M916

SERVICE MANUAL

CONTENTS

YAMAHA

'80.9. 2.5K. YS. Printed in Japan.

GENERAL SPECIFICATIONS

Frequency Responce(+4dB/600Ω)	0^{+0}_{-3}dB, 20Hz to 20kHz $0^{+0}_{-0.5}$dB, 30Hz to 15kHz
Total Harmonic Distortion	Less than 0.5% at +10dB* output, 20Hz to 20kHz; Less than 0.1% at +20dB* output, 70Hz, to 20kHz.
Hum & Noise(20Hz to 20kHz, input termination of 150 ohms, all output assign switches ON, Input Level switches at "–60")**	–127dB Equivalent Input Noise – 95dB* residual output noise: all Faders down – 78dB (82dB S/N) PGM OUT: Master Fader at nominal level and all Input Faders down. – 63dB (67dB S/N) PGM OUT: Master Fader and one Input Fader at nominal level. – 73dB (77dB S/N) MTRX OUT: Matrix mix and Master level controls at maximum, one Master Fader at nominal level and all Input Faders down. – 63dB (67dB S/N) MTRX OUT: Matrix mix and Master level controls at maximum, one Master Fader and one Input Fader at nominal level. – 73dB (77 dB S/N) FB or ECHO OUT: Master Fader or level control at nominal level and all FB or ECHO mix controls at minimum level. – 63dB: (67dB S/N) FB or ECHO OUT: Master Fader or level control and one FB or ECHO mix control at nominal level.
Crosstalk	– 60dB at 1kHz : adjacent Inputs. – 60dB at 1kHz : Input to Output
Maximum Voltage Gain (Input level switch at "–60", where applicable)	PGM 84 dB : CHANNEL IN to PGM OUT MTRX 84 dB : CHANNEL IN to MTRX OUT FB 94 dB : CHANNEL IN to FB OUT ECHO 94 dB : CHANNEL IN to ECHO OUT SUB IN 10 dB : SUB IN to PGM OUT EFFECTS IN 20 dB : EFFECTS IN to PGM OUT MTRX AUX IN 10 dB : MTRX AUX IN to MTRX OUT.
Channel Equalization	HIGH ±15 dB : 10kHz Shelving MID ±15 dB : 500, 700, 1k, 1.6k, 2.5k, 3.5kHz Peaking LOW ±15 dB : 100, 250 Hz Shelving
High Pass Filter	18 dB/octave roll-off below 80 Hz
Talkbak	Microphone or Line input XLR, preamp, level control, and push-to-talk switch; to PGM/MTRX busses, FB busses, ECHO busses.
Inputs and Outputs	(See accompanying tables of "Input Specifications" and "Output Specifications".)
VU Meters (0 VU @ +4 dB)	5 x illuminated meters; Switchable for PGM/MTRX, FB/MTRX or ECHO 1/ECHO 2/CUE
Peak Indicators	2 LEDs built into each Channel Input "GREEN" turns ON when the pre-Fader level reaches 13 dB below clipping. "RED" turns ON when the pre-Fader level reaches 3 dB below clipping. LED (red) built into each VU meter turns ON when post-Master Fader level reaches 10 dB below clipping.
Phantom Power	48V DC is applied to balanced input transformers (via 6.8 k ohm current-limiting/isolation resistors) for powering condenser microphones; may be turned ON or OFF via rear-Panel phantom switch. (U.S.A., Canadian type = 40 V DC)
Finish	Black panel, padded armrest, resowood veneer cabinet.
Dimension	Wide 32-9/32" (820 mm) Depth 29-3/4" (756 mm) High 11-17/64" (286 mm)
Weight	84.8 pounds (43 kg)
Power Supply	Self-contained module inside console, fused and fully reglated.
Line Voltage and Power Consumption	Japanese: 100V 75W U.S.A.: 120V 85W Canadian: 120V 100VA General: 240V 90W (Selectable 110/120/220/240V)

* 0dB is referenced to 0.775VRMS (0dBm @600 ohms).
** Measured with 6dB/octave filter @12.47kHz : equivalent to a 20kHz filter with infinite dB/octave attenuation.
*** Specifications subject to change without notice.

INPUT AND OUTPUT SPECIFICATIONS

Input Specifications

Connection	Level Switch*	Actual Load Im-pedance	For Use With Nominal	Sensitivity**	Input Level		Connector In Console***
					Nominal	Max. Before Clip	
CHANNEL INPUTS (1 - 16)	−60dB	800Ω	50 to 250Ω microphones or 600Ω line level sources	−80dB(0.08mV)	−60dB(0.78mV)	−30dB(24.5mV)	XLR-3-31
	−50dB	800Ω		−70dB(0.25mV)	−50dB(2.5mV)	−20dB(78mV)	
	−35dB	800Ω		−55dB(1.4mV)	−35dB(14mV)	−5dB(436mV)	
	−20dB	1kΩ		−40dB(7.8mV)	−20dB(78mV)	+10dB(2.45V)	
	−10dB	2kΩ		−30dB(24.5mV)	−10dB(245mV)	+20dB(7.75V)	
	+ 4dB	4kΩ		−16dB(123mV)	+ 4dB(1.23V)	+24dB(12.3V)	
MTRX AUX IN(1-4)		5kΩ	600Ω lines	−10dB(245mV)	+ 4dB(1.23V)	+24dB(12.3V)	Phone Jack
EFFECTS IN(1,2)		5kΩ	600Ω lines	−20dB(78mV)	+ 4dB(1.23V)	+24dB(12.3V)	Phone Jack
SUB IN PGM(L,R)		1kΩ	600Ω lines	− 6dB(388mV)	+ 4dB(1.23V)	+24dB(12.3V)	Phone Jack
SUB IN FB(1,2)							
SUB IN ECHO(1,2)							
TALKBACK IN	−50dB	800Ω	50 to 250Ω mic	−70dB(0.25mV)	−50dB(2.5mV)	−20dB(78mV)	XLR-3-31
	+ 4dB	12kΩ	600Ω lines	−16dB(123mV)	+ 4dB(1.23V)	+24dB(12.3V)	
CH PATCH FADER IN (1-16)		10kΩ	600Ω lines	−26dB(39mV)	− 6dB(388mV)	+24dB(12.3V)	Phone Jack
PGM MASTER IN (L,R)		10kΩ	600Ω lines	−16dB(123mV)	− 6dB(388mV)	+24dB(12.3V)	Phone Jack
FB MASTER IN (1,2)							
ECHO MASTER IN (1,2)							

Output Specifications

Connection	Actual Source Impedance	For Use With Nominal	Output Level		Connector In Console***
			Nominal	Max. Before Clip	
PGM OUT (L,R)	150Ω	600Ω Lines	+ 4dB(1.23V)	+24dB(12.3V)	XLR-3-32
MTRX OUT (1-4)					
FB OUT (1,2)					
ECHO OUT (1,2)					
CH PATCH EQ OUT (1-16)	600Ω	10kΩ Lines	− 6dB(388mV)	+24dB(12.3V)	Phone Jack
PGM MASTER OUT (L,R)					
FB MASTER OUT (1,2)					
ECHO MASTER OUT (1,2)					
HEADPHONES	25Ω	8Ω Phones	− 6dB(388mV)	+ 4dB(1.23V)	Phone Jack
		600Ω Lines	+ 8dB(1.95V)	+18dB(6.16V)	

* 0dB = 0.775V

** With output level of +4dB (1.23V)

*** All XLR connectors are balanced connectors, while PHONE JACK is unbalanced.

DISASSEMBLY PROCEDURES

1. Opening the Control Panel

1) Remove the 7 screws from the bottom plate, lift the control panel, and secure it with the support stay as shown in Fig. 1 (making sure that the stay is firmly locked into position).

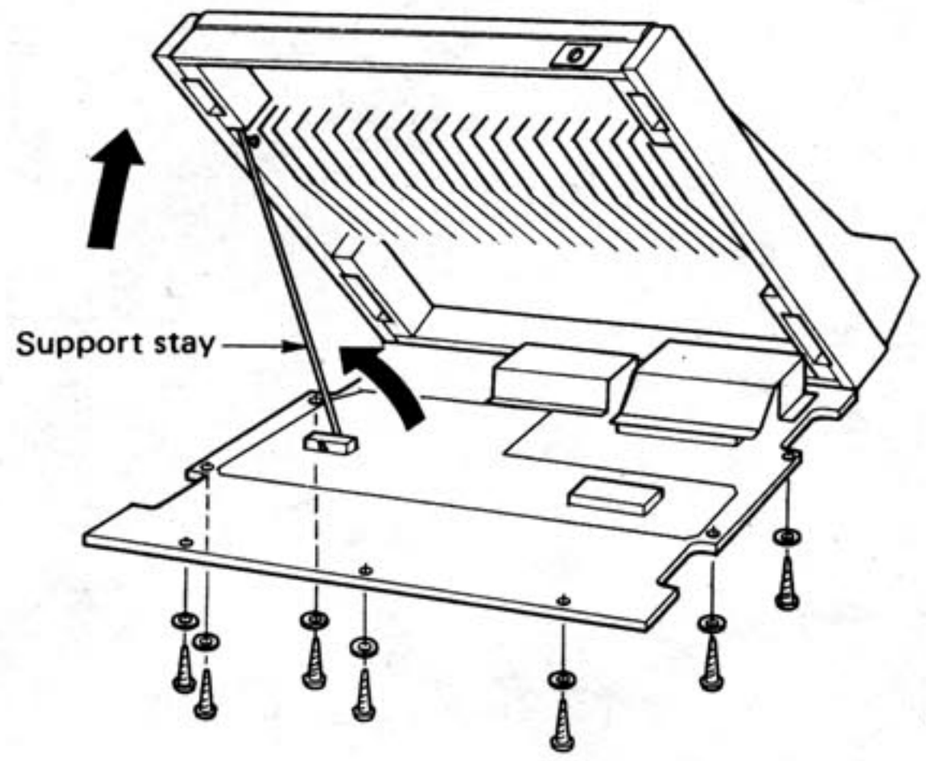


Fig. 1

2. Removing the Fader

1) Open the control panel as described in procedure 1 above.
2) Remove the fader control knobs. (Four fader channels are mounted on a single sub-panel).
3) Disconnect the connector from the C. Board.
4) Once the 2 sub-chassis securing screws are removed, the sub-chassis may be dislodged and the fader then removed.

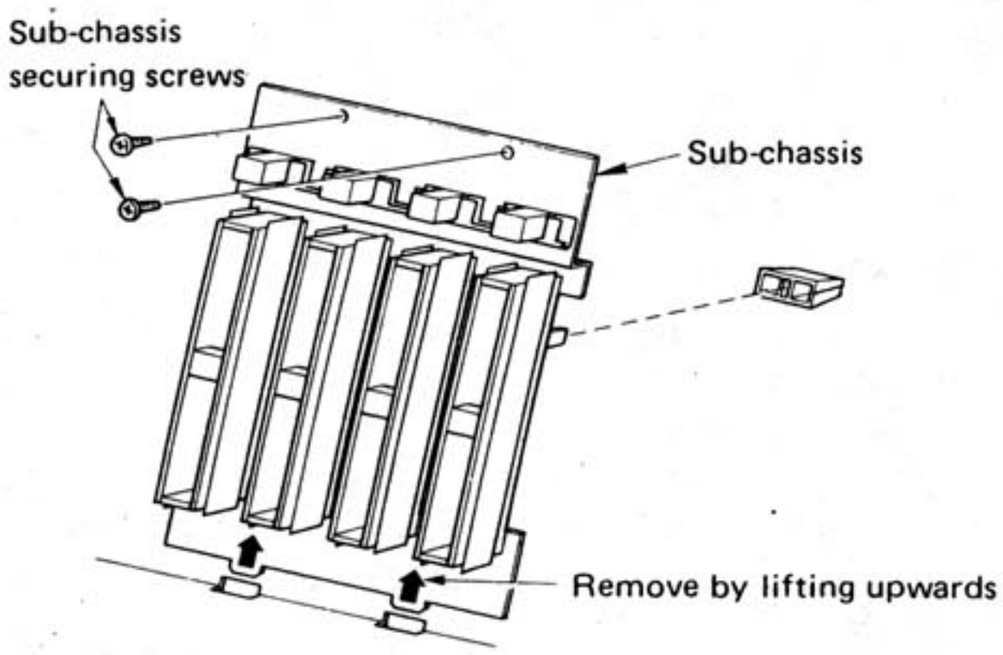


Fig. 2

3. Removing the C. Board

3-1 INPUT (1 ~ 16), PGM R, FB 1 and FB 2

1) Open the control panel as described in procedure 1 above.
2) Remove all channel control knobs used for control panel checking purposes, and also remove all nuts.
3) Disconnect the C. Board connector.
4) Then after removing the earth bus screw, the C. Board may also be removed.

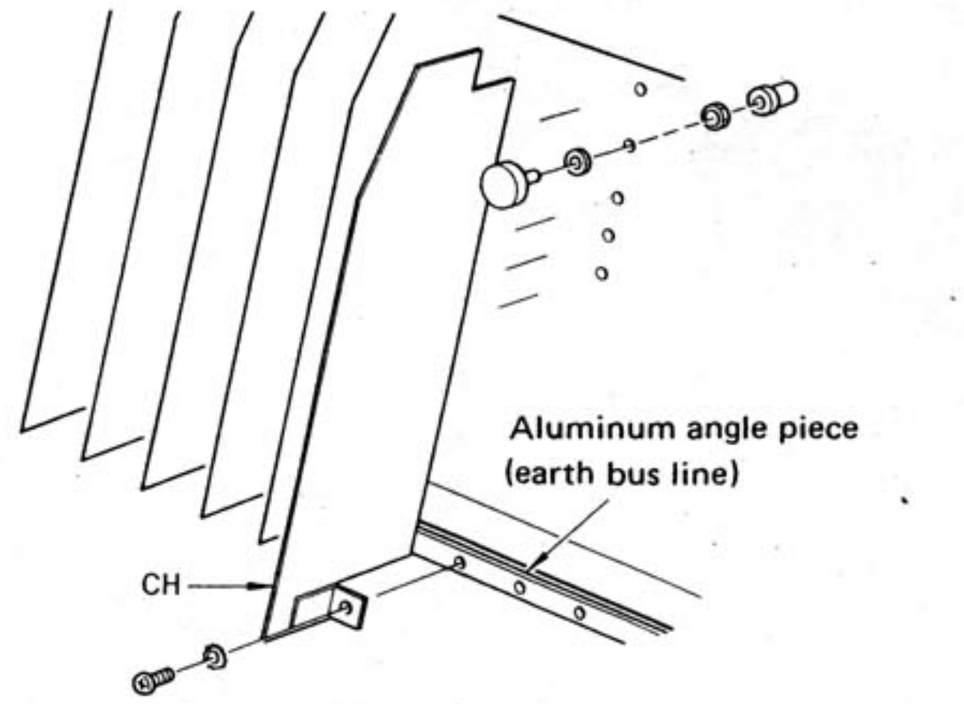


Fig. 3

3-2 PGM L C. Board

1) Remove in the same way as described in procedure 3-1.
2) Since the shield plate (circuit board holder) will also be dislodged at this time, extract the C. Board from the holder by using a pair of radio pliers etc.

3-3 TB C. Board

1) Open the control panel as described in procedure 1 above.
2) Remove the control knobs in the TB section of the control panel, and also remove all nuts.
3) Remove the 2 screws from the TB IN canon connector in the control panel.
4) Disconnect the C. Board connector.
5) Then after removing the 2 securing screws, the C. Board may also be removed.

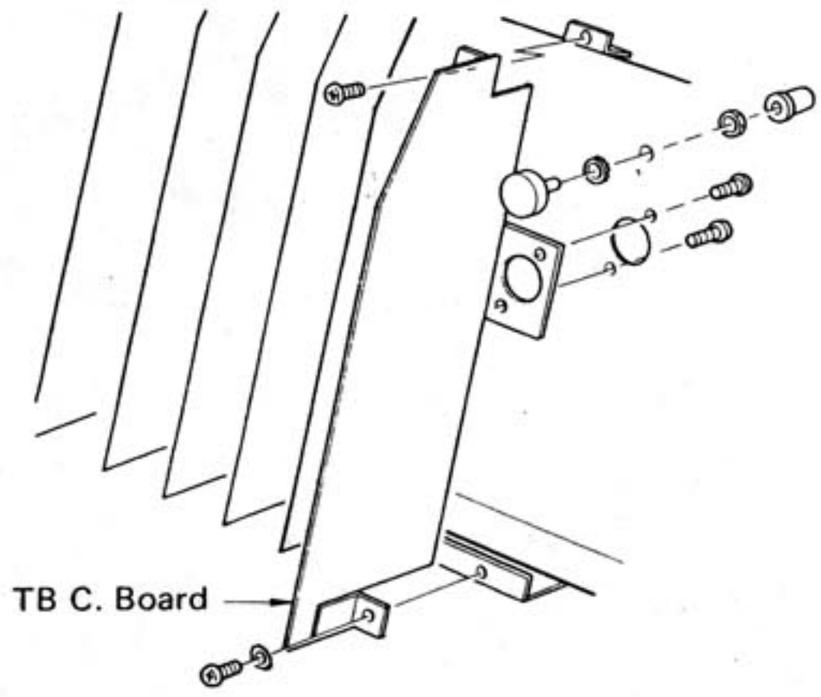


Fig. 4

3-4 HP C. Board

1) Open the control panel as described in procedure 1 above.
2) Disconnect the C. Board connector.
3) Then remove the 3 securing screws to enable the removal of the HP C. Board.

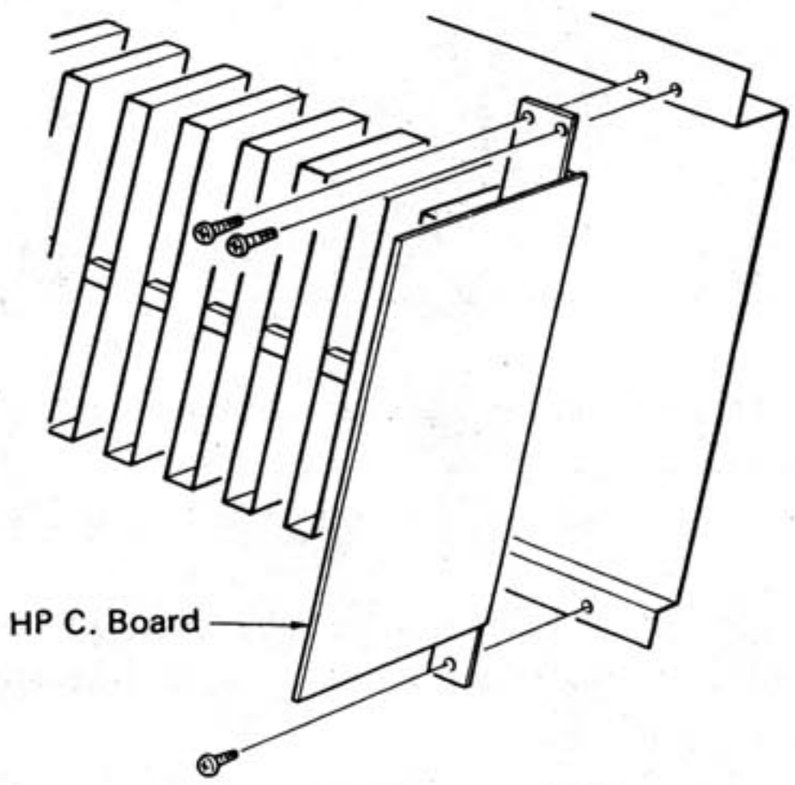


Fig. 5

4. Removing the Power Supply Unit

1) Open the control panel as described in procedure 1 above.
2) Disconnect the power unit connector, and the heat sink earth lead.
3) Then remove screws ① securing the unit, and loosen screws ② .The unit may now be taken out.
4) And by removing the four securing screws ③ ,the component parts on the power supply C. Board may be seen.

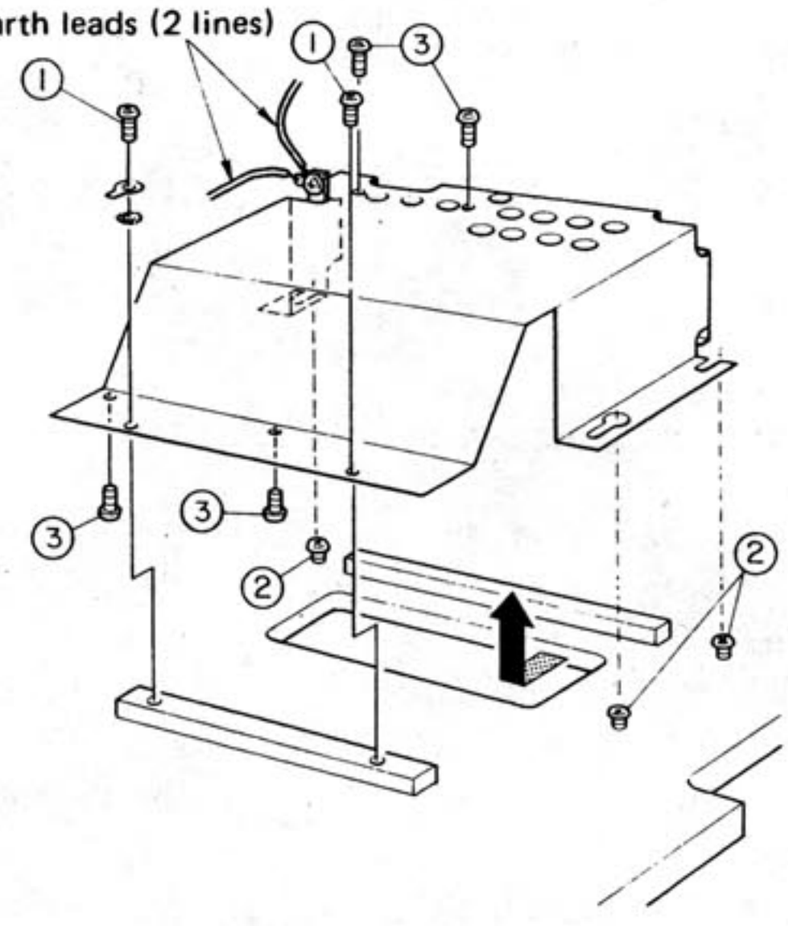


Fig. 6

5. Removing the Rear Panel and Meters plus MT1 and MT2 C. Boards

1) The rear panel may be opened after removing the 8 screws securing the panel. In this condition, the rear panel may be checked, and connectors and jacks replaced if necessary.
2) Remove the connectors to the MT1 and MT2 C. Boards.
3) When the screw shown in Fig. 8 is removed, the C. Board may be taken out together with the meter.

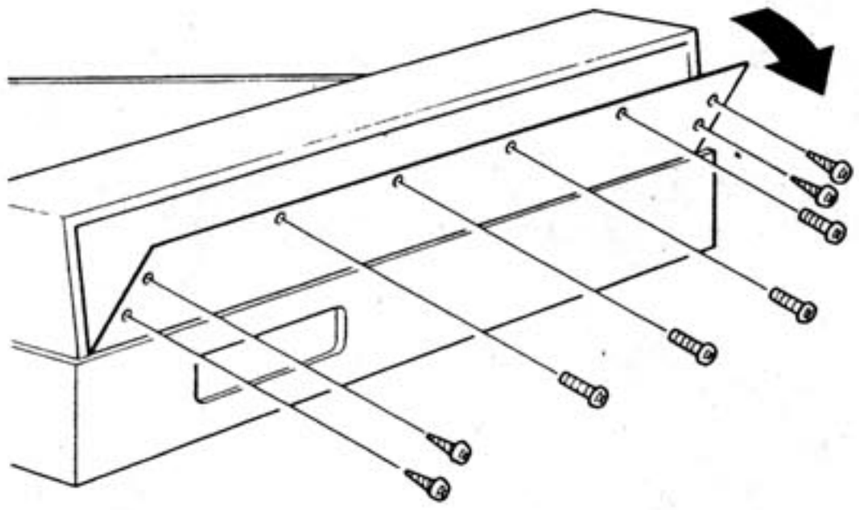


Fig. 7

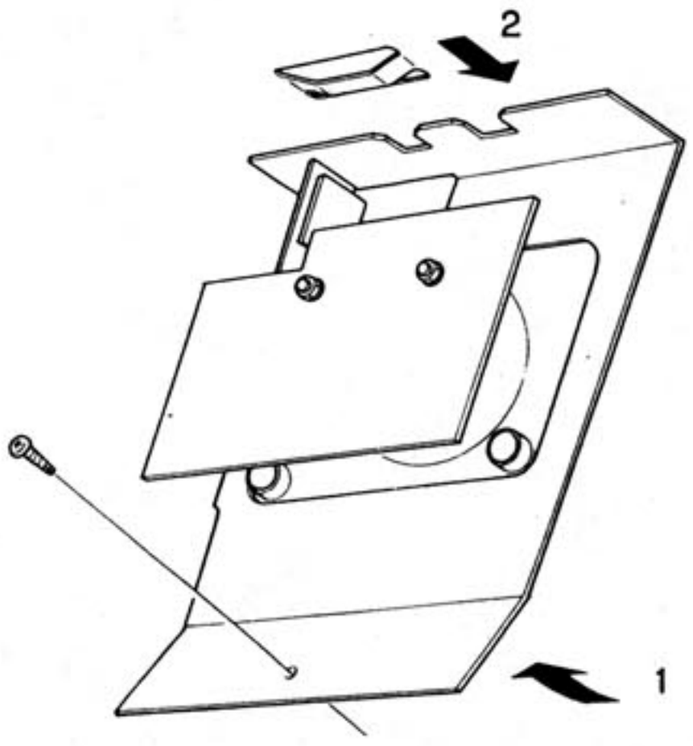


Fig. 8

GENERAL ADJUSTMENTS AND CHECKS

* Unless otherwise specified, all control knobs etc must be set to the positions shown in Table 1 when checking and adjusting the various circuit boards.
* The input test signal must be a 1kHz sine wave signal with a signal source impedance of 150Ω.
* The load resistances for the different output terminals are as follows.

  CH and MASTER
  INSERT OUT . . . . . 10kΩ (But only for measurements)

  PGM, FB, ECHO and
  MTRX OUT 600Ω
  PHONES OUT . . . . . 8Ω x 2 (STEREO)

Table 1

CONTROLS	SETTING
CH INPUT (for channels 1 to 16)	
FADER	*
EQ (LO,MID,HI)	Center
MID EQ FREQ.	Any position
LOW EQ FREQ.(100/250)	100Hz
ECHO 1,2 VOL.	*
FB 1,2 VOL.	*
PANPOT	Center
INPUT LEVEL SW	−60
PRE-POST SW	**
HPF SW	OFF
M1/M2 SW	M1
CUE SW	OFF
EFFECTS IN (1,2)	
VOLUME	*
PANPOT	Center
MASTER	
PGM FADER (L,R)	Max.
FB FADER (1,2)	Max.
ECHO VOLUME (1,2)	Max.
CUE SW	OFF
MTRX (1 to 4)	
MTRX AUX IN	*
FB VOLUME (1,2)	*
PGM VOLUME (L,R)	*
MASTER VOLUME	Max.
PHONES	
VOLUME	*
SELECT SW	All OFF
TALK BACK	
VOLUME	*
ASSIGN SW	All OFF
GAIN SW (−50/+4)	−50
METER SW	
PGM L/MTRX 1	PGM L
PGM R/MTRX 2	PGM R
FB 1/MTRX 3	FB 1
FB 2/MTRX 4	FB 2
ECHO 1/ECHO 2/CUE	ECHO 1
PHANTOM SW (Rear Panel)	
PHANTOM SW	OFF

* Maximum position for measured channel, minimum position for the other channel.
** FB & ECHO both in POST position

1. Amplification Characteristics

1-1 Gain

1) CH 'INPUT (level changes by switching INPUT LEVEL SW)

Table 2

INPUT LEVEL SW	INPUT SIGNAL LEVEL	PGM OUT (L, R)	FB OUT (1, 2)	ECHO OUT (1, 2)	CH INSERT OUT	MASTER INSERT OUT
−60	−80	+ 4±2	+14±2	+14±2	−26±2	−16±2
−50	−80	− 6±2	+ 4±2	+ 4±2	−36±2	−26±2
−35	−80	−21±2	−11±2	−11±2	−51±2	−41±2
−20	−40	+ 4±2	+14±2	+14±2	−26±2	−16±2
−10	−40	− 6±2	+ 4±2	+ 4±2	−36±2	−26±2
+ 4	−40	−20±2	−10±2	−10±2	−50±2	−40±2

(Unit: dB)

- Output level differences between different channels must not exceed 2dB.
- Nor must the output level difference between PGM L and R exceed 2dB.
- When the PRE/POST SW is set to the PRE position, the FB and ECHO OUT output level should lie within the +4±2dB range.
- When the INPUT LEVEL SW is set to "−60", and the M2 input terminal used with the M1/M2 SW in the M2 position, an output level of +4±2dB should be obtained from the PGM OUT L terminal. In addition, the M1 and M2 output level difference should not exceed 1dB.
- For MASTER INSERT OUT measurements, measure at INPUT CH1 as a typical example.

2) Relation with other INPUT terminals

Table 3

INPUT	INPUT SIGNAL LEVEL	PGM OUT (L. R)	FB OUT (1. 2)	ECHO OUT (1. 2)
CH INSERT IN	−16	+14±2	*	*
MASTER INSERT IN	−16	+4 ±2	+4 ±2	+ 4±2
EFFECTS IN	−16	+ 4±2	*	*
SUB IN	−16	− 6±2	− 6±2	− 6±2
TB IN	−80	− 6±2	− 6±2	− 6±2

(Unit: dB)

- When the input levels listed in Table 3 are applied, the rated output levels should be obtained at each of the output terminals.
- For MASTER IN and SUB IN, output signals should be obtained from the output terminals of the same name as the input terminals to which the input signal was applied.
- And in the case of TB IN, an output signal should be obtained from the output terminal of the same name as the switched ON ASSIGN SW. The TB SW is

turned off again immediately when the switch is released.

- When a −16dB input signal is applied with the −50/+4 SW in the +4 position, a +4±2dB output should be obtained from PGM OUT (L).

Table 4

INPUT	INPUT SIGNAL LEVEL	MAX. SETTING KNOB	MTRX OUT 1	MTRX OUT 2	MTRX OUT 3	MTRX OUT 4
CH1	−80	FB 1	+14±2	+14±2	+14±2	+14±2
		FB 2	+14±2	+14±2	+14±2	+14±2
		PGM L	+4±2	+4±2	+4±2	+4±2
		PGM R	+4±2	+4±2	+4±2	+4±2
MTRX AUX IN	−16	MTRX AUX IN	−6±2	−6±2	−6±2	−6±2
TB IN	−80	INPUT LEVEL	−16±2	−16±2	−16±2	−16±2

(Unit: dB)

- When the input levels listed in Table 4 are applied, and only the maximum setting control knobs are set to maximum position, the rated output levels should be obtained from each output terminal.
- Set only VOLUME of the maximum setting control knobs to maximum position, and set the others to minimum position.

3) PHONES OUT

- When PHONES SELECT is set to CUE, and a −80dB signal is applied to CH INPUT with CH CUE set to the ON position, a −16±2dB output should be obtained from PHONES OUT. And level differences between channels should not exceed 2dB.
- When a +4dB output is obtained from PGM OUT and each CUE SW is turned ON, the PHONES OUT output should read −6±2dB.
- When +4dB outputs are obtained from both ECHO OUT and MTRX OUT, and PHONES SELECT is switched to ECHO and MTRX, the PHONES OUT output should read +4±2dB in both cases.

Note: Do not press more than one CUE SW or PHONES SELECT key at the same time. Also note that MTRX 1 and 3 signals are obtained from the left channel, and 2 and 4 from the right channel. CUE and ECHO are obtained from both channels. The level difference between left and right channels, however, must not exceed 2dB.

1-2 Distortion

- Table 1 setting positions.
- Set the INPUT LEVEL SW to "−60", and each volume and fader control to the "nominal" positions ("−10" for faders and about 7 to 8 for volume controls).
- When the PGM (L & R), FB (1 & 2), ECHO (1 & 2) and MTRX (1 to 4) output levels are at +10dB, distortion will be less than 0.2%.

1-3 Frequency Response

- Table 1 setting positions.
- INPUT LEVEL SW at "−60".
- With reference output level at 1kHz, the PGM (L & R), FB (1 & 2), ECHO (1 & 2) and MTRX (1 to 4) output levels must lie within the $0\ ^{+0}_{-3}$ dB at both 20Hz and 20kHz.

1-4 Maximum Output

- When a signal is applied to CH1 and an output level of +24dB is obtained from each of the output terminals PGM (L & R), FB (1 & 2), and ECHO (1 & 2) OUT, the distortion should not exceed 1%.
- When a signal is applied to MTRX AUX IN and an output level of +24dB is obtained from the MTRX OUT terminal, distortion again should not exceed 1%.

1-5 Separation

- Table 1 setting positions.
- Turn the PANPOT control of the channel to be measured full around to the L position. When an output level of +7dB is obtained from the PGM OUT (L) terminal, the leakage level at the PGM OUT (R) terminal should not exceed −53dB (i.e. separation of 60dB).
- The turn full around to the R position, and obtain the same leakage level at the PGM OUT (L) terminal.

1-6 Noise Level

- When the CHANNEL FADER, FB and ECHO VOLUME controls are set to maximum position only for the channel to be measured, the PGM OUT (L & R) noise level must not exceed −42dB, and the FB OUT (1 & 2) and ECHO OUT (1 & 2) noise levels must not exceed −32dB.

Note: Input terminals must be shorted with 150Ω. If the above specifications cannot be met, however, an equivalent noise level of −126dB max. at the input is also acceptable.

1-7 Residual Noise

- Table 1 setting positions
- When the CHANNEL FADER, FB AND ECHO VOLUME controls are all set to minimum position, the PGM OUT (L & R) noise level must not exceed –63dB, and the FB OUT (1 & 2) and ECHO OUT (1 & 2) noise levels must not exceed –53dB.
- And when each MASTER FADER and VOLUME control is also then set to minimum position, the noise level at each output terminal must be dropped to at least –95dB. When the MTRX MASTER VOLUME is set to minimum position, the MTRX OUT (1 to 4) noise level, too, must be below –95dB.
- When PHONES VOLUME is set to minimum position, the PHONES OUT noise level must not exceed –65dB.

1-8 LEDs

- Table 1 setting positions.
- When the M1/M2 SW for each channel is switched to the M2 position, the corresponding yellow indicator LED lamp should light up.
- In order for the VU meter peak indicator LED lamps to light up, the output level at each output terminal will have to reach +4±2dB.
- The green peak indicator LED lamps for each channel will start to light up when the input level is –43±2dB, While the red LED lamps will start to light up at –33±2dB. The CHANNEL FADER, however, must in minimum position at this time.

1-9 VU Meters

- Each VU meter should read 0±1VU when the output level at each output terminal is +4dB.
- MTRX (1 to 4) and ECHO 2 are used by switching METER SW.
- A VU reading of 0±1.5VU should be obtained when a –60dB signal is applied to CH IN with ECHO 1/ ECHO 2 / CUE SW in CUE position, and the CHANNEL CUE SW in the ON position.

1-10 PHANTOM

- When the rear panel PHANTOM SW is switched ON, a DC voltage of (Japan, General : 35±3V ; U.S.A., Canadian : 29±3V) should be obtained across 1–2 of CHANNEL INPUT XLR connector. In this case, however, load resistances of at least 10kΩ/1W must be connected across 1–2 of all channels (CH 1 to CH 16), and a short circuit placed across terminals 2–3.

1-11 EQ Variation Characteristics

- Table 1 setting positions.
- When each channel equalizer is varied, the variations listed in Table 5 should be obtained with the PGM OUT L terminal output level at 1kHz (EQ FLAT) serving as the reference level. (See the equalizer characteristic curves in the following diagram).

- Equalizer Characteristic Curves.

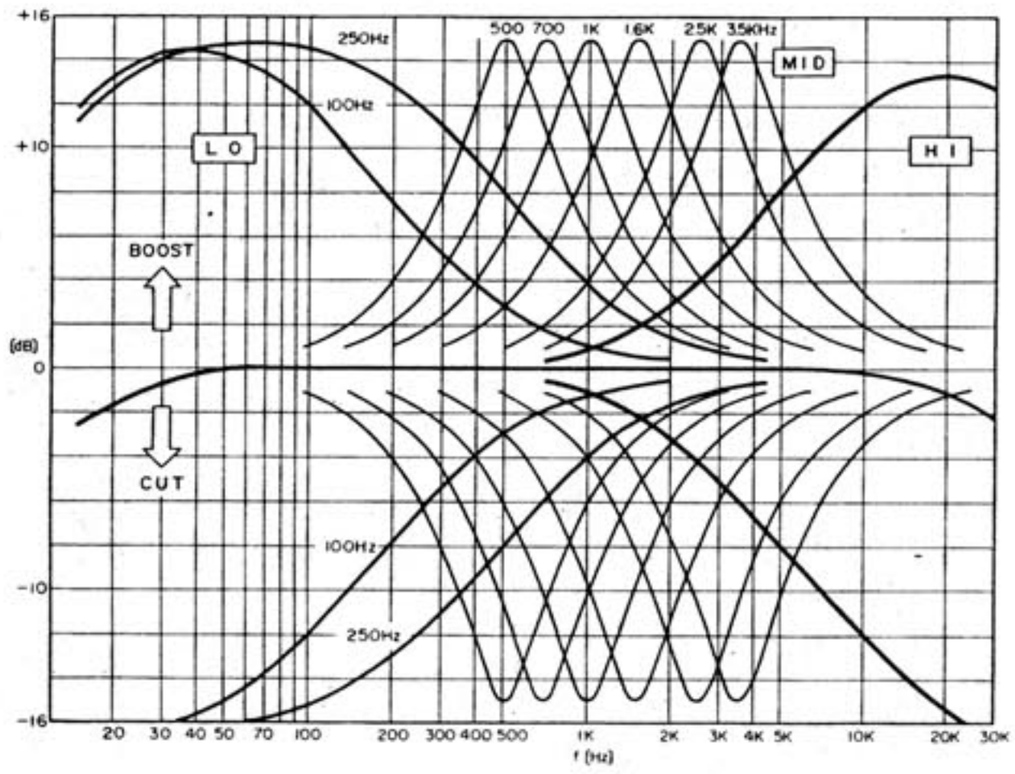


Table 5

Low		Mid		Hi	INPUT SIGNAL								
EQ	f	EQ	f	EQ	100Hz	250Hz	500Hz	700Hz	1kHz	1.6kHz	2.5kHz	3.5kHz	10kHz
MA X MIN	100Hz	CENTER	*	MAX MIN	+12±2 −12±2	*	*	*	*	*	*	*	+12±2 −12±2
MAX MIN	250Hz	〃	*	*	*	+12±2 −12±2	*	*	*	*	*	*	*
CENTER	*	MAX MIN	500Hz	CENTER	*	*	+15±2 −15±2	*	*	*	*	*	*
〃	*	MAX MIN	700Hz	〃	*	*	*	+15±2 −15±2	*	*	*	*	*
〃	*	MAX MIN	1kHz	〃	*	*	*	*	+15±2 −15±2	*	*	*	*
〃	*	MAX MIN	1.6kHz	〃	*	*	*	*	*	+15±2 −15±2	*	*	*
〃	*	MAX MIN	2.5kHz	〃	*	*	*	*	*	*	+15±2 −15±2	*	*
〃	*	MAX MIN	3.5Hz	〃	*	*	*	*	*	*	*	+15±2 −15±2	*

(Unit: dB)

1-12 HPF

- Table 1 setting positions.
- When an 80Hz, −80dB signal is applied to the input, the PGM (L) output level should be −3±1.5dB with the HPF SW ON (with the OFF position level as reference level).

2. Stability

2-1 Power Supply Voltage Fluctuations

- Normal operation should be possible even if the power supply voltage fluctuates by up to ±10% of the rated voltage.

2-2 Oscillation

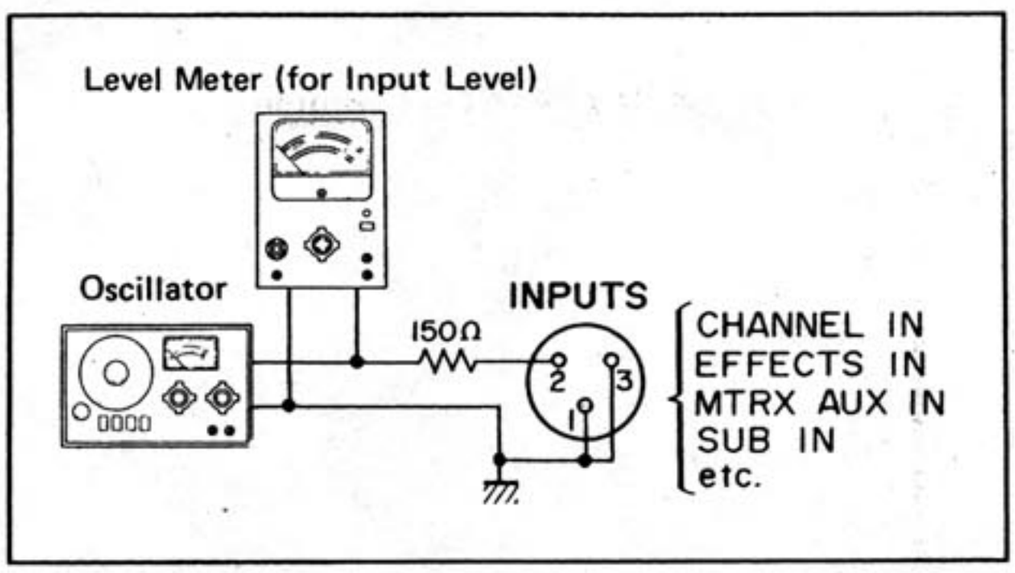
- When all equalizers are set to "flat" characteristics with all FADER and VOLUME controls in maximum position, and when all equalizers are set to maximum position with the FADER and VOLUME controls set to "nominal" positions, no abnormality should be detected in the oscillation etc. All input terminals, however, should be shorted with 150Ω.
- Nor should any oscillator abnormality etc be detected when 10pF to 0.1μF capacitors are connected in parallel with 600Ω load resistors to the PGM, FB, ECHO and MTRX output terminals.

3. Measuring Equipment

- Oscilloscope and level meters with 500kΩ min. input impedance.
- When measuring noise levels, also use a 12.47kHz 6dB/oct. compensating low-pass filter.
- Oscillator output impedance must not exceed 10Ω.

4. Oscillator Connections

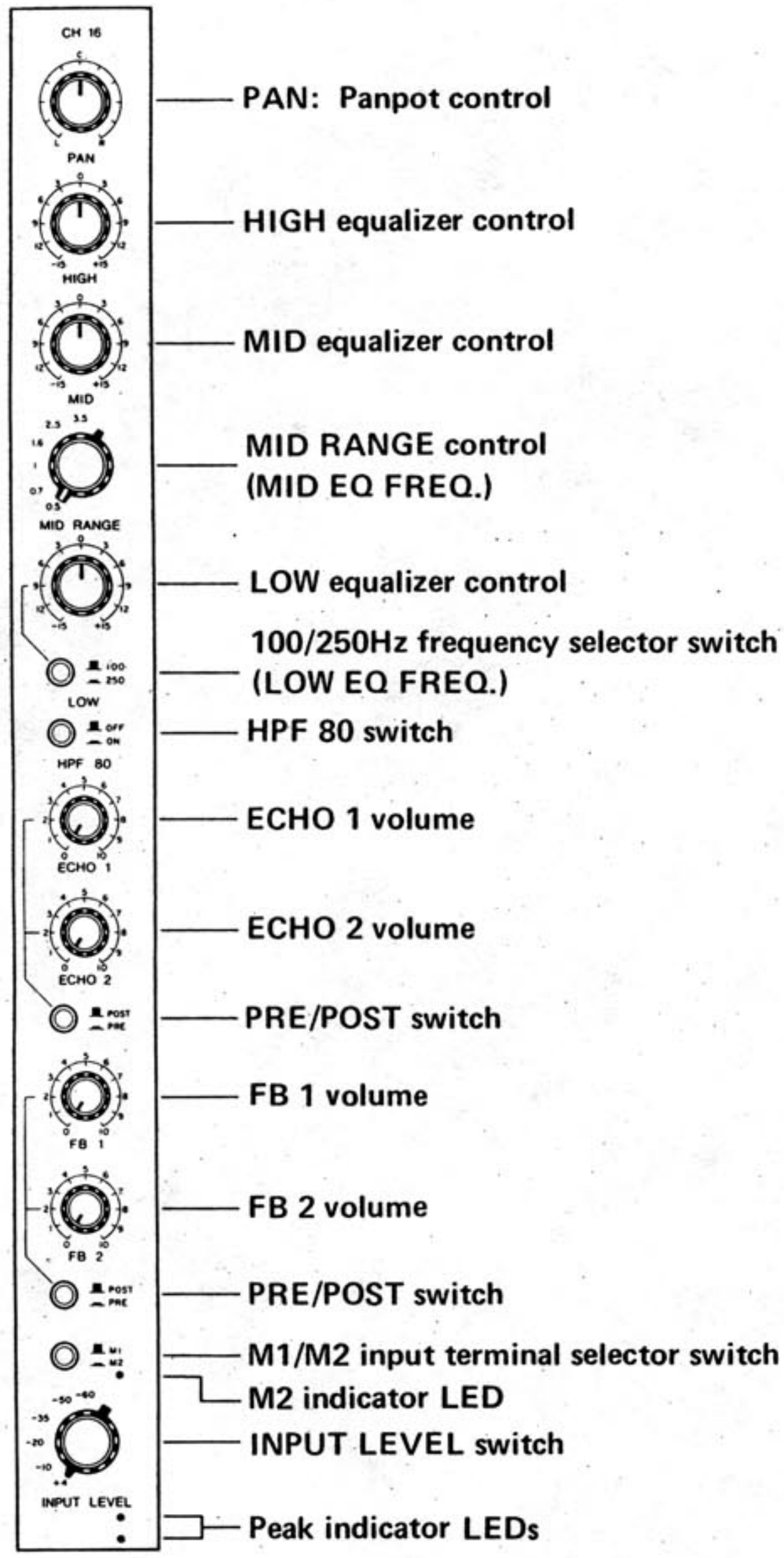
- Connect and measure as shown in the following diagram for all INPUT terminals.

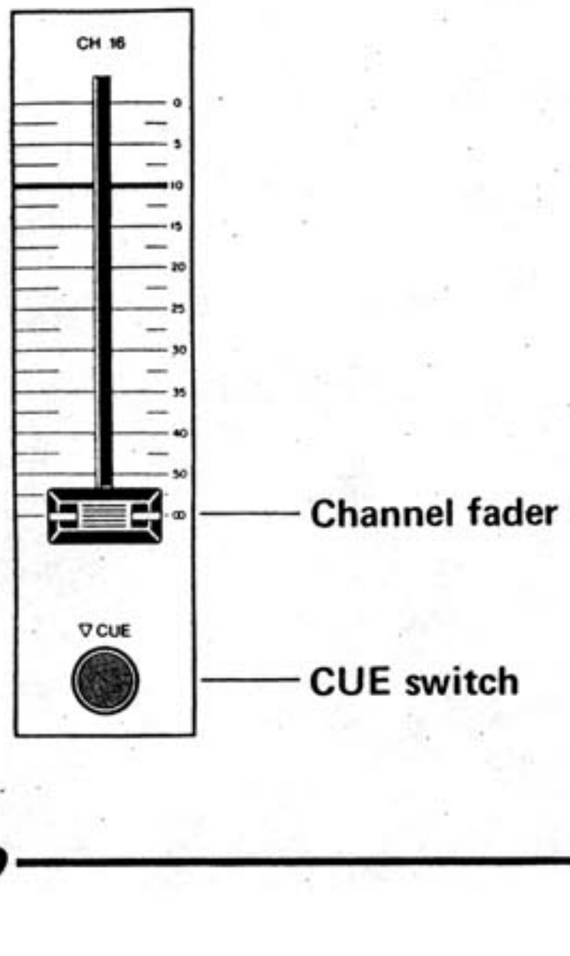


CONTROLS AND FUNCTIONS

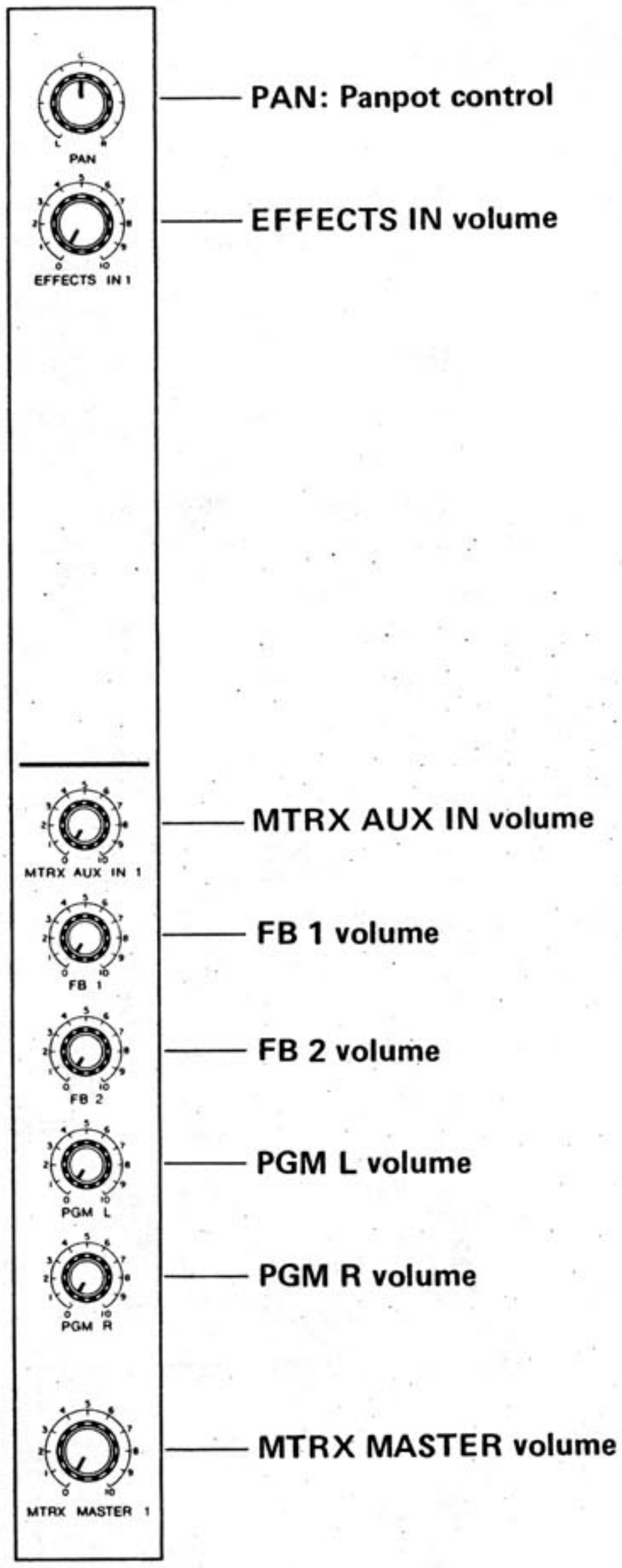
Control Panel

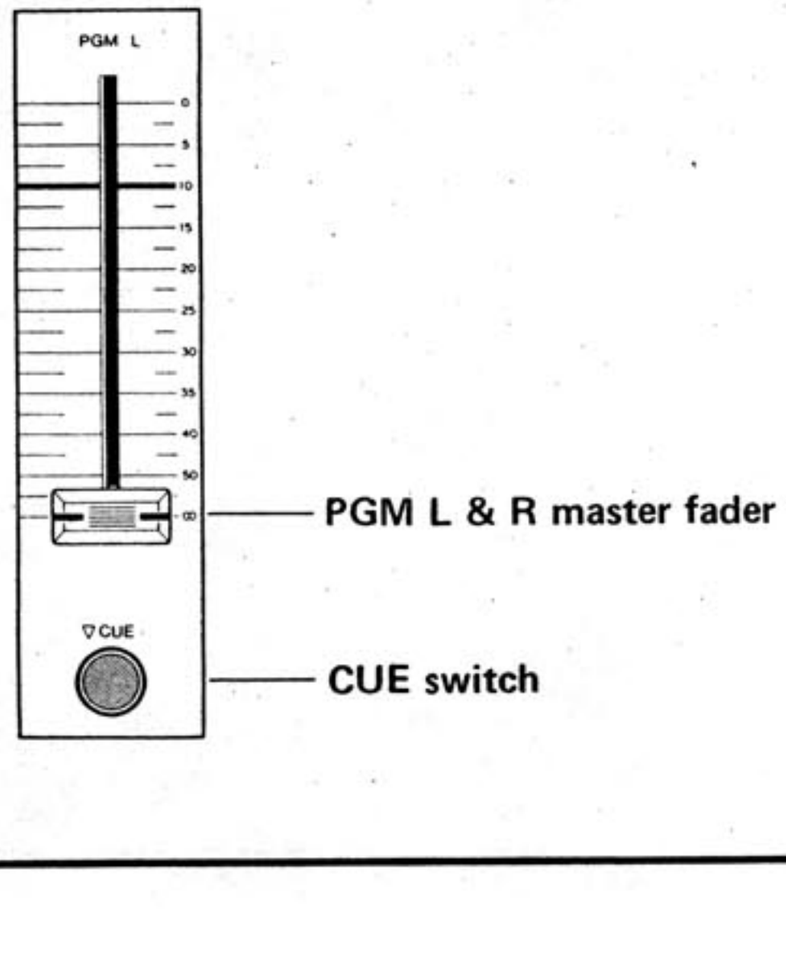
INPUT SECTION





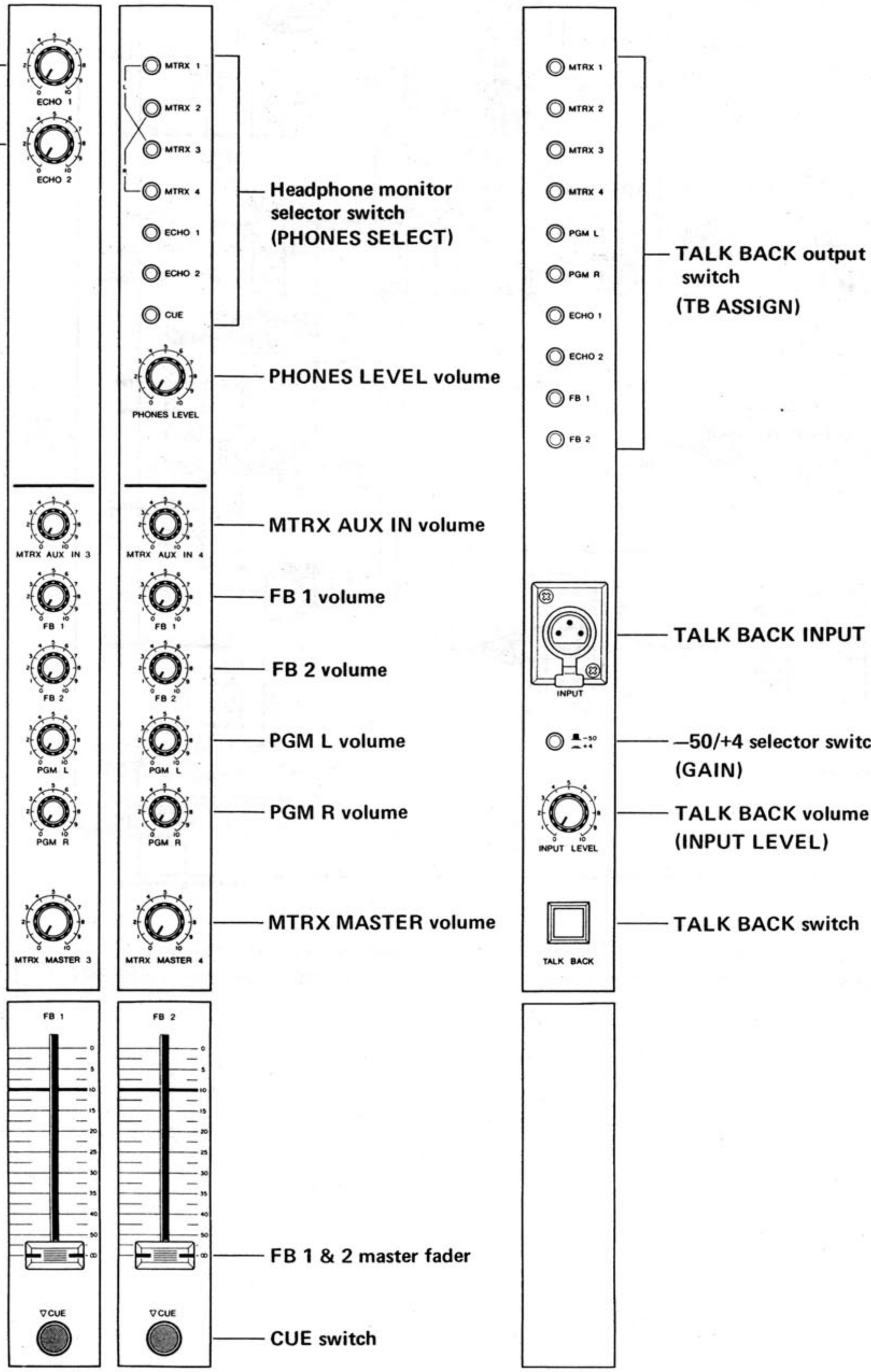
PGM L,R SECTION



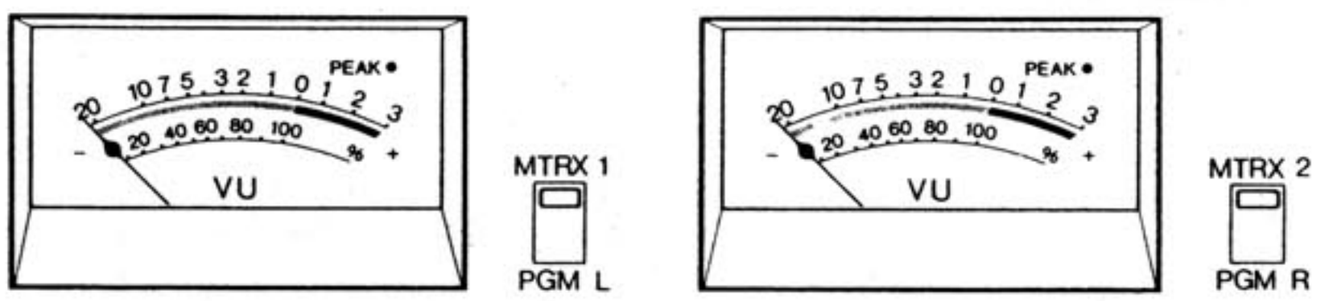


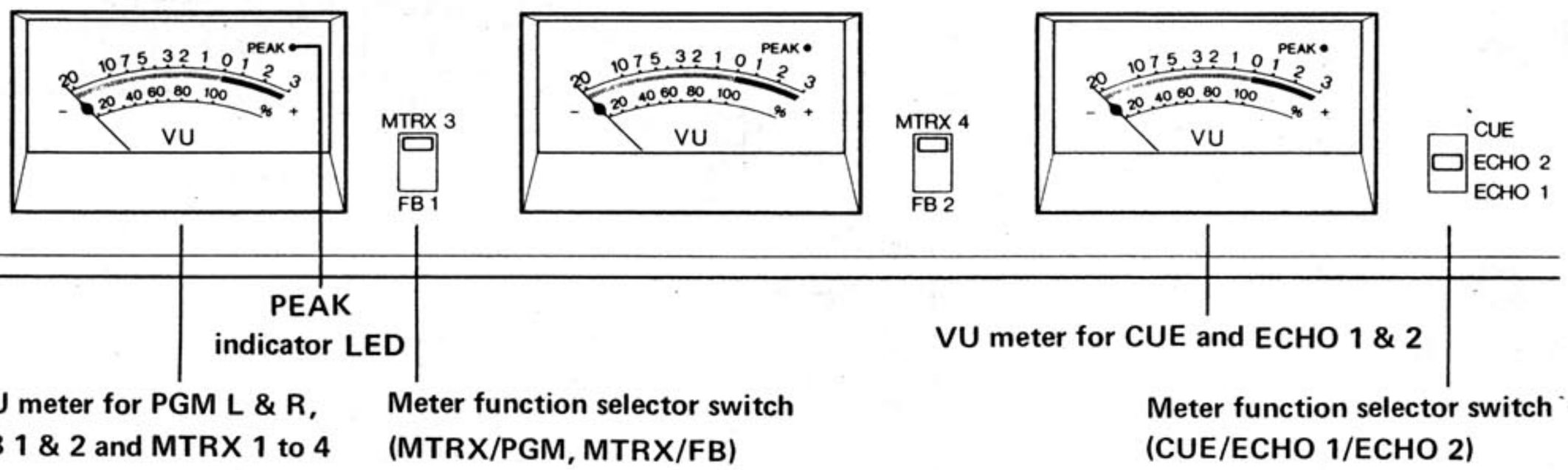
FB 1,2 SECTION

TALK BACK SECTION

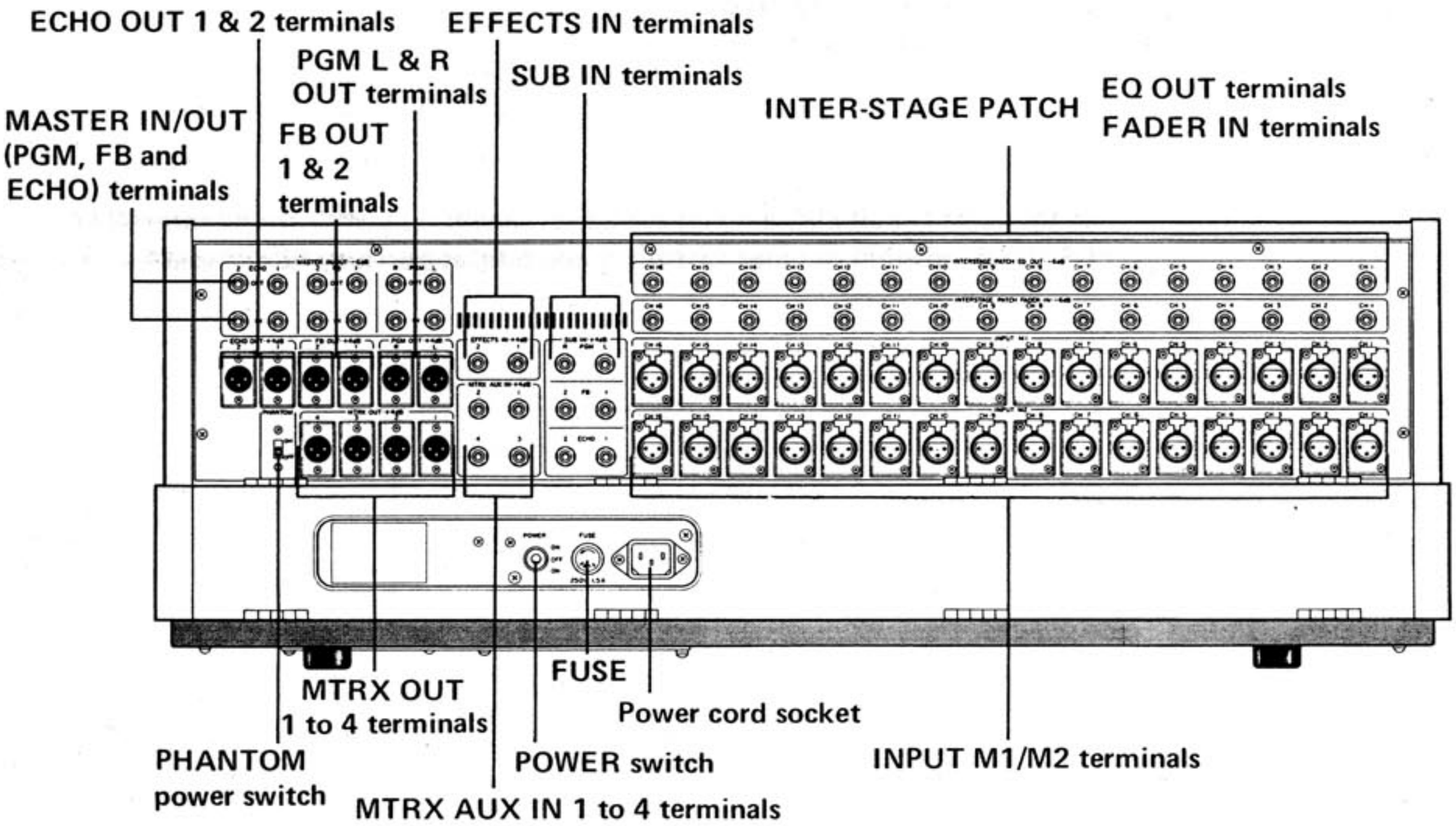


Meter Panel



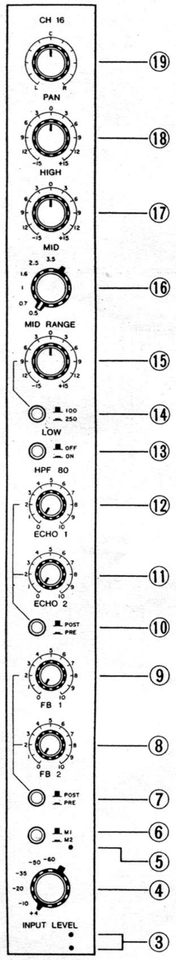


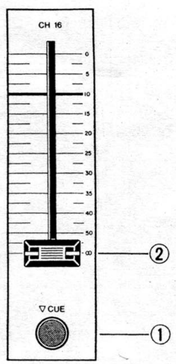
Rear Panel

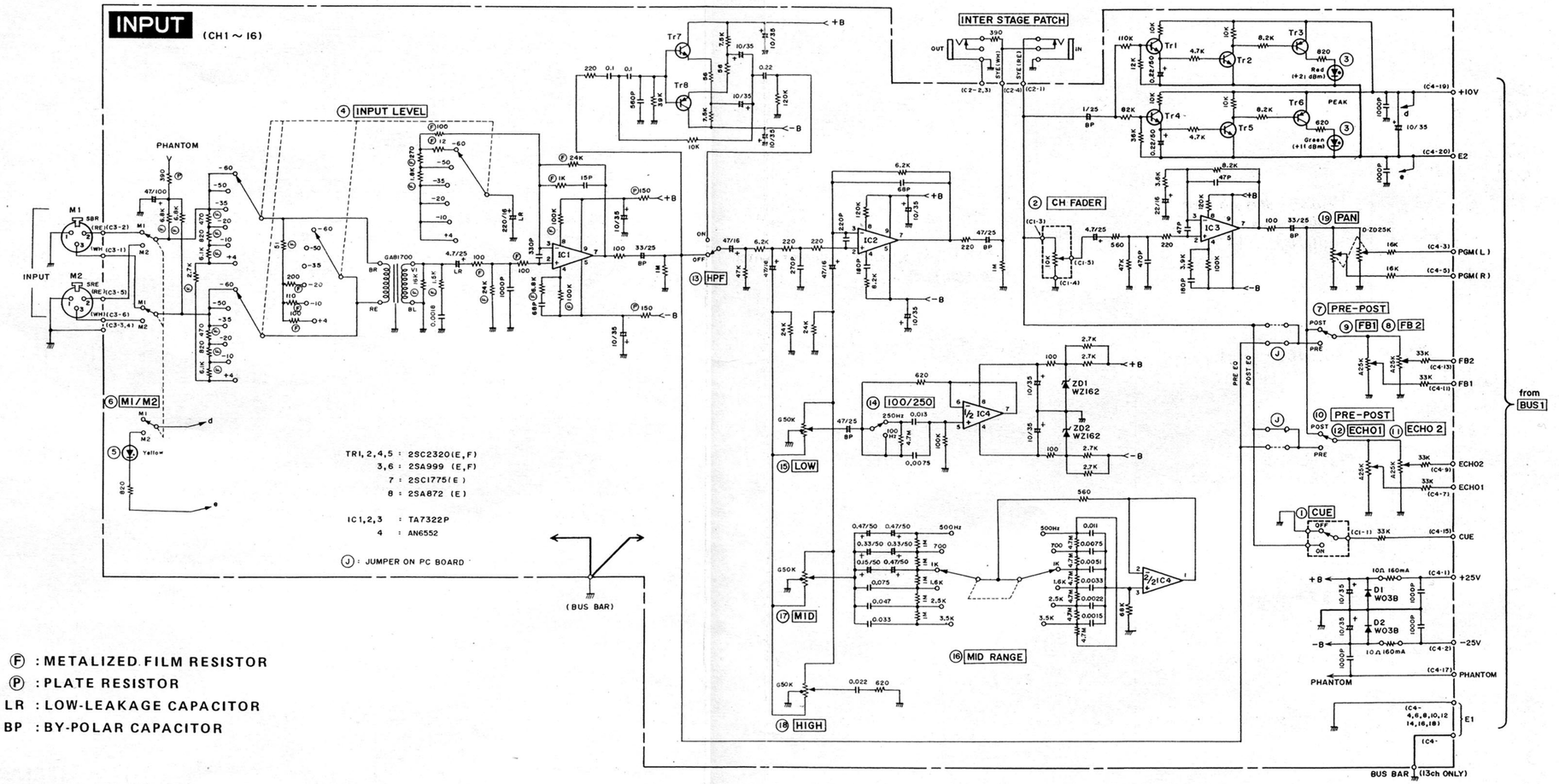


INPUT SECTION

Circuit Diagram



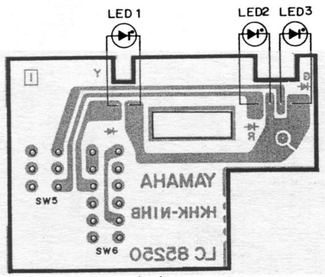




Ⓕ : METALIZED FILM RESISTOR
Ⓟ : PLATE RESISTOR
LR : LOW-LEAKAGE CAPACITOR
BP : BY-POLAR CAPACITOR

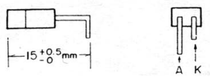
* See the earth circuit diagram on page 23 for details on earth wiring connections.
* PRE/POST position or input sensitivity and output gain may be changed by altering the jumper wiring marked Ⓙ.

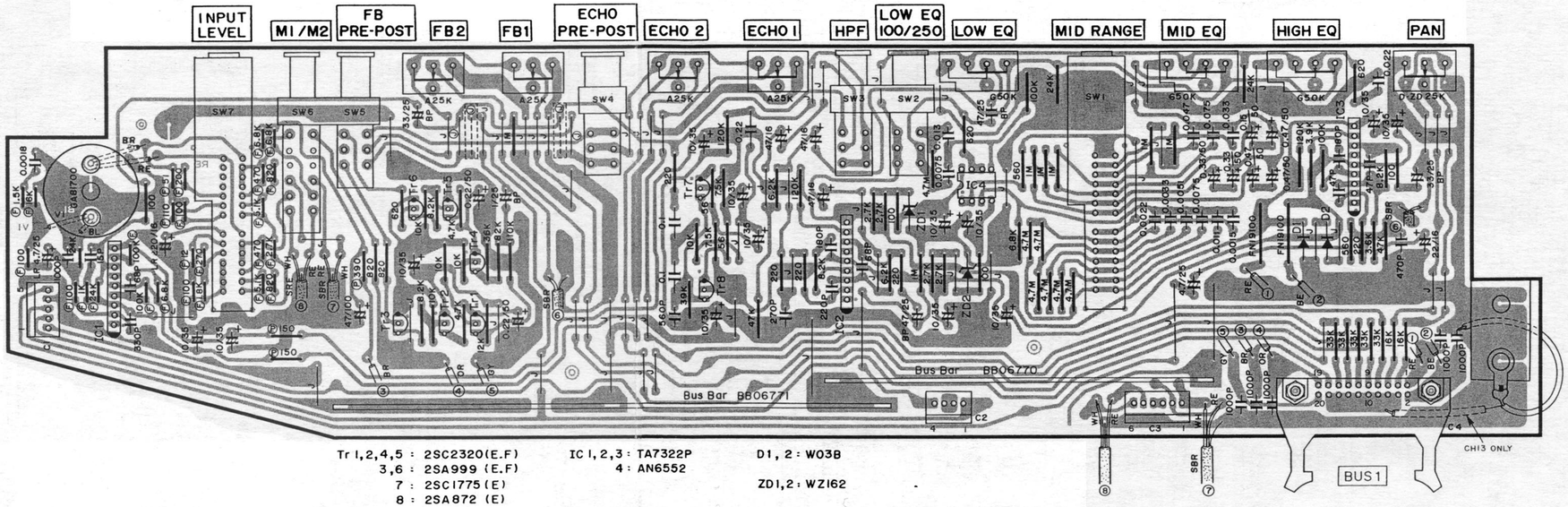
Circuit Board Diagram



LED1: LN422YP(YE)
LED2: LN222RP(RE)
LED3: LN322GP(GR)

※ Fitting a LED





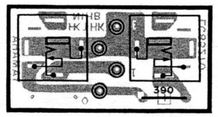
Tr 1,2,4,5 : 2SC2320(E.F)
3,6 : 2SA999 (E.F)
7 : 2SC1775(E)
8 : 2SA872 (E)

IC 1,2,3 : TA7322P
4 : AN6552

D1, 2 : W03B

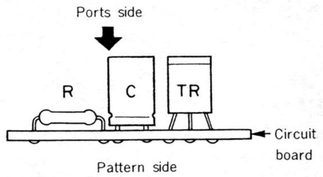
ZD1,2 : WZ162

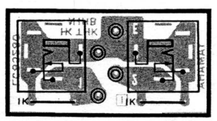
Lines in the circuit board marked by encircled numbers are connected in the board to lines of the same number.
The Ⓙ jumpers in the [---] blocks denote the Ⓙ jumper wiring in the circuit diagram.



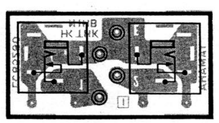
JK1: INTERSTAGE PATCH EQ OUT/FADER IN
MASTER IN/OUT

●The circuit board diagram is the diagram as viewed from the parts side.



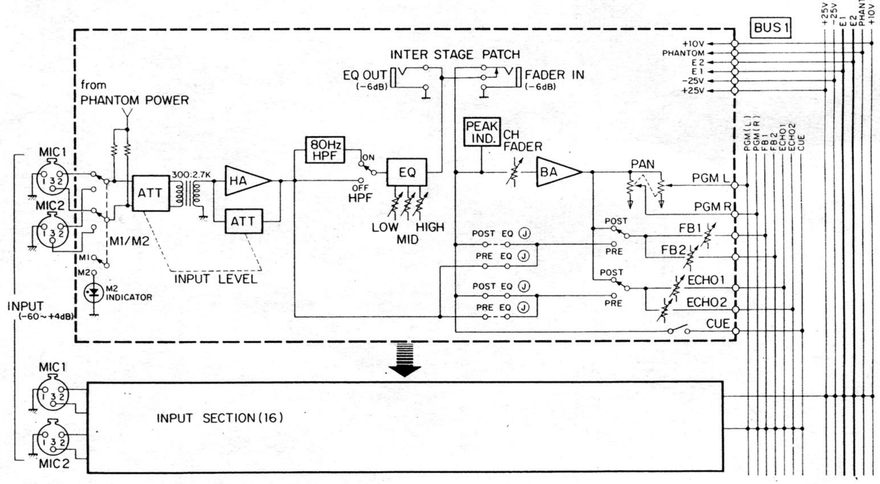


JK2: SUB IN



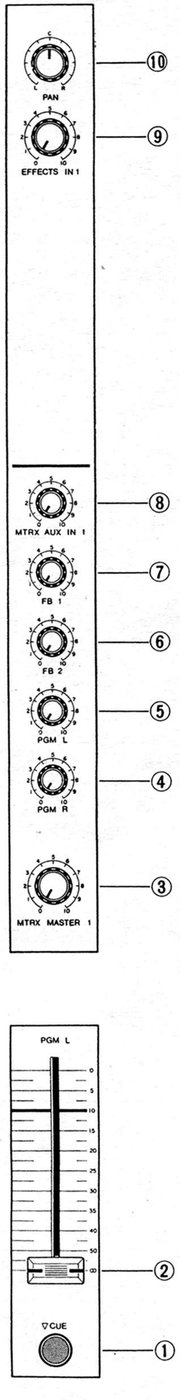
JK3: EFFECTS IN

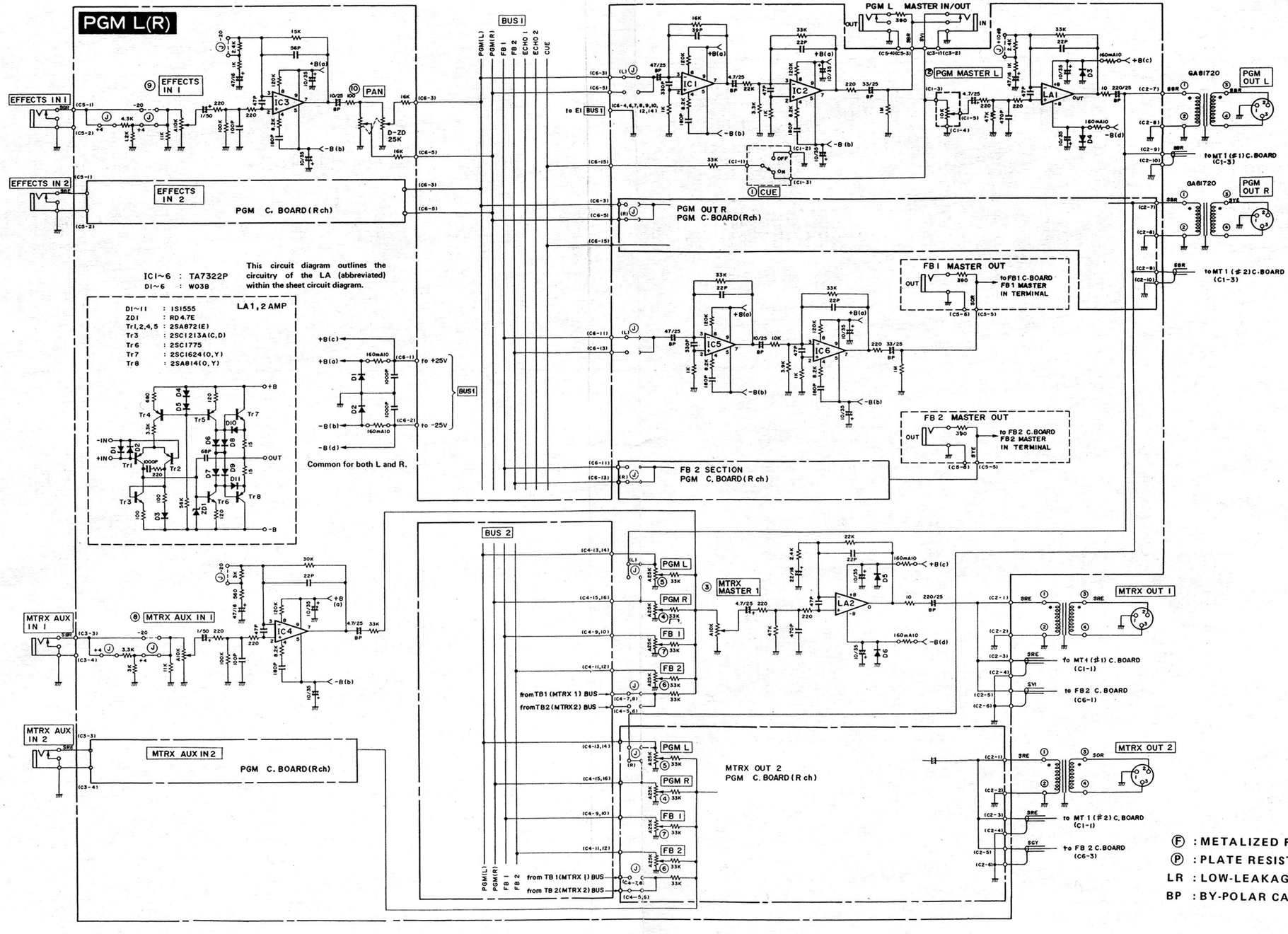
Block Diagram



PGM L and R SECTION

Circuit Diagram





Ⓕ : METALIZED FILM RESISTC
Ⓟ : PLATE RESISTOR
LR : LOW-LEAKAGE CAPACITOI
BP : BY-POLAR CAPACITOR

** See the earth circuit diagram on page 23 for details on earth wiring connections.

Note: Although this diagram shows both L and R PGM channels, these two channels are in fact located on two separate PGM sheets. By altering the internal jumper wiring, the L channel sheet and R channel sheet may be used in different ways.

* PRE/POST position or input sensitivity and output gain may be changed by altering the jumper wiring marked Ⓙ. (L and R channels may be changed only in the PGM sheet).