

“PULSE* 120” – SG-1A

ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

CIRCUIT OPERATIONS AND CABINET CABLING

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GENERAL	3	2.01 A simplified block diagram of the PULSE 120 EPABX is shown in Fig. 1. The system consists of five functional blocks within the cabinet: the power shelves, control shelf, line shelves, trunk shelves, and option shelf; with external connections to the commercial power source, station lines (extensions), trunks and the attendant console. System operations, including the switching of voice circuits from the lines, trunks, and attendant's position onto the main speech highway, are coordinated by the call control signals.
POWER SHELF NO. 1	4	2.02 The call control signals are timed by a solid-state clock which produces a continual train of 3.3 microsecond pulses, referred to as time slots. The continuing series of time slots is divided into time frames, groups of 25 time slots, the last time slot in a group being specially identified.
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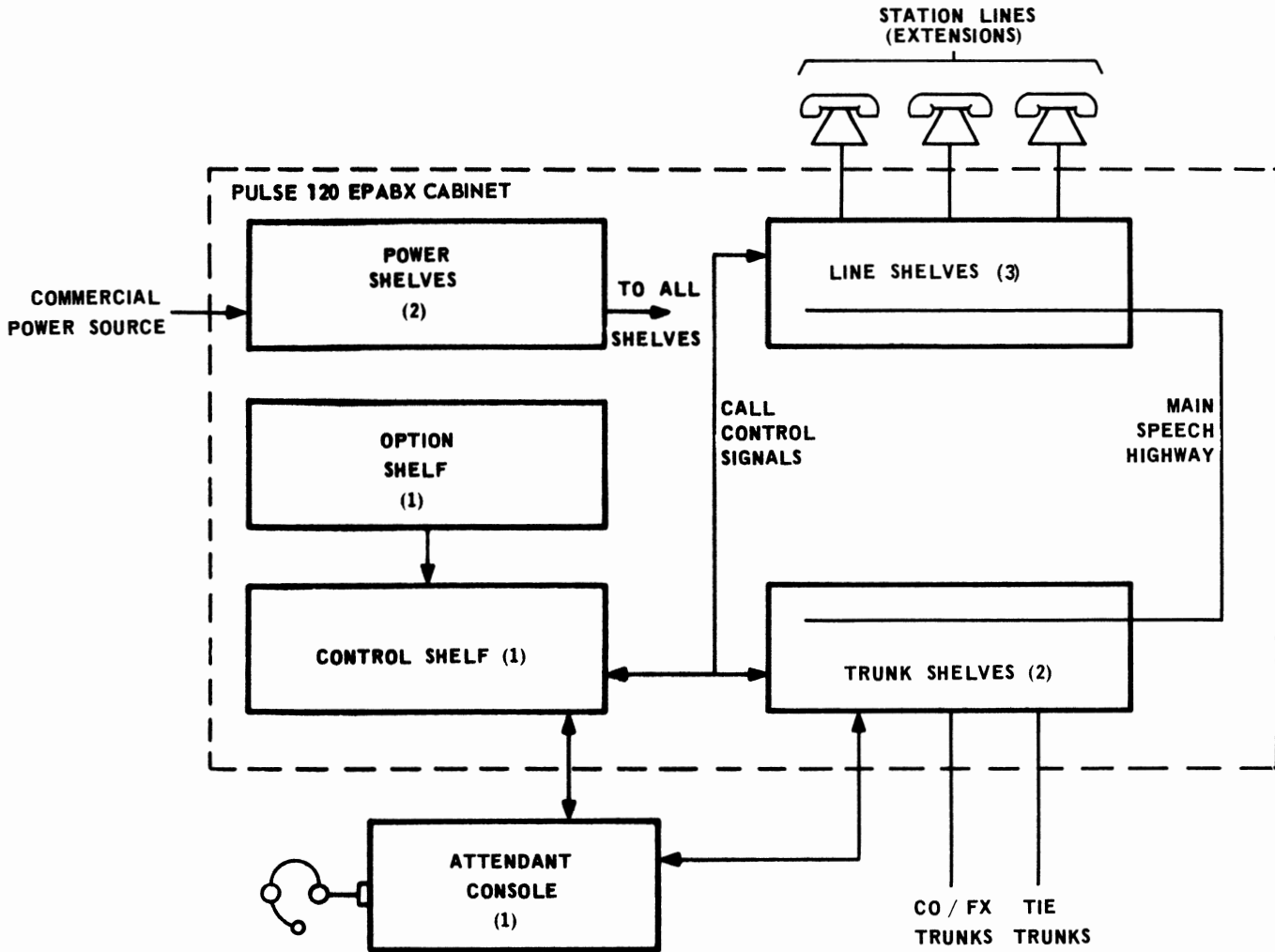


Fig. 1 – Simplified Block Diagram of the PULSE 120 EPABX

2.03 Detection of call origination takes place only during the last time slot in each time frame. One line or trunk is scanned during each final time slot, so that a complete scanning cycle of all lines and trunks for call origination occurs every 63 milliseconds. The remaining 24 time slots in each time frame are assigned as required for call processing.

2.04 When a call origination is detected, the address (number) of the calling station or trunk is assigned to a time slot; the call control signals which then appear in that time slot provide for the detection of dialing signals, the provision of ringing and supervisory tones, and the detection of answering. When the called party answers, the call

control signals switch both parties onto the main speech highway during the same time slot in each successive time frame. At the conclusion of the call, the call control signals provide for the detection of the disconnections, and make the time slot available for reassignment.

2.05 The switching principle employed is a sequential sampling process under the control of call control signals, which permits up to 24 voice signals to be switched onto a common speech highway for assigned time slot periods. Each voice signal is sampled once per time frame, that is, at intervals of less than 100 microseconds. The sampling process is such that the user is not aware that up to 23 other conversations may be in

progress on the same common speech highway. The sampling process is referred to as time division multiplex pulse amplitude modulation with resonant energy transfer.

SYSTEM ELEMENTS

2.06 The units comprising the power shelves operate from the commercial power source and supply all the power requirements of the system.

2.07 The units comprising the control shelf perform the system timing and control functions. Signals indicating the state of lines and trunks, dialing signals, and class of service are accepted by the control shelf during assigned time slots. The control circuit analyzes these signals, produces appropriate control and information signals in each time slot, and stores them for use in the control of call processing during the matching time slot in the next time frame. The voice signal sampling, the detection of state of line and trunk signals, and the production of further switching and control signals, is a continuous cyclical process which occurs at the regular time intervals determined by the system timing clock.

2.08 A choice between a subshelf or fully wired type option shelves is available. The subshelf type accommodates the subshelves required for the control of the busy lamp field, DIGITONE calling and toll denial options, and also the COS selector facilities for Line Shelf No. 3. The fully wired type option shelf does not employ subshelves and is used to provide code restriction, DIGITONE-to-dial pulse conversion, call pickup and call forward options in addition to those options provided on the subshelf type. If the system is used for hotel/motel service, the fully wired hotel/motel option shelf is required.

2.09 The units comprising the line shelves provide an interface between the station lines and the speech highway. Scanning signals from the control shelf cause state of line information (on-hook, off-hook, dialing, etc.) to be returned from the individual station line addresses (numbers) to the control shelf. Control signals from the control shelf cause the application of ringing to the station lines, or operate the switches which close the voice path between station lines and the speech highway, as appropriate.

2.10 The units comprising the trunk shelves provide an interface between the speech highway, the attendant console, the tone generators and the various types of trunks, i.e., Central Office (CO), Foreign Exchange (FX), tie, Common Control Switching Access (CCSA) line, Wide Area Telephone Service (WATS), Direct Inward Dialing (DID), paging, dictation, and music-on-hold. The control shelf interacts with the trunk shelves in a similar fashion to the line shelves, receiving state of trunk information from the individual trunks, and transmitting control signals to the trunks, which apply signaling to the trunk lines or connect the trunks to the speech highway.

2.11 The attendant console interfaces with the trunk shelf and the control shelf to provide access to the control and speech circuits of the system so that the attendant can perform the required services.

3. SYSTEM CONFIGURATION

GENERAL

3.01 The cabinet layout is illustrated in Fig. 2 which shows the location of the shelves on the two slides, the connector panel, and the power-fail transfer relays.

3.02 Apparatus base codes, followed by an asterisk instead of a suffix letter, are used to identify circuit pack locations, since this information applies to all family members of the same apparatus code. Make-up of a typical circuit pack assembly code QPJ60A CALL TFER IND CTL is:

QPJ – prefix and common to all Pulse 120 EPABX circuit packs

60 – Base code number for identification of individual circuit packs

A – Vintage control suffix letter

CALL TFER

IND CTL – abbreviated name

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When replacing circuit packs the base code numbers of replacing and existing circuit packs must be identical. The vintage control suffix letter may be identical or a following letter e.g., A QPJ60A or QPJ60B.

Note: A QPJ60A should not be used to replace a QPJ60B.

3.03 Some circuit packs bearing the same code number and color designation may differ in appearance, e.g., there may be surface wiring on some packs and not on others. These differences do not affect the interchangeability of the circuit packs, provided the code numbers are identical.

POWER SHELF NO. 1

3.04 This shelf is a unit assembly which uses no circuit packs, as shown in Fig. 3. When connected to the commercial power source, the shelf provides the following power supplies to the system:

-48 V dc	}	Fused and filtered
-24 V dc		
+24 V dc		
+12 V dc		
-12 V dc		
-48 V dc	}	Fused and unfiltered
-24 V dc		

POWER SHELF NO. 2

3.05 This shelf accommodates up to seven circuit packs as shown in Fig. 3.

The functions of the circuit packs are as follows:

- **QPJ43* +5 V REGULATOR:** Provides regulated +5 V dc power for the system. Each of the four circuit packs supplies power to particular system locations:

Control Shelf Option Shelf	}	Power supplied by Two regulators in connector locations 1 and 7.

Line Shelf No. 1 Trunk Shelf No. 1	}	Power supplied by one regulator in connector location 2.

Line Shelf No. 2 Line Shelf No. 3 Trunk Shelf No. 2	}	Power supplied by one regulator in connector location 3. (removed for basic system)

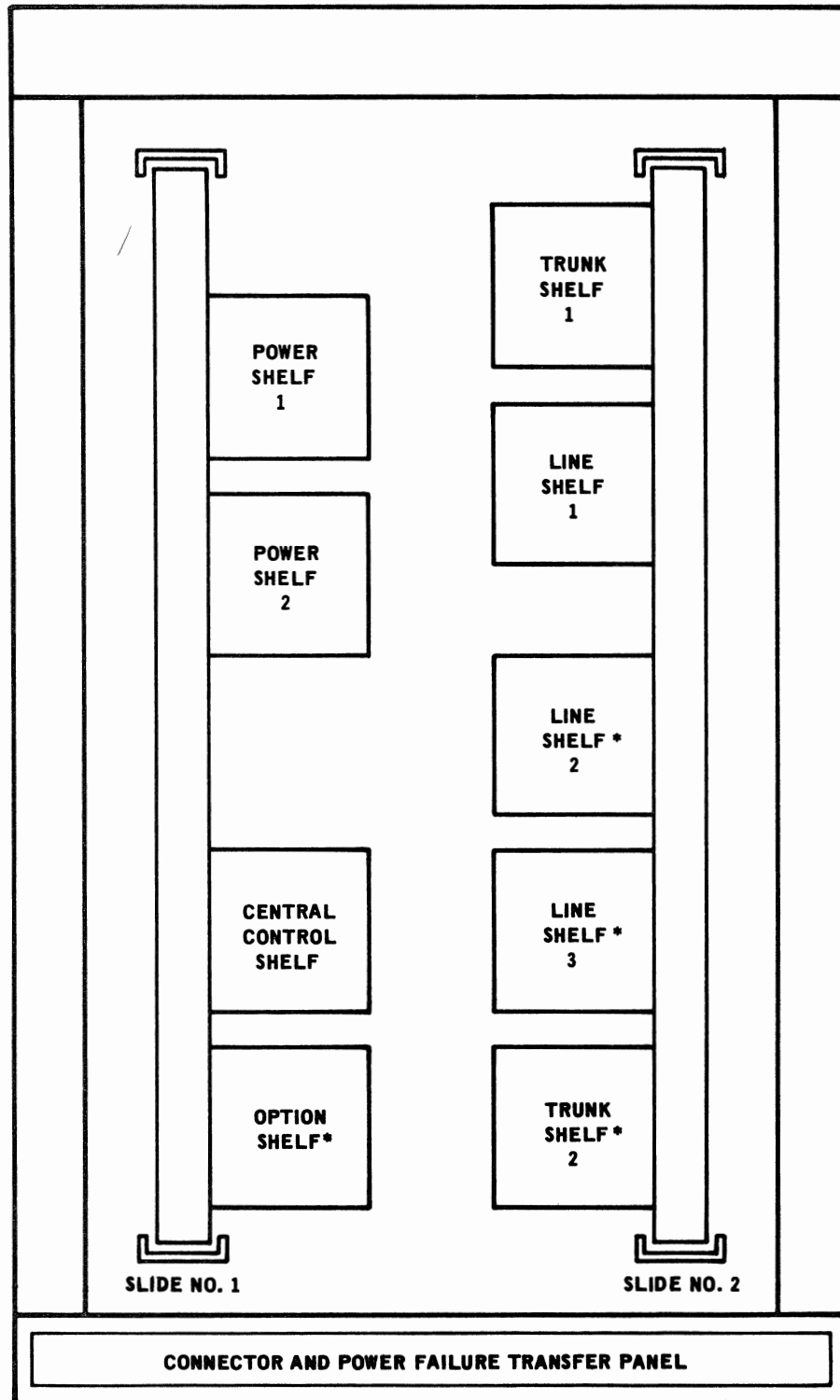
- **QPJ44* 20 Hz RINGING GEN:** Generates the 12 V, 20 Hz ringing supply which is stepped up to 86 V, 20 Hz by a separate transformer. The 12 V, 20 Hz test point on the handle facilitates output measurement of the pack.
- **QPJ47* PWR FAIL TFER CTL:** Detects power and ringing supply failures and releases the power fail transfer relays. Indicates failure of +5 V, +24 V, and 86 V, 20 Hz power supplies when light emitting diodes (LED) on the circuit pack handle are lit.
- **QPJ46* RING DISTRIBN:** Distributes the 86 V, 20 Hz ringing power to the line shelves, and carries the fuse alarm relays.

CONTROL SHELF

3.06 This shelf accommodates up to 26 circuit packs, as shown in Fig. 4. The functions of the circuit packs are as follows:

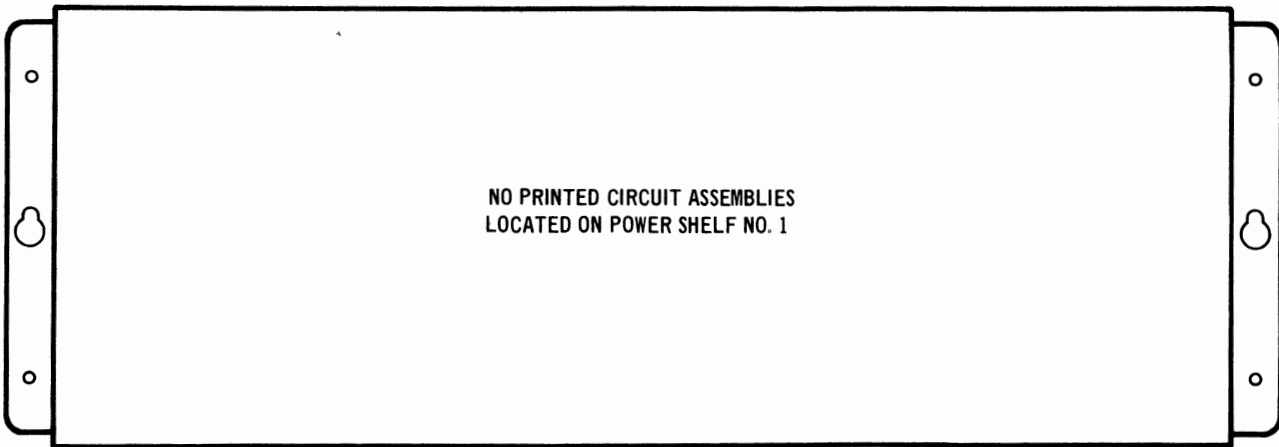
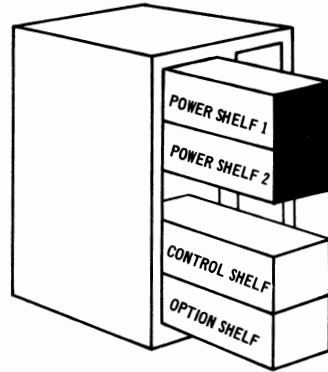
- **QPJ74* TRAFFIC MEAS-ATT, and QPJ78* TRAFFIC MEAS-TKS:** These circuit packs enable traffic measurements to be taken with an ALSTON† type portable traffic usage recorder or equivalent. Signals are provided from the PULSE 120 EPABX to enable usage, peg-count, and overflow measurements. The busy condition is a ground on an individual usage or peg-count lead for each circuit, and on an overflow lead per group of circuits.

† A trademark of Conrac Corporation.

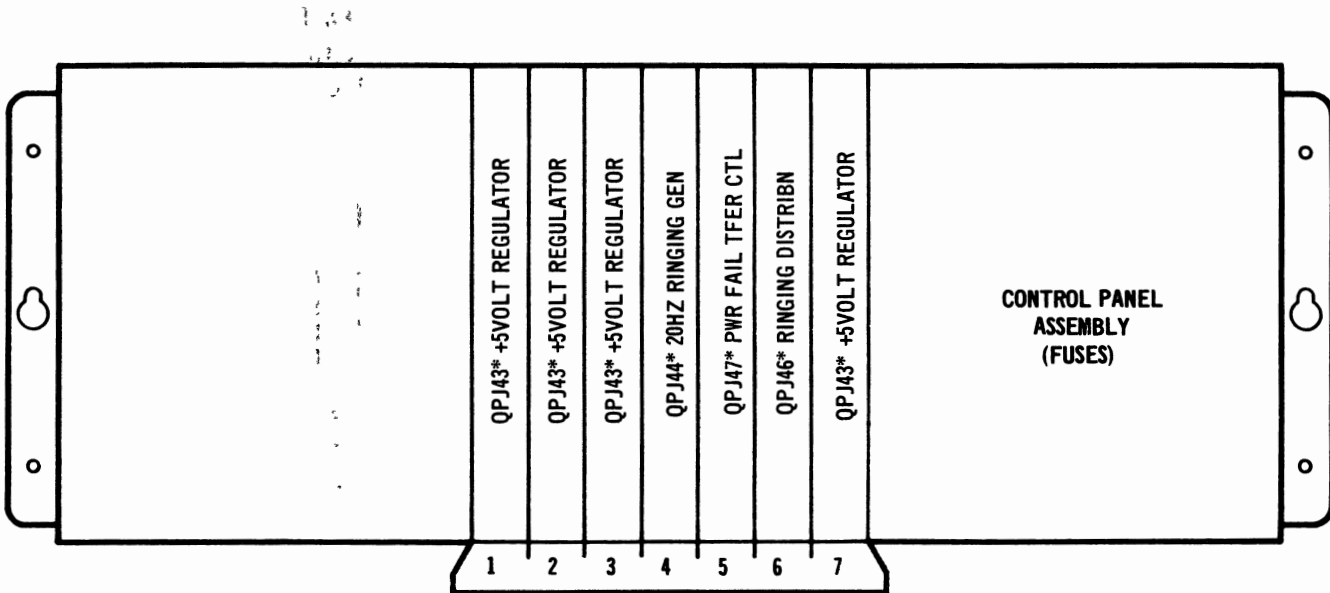


* THESE SHELVES ARE NOT INCLUDED IN THE BASIC UNIT.

Fig. 2 – PULSE 120 Cabinet Layout



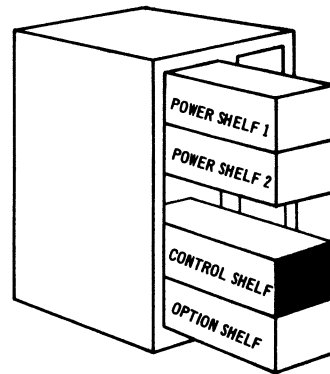
(a) Power Shelf No. 1



(b) Power Shelf No. 2

Fig. 3 – Layout of Power Shelves

- **QPJ97* MAINT TEST UNIT:** Used in checking the operation of the system during the fault-finding procedure. Provides diode pin test points and indicates failure of -12 V and +24 V supplies to the control shelf when LED on the faceplate are not lit.
- **QPJ54* 120 LINE CTL:** Controls the first dialed digit of a three-digit station line number.
- **QPJ19* 80 LINE CONVERSION:** Provides strapping connections necessary for the central control to respond correctly to a two-digit station line numbering plan.
- **QPJ65* CONFERENCE CTL:** Provides call processing specific to the attendant conference feature.
- **QPJ77* RBK/OVERRIDE CTL:** Provides call processing associated with executive ringback and override features.
- **QPJ30* DIAL PULSE SENDER:** Converts dc key pulse signals from the attendant console to standard dial pulses for transmission through CO trunks or tie trunks.
- **QPJ68* DIGITONE SENDER:** Converts dc key pulse signals from the attendant console to DIGITONE dialing signals for transmission through CO trunks or tie trunks.
- **QPJ60* CALL TFER IND CTL:** Provides call processing specific to the call transfer – individual, add-on, and consultation hold features.



- **QPJ61* CAMP ON/TAFAS CTL:** Provides call processing specific to the camp-on and indication of camp-on features. Also produces signals to light the permanent signal (PS) lamp on the console.
- **QPJ63* ATT OPTION CTL:** Provides call processing specific to the busy verification and barge-in lockout and secrecy features.

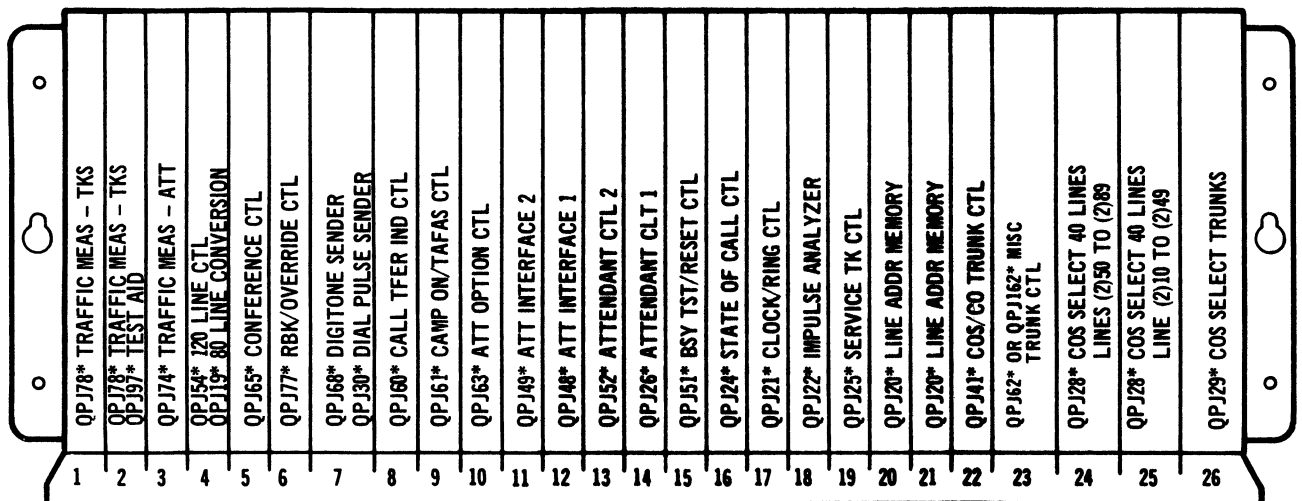


Fig. 4 – Layout of Control Shelf

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- **QPJ49* ATT INTERFACE 2:** Produces signals to control the processing of attendant calls as directed by loop key and control key signals received from the attendant console, and lights the associated indicator lamps on the attendant console.
- **QPJ48* ATT INTERFACE 1:** Produces signals which affect the processing of attendant directed calls, and lights the appropriate indication lamps on the attendant console.
- **QPJ52* ATTENDANT CTL 2:** Stores signals indicating the state reached in the processing of attendant directed calls, changes the stored signals as the states of calls change, and produces signals controlling the following attendant directed services:

Night Service – Assigned Night Answer

Night Service – Trunk Answer From Any Station (TAFAS)

Attendant Key Sending

Attendant Incoming Calls

Attendant Incoming Call Identification

- **QPJ26* ATTENDANT CTL 1:** Stores signals indicating the state reached in the processing of attendant directed calls, changes the stored signals as the states of calls change, and produces appropriate control signals.
- **QPJ51* BSY TST/RESET CTL:** All off-hook conditions detected during the continuous cyclical monitoring of all the station lines and trunks are tested by this circuit for call origination or busy condition. The busy/idle condition is checked by this circuit. Appropriate control signals are produced to direct the next stage of call processing.

- **QPJ24* STATE OF CALL CTL:** Stores signals indicating the state reached in the processing of calls, changes the stored signals as the states of calls change, and produces signals controlling the processing of calls.
- **QPJ21* CLOCK/RING CTL:** Provides the system timing signals, which control system operations. Also produces ringing signals.
- **QPJ22* IMPULSE ANALYZER:** Times on-hook, off-hook, dialing, and flash signals and generates appropriate control signals suitable for use in the system.
- **QPJ25* SERVICE TRUNK CTL:** Stores signals indicating the supervisory tones required for particular calls, changes the stored signals as the states of calls change, and produces signals used in controlling the application of supervisory tones to individual station lines or trunks.
- **QPJ20* LINE ADDR MEMORY:** The two identical line address memory circuit packs store information on the source and destination of all calls being processed, and provide signals to direct the main cyclical monitoring and sampling processes in response to control signals received from other circuit packs.
- **QPJ41* COS/CO TRUNK CTL:** Uses signals derived from the class-of-service (COS) trunks circuit pack to control the usage of any trunk when its address (number) is recognized, and also produces additional signals to control the processing of calls through CO trunks. CO to CO, and CO to FX, connections are prohibited.
- **QPJ62* or QPJ162* MISC TRUNK CTL:** Produces signals to control the processing of calls through universal trunks. The particular use of a trunk is determined by the position of diode pins in a diode block.

- **QPJ28* COS SELECT 40 LINE:** Produces signals indicating the COS assigned to each station line when the address (number) of the station line is recognized. The COS for each station line is determined by the position of a number of diode pins in a COS block on the circuit pack. The two of a number of diode pins in a COS block on the circuit pack. The two circuit packs shown in Fig. 4 serve line shelves no. 1 and no. 2.
- **QPJ29* COS SELECT TRUNKS:** Produces signals indicating the COS assigned to each trunk when the address (number) of the trunk is recognized. The COS for each trunk is determined by the position of a number of diode pins in a COS block on the circuit pack.

OPTION SHELF (SUBSHELF TYPE)

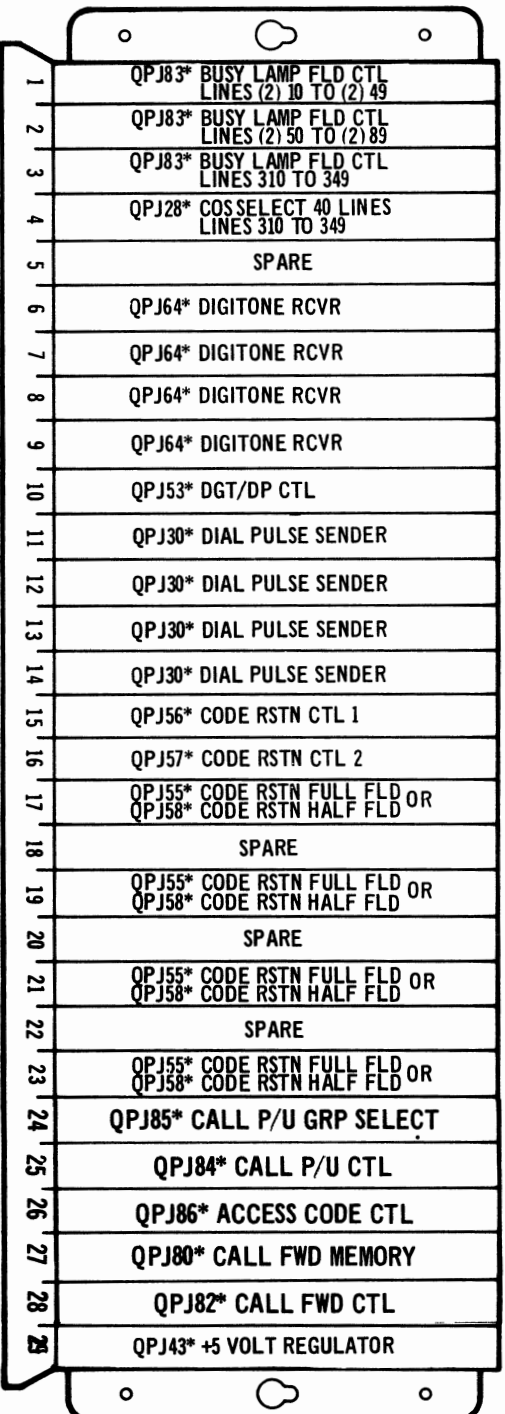
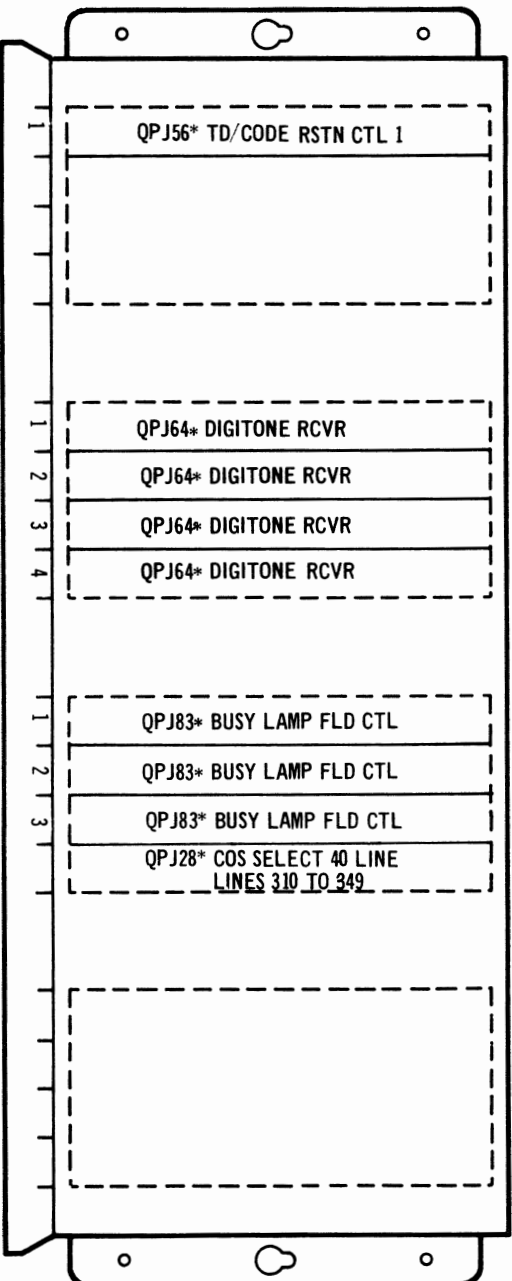
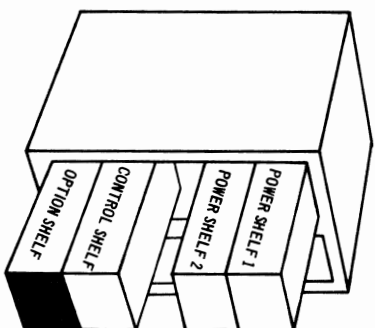
3.07 This shelf accommodates up to nine circuit packs, mounted on three subshelves as shown in Fig. 5. The functions of the circuit packs are as follows:

- **QPJ56* TD/CODE RSTN CTL 1:** Monitors the first and second dialed digits following the trunk access code, for a '0' or '1'. Detection of either of these digits denies a toll connection when the station line has a toll denial COS.
- **QPJ64* DIGITONE RCVR:** Accepts DIGITONE calling signals and converts them into signals suitable for use in the call control circuit packs. Up to four DIGITONE receiver circuit packs may be accommodated on the subshelf, the required number depends upon the anticipated traffic level.
- **QPJ83* BUSY LAMP FLD CTL:** Provides power to light individual lamps in the busy lamp field as directed by the call control circuit packs when the associated station lines are busy. Each circuit pack serves up to 40 busy lamps.

OPTION SHELF (FULLY-WIRED TYPE)

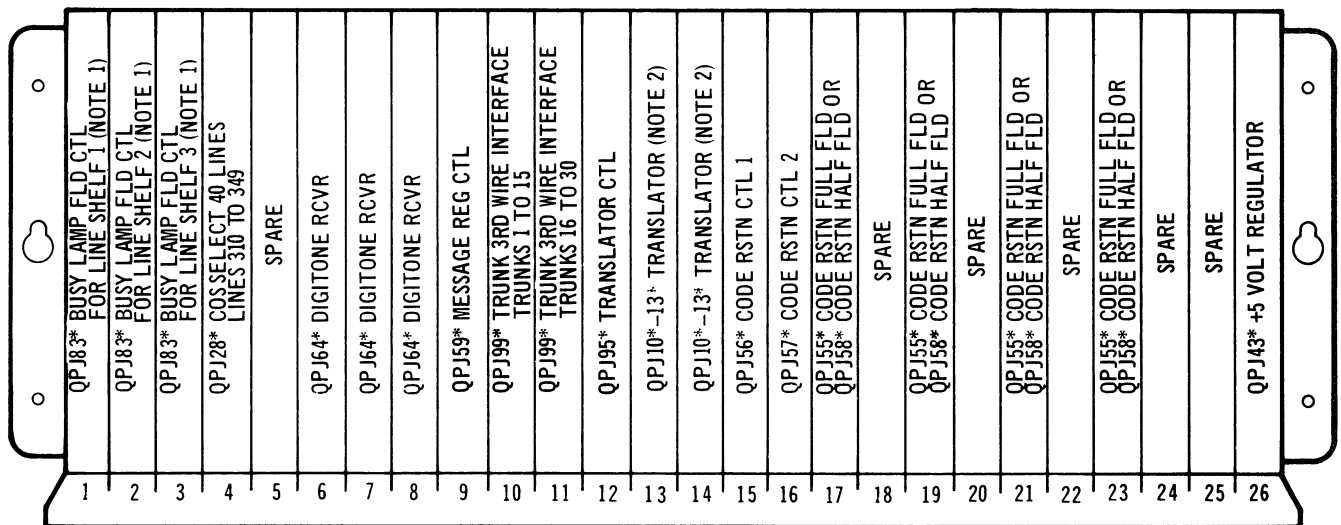
3.08 This shelf accommodates up to 24 circuit packs as shown in Fig. 5. The functions of the circuit packs are as follows:

- **QPJ83* BUSY LAMP FLD CTL:** Provides power to light individual lamps in the busy lamp field as directed by the call control circuit packs when the associated station lines are busy. Each circuit pack serves up to 40 busy lamps.
- **QPJ28* COS SELECT 40 LINE:** Produces signals indicating the COS assigned to each station line when the address (number) of the station line is recognized. The COS for each station line is determined by the position of a number of diode pins in a COS block on the circuit pack. This circuit pack serves line shelf no. 3.
- **QPJ64* DIGITONE RCVR:** Accepts DIGITONE calling signals and converts them into signals suitable for use in the call control circuit packs. Up to four DIGITONE receiver circuit packs can be accommodated on the shelf, the number required depends upon the anticipated traffic level.
- **QPJ53* DGT/DP CTL:** Controls the use of the DIGITONE receiver and dial pulse sender circuit packs during DIGITONE to dial pulse signaling on trunk calls by pretranslation of dialed digits.
- **QPJ30* DIAL PULSE SENDER:** Converts the dc pulse signals from the call control circuit packs to standard dial pulses for transmission through trunk circuits. Up to



Note: Fully wired type shelf QSP6M has no provision for QPJ80, 82, 84, 85, 86 cards. Also QPJ43 is installed in connector location 26.

Fig. 5 - Layout of Option shelves



NOTE 1: FOR HOTEL/MOTEL SERVICE QPJ83-TYPE CIRCUIT PACKS ARE USED TO DRIVE MESSAGE REGISTRATION EQUIPMENT.

NOTE 2: THE CODE NUMBER OF THE TRANSLATOR DEPENDS UPON THE CHOICE OF ROOM NUMBERING PLAN.

(c) Hotel/Motel Type

Fig. 5 (cont) — Layout of Option Shelves

four circuit packs can be accommodated on the shelf, the number required depends upon the anticipated traffic level.

- **QPJ56* TD/CODE RSTN CTL 1:** Monitors the first and second dialed digits following the trunk access code for a '0' or '1'. When these digits are detected the circuit pack provides further control over area, service and exchange code numbers dialed by station lines with a code restriction COS.
- **QPJ57* CODE RSTN CTL 2 :** Provides signals to control toll access digit absorption, area, service, and exchange code dialing from station lines with a code restriction COS.
- **QPJ55* CODE RSTN FULL FLD:** Produces signals indicating which toll access digits are to be absorbed and which area of service codes may be dialed through CO or FX trunks by station lines with a

code restriction COS. Each digit of the designated code numbers is determined by the position of a shorting pin in a code restriction field (CRF) block on the circuit pack. The CRF consists of:

Digit Absorption	4 different single digits
Allowed Area or Service Codes	8 three digit codes.
Allowed or Denied Exchange Codes	28 -1, -2, or 3 codes.

Up to four CRF circuit packs may be accommodated on the shelf.

- **QPJ58* CODE RSTN HALF FLD:** Identical to the QPJ55 type circuit in all respects except that only eight Allowed or Denied Exchange codes may be programmed on the CRF.

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- **QPJ85* CALL PICKUP GRP SELECT:** Provides switches for the assignment of station lines (up to 120) to one of nine Call Pickup Groups. No more than thirty stations can be assigned to a single pickup group. Also, it provides a switch position for stations not assigned to a pickup group.
- **QPJ84* CALL PICKUP CTL:** Provides the circuitry to allow a station user to answer a call directed to another station, if the number of the ringing station is known. Also, provides control signals to the QPJ85 circuit pack when call pickup by group is provided.
- **QPJ86* ACCESS CODE CTL:** Provides decoding of access codes 41, 42, 43, and 44 used for call pickup and call forward features.
- **QPJ80* CALL FWD MEMORY:** Contains the call forward memory which stores the destination number of stations whose calls are to be forwarded. Also, contains the call forward store which provides signals regarding the status of call forward processing.
- **QPJ82* CALL FWD CTL:** Provides the necessary logic circuitry to implement call forwarding.
- **QPJ43* +5 V REGULATOR:** Provides regulated +5 V dc power for optional features on the shelf.
- **QPJ28* COS SELECT 40 LINE:** Produces signals indicating the COS assigned to each station line when the address (number) of the station line is recognized. The COS for each station line is determined by the position of a number of diode pins in a COS block on the circuit pack. The circuit pack serves line shelf No. 3.
- **QPJ64* DIGITONE RCVR:** Accepts DIGITONE calling signals and converts them into signals suitable for use in the call control circuit packs. Up to three DIGITONE receiver circuit packs can be accommodated on the shelf; the number required depends upon the anticipated traffic level.
- **QPJ59* MESSAGE REG CTL:** Accepts signals from either the reverse battery bus or the trunk third wire (message register) bus indicating completed local telephone calls from guest rooms. Provides signals for the busy lamp field control packs to operate message registers. Allows selection of one count or multiple counts per completed call (with third wire operation).
- **QPJ99* TRUNK 3RD WIRE INTFACE:** Accepts third wire (message register) lead from a central office trunk and detects the presence of a -48Vdc (nominal) signal on this lead. Provides a signal to the message register central pack for counting completed local telephone calls from guest rooms. Each pack serves up to 15 trunks.
- **QPJ95* TRANSLATOR CTL:** Provides control signals to the translator packs to allow conversion of dialed numbers into valid PULSE 120 EPABX system addresses. Provides storage of the dialed numbers while the search for a valid system address is in progress. Operation of a switch determines the use of seven plus (7+) or non seven plus dialing.

OPTION SHELF (HOTEL/MOTEL TYPE)

3.09 This shelf accommodates up to 20 circuit packs as shown in Fig. 5. The functions of the circuit packs are as follows:

- **QPJ83* BUSY LAMP FLD CTL:** Provides the signals to operate individual guest room telephone message registers (24 Vdc or 48 Vdc) as directed by the QPJ59*. Can also interface with electronic message registration systems. Each circuit pack serves up to 40 message registers.

- **QPJ10* THROUGH 13* TRANSLATOR:**
Accepts control signals and dialed digits from the translator control pack. Contains a programmable read only memory (PROM) and the necessary logic to convert dialed numbers into valid PULSE 120 EPABX system addresses. Two translator packs are recommended for enhanced system reliability.
- **QPJ56* TD/CODE RSTN CTL 1:** Monitors the first and second dialed digits following the trunk access code for a '0' or '1'. When these digits are detected the circuit pack provides further control over area, service and exchange code numbers dialed by station lines with a code restriction COS.
- **QPJ57* CODE RSTN CTL 2:** Provides signals to control toll access digit absorption, area, service, and exchange code dialing from station lines with a code restriction COS.
- **QPJ55* CODE RSTN FULL FLD:** Produces signals indicating which toll access digits are to be absorbed and which area of service codes may be dialed through CO or FX trunks by station lines with a code restriction COS. Each digit of the designated code numbers is determined by the position of a shorting pin in a code restriction field (CRF) block on the circuit pack. The CRF consists of:

Digit Absorption	4 different single digits
Allowed Area or Service Codes	8 three digit codes..
Allowed or Denied Exchange Codes	28 -1, -2, or 3 digit codes.

Up to four CRF circuit packs may be accommodated on the shelf.
- **QPJ58* CODE RSTN HALF FLD:** Identical to the QPJ55 type circuit in all respects except that only eight Allowed or Denied Exchange codes may be programmed on the CRF.

LINE SHELVES

3.10 Each of the three shelves accommodates up to 24 circuit packs, as shown in Fig. 6. Up to 20 Line Circuit circuit packs can be carried on each shelf in connector locations 1 to 10, 15 to 24. Each connector location terminates two station lines, which are consecutively numbered, even number first. The "tens groups" are arranged consecutively on the shelves starting from the left, the (2)10s, (2)20s, (2)30s and (2)40s on line shelf no. 1, the (2)50s, (2)60s, (2)70s, and (2)80s on line shelf no. 2 and to 310s, 320s, 330s and 340s on line shelf no. 3. The 10-voice circuits of the 5-line circuit circuit packs in a 10s group are switched on to the same subgroup speech highway. Each subgroup speech highway is switched on to the main speech highway through a link gate on the clamp and link gate circuit pack on the shelf. The functions of the individual circuit packs on the shelves are as follows:

- **QPJ36* LINE CIRCUIT:** One circuit pack provides individual interfacing between station apparatus and the electronic control and switching operations of the PULSE 120 EPABX for two station lines consecutively numbered, even number first.
- **QPJ37* DECOUPLING:** Contains decoupling capacitors for the ± 24 V and +5 V power buses on the line shelves; and circuitry to revert one-way incoming only trunks to 2-way during the setting up of flexible night service. It also provides test points on the four 86 V, 20 Hz ringing supplies.
- **QPJ34* LINE BUFFER:** The two line buffer circuit packs (terminating and calling), which are identical, are used to direct call control signals to individual terminating and calling station lines, respectively, located on the shelf. The signals provide for off-hook and on-hook detection, ringing control, and control of switching to the speech highway.

1	QPJ36* LINE CIRCUIT	(2)10 (2)11
2	QPJ36* LINE CIRCUIT	(2)12 (2)13
3	QPJ36* LINE CIRCUIT	(2)14 (2)15
4	QPJ36* LINE CIRCUIT	(2)16 (2)17
5	QPJ36* LINE CIRCUIT	(2)18 (2)19
6	QPJ36* LINE CIRCUIT	(2)20 (2)21
7	QPJ36* LINE CIRCUIT	(2)22 (2)23
8	QPJ36* LINE CIRCUIT	(2)24 (2)25
9	QPJ36* LINE CIRCUIT	(2)26 (2)27
10	QPJ36* LINE CIRCUIT	(2)28 (2)29
11	QPJ37* DECOUPLING	
12	QPJ34* LINE BUFFER	
13	QPJ34* LINE BUFFER	
14	QPJ33* CLAMP & LINK GATE	
15	QPJ36* LINE CIRCUIT	(2)30 (2)31
16	QPJ36* LINE CIRCUIT	(2)32 (2)33
17	QPJ36* LINE CIRCUIT	(2)34 (2)35
18	QPJ36* LINE CIRCUIT	(2)36 (2)37
19	QPJ36* LINE CIRCUIT	(2)38 (2)39
20	QPJ36* LINE CIRCUIT	(2)40 (2)41
21	QPJ36* LINE CIRCUIT	(2)42 (2)43
22	QPJ36* LINE CIRCUIT	(2)44 (2)45
23	QPJ36* LINE CIRCUIT	(2)46 (2)47
24	QPJ36* LINE CIRCUIT	(2)48 (2)49 †

† QPJ40* TEST PACK MAY BE INSTALLED IN THIS OR ANY OTHER LINE CIRCUIT POSITION IN LINE SHELVES 1, 2, 3, BUT PREFERABLY IN AN EMPTY TRUNK POSITION IN TRUNK SHELF 1 OR 2.

(a) Line Shelf No. 1

1	QPJ36* LINE CIRCUIT	(2)50 (2)51
2	QPJ36* LINE CIRCUIT	(2)52 (2)53
3	QPJ36* LINE CIRCUIT	(2)54 (2)55
4	QPJ36* LINE CIRCUIT	(2)56 (2)57
5	QPJ36* LINE CIRCUIT	(2)58 (2)59
6	QPJ36* LINE CIRCUIT	(2)60 (2)61
7	QPJ36* LINE CIRCUIT	(2)62 (2)63
8	QPJ36* LINE CIRCUIT	(2)64 (2)65
9	QPJ36* LINE CIRCUIT	(2)66 (2)67
10	QPJ36* LINE CIRCUIT	(2)68 (2)69
11	QPJ37* DECOUPLING	
12	QPJ34* LINE BUFFER	
13	QPJ34* LINE BUFFER	
14	QPJ33* CLAMP & LINK GATE	
15	QPJ36* LINE CIRCUIT	(2)70 (2)71
16	QPJ36* LINE CIRCUIT	(2)72 (2)73
17	QPJ36* LINE CIRCUIT	(2)74 (2)75
18	QPJ36* LINE CIRCUIT	(2)76 (2)77
19	QPJ36* LINE CIRCUIT	(2)78 (2)79
20	QPJ36* LINE CIRCUIT	(2)80 (2)81
21	QPJ36* LINE CIRCUIT	(2)82 (2)83
22	QPJ36* LINE CIRCUIT	(2)84 (2)85
23	QPJ36* LINE CIRCUIT	(2)86 (2)87
24	QPJ36* LINE CIRCUIT	(2)88 (2)89

(b) Line Shelf No. 2

1	QPJ36* LINE CIRCUIT	310 311
2	QPJ36* LINE CIRCUIT	312 313
3	QPJ36* LINE CIRCUIT	314 315
4	QPJ36* LINE CIRCUIT	316 317
5	QPJ36* LINE CIRCUIT	318 319
6	QPJ36* LINE CIRCUIT	320 321
7	QPJ36* LINE CIRCUIT	322 323
8	QPJ36* LINE CIRCUIT	324 325
9	QPJ36* LINE CIRCUIT	326 327
10	QPJ36* LINE CIRCUIT	328 329
11	QPJ37* DECOUPLING	
12	QPJ34* LINE BUFFER	
13	QPJ34* LINE BUFFER	
14	QPJ33* CLAMP & LINK GATE	
15	QPJ36* LINE CIRCUIT	330 331
16	QPJ36* LINE CIRCUIT	332 333
17	QPJ36* LINE CIRCUIT	334 335
18	QPJ36* LINE CIRCUIT	336 337
19	QPJ36* LINE CIRCUIT	338 339
20	QPJ36* LINE CIRCUIT	340 341
21	QPJ36* LINE CIRCUIT	342 343
22	QPJ36* LINE CIRCUIT	344 345
23	QPJ36* LINE CIRCUIT	346 347
24	QPJ36* LINE CIRCUIT	348 349

(c) Line Shelf No. 3

Fig. 6 – Layout of Line Shelves

- **QPJ33* CLAMP/LINK GATES:** Four electronic switches form the link gate, each switch being associated with a subgroup speech highway on the shelf. A sampling signal appearing in a time slot assigned to a station line causes the link gate switch associated with that station line to connect the subgroup highway to the main speech highway. Between sampling signals in successive time slots, the speech highways are switched (clamped) to ground by the clamp to clear the highways for the next sample.
- **QPJ40* MAINT TEST UNIT:** Used in checking all the power supplies to the line and trunk shelves during the fault-finding procedure. Provides eight test points and indicates the failure of a power supply to a shelf or connector when an associated LED on the faceplate of the circuit pack is not lit. This circuit pack is stored in any spare connector on a line or trunk shelf, but preferably in a spare trunk shelf connector.

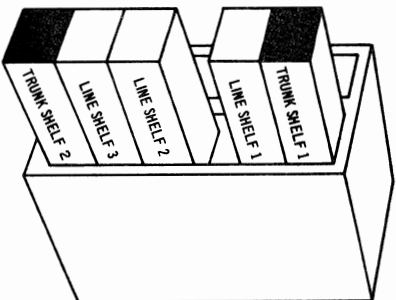
TRUNK SHELF NO. 1

3.11 This shelf accommodates up to 24 circuit packs as shown in Fig. 7. Each of the connector locations, 5 to 9 and 15 to 24, terminates one external trunk line. All 15 locations may be connected to CO trunks, in which case a CO trunk circuit pack is inserted in each connector. Other types of trunk may be terminated at the connectors as listed in Table A, in which case the appropriate circuit packs are inserted in the connectors as shown in the table. The remaining connector locations, 1 to 4 and 10 to 14, are permanently assigned to circuit packs as shown in Fig. 7. Connections from the circuit pack voice circuits to the four subgroup highways associated with the link gate on the shelf are arranged for optimum system operation. The functions of the individual circuit packs on the shelf are as follows:

- **QPJ50* TONE GEN/INTRUPTR:** Produces three basic tones, dial, audible ringback, and miscellaneous, which are interrupted as required for supervisory

signals in the system. The interruptions are determined by control signals from the control shelf.

- **QPJ39* TONE TRUNKS:** Control signals switch the supervisory tones from the tone generator/interrupter on to the associated subgroup speech highway as required. Three circuits are provided for dial, busy, and overflow tones, four for ringback tone, and one for miscellaneous tone.
- **QPJ67* DIGITONE INTFACE:** Provides four separate circuits to receive DIGITONE signals from the speech highway, and provides filtering and onward transmission to the associated DIGITONE receiver circuit packs.
- **QPJ35* ATT LIN/ADD-ON TK:** Provides the electronic switch between the attendant console speech circuit and the subgroup speech highway. Three add-on trunks are also provided for use with the call transfer individual feature.
- **QPJ72* CONFERENCE AMPL:** Provides the interconnections and the amplification necessary to maintain standard speech signal levels for a 6-port conference connection (attendant and up to five conferees).
- **QPJ71* CONF AMPL INTFACE:** Provides control signals for conference calls with up to five conferees and the attendant, switching the voice circuits and the conference trunk amplifier on to the highway as required.
- **QPJ31* TRUNK BUFFER 1:** Directs call control signals from the control shelf to individual trunk circuit packs in connector locations 5 to 9 and 15 to 24.
- **QPJ42* TRUNK BUFFER 2:** Directs call control signals affecting the assignment of supervisory tones and switching signals to the appropriate circuit pack. Also contains drive circuitry for three trunk group busy lamps.



1	QPJ50* TONE GEN/INTRUPTR
2	QPJ39* TONE TRUNKS
3	QPJ67* DIGITONE INTFACE
4	QPJ35* ATT LIN/ADD-ON TK
5	TRUNK 11
6	TRUNK 12
7	TRUNK 13
8	TRUNK 14
9	TRUNK 15
10	QPJ72* CONFERENCE AMPL
11	QPJ71* CONF AMPL INTFACE
12	QPJ31* TRUNK BUFFER 1
13	QPJ42* TRUNK BUFFER 2
14	QPJ33* CLAMP/LINK GATES
15	TRUNK 1
16	TRUNK 2
17	TRUNK 3
18	TRUNK 4
19	TRUNK 5
20	TRUNK 6
21	TRUNK 7
22	TRUNK 8
23	TRUNK 9
24	TRUNK 10

NOTE: QPJ40* TEST PACK MAY BE INSTALLED AND STORED IN ANY SPARE TRUNK OR LINE SHELF CONNECTORS, BUT PREFERABLY IN A SPARE TRUNK SHELF CONNECTOR.

(a) Trunk Shelf No. 1

1	SPARE
2	QST3* TK CURR LIMITER
3	SPARE
4	SPARE
5	TRUNK 26
6	TRUNK 27
7	TRUNK 28
8	TRUNK 29
9	TRUNK 30
10	SPARE
11	SPARE
12	QPJ31* TRUNK BUFFER 1
13	QPJ42* TRUNK BUFFER 2
14	QPJ33* CLAMP/LINK GATES
15	TRUNK 16
16	TRUNK 17
17	TRUNK 18
18	TRUNK 19
19	TRUNK 20
20	TRUNK 21
21	TRUNK 22
22	TRUNK 23
23	TRUNK 24
24	TRUNK 25

(b) Trunk Shelf No. 2

Fig. 7 — Layout of Trunk Shelves

**TABLE A
TRUNK CONNECTIONS**

CONNECTOR LOCATIONS	CIRCUIT PACKS/EXTERNAL TRUNK TERMINATIONS			
	CO, FX (I/C ONLY) OR DID TRUNK	CCSA, FX OR TIE TRUNK	PAGING TRUNK	DICTION TRUNK APPLIQUE
5	X	X	X	
6	X	X	X	X
7	X	X	X	X
8	X	X	X	
9	X	X	X	
15	X			
16	X			
17	X			
18	X			
19	X			
20	X			
21	X			
22	X			
23	X			
24	X			

Notes:

1. Paging trunks and dictation trunk appliques may only be installed in trunk shelf no. 1.
2. A paging trunk in connector location 5 only, may have the attendant preemption facility.
3. FX trunks are restricted to connector locations 5 to 9 only, if assigned dial access is required.

- **QPJ33* CLAMP/LINK GATES:** Switches the subgroup speech highways onto the main speech highway, and provides ground clamping, as described in 3.06. (This circuit pack is identical to the one used on each line shelf and on trunk shelf no. 2.)
- **QPJ38* CO/FX NONGAIN TK:** Provides an interface between the CO or FX and both the subgroup speech highway and the control circuitry.
- **QPJ81* CO/FX GAIN TK:** Provides an interface between the CO or FX and both the subgroup speech highway and the control circuitry. A 2-way amplifier and switchable attenuating pads are provided in the speech path.
- **QPJ76* LOOP SIG TK:** Provides an interface between a distant private branch exchange (PBX) tie trunk or a CO and both the subgroup speech highway and the control circuitry for 2-way dialing or one-way direct inward dialing (DID) service respectively. Various combinations of battery and ground or loop pulsing, loop supervision, and dialing repeaters are available by strapping options as required.
- **QPJ69* E&M/DX TK:** Provides an interface between a distant PBX tie trunk or a CCSA line and both the subgroup speech highway and the control circuitry for 2-way dialing service. The circuit provides outgoing dial selection and dial repeating, incoming pulse correction, and

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DX or E and M signaling. Resistor lamps to limit the current in the M lead of the E and M tie trunks are located in the base of the cabinet.

- **QPJ75* PAGING TRUNK:** Provides an interface between customer-owned paging equipment and the subgroup speech highway. Connector location 5 is wired to permit pushbutton preemption of the paging trunk by the attendant. Attendant access to a paging trunk in any other location is by dialing.
- **QPJ73* DICTN TK APPLIQUE:** Provides an interface between an external electromechanical recorded telephone dictation trunk and the subgroup speech highway and control circuitry.
- **QPJ181* CO/FX MOH TRUNK:** Provides an interface between the CO or Foreign Exchange and both the subgroup speech highway and the control circuitry. A 2-way amplifier and a switchable 1 dB attenuating pad are provided in the speech path. Also, under certain non-talking conditions, a customer-supplied audio signal can be applied to the party connected to the trunk tip and ring (see Table N in Section 553-5011-204).
- **QPY112* AND QPY113* DECOUPLE UNITS:** Contain decoupling capacitors for the power buses on the trunk shelf as follows:

QPY112* for +24 V and -24 V
QPY113* for -48 V and +5 V

Both of these units consist of two capacitors mounted on a printed circuit board which is secured, by two screws, to the shelf side of the hinged backplate at the rear of the trunk shelf. Slip-on connections are made from the shelf wiring to the circuit board.

TRUNK SHELF NO. 2

3.12 The shelf assembly is similar to trunk shelf no. 1, with connector locations for 23 circuit packs as shown in Fig. 7. However, the full complement of circuit packs for trunk shelf no. 2 is 18, with five spare connector locations. The functions of the circuit packs carried on the shelf, listed below, are identical to those of the same circuit packs on trunk shelf no. 1, except that paging trunk and dictation trunk applique circuit packs may not be installed in trunk shelf no. 2.

- (a) **QPJ31* TRUNK BUFFER 1**
- (b) **QPJ42* TRUNK BUFFER 2**
- (c) **QPJ33* CLAMP/LINK GATES**
- (d) **QPJ38* CO/FX NONGAIN TK**
- (e) **QPJ81* CO/FX GAIN TK**
- (f) **QPJ76* LOOP SIG TK**
- (g) **QPJ69* E&M/DX TK**
- (h) **QPJ181* CO/FX MOH TK**
- (i) **QPY112* AND QPY113* DECOUPLE UNITS.**

In addition, the following item is permanently wired in connector location 2:

- (j) **QST3* TK CURR LIMITER:** Provides five resistor lamps to limit the current in the signaling leads of five E&M/DX trunks in connector locations 5 through 9 of trunk shelf no. 2.

4. CABINET CABLING

4.01 The arrangement of the cabinet cabling for the possible shelf configurations is shown in Fig. 8 through 13.

4.02 The back plane wiring of each shelf is brought out to a cable connector either on the shelf or on a flexible cable. The connectors are NS19163 plugs. The pin numbers are molded in the plastic on the wire connection side of the plug, and number from bottom to top and left to right, see Fig. 14. The matching jacks are also numbered on the wire connection side. The two rows of pins on each circuit pack connector, at the rear of the shelves, are numbered from the top of the connector. The left row are the A pins and the right row are the B pins.

Note: When removing the jack from the plug, loosen the two screws alternately an equal number of turns.

4.03 The terminating plug (QPF18*) must be inserted in the following connectors under the circumstances indicated:

- (a) P310 – When line shelves no. 2 and no. 3, and trunk shelf no. 2 are not installed
- (b) P330 – When line shelf no. 3 trunk shelf no. 2 is not installed
- (c) P390 – When trunk shelf no. 2 is not installed

- (d) P340 – When trunk shelf no. 2 is installed. (Line shelves no. 2 and no. 3 may or may not be installed.)

4.04 The external cables, commercial power supply cable, and external ground lead are connected to the system at the connector panel. The connector panel is located beneath the slides at the bottom of the cabinet. The connections are made through a row of connector plugs on the panel, except for the ground connection. Two connector plugs are provided on the connector panel to permit connections to the power fail transfer panel.

4.05 The power fail transfer (PFT) panel is also located beneath the slides at the bottom of the cabinet. Four PFT relays and six resistor lamps are mounted on the panel. When power failure occurs the PFT relays release and bridge station lines 10 through 19 directly to trunks 1 through 10. Five resistor lamps (LP 2 through 6) are provided to limit the current in the signaling leads of five E&M/DX tie trunks in connector locations 5 through 9 of trunk shelf no. 1. The sixth resistor lamp (LP 1) is provided to limit the current through the R-BAT lead of the PFT CO alarm battery circuit.

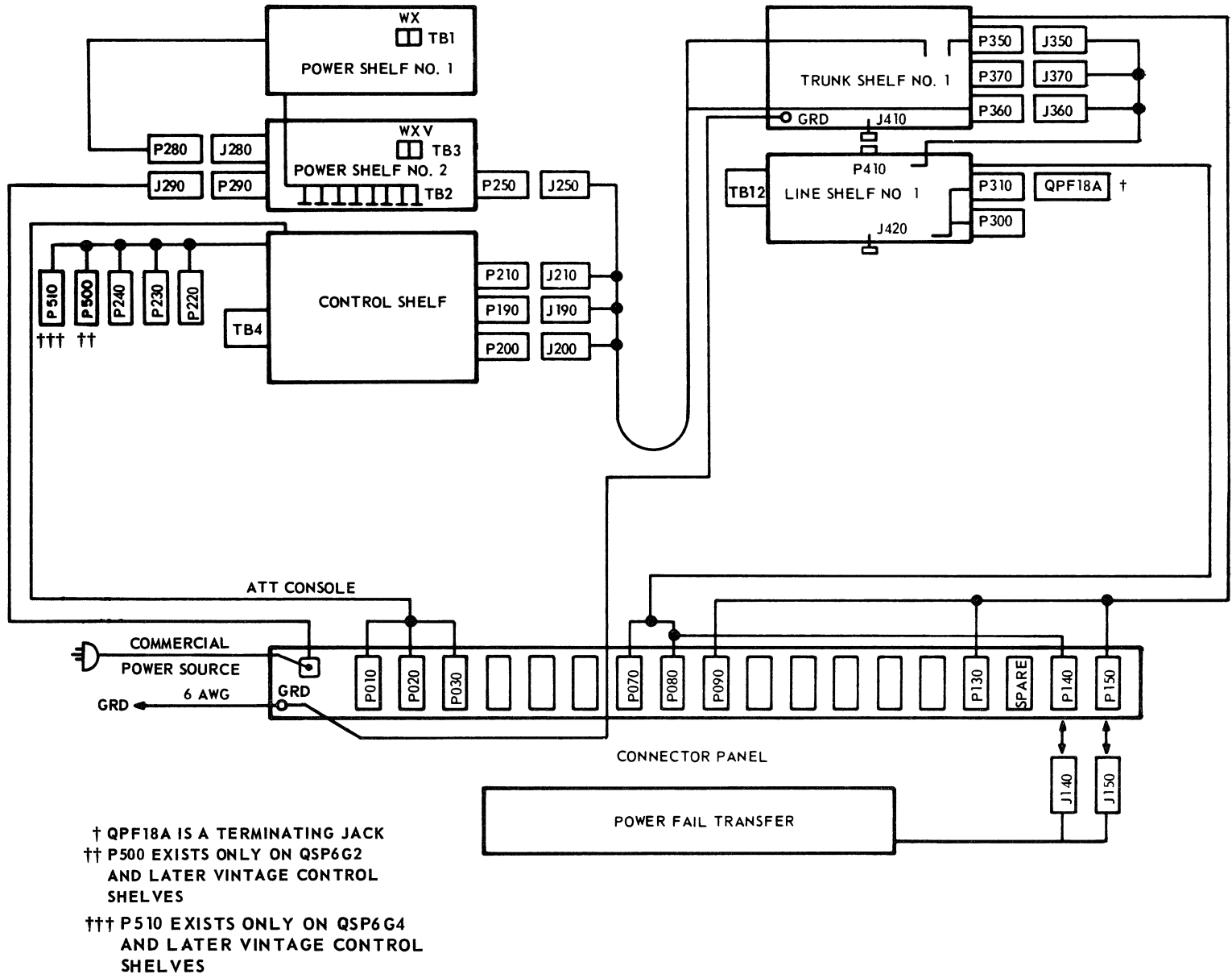


Fig. 8 – Internal Cabling of Basic Unit

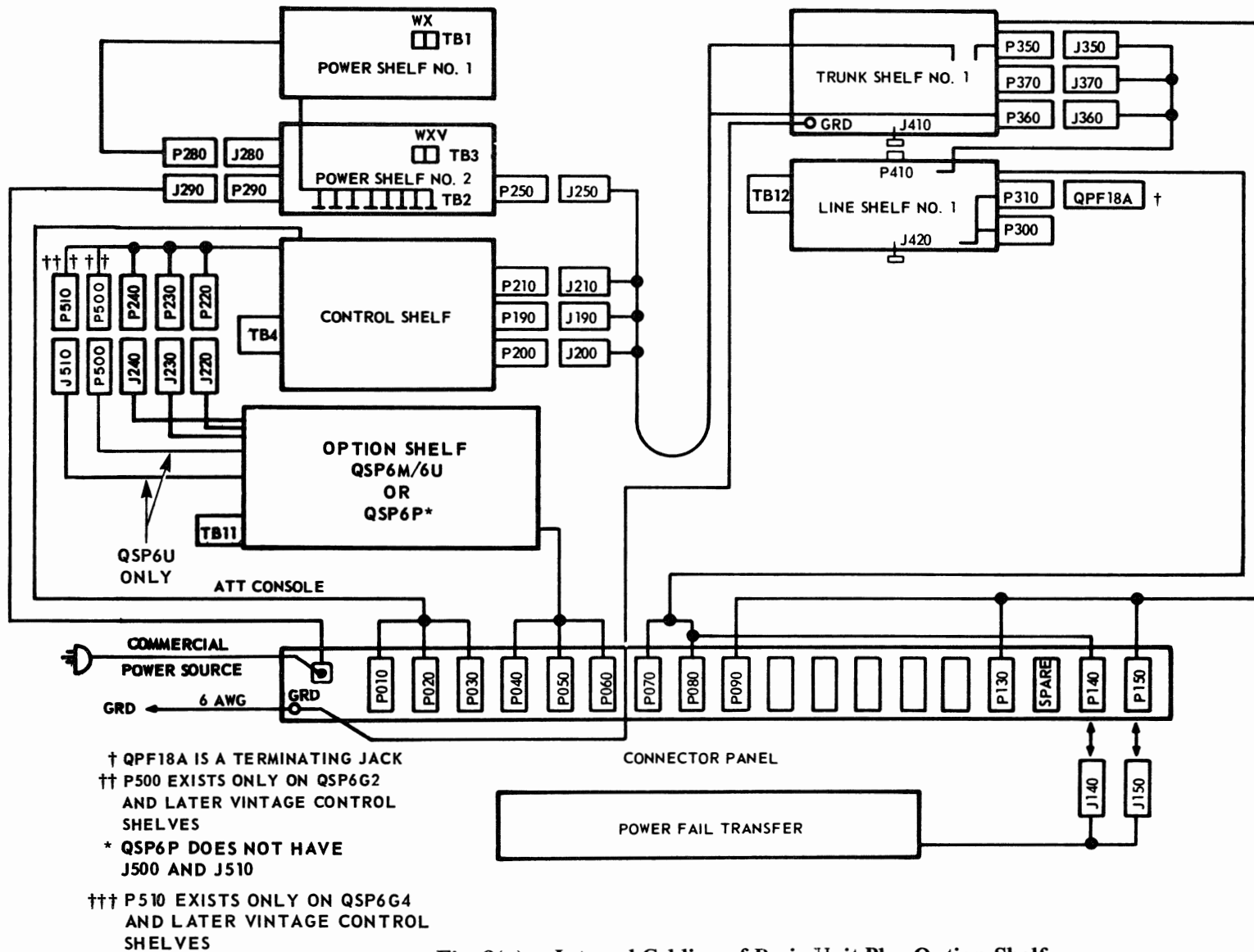


Fig. 9(a) – Internal Cabling of Basic Unit Plus Option Shelf
 (Except for Hotel/Motel Service)

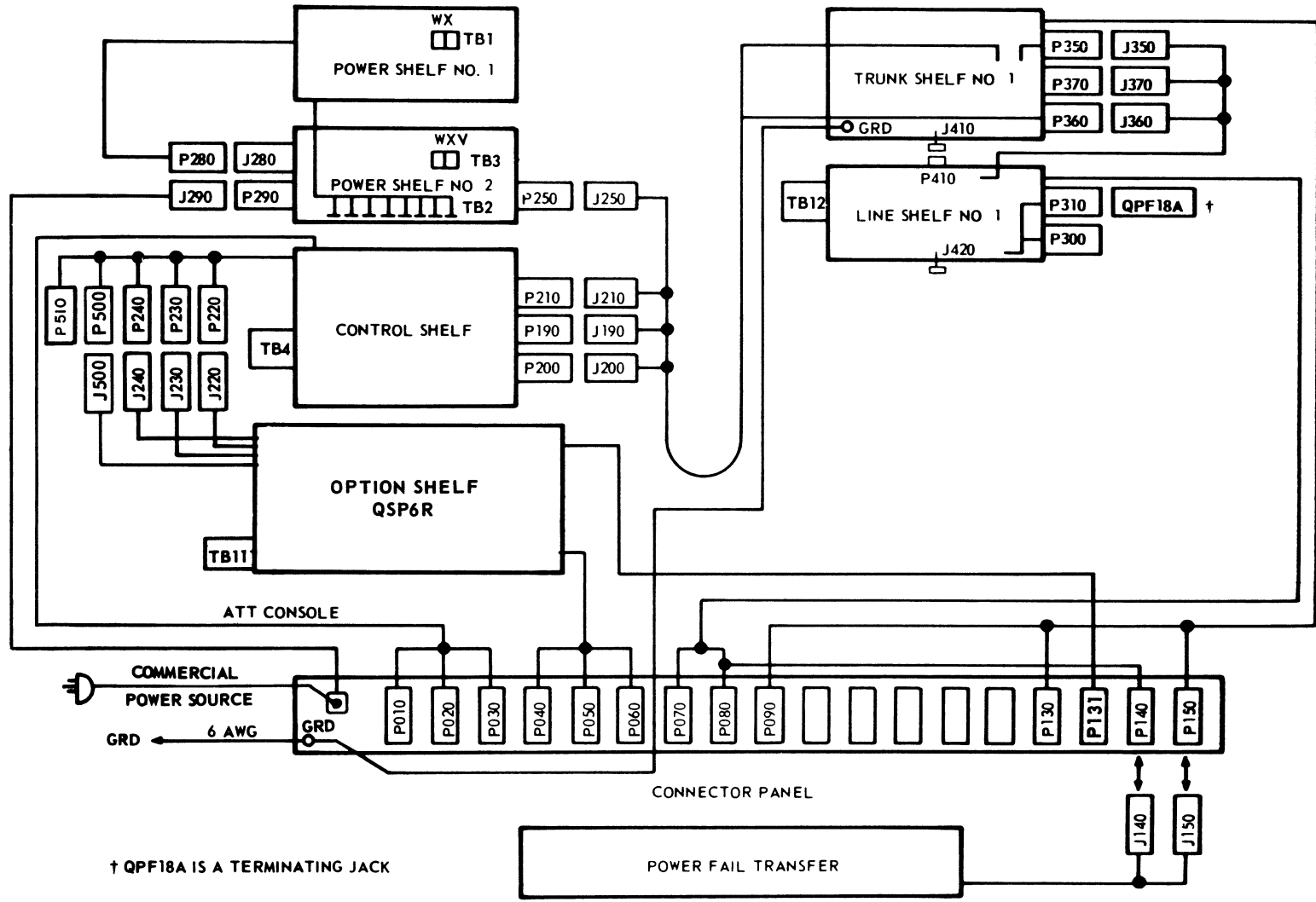


Fig. 9(b) – Internal Cabling of Basic Unit Plus Option Shelf
(Hotel/Motel Service Only)

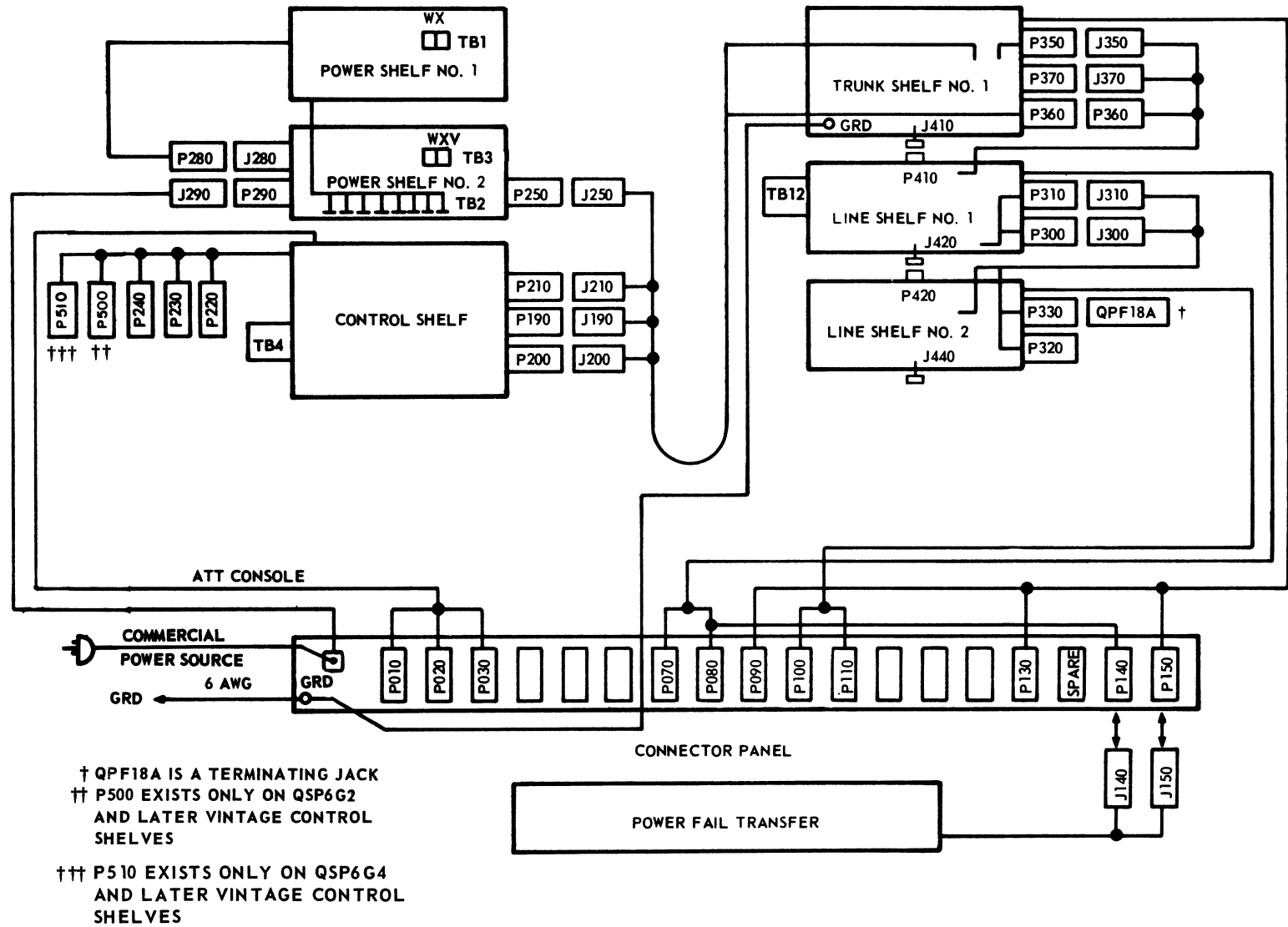


Fig. 10 — Internal Cabling of Basic Unit Plus Line Shelf No. 2

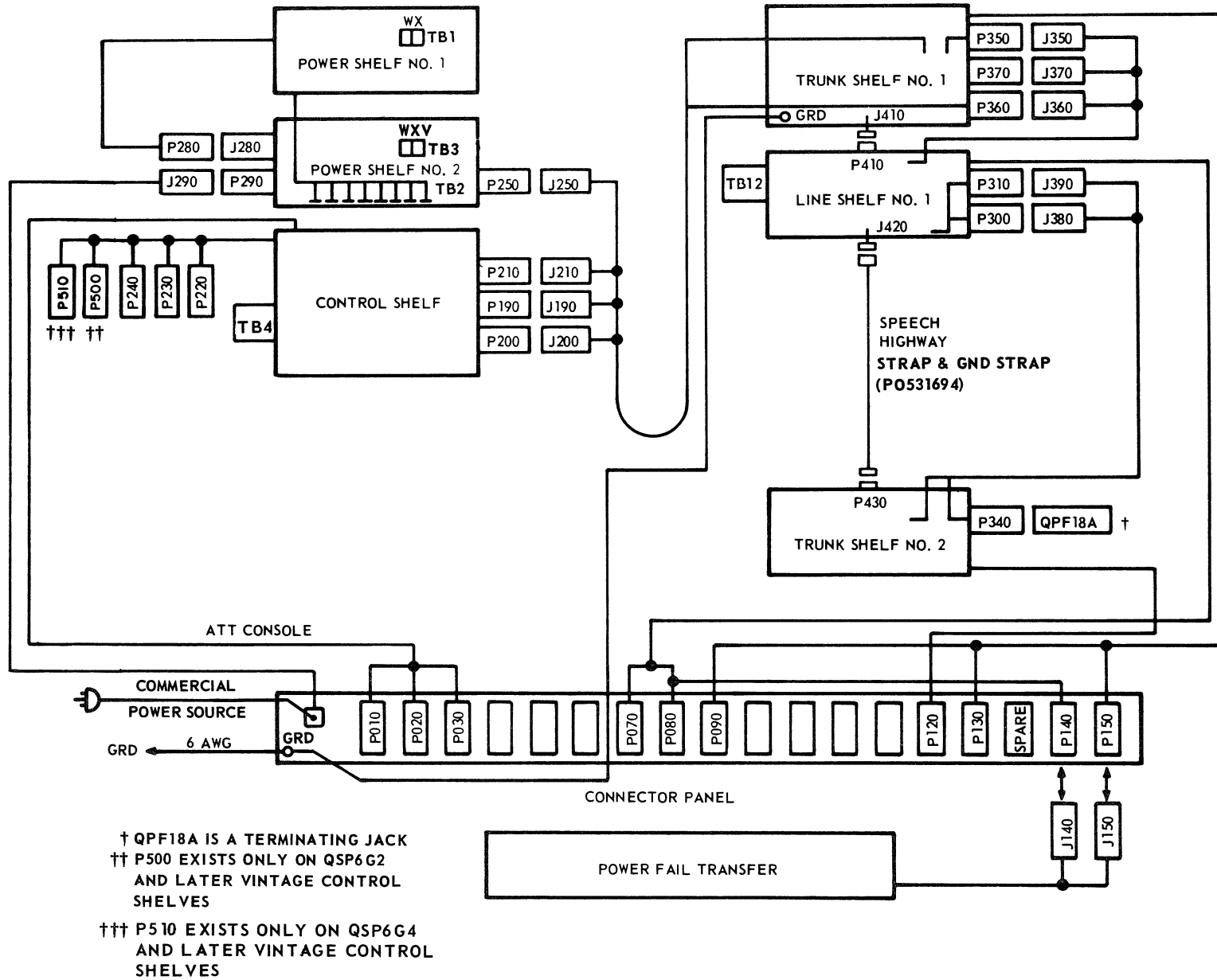


Fig. 11 — Internal Cabling of Basic Unit Plus Trunk Shelf No. 2

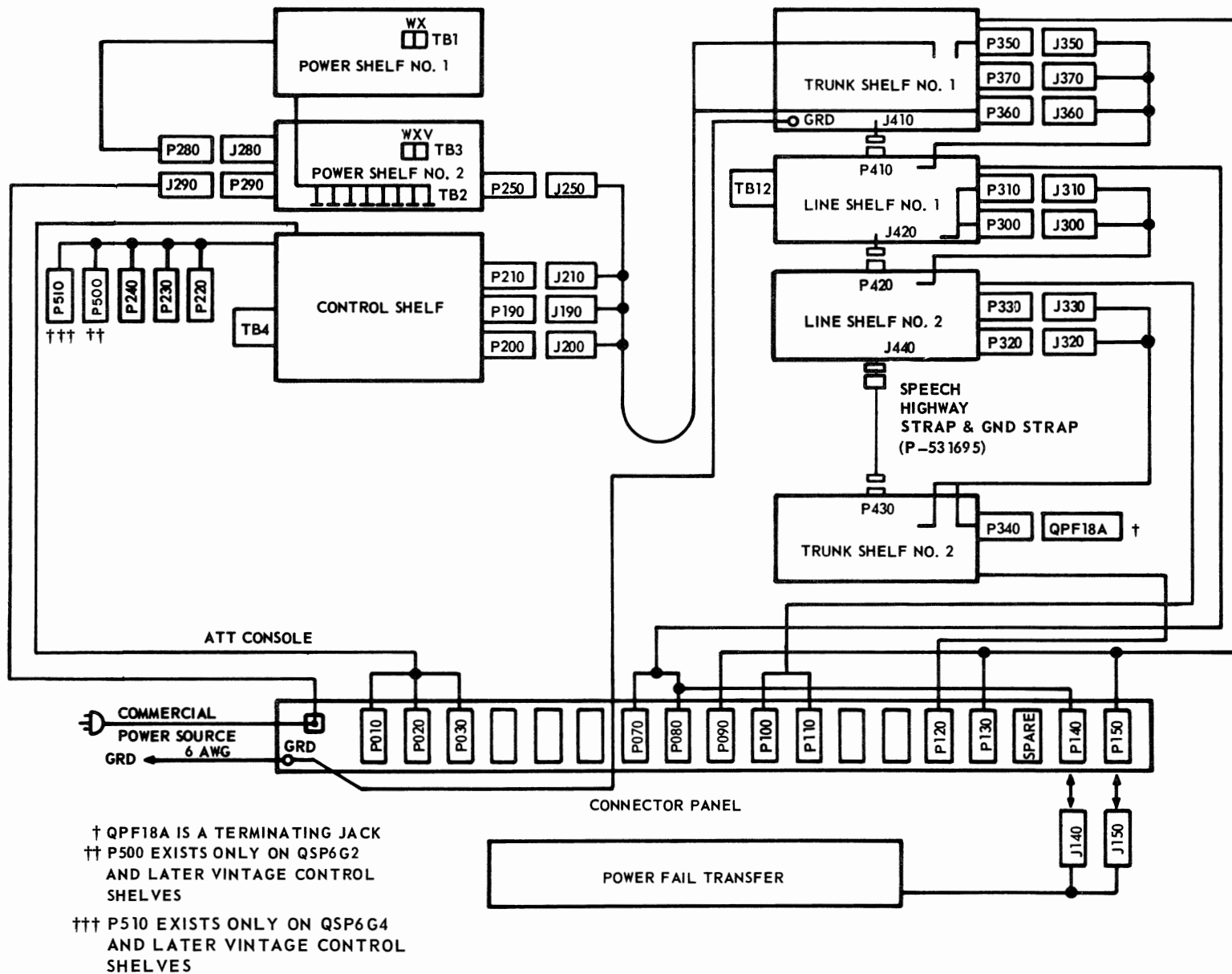


Fig. 12 – Internal Cabling of Basic Unit Plus Line Shelf No. 2 and Trunk Shelf No. 2

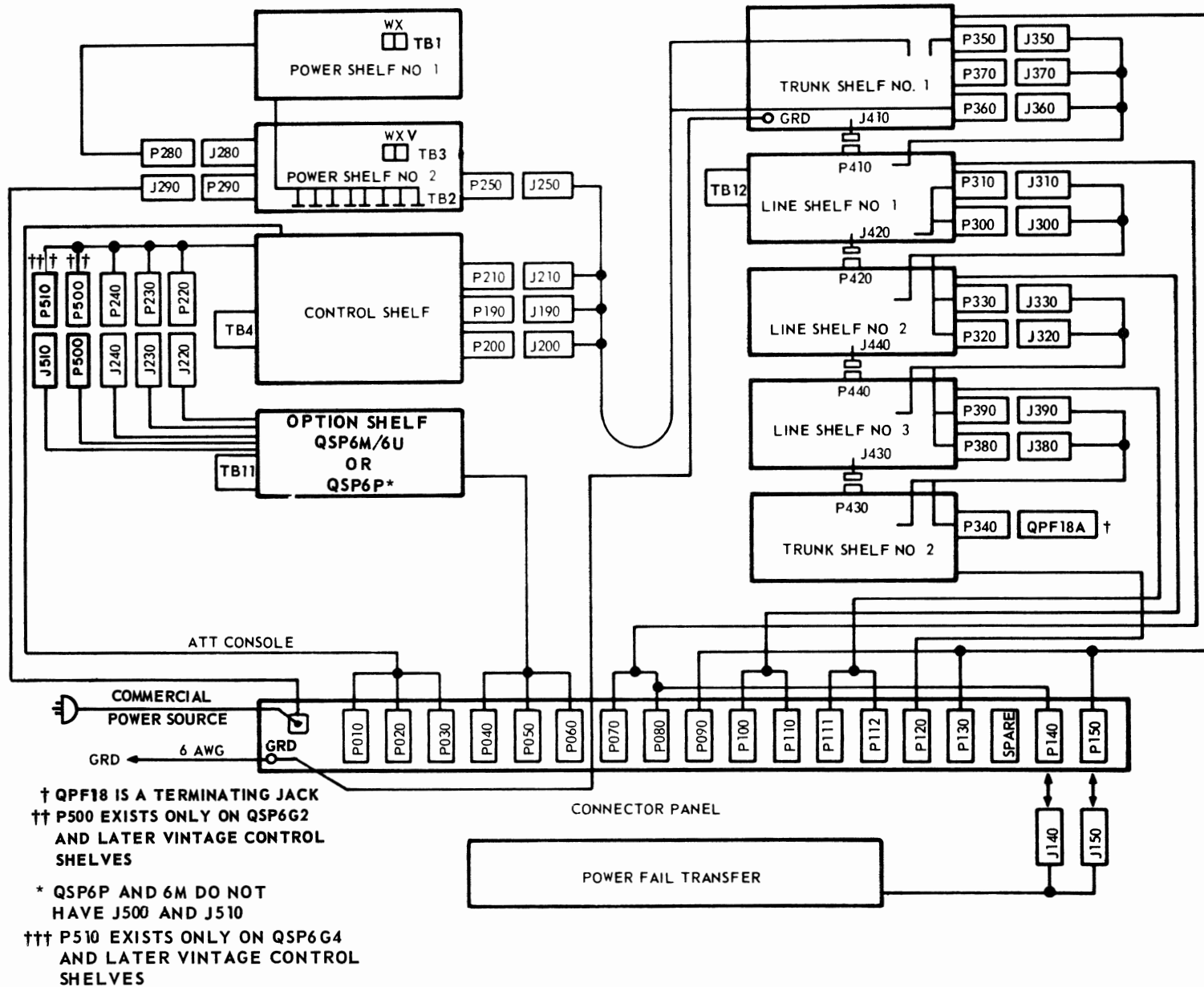
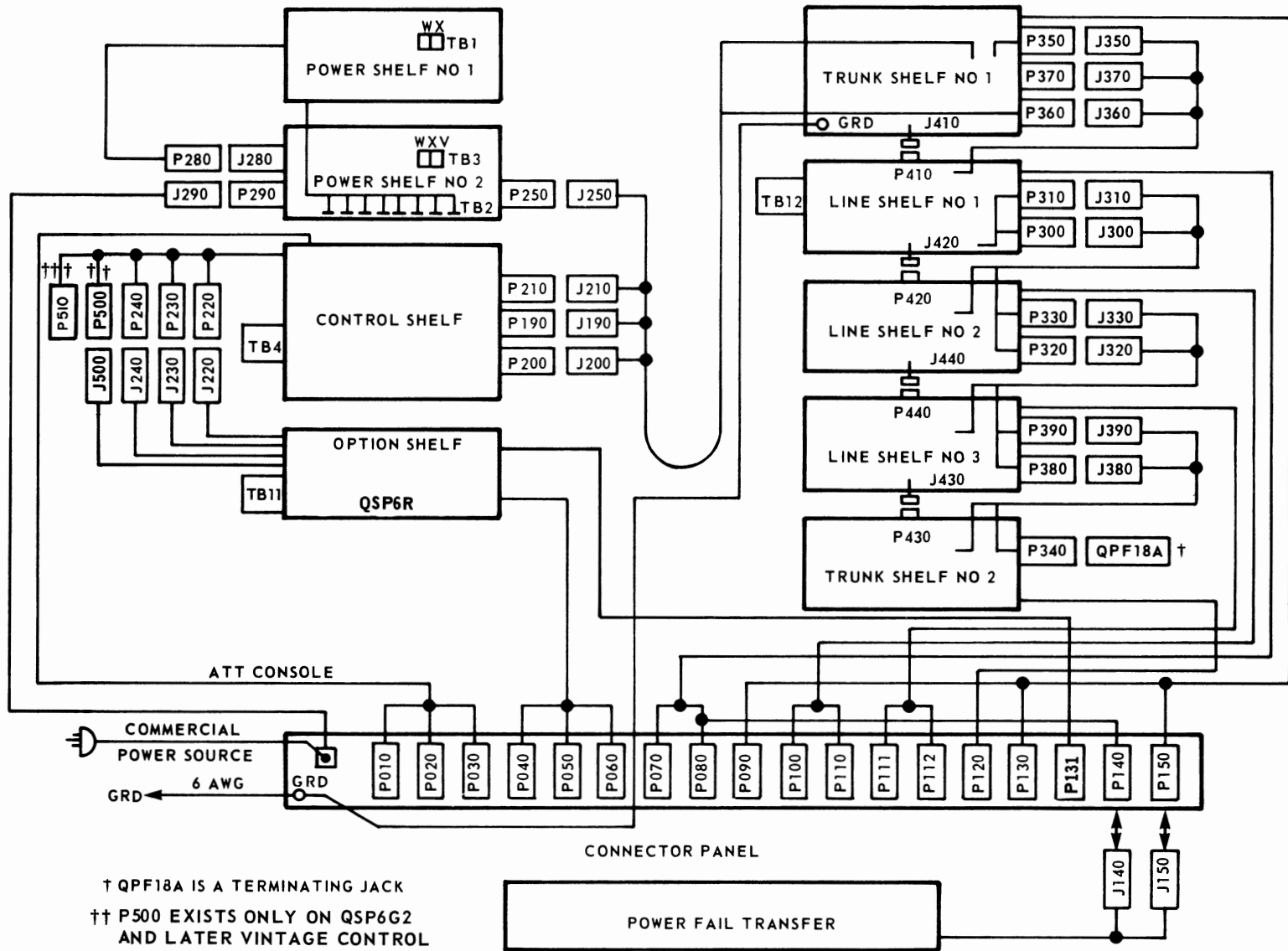


Fig. 13(a) – Internal Cabling of Fully Equipped EPABX
 (Except for Hotel/Motel Service)



- † QPF18A IS A TERMINATING JACK
- †† P500 EXISTS ONLY ON QSP6G2 AND LATER VINTAGE CONTROL SHELVES
- ††† P510 EXISTS ONLY ON QSP6G4 AND LATER VINTAGE CONTROL SHELVES

Fig. 13(b) – Internal Cabling of Fully Equipped EPABX
(Hotel/Motel Service Only)

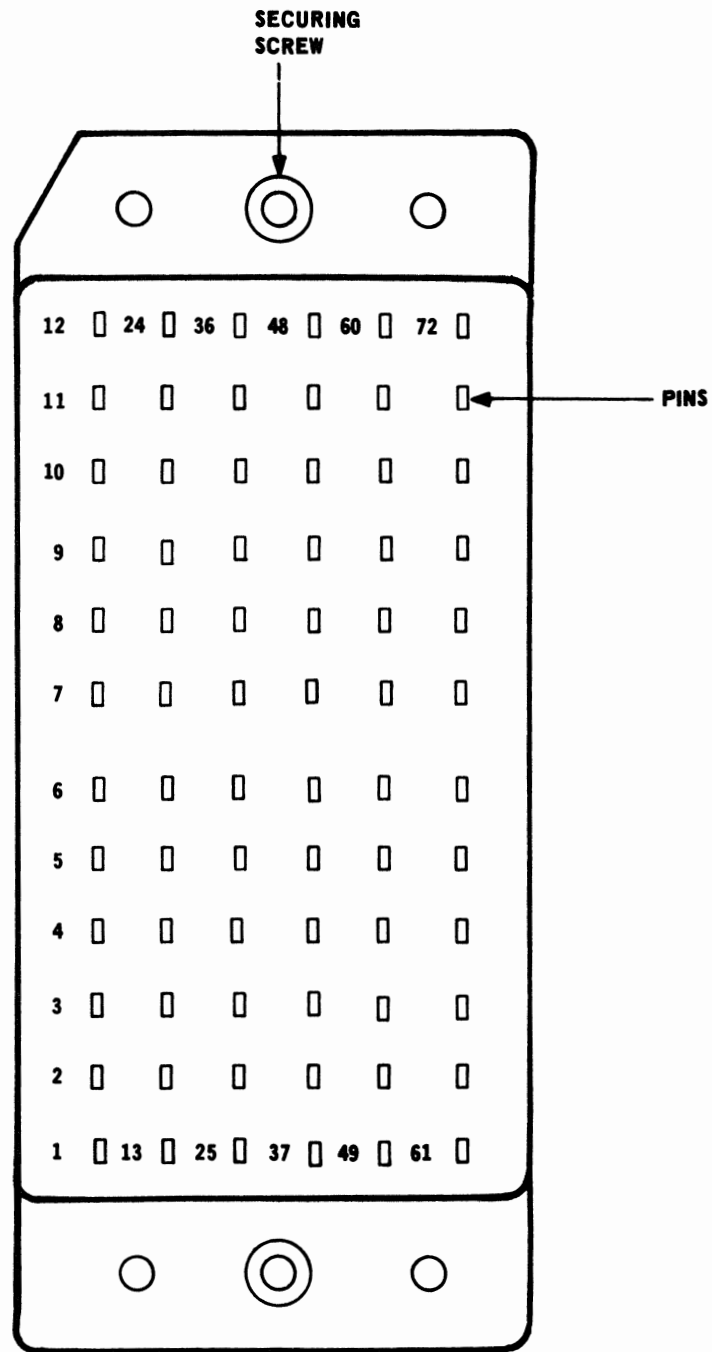


Fig. 14 – Wire Connection Side View of NS19163 Connector Plug