

YAMAHA

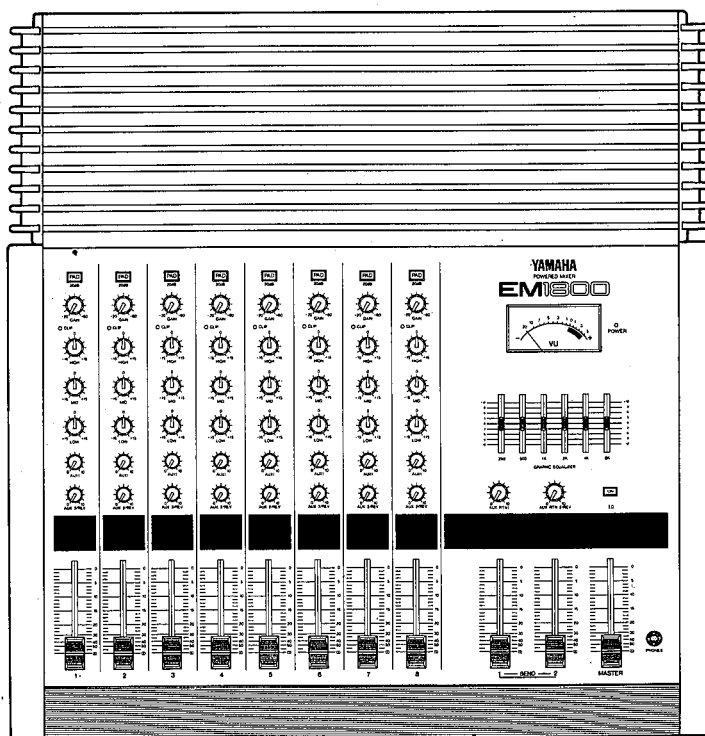
POWERED MIXERS

EM1400

EM1600

EM1800

OPERATION MANUAL



CONGRATULATIONS!

You are the proud owner of a Yamaha EM-series Powered Mixer. Whether you chose the 4, 6 or 8-channel model, your Yamaha powered mixer is a high-quality product that will give you superior performance in a wide range of applications. In addition to offering a powerful 100-watt amplifier built-in (150 watts into a 4-ohm load), the EM-series mixers feature a high-quality built-in reverb system that can be used to add depth and ambience to your mix. Of course, you can use external signal processing equipment in addition to the internal reverb system. For additional control and versatility, the EM-series powered mixers offer three-band equalization on every input channel, and a master six-band graphic equalizer for fine tuning the overall output mix. Of course, the EM-series powered Mixers also offer the high standard of quality and great sound that Yamaha is famous for. We urge you to read this operation manual thoroughly in order to make the most of the mixer's many features and controls.

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PRECAUTIONS

1. AVOID EXCESSIVE HEAT, HUMIDITY, DUST AND VIBRATION

Keep the unit away from locations where it is likely to be exposed to high temperatures or humidity—such as near radiators, stoves, etc. Also avoid locations which are subject to excessive dust accumulation or vibration which could cause mechanical damage.

2. AVOID PHYSICAL SHOCKS

Strong physical shocks to the unit can cause damage. Handle it with care.

3. DO NOT OPEN THE UNIT OR ATTEMPT REPAIRS OR MODIFICATIONS YOURSELF

This product contains no user-serviceable parts. Refer all maintenance to qualified Yamaha service personnel. Opening the unit and/or tampering with the internal circuitry will void the warranty.

4. MAKE SURE POWER IS OFF BEFORE MAKING OR REMOVING CONNECTIONS

Always turn the power OFF prior to connecting or disconnecting cables. This is important to prevent damage to the unit itself as well as other connected equipment.

5. HANDLE CABLES CAREFULLY

Always plug and unplug cables—including the AC cord—by gripping the connector, not the cord.

6. CLEAN WITH A SOFT DRY CLOTH

Never use solvents such as benzine or thinner to clean the unit. Wipe clean with a soft, dry cloth.

7. ALWAYS USE THE CORRECT POWER SOURCE

Make sure that the power source voltage specified on the rear panel matches your local AC mains supply.

U.S. & Canadian models: 120V AC (105 ~ 130V),
60 Hz

General model: 110-120/220-240V AC
(± 10%), 50/60 Hz

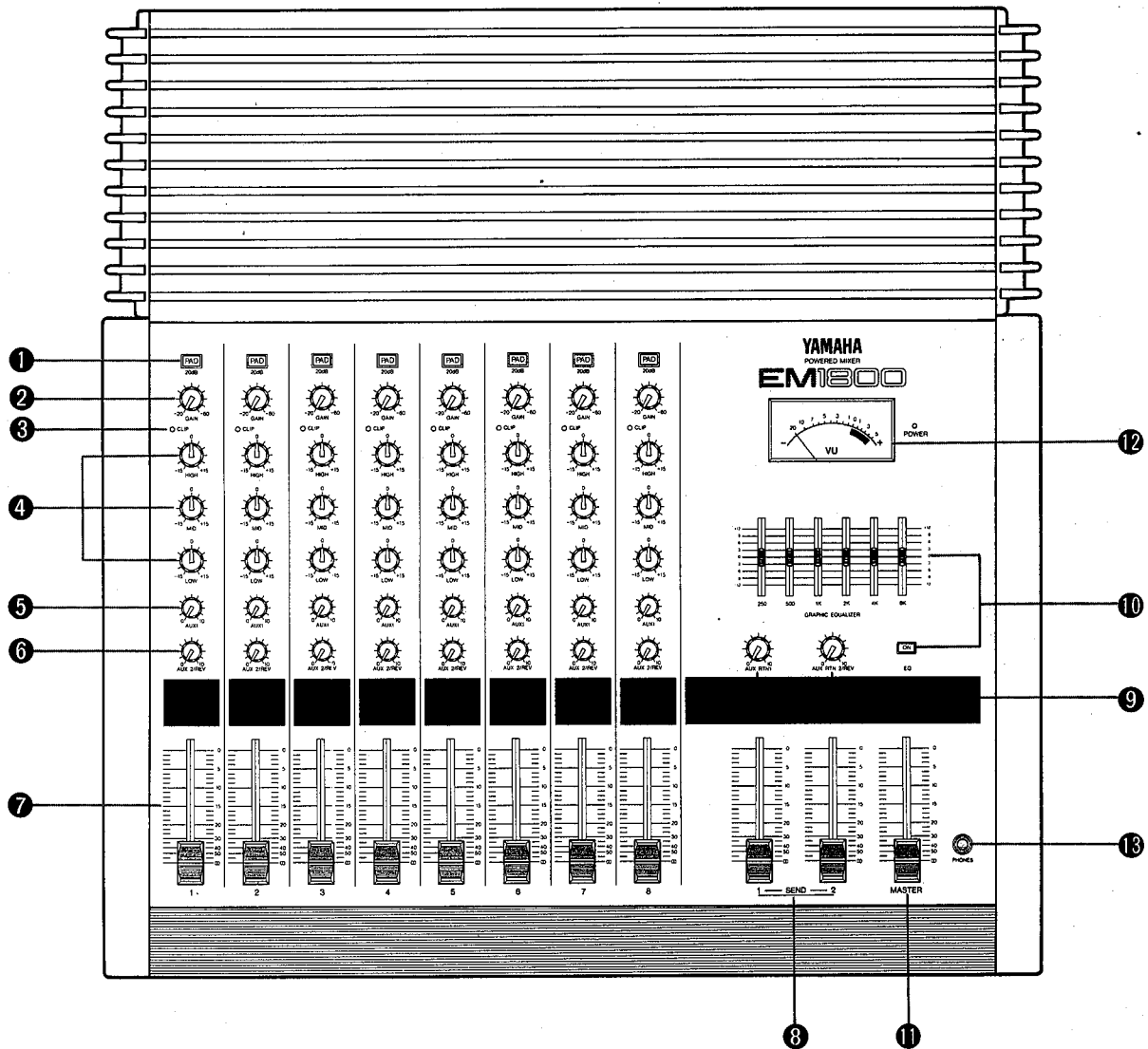
8. XLR TYPE CONNECTORS

The XLR Type Input connectors are wired in the following configuration: Pin 1 : GROUND, Pin 2 : HOT, Pin 3 : COLD.

Ensure that all equipment connected to the EM1400 /EM1600/EM1800 matches this wiring.

—ALSO CHECK THE PRECAUTIONS IN THE
“OPERATING TIPS” SECTION—

FRONT PANEL CONTROLS



INPUT CHANNELS

1 PAD Switch

This switch attenuates the signal applied to the corresponding rear-panel HI-Z or LO-Z input by 20 dB prior to the head amplifier and input gain control. The PAD switch effectively increases the range of input signal levels that can be handled by the mixer, preventing overloading of the input circuitry when receiving high-level signals.

2 GAIN Control

This control adjusts the input sensitivity of each input channel between -60 dB (0.775 mV) and -20 dB (77.5 mV) when the PAD switch is OFF (between -40 dB and 0 dB when the PAD switch is ON). Continuously variable gain control allows optimum matching with virtually any microphone or line source.

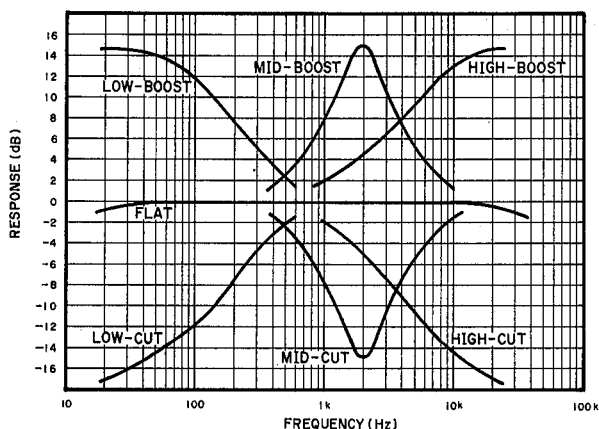
3 CLIP LED indicator

The CLIP indicator LED lights when the post-EQ signal of the corresponding channel's input reaches a level 3 dB below the clipping level of the channel's circuitry. If the CLIP indicator lights more than only briefly on high-level transients it is necessary to decrease the input sensitivity of the channel using the GAIN control and PAD switch or, if this does not provide sufficient attenuation, to reduce the output level of the source connected to that channel's input.

4 3-band Equalizer

These three controls permit individually modifying the response of each channel. The HIGH, MIDDLE and LOW EQ controls function as follows:

CONTROL	MAXIMUM BOOST/CUT	FC	TYPE
HIGH	± 15 dB	8 kHz	Shelving
MIDDLE	± 15 dB	2 kHz	Peaking
LOW	± 15 dB	100 Hz	Shelving



5 AUX 1 Control

The AUX 1 control determines the level of the signal sent from that channel to the AUX 1 mixing buss, where the AUX send signals from all channels are mixed and fed to the AUX SEND 1 fader (8) and the AUX 1 jack (16) on the mixer's rear panel. The AUX 1 controls can be used to determine the amount of signal from the corresponding input channel sent to external effect devices or power amps fed by the AUX SEND 1 jack. In its factory preset configuration, AUX 1 is pre-EQ/pre-fader thus making it ideal for use with stage monitor systems.

* AUX 1 is factory pre-wired for pre-EQ/pre-fader operation, so the AUX 1 signal is not affected by the setting of the channel EQ controls or fader. Internal jumpers allow the AUX 1 control to be rewired for post-EQ/pre-fader or post-EQ/post-fader operation—REFER THIS JOB TO YOUR YAMAHA DEALER OR A QUALIFIED SERVICE CENTER!

6 AUX 2/REV Control

The AUX 2/REV control determines the level of the signal sent from that channel to the AUX 2 mixing buss, which in turn feeds the internal reverb system as well as the rear-panel AUX SEND 2 jacks via the SEND 2 fader. Please note that the SEND 2 fader does not affect the level of the AUX 2 signal sent to the internal reverb system.

* AUX 2 is factory pre-wired for post-EQ/post-fader operation, so the AUX 2 signal is affected by the setting of the channel EQ controls and fader. Internal jumpers allow the AUX 1 control to be rewired for pre-EQ/pre-fader or post-EQ/pre-fader operation—REFER THIS JOB TO YOUR YAMAHA DEALER OR A QUALIFIED SERVICE CENTER!

7 Channel Fader

This is the main level control for each input channel. It determines the level of the signal sent from the corresponding input channel to the master mixing buss and to the mixer's power amplifier via the master fader. The settings of the input channel faders determines the "mix" or balance of sound levels between the instruments or other sources connected to the inputs.

* If a channel is not being used, its fader should be set to the minimum position to prevent unwanted noise from being added to the main program signal.

MASTER CONTROL SECTION

8 SEND 1 & SEND 2 Faders

These adjust the overall output level of the AUX 1 and AUX 2 "mixes" set up using the AUX 1 and AUX 2 controls. SEND 1 sets the overall level of the AUX 1 mix signal appearing at the AUX SEND 1 jack, and SEND 2 sets the overall level of the AUX 2 mix signal appearing at the AUX SEND 2 jacks (there are two AUX SEND 2 jacks). These controls should be used to optimally match the AUX SEND output level of the mixer to the input sensitivity of the external effect, signal processing device or power amplifier used.

9 AUX RTN 1 & AUX RTN 2/REV controls

These controls adjust the level of the signal received at the corresponding rear-panel AUX RTN jacks and mixed into the main program. If no plug is inserted into the AUX RTN 2 jack, the AUX RTN 2 /REV control adjusts the level of the reverb signal from the internal reverb system mixed into the main program. If, however, an external effect device is inserted into the AUX 2 RTN jack, the internal reverb system will be bypassed.

10 Graphic Equalizer & EQ Switch

This 6-band graphic equalizer allows fine response shaping of the main output. It has 6 linear controls with center frequencies of 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz and 8 kHz. Each control permits a maximum boost or cut of 12 dB. When set to the center or "0" position, response in the corresponding band is unaffected. The EQ switch turns the graphic equalizer ON or OFF.

11 MASTER Fader

The MASTER fader is the main "volume control" for the overall program mix, controlling the level of the signal sent to the rear-panel SPEAKER OUT 1 & 2 jacks as well as the front-panel PHONES jack.

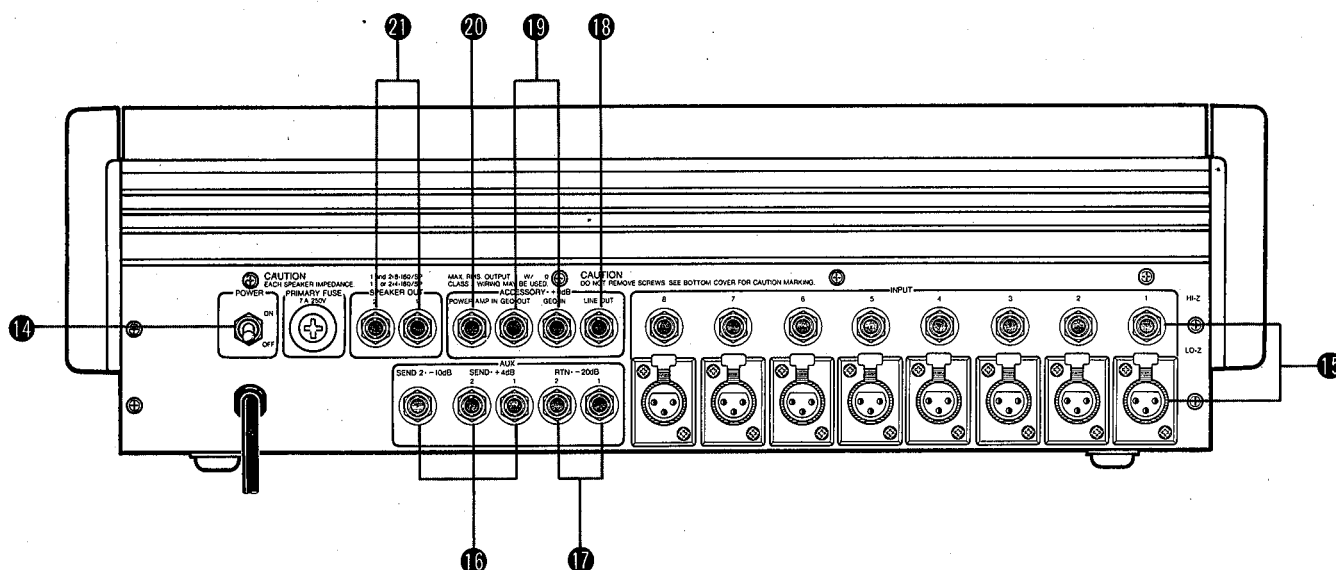
12 VU Meter

Displays the VU level of the signal appearing at the output of the mixer's power amplifier. The meter is a useful aid in setting optimum output level using the MASTER fader.

13 PHONES Jack

The PHONES jack delivers the main program signal to a pair of 8 ohm stereo or mono monitor headphones. The MASTER fader adjusts the headphone monitoring level.

REAR PANEL CONNECTORS AND CONTROLS



14 POWER Switch

Flip up to turn power ON, and down to turn power OFF. The "POWER" lamp to the right of the VU meter will light when the power is ON.

15 HI-Z and LO-Z Input Connectors

Each input channel offers a choice of two input connectors: a balanced LO-Z (low-impedance) XLR-type connector and a balanced HI-Z (high-impedance) tip-ring-sleeve 1/4" phone jack. The LO-Z inputs are primarily intended for use with professional low-impedance microphones or electronic instruments having low-impedance balanced outputs. The HI-Z inputs will accept either balanced or unbalanced signals from high-impedance microphones, musical instruments or other source equipment.

16 AUX SEND 1 & AUX SEND 2 jacks

These jacks deliver the AUX 1 and AUX 2 mixes, respectively, to feed an external effect device or power amplifier. Nominal output level of the main AUX send jacks is +4 dB. A second AUX SEND 2 jack is provided with a nominal output level of -10 dB. Use the -10 dB AUX SEND 2 jack if your external signal processor can not handle the +4 dB level of the main AUX SEND jacks. The signal from AUX SEND 2 is also used for the internal reverb system.

17 AUX RTN 1 & AUX RTN 2 Jacks

The output from the effect units fed by the AUX OUT 1 and AUX OUT 2 jacks can be returned to the main program mix via these jacks. Nominal input level/impedance is -20 dB/10 k-ohms.

18 LINE OUT Jack

The LINE OUT jack delivers the main program signal at line level (+4 dB). The signal is derived prior to the graphic equalizer, and is not affected by the graphic equalizer settings. The LINE OUT jack can

be used to feed an external power amplifier, a tape recorder, or any other device which accepts line-level input.

19 GEQ IN & GEQ OUT Jacks

An external line-level source signal can be fed directly to the input of the graphic equalizer via this jack. Inserting a plug into the EQ IN jack disconnects the internal mixer program signal, so only the external source is fed to the graphic equalizer and power amplifier.

The GEQ OUT jack delivers the main program signal after graphic equalization. In all other respects, it functions in the same way as the LINE OUT jack described above.

20 POWER AMP IN Jack

An external line-level source signal can be fed directly to the input of the mixer's power amplifier via this jack. Inserting a plug into the POWER AMP IN jack disconnects the internal mixer program signal, so only the external source is fed to the power amplifier.

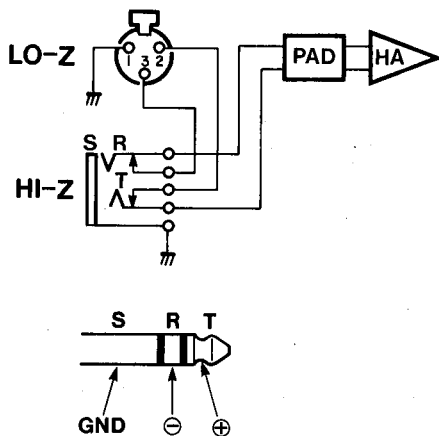
21 SPEAKER OUT 1 and 2 Jacks

These are the main speaker-level outputs from the powered mixer. SPEAKER OUT 1 and SPEAKER OUT 2 are standard mono 1/4" phone plugs wired in parallel. If you connect your speaker system to only one of these jacks then the total load impedance of the speaker system may be no less than 4 ohms. If you plug speakers into both the speaker output jacks the total load impedance of each speaker system must be no less than 8 ohms.

OPERATING TIPS

CONNECTING SOURCES

The fact that the EM-series mixers offer both LO-Z XLR-type and HI-Z phone jack inputs makes it simple to connect virtually any type of source equipment. Professional low-impedance microphones and other equipment almost invariably are fitted with an XLR connector which matches the LO-Z inputs on the mixer. Electronic musical instruments and other equipment with relatively high-impedance outputs usually have a phone-jack output connector that can be directly connected to the HI-Z inputs using a standard phone plug → phone plug cable. For your reference, the LO-Z and HI-Z connectors are wired as follows:



LO-Z Connector	HI-Z Connector
Pin 1 : GROUND	Sleeve : GROUND
Pin 2 : HOT (+)	Tip : HOT (+)
Pin 3 : COLD (-)	Ring : COLD (-)

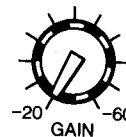
* MAKE SURE THE MIXER'S POWER SWITCH IS OFF WHEN CONNECTING OR DISCONNECTING ANY CABLES.

* ALWAYS TURN THE MIXER'S POWER ON AFTER TURNING ON CONNECTED SOURCES SUCH AS ELECTRONIC INSTRUMENTS, ETC.

MATCHING INPUT LEVELS

Once all your sources are connected and the entire system is turned on, it is important to accurately match the input sensitivity of each input channel with the source signal it is receiving. Do this one channel at a time.

Begin by setting the lowest possible sensitivity for each input: turn the PAD switch ON and set the GAIN control to -20 dB. "Play" the source connected to the first input channel at the loudest level it will be played in actual use—if a microphone, have the vocalist sing his or her loudest note into it. Watch the channel CLIP indicator carefully. If it lights at this point (with the input controls set for minimum sensitivity) then the output level of the source must be reduced. Normally, however, you will have to increase the input sensitivity to achieve optimum matching. Gradually increase the setting of the GAIN control until the CLIP indicator just barely flashes on the loudest peaks. If you turn the GAIN control all the way up and the CLIP LED still doesn't light, then reduce the GAIN control setting to minimum, turn the PAD switch OFF, then gradually increase the GAIN control setting again. This time you should definitely get a CLIP indication somewhere in the GAIN control range. If there is still no indication, check that the source is functioning properly and that it is properly connected to the appropriate input of the mixer. It may also be a good idea to check the cable for faults (try another cable). Remember, the CLIP indicator lights when the channel signal is 3 dB below clipping level, so it is quite OK if it flashes briefly on loud peaks. This, in fact, is about the optimum input sensitivity setting.

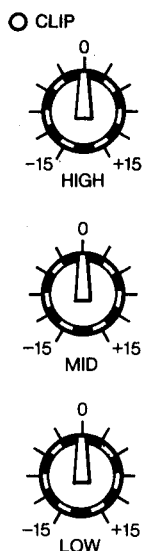


○ CLIP

CHANNEL EQ

The HIGH, MIDDLE and LOW equalization controls on each channel of the mixer make it possible to independently equalize the channel signals to some degree. The basic rule of thumb is that equalization should NOT be used unless it is absolutely necessary. Always put some effort into proper microphone selection, careful microphone placement and/or setting of source instrument controls to achieve the desired sound before resorting to equalization. When you've set everything up as best you can, but still need to modify a sound, then go ahead and equalize. Channel EQ can be most useful in tonally separating one sound from another or from a group.

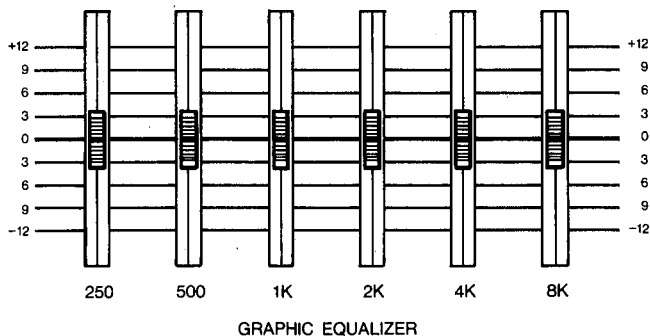
A bit of extra HIGH EQ added to a guitar sound, for example, can give it a bit more "bite" and help it to stand out more clearly from the background. Vocals tend to stand out nicely if given a bit of boost in the MIDDLE range. Speech generally benefits from a reduction in the low frequencies—to prevent that "boomy" sound that occurs when the speaker gets too close to the microphone. Experimentation and experience will tell you how much EQ is right for different types of sound. Also keep in mind the fact that the CLIP LED indicator is post-EQ. This means that excessive equalization can cause the CLIP LED to light indicating that you either need to reduce the input gain control or reduce the amount of equalization being applied.



GRAPHIC EQUALIZATION

Graphic equalization has two main uses in powered mixers like the EM-series: compensation for acoustic deficiencies in the listening area and feedback control. Like the channel equalizers, the graphic equalizer should be left alone unless it is absolutely necessary. The more equalization you use, the more phase deviation you introduce into the program signal, and this can result in an unnatural, distorted sound. There are many instances, however, in which the listening area itself causes response anomalies due to its acoustic characteristics. Large areas of uncovered glass or tiled floors, for example, are extremely effective reflectors of high-frequency sound. Sound produced in environments like this can sound painfully sharp, and some reduction in the high frequency range may be called for. Smaller symmetrical rooms (a square room being the worst case) can actually have resonant frequencies within the audible low-frequency range. A bit of reduction in the low frequencies can help to make the sound more intelligible. Note that in almost all cases good equalization practice demands a cut in the offending frequency range rather than a boost in ranges where response is lacking.

The graphic equalizer can also be used—although to a limited degree—for feedback control. Proper microphone placement is the primary tool for prevention of feedback, but this can be extremely difficult if you're working in a tight stage area. Simply cut response in the frequency range where the feedback is occurring (this will have to be found by experimentation). This will compromise the overall frequency response of the program, but it's better than facing the possibility of squealing feedback in the middle of an important performance.



EQ

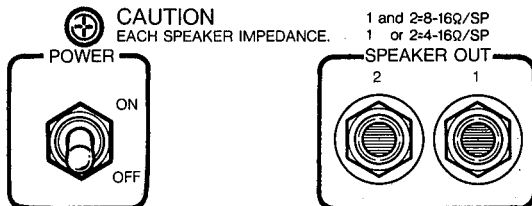
CONNECTING SPEAKERS

The EM-series powered mixers have two 1/4" phone-jack speaker outputs which are internally connected in parallel. This places some restrictions on their use.

- * IF YOU CONNECT SPEAKERS TO ONLY ONE OF THE AVAILABLE SPEAKER OUTPUTS, THE TOTAL IMPEDANCE OF THE CONNECTED SPEAKER SYSTEM MAY BE NO LESS THAN 4 OHMS.
- * IF YOU CONNECT SPEAKERS TO BOTH OF THE AVAILABLE SPEAKER OUTPUTS, THE TOTAL IMPEDANCE OF THE SPEAKER SYSTEM CONNECTED TO EACH OUTPUT MAY BE NO LESS THAN 8 OHMS (equalling a total of 4 ohms).
- * THE MAXIMUM TOTAL IMPEDANCE OF SPEAKERS CONNECTED TO THE SPEAKER OUTPUT (S) SHOULD BE 16 OHMS.
- * MAXIMUM SPEAKERS ALLOWABLE:
ONE 4-OHM SPEAKER
TWO 8-OHM SPEAKERS
FOUR 16-OHM SPEAKERS

While a higher total load impedance than the recommended 16 ohms will only result in a loss of power output, a total load impedance that is too low can actually damage the powered mixer. With a total load impedance of 8 ohms (one 8-ohm speaker or two 16-ohm speakers) the maximum output power of EM-series mixers is 100 watts. With a total load impedance of 4 ohms (one 4-ohm speaker or two 8-ohm speakers) maximum output power is 150 watts.

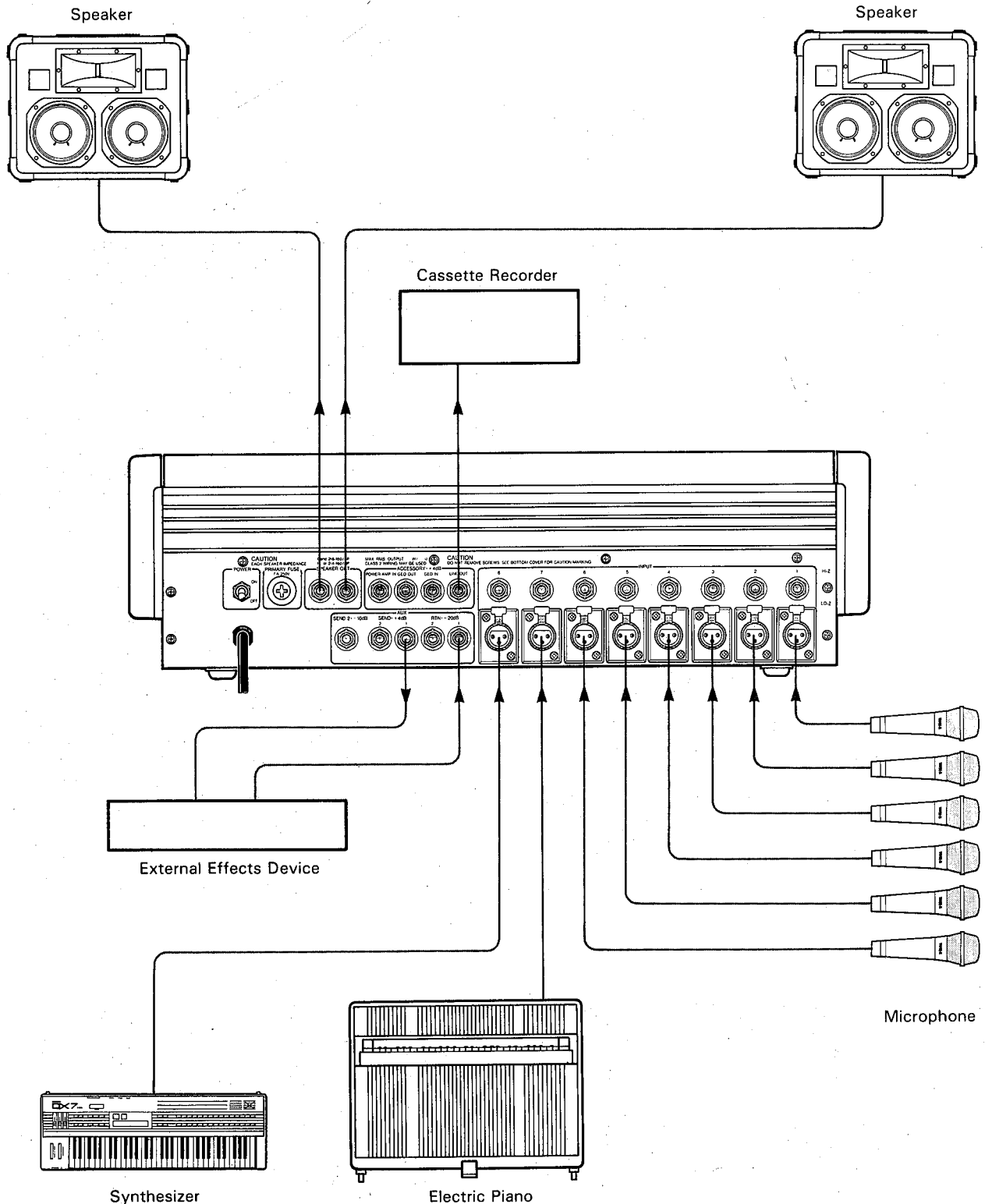
- * NEVER CONNECT OR DISCONNECT SPEAKERS WHILE THE MIXER'S POWER IS TURNED ON!!



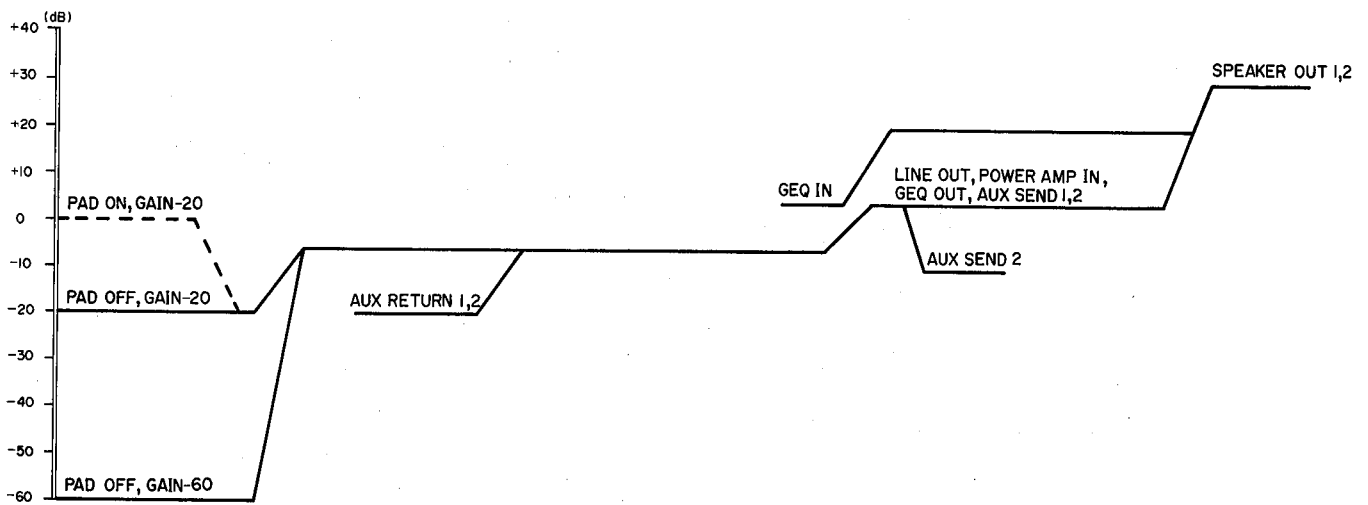
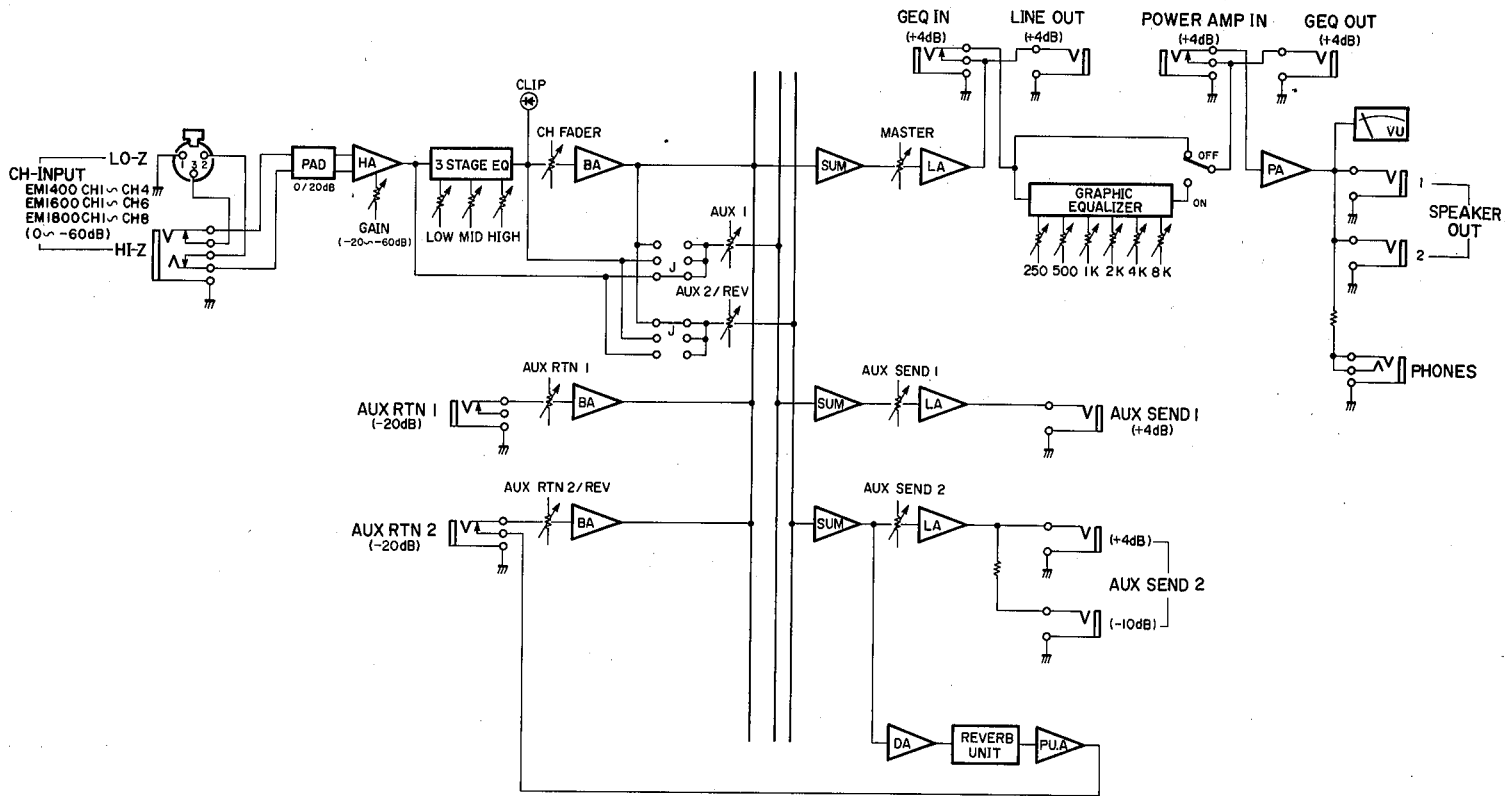
A BASIC SYSTEM

The accompanying illustration shows a simple sound reinforcement system set up using the EM-1800 (8-channel) Powered Mixer. In the example, microphones are connected to inputs 1 through 6—some for vocal use and some for pickup of acoustic instruments. The remaining 2 channels directly accept the output from an electric piano (CP60M) and a synthesizer (DX7II). An external effects device is

connected into the AUX 1 send/return loop, complementing the mixer's internal AUX 2 reverb system. The LINE OUT jack is connected to a cassette recorder so that the performance can be recorded directly via the mixer. Two PA-type speakers (each with an impedance of 8 ohms or greater) are connected to the SPEAKER OUT 1 and SPEAKER OUT 2 jacks.



BLOCK & LEVEL DIAGRAM



SPECIFICATIONS

GENERAL SPECIFICATIONS

Maximum Output Power	150W @ 4ohms 0.5% (THD) @ 1 kHz 100W @ 8ohms 0.3% (THD) @ 1 kHz
Maximum Output Level (LINE OUT)	+20dB @ 10kohms 0.5% 20Hz~20kHz
Total Harmonic Distortion (Power Amp. Section) (Mixer Section)	Less than 0.2% 20Hz~20kHz @ 75W/4ohms (POWER AMP IN to SPEAKER OUT) Less than 0.2% 20Hz~20kHz @ +4dB/10kohms (CH IN to LINE OUT)
Frequency Response (SPEAKER OUT) (LINE OUT)	+1, -3dB 20Hz~20kHz @ 1W/8ohms +1, -3dB 20Hz~20kHz @ +4dB/10kohms
Hum & Noise (20Hz~20kHz) Rs = 150ohms Input Gain = Max. Input Pad = 0dB Input sensitivity = -60dB	-126dB Equivalent Input Noise -64dB residual output noise (SPEAKER OUT) -88dB residual output noise (LINE OUT) -73dB (77dB S/N) LINE OUT Master fader at maximum level and all CH fader at minimum level. -62dB (66dB S/N) LINE OUT Master fader and one CH fader at maximum level. -73dB (77dB S/N) AUX OUT Master fader at maximum and all CH mix level control at minimum level. -62dB (66dB S/N) AUX OUT Master fader and one CH mix level control at maximum level.
Maximum Voltage Gain	90dB CH IN to SPEAKER OUT 64dB CH IN to LINE OUT 64dB CH IN to AUX SEND 1, 2 (+4dB) 50dB CH IN to AUX SEND 2 (-10dB) 24dB AUX RETURN to LINE OUT 26dB POWER AMP IN to SPEAKER OUT
Crosstalk (@ 1 kHz)	60dB adjacent input channels 60dB input to output
Input channel gain control	40dB (-60dB ~ -20dB) variation in gain stop to stop
Input channel pad switch	0/20dB of attenuation
Input channel equalization	±15dB maximum boost or cut in each of three bands. HIGH : 8kHz shelving MIDDLE : 2kHz peaking LOW : 100Hz shelving
Master equalization (GEO)	250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz ±12dB
Level Meter	Illuminated meter (+5VU = 150W/4ohms)
Clip indicators	RED LED built into each input channel. In turns on when post-EQ signal is 3dB below clipping.
Power Requirements U.S. & Canadian models West Germany model	120V AC, 60Hz 220V AC, 50Hz
Power Consumption U.S. & Canadian models West Germany model	EM1400 330W EM1600 330W EM1800 330W EM1400 330W EM1600 330W EM1800 330W
Dimensions	Height 6-1/8" (155 mm) Depth 20-5/8" (525 mm) Width EM1400 14-1/8" (360 mm) EM1600 16-7/8" (430 mm) EM1800 19-5/8" (500 mm)
Weight	EM1400 28 lbs. 11 ozs. (13 kg) EM1600 33 lbs. 1 ozs. (15 kg) EM1800 35 lbs. 4 ozs. (16 kg)

* 0dB = 0.775 Vr.m.s.

* Specifications and appearance subject to change without notice.

INPUT CHARACTERISTICS

Input Terminals	PAD	Gain Trim	Actual Load Impedance	For Use With Nominal	Input Level			Connector In Mixer	
					Sensitivity	Nominal	Max. before clip		
CH Input *	0	-60	4k ohms	50~600 ohm Mics	-60dB (0.8mV)	-60dB (0.8mV)	-34dB (15.5mV)	XLR-3-31 type & Phone Jack (TRS)	
		-20		600 ohm Lines		-20dB (77.5mV)	-20dB (77.5mV)		+6dB (1.55V)
		20				0dB (775mV)	0dB (775mV)		+26dB (15.5V)
AUX RETURN (1, 2)			10k ohms	600 ohm Lines	-20dB (77.5mV)	-20dB (77.5mV)	—	Phone Jack	
GEQ IN			10k ohms	600 ohm Lines	+4dB (1.23V)	+4dB (1.23V)	+20dB (7.75V)	Phone Jack	
POWER AMP IN			10k ohms	600 ohm Lines	+4dB (1.23V)	+4dB (1.23V)	+4dB (1.23V)	Phone Jack	

- (1) Sensitivity is the lowest level that will produce an output of full power or the nominal output level when the unit is set to maximum gain.
- (2) XLR type connectors are balanced, CH Phone Jacks are balanced (T = +, R = -, S = GND) and another Phone Jacks are unbalanced.
- (3) In these specifications, when dB represents a specific voltage, 0dB is referenced to 0.775V RMS.
- (4) * CH No EM1400=4CH EM1600=6 CH EM1800=8CH

OUTPUT CHARACTERISTICS

Output Terminals	Actual Source Impedance	For Use With Nominal	Output Level		Connector In Mixer	
			Nominal	Max. before clip		
SPEAKER OUT	0.08 ohms	8 ohm speakers	100 W	100 W	Phone Jack	
		4 ohm speakers	150 W	150 W		
LINE OUT	600 ohms	10k ohm lines	+4dB (1.23V)	+20dB (7.75V)	Phone Jack	
GEQ OUT	600 ohms	10k ohm lines	+4dB (1.23V)	+20dB (7.75V)	Phone Jack	
AUX SEND 1	150 ohms	600 ohm lines	+4dB (1.23V)	+20dB (7.75V)	Phone Jack	
AUX SEND 2	+4dB	150 ohms	600 ohm lines	+4dB (1.23V)	+20dB (7.75V)	Phone Jack
	-10dB	600 ohms	10k ohm lines	-10dB (245mV)	+6dB (1.55V)	
PHONES	150 ohms	8 ohm phones	75mW	75mW	Stereo Phone Jack	

- (1) All Phone Jacks are unbalanced.
- (2) In these specifications, when dB represents a specific voltage, 0dB is referenced to 0.775V RMS.

SERVICE

This product is supported by Yamaha's worldwide network of factory trained and qualified dealer service personnel. In the event of a problem, contact your nearest Yamaha dealer.

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