: Detector 5 should not exceed 21 ms.	
21a	If TUR stops scanning before completing test, reoperate TST key.	
22	After completing check— Operate A1 key to position 0.	
23	⧫Set A0-A3 switches to 1-0-1-0, respectively. (Clear usage command.)⧫	
24	Momentarily operate TST key.	TUR ON relay released.
25	At ETDC— ⧫Set A0-A3 switches to 0-0-0-0, respectively.⧫	
26	Operate LT2 key to RMT.	
27	Operate LT1 key to RMT.	ETDC returned to CCU control.

6. 4A TUR PERFORMANCE TESTS FOR FADS APPLICATION

STEP	ACTION	VERIFICATION
O. TUR Turn-On and Warm-Up Cycle		
5	At master TUR frame— Block ON relay operated.	IS and DC relays operated. ***CORRECTIVE ACTION*** Should IS and DC relays not operate— Cease testing until problem is corrected. (Refer to sheet B-2, location G-3 and B-9 for relay location.) CT relay nonoperated. ***CORRECTIVE ACTION*** Should CT relay be operated— Verify that 1B and 2B of STP relay are insulated. Verify wiring of CT relay. (Refer to sheet B-1, location C-2.)
6	Manually hold CT relay operated until CT1 relay operates.	In approximately 6 seconds— CT1 relay operated. CT relay locked operated for 94 seconds and then released. In approximately 100 seconds after operating CT relay— CT3 relay operated.

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should CT1 relay fail to operate in approximately 6 seconds— Check CS timer and CTC relay for wiring problems. Check CS timer for defective Micro Switch. (Refer to sheet B-1, location E-7 and D-2.)
7	Block ADV relay operated.	
8	Using J94723A test set, connect B lead to -48 volt battery supply.	
9	Connect G lead to ground.	
10	Connect P lead to contact 2T of ADV relay.	
11	Manually hold CT relay operated until CT1 relay operates.	
12	Record pulses per second (PPS) and percent break (%) of TUR PG pulser.	Limits: PPS = 6.8 - 7.2 % Break = 35 - 45% ***CORRECTIVE ACTION*** Should PPS reading be out of limit, either high or low, remove or add strap or straps on RJ resistor to bring PG pulser back into specification. (Refer to sheet B-3A, location C-1.) Should percent break be out of limits, replace PG pulser.
13	Disconnect J94723A test set.	
14	Unblock ADV relay.	
15	Momentarily release ON relay.	ON relay reoperated.
16	Manually hold CT relay operated until CT1 relay operates.	When TUR finishes warm-up cycle— CT3 relay operated. CT relay released.
17	Manually hold CT relay operated until CT1 relay locks operated.	
18	Block SS8 relay nonoperated.	
19	When CT relay releases— Momentarily operate MSC relay.	TBL relay operated. Central office alarm activated.

STEP	ACTION	VERIFICATION
20	Momentarily operate AR key.	AR relay operated. TBL relay released. Central office alarm silenced. An ARG lamp lighted. ***CORRECTIVE ACTION*** Should any verification not be obtained— Check wiring of TBL relay. (Refer to sheet B-3A, location F-H, 0-3.) ***Note:*** ZF option should be used and recommended. ZE option is rated Mfr Disc.
21	Block XT relay operated.	XT1, XT2, XTT1, XTT2 relays operated. End of scan detector test performed.
22	Block TBL relay nonoperated.	
23	Block DTA relay operated.	
24	Manually hold AR relay released.	All detector tubes operated. D (0-5) lamps lighted.
25	Unblock TBL relay.	Alarm sounded.
26	Operate AR key.	TBL relay released. XV relay already operated. XV lamp lighted. Alarm silenced. ***CORRECTIVE ACTION*** Should any verification not be obtained— Check wiring of XV relay. (Refer to sheet B-9, location F-3.)
27	Unblock SS8, XT, and DTA relays.	
28	Manually release ON relay.	

P. Detector Failure Circuits and Alarms

5	At TUR being tested— Remove detector tubes 0 and 1.	
6	Block ON relay operated.	
7	Block CT and DTA relays operated.	In approximately 200 seconds— TBL lamp lighted. DF lamp lighted. Office alarm activated.

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should no alarm be present 200 seconds after start— Check wiring of RO-5 relays. (Refer to sheet B-9.) Check for proper options of TUR setup. (ZF option and Apparatus Figure 48 are preferred). Check wiring of DOK relay. (Refer to FS-16 and associated wiring on sheet B-3A, location E-2.)
		TBL lamp extinguished. Office alarm silenced.
8	Unblock ON relay.	
9	Manually release ON relay.	
10	Block ON relay operated.	
11	Unblock CT and DTA relays.	
12	Replace detector tubes 0 and 1.	
Q. TUR Scan and Sequence		
5	Block ON relay operated.	
6	Manually hold CT relay operated until CT1 relay operates. ***Note:*** Allow TUR to go through a warm-up cycle.	TUR ready to begin scan cycle.
7	Connect a mechanical register equipped with a 185-type contact protection network between terminal 2B of EC1 relay and a -48 volt source.	
8	Record register reading.	
9	Connect another mechanical register equipped with a 185-type contact protection network between terminal 7T of MSC relay and a -48 volt source.	
10	Record register reading.	
11	Connect a jumper wire between 1T of XT relay and ground.	DTA relay operated. TUR in detector test mode.

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should DTA relay fail to operate, check DTA wiring. (Refer to sheet B-5, location F-3.)
12	Block CT relay operated.	TUR begins scanning. ***CORRECTIVE ACTION*** Refer to Section 252-122-501.
13	While TUR is scanning— Observe operation of scan and register switches. Note any unusual operations.	D (0-5) lamps lighted during scanning. At end of scan detector test, only even or odd tubes fire and corresponding lamps light. ***CORRECTIVE ACTION*** Replace detector tube and/or corresponding R- relay. Check for defective lamp. CE and CO relays operate alternately. (May be 3 cycles before they begin.) ***CORRECTIVE ACTION*** Check associated wiring of CE and CO relay. (Refer to FS-15 of SD-95738-01.) Check A and B relays. (Refer to sheet B-1, location C-6.)
14	When TUR begins eighteenth cycle— After CT1 relay operates— Unblock CT relay.	At end of scan interval— EC, EC1 relays operated. XT, XT1, XTT1, XTT2, and DOK relays operated. ***CORRECTIVE ACTION*** Refer to appropriate sequence charts of SD-95738-01. Refer to CD-95738-01. Refer to Section 252-122-501.
15	When TUR stops scanning— Record register readings.	
16	Using J94723A test set, connect B lead to -48 volt battery supply.	
17	Connect G lead to ground.	
18	Connect P lead to contact 2T of ADV relay.	
19	Record pulses per second (PPS) and percent break (%) of TUR PG pulser.	Limits: PPS = 6.8 - 7.2 % Break = 35 - 45%.

STEP	ACTION	VERIFICATION
		CORRECTIVE ACTION Should limits be exceeded— Replace PG resistor and recheck pulser.
20	Remove all blocking tools.	
21	Calculate difference of before and after readings of registers. Reading of register connected to 2B of EC1 relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— —— Reading of register connected to 7T of MSC relay. BEFORE TEST AFTER TEST DIFFERENCE —— —— ——	
22	Divide results of one by results of the other.	Quotient equals 660. (TUR has scanned correct number of crosspoints.) ***CORRECTIVE ACTION*** Should results be higher, TUR has repeated scanning of crosspoints. Should results be low, TUR has skipped one or more crosspoints. In either case, relay contacts of steering and control relays should be cleaned.

R. TUR Restoration and Detector Test

1	Remove all blocking tools from relays.	
2	Remove all jumper wires associated with LP relay.	
3	Remove jumper wire from XT relay.	
4	Disconnect all test equipment.	TUR operating normally.
	Note: CT relay should be operated for 98 seconds and released for 2 seconds. Should this fail to happen, check controlling circuit for proper hookup to TUR via YV option.	

7. MISCELLANEOUS

STEP	ACTION	VERIFICATION
S.	**Switchwear Inspection Test**	
1	Make proper arrangements to have TUR cease scanning.	
2	Examine switches on basis of requirements in Section 030-720-701 to determine if any are beyond listed wear limits or in need of adjustment. ***Exception:*** Test limit for crosspoint front contact make shall be .008" instead of .016".	
3a	If excessive wear is determined, particularly in crosspoint contact make or any items found in need of adjustment— Readjust switches to readjust limits or conditions defined in Section 030-720-701.	
4b	If any part replacement is necessary— Follow appropriate procedures outlined in Section 030-720-801.	

TABLE A

COMMON TROUBLES WITH ICUR	
TROUBLE DESCRIPTION	**ITEMS TO CHECK**
Dropping vertical 9 (last crosspoint on TUR) at end of scan.	• Check for proper sequence of EC and EC1 relays. The EC relay will operate when stepping onto the last crosspoint and EC1 when stepping off the last crosspoint. • The release sequence of the SC and SC1 relays. Both relays should release at same time.
Detector states incorrect or missing data.	• Check timing sequence of detectors. The last detector (DET5) should not exceed 21ms delay in reference to the ICUR SYNC. • Defective detector tube and/or R relay. • Improper operation of the GA or GB relays or excessive time delay of these relays. • A defective PLC relay.
TUR repeats crossbar switch 5 at end of scan.	• Check CS timer. Should be a L-3 98-second timer. • The PG pulser may be out of timing-readjust. • Improper sequencing of EC, EC1, SC, and SC1 relays which prevent the TUR from stopping. When the last crosspoint is reached, relay EC will operate, and when stepping off the last crosspoint, the EC1 relay will operate. At this time, the end of scan test is begun, and both the SC and SC1 relays are released.
TUR shifts vertical or horizontal positions.	• Clean contacts of control circuitry.
TUR always in detector test mode.	• Check if YJ option has been removed. • If TUR control box is provided, the AUTO/MAN key should be in the center OFF position. • Possible trouble in ETDC.
TUR keeps scanning.	• Check if YJ option has been removed.

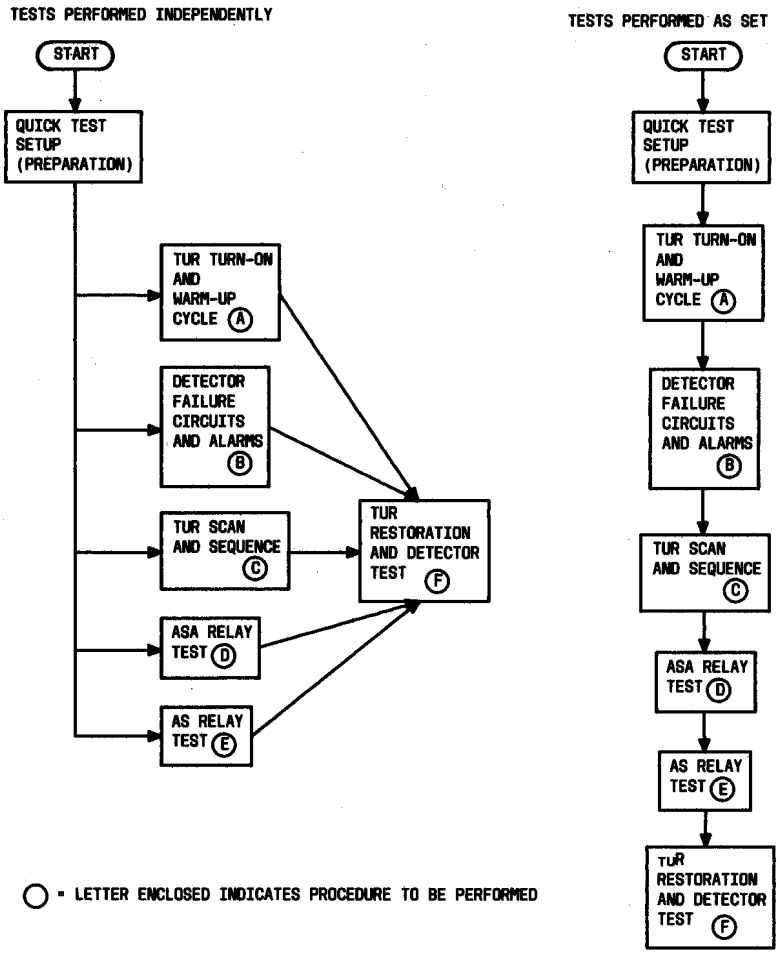


Fig. 1—4A TUR Performance Test Sequence for General Application

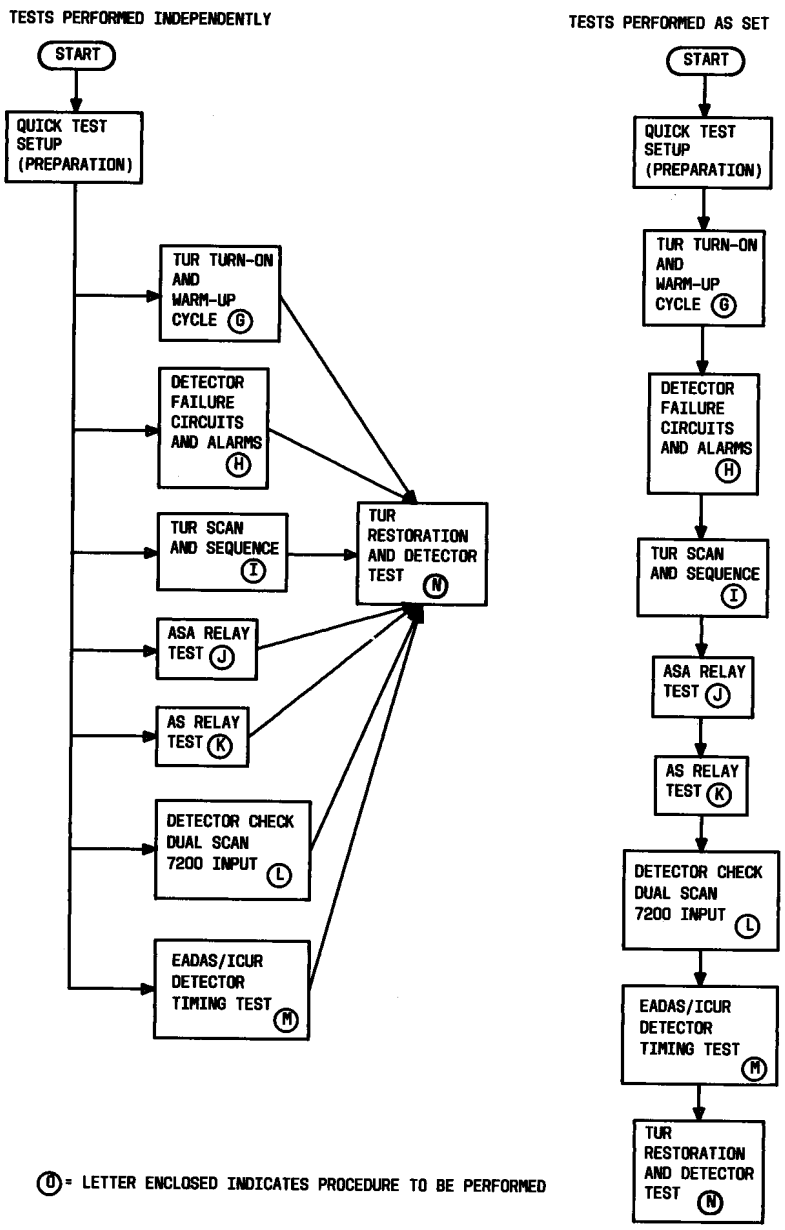


Fig. 2—4A TUR Performance Test Sequence for EADAS ICUR Application

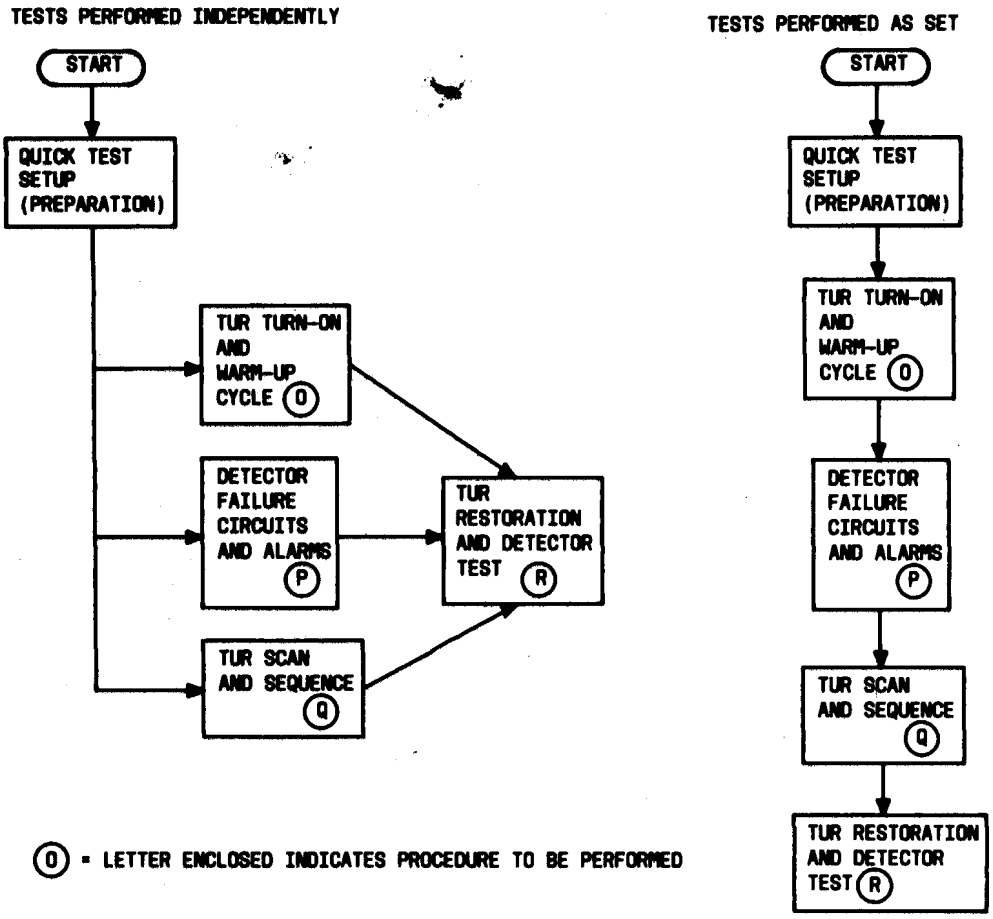


Fig. 3—4A TUR Performance Test Sequence for FADS Application