

**NO. 1 TRUNK CONCENTRATOR
DESCRIPTION**

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INTERCEPT CALLS—NO. 5 ACD OR NO. 23-DESK	5	1. GENERAL	
A. Preference and Control Circuits	5	1.01 The No. 1 trunk concentrator (No. 1 TC) is used to concentrate trunks from a remote central office to an Automatic Intercept System (AIS) for connection to a recorded announcement machine or operator and also to an operator by means of an automatic call distributor (ACD) or No. 23 operating room desk (No. 23-desk). The trunk concentrator is also used to route	
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directory assistance (DA) traffic to No. 5 crossbar automatic call distributor (No. 5 ACD) or No. 23-desk. The basic arrangement is shown in Fig. 1.

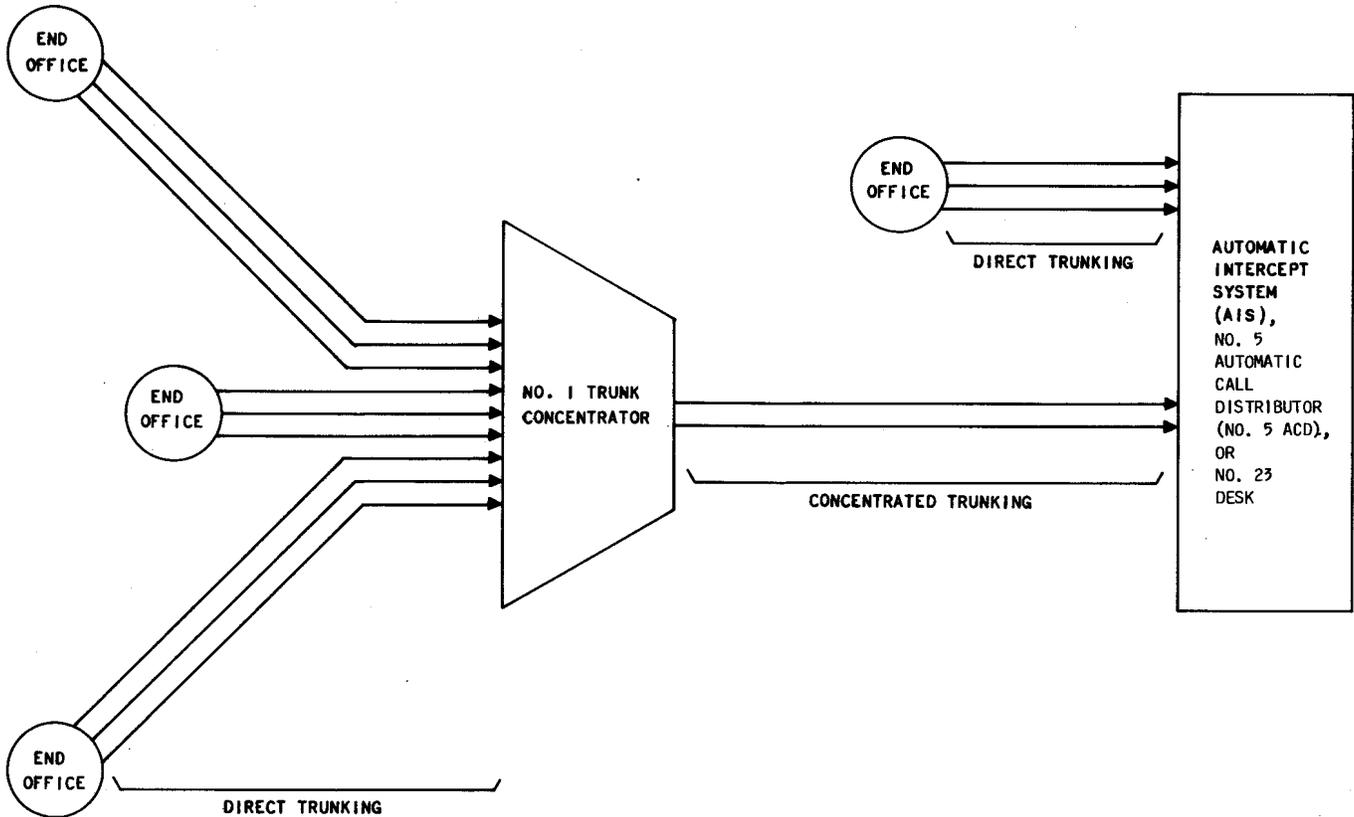


Fig. 1—No. 1 Trunk Concentrator—Basic System Arrangement

1.02 This section is reissued to include the arrangements handling intercept and information traffic to a No. 23 operating room desk or a No. 5 ACD. Also included are the arrangements utilizing low profile (7 ft, 0 in.) frames.

1.03 When the trunk concentrator is used in conjunction with an AIS or No. 5 ACD, the trunk concentrator will normally be located in a class 4 office which is near the end office being served by the trunk concentrator. The end office is normally a class 5 office and may be a step-by-step, No. 5 crossbar, No. 1 crossbar, panel, No. 1 ESS or No. 2 ESS office. The switching machine at the AIC will be a No. 1A AIS machine, No. 5 ACD, or No. 23-desk.

1.04 The three basic types of intercepts are trouble, regular, and blank number (T, R, and BN respectively). Regular intercept calls are classified as those calls to recently changed or disconnected numbers. Trouble intercept calls are classified as calls to lines which are out of service due to some trouble condition. Blank number intercept calls are calls to blank or unassigned numbers. All three types can be routed to AIS. However, only regular intercept can be routed to a No. 23-desk or a No. 5 ACD.

2. EQUIPMENT ARRANGEMENTS

2.01 The three basic units of the concentrator (Fig. 2) are the switch, the incoming trunk preference and control circuit, and the outgoing

trunk and control circuit. The switch preference and control circuit is a part of the outgoing trunk and control circuit.

2.02 The switch is a six-wire, 240-point small crossbar switch of the CF type with banjo strapping cut between the tenth and eleventh verticals. The split banjo strapping results in two 10 by 12 half switches. The incoming trunks are associated with the verticals of the switch, and the outgoing trunks are associated with the horizontals of the switch.

2.03 A trunk concentrator system may grow from a minimum size of two switches to a maximum of ten switches. In the AIS application, ten switches provide 200 incoming trunks with access to a maximum of 60 outgoing trunks. When the trunk concentrator is used with No. 5 ACD for handling directory assistance traffic, 200 incoming trunks have access to a maximum of 100 outgoing trunks. The outgoing trunks are graded across the switch horizontals to accomplish the concentration ratio. A typical grading plan for AIS is shown in Fig. 3.

The grading plan for ACD is accomplished in a similar plan.

HIGH PROFILE ARRANGEMENT

A. AIS Arrangement

2.04 Figure 4 shows the two frames utilizing ten switches of a trunk concentrator AIS installation. Frame A may be equipped with a minimum of two and a maximum of four switches numbered 0 to 3. Frame B may be equipped with a maximum of six switches numbered 4 to 9. If required, both concentrator frames combined have sufficient space for terminating 50 outgoing trunks. The remaining 10 outgoing trunks require an additional miscellaneous relay rack frame. Figure 5 shows the concentrator incoming trunk frames for AIS.

B. No. 5 ACD or No. 23-Desk Arrangement

2.05 Figure 6 shows three frames utilizing ten switches in a trunk concentrator No. 5 ACD or No. 23-desk installation. Frame 0 may be equipped with a minimum of two and a maximum

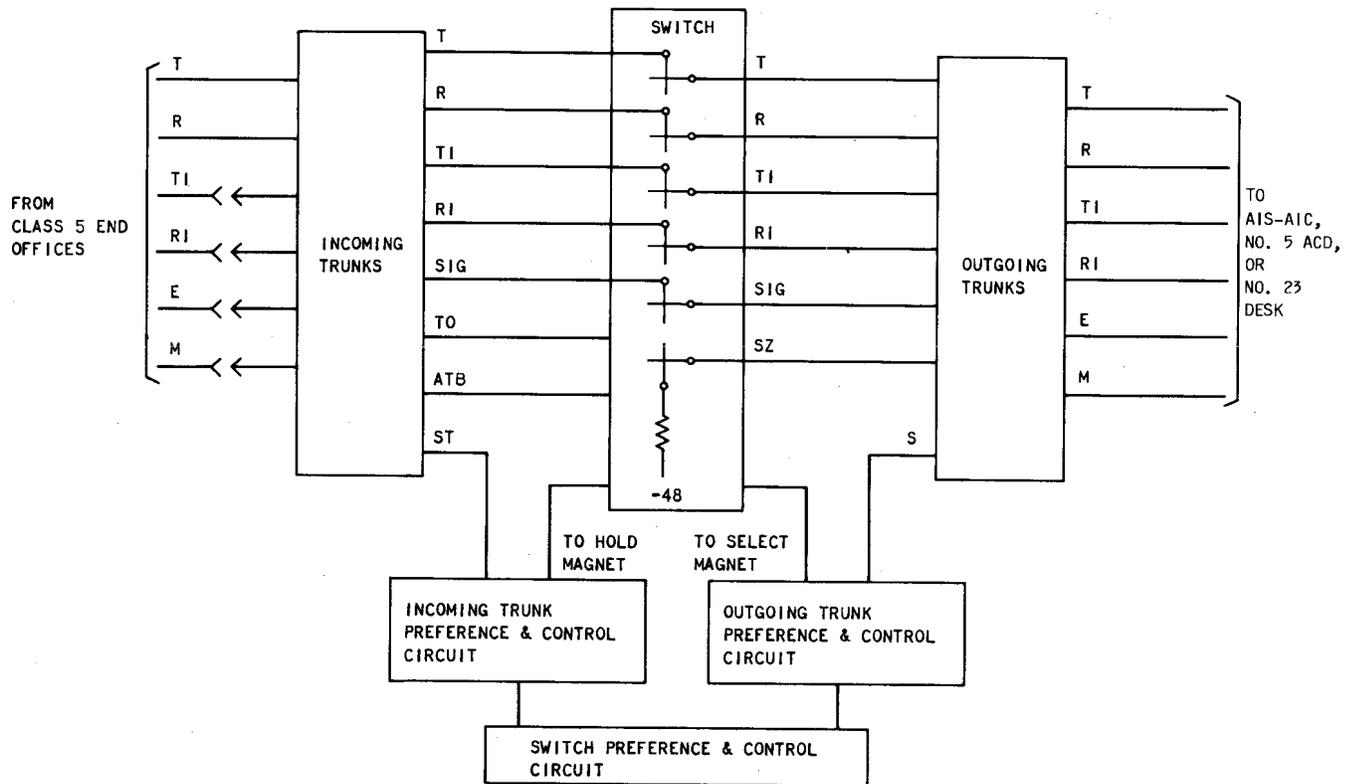


Fig. 2—No. 1 Trunk Concentrator—Block Diagram

of three switches numbered 0 to 2. Frame 1 may be equipped with four switches numbered 3 to 6. Frame 3 may be equipped with three switches numbered 7 to 9. The three concentrator frames have the capacity to terminate 100 outgoing trunks. The trunk concentrator, when used with No. 5 ACD, may have up to 14 incoming trunk frames per system. A typical incoming trunk frame is shown in Fig. 6 and 7. When using the No. 23 desk or a No. 5 ACD for intercept traffic, the No. 1 trunk concentrator can terminate only 60 outgoing trunks instead of 100 with directory assistance.

LOW PROFILE ARRANGEMENT

A. AIS Arrangement

2.06 Fig. 8 shows the frames needed for AIS arrangement. Frame 0 is always used and can accommodate 20 incoming trunks and 20 outgoing trunks. Full capacity offices can use four frames (0, 1, 2, and 3) and can accommodate 200 incoming trunks and 50 outgoing trunks. When additional outgoing trunks are required (up to a maximum of 60 for the system), they shall be mounted on a miscellaneous relay rack arranged for 23-inch wide mounting plates. Fig. 9 shows the concentrator incoming trunk frames for AIS.

B. No. 5 ACD or No. 23-Desk Arrangement

2.07 Fig. 10 shows the frames utilized in the No. 5 ACD or No. 23-desk arrangement. The concentrator and outgoing trunk frames have the following capacities: Frame 0 has 20 incoming trunks, 20 outgoing trunks; frame 1 has 60 incoming trunks, 10 outgoing trunks; frames 2, 3, and 4 have 40 incoming trunks and 20 outgoing trunks each. Full capacity offices can use all five frames accommodating 200 incoming trunks and 90 outgoing trunks. When additional outgoing are required (up to a maximum of 100), they shall be mounted on a miscellaneous relay rack. A typical incoming trunk frame is shown in Fig. 11.

3. OPERATION

INTERCEPT CALLS—AIS ARRANGEMENT

A. Preference And Control Circuits

3.01 The incoming trunk preference and control circuit interfaces incoming trunks to the

switch and determines the order in which incoming trunks demanding service are served.

3.02 The outgoing trunk preference and control circuit interfaces the switch to the outgoing trunks and determines which idle outgoing trunk is to be connected to a particular incoming trunk. Part of this circuit (the switch preference control) forms a chain with other outgoing trunk preference and control circuits associated with other switches to guarantee only one outgoing trunk will be seized at any given time. The outgoing trunk preference and control circuit also determines when all outgoing trunks to the half-switch being served are busy.

B. Trunks

3.03 The incoming trunk circuit interfaces the intercept trunks from the end central offices to the trunk concentrator. The incoming trunk performs various timing and control functions which are required for all classes of intercept trunks. The incoming trunk is also provided with the necessary circuitry to transform two-wire trunks to four-wire trunks and to generate MF pulses to the AIC when required.

3.04 The outgoing trunk circuit is a four-wire trunk circuit which interfaces the trunk concentrator with the trunks to the AIC. The outgoing trunk also provides various timing features.

C. Seizure

3.05 When a customer dials a number that has been placed on intercept, the customer will be connected to an intercept line or trunk circuit in the end office (Fig. 1). An off-hook signal will be sent to the trunk concentrator incoming trunk which will make a connection through the concentrator to the concentrator outgoing trunk.

3.06 When the concentrator outgoing trunk is seized, it will generate an off-hook signal to the AIC incoming trunk which will in turn bid for and be connected to a multifrequency receiver.

D. Multifrequency Signaling

3.07 When the AIC incoming trunk is connected to a multifrequency receiver, the AIS incoming trunk will generate a wink signal to the concentrator outgoing trunk. The concentrator outgoing trunk will repeat the wink to the concentrator incoming

trunk. The response of the trunk concentrator to the wink will vary depending on the type of intercept trunk at the central office.

3.08 If the central office is arranged for automatic number identification (ANI) of intercepted numbers (the called number), the concentrator incoming trunk will repeat the wink to the central office. The central office machine will then send a sequence of multifrequency digits to the AIC indicating the class of intercept and the number the customer dialed.

3.09 If the central office is not arranged for ANI, an operator is required at the AIC to determine the intercepted number. Trunks requiring operator treatment are designated operator number identification (ONI) trunks.

3.10 ONI trunks that handle only one class of intercept are designated ONI-1 trunks. Those handling up to three classes of intercept are designated ONI-3 trunks.

3.11 On ONI-1 type trunks the wink signal generated by the AIC will cause the concentrator incoming trunk to send the proper multifrequency digit followed by the ST digit to the AIC. The AIC interprets this signal as a regular intercept call requiring operator assistance.

3.12 On ONI-3 type trunks, the trunk concentrator incoming trunks determine which class of intercept is required by the manner in which the central office intercept trunk seizes the concentrator incoming trunk.

3.13 Upon receipt of the wink, the concentrator incoming trunk will send the proper multifrequency digit followed by the ST digit according to the class of intercept. The AIC will then connect the AIC incoming trunk to an announcement or an operator according to the class of intercept as indicated by the central office or the concentrator incoming trunk.

3.14 On an ANI call, the central office trunk circuit will cut through the talking path as soon as it has completed multifrequency signaling. On an ONI call, the central office trunk circuit may not cut through the talking path until off-hook supervision is provided by the concentrator incoming trunk.

3.15 Disconnect is in general under the control of the customer. After receiving the message from the AIC, the customer will hang up, causing the central office intercept trunk to release the connection through the central office and to go on-hook to the concentrator incoming trunk. The incoming trunk will release the concentrator connection to the outgoing trunk. The outgoing trunk supervisor in turn will go on-hook to the AIC incoming trunk. The AIC incoming trunk will then restore to normal.

3.16 Following the wink, if an on-hook is generated by the AIC which persists for approximately 30 seconds, the outgoing trunk will signal the concentrator incoming trunk, which will release the concentrator connection and begin permanent signal timing.

E. Optional Spin-Off Arrangements—ONI-3 Type Trunks

3.17 If the trunk concentrator is located in a switching center which provides an announcement for blank number intercept, the incoming trunk can be provided with an optional arrangement for switching blank number intercept traffic directly to the announcement machine without setting up a connection to the AIC. Such calls may be routed to the AIC operator after a predetermined number of announcements have been sent and the customer has not been disconnected due to dissatisfaction with the recorded announcements.

3.18 If the trunk concentrator is located in a switching center which presently handles trouble intercept at a switchboard or No. 19-desk, the incoming trunk may be arranged on an optional basis to switch this traffic to the operator.

◆INTERCEPT CALLS—NO. 5 ACD OR NO. 23-DESK◆

A. Preference And Control Circuits

3.19 The operation of the preference and control circuits for No. 5 ACD and No. 23-desk are the same as the description given in 3.01 and 3.02 for AIS.

B. Trunks

3.20 Outgoing trunks from the end office terminate on the trunk concentrator incoming trunks. The trunk concentrator outgoing trunks terminate

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on ACD incoming line circuits or No. 23-desk incoming trunk circuits.

C. Seizure

3.21 Upon seizure by a central office outgoing trunk, the concentrator incoming trunk bids for a connection through the concentrator to a concentrator outgoing trunk. When the concentrator incoming and outgoing trunks are connected, the outgoing trunk seizes the ACD incoming line circuit or No. 23-desk incoming trunk circuit.

3.22 When the incoming line circuit is seized, audible ringing is returned by the ACD. When an operator answers, off-hook supervision is passed by the ACD incoming line circuit or No. 23-desk incoming trunk circuit to the concentrator outgoing trunk and by the concentrator outgoing trunk to the concentrator incoming trunk. The concentrator incoming trunk passes the off-hook supervision to the remote central office when required.

INFORMATION CALLS—NO. 5 ACD OR NO. 23-DESK

A. Preference and Control Circuits

3.23 The operation of the preference and control circuits for the No. 5 ACD and No. 23-desk is the same as the description given in 3.01 and 3.02 for AIS.

B. Trunks

3.24 Outgoing trunks from the end office terminate on the trunk concentrator incoming trunks. The trunk concentrator outgoing trunks terminate on the No. 5 ACD or No. 23-desk incoming trunk circuits.

C. Seizure

3.25 Upon seizure by a central office outgoing trunk, the concentrator incoming trunk bids for a connection through the concentrator to a concentrator outgoing trunk. When the concentrator incoming and outgoing trunks are connected, the outgoing trunk seizes the No. 5 ACD or No. 23-desk incoming trunk circuit.

3.26 When the incoming trunk circuit is seized, an operator answers, off-hook supervision is passed by the incoming trunk circuit to the

concentrator outgoing trunk to the concentrator incoming trunk. The concentrator incoming trunk passes the off-hook supervision to the local office when required.

4. ALARMS AND TROUBLE INDICATIONS

INCOMING TRUNKS

4.01 Each incoming trunk is equipped with two service lamps. The ON lamp indicates when the circuit is off-normal. The CT lamp indicates that a connection is established through the concentrator. In addition, each incoming trunk is equipped with two trouble indicating lamps, PS and TBL.

4.02 The PS lamp lights when the incoming trunk is held off-normal by a permanent signal for six minutes or longer. A permanent signal alarm is also activated. The TBL lamp lights when a crossed start lead or connection time-out condition exists. Either condition will also cause a minor office alarm to be activated.

4.03 If a predetermined number of incoming trunks in a group become permanently seized (two in an incoming group of five, for example), a major office alarm will be activated.

OUTGOING TRUNKS

4.04 Each outgoing trunk is equipped with three service lamps. The ON lamp indicates when the circuit is off-normal. The OFH lamp indicates that the AIC or ACD is off-hook. The RMB lamp indicates that the trunk is made busy from the AIC or ACD. In addition, each outgoing trunk is equipped with a TO lamp which indicates that the integrity wink was not received within five seconds after a seizure (off-hook) signal was sent to the AIC or ACD.

4.05 After the initial five-second timeout, the outgoing trunk will release the call and lock out of service (the customer will receive reorder tone). If an outgoing trunk remains out of service for six minutes, a minor office alarm will be activated. If the outgoing trunk receives the integrity wink within the six-minute interval, it will restore to service and reset the six-minute timer.

4.06 If a predetermined number of outgoing trunks are out of service due to time-outs, a major office alarm is activated.

CONCENTRATOR

4.07 If the concentrator fails any of the self-checks which are made during a call setup, a short time-out occurs. This condition causes a MNR lamp to light and a minor office alarm to be activated. If a second time-out occurs, a MJR lamp will light and a major office alarm will be activated.

4.08 If the concentrator fails to switch a call within two seconds and a short time-out has not occurred, a long time-out will occur. This condition causes a MJR lamp and a TO or TOA lamp to light and a major office alarm to be activated.

4.09 If the concentrator detects a double connection, a DCK lamp will light and a major office alarm will be activated. If the concentrator detects a crossed TO lead to the incoming trunks and a switch time-out has not occurred, an XTO lamp will light and a major office alarm will be activated.

5. TRANSMISSION CHARACTERISTICS

2-WIRE TRUNKS

5.01 The 2-wire incoming trunks (Fig. 12), use a 1M terminating set for interfacing between the 2-wire lines and the 4-wire concentrator. Using the 1M terminating set, however, introduces loss in the transmission path which when coupled with the losses in the 2-wire line, requires gain in order to assure the proper transmission level. To avoid the need to provide gain in the trunk concentrator as well as in local offices, the trunk concentrator is operated in a high-loss configuration. In order to compensate for this loss, gain transferred from the carrier facility is always required.

4-WIRE TRUNKS

5.02 In 4-wire trunks (Fig. 13) a 4182-type network is used to extend 4-wire voice frequency or carrier facilities to the 4-wire trunk concentrator. The transmission requirements is to match incoming and outgoing carrier levels through the trunk concentrator for proper transmission performance. Transmission levels can be controlled

and adjusted for optimum performance by applying appropriate 89-type resistors in the 4182-type network.

6. MAINTENANCE

CONCENTRATOR

6.01 The concentrator, to the extent possible, is arranged to lock in on trouble conditions, thus giving the maintenance personnel the status of the switch when the trouble is detected. When a switch is out of service, which only occurs when trouble is detected, all traffic to the switch is turned back. The trunk concentrator is provided with apparatus for enabling a connection to be forced from a particular incoming trunk to a particular outgoing trunk. This allows for the selective testing of every path through the switch.

6.02 A key is provided which allows traffic to be blocked to the switch while determining the source of the trouble and verifying that the trouble is cleared. Operation of this key does not affect connections already established through the switch.

OUTGOING TRUNKS

6.03 Operational testing of the outgoing trunks is performed using the trunk concentrator portable trunk test set J94747A (SD-97576-01). The test set is equipped with an MF pad to enable call through testing. Testing of the time-out and trouble detecting functions will involve blocking relays and insulating contacts.

6.04 Transmission testing of the outgoing trunks is accomplished by using the concentrator test set to send appropriate MF digits to the AIC or ACD to connect to a test line. Jack access is provided on the test set for patching conventional transmission measuring equipment to the transmission path. The concentrator test set is also provided with 10 dB pads in the transmit and receive pairs to obtain the proper transmission level point for the outgoing trunk as seen by the maintenance personnel.

INCOMING TRUNKS

6.05 The concentrator portable trunk test set J94747A (SD-97576-01) is used for testing the operational features of the incoming trunks. Two modes of testing are available. A routine

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check of the operational features is performed by setting up a connection to the AIS or ACD through the concentrator. In addition, the incoming trunk may be tested alone without involving the AIS, ACD, or the concentrator. This is particularly useful in testing the various timing and trouble functions of the incoming trunks.

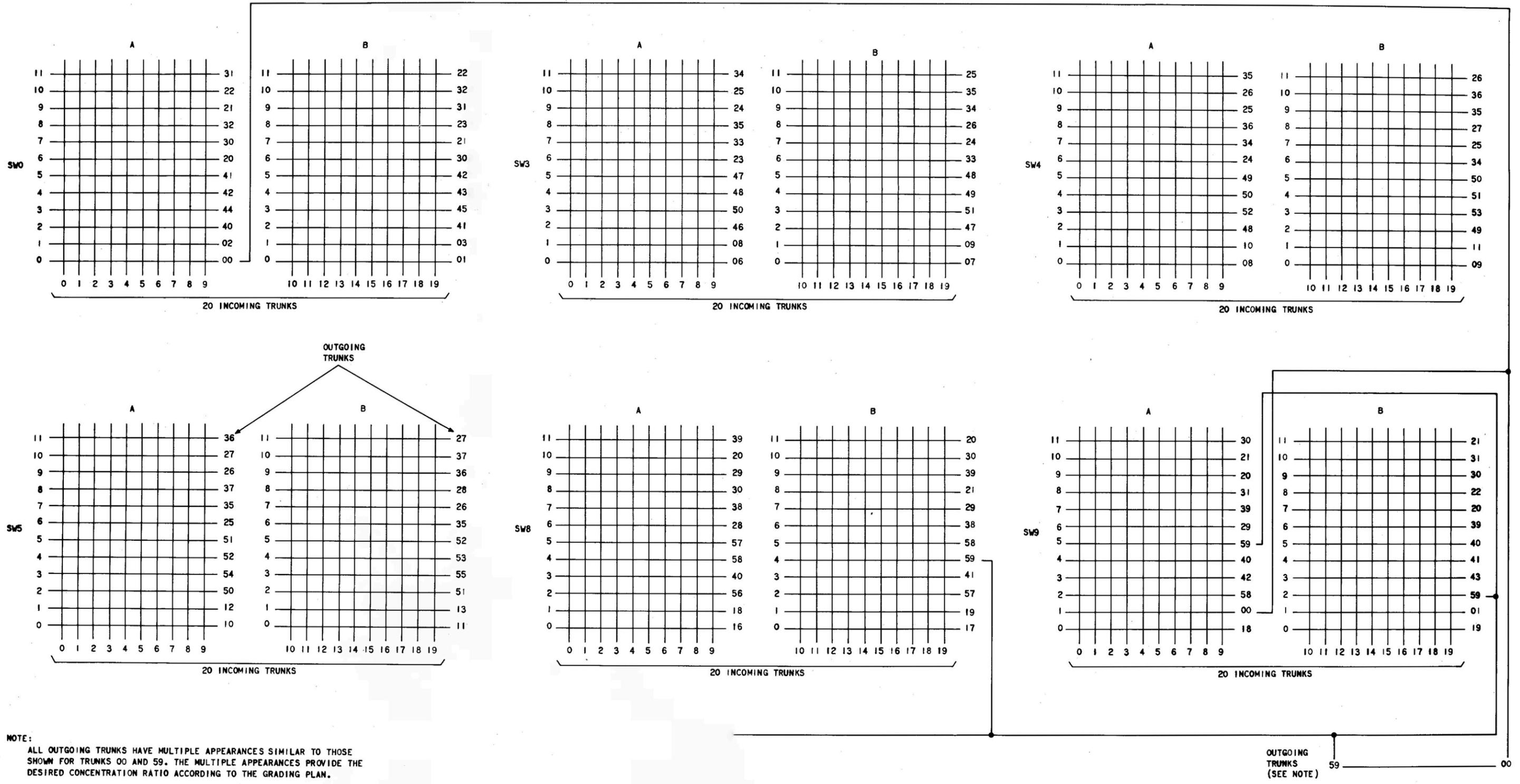
6.06 Access to incoming trunks for operational tests is provided by means of jacks on the line side of the trunks. ONI trunks must be made busy at the remote central office before testing can begin. If the central office trunk circuit is equipped with the reverse make-busy feature, the incoming trunk may be made busy under key control before testing begins.

6.07 Transmission testing requires a craftperson at the remote central office outgoing trunk and also a craftperson at the trunk concentrator incoming trunk. Test jacks are provided at the trunk concentrator incoming trunks for transmission

testing. In order to provide a uniform transmission level point, 5 dB amplifiers are inserted in the transmit and receive pairs. The concentrator portable test set is equipped with these amplifiers.

6.08 Standard transmission measuring test sets and test tones can be connected to the test set to gain connection to the concentrator incoming trunk through the 5 dB amplifiers. This arrangement provides a 0 dB transmit and a -5 dB receive as viewed by the craftperson. The actual transmission level point is +5, -10 dB as viewed from the concentrator side of the incoming trunk.

6.09 A test tone of 1000 Hz is provided at the incoming trunk frame for jack access to the concentrator portable trunk test set. The impedance is 600 ohms and is available in 0, -10, and -16 dB levels. Jack access to the DDD network is also provided at the frame for telephone communication between craftpersons.



NOTE:
 ALL OUTGOING TRUNKS HAVE MULTIPLE APPEARANCES SIMILAR TO THOSE SHOWN FOR TRUNKS 00 AND 59. THE MULTIPLE APPEARANCES PROVIDE THE DESIRED CONCENTRATION RATIO ACCORDING TO THE GRADING PLAN.

Fig. 3—Grading Plan for 200 Incoming Trunks and 60 Outgoing Trunks

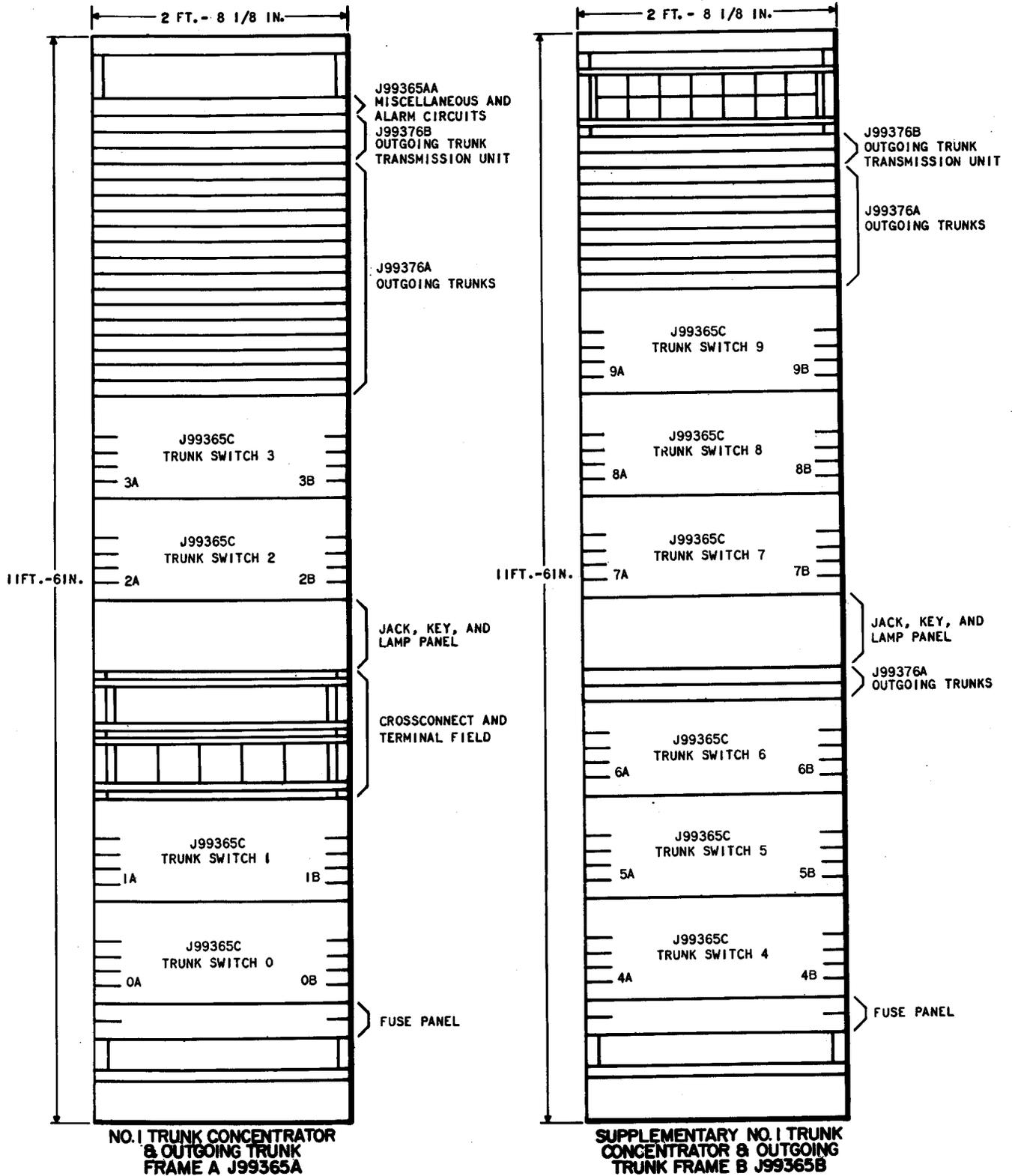


Fig. 4—No. 1 Trunk Concentrator and Outgoing Trunk Frames—(High Profile) AIS Arrangement

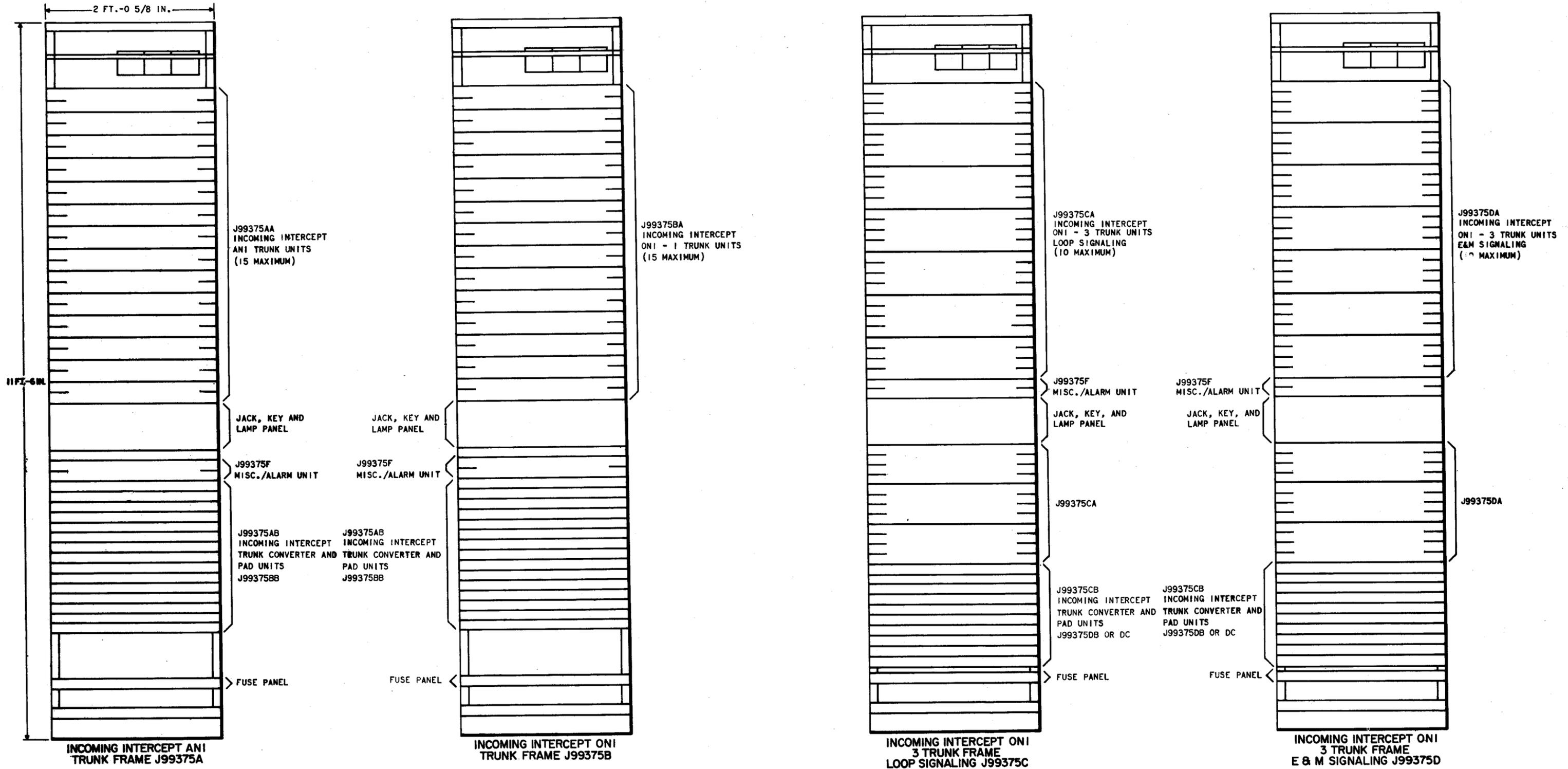


Fig. 5—No. 1 Trunk Concentrator—Incoming Intercept Trunks—High Profile Version

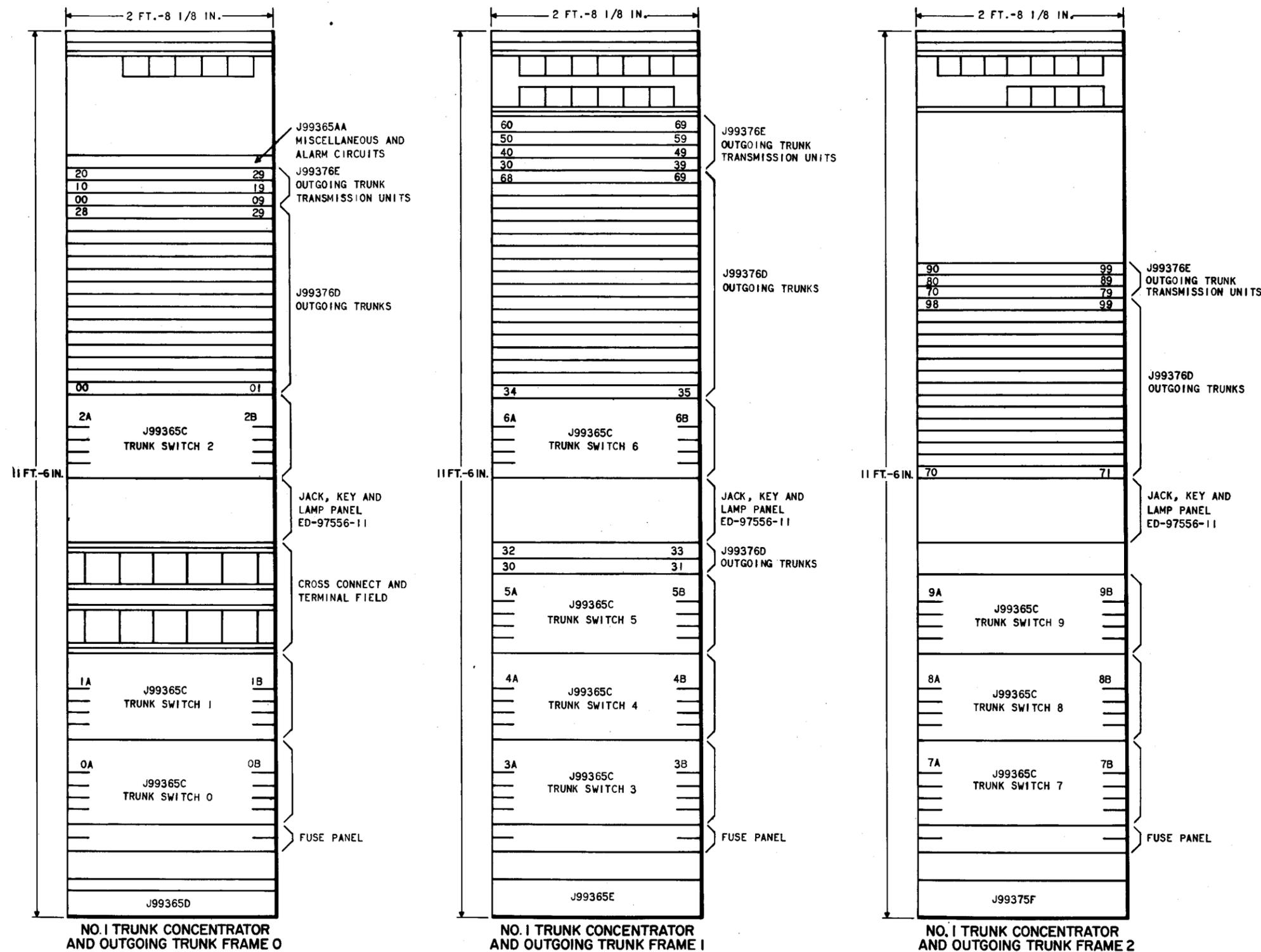


Fig. 6—No. 1 Trunk Concentrator and Outgoing Trunk Frames (High Profile) No. 5 ACD or No. 23-Desk Version

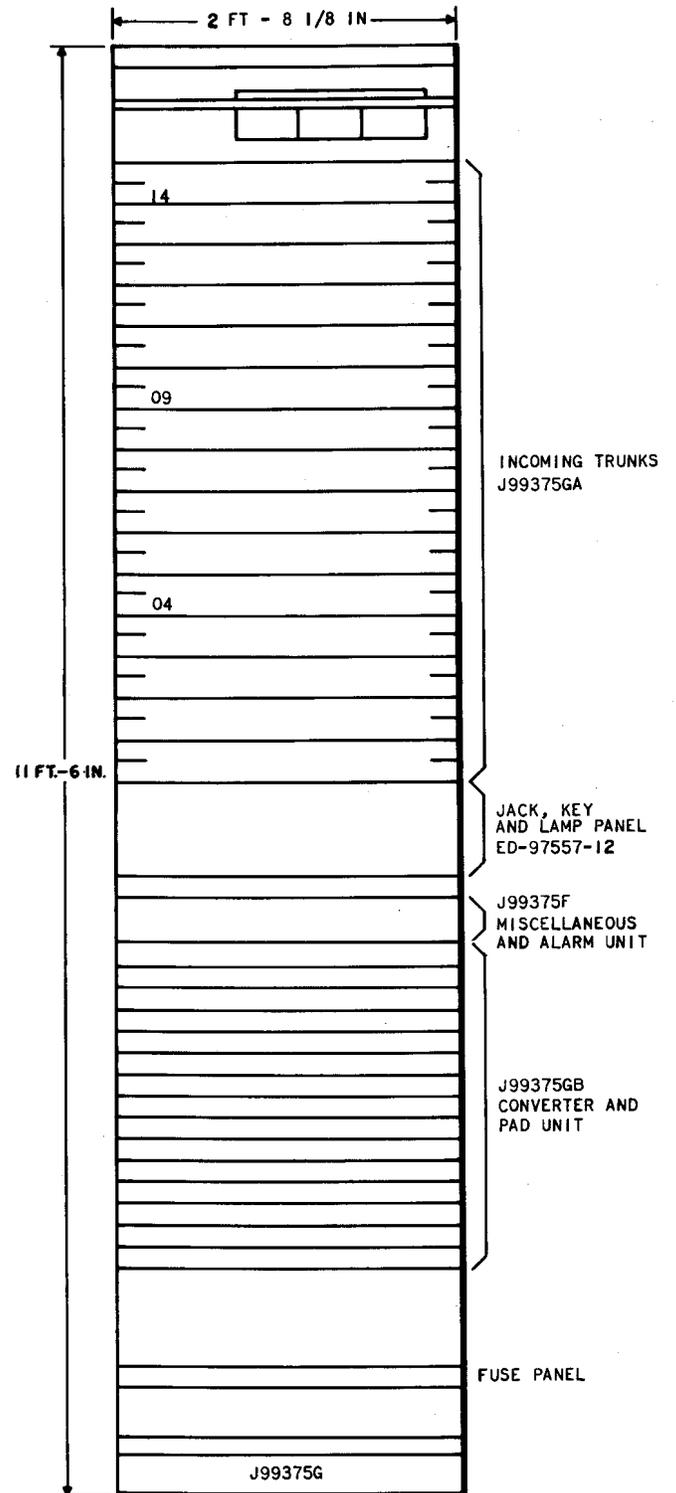


Fig. 7—No. 1 Trunk Concentrator—Typical (High Profile) No. 5 ACD or No. 23-Desk Incoming Trunk Frame

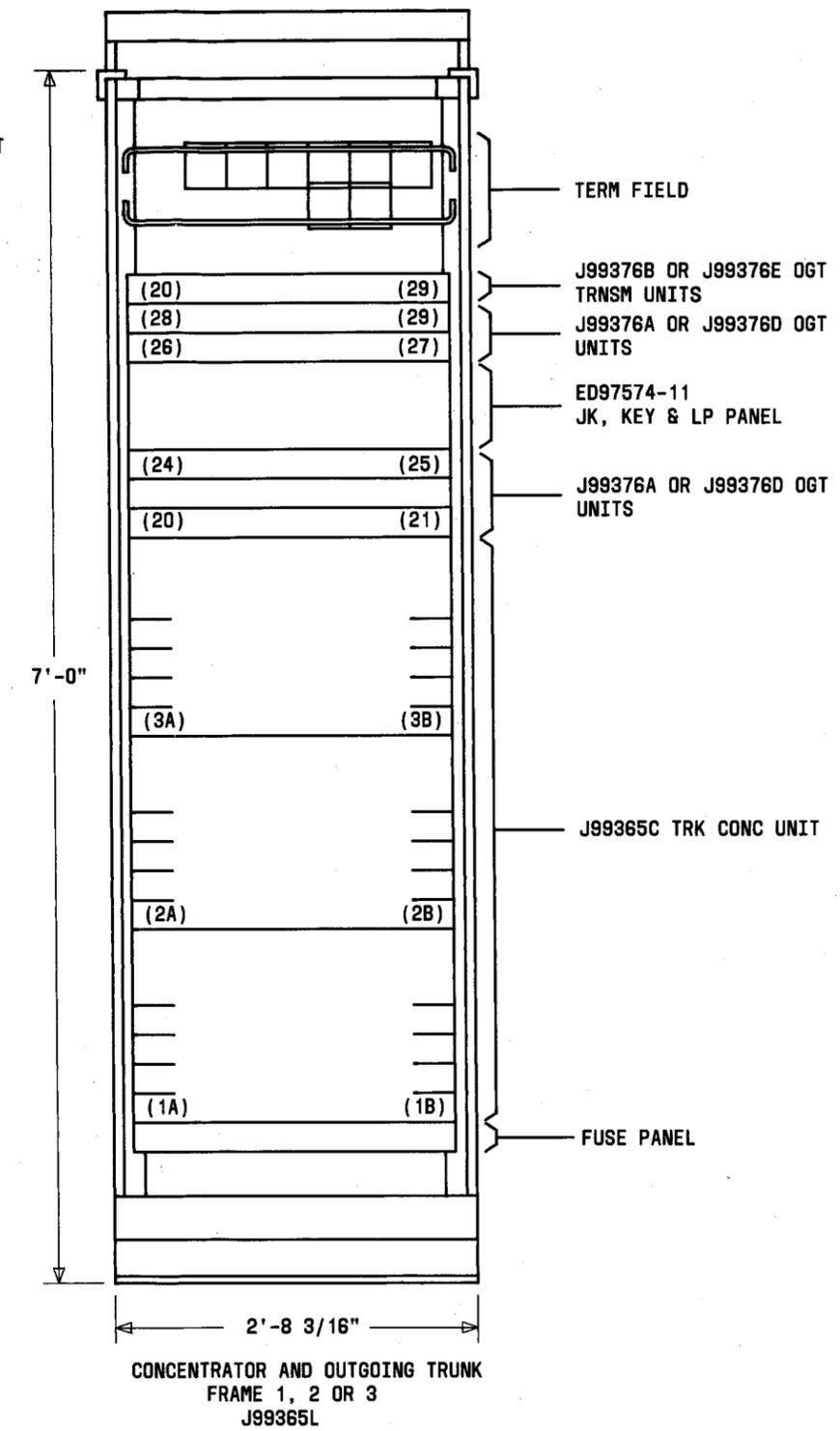
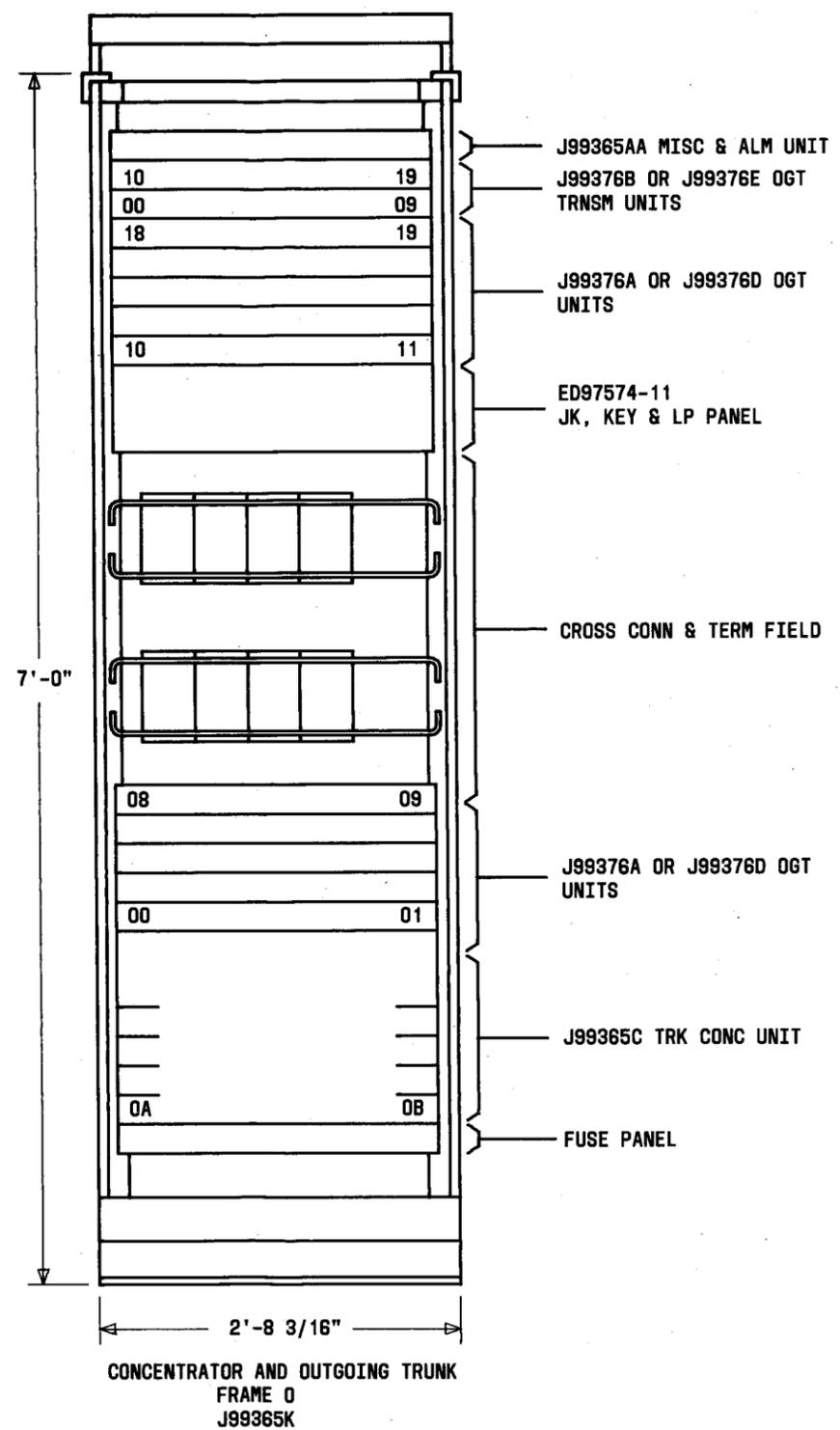


Fig. 8—No. 1 Trunk Concentrator and Outgoing Trunk Frames—(Low Profile) AIS Version

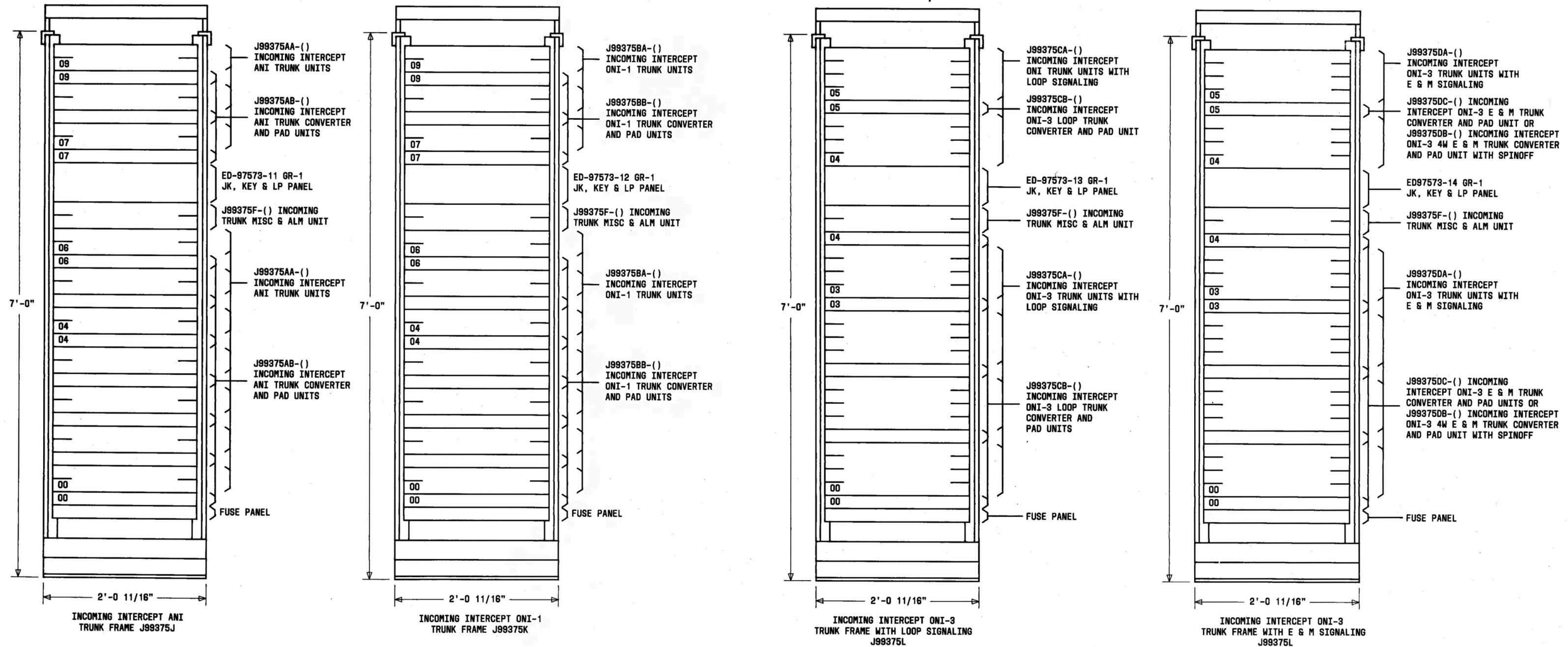
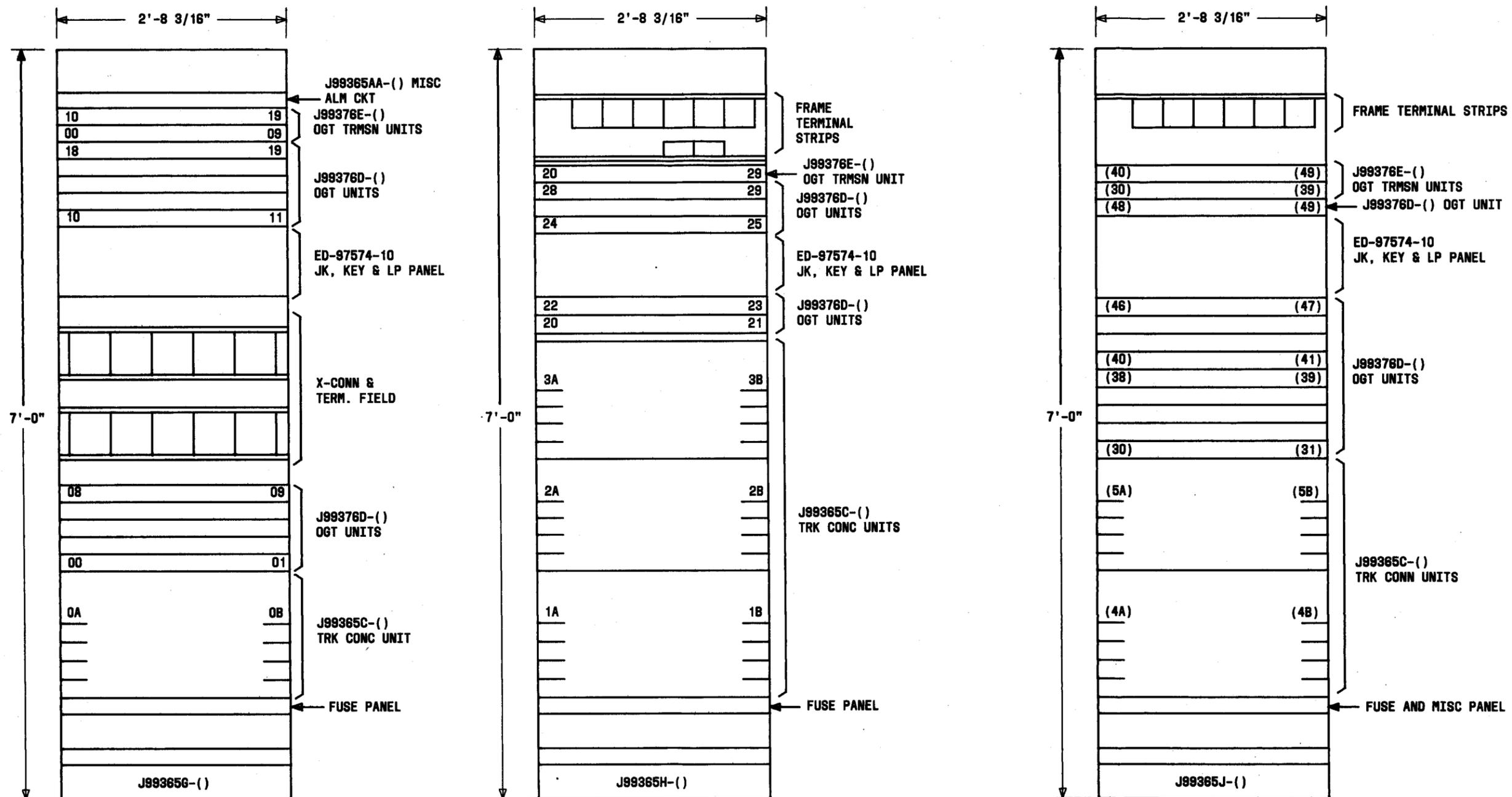


Fig. 9—No. 1 Trunk Concentrator—(Low Profile) Incoming Intercept Trunk Arrangement



7 FOOT HIGH NO. 1 TRUNK CONCENTRATOR AND OUTGOING TRUNK FRAME 0

7 FOOT HIGH NO. 1 TRUNK CONCENTRATOR AND OUTGOING TRUNK FRAME 1

7 FOOT HIGH NO. 1 TRUNK CONCENTRATOR AND OUTGOING TRUNK FRAMES 2, 3, & 4

Fig. 10—No. 1 Trunk Concentrator and Outgoing Trunk Frames—(Low Profile) No. 5 ACD or No. 23-Desk Version

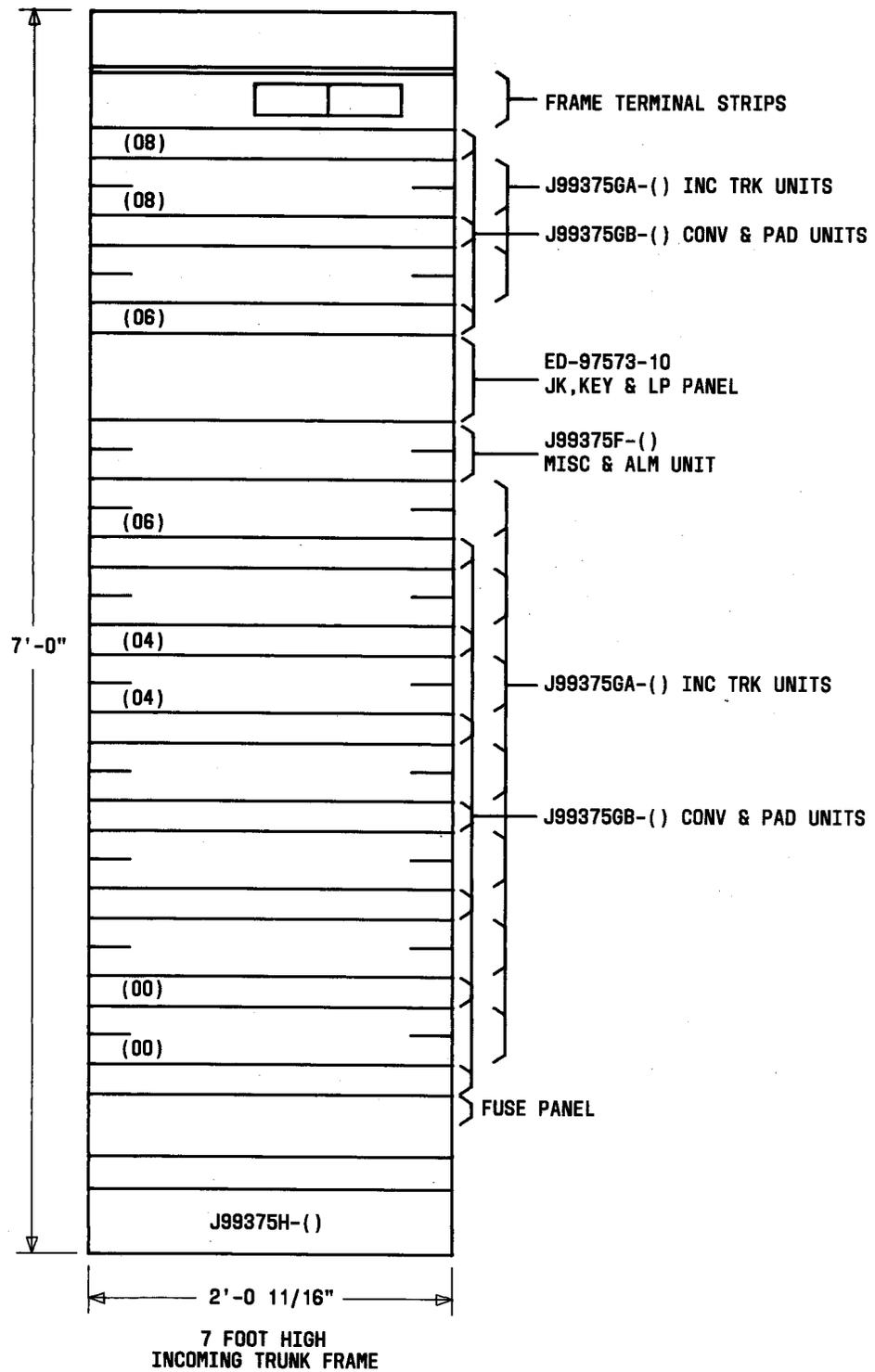
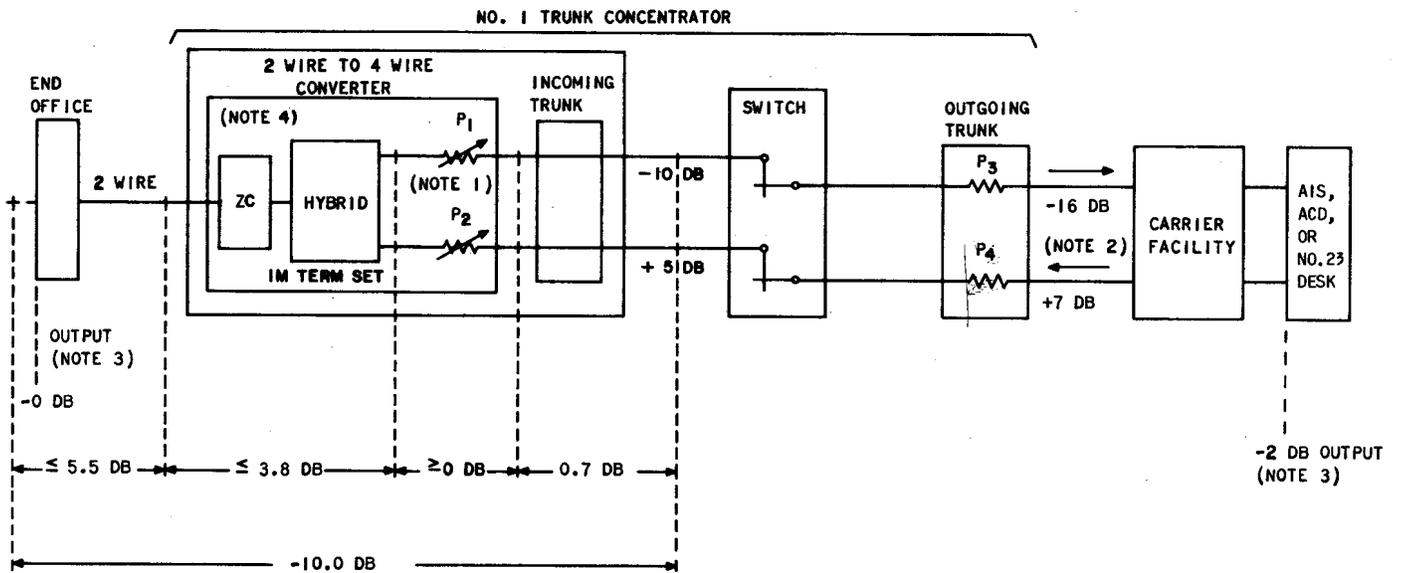


Fig. 11—No. 1 Trunk Concentrator—(Low Profile) No. 5 ACD or No. 23-Desk Incoming Trunk Frame



NOTES:

1. PADS P₁ AND P₂ PROVIDE 0 TO 15DB LOSS IN .25DB INCREMENTS TO ADJUST 10DB TRANSMISSION LOSS FROM AN END OFFICE TO THE NO. 1 TC OUTGOING TRUNK.
2. PADS P₃ AND P₄ PROVIDE 6DB AND 2DB LOSS RESPECTIVELY WITH ALLOWANCE FOR OFFICE CABLE LOSS TO CARRIER BAYS.
3. AT THE OUTPUT OF THE LOCAL OFFICE SWITCH, 0DB LEVEL; AT THE AIS OR ACD, OUTPUT -2DB LEVEL.
4. ZC DENOTES AN IMPEDANCE COMPENSATOR.

Fig. 12—No. 1 Trunk Concentrator—Transmission Plan—2-Wire Incoming Trunks

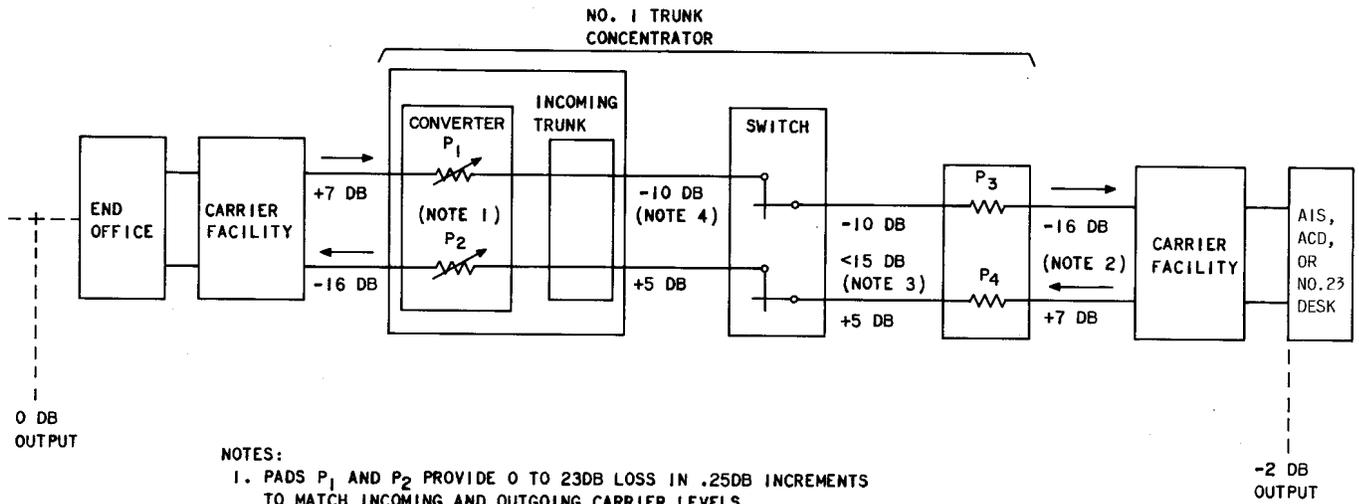


Fig. 13—No. 1 Trunk Concentrator—Transmission Plan—4-Wire Incoming Trunks