CRM-100 CUSTOM MONITOR SYSTEM FOR MASTERMIX

E.M.LONG ASSOCIATES
4107 OAKMORE ROAD
OAKLAND, CA 94602
(510)-531-8725

INTRODUCTION

A monitor must be capable of reproducing everything in the sound, good and bad, without masking any of it. Excellent program material should sound excellent and bad program material should sound bad. This is because a monitor is a tool used by a professional recording engineer which should allow him to hear defects in the program material such as noise, poor edits, bad notes, reverberation and processing defects, etc. The word monitor comes from the Latin word "monare" which means "to warn." A true monitor system should not be designed to be pleasant or impressive; it should be designed "to warn" the professional recording engineer so that he can take corrective action.

You have made a wise decision in buying a CRM system as your monitor. It was designed specifically for monitoring applications and nothing else. There are loudspeakers which are sometimes found being used as "monitors" which are actually more suitable for use in either sound re-enforcement or for home entertainment applications. Systems designed for those applications have entirely different criteria.

The two main criteria for loudspeaker systems designed for sound re-enforcement applications are to provide high sound pressure levels (SPL) and to be capable of operation at these high levels over long periods. The ability of this type of loudspeaker to reproduce the subtle nuances and details of the program material is often sacrificed to meet the first two criteria. The decision to use a large group of drivers indicates that the designer is trying to achieve high SPL and is willing to sacrifice some clarity and coherence as well as smooth off-axis response. This can affect the way a stereo sound field is reproduced and can lead to erroneous image placement during the mixing session. It also narrows the "sweet spot" at the mixing console which makes it difficult to have more than one person in the right position to make decisions about the mix.

The main criterion for a successful home entertainment loudspeaker system is directly opposed to the main criteria for a monitor; it must make excellent program material sound good and bad program material sound acceptable. A clever designer can manipulate the parameters to produce such a loudspeaker system. This is perfectly acceptable and even desirable because the end user, for whom such a system is designed, has little or no control over the quality of the program material to which he is listening; Such a loudspeaker system is unacceptable as a monitor because it masks problems in the sound which a professional recording engineering must be able to hear if he is to take corrective action to eliminate it. The other problem with loudspeaker systems designed for use in home entertainment applications is their lack of sensitivity or efficiency and their inability to produce high SPL for long periods. This is because these criteria are not usually an important consideration in the design of home entertainment type loudspeaker systems.

The CRM CUSTOM MONITORS are designed specifically to be monitors in the best sense of the word. If the source material is excellent, it will be heard as being excellent; if it is bad, it will sound bad. But then, you can do something about it to make it sound better and isn't that what monitors are for?

CRM CUSTOM MONITOR SYSTEMS DESCRIPTION

The CRM CUSTOM MONITOR SYSTEMS are the result of years of research into loudspeaker driver and system design. They are designed to let you to hear every detail of the program material so that you can make it as good as possible. The system consists of a pair of CRM-1TA mid/high range modules, pairs of bass modules, and an HLE2 ELF™ electronic crossover. The system is calibrated to produce an acoustical output in a free field from 30 Hz to 20 kHz, which, when it is installed in your monitoring environment, will produce a flat response. If necessary, the balance between the bass and the mid/high range can be adjusted by a single control inside the processor.

The TD3/5 high frequency driver of the CRM-1TA is capable of very high SPL and is at the same time very efficient. The off-axis response is excellent because although the voice coil and diaphragm are 1.75 inches in diameter, the actual radiating diameter is only 1.0" inch. No matter where you sit in front of a pair of CRM CUSTOM MONITOR SYSTEMS you will hear the high frequencies.

The MD20/182 midrange drivers of the CRM-1TA are the result of 29 design iterations carried out over a two year period. The criteria for the design were: clarity and articulation in the important voice range, response on and off-axis to at least 4 kHz, and high efficiency. The design parameters of the MD20/182 were finalized only after the most careful and extended listening. Two MD/182 drivers are used in each CRM-1TA module arranged in a vertical array to match the excellent off-axis response of the TD3/5 high frequency driver.

The internal passive crossover of the CRM-1TA is designed to match the physical arrangement of the TD3/5 high frequency and the two MD20/182 midrange drivers to produce a **TIME ALIGN**™ system. The crossover is at 3200 Hz which places it above the critical voice range. The fundamental of most musical instruments are also below this frequency. Most of the important information is reproduced by the MD20/182 drivers, while the higher frequency overtones are reproduced by the TD3/5 which is in **TIME ALIGNMENT**™ with them.

The CRM-B18 bass system is designed to work with the HLE2 **ELF**™ Electronics which incorporates the patented **Extended Low Frequency** system. Ordinarily, an 18" diameter bass driver would have to be mounted in a large cabinet with an internal volume of at least 12 to 16 cubic feet. In the case of the CRM-B18 however, the enclosure volume is only 2 cubic feet. The resonance of the 18" driver in the CRM-B18 enclosure is about 75 Hz which is the desired upper frequency point of the CRM-B18 system. The **ELF**™ electronic circuitry causes the CRM-B18 to be driven with a signal which is exactly complimentary to its response above and below resonance; it produces a rolled-off response above resonance and a response which is flat to 32 Hz below resonance. Because of its small size and relatively light weight, it can be placed easily where other bass systems can not. It can fit conveniently into soffits, to the top, bottom, or side of the CRM-1TA mid/high range system. It can be used in a free standing mode, away from walls and ceilings or close to them. One design goal of the CRM-B18 bass system was to allow it to be placed in such a way as to help break up standing waves in the room. This is possible because the CRM-B18 bass systems are modules separate from the CRM-1TA mid/high range modules.

The CRM CUSTOM MONITOR SYSTEMS can be ordered with or without power amplifiers. The amplifiers should be among those auditioned and qualified to assure that the system will perform as intended. If you wish to purchase the amplifiers yourself you can ship them to our laboratory to be calibrated with the CRM CUSTOM MONITOR SYSTEM. The recommended mid/high frequency amplifiers are selected for their transparent, "audiophile", sound qualities and their high power output and ruggedness. The recommended bass amplifiers are selected for their superb low frequency sound and good damping. They provide an excellent match for the 18" driver used in the CRM-B18 bass systems.

The HLE2 **ELF™** Electronics, which has two separate channels, provides the high and low pass output signals to drive the mid/high and bass amplifiers. The high pass filter cut-off point is set by internal dip switches to provide an exact acoustical crossover for the CRM-1TA mid/high systems. The low pass output is provided by the patented **ELF™** circuitry. The function of the HLE2 might be compared to a conventional crossover, however, with respect to the low pass section it is very different. The signal is shaped to be a perfect reciprocal of what the CRM-B18 bass system requires to be flat to 32 Hz and to blend perfectly with the CRM-1TA mid/high system at 100 Hz. An advantage of the **ELF™** is that it does not exhibit the long time delay associated with a conventional low pass filter. A conventional low pass filter, designed for the 100 Hz crossover frequency, would exhibit a time delay of 10 milliseconds or more. This means that the bass fundamentals would be delayed by as much as 10 feet from the sound of the CRM-1TA mid/high sounds. While the wavelengths at frequencies below 100 Hz are quite long and the ability to perceive time off-sets is reduced in this range, at least it is good to realize that the **ELF™** does not aggravate the problem as conventional low pass filters do. Another advantage of the **ELF™** system is that, since the CRM-B18 bass system is operated completely below resonance, the quality of its bass output is affected very little by the damping of the amplifier or the resistance of the connecting cables, and if at all, at the upper frequency cut-off, not down lower at the bass fundamentals.

Each CRM CUSTOM MONITOR SYSTEM is completely assembled, tested, calibrated and auditioned. It is subjected to the most severe conditions and program material.

If, after installing a CRM CUSTOM MONITOR SYSTEM, you decide that you need more bass output level, you can easily upgrade by adding CRM-B18 systems and amplifiers. Please contact us for details. If you have any questions about the CRM CUSTOM MONITOR SYSTEMS, please call (415)-531-8725.

"It is my hope that the CRM CUSTOM MONITOR SYSTEMS will help you to produce recordings of high technical quality. If they do I will be pleased." (Ed Long)

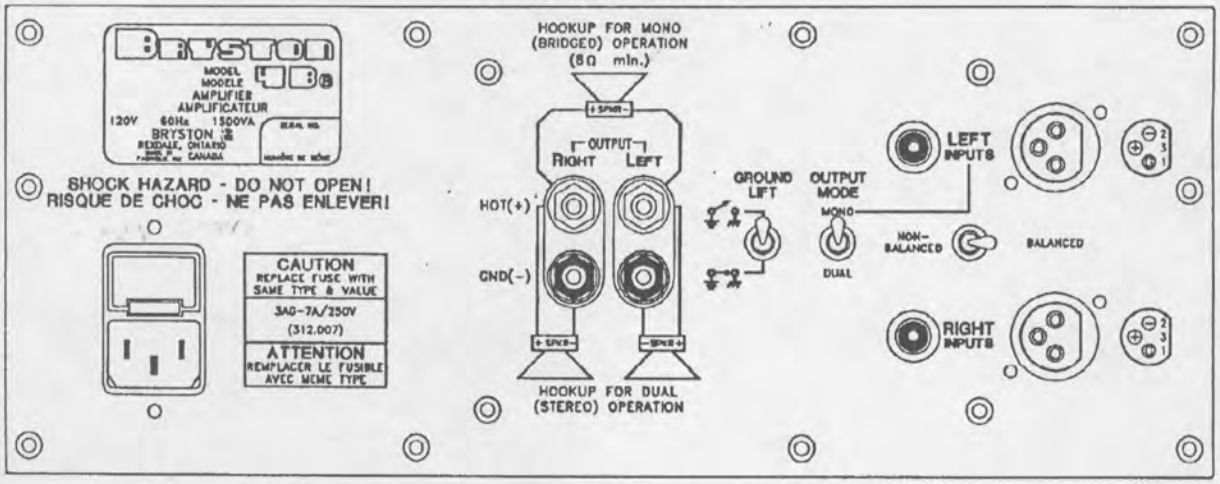
CRM-100 CUSTOM MONITOR SYSTEM

HOOK-UP DIAGRAM

CRM-100 CUSTOM MONITOR SYSTEM HOOKUP

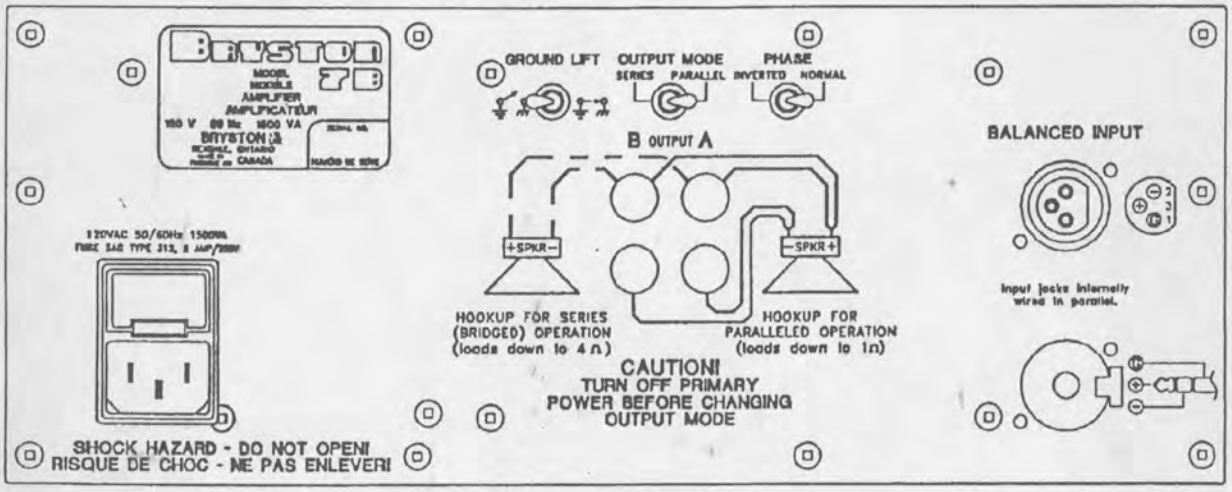
The diagram below should be used as a guide to connect the components of the CRM CUSTOM MONITOR SYSTEM. The interconnect cables to be connected between the output jacks on the HLE2 Electronics and the inputs of the power amplifiers should be three wire shielded cable with XLR plugs at each end. The plugs should be wired with pin 1 common, pin 2 minus and pin 3 plus. The loudspeaker cables should be of sufficient gauge to allow for their length (the resistance of the cables is directly proportional to their length.) The minimum impedance of the CRM-1TA system is about 4.2 Ohms; the minimum impedance of the CRM-B18 system is 7.1 Ohms. The input to the HLE2 Electronics can be either balanced or unbalanced.

4B REAR PANEL



The Bryston 4B amplifier is used in "stereo" mode. Connect HLE2 left and right high pass outputs to the Bryston 4B left and right inputs. The "+" or "hot" is pin 3 of the XLR and the tip of the TRS jacks. The output binding posts of the 4B left and right channels are connected to the left and right binding posts of the CRM-1TA systems with red to red and black to black.

REAR PANEL OF 7B "PRO"



Each Bryston 7B amplifier is used in the "bridged" mode. Connect HLE2 left and right low pass outputs to the inputs of each Bryston 7B. The input of one Bryston 7B should be connected to the HLE2 left low pass output and the other 7B to the HLE2 right low pass output. The "+" or "hot" is pin 3 of the XLR and the tip of the TRS jacks. Connect the two red binding posts of the left channel 7B amplifier to the binding posts of the left CRM-B18 system with the (+) red post to the red post of the CRM-B18 and the (-) red post to the black post of the CRM-B18. Do the same for the right channel 7B amplifier, which should be connected to the right channel CRM-B18.

SPECIFICATIONS AND GRAPHICS

CRM-100 CUSTOM MONITOR SYSTEM

The CRM-100 is a complete 2 channel system for high level monitoring. It includes 2 CRM-1TA top systems which reproduce the range from 100 Hz to 20 kHz, 2 CRM-B18 bottom systems for the range from 32 Hz to 100 Hz, 1 HLE-1 ELF™ Electronics which provides for signal processing, control and routing, 1 custom 300 watt/channel top amplifier to drive the 2 CRM-1TA systems, 2 6260 600 watt bottom amplifiers to drive the 2 CRM B18 bottom systems, and the interconnect cable.

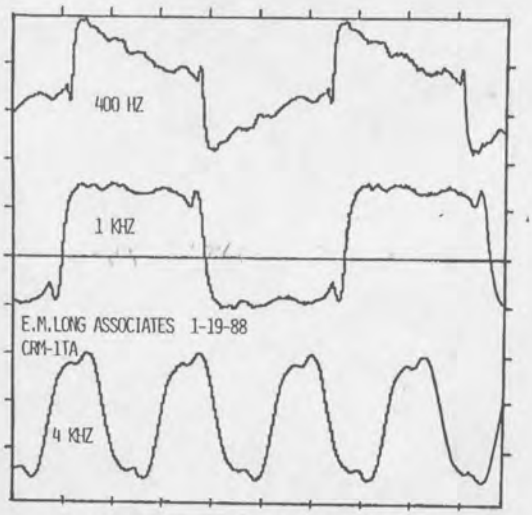
CRM-100 SYSTEM SPECIFICATIONS

FREQUENCY RESPONSE:	+/- 3 dB 32 to 20 kHz
MATCHED PAIR RESPONSE:	+/- 0.5 dB
TIME DELAY:	Less than +/- 200 µseconds 32 to 100 Hz Less than +/- 25 µseconds 100 Hz to 20kHz
INPUT SENSITIVITY:	0.8 Volts for full power (Adjustable).
ACOUSTIC SENSITIVITY:	98 dB SPL/Watt/Meter from power amplifier 111 dB SPL for 0.8 volts at HLE2 input
MAXIMUM OUTPUT:	121 dB SPL
POWER RECOMMENDED:	1800 Watts Total 300 Watts for each CRM-1TA Top System 600 Watts for each CRM-B18 Bottom Systems
DISTORTION:	< 5% THD or IM, 32 to 100 Hz, 104 dB SPL < 3% THD or IM, 100 Hz to 5 kHz, 108 dB SPL < 3% THD or IM, 5 kHz to 20 kHz, 104 dB SPL
IMPEDANCE:	20 kOhms balanced, 10 kOhms unbalanced
CROSSOVERS:	100 Hz 12 dB/Oct roll-off with HLE2 3.2 kHz CRM-1TA passive 24 dB/octave
SYSTEM COMPONENTS:	2 CRM-1TA Top Systems 2 CRM-B18 Bottom Systems 1 HLE-1 ELF™ Electronics
ENCLOSURE VOLUMES:	CRM-1TA 43.9 liters (1.55 Cubic Feet) CRM-B18 57.6 liters (2.0 Cubic Feet)
ENCLOSURE DIMENSIONS:	CRM-1TA 20"H x 19"W x 9.75"D CRM-B18 20"H x 20"W x 11.75"D
MATERIAL AND FINISH:	3/4" MDF with black finish
SYSTEM SHIPPING WEIGHT:	393 POUNDS (178 KILOGRAMS)

CRM-100 AND CRM-200 GRAPHICS

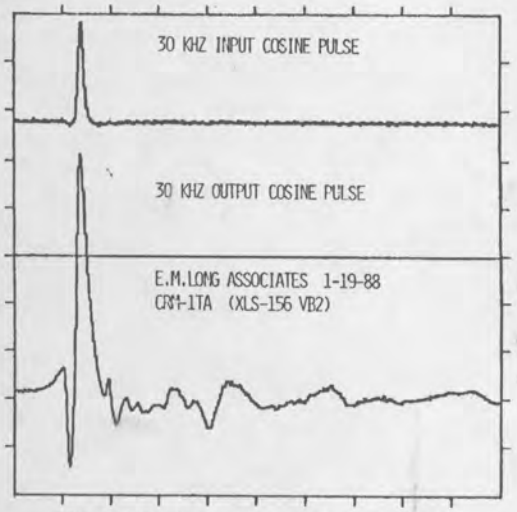
ALL DATA APPLIES TO THE CRM-100 AND CRM-200 SYSTEM EXCEPT WHERE NOTED

To reproduce square waves accurately, a loudspeaker must retain the exact time relationships of all the harmonic components. The square waves shown below indicate that the CRM-1TA has excellent time vs. frequency response. Other monitors usually have so much time offset that their square wave output is terrible. When a monitor reproduces complex sounds, such as music and speech, the time relationship of harmonics is essential to accuracy.

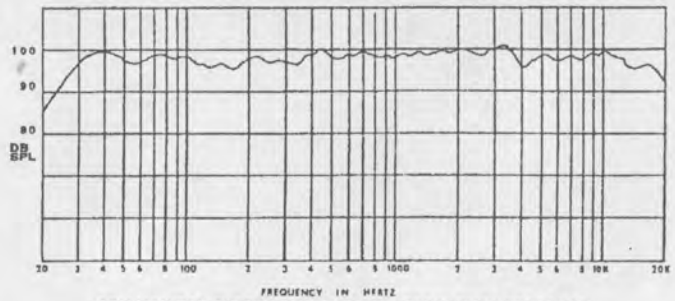


CRM-1TA MID/HIGH SYSTEM SQUARE WAVE RESPONSE

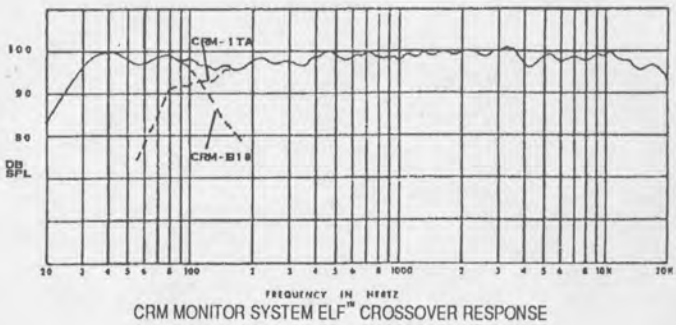
The response of the CRM-1TA to a 30 kHz cosine input is shown below. This test signal also indicates the excellent time vs. frequency response. The tight package of energy covers the complete spectrum. This is shown in the phase and magnitude vs. frequency transfer function graph.



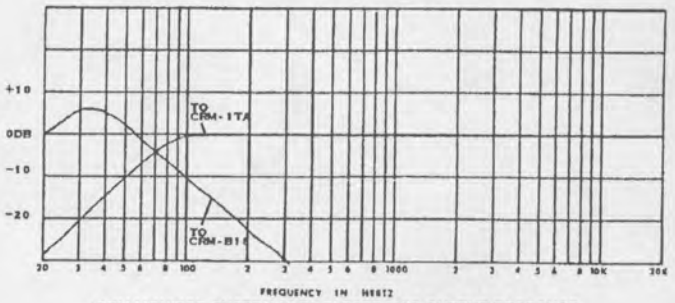
CRM-1TA MID/HIGH SYSTEM 30 kHz PULSE RESPONSE



CRM MONITOR SYSTEM AMPLITUDE VS. FREQUENCY RESPONSE

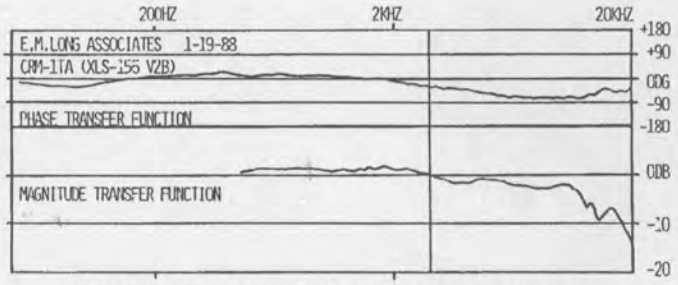


CRM MONITOR SYSTEM ELF™ CROSSOVER RESPONSE



CRM MONITOR SYSTEM HLE2 ELECTRONIC OUTPUT RESPONSE

The three graphs above show the amplitude vs. frequency response for the complete CRM-200 system, the blend between the CRM-1TA top system and the CRM-B18 bottom systems, and the electronic drive to the CRM-1TA and CRM-B18.



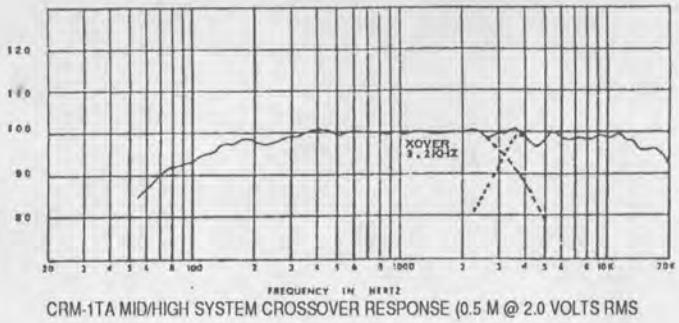
CRM-1TA PHASE AND MAGNITUDE TRANSFER FUNCTION RESPONSE

CRM-1TA MID/HIGH SYSTEM

CRM-1TA DATA APPLIES TO THE CRM-100 AND CRM-200 SYSTEMS

CROSSOVER PERFORMANCE

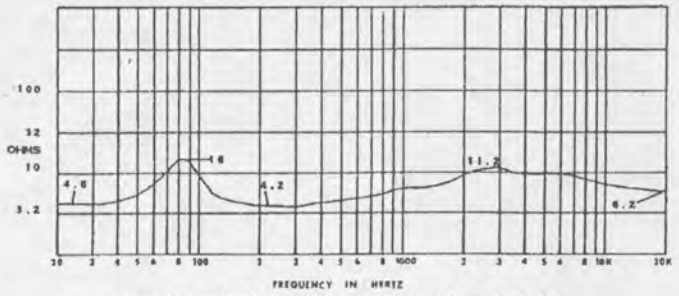
A coherent acoustical output from different drivers in a multi-way system if the sound arrives at the same time at the measuring or listening position. The acoustical outputs from different drivers will add to give exactly double the sound pressure or 6 dB. For the CRM-1TA Mid/High System, the smooth crossover at 3.2 kHz shows the excellent coherence between the midrange and high frequency outputs. This is true because at the -6 dB point (94 dB SPL), they add exactly to produce a 0 dB output (100 dB SPL) or 6dB more than either produces by themselves.



CRM-1TA MID/HIGH SYSTEM CROSSOVER RESPONSE (0.5 M @ 2.0 VOLTS RMS

IMPEDANCE VS. FREQUENCY

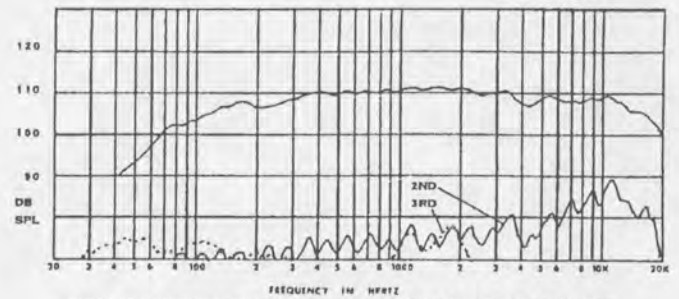
The impedance vs. frequency curve indicates that the CRM-1TA top system presents a very easy load for the upper range power amplifier. The maximum is 16 ohms and the minimum is 4.2 ohms. The wire used to connect the CRM-1TA to the output of the power amplifier is not critical from this standpoint as long as it is low resistance. The CRM-1TA will allow you to hear the qualities of better quality cables because of its clarity and coherence.



CRM-1TA MID/HIGH SYSTEM IMPEDANCE VS. FREQUENCY

HARMONIC DISTORTION CURVES

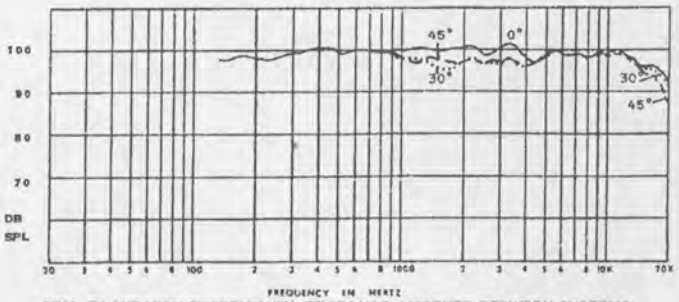
The 2nd and 3rd harmonic distortion vs. frequency, for the CRM-1TA is shown at an essentially steady state sound pressure level (SPL) of 110 dB SPL. The distortion is relatively low considering that this is a very high SPL. Distortion curves are rarely shown for any loudspeakers at this high SPL. At 100 dB SPL the distortion drops dramatically.



CRM-1TA MID/HIGH SYSTEM HARMONIC DISTORTION (@ 6.3 VOLTS RMS)

CRM-1TA AXIAL RESPONSE FOR RECOMMENDED ORIENTATION WITH LISTENER IN BETWEEN SYSTEMS

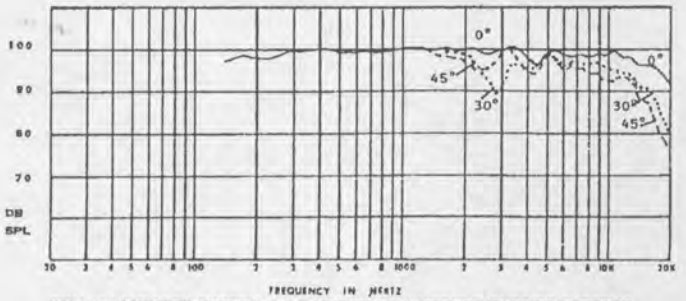
The triangular driver configuration of the CRM-1TA Mid/High System is designed to produce the most uniform off-axis response when the midrange drivers are in a vertical array and the high frequency driver is to the inside, toward the listening position. This produces the optimum results as shown. The 30 and 45 degree curves are almost identical for this arrangement.



CRM-1TA MID/HIGH SYSTEM AXIAL RESPONSE (LISTENER BETWEEN SYSTEMS)

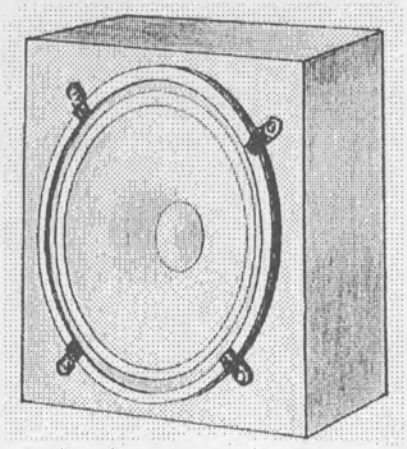
CRM-1TA AXIAL RESPONSE WITH LISTENER POSITIONED OUTSIDE OF SYSTEMS

The off-axis response is not as smooth when the listener is to the outside of a stereo pair of CRM-1TA Mid/High Systems set up as described above, with the high frequency driver to the inside of the triangular array.



CRM-1TA MID/HIGH SYSTEM AXIAL RESPONSE (LISTENER OUTSIDE SYSTEMS)

CRM-B18 BASS SYSTEM

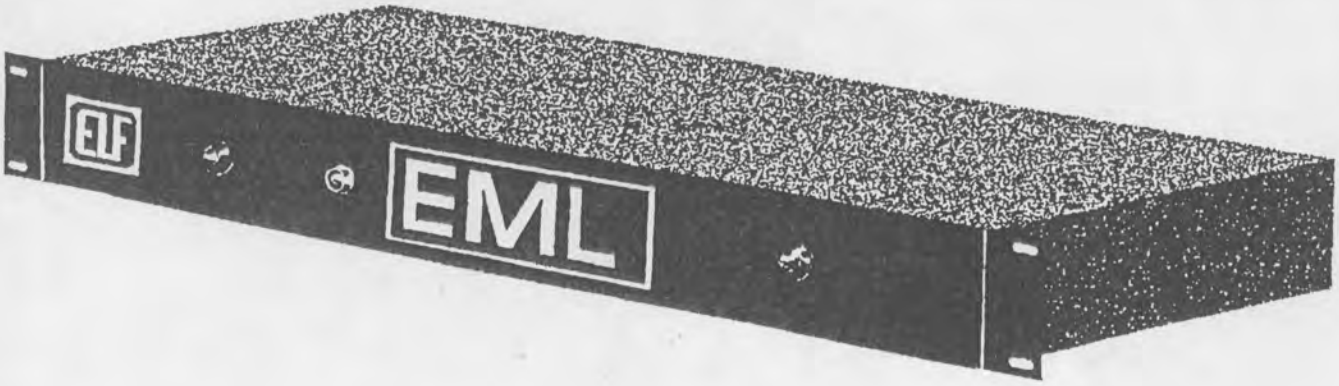


The CRM-B18 Bass System is designed to work with the E.M.LONG HLE2 ELF™ Electronics to produce a seamless acoustical output with the CRM-1TA TIME ALIGN® Mid/High System to add realistic bass power from 32 to 100 Hz at high acoustic output. The dimensions of the CRM-B18 acoustical enclosures were chosen to provide both, the correct volume necessary for proper acoustical operation with the HLE2 ELF™ Electronics, and to allow ease of placement in even small control rooms. The B-18 enclosures can be placed to minimize problems due to room modes at low frequencies without drastically affecting the time offset. This is because time off-set between the CRM-B18 and the CRM-1TA is very small and because time off-sets caused by placing the CRM-B18 at a moderate distance from the CRM-1TA will cause only a slight time offset at low frequencies because the wavelengths are very long. For example one wavelength at 100 Hz is about 11.3 feet and as much as 35.3 feet at 32 Hz.

CRM-B18 SPECIFICATIONS

FREQUENCY RESPONSE:	+/- 1 dB 32 to 90 Hz
MATCHED PAIR RESPONSE:	+/- 0.5 dB
TIME DELAY:	Less than +/- 200 microseconds 32 to 90 Hz
SENSITIVITY:	Variable to match various monitors (with HLE2)
POWER REQUIRED:	150 Watts minimum per enclosure (110 dB SPL)
POWER HANDLING:	600 Watts maximum per enclosure (116 dB SPL)
DISTORTION:	> 5% THD or IM, 32 to 100 Hz, 106 dB SPL (each enclosure) 112 dB SPL (2 enclosures) 118 dB SPL (4 enclosures) (2 PI FREE FIELD)
IMPEDANCE:	8 Ohms for each enclosure
CROSSOVER:	12 dB/Oct roll-off above 100 Hz with HLE2
DRIVERS:	One specially selected 18" driver per enclosure
ENCLOSURE VOLUME:	57 liters (2.0 Cubic Feet)
DIMENSIONS:	20" High x 20"Wide x 11.75" Deep
FINISH:	Black
SYSTEM WEIGHT:	30 kgm Net 31 kgm Shipping 65 lbs Net 68 lbs Shipping

HLE2 ELF™ ELECTRONICS



The E.M.LONG ELF™ Electronics utilizes the patented ELF(TM) technology. ELF™, which stands for Extended Low Frequency, is a very direct way of achieving superb low frequency response while eliminating the need for a separate low frequency crossover with its attendant time delay. Because of the small amount of time delay in the E.M. LONG ELF™ system, the result is a seamless transition which is truly remarkable. The spatial offset caused by the time delay between the E.M.LONG ELF™ system and any upper range systems, is much less than that of any conventional sub woofer systems.

The HLE2 Stereo ELF™ Electronics is a single height rack mount unit with 3 pin XLR and 2 circuit phone jacks for the inputs and the high and low pass outputs. It is designed to operate at line level and be inserted between the monitor output bus of a console and the power amplifiers which drive the monitors and the amplifiers which drive the ELF™ Bass Enclosures. The HLE2 features balanced and unbalanced inputs and outputs, separate Dynamic Frequency Control modules for each channel, and provision for switching the absolute polarity of the acoustical output of the complete system.

HLE-2 ELF™ ELECTRONICS SPECIFICATIONS

INPUT:	IMPEDANCE: > 20 kOhms balanced > 10 kOhms unbalanced TRS PHONE JACK: (Tip, ring, sleeve) XLR3: (pin 1 common, pin 2 minus, pin 3 plus)
OUTPUT:	IMPEDANCE: < 600 Ohms balanced < 2000 Ohms unbalanced 5.0 volts maximum TRS PHONE JACK: (Tip, ring, sleeve) XLR3: (pin 1 common, pin 2 minus, pin 3 plus)
SENSITIVITY:	Variable from 200 mv to 8 volts RMS to provide output to feed power amplifiers with voltage gains from 24 to 36 dBV.
CONTROLS:	All controls are internal: input level, high pass output level, low pass output level, high pass filter frequencies, BEM level, DCM level, Low Frequency "Q".
HIGH PASS FILTER:	70 to 200 Hz set by internal dip switches.
LOW PASS FILTER:	30 Hz at -1 dB with adjustable "Q". Upper roll-off determined by combined Enclosure/Driver system resonance.
POWER REQUIRED:	90 to 130 Volts AC. 50/60 Hz 50 Watts.
SYSTEM WEIGHT:	2.7 kgm Net 3.6 kgm Shipping 6 lbs Net 8 lbs Shipping

DIP SWITCHES 2, 3, 6, 7 ON 100 HZ 16K OHMS
12dB/oct rolloff above 100
AT BASS CABINET
51 OFF = FILTER ON

CALIBRATION PROCEDURES

The following pages give in depth instructions for calibrating the power amplifiers and the HLE2 ELF™ for the CRM CUSTOM MONITOR SYSTEM. The chart below shows the gain structure for the power amplifiers and the HLE2 as they were calibrated in the laboratory of E.M.LONG ASSOCIATES before shipping:

CRM-100 CUSTOM MONITOR SYSTEM CALIBRATION									
	VOLTS		VOLTS	dB		VOLTS		VOLTS	dB
HLE2 INPUT	0.1	HLE2 HP OUTPUT	0.1	0.0	MID/HIGH AMPLIFIER INPUT	0.1	MID/HIGH AMPLIFIER OUTPUT	0.85	18.6
		HLE2 LP OUTPUT	0.2	6.0	LOW FREQUENCY AMPLIFIER INPUT	0.2	LOW FREQUENCY AMPLIFIER OUTPUT	4.80	27.6
		DIFFERENCE		6.0			DIFFERENCE		9.0
			TOTAL DIFFERENCE			15.0			

MID/HIGH RANGE AMPLIFIER ...A CAUTION

The Bryston 4B Mid/high range amplifier has been chosen to provide clean, transparent and un-distorted power for the CRM-1TA upper range system. Under severe high level testing it has proven to be an excellent match for the CRM-1TA system, providing just enough power without causing system overload and damage. If amplifiers with different power ratings or overload characteristics are substituted, calibration must be performed with great care or problems can occur and components in the CRM-1TA can be destroyed.

MID/HIGH RANGE AMPLIFIER CALIBRATION

1. Set both input controls of power amplifier to the full counter-clock-wise position.

2. Connect a dummy 8 Ohm resistive load to the output of Channel A of the power amplifier.

3. Connect an AC voltmeter and an oscilloscope to the output of Channel A.

4. Connect an audio signal generator to the input of Channel A by using a mono phone plug inserted into the TRS jack. This will cause the input of the Mid/high to be in the un-balanced mode.

5. Set the signal generator frequency to a frequency above 300 Hz (ie: 350 Hz) and its output to 0.1 volts RMS.

6. Set the Channel A input control to give 0.85 volts RMS at the Channel A output (+18.6 dB GAIN). (This is equivalent to 0.1 watts at 8 Ohms and 0.2 watts at 4 Ohms).

7. (THIS NEXT STEP SHOULD BE PERFORMED QUICKLY TO KEEP THE LOAD RESISTOR FROM OVER-HEATING). Increase the signal generator output to 5.2 volts RMS. This will give an output of 44.2 volts RMS. (This is equivalent to 244 watts/8 Ohms and 488.4 watts/4 Ohms) This is the clipping point of the Bryston 4B. The oscilloscope should show clipping at or above this point.

8. Repeat steps 2 through 7 for channel B.

9. This completes the calibration of the mid and upper range amplifier for the CRM-1TA system.

NOTE: If a dummy load is not available, steps 1 through 6 can still be carried out to accomplish the calibration. Do not perform step 7 without a dummy load.

CRM-100 MONITOR SYSTEM BRYSTON AMPLIFIER CALIBRATION

LOW FREQUENCY AMPLIFIER ... A CAUTION

The Bryston 7B Low frequency amplifier has been chosen because, when operated in the bridge mode, it provides an excellent match to the selected 18" bass driver. When calibrated as described below, it can provide the maximum output of which the selected 18" driver is capable without the danger of burning out the voice coil or destroying the suspension. If other power amplifiers are substituted, great care must be taken that they are calibrated so that they can not provide more power than the selected bass drivers can handle or they will be destroyed.

LOW FREQUENCY AMPLIFIER CALIBRATION

1. Set both input controls on the front of the low frequency power amplifier to the full counter-clock-wise position.

2. Connect a dummy 8 Ohm resistive load between the red binding posts of the output of Channel A of the low frequency power amplifier. (This is the bridged mode connection).

3. Connect a **BATTERY OPERATED AC VOLTMETER AND OSCILLOSCOPE** between the red binding posts of the output of channel A. **(THERE MUST BE NO CONNECTION BETWEEN THE COMMON OR GROUND OF THE SIGNAL GENERATOR AND THE OUTPUT OF THE POWER AMPLIFIER. ALSO, NOTHING SHOULD BE CONNECTED TO THE BLACK BINDING POSTS BECAUSE THE OUTPUT MUST BE FLOATING WITH NO COMMON CONNECTION.)**

4. Connect an audio signal generator to the input of Channel A by using a mono phone plug inserted into the TRS jack. This will cause the input of the Bryston 7B amplifier to be in the un-balanced mode.

5. Set the signal generator frequency to 32 Hz and its output to 0.1 volts RMS.

6. Set the Channel A input control to give 4.8 volts RMS at the Channel A output (27.6 dB GAIN). (This is equivalent to 2.9 watts at 8 Ohms)

7. (THIS NEXT STEP SHOULD BE PERFORMED QUICKLY TO KEEP THE LOAD RESISTOR FROM OVER-HEATING). Increase the signal generator output to 2.0 volts RMS. This will give an output of 48.0 volts RMS. (This is equivalent to 288 watts/8 Ohms) Watch the oscilloscope to make certain that the 32 Hz sine wave is not distorted.

8. Repeat steps 2 through 7 for channel B.

9. This completes the calibration of the bass range amplifier for the CRM-B18 system.

NOTE: If a dummy load is not available, steps 1 through 6 can still be carried out to accomplish the calibration. Do not perform step 7 without a dummy load.

NOTE: The output of the Low Pass section of a properly calibrated HLE2 Electronics is set to allow the maximum output from the system. As the input to the HLE2 is increased, the Dynamic Control Module inside the HLE2 will not allow the Low Pass output to be more than 2.0 volts RMS, even with as much as 5.0 volts RMS input. This will allow the maximum output of the Low frequency power amplifier to be achieved with high level, transient signals without allowing it to overload which could destroy the selected 18" drivers. (The low frequency amplifier clip light may be seen occasionally during high level bass passages.)

CRM-100 MONITOR SYSTEM HLE2 CALIBRATION PROCEDURE FOR BRYSTON AMPLIFIERS

HLE2 HIGH PASS SECTION

1. For use with the CRM Monitor system, set the High Pass Filter dip switches 2,3,6,and 7 to "ON". All other switches should be set to the "OFF' position. Set the switches to the appropriate high pass filter frequency for other systems.
2. Connect signal generator to input pin 3 of the XLR jack or tip of TRS jack. If you use the XLR input make sure that the signal is to pin 3 and that you connect pin 2 to pin 1 to obtain an unbalanced input. If you use a mono phone plug to the TRS jack this will make the input unbalanced since the barrel of the plug will connect the sleeve and common of the TRS jack together.
3. Connect an AC voltmeter to the tip of the High Pass Output TRS jack or the pin 3 of the XLR output jack. Make certain that the output is unbalanced. If you insert a dummy phone plug into the TRS jack it will connect the sleeve and common together making the output unbalanced.
4. Set the frequency of the signal generator to 350 Hz and the output to 0.8 volts RMS.
5. Set the P2 Master Input Level control to the full clock-wise position.
6. Set the P5 High Pass Output Level control to the full clock-wise position.
7. The output should be at least 3.2 volts RMS at the High Pass Output.
8. Adjust P2 Master Input Level control to give 1.6 volts RMS output.
9. Adjust P5 High Pass Output control to give 0.8 volts RMS.
10. This completes the calibration of the High Pass section.

HLE2 LOW PASS SECTION

11. Adjust the frequency of the signal generator to 32 Hz and the output to 0.8 volts RMS.
12. Connect the AC voltmeter to the tip of the Low Pass Output TRS jack. Place a dummy phone plug into the TRS jack to connect the sleeve to the common to make the output unbalanced.
13. Set the P4 BEM Input level control and P9 Low Pass Output level control to the full clock-wise position.
14. Set the P6 DCM input control to the full counter-clock-wise position.
15. The output at 32 Hz should be between 6.0 to 8.0 volts RMS. (Do not be alarmed if the output looks distorted)
16. Set the P4 Low Pass Input level control to give 3.2 volts RMS output.
17. Increase the input from the signal generator until distortion just appears. The output should be at least 5.0 volts RMS. (The gain from input to output should be about 4 times or 12 dB).
18. Reset the output of the signal generator to 0.8 volts RMS and adjust the P9 Low Pass output control to give 1.6 volts RMS.
19. Set the DCM input level control clock-wise until the "DF" LED on the HLE2 front panel just lights. (The output should still be 1.6 volts RMS).
20. This completes the calibration of the Low Pass section.

IMPORTANT NOTE:

To re-adjust the balance between the bass and the upper range, only the P5 High Pass Output level control should be used. If more output is needed for the upper range, there is 6.0 dB more output available when the P5 control is at the full clock-wise position. If less upper range output is needed to balance the sound, P2 can be turned counter-clock-wise until balance is achieved.

The High Pass section gain is set to 1.0 times (0 dB) while the Low Pass section gain is set to 2.0 times (+6 dB) to achieve flat response in a room with the amplifiers calibrated according to instructions for the CRM-100 SYSTEM.
The DCM (Dynamic Control Module will cause the Low Pass output to be held to a maximum of 2.0 volts RMS or less even when the input to the HLE2 is as high as 5.0 volts.
The P2 Master Input control may be turned counter-clockwise if the input level to the HLE2 is too great (consistently above 0.8 volts RMS) but it is better to reduce the level externally, if possible. If the input to the HLE2 is too low, the P2 Master Input control can be turned clockwise to increase the sensitivity by as much as 6 dB but this will also increase the noise at the output.

TECHNICAL NOTES

E.M.LONG ASSOCIATES
4107 OAKMORE ROAD OAKLAND, CA 94602 510-531-8725

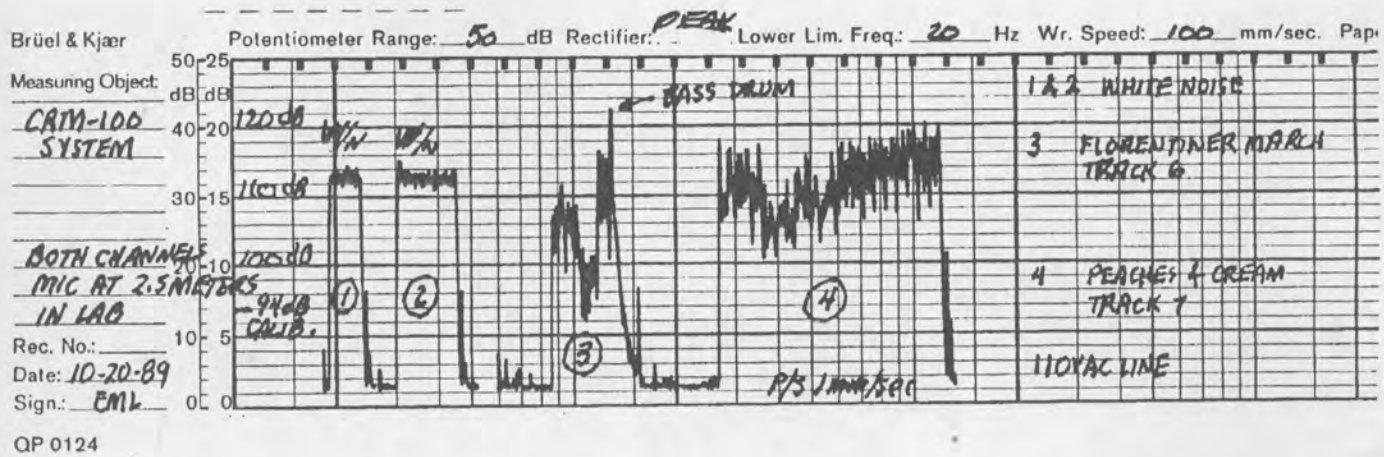
CRM-100 TECHNICAL NOTE 1.

CRM-100 PERCEIVED VS. ACTUAL LOUDNESS...A CAUTION

The CRM-100 Monitor System is capable of very high acoustical output. When compared to the sound of other monitor systems, this is not always immediately apparent. This is because the, even at very high sound pressure levels (SPL), the sound of the CRM-100 is clean and un-distorted. While other monitors might be perceived as being louder, it is usually because their loudness is accompanied by a shrieking and piercing distortion.

ACOUSTICAL OUTPUT SOUND PRESSURE LEVEL TESTS (SPL)

Tests were performed in the laboratory to determine the practical acoustical output SPL of the CRM-100 Monitor system. A B&K 4133 1/2" laboratory condenser microphone was placed at 2.5 meters from each monitor and in the center between them. The test signals were from a B&K 1024 Sine and Noise Generator and from a CD player. The AC power line voltage was 110 Volts RMS with no signal applied to the CRM-100. The AC power line voltage dropped to 105 volts RMS when the maximum output was obtained. If the AC power line voltage had been regulated to maintain a constant 120 volts, the maximum SPL would have been greater than that shown by at least 3 to 4 dB SPL.



SPL OF CRM-100 MONITOR SYSTEM. (1) SHORT 10 SECOND BURST OF WHITE NOISE (2) LONG 25 SECOND BURST OF WHITE NOISE (3) MUSIC: TRUMPET AND BASS DRUM SEQUENCE FROM "FLORENTINER" TRACK 7 OF TELARC CD-80099 "STARS AND STRIPES" (4) MUSIC: ORCHESTRA WITH HEAVY BASS DRUM SEQUENCE FROM "PEACHES & CREAM" TRACK 7 OF THE CD MCD-10005 OF THE SAME NAME.

HLE2 SCHEMATIC AND BLOCK DIAGRAMS

E.M.LONG ASSOCIATES

4107 OAKMORE ROAD OAKLAND, CA 94602 510-531-8725

EQUIPMENT LIST 12 16-91

MASTERMIX
1808 Division Street
Nashville, TN 37203
615-321-5970
Hank Williams

SUPPLIED EQUIPMENT

QTY	COMPANY	MODEL	DESCRIPTION	SER. NO.
1	EML	HLE2	ELF™ ELECTRONICS	SE107022
1	EML	CRM-1TA	MID/HIGH MONITORS	6906009A
1	EML	CRM-1TA	MID/HIGH MONITORS	6906010A
1	EML	CRM-B18	BASS MONITORS	7906009
1	EML	CRM-B18	BASS MONITORS	7906010
1	JBL	2245H	18" BASS DRIVER	28761
1	JBL	2245H	18" BASS DRIVER	28767

CALIBRATED EQUIPMENT

QTY	COMPANY	MODEL	DESCRIPTION	SER. NO.
1	BRYSTON	4B	POWER AMPLIFIER	440274
1	BRYSTON	7B	POWER AMPLIFIER	770152
1	BRYSTON	4B	POWER AMPLIFIER	770186