TYPE N1 CARRIER SYSTEMS
ORDER-WIRE AND ALARM FACILITIES
LINE-UP AND MAINTENANCE

CONTENTS PAGE

1. GENERAL

1.01 This section provides line-up and maintenance procedures for the N1 order-wire and alarm facilities.

1.02 The N1 order-wire facilities are provided primarily to enable maintenance personnel to communicate with the route control center. The facilities are required for initial line-up and maintenance of the carrier systems during the routine checks of the repeater points, and for restoration work in the event of a system failure.

1.03 The alarm system provides a separate continuous alarm tone from each power supply point. The tones are identified at the receiving location, and any interruption of the alarm tone indicates an alarm condition.

1.04 Refer to section 362-010-150 for detailed circuit and equipment description and drawing references.

1.05 The tests and adjustments included in this section are basically the line-up procedures for the order-wire and alarm equipment. They may be used in routine maintenance and may be helpful in isolating trouble conditions that might occur. Part 2 pertains to the alarm circuit and Part 3 pertains to the order-wire circuit.

1.06 The following test equipment is required to perform the tests and adjustments of this section; however, not all the equipment is required at every test point. The test to be performed at a particular location determines the test equipment that is required at that location.

1 — 21A Transmission Measuring Set (TMS)

1 — Hewlett-Packard 400-type Vacuum Tube Voltmeter or equivalent (VTVM)

1 — 72A Frequency Meter

1 — 35-Type Test Set

1 — 2D Singing Point Test Set

1 — 84A Test Set

1 — 52-Type Headset

1 — Whistle P499093 (1900⌣) or 1A (1000⌣) as required

1 — 3P17B Cord (Use with the 21A TMS and the 72A frequency meter.)

1 — W2DW Cord with Hubbell 709529 (red) and 708529 (black) alligator clips. (Used with the 400-type VTVM.)

2 — 2W24A Cords

1 — 2P13A Cord

1 — 258-Type Plug

4 — 262B Plugs

2 — 360C Plugs

2. ALARM LINE-UP TESTS AND ADJUSTMENTS

2.01 Basically, an overall alarm line-up should begin at the far alarm oscillator and proceed toward the alarm receiving location. Typical alarm layouts and the suggested sequence of tests for each are shown in Fig. 1 through 7. These layouts and the circuit layout card may be used to determine the alarm circuit layout and the tests that are required. These layouts also define the far oscillator under various conditions.

A. J98704A Alarm Oscillator Frequency Check

Note: This test is optional and need only be made if trouble in the oscillator is suspected.

STEP	PROCEDURE
1	Connect the frequency meter to the oscillator OUT jack.
2	Adjust oscillator FREQ control until the frequency requirement for the oscillator under test is met. ***Requirement:*** **J98704A List** — **Nominal Frequency (cps)** 1 — 700±6 2 — 1100±8 3 — 1500±8 4 — 1900±8 5 — 900±8 6 — 1300±8 7 — 1700±8 8 — 2100±8
3	Remove the test connections.

B. J98704A Alarm Oscillator Maximum Output Check and Feedback Adjustment

STEP	PROCEDURE
1	Connect the TMS to the OUT jack of the oscillator under test.
2	Turn the LEVEL control of the oscillator under test to its maximum clockwise position.
3	Turn the OUT control of the oscillator under test to its maximum clockwise position.
4	Observe the oscillator output on the TMS. ***Requirement:*** +14 ±2 dbm ***Note:*** If the requirement cannot be met, replace the 407A tube.
5	Turn the LEVEL control of the oscillator under test counterclockwise until a reading of +6.0 dbm is obtained. ***Note:*** This requirement may be increased to +10 dbm at the expense of increased harmonic output if required to meet the oscillator output requirement per the circuit layout card or per the following alarm line-up tests.
6	Remove the test connections.

C. J98704A Alarm Oscillator Output Adjustment

Note 1: The purpose of this test is to adjust the alarm oscillator outputs to compensate for loss differences due to their locations.

Note 2: Test C is divided into four parts (C1, C2, C3, and C4) to cover various alarm circuit arrangements in which the oscillator is used (Fig. 1 through 7).

Note 3: Test B should be completed before starting this test.

C1. Far Alarm Oscillator Adjustment

Note: This test applies to the oscillator farthest from the alarm receiving location when VF amplifiers are used in the alarm circuit.

STEP	PROCEDURE
1	Connect the TMS to the OUT jack of the oscillator under test.
2	Measure the output level of the oscillator. ***Requirement:*** See circuit layout card for output level.
3	If necessary, adjust the OUT control of the oscillator under test to meet the requirement.
4	Remove the test connections.

C2. Intermediate Alarm Oscillator Adjustment

Note: The oscillator to be adjusted in this test is intermediate between the farthest oscillator and the alarm receiving location.

STEP	PROCEDURE
1	Connect the VTVM across the alarm pair at the intermediate location. ***Note:*** Connection to the alarm pair can be made at the cable terminals, at the MDF, or at the punchings on the J98704E panels. In alarm circuit layouts involving spur cables, the test set must be connected to the alarm pair at a location common to the alarm tones from both main and spur cables.
2	Disable all oscillators on the alarm pair, except the far oscillator, by blocking the K1 relay at each location nonoperated.
3	Record the level of the alarm tone as received from the far oscillator.
4	Release the K1 relay of the intermediate oscillator under test and block the far oscillator K1 relay nonoperated.
5	Adjust the OUT control of the intermediate oscillator until its level on the VTVM equals that recorded for the far oscillator.
6	Release the oscillator K1 relays.
7	Remove the test connections.

C3. Intermediate Alarm Oscillator Adjustment — Output Toward Balance Hybrid

Note 1: The oscillator to be adjusted in this test is interconnected to the alarm circuit by means of an adjustable resistance hybrid.

Note 2: Tests D and E must be completed before proceeding with this test.

STEP	PROCEDURE
1	Connect the TMS to the EQ OUT jack of the J98704E panel on which the final V3 amplifier stage appears.
2	Disable all oscillators on the alarm pair, except the far oscillator, by blocking the K1 relay of each nonoperated.
3	Record the level of the alarm tone as received from the far oscillator.
4	Release the K1 relay of the intermediate oscillator under test.
5	Block the far oscillator relay (K1) nonoperated.

STEP	PROCEDURE
6	Adjust the OUT control of the intermediate oscillator until the reading on the TMS equals that recorded for the far oscillator in Step 3. ***Note:*** In those cases where the oscillator output is not great enough to make this adjustment, an arbitrary setting will have to be made; and the final equalizing will have to be completed in accordance with Test E Step 2b.
7	Release the K1 oscillator relays.
8	Remove the test connections.

C4. Far Alarm Oscillator Adjustment — No VF Amplifiers on the Alarm Circuit

Note: The purpose of this test is to adjust a far oscillator in an alarm circuit which contains no VF amplifiers at any location.

STEP	PROCEDURE
1	Connect the TMS to the EQ OUT jack at the alarm receiving station.
2	Disable all oscillators on the alarm pair, except the far oscillator, by blocking the K1 relay at each location nonoperated.
3	Adjust the OUT control of the far oscillator at the alarm sending location until a −10 dbm reading is obtained on the TMS at the alarm receiving location.
4	Release the K1 oscillator relays.
5	Remove the test connection.

D. J68651Z Alarm Equalizer Adjustment

STEP	PROCEDURE
1	Connect the VTVM to terminal strip punchings 3 and 4 of the J68651Z panel. ***Note:*** Arrangements that include an associated V3 amplifier may be adjusted with the TMS at the EQ OUT jack of the J98704E panel.
2	Disable all alarm tones, except the one to be measured, by blocking the K1 relay at each location nonoperated.
3	Measure the level of the incoming alarm tone and repeat Step 2 until the level of each tone has been measured.

STEP	PROCEDURE
4	Restrap equalizer, as necessary, to meet requirement. ***Requirement:*** The difference between maximum and minimum levels of the alarm tones should not exceed 1 db. ***Note:*** If necessary, a less critical requirement may be tolerated as long as the level difference does not cause either of the following failures: (a) Failure of any alarm tone to operate its corresponding alarm receiver. (b) Failure of an alarm receiver to release during an alarm condition, because of excessive input power from an alarm tone of adjacent frequency.
5	Release the K1 oscillator relays.
6	Remove the test connections.

E. Alarm Balance Hybrid Adjustment

Note: Adjustments covered by test D must be completed before this adjustment is made.

STEP	PROCEDURE
1	Connect the VTVM to punchings 13 and 14 of the J98704E panel on which the balance hybrid is located. ***Note:*** All alarm tones, except the one to be measured, must be removed from the circuit. Disable and reconnect alarm oscillators, as may be necessary, to make this test.
2	Make the following applicable adjustment: (a) If one of the incoming branches originates in a local oscillator, adjust the BAL control for midposition (6 db in each path). (b) In all other cases, adjust the BAL control until the individual tone levels of each branch are equal at the output of the balance hybrid.
3	Release K1 relays used to disable alarm oscillators.
4	Remove the test connections.

F. VF Alarm Amplifier Output Adjustment

Note 1: Test F is divided into four parts (F1, F2, F3, and F4) to cover various alarm circuit arrangements in which the VF amplifier is used.

Note 2: All alarm tones in the alarm section preceding the VF amplifier must be equalized in accordance with applicable portions of tests C, D, and E.

F1. Alarm Output Toward Alarm Receive Circuit

Note: The output of the VF amplifier in this test feeds directly into one or more J98704B receive panels.

STEP	PROCEDURE
1	Connect the TMS to the AMP OUT jack associated with the VF amplifier under test. ***Note:*** All alarm tones, except the one to be measured, must be removed from the circuit. Disable and reconnect alarm oscillators, as may be necessary, to make this test.
2	Measure the level of a single alarm tone. ***Note:*** Any alarm tone may be used in this adjustment as long as all alarm tones of previous tests do not vary more than 1 db. If the alarm tones vary more than 1 db, the one of highest level, if known, should be used for this adjustment. If the highest level is not known or if it is not known whether or not the levels vary more than 1 db, measure each incoming alarm tone; and use the one of highest level.
3	Adjust the VF amplifier GAIN control until the alarm tone measured in Step 2 equals −10 dbm.
4	Release K1 relays used to disable alarm oscillators.
5	Remove the test connection.

F2. Alarm Output Toward Line with Additional Amplifiers

Note: The output of the VF amplifier in this test is toward the line and an alarm section in which there are one or more additional VF amplifiers.

STEP	PROCEDURE
1	Connect the TMS to the AMP OUT jack associated with the VF amplifier under test. ***Note:*** All alarm tones, except the one to be measured, must be removed from the circuit. Disable and reconnect alarm oscillators, as may be necessary, to make this test.
2	Measure the level of a single alarm tone. ***Note:*** Any alarm tone may be used in this adjustment as long as all alarm tones of previous tests do not vary more than 1 db. If the alarm tones vary more than 1 db, the one of highest level, if known, should be used for this adjustment. If the highest level is not known or if it is not known whether or not the levels vary more than 1 db, measure each incoming alarm tone; and use the one of highest level.

STEP	PROCEDURE
3	Adjust the VF amplifier GAIN control until the alarm tone measured in Step 2 equals the value specified on the circuit layout card.
4	Release K1 relays used to disable alarm oscillators.
5	Remove the test connection.

F3. Alarm Output Toward Line with No Additional Amplifiers

Note: The output of the VF amplifier in this test is toward the line where there are no additional amplifiers. The output terminates in a nonamplified alarm receive circuit.

STEP	PROCEDURE
1	At the alarm receive location, connect a TMS to the EQ OUT jack on the J98704E panel associated with the nonamplified alarm receive circuit. ***Note:*** All alarm tones, except the one to be measured, must be removed from the circuit. Disable and reconnect alarm oscillators, as may be necessary, to make this test.
2	Measure the level of a single alarm tone at the alarm receiving location. ***Note:*** Any alarm tone may be used in this adjustment as long as all alarm tones of previous tests do not vary more than 1 db. If the alarm tones vary more than 1 db, the one of highest value, if known, should be used for this adjustment. If the highest level is not known or if it is not known whether or not the levels vary more than 1 db, measure each incoming alarm tone; and use the one of highest level.
3	Adjust the VF amplifier GAIN control until the alarm tone measured in Step 2 equals −10 dbm.
4	Release the K1 relays used to disable alarm oscillators.
5	Remove the test connection.

F4. VF Alarm Amplifier Output Toward Balance Hybrid

STEP	PROCEDURE
1	Connect the TMS to the AMP OUT jack associated with the VF amplifier under test. ***Note:*** All alarm tones, except the one to be measured, must be removed from the circuit. Disable and reconnect alarm oscillators, as may be necessary, to make this test.

STEP	PROCEDURE
2	Measure the level of a single alarm tone. ***Note:*** Any alarm tone may be used in this adjustment as long as all alarm tones of the previous test do not vary more than 1 db. If the alarm tones vary more than 1 db, the one of highest value, if known, should be used for this adjustment. If the highest level is not known or if it is not known whether or not the levels vary more than 1 db, measure each incoming alarm tone; and use the one of highest level.
3	Adjust the VF amplifier GAIN control until the alarm tone measured in Step 2 equals −10 dbm.
4	Release the K1 relays used to disable the alarm oscillators.
5	Remove the test connection.

G. J98704B Alarm Receiver Sensitivity Adjustment

STEP	PROCEDURE
1	Connect the OSC OUT of the TMS to the ALM IN or EQ IN jack of the associated J98704E panel. ***Note:*** The front view of the J98704E panel and the position of the ALM IN or EQ IN jack will vary, depending upon the alarm arrangement on which it appears.
2	Connect the 35-type test set to the RC jack of the J98704B receiver panel under test and arrange the test set controls for use as a milliammeter.
3	Adjust the FREQ controls of the TMS to the nominal frequency of the panel under test. ***Note:*** The J98704B panel frequencies are:

List	Frequency (cps)
1	700
2	1100
3	1500
4	1900
5	900
6	1300
7	1700
8	2100

STEP	PROCEDURE
4	Adjust the oscillator output to −15 dbm.
5	Fine tune the oscillator for a peak indication on the milliammeter.
6	Adjust the SENS control to meet the following requirements. ***Requirements:*** (a) 13 ±0.4 ma. (b) L1 pilot lamp lights. ***Note:*** In arrangements without a VF amplifier and the input level of individual alarm tones is less than −15 dbm, it may be necessary to adjust the receiver sensitivity using the actual alarm tone rather than the test oscillator. If 4.5 db more sensitivity is required than can be provided by the SENS control, resistor R4 can be strapped out at the expense of a reduction in feedback voltage. Therefore, adjacent alarm tones should be checked to make certain that they do not operate alarm receivers that have been made more sensitive.
7	Remove the test connections.

H. J98704B Alarm Receiver Filter Performance Check

Note: This test is optional and need only be made if trouble is suspected in the unit.

STEP	PROCEDURE
1	Connect the OSC OUT of the TMS to the ALM IN or EQ IN jacks on the associated J98704E panel. ***Note:*** The front view of the J98704E panel and the position of the ALM IN or EQ IN jack will vary depending upon the alarm arrangement on which it appears.
2	Adjust the oscillator output to −15 dbm.
3	Sweep the FREQ control of the TMS over a range from 100 to 3000 cps. ***Requirement:*** The L1 pilot lamp of the J98704B panel under test lights only in a range that is ±80 cps from the nominal value of the receiver filter.

STEP	PROCEDURE
3 (Cont)	***Note 1:*** The nominal values of the J98704B filters are:

List	Frequency (cps)	Filter
1	700	200E
2	1100	200G
3	1500	200J
4	1900	200L
5	900	200F
6	1300	200H
7	1700	200K
8	2100	200M

Note 2: The L1 pilot lamp on parallel receiver panels will light and go out as the oscillator frequency sweeps past their nominal frequencies.

Note 3: Failure to meet the above requirements indicates a defective filter.

4	Remove the test connections.

I. J98704C Alarm Delay Panel Timing Check

STEP	PROCEDURE
1	Place a 258-type plug in the RC jack on any associated J98704B alarm receive panel. ***Requirement:*** The following events should take place 5 seconds after the RC jack is opened. (a) The K4 relay on the J98704C delay panel operates. (b) The ALM pilot lamp on the J98704C delay panel lights. (c) The audible alarm sounds.
2	Remove the 258-type plug.

J. Alarm Operation Test

Note 1: All alarm oscillators must be transmitting and the pilot lamps on all the J98704B alarm receiving panels must be lighted before this test is performed.

Note 2: Conduct this test for each remote alarm location.

STEP	PROCEDURE
1	At the remote location, initiate an alarm condition by blocking the K1 oscillator relay non-operated or by inserting a 258-type plug in the OSC OUT jack.
2	At the alarm receiving location, check to see that the following requirements are met. ***Requirements:*** (a) PILOT lamp extinguishes on correct J98704B alarm receiving panel. (b) The audible alarm sounds.
3	Operate the ALM CO key on the same alarm receiving panel. ***Requirement:*** Audible alarm is silenced.
4	Clear the alarm condition initiated in Step 1.
5	At the alarm receiving location the following requirements must be met. ***Requirements:*** (a) The PILOT lamp relights. (b) The audible alarm again sounds.
6	Silence the audible alarm by restoring the ALM CO key.

3. ORDER-WIRE LINE-UP TESTS AND ADJUSTMENTS

3.01 The N1 order-wire transmission line-up tests are divided into three parts: (1) Singing point tests and adjustments; (2) Transmission level, net loss, and repeater tests and adjustments; (3) Signaling tests and adjustments.

3.02 Figure 8 may be used to help determine which tests are applicable for the order-wire equipment at a particular location. It lists the order-wire equipment by part number and indicates the test to be performed for each part.

3.03 Singing point tests are covered in detail in Section 332-015-500. However, additional instructions and clarification in application of the section to order-wire equipment are covered in these tests. These tests are based on the procedures of method 1, Chart 3C, of Section 332-015-500.

3.04 Singing point tests and adjustments must be made and recorded for future reference on order-wire equipment panels J98704J, J98704H, and J98704M. In order to perform these tests, the distant end of the repeater section to be tested must be terminated. Order-wire equipment panels which may be found at the distant end of a repeater section and information on how to terminate them are listed in (a) through (e).

(a) J98704F — No special termination is required, since normal idle-line termination is provided by the B relay as long as nothing is inserted into the TEL SET jacks.

(b) J98704H — Either block the SW relay non-operated and insert a 52-type headset into the TEL SET jacks or insert 360C plugs in place of the V3 amplifiers.

(c) J98704J — Insert 262B plugs into the L EQ IN and L EQ OUT jacks toward the cable section under test. At the same time terminate the associated BRDG IN and BRDG OUT jacks with 262B plugs to prevent singing in the repeater in the other direction.

(d) J98704M — Remove the two V3 amplifiers from the line (L1, L2, or L3) to be terminated, and replace them with 360C plugs.

(e) The J98704D, F, G, and L equipment panels are intermediate order-wire arrangements and cannot be used to provide a termination for singing point tests.

A. J98704J Intermediate Order-Wire Repeater — Singing Point Test and Adjustment

STEP	PROCEDURE
1	Terminate the distant end of the repeater section to be tested by one of the methods outlined in 3.04. ***Note:*** The method of termination is dependent upon the type of order-wire equipment at the distant end of the repeater section.
2	If the test is toward a West cable section, connect from the 2D singing point test set IN and OUT jacks to the repeater panel WE L EQ OUT and EW L EQ IN jacks respectively. If the test is toward an East cable section, connect from the 2D singing point test set IN and OUT jacks to the repeater panel EW L EQ OUT and WE L EQ IN jacks respectively.
3	Operate the test set FILTER key to OUT.
4	Operate the test set POLING key to NORMAL.
5	Connect a 52-type headset to the MON jack of the test set.
6	Monitor with headset and increase GAIN dials until, by increasing a single db, sustained singing begins. Record the sum of the two GAIN dial settings.
7	Operate the test set POLING key to REVERSED.
8	Monitor with the headset and increase GAIN dials until, by increasing a single db, sustained singing begins. Record the sum of the two GAIN dial settings.
9	Compute the singing point as follows: (a) From the lower value of Step 6 or Step 8, subtract the sum of the input and output hybrid coil losses per the circuit layout card. (b) From the value obtained in (a), subtract the sum of the TRSG and REC pads in the line being tested.
10	Adjust the appropriate network WE or EW corresponding to the direction of the line under test to obtain optimum singing point and repeat Steps 1 through 8.
11	Remove the test connections from the repeater panel.

B. J98704H Terminal Order-Wire Repeater — Singing Point Test and Adjustment

STEP	PROCEDURE
1	Terminate the distant end of the repeater section to be tested by one of the methods outlined in 3.04. ***Note:*** The method of termination is dependent upon the type of order-wire equipment at the distant end of the repeater section.
2	Remove both V3 amplifiers from their sockets.
3	With a 2W24A cord, connect from the IN jack of the 2D singing point test set to pins 1 and 2 at the rear of the V3 REC socket. With another 2W24A cord, connect from the OUT jack of the test set to pins 3 and 4 at the rear of the V3 TRSG socket.
4	Operate the test set FILTER key to OUT.
5	Operate the test set POLING key to NORMAL.
6	Connect a 52-type headset to the MON jack of the test set.
7	Monitor with the headset and increase the test set GAIN dials until, by increasing a single db, sustained singing begins. Record the sum of the two GAIN dial settings.
8	Operate the test set POLING key to REVERSED.
9	Monitor with the headset and increase the test set GAIN dials until, by increasing a single db, sustained singing begins. Record the sum of the two GAIN dial settings.
10	Compute the singing point by subtracting the sum of the input and output hybrid coil losses per the circuit layout card from the lower value of Step 7 or Step 9.
11	Adjust the network to obtain optimum singing point, and repeat Steps 1 through 10.
12	Remove test connections from the repeater panel, and restore V3 amplifiers to their sockets.

C. J98704M Intermediate Order-Wire Repeater for Branching Point — Singing Point Test and Adjustment

Note: This test should be performed on each line common to the J98704M panel.

STEP	PROCEDURE
1	Terminate the distant end of the repeater section to be tested by one of the methods outlined in 3.04. ***Note:*** The method of termination is dependent upon the type of order-wire equipment at the distant end of the repeater section.
2	Remove the two V3 amplifiers from their sockets for the line under test.

STEP	PROCEDURE
3	With a 2W24A cord, connect from the 2D singing point test set IN jack to pins 1 and 2 at the rear of the V3 REC socket of the line under test. With another 2W24A cord, connect from the test set OUT jack to pins 3 and 4 at the rear of the V3 TRSG socket for the line under test.
4	Operate the test set FILTER key to OUT.
5	Operate the test set POLING key to NORMAL.
6	Connect a 52-type headset to the MON jack of the test set.
7	Monitor with the headset and increase the test set GAIN dials until, by increasing a single db, sustained singing begins. Record the sum of the two GAIN dial settings.
8	Operate the test set POLING key to REVERSED.
9	Monitor with the headset and increase the test set GAIN dials until, by increasing a single db, sustained singing begins. Record the sum of the two GAIN dial settings.
10	Compute the singing point by subtracting the sum of the input and output hybrid coil losses per the circuit layout card from the lower value of Step 7 or Step 9.
11	Adjust the network for the line under test to obtain optimum singing point, and repeat Steps 1 through 10.
12	Remove test connections from the repeater panel, and restore V3 amplifiers to their sockets.

TRANSMISSION LEVEL, NET LOSS, AND REPEATER ADJUSTMENTS

3.05 Transmission level and net loss requirements on the N1 order wire are covered in the following tests. The requirements plus all test set connections and repeater adjustments necessary are given for each order-wire panel arrangement.

3.06 If repeatered equipment (J98704H, J, or M) is used in the order-wire section under test, start tests at one terminal and proceed with tests in the direction of transmission to the other terminal in accordance with the applicable test for the equipment at a particular location. Make sure that all preceding repeaters have been adjusted before proceeding with an adjustment. When all tests in one direction of transmission (WE or EW) are completed, adjust all repeaters in the other direction of transmission in accordance with applicable tests and adjustments making certain that each preceding repeater has been adjusted.

D. J98704D Panel — Order-Wire Equipment for Pole-Mounted Repeater Points

STEP	PROCEDURE
1	Connect an 84A test set to the TLK binding post on the J98704D panel.
2	Connect a 52-type headset to the 84A test set.

STEP	PROCEDURE
3	Use the appropriate whistle and signal all terminal and repeater points on the order-wire section under test. ***Requirement:*** Communication with the other order-wire and repeater points must be possible.
4	Remove test set connections.

E. J98704F Panel — Nonrepeatered Order-Wire Equipment for Terminals or Intermediate Stations

Note: Use Test E1 for J98704F panels at intermediate stations and Test E2 for J98704F panels at non-repeatered order-wire terminals.

E1. J98704F Panel — Nonrepeatered Order-Wire Equipment for Intermediate Stations

STEP	PROCEDURE
1	Connect from the TEL LINE jack to the OW jack using a 2P13A cord.
2	Connect the 52-type headset to the TEL SET jack.
3	Depress the RING key to signal the order-wire terminal and repeater points on the order-wire section under test. ***Requirement:*** Communication with the other order-wire and repeater points must be possible.
4	Remove the 2P13A cord and the 52-type headset.

E2. J98704F Panel — Nonrepeatered Order-Wire Equipment for Terminals

STEP	PROCEDURE
1	Make applicable tests in accordance with Chart I.
2	Remove all test connections.

CHART I

TEST	TEST CONDITIONS	APPLY 1000~ (0 DBM) AT:	MEASURE WITH TMS AT:	REQUIRED LEVEL	ADJUSTMENT
1	There are no repeaters on the order wire	Distant order-wire terminal	OW jack	Per circuit layout card	None
2		OW jack	Distant order-wire terminal	Per circuit layout card	
3	There are one or more repeaters on the order wire	No tests required; however, adjacent repeaters must be adjusted in accordance with the applicable procedures of Chart II, III, or IV.			

F. J98704G Panel — Nonrepeatered Intermediate Order-Wire Equipment

STEP	PROCEDURE
1	Connect a 52-type headset to the TEL SET jacks.
2	Use the appropriate whistle and signal all terminal and repeater points on the order-wire section under test. ***Requirement:*** Communication with the other order-wire and repeater points must be possible.
3	Remove the headset connections.

G. J98704H Panel — Terminal Order-Wire Repeater Equipment

STEP	PROCEDURE
1	Make applicable tests and adjustments in accordance with Chart II.
2	Remove all test connections.

CHART II

TEST	TEST CONDITIONS	APPLY 1000~ (0 DBM) AT:	MEASURE		REQUIRED LEVEL	ADJUST GAIN POTENTIOMETER ON:
			WITH	AT		
TRSG Amplifier Adjustments						
1	One or more INTERMEDIATE repeaters are on the order wire	OW jack	VTVM	Pins 1 and 2 at the rear of the TRSG amplifier socket	Per circuit layout card	TRSG V3 Amplifier.
2	No other repeaters are on the order wire	OW jack	TMS	OW jack (distant terminal)	−14 dbm	TRSG V3 Amplifier.
REC Amplifier Adjustment						
3	See Note.	OW jack (distant terminal)	TMS	OW jack	−14 dbm	REC V3 Amplifier.

Note: If the repeaters are located between the distant terminal and this panel, adjust them in accordance with the applicable procedures. These adjustments should begin at the far repeater and progress in sequence toward the receive amplifier in accordance with the applicable tests for each type of panel.

H. J98704J Panel — Intermediate Order-Wire Repeater

STEP	PROCEDURE
1	Make applicable tests and adjustments in accordance with Chart III.
2	Remove all test connections.

CHART III

TEST	TEST CONDITIONS	TRSG EW or WE	APPLY 1000~ (0 DBM) AT:	MEASURE WITH TMS AT:	REQUIREMENT	ADJUSTMENT
1		EW	OW jack at distant terminal on the east end of this line (see Note).	EW L EQ OUT jack	−24 dbm	Change value of EW REC pad.
2				EW BRG OUT jack	+10 dbm	Adjust GAIN potentiometer on EW V3 amplifier.
3	No additional repeaters on the west line			OW jack at distant terminal on west line	−14 dbm	Change value of EW SEND pad.
4	Additional repeaters on the west line				Adjust the EW SEND pad to the value specified on the circuit layout card.	
5		WE	OW jack at distant terminal on the west end of this line (see Note).	WE L EQ OUT jack	−24 dbm	Change value of WE REC pad.
6				WE BRG OUT jack	+10 dbm	Adjust GAIN potentiometer on WE V3 amplifier.
7	No additional repeaters on the east line.			OW jack at distant terminal on each line.	−14 dbm	Change value of WE SEND pad.
8	Additional repeaters on the east line.				Adjust the WE SEND pad to the value specified on the circuit layout card.	

Note: If additional repeaters are located between this test point and the distant order-wire terminal on this line, they should be adjusted (in this direction of transmission) before this test is started.

I. J98704L — Order-Wire Panel for Power Receiving Points in Offices

STEP	PROCEDURE
1	Connect a 52A headset to the TEL SET jack.
2	Use the appropriate whistle and signal all terminal and repeater points on the order-wire section under test. ***Requirement:*** Communication with the other order-wire and repeater points must be possible.
3	Remove the headset connections.

J. J98704M — Intermediate Repeater Panel for Branching Points

STEP	PROCEDURE
1	Make applicable tests and adjustments in accordance with Chart IV.
2	Remove the test connections.

CHART IV

TEST	LINE UNDER TEST	APPLY 1000~ (0 DBM) AT:	MEASURE		REQUIRED LEVEL	ADJUST GAIN POTENTIOMETER ON:
			WITH	AT		
1	L1 See Note 1	Distant order-wire terminal on line 1.	VTVM	Pins 1 and 2 at the rear of the L1 REC amplifier socket.	+4 dbm	REC V3 amplifier on line 1.
2	L2 See Note 1	Distant order-wire terminal on line 2.		Pins 1 and 2 at the L2 REC amplifier socket.		REC V3 amplifier on line 2.
3	L3 See Note 1	Distant order-wire terminal on line 3.		Pins 1 and 2 at the rear of the L3 REC amplifier socket.		REC V3 amplifier on line 3.
4	TEL SET	Distant order-wire terminal on line 1, 2, or 3 (see Note 2).	TMS	OW jack	−14 dbm	TRSG V3 amplifier on TEL SET line.
5	TEL SET	OW jack	VTVM	Pins 1 and 2 at the rear of the TEL SET REC amplifier socket.	+4 dbm	REC V3 amplifier on TEL SET line.
6	L1			Pins 1 and 2 at the rear of L1 TRSG amplifier socket.	Per circuit layout card for L1 or per Note 3 (see Note 4).	TRSG V3 amplifier on line 1.
7	L2			Pins 1 and 2 at the rear of the L2 TRSG amplifier socket.	Per circuit layout card for L2 or per Note 3 (see Note 4).	TRSG V3 amplifier on line 2.
8	L3			Pins 1 and 2 at the rear of the L3 TRSG amplifier socket.	Per circuit layout card for L3 or per Note 3 (see Note 4).	TRSG V3 amplifier on line 3.

Note 1: If additional repeaters are located between this test point and the distant terminal of this line, they should be adjusted in this direction of transmission before this test is started.

Note 2: Test 1, 2, or 3 must be completed before Test 4 is started. Apply the 1000 ∽ for Test 4 at the distant order-wire terminal of the line tested in 1, 2, or 3.

Note 3: If no additional amplifiers are located between this test point and the distant order-wire terminal on this line, adjust this amplifier to obtain −14 dbm at the distant terminal.

Note 4: Test 5 must be completed before Test 6, 7, or 8 is started.

3.07 Signaling tests and adjustments on the N1 order wire are covered in the following tests. The signaling system uses the same type of oscillators, receiving, and delay circuits as are used in the alarm system. Only one frequency (1900 ∽) is used for the signaling frequency. Where no signaling oscillator is provided such as pole-mounted or nonpower points, a 1900-cycle whistle is used as the signal source.

3.08 1000-cycle interrupted signaling may be provided in some installations. This type signaling is not covered in these tests.

K. J98704A Order-Wire Signaling Oscillator Frequency Check

Note: This test is optional and need only be made if trouble is suspected in the oscillator.

STEP	PROCEDURE
1	Connect the frequency meter to the OSC OUT jack.
2	Adjust FREQ control until requirement is met.
	Requirement: 1900 ±8 cps (J98704A List No. 4)
3	Remove the test connections.

L. J98704A Order-Wire Signaling Oscillator Output Check and Feedback Adjustment

STEP	PROCEDURE
1	Connect the TMS to the OSC OUT jack of oscillator under test.
2	Turn the LEVEL control to its maximum clockwise position.
3	Turn the OUT control to its maximum clockwise position.
4	Measure oscillator output on the TMS.
	Requirement: +14 ±2 dbm
	Note: If the requirement cannot be met, replace the 407A tube.
5	Turn LEVEL control counterclockwise until a reading of +6 dbm is obtained.
	Note: If necessary this value may be increased to +10 dbm at the expense of increased harmonic output to meet the oscillator output per the circuit layout card.
6	Remove the test connections.

M. J98704A Order-Wire Signaling Oscillator Output Adjustment

STEP	PROCEDURE
1	Connect a TMS to the oscillator OSC OUT jack.
2	Adjust the OUT control until a reading of 0 dbm is obtained. ***Note:*** On short, nonrepeatered order wires, it may be necessary to reduce the oscillator output to below 0 dbm in order to meet the −10 dbm input requirements of Test K.
3	Remove the test connection.

N. J98704C Order-Wire Signaling VF Amplifier Adjustment

STEP	PROCEDURE
1	Connect a TMS to the AMP OUT jack of the J98704C panel on which the order-wire signaling VF amplifier is located.
2	Apply a signal to the order wire at a distant location (J98704A oscillator source). ***Note:*** Choose the location from which the signal level in dbm is lowest.
3	Adjust the GAIN control until a signal level of −10 dbm is obtained on the TMS.
4	Remove the test connections.

O. J98704B Order-Wire Signaling Receiver Sensitivity Adjustment

STEP	PROCEDURE
1	Connect the OSC OUT of the TMS to the SIG IN jacks on the associated J98704C order-wire delay panel.
2	Connect the 35-type test set to the RC jack of the J98704B receiver panel under test and arrange the controls for use as a milliammeter.
3	Adjust the FREQ controls of the TMS to the nominal frequency of the panel under test.
4	Adjust the oscillator output to −15 dbm.
5	Fine tune the oscillator for a peak indication on the milliammeter.

STEP	PROCEDURE
6	Adjust the SENS control to meet the following requirements. ***Requirements:*** (a) 13 ±0.4 ma (b) L1 pilot lamp lights.
7	Remove the test connections.

P. J98704B Order-Wire Signaling Receiver Filter Performance Test

Note: This test is optional and need only be made if trouble is suspected in the unit.

STEP	PROCEDURE
1	Connect an OSC OUT of the TMS to the SIG IN jacks on the associated J98704C order-wire delay panel.
2	Adjust the oscillator output to −15 dbm.
3	Sweep the FREQ control of the TMS over a range from 100 to 3000 cps. ***Requirement:*** The L1 pilot lamp of the J98704B panel under test lights only in a range that is ±80 cps from the nominal value of the receiver filter. ***Note:*** Failure to meet this requirement indicates a defective filter.
4	Remove the test connections.

Q. J98704C Order-Wire Signaling Delay Panel Timing Check

STEP	PROCEDURE
1	Manually operate the K2 relay on the associated J98704B order-wire signaling receive panel. ***Requirements:*** One second after operation of the K2 relay the following events take place: (a) The K4 relay on the J98704C delay panel operates. (b) The ALM pilot lamp on the J98704C delay panel lights. (c) The audible alarm sounds.

R. Order-Wire Signaling Operation Test

STEP	PROCEDURE
1	Initiate a signal at one of the other order-wire locations by either operating the RING key on the order-wire panel (only if a signaling oscillator is provided) or by blowing a 1900 ∽ whistle into the transmitter of a 52-type headset connected to the order wire.
2	Check to see that the following events take place at the test location: (a) ALM lamp lights. (b) Audible alarm sounds. (c) Visual and audible signals cease at the end of the ring period.
3	Repeat Steps 1 and 2 until it is ascertained that signals can be received from all locations on the order-wire section under test.
4	If used, remove the 52-type headset connections.

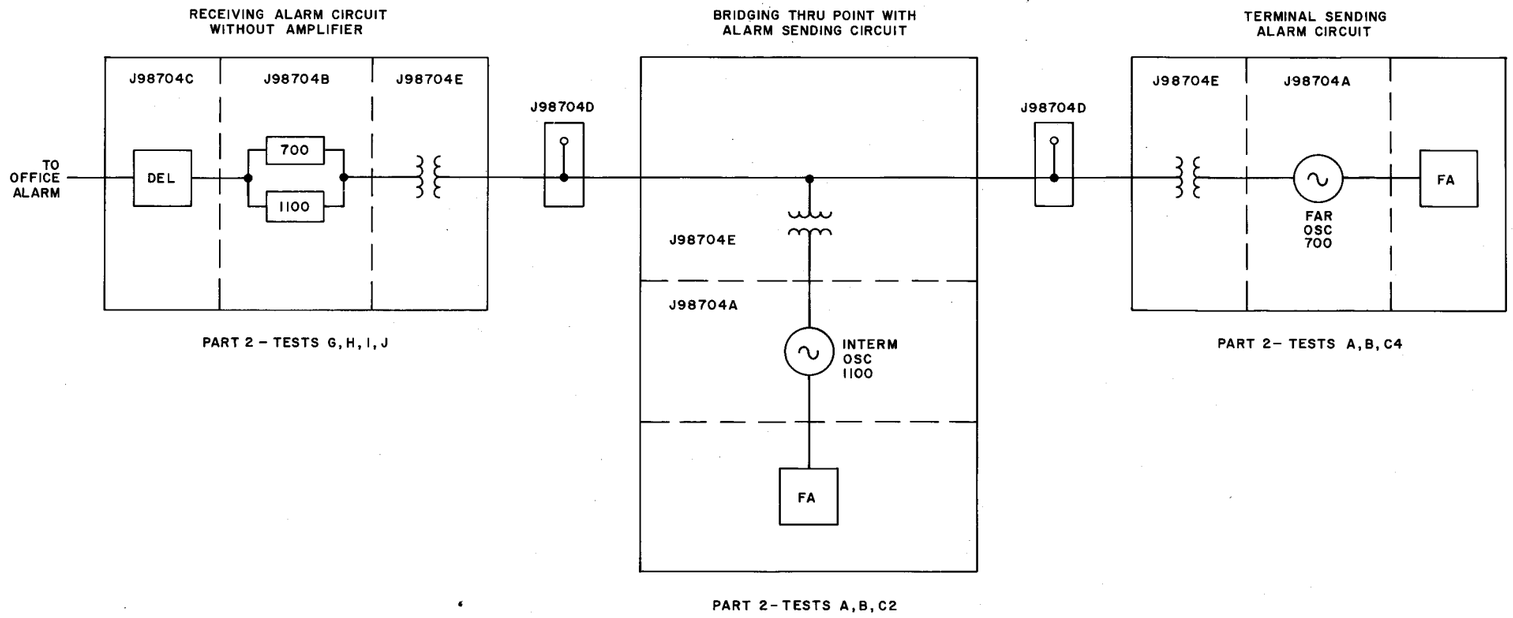

Fig. 1 — Typical Alarm Layout Without Amplifiers

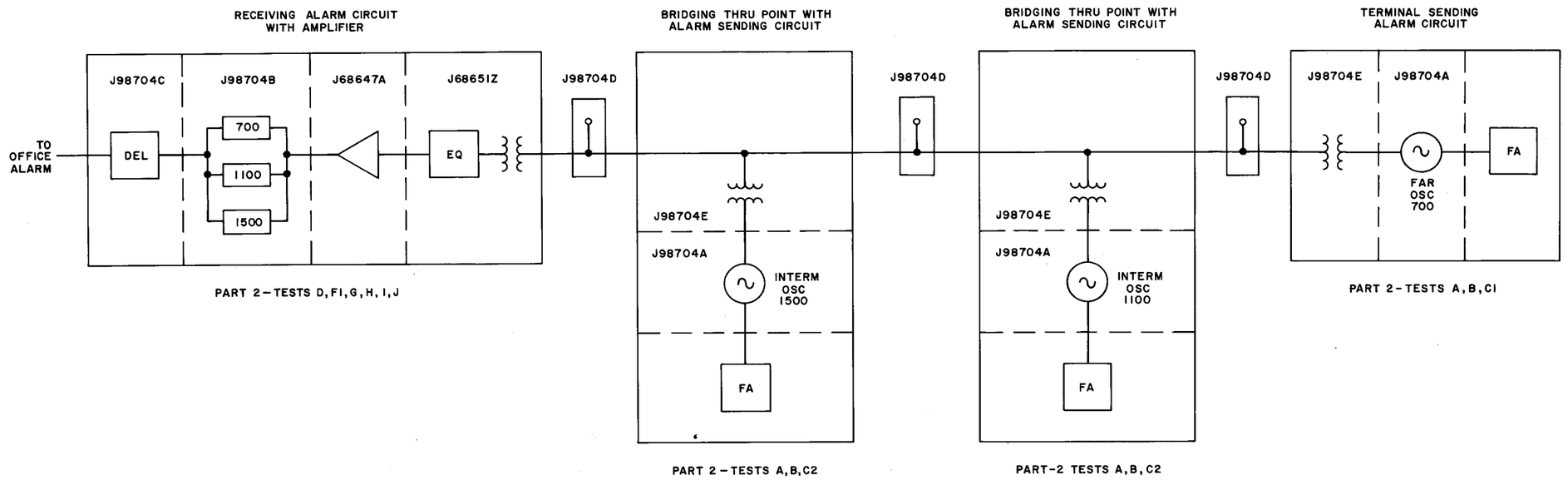

Fig. 2 — Typical Alarm Layout With Amplifier in Receiving Circuit and Alarm Sending at Far Terminal

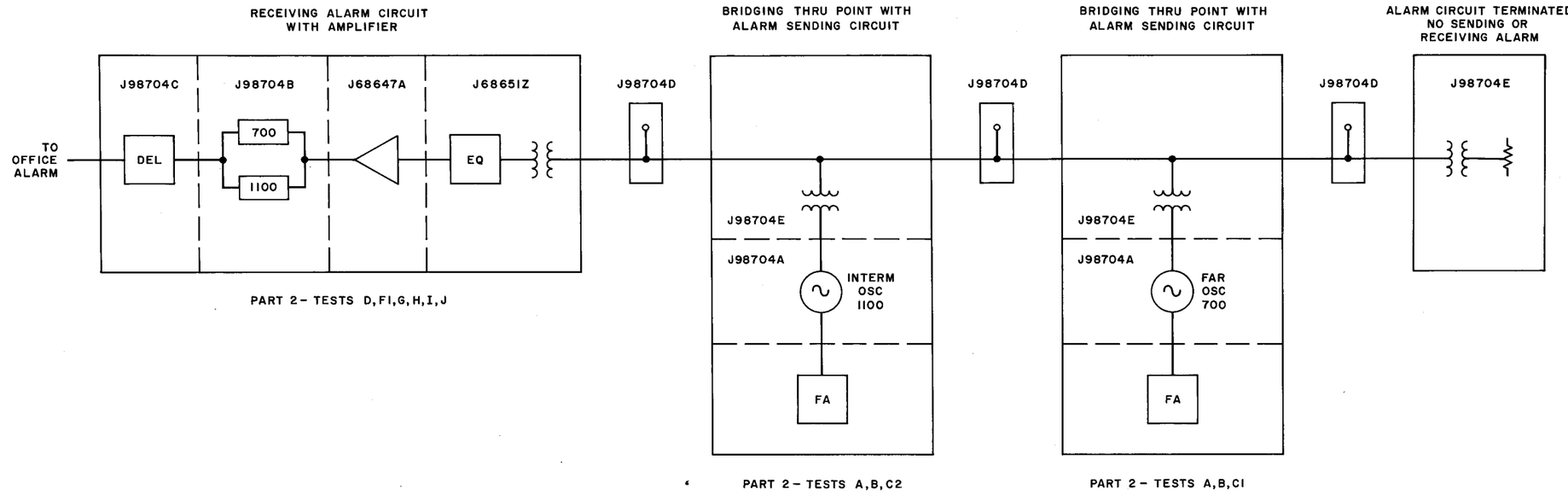

Fig. 3 — Typical Alarm Layout With Amplifier in Receiving Circuit and Without Alarm Sending at Far Terminal

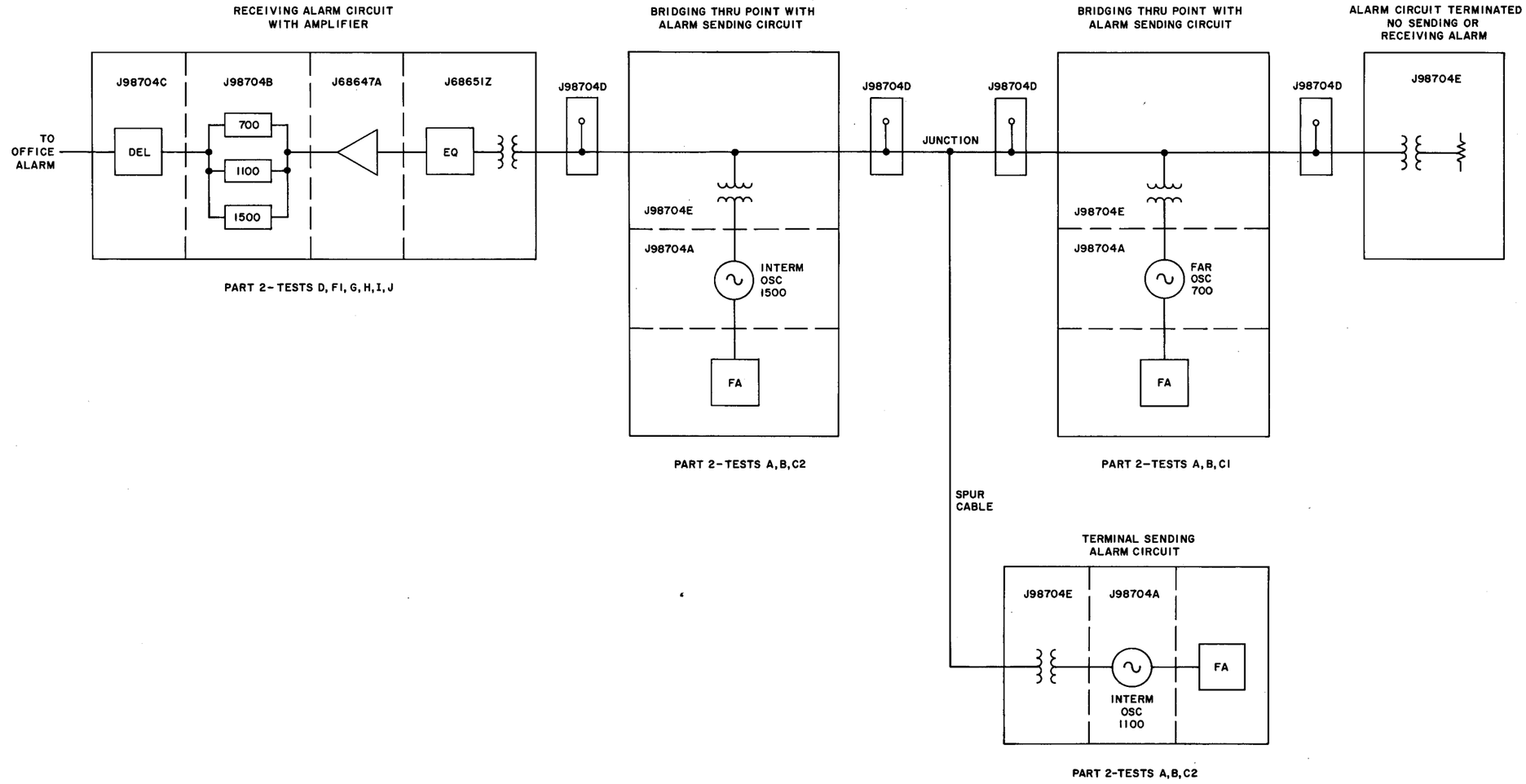

Fig. 4 — Typical Alarm Layout — Alarm Sending from Spur Cable

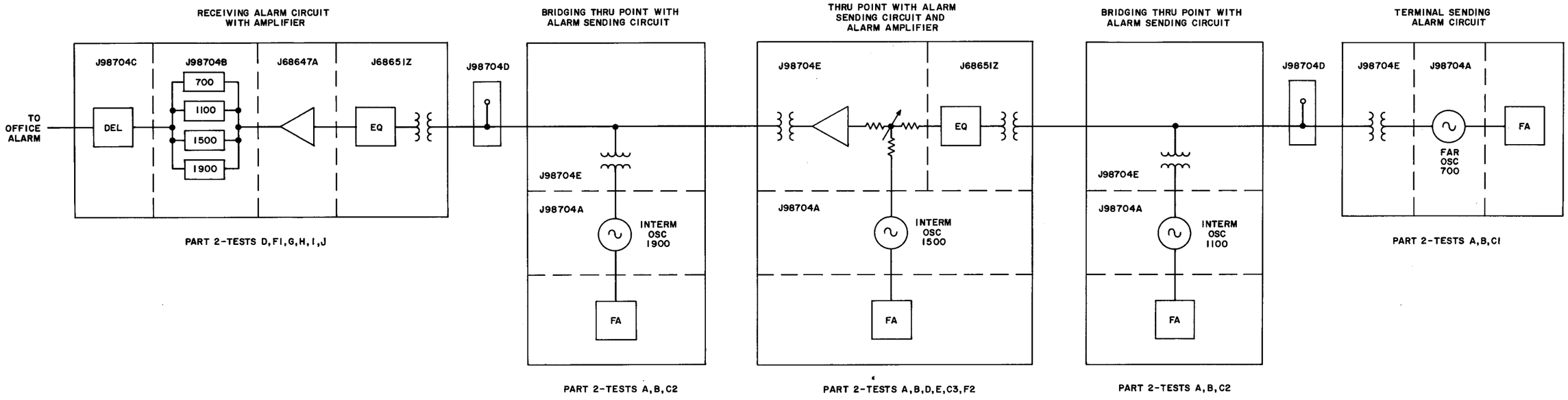

Fig. 5 — Typical Alarm Layout With Alarm Sending and Amplifier at Thru Point

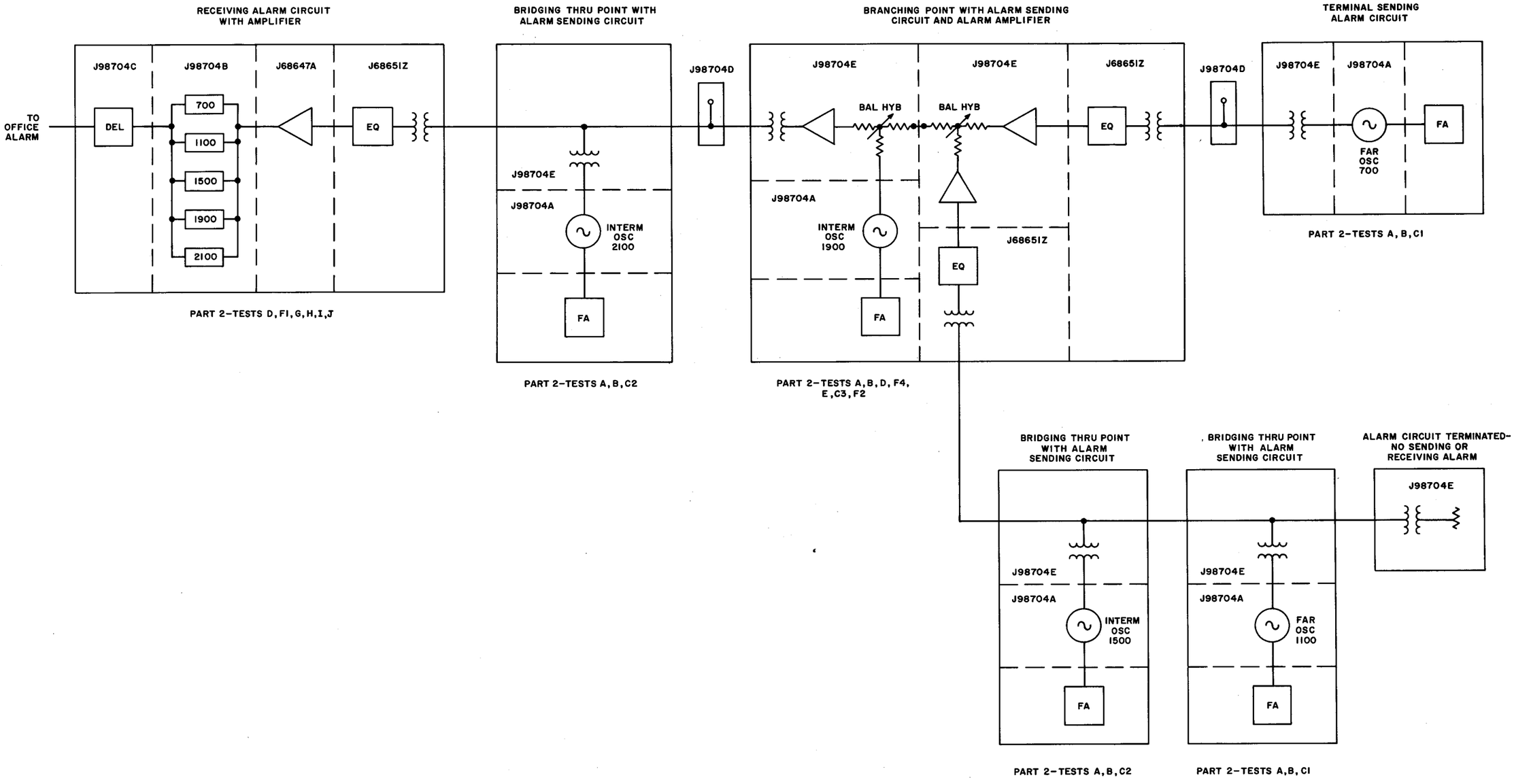

Fig. 6 — Typical Alarm Layout With Alarm Sending and Amplifiers at Branching Point

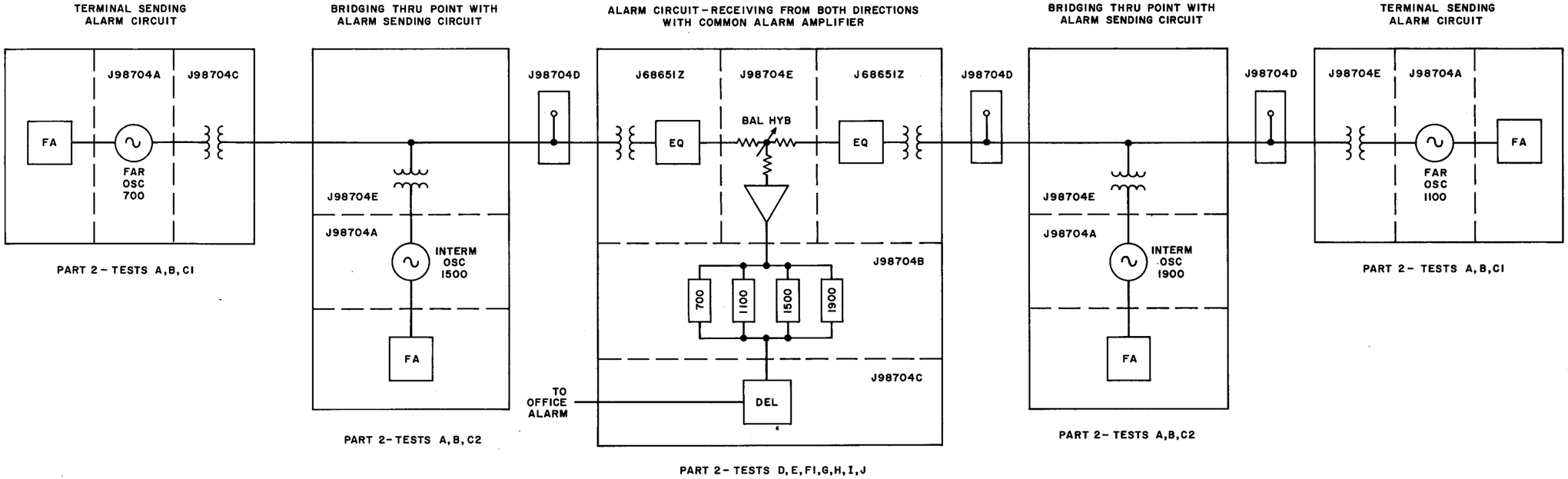

Fig. 7 — Typical Alarm Layout With Amplifier Receiving from Two Directions

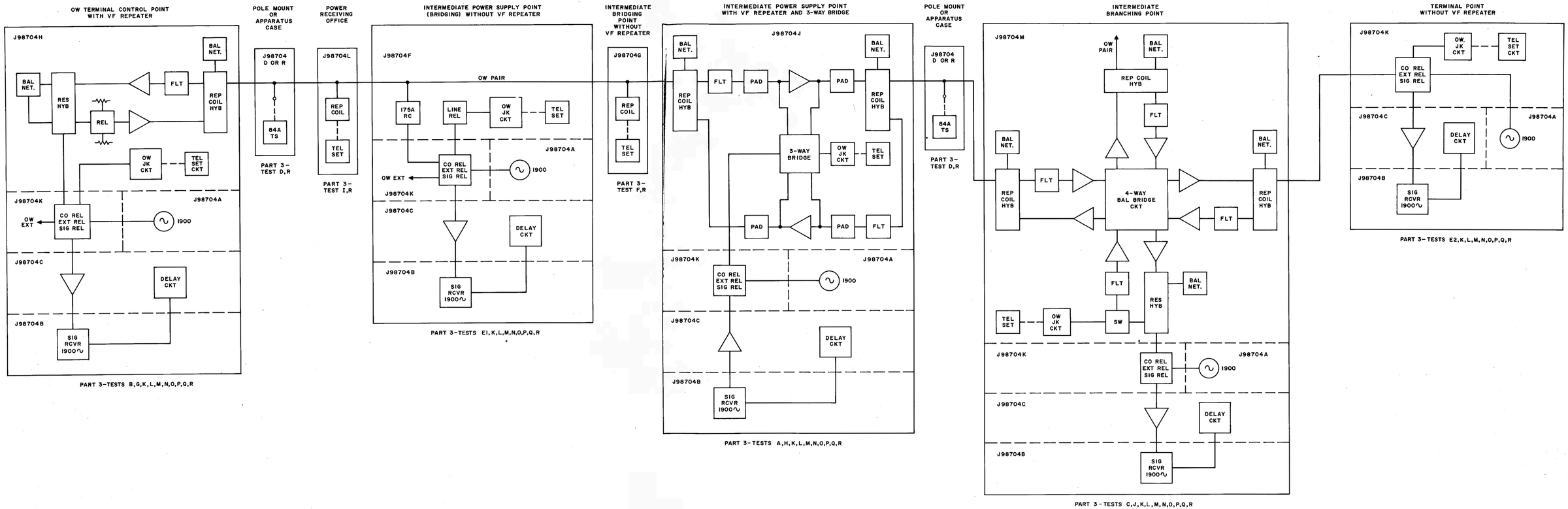

Fig. 8 — Order-Wire Layouts — Composite Diagram