MOTOROLA INC.
Communications
Sector

MSF 5000™ & PURC 5000™ EXPANSION TRAY

C695 OPTION

1. GENERAL

The expansion tray option is used as the installation site of various option module/boards. Each tray will house up to three single-width option module/boards, which are secured to the tray by front panel bezels. The optional expansion tray may be either factory or field installed. It may be either snap-mounted to the top of the station control tray, or separately rack-mounted on slide-out rails, or both. Each expansion tray option includes its own dc-dc converter power supply, three blank bezels, and two cables. Refer to Table 1 for model complement information.

The expansion tray power supply board terminates one leg of a Y-cable from the station control expansion connector, and then provides a multi-path signal interface between the expansion connector of the station control tray and the optional module(s) installed in the expansion tray. The other leg of the Y-cable is routed to a connector that is accessible through the top of the expansion tray cover. That connector is used to further daisy-chain the station control expansion signals, or to attach a radio or diagnostic metering panel.

2. DESCRIPTION

2.1 The TRN5177A Expansion Tray Hardware Kit contains a 40 conductor cable which provides power from the expansion power supply and interconnects from the expansion jack (J800) on the station control

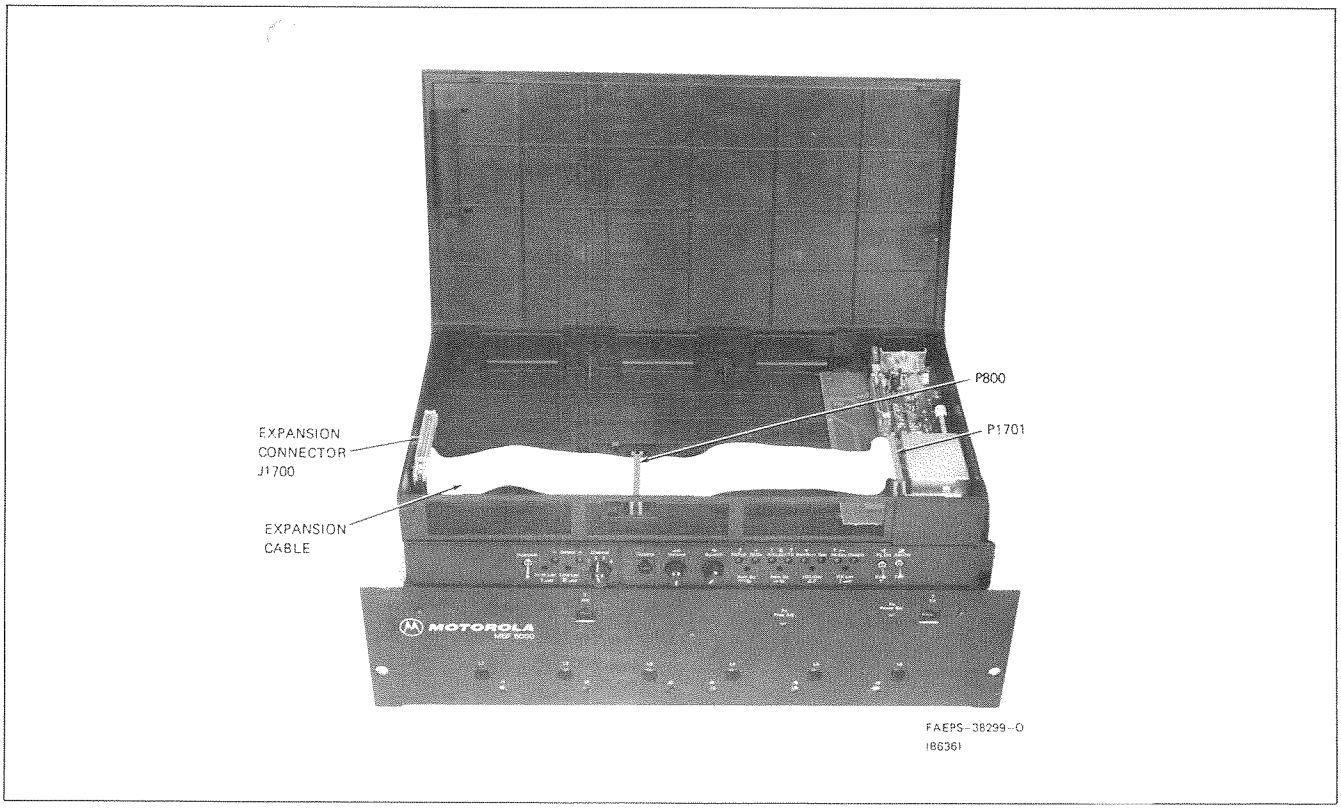

Figure 1. Internal View of Expansion Tray

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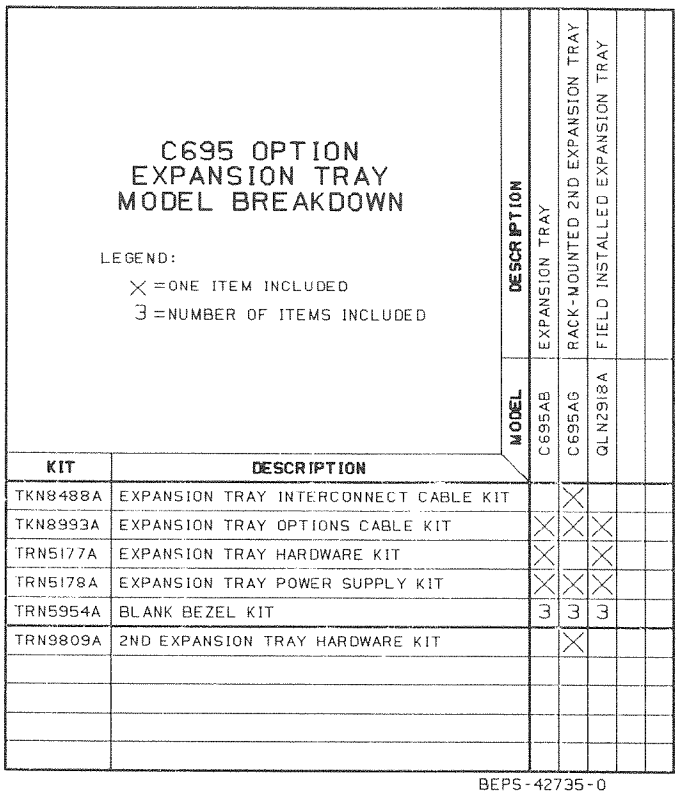


Table 1. Model Complement Chart

module to the expansion option boards and expansion connector J1700. J1700 is accessible through the top cover of the expansion tray for interfacing power, audio, and digital signals to external equipment such as a diagnostic metering panel. The dust cover normally used on J800 is retrofit onto the expansion tray cover. Refer to the station control section for expansion jack details.

2.2 The TRN5178A Expansion Power Supply is a dc-dc converter type that converts the auxiliary +13.8 V input into regulated +9.6 V and regulated +5 V required for certain options. The supply mounts on the right hand side of the expansion tray.

2.2.1 9.6 V Regulator

The 9.6 V regulated output is obtained from a series regulator circuit. A sensing circuit regulates the amount of current allowed to pass through the series regulator, thus controlling voltage across the load. The output is filtered by capacitor C1710. Refer to the schematic at the end of this section for details.

2.2.2 +5 V Power Supply Circuit

The dc-dc converter section (refer to the schematic at the end of this section) converts the auxiliary 13.8 V input into the filtered and regulated +5 V required by the station by using a controlled pulse-width modulator (PWM). The 5.1 volt Vz is derived from Zener VR1701 and resistor R1724 connected to the +9.6 V expansion power supply regulator. Further details of operation are included on the schematic diagram.

When the auxiliary 13.8 V supply comes up, the +9.6 V regulator also begins operation. A bias voltage is developed from the 5.1 Vz input to divider network R1729-R1730 and provides a reference voltage to shut down comparator U1701D. Thus, when A+ turns on, and SHUTDOWN goes high (station control +5 V supply on), U1701D output goes high and turns on oscillator U1701A, allowing the station to begin operation after the +5 V supply stabilizes. The station is kept in a reset condition, for at least 100 milliseconds after the station control and expansion +5 V outputs come on, by the EXPANSION RESET signal generated from station control. This provides sufficient time for all microprocessor clock oscillators to stabilize before the option boards in the expansion tray become operational. Similarly, when A+ is removed from the station, SHUTDOWN is immediately driven low by the station control module. This causes the output of U1701D to go low, discharging C1709 through R1715 which will turn off oscillator U1701A after a 50 millisecond delay. The purpose of the SHUTDOWN signal is to disable the expan-

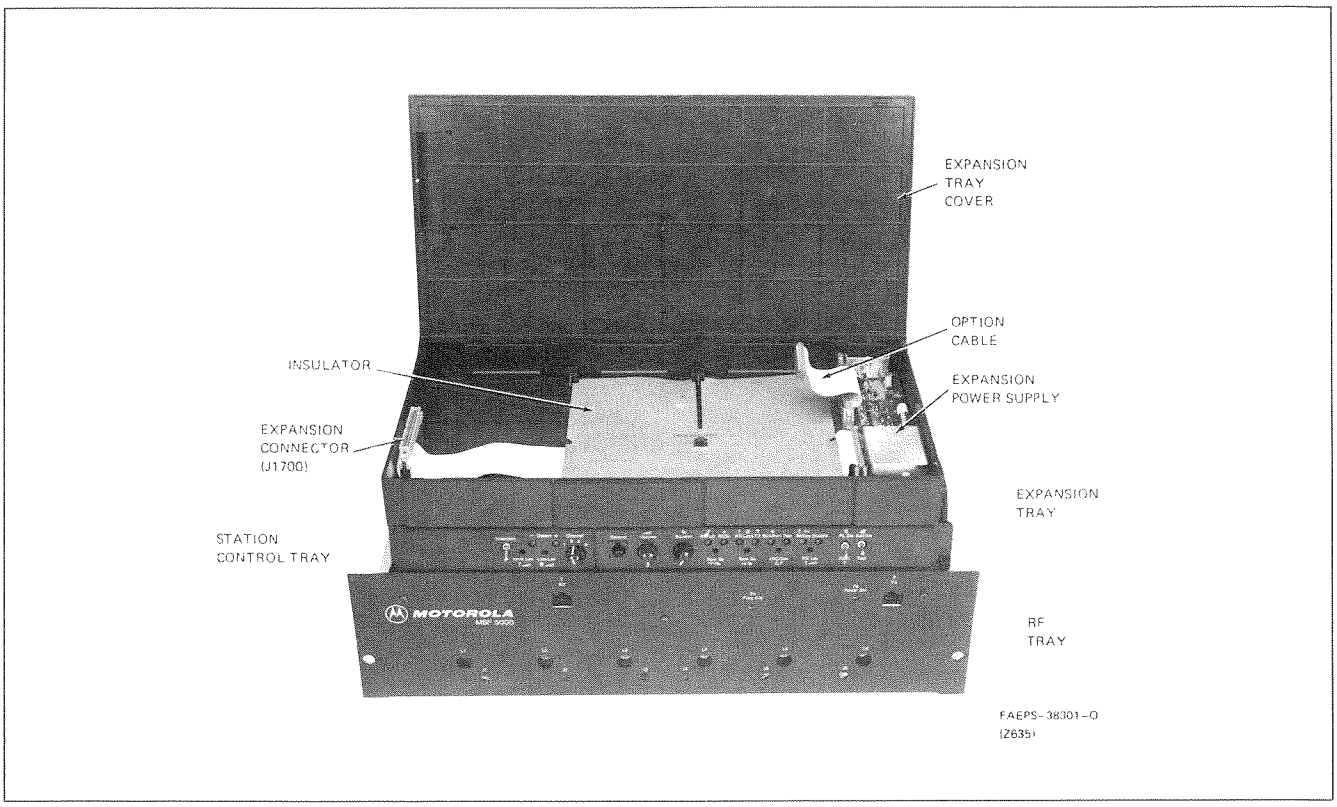


Figure 2. Complete Expansion Tray

sion power supply +5 V circuit until the station control +5 V supply is restored. The +5 V supply includes a current limiting circuit, consisting of Q1704 and R1725-R1728, which reduces the +5 V supply output voltage if the output current exceeds approximately 2 amperes. The expansion tray activates (holds low) EXPANSION RESET by turning Q1701 on. Q1701 is turned on if A+ is absent (eg. if F1701 is open) or if the expansion +9.6 V supply or expansion +5 V converter has failed. Thus, the reset circuits on the station control and expansion power supply disable all control boards in both control trays by generating the EXPANSION RESET and SHUTDOWN signals if any supply voltage is absent.

3. INSTALLATION OF OPTION BOARDS

NOTE

The option boards should be installed in the right side of the expansion tray as close as possible to the expansion power supply in order to minimize the voltage drop on the ribbon cable. If more than one option board is installed, the board with greatest +5 V current drain should be installed closest to the supply.

Step 1. Insert the option board into the tray so that the front of the board is protruding through the bezel aperture on the front of the tray.

Step 2. Align the board position so that the rear edge of the board inserts into the notches molded into the lower-rear corner of the expansion tray.

Step 3. Lower the front end of the board so that it lies flat in the expansion tray.

Step 4. Position the bezel so that the front edge of the board inserts into the molded notches on the bezel.

Step 5. Firmly press the bezel into the expansion tray until it snaps into place.

Step 6. Insert the options cable plug (s) into the option jack(s).

4. EXPANSION TRAY INSTALLATION

The TLN2698 Field Modification Kit should be installed using the following procedure.

Step 1. Roll out the rf tray drawer from the cabinet.

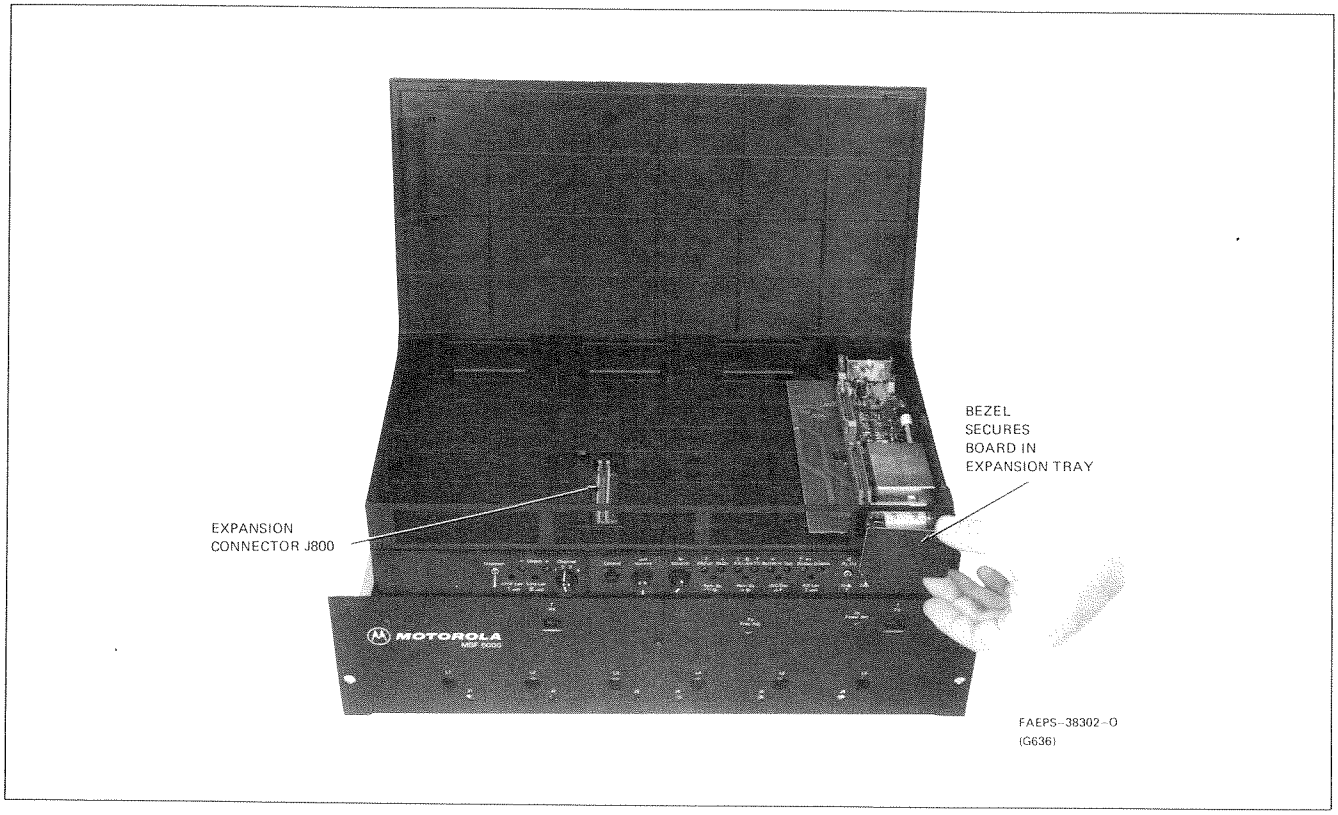


Figure 3. Installation of Expansion Power Supply

Step 2. Remove the dust cover from the station control tray and attach to the expansion tray cover at the far left end.

Step 3. Secure the expansion tray to the station control tray by using the two hooks on the bottom left of the expansion tray.

Step 4. Align the tab on the bottom right of the expansion tray with the slot in the station control tray and snap together, ensuring that the two expansion tray flanges seat fully.

Step 5. Attach the cover to the expansion tray.

Step 6. Install the expansion power supply into the expansion tray. (Refer to paragraph 3, Installation of Option Boards.)

Step 7. Insert the middle plug on the 40-wire ribbon cable into J800 on the station control module.

Step 8. Insert the right-end plug on the 40-wire ribbon cable to J1701 on the expansion power supply. Dress the cable by creasing it with your thumb along the base of J1701, so that the cable lies flat along the bottom of the tray.

Step 9. Install the left-end (male) plug on the 40-wire ribbon cable to the two expansion tray posts with the two screws provided. Dress the cable by pushing it underneath the left plug so that the cable lies flat along the bottom of the tray.

Step 10. Insert the second-from-the-right-end plug on the 34-wire ribbon cable to J1702 on the expansion power supply. The right end of the cable is the end with the 2 plugs close together. The cable should lie to the left.

Step 11. Dress the 34-wire ribbon cable so that it lies flat along the bottom of the tray.

Step 12. Insert the paper insulator into the tray. The insulator is force fitted onto the middle expansion tray post. The slot goes to the back. The insulator should cover both ribbon cables.

Step 13. Install the option board(s) now. (Refer to paragraph 3, Installation of Option Boards.) Note that if a single-slot width board (such as wild card) is installed in the middle slot, then the 34-wire ribbon cable must be redressed so that the plug second from the left end emerges approximately 1-1/2 inches from the paper insulator slot.

Step 14. Close the expansion tray cover and slide the rf tray back into the cabinet until it latches.

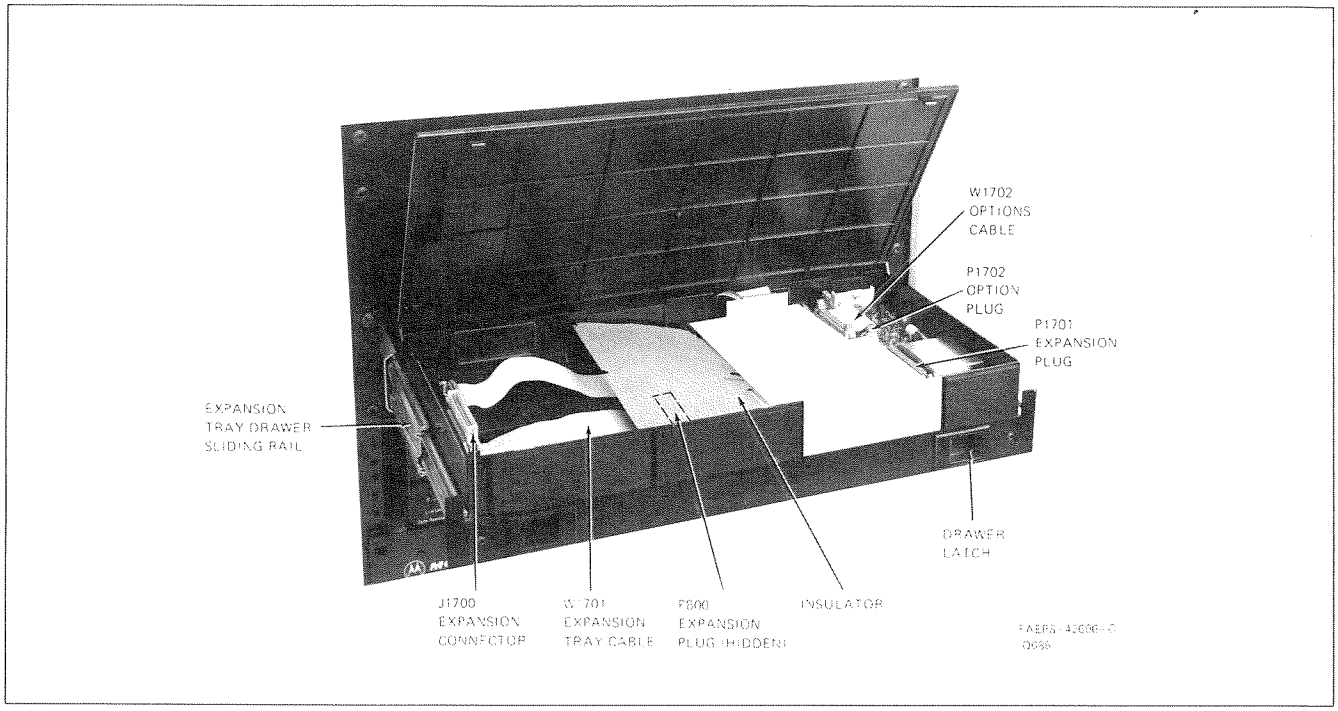
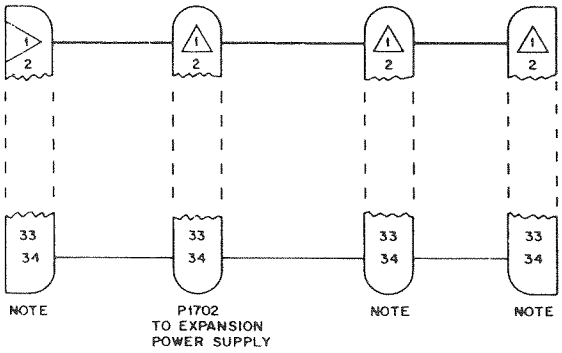
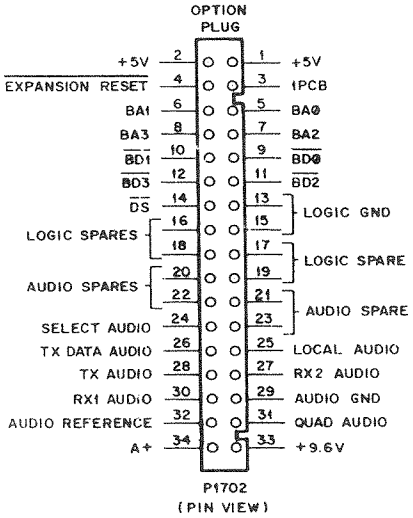


Figure 4. Rack-Mounted Expansion Tray

EXPANSION AND OPTIONS CABLES
SCHEMATIC DIAGRAMS

W1702 OPTIONS CABLE





NOTE:
THESE PLUGS DO NOT HAVE DESIGNATORS. THEY WILL ASSUME THE DESIGNATOR NUMBER OF THE JACK OF THE OPTION USED.

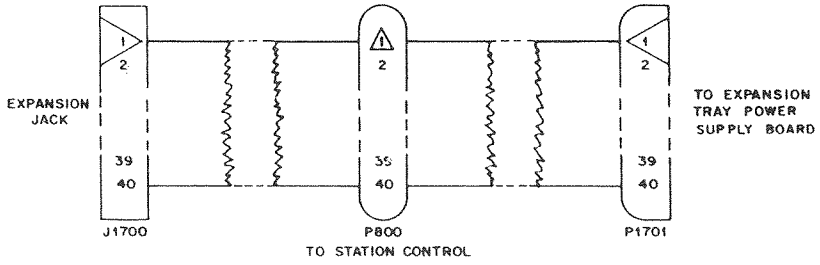
BEPS-38427-A

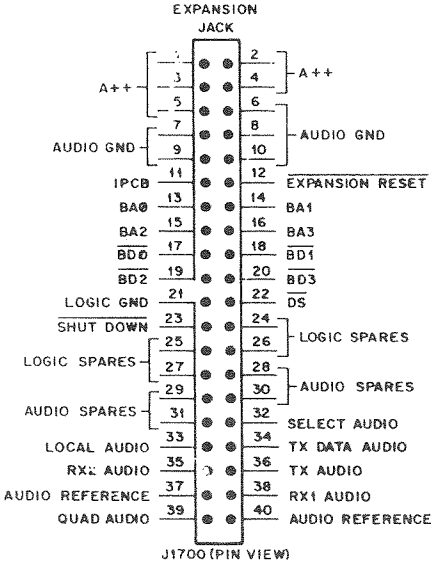
parts list

TKN8993A Options Cable Kit PL-8982-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
P1702	p/o W1702	female, 34-contact
Pxxxx thru Pzzzz	p/o W1702	female, 34-contact
		cable, ribbon w/connectors:
W1702	30-83351P01	includes: P1702 and Pxxxx thru Pzzzz; 34-connector; 16.3" used

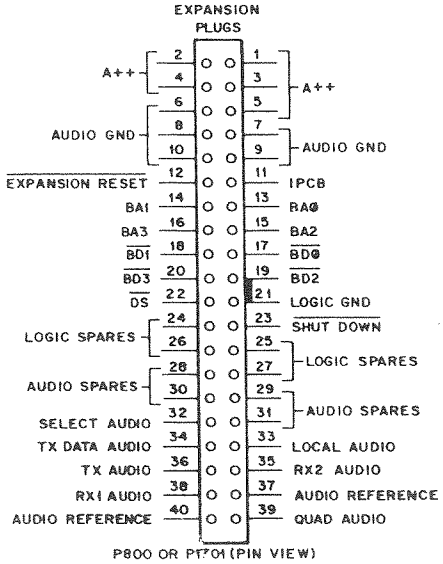
W1701 EXPANSION TRAY CABLE

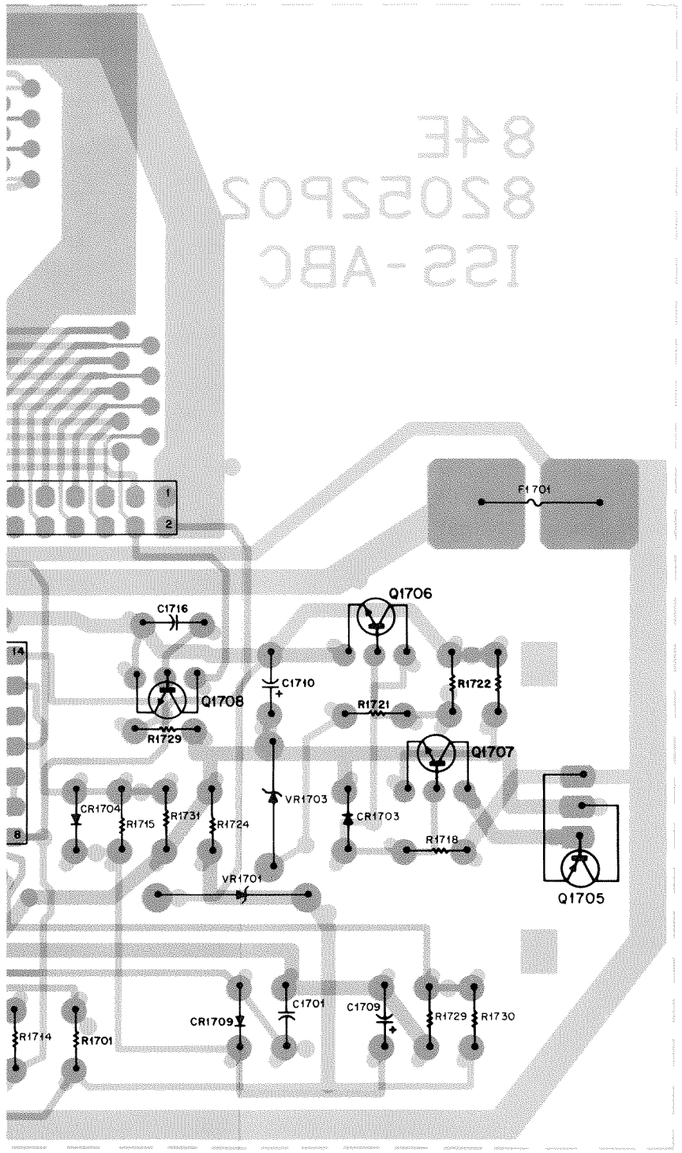




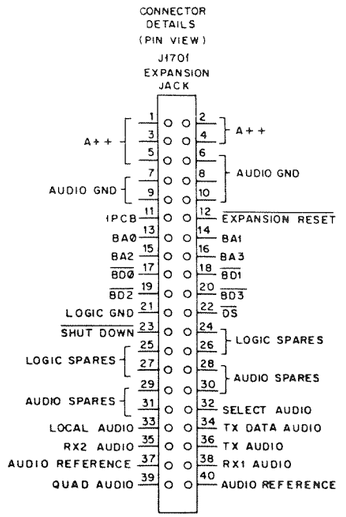
CONNECTOR DETAILS

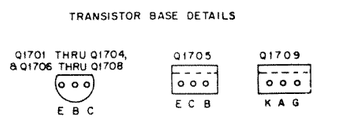
BEPS-38227-A





42797-0
42798-0
42799-0





parts list

TRN5178A Expansion Power Supply — PL-8774-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed; uF ±10%: unless otherwise stated
C1701	8-11017A01	.001 ±5%; 50 V
C1702	23-82601A48	660 +100-10%; 40 V
C1703	8-11017B17	0.1; 50 V
C1704, 1705	21-82372C09	0.1 +80-20%; 25 V
C1706	23-82747L26	1000 +100-10%; 12 V
C1707	8-11017B01	.001; 50 V
C1708	8-11017B08	.01; 50 V
C1709	23-11019A09	1.0 ±20%; 50 V
C1710	23-11019A45	100 ±20%; 16 V
C1711 thru 1716	21-11014H32	20 pF ±5%; 100 V
C1717	21-11015C01	.01 +80-20%
		diode: (see note)
CR1701	48-82525G18	silicon
CR1702	48-82466H13	silicon
CR1703 thru silicon	1705	48-11034D01
CR1706, 1707	48-11034A01	silicon
CR1708, 1709	48-11034D01	silicon
CR1711	48-82466H13	silicon
		light emitting diode: (see note)
DS1710	48-84404E04	green
		fuse:
F1701	65-82859N01	4 amp; 32 V
		coil, rf:
L1701	24-82380N01	choke, 400 uH
L1702	25-82786N01	choke; 620 uH
L1703	24-83977B01	1-1/2 turns
		connector, plug:
P1701	28-83136N02	male; 40-contact
P1702	28-83136N05	male; 34-contact
		transistor:
Q1701	48-869829	PNP; type M9829
Q1702	48-869328	PNP; type M9328
Q1703, 1704	48-869643	PNP; type M9643
Q1705	48-869647	PNP; type M9647
Q1706, 1707	48-869642	NPN; type M9642
Q1708	48-869528	NPN; type M9528
Q1709	48-83875D05	controlled rectifier
		resistor, fixed ±5%; 1/4 W: unless otherwise stated
R1701	6-11009F04	180k
R1702	6-11009E91	56k
R1703	6-11009E75	12k
R1704	6-11009E81	22k
R1705	6-11009E59	2.7k
R1706	6-11009E63	3.9k
R1707	6-11009E99	120k
R1708	6-11009E47	820
R1709	6-11009E61	3.3k
R1710	6-11045A37	330 ±5%; 1/2 W
R1711	6-11009E55	1.8k
R1713	6-11009E71	8.2k
R1714	6-11009E59	2.7k
R1715	6-11009E95	82k
R1716	6-124D55	2.7 ±10%; 1/2 W
R1717	6-11009E33	220
R1718	6-11009E61	3.3k
R1719	6-11009E13	33
R1720	6-11009E43	560
R1721, 1722	6-10621A60	41.2 ±1%; 1/8 W
R1723	6-11009E71	8.2k
R1724	6-11009E33	220
R1725 thru 1728	6-125D70	1; 1/2 W
R1729	6-11009E65	4.7k
R1730	6-11009E67	5.6k
R1731	6-11009E71	8.2k
R1732	6-11009E39	390
R1733	6-11009E25	100
R1734	6-11009E47	820
R1735	6-11009E17	4.7
R1736	6-11009E33	220
		integrated circuit: (see note)
U1701	51-84371K74	quad comparator
		voltage regulator: (see note)
VR1701	48-83461E40	Zener type; 5.1 V
VR1702	48-83461E27	Zener type; 6.0 V
VR1703	48-83461E32	Zener type; 8.2 V
		mechanical parts
	2-10971A16	NUT, machine; M3 × 0.5 mm; 2 used
	3-83497N04	SCREW, machine; M3 × 0.5 × 8mm; 2 used
	4-7683	LOCKWASHER, #4 internal; 2 used
	4-84152B01	WASHER, shoulder
	14-83820M02	INSULATOR
	14-83820M03	INSULATOR, thermoconductive
	15-84576N01	SHROUD, fuse terminal
	29-82906N01	TERMINAL, fuse; 2 used
	26-83130N01	SHIELD, coil bottom
	26-83131N01	SHIELD, coil top
	26-83192N01	HEAT SINK, power supply end
	26-83192N02	HEAT SINK, mounting board
	46-83345P01	KEY; 2 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN5177A Expansion Tray Hardware Kit — PL-8983-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle:
J1700	p/o W1701	male, 40-contact
		connector, plug:
P800	p/o W1701	female, 40-contact
P1701	p/o W1701	female, 40-contact
		cable, ribbon w/connectors:
W1701	30-83268P01	40-conductor; 16" used includes: P800, P1701 and J1700
		mechanical parts
	3-10944A13	SCREW, tapping: P3.12 × 1.27 × 13mm 2 used
	13-84201N01	BEZEL, expansion tray
	14-83320P01	INSERT, expansion tray
	15-83831N01	TRAY, expansion
	15-83832N01	COVER, expansion tray

TRN5954A Blank Bezel Kit — PL-8984-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	13-84202N01	BEZEL, expansion tray

TRN9809A 2nd Expansion Tray Hardware Kit — PL-9889-A

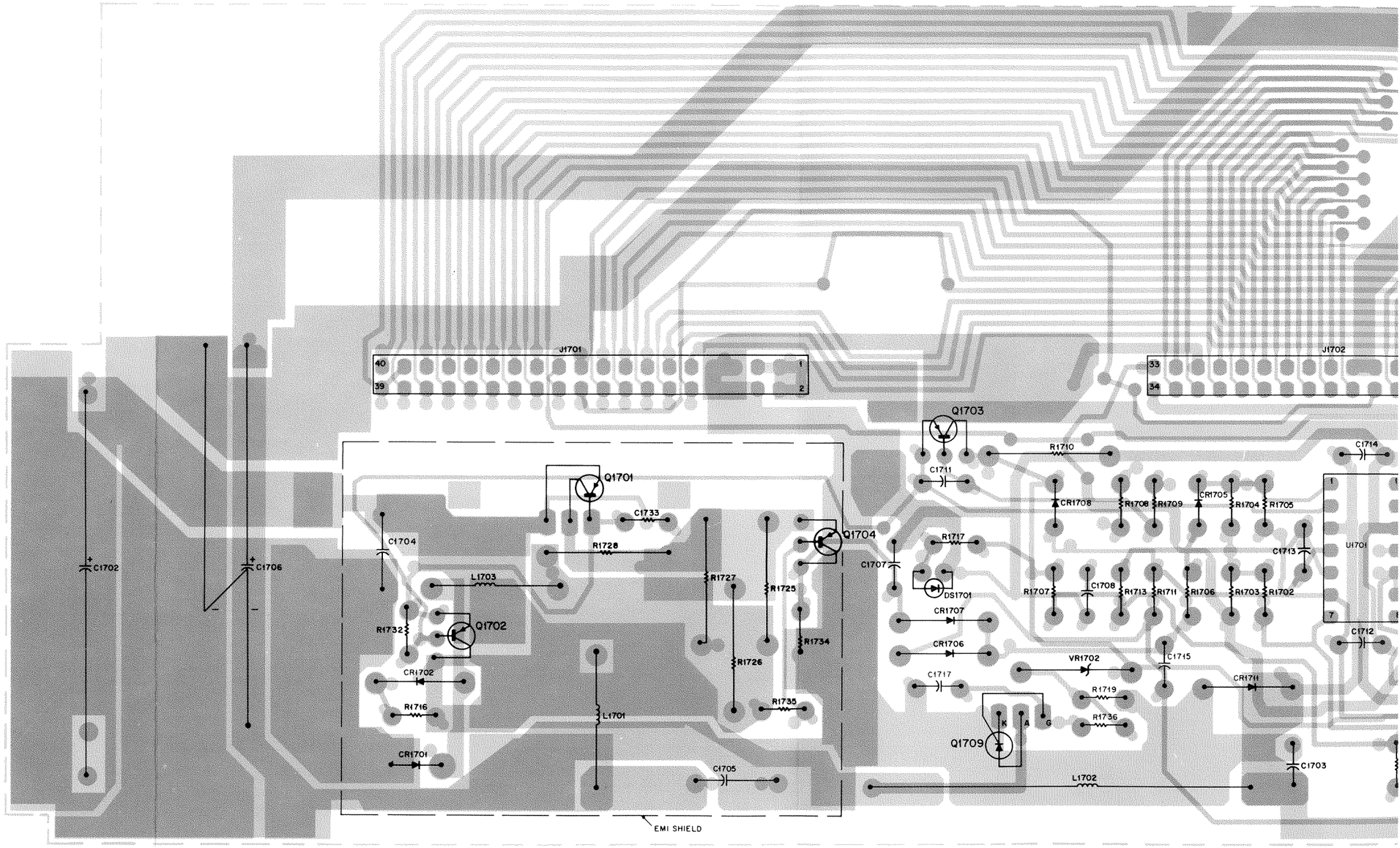
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		cable, ribbon w/connectors:
W1701	30-83268P01	40-conductor; 16" used includes: P800, P701, and J1700
		mechanical parts
	3-10943M62	SCREW, tapping: TT3.5 × 0.6 × 13mm; 8 used
	3-10944A13	SCREW, tapping: P3.12 × .27 × 13mm; 2 used
	3-10907A20	SCREW, machine: M3 × 0.5 × 10mm; 2 used
	3-83498N02	SCREW, tapping: M3 × 0.5 × 5; 2 used
	3-83498N04	SCREW, tapping; M4 × 0.7 × 7mm; 8 used
	3-83498N08	SCREW, tapping; M6 × 1.0 × 10mm; 4 used
	4-82418B89	WASHER, insulator; 2 used
	5-10281A10	RIVET, drive pin nylon; 2 used
	7-82910R01	BRACKET
	13-84201N01	BEZEL
	14-83320P01	INSULATOR
	15-82031R01	BRACKET, right hand
	15-82031R02	BRACKET, left hand
	15-82032R01	BRACKET, expansion rail, right hand
	15-82032R02	BRACKET, expansion rail, left hand
	15-83831N02	TRAY, expansion
	15-83832N01	COVER, tray
	15-84078N01	COVER, dust
	42-83981P02	RETAINER; 3 used
	45-83103N01	SLIDE; 2 used
	47-83030R01	ROD, cable support
	55-83354M01	HANDLE; 2 used
	64-82030R01	PANEL

TKN8488A 2nd Expansion Tray Interconnect Cable Kit — PL-9904-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	30-83031R01	CABLE, ribbon; 40-connector w/molded-on connectors; 47" used

TRN5178A EXPANSION POWER SUPPLY

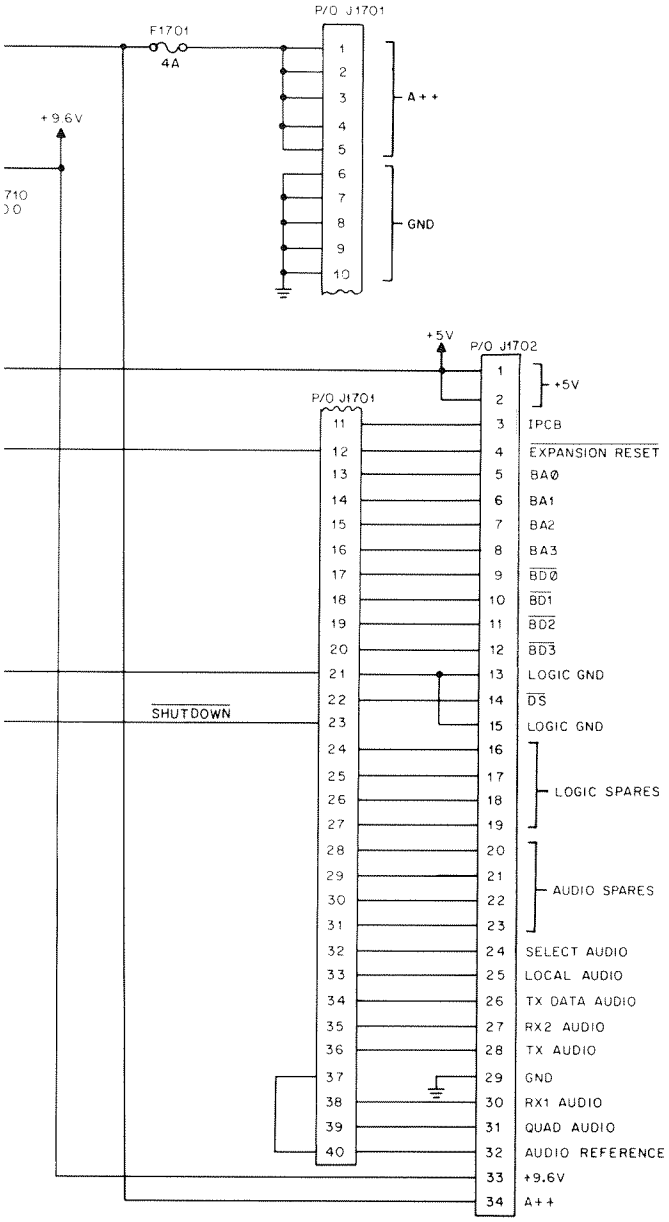
CIRCUIT BOARD DETAIL AND PARTS LISTS



COMPONENT SIDE ☆ BD-EEPS-4
SOLDER SIDE ☆ BD-EEPS-4
OL-EEPS-4

SHOWN FROM COMPONENT SIDE

TRN5178A EXPANSION POWER SUPPLY TRAY
SCHEMATIC, AND REVISIONS



Shutdown is the 5 volt supply line from the station control, and is used as a signal line to shut this board off if station control's 5 volt supply shuts off.

NOTES:

1. Unless otherwise specified, all resistor values are in ohms and all inductor values are in microhenries, and all capacitor values are in microfarads.
2. Voltage measurements must be performed with a high-impedance meter (at least 10 megohm/volt or greater for increased accuracy).

EEPS-38167-C

DC-DC CONVERTER

Protective crowbar circuit formed by Q1709 R1719 and VR1702 blows A + fuse F1701 if 5 V rises above approx 6.3 V due to failure of DC-DC Converter.

VR1702 6V

R1736 220

R1719 33

C1717 .01

Q1709

C1703 0.1

CR1711

L1702

C1702 660

C1704 0.1

Driver Q1702 and power transistor Q1701 comprise the + 5 V power switch.

Current limiter Q1704 turns on when current in R1725-R1728 increases sufficiently, forcing U1701B to turn off power switch by pulling U1701B-5 high.

R1728 1

R1727 1

R1726 1

R1725 1

Q1704 M9643

R1734 820

R1735 47

Q1701 M9829

Noise suppression is provided by CR1702, L1703, R1716.

L1701

R1733 100

Power transistor output collector of Q1701 with A + = 14 V, V9.6 = 9.4 V.

15V 15V 5V 0V

24US 19US

R1716 2.7

L1703

CR1702

C1705 0.1

CR1701

R1732 390

Q1702 M9328

9.6V REGULATOR

Q1705 M9647

13.8VDC

Q1707 M9642

13.1 VDC

R1720 560

CR1703

Q1706 M9642

0.7 VDC

VR1703 8.2V

1.4VDC

C1710 100

R1721 41.2,1%

R1722 41.2,1%

R1718 3.3K

+9.6V

F1701 4A

P/O J1701

1 2 3 4 5 6 7 8 9 10

A++

GND

Components C1705, C1706, L1701 are + 5 V filter for Q1701-Q1702 squarewave output.

C1706 1000

R1717 220

DS1710 GRN

LED DS1710 is lit only if A + , + 9.6 V, and + 5 V are all present.

CR1701 conducts after Q1701-Q1702 turn off, maintaining L1701 current and clamping Q1701-Q1702 collectors to within approximately 1 V of ground.

+5V

P/O J1702

P/O J1701

1	11	+5V
2	12	IPCB
3	13	EXPANSION RESET
4	14	BA0
5	15	BA1
6	16	BA2
7	17	BA3
8	18	BD0
9	19	BD1
10	20	BD2
	21	BD3
	22	LOGIC GND
	23	DS
	24	LOGIC GND
	25	LOGIC SPARES
	26	LOGIC SPARES
	27	LOGIC SPARES
	28	LOGIC SPARES
	29	LOGIC SPARES
	30	AUDIO SPARES
	31	AUDIO SPARES
	32	AUDIO SPARES
	33	SELECT AUDIO
	34	LOCAL AUDIO
	35	TX DATA AUDIO
	36	RX2 AUDIO
	37	TX AUDIO
	38	GND
	39	RX1 AUDIO
	40	QUAD AUDIO
		AUDIO REFERENCE
		+9.6V
		A++

SHUTDOWN

+9.6V

R1703 12K

R1702 180K

Oscillator output pin 1 of U1701A A + = 14 V, V9.6 = 9.4 V.

8V 6V 4V 2V GND (0V)

43US 43US

R1704 22K

CR1705

R1706 3.9K

CR1707

CR1706

C1715 20PF

+5.1VZ

PWM comparator (-) input pin 4 of U1701B A + = 14 V, V9.6 = 9.4 V.

6V 5V 4V 3V 2V 1V 0V

18US 25US

Q1703 M9643

R1711 1.8K

C1711 20PF

R1708 820

R1710 330, 1/2 W

CR1708

R1709 3.3K

C1713 20PF

U1701B

R1707 120K

R1713 8.2K

R1714 2.7K

C1708 .01

5.1VZ

R1701 180K

U1701A

Oscillator U1701A output drops to 0.3 V for 1.2 microsec to trigger PWM comparator U1701B. When U1701A-1 goes to its high impedance state, it allows the voltage at U1701A-1 voltage to rise and charge C1701 for approximately 43 microsec.

C1712 20PF

C1701 .001

R1705 2.7K

CR1709

Pulse width modulator (PWM) comparator U1701B controls power switching through driver Q1703 to produce + 5 V ± 5% output at J1702, pins 1 and 2.

+5.1VZ

VR1701

R1724 220

R1731 8.2K

+9.6V

R1715 82K

CR1704

C1709 1

When A + is removed from the station, SHUTDOWN and expansion reset are driven low by station control. A low shutdown signal causes U1701D-13 to go low. R1715 and C1709 cause a 50 msec. delay before the oscillator (U1701A) turns off through CR1709.

Both 9.6 V regulators and both 5 V converters must be on for normal station operation. This circuit provides 5 V to all expansion modules for 50 ms after A + is removed in order to allow them to perform power down functions.

SHUTDOWN COMPARATOR

5.1VZ

R1730 5.6K

R1729 4.7K

A+

C1714 20 PF

U1701D

7.26V-OPERATE (0.1V-SHUTDOWN)

PWM comparator (+) input pin 5 of U1301B with A + = 14 V, 6 = 9.4 V.

5V 4V 3V 2V 1V 0V

18US 25US

PWM comparator output pin 2 of U1701B with A + = 14 V, V9.6 = 9.4 V.

20V 15V 10V 5V 0V

25US 18US

U1701C

0.1V-OPERATE (0.7V-SHUTDOWN)

+9.6V

R1723 8.2K

Q1708 M9528

C1716 20PF

EXPANSION RESET line is held low (0.2 V) by Station Control for approximately 450 millisec. after + 5 V output turns on.

SHUTDOWN is the 5 volt supply line from the station control, and is used as a signal line to shut this board off if station control's 5 volt supply shuts off.

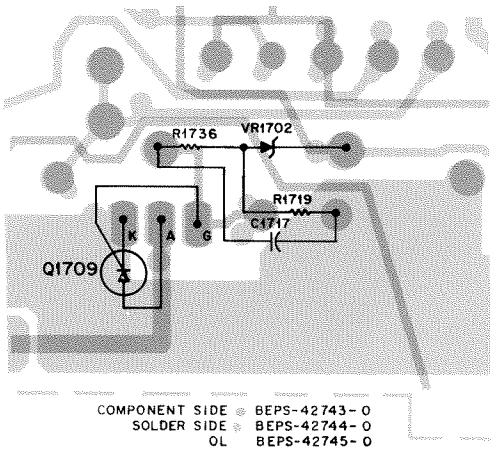
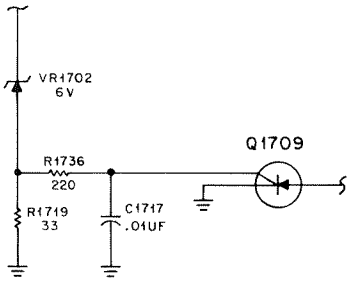
SHUTDOWN

RESET TIMER

EEPS-38167-C

REVISIONS

PEPS-38475

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
O	84-82052P01-OAB	C1717 R1719 R1736	Added: 21-82428B62; .01 +80-20% Exchanged: 6-1109C13 33 ±5%; 1/4 W Added: 6-11009C33; 220 ±5%; 1/4 W	Q1709 Circuit of FCB Detail and Schematic. Refer to Diagram Details.
		 		
A	84-82052P02-ABC	— C1717 R1719 R1736	New PCB Added To Absorb Static Protection Circuit. Exchanged: 21-11015C01 .01 +80-20% Exchanged: 6-11009E13 33 ±5%; 1/4 W Exchanged: 6-11009E33 220 ±5%; 1/4 W	Schematic, PCB, and Parts List.
	TRN5177A Expansion Tray Hardware Kit	—	Changed 9MM Screw, tapping (3-83678N01) to 13MM Length	Parts List