HC6S

HEADPHONE CONSOLE

CONTENTS *(in order of appearance)*

22340

IMPORTANT SAFETY INSTRUCTIONS

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any ventilation openings. Install in accordance with manufacturer's instructions.
8. Do not install near any heat sources such as radiators, registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord and plug from being walked on or pinched particularly at plugs, convenience receptacles, and the point where it exits from the apparatus.
11. Only use attachments and accessories specified by Rane.
12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. The plug on the power cord is the AC mains disconnect device and must remain readily operable. To completely disconnect this apparatus from the AC mains, disconnect the power supply cord plug from the AC receptacle.
16. This apparatus shall be connected to a mains socket outlet with a protective earthing connection.
17. When permanently connected, an all-pole mains switch with a contact separation of at least 3 mm in each pole shall be incorporated in the electrical installation of the building.
18. If rackmounting, provide adequate ventilation. Equipment may be located above or below this apparatus, but some equipment (like large power amplifiers) may cause an unacceptable amount of hum or may generate too much heat and degrade the performance of this apparatus.
19. This apparatus may be installed in an industry standard equipment rack. Use screws through all mounting holes to provide the best support.

WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the apparatus.

WARNING

To reduce the risk of electrical shock, do not open the unit. No user serviceable parts inside. Refer servicing to qualified service personnel.

The symbols shown below are internationally accepted symbols that warn of potential hazards with electrical products.

This symbol indicates that a dangerous voltage constituting a risk of electric shock is present within this unit.

This symbol indicates that there are important operating and maintenance instructions in the literature accompanying this unit.

WARNING: This product may contain chemicals known to the State of California to cause cancer, or birth defects or other reproductive harm.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Changes or modifications not expressly approved by Rane Corporation could void the user's authority to operate the equipment.

CAN ICES-3 (B)/NMB-3(B)

INSTRUCTIONS DE SÉCURITÉ

1. Lisez ces instructions.
2. Gardez précieusement ces instructions.
3. Respectez les avertissements.
4. Suivez toutes les instructions.
5. Ne pas utiliser près d'une source d'eau.
6. Ne nettoyer qu'avec un chiffon doux.
7. N'obstruer aucune évacuation d'air. Effectuez l'installation en suivant les instructions du fabricant.
8. Ne pas disposer près d'une source de chaleur, c-à-d tout appareil produisant de la chaleur sans exception.
9. Ne pas modifier le cordon d'alimentation. Un cordon polarisé possède 2 lames, l'une plus large que l'autre. Un cordon avec tresse de masse possède 2 lames plus une 3è pour la terre. La lame large ou la tresse de masse assurent votre sécurité. Si le cordon fourni ne correspond pas à votre prise, contactez votre électricien.
10. Faites en sorte que le cordon ne soit pas piétiné, ni au niveau du fil, ni au niveau de ses broches, ni au niveau des connecteurs de vos appareils.
11. N'utilisez que des accessoires recommandés par Rane.
12. N'utilisez que les éléments de transport, stands, pieds ou tables spécifiés par le fabricant ou vendu avec l'appareil. Quand vous utlisez une valise de transport, prenez soin de vous déplacer avec cet équipement avec prudence afin d'éviter tout risque de blessure.
13. Débranchez cet appareil pendant un orage ou si vous ne l'utilisez pas pendant un certain temps.
14. Adressez-vous à du personnel qualifié pour tout service après vente. Celui-ci est nécessaire dans n'importe quel cas où l'appareil est abimé : si le cordon ou les fiches sont endommagés, si du liquide a été renversé ou si des objets sont tombés sur l'appareil, si celui-ci a été exposé à la pluie ou l'humidité, s'il ne fonctionne pas correctement ou est tombé.
15. La fiche du cordon d'alimentation sert à brancher le courant alternatif AC et doit absolument rester accessible. Pour déconnecter totalement l'appareil du secteur, débranchez le câble d'alimentation de la prise secteur.
16. Cet appareil doit être branché à une prise terre avec protection.
17. Quand il est branché de manière permanente, un disjoncteur tripolaire normalisé doit être incorporé dans l'installation électrique de l'immeuble.
18. En cas de montage en rack, laissez un espace suffisant pour la ventilation. Vous pouvez disposer d'autres appareils au-dessus ou en-dessous de celui-ci, mais certains (tels que de gros amplificateurs) peuvent provoquer un buzz ou générer trop de chaleur au risque d'endommager votre appareil et dégrader ses performances.
19. Cet appareil peut-être installé dans une baie standard ou un chassis normalisé pour un montage en rack. Visser chaque trou de chaque oreille de rack pour une meilleure fixation et sécurité.

ATTENTION: afin d'éviter tout risque de feu ou de choc électrique, gardez cet appareil éloigné de toute source d'humidité et d'éclaboussures quelles qu'elles soient. L'appareil doit également être éloigné de tout objet possédant du liquide (boisson en bouteilles, vases,…).

ATTENTION

Afin d'éviter tout risque de choc électrique, ne pas ouvrir l'appareil. Aucune pièce ne peut être changée par l'utilisateur. Contactez un SAV qualifié pour toute intervention.

Les symboles ci-dessous sont reconnus internationalement comme prévenant tout risque électrique.

Ce symbole indique que cette unité utilise un voltage élevé constituant un risque de choc électrique.

Ce symbole indique la présence d'instructions d'utilisation et de maintenance importantes dans le document fourni.

REMARQUE: Cet équipement a été testé et approuvé conforme aux limites pour un appareil numérique de classe B, conformément au chapitre 15 des règles de la FCC. Ces limites sont établis pour fournir une protection raisonnable contre tout risque d'interférences et peuvent provoquer une énergie de radiofréquence s'il n'est pas installé et utilisé conformément aux instructions, peut également provoquer des interférences aux niveaux des équipements de communication. Cependant, il n'existe aucune garantie que de telles interférences ne se produiront pas dans une installation particulière. Si cet équipement provoque des interférences en réception radio ou télévision, ceci peut être detecté en mettant l'équipement sous/hors tension, l'utilisateur est encouragé à essayer de corriger cette interférence par une ou plusieurs des mesures suivantes:

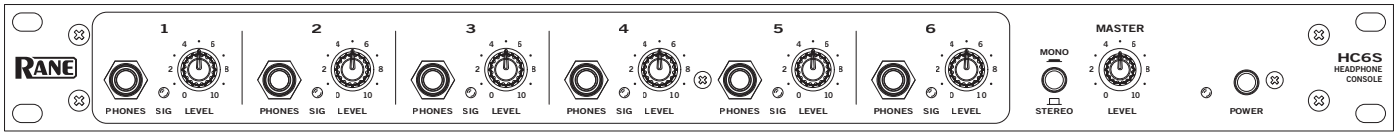
- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Connecter l'équipement à une sortie sur un circuit différent de celui sur lequel le récepteur est branché.
- Consulter un revendeur ou un technicien radio / TV expérimenté.

ATTENTION: Les changements ou modifications non expressément approuvés par Rane Corporation peuvent annuler l'autorité de l'utilisateur à manipuler cet équipement et rendre ainsi nulles toutes les conditions de garantie.

CAN ICES-3 (B)/NMB-3(B)

Cartons et papier à recycler.


RANE



QUICK START

Okay, you're in a hurry. Well this section's just for you. It explains enough of the HC6S's workings to keep you out of trouble. It allows operation without reading the whole manual. Please read at least this section to ensure reasonable operation of the unit.

The HC6S operates from either a common stereo or mono source, or from individual stereo sources. For a common stereo source, plug the left and right input plugs into the respective **MASTER INPUTS** jacks. The Inputs accept balanced or unbalanced sources. Just plug them in. This source is now routed to each of the six input channels to drive all of the Outputs.

For a single mono source feeding all headphones, connect it to one of the **MASTER INPUT** jacks and engage the **STEREO/MONO** switch. Set the overall input level with the **MASTER LEVEL**, and use the channel **LEVEL** controls for individual headphones. These Inputs may also be converted to balanced mono inputs by moving internal jumpers. See page Manual-4.

Use the separate stereo **IN** jacks when driving a pair of headphones with different program material than what is on the **MASTER INPUTS**. Connecting a plug into these jacks automatically disconnects that channel from the Master Input program material.

HC6S CONNECTION

When first connecting the HC6S to other components, *leave the power off*. This gives you a chance to make mistakes and correct them without damage.

1. With the power switch in the *off* position, plug the power line cord into the rear panel.

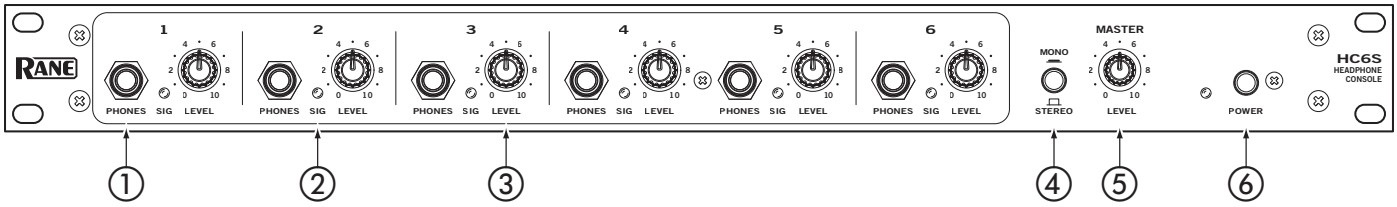
2. Plug the outputs from a mono or stereo source into the MASTER INPUTS. For unbalanced systems use a standard ¼" TS cable. For balanced operation, use a stereo ¼" TRS connector with pin 2 (+) wired to the Tip; pin 3 (–) wired to the Ring; and pin 1 (ground) wired to the Sleeve. Please consult the RaneNote, "Sound System Interconnection" (enclosed) for additional wiring arrangements.

3. When rack mounting the HC6S, you may wish to permanently wire the rear headphone Outputs to remote jack locations, such as in walls of a studio or other rooms. Use the front panel Outputs for local or control room monitoring.

4. You might also consider wiring the six direct stereo INs permanently to a patch bay or monitor mixer, but *only* if you do not plan to use the MASTER INPUTS as well. Whenever a plug is inserted into any individual stereo IN, the MASTER INPUTS are bypassed for that particular channel. So for maximum flexibility, we suggest that only the MASTER INPUTs be permanently wired and that the direct stereo INs be patched as necessary.

WEAR PARTS: This product contains no wear parts.

FRONT PANEL DESCRIPTION



① **Front panel PHONES Output jacks** are in parallel with the rear panel stereo OUT jacks. Use them to monitor any of the six channels for level or mix adjustments, or for easy access when the HC6S is rack mounted. Plugging into these front jacks does *not* disengage the rear Outputs.

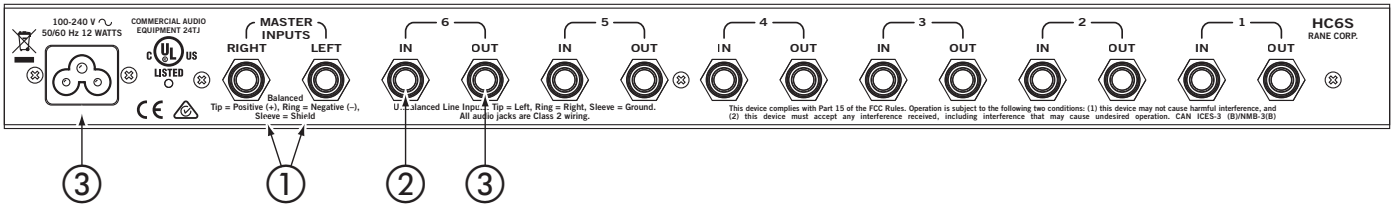
② **SIGnal present indicators** light (green) with any input signal above -20 dBu. See OPERATING INSTRUCTIONS (on page Manual-4) for details.

③ **Individual LEVEL controls** set the volume for each set of headphones, regardless of whether they are driven from the MASTER INPUTS or from the direct stereo INs. When using the front and rear panel headphone jacks together, this control varies the level of each headphone simultaneously.

④ **MONO / STEREO switch** converts the MASTER INPUTS from stereo to mono so that a single input cable drives both sides of the headphones.

⑤ **MASTER LEVEL** sets the volume simultaneously to all headphones driven from the MASTER INPUTS. This does not alter the volume on any headphones driven from the direct stereo INs.

⑥ **POWER switch.** Your basic, straightforward power switch. When the yellow LED is lit, the HC6S is ready to go.



① **MASTER INPUTS** are automatic balanced/unbalanced Inputs, which accept either a ¼" TRS (tip-ring-sleeve) plug for balanced operation, or a ¼" TS (tip-sleeve) plug for mono operation. You do nothing different when hooking up balanced or unbalanced lines. The HC6S is one smart dude. He *knows* what you are doing so you better watch out.

② **Direct Stereo INs** allow each stage to be driven separately, from any source. Whenever a plug is inserted into one of these Inputs, the MASTER INPUTS are disconnected from that stage (and only that stage). I told you the dude be smart!

These are ¼" TRS (tip-ring-sleeve) Input jacks, each accepting both left and right channels. If you plug a regular TS (tip-sleeve) into this jack, you will only connect the left channel.

To feed this input with an unbalanced mono signal, use a TRS plug and wire the tip and ring together.

To build a cable that will combine separate left and right cables into a single ¼" TRS, follow the diagram below, connecting all shields. RCA connectors can be substituted for the ¼" connectors.

To use balanced mono sources, set the internal jumpers as shown on page Manual-4.

③ **Stereo Headphone OUTs** allow any headphone with an impedance from 32 to 600 Ω. Then kick back and enjoy. (Lower and higher impedance headphones may be used; they just won't be very loud.)

④ **Universal Voltage Input:** via a miniature IEC 60320 C6 appliance inlet. This mates with an IEC 60320 C5 line cord (USA domestic). Do **not** lift the ground connection! The wide voltage range of this input allows it to be powered almost anywhere in the world.

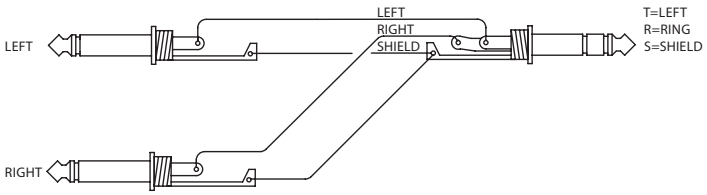


Figure 1. Dual Mono to Stereo TRS Wye Cable.

See ② above.

OPERATING INSTRUCTIONS

MASTER STEREO INPUTS

Apply a source program to the MASTER INPUTS and turn up the MASTER LEVEL until the green signal-present LEDs light up. Further adjustment of this control raises or lowers the volume level in all headphones simultaneously, i.e., all those being driven from the MASTER INPUTS. The MASTER LEVEL does *not* affect channels driven from the direct stereo INs.

INDIVIDUAL LEVEL CONTROLS

These adjust the level in each set of headphones to the desired loudness. When using a direct stereo IN, only this control affects the volume in the headset—the MASTER LEVEL is bypassed.

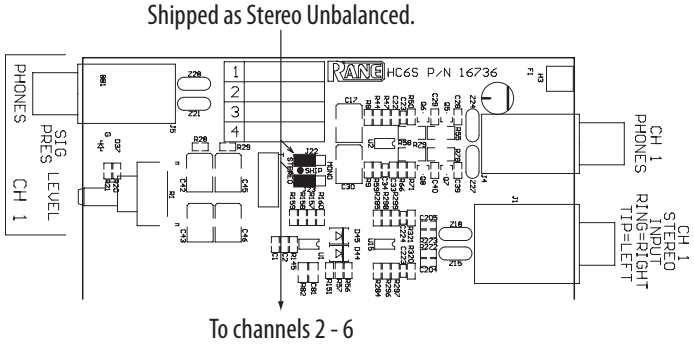
DIRECT STEREO INPUTS

These allow completely independent operation of up to six different stereo programs. These Inputs are stereo only, and wired to accept unbalanced signals, using the tip=left, ring=right convention. Unbalanced mono sources require using a stereo ¼" TRS plug and shorting the tip and ring together.

Any channel not directly driven is automatically driven from the MASTER INPUTS.

When using balanced mono sources, internal jumpers must be moved as in Figure 2 below. Jumpers are wired at the factory for stereo. Jumpers must be moved for balanced mono operation. Each jack is jumpered separate, so any combination of input types is possible within a single HC6S. ***SHOCK HAZARD WARNING***: Any service requiring access to the inside of the unit (including changing jumpers and switch settings) should be done by qualified service personnel.

Figure 2. Stereo Unbalanced / Mono Balanced Jumpers Shipped as Stereo Unbalanced.



SIGNAL-PRESENT LEDS

These light up with any signal input above -20 dBu. They are located in the signal path after the MASTER INPUTS and before the individual LEVEL controls. This means that adjusting the MASTER LEVEL affects the SIG LEDs, while adjusting the individual LEVEL controls does not. When using a direct stereo IN, the LED responds to that Input only. This means these indicators aid in quickly identifying which stages are driven by the MASTER INPUTS and which by the direct stereo INs: Simply turn the MASTER LEVEL up and down and observe which LEDs respond. These are the channels being driven by the MASTER INPUTS.

STEREO / MONO SWITCH

This serves the basic function of allowing both Left and Right channels of all headphones to be driven from a mono MASTER INPUT. In some instances a stereo program can be confusing for live monitoring purposes, due to extreme separation and the increased difficulty in perceiving several different volume levels. Using the MONO / STEREO switch converts the system to mono operation to better suit these particular monitoring needs.

FRONT PANEL OUTPUT JACKS

These jacks parallel the rear OUTs, providing easy access patching into any channel for cueing or additional monitoring. When using more than six sets of headphones at once, keep two things in mind:

1. There are still only six LEVEL controls. Additional headsets must double up with those already in use. To avoid intolerable volume differences to two listeners on the same channel of the HC6S, use headphones of the same make and model.

2. The HC6S has limited power output. The more headphones you connect to it, the less power there is available to each set, and the more strain on the HC6S. Blasting 10 or 12 sets of low impedance headphones is asking too much from the HC6S. To lessen the power drain from the HC6S, use only high impedance (100 Ω or greater) headphones when paralleling.

General Description

The Rane HC6S is one of the most indispensable products in today's audio industry. Featuring six stereo headphone amplifiers, the HC6S performs a number of necessary tasks, not all of which are headphone related.

The HC6S provides Master stereo Inputs which can be used to drive any or all of the 6 stereo headphone amplifiers. A Mono switch is provided on the front panel to drive both channels of all 6 amplifiers from a common mono source. Six individual unbalanced stereo Inputs are available to drive any individual amplifier from a separate stereo source. These Inputs can be converted to mono balanced Inputs through internal jumpers if required. Outputs for all six channels are provided on the front panel and on the rear panel so that headphones may be connected on either side based on the requirements of a given installation. Two pairs of headphones may be driven from each channel, one pair connected to the front and one to the rear.

The HC6S is capable of delivering up to 500 milliwatts into headphones with rated impedances between 32-600 ohms. The precise amount of power depends on the exact impedance of the headphone in use and the number of headphones connected to the unit. Under most conditions, the HC6S produces sound pressure levels in excess of 120 dB. This level is more than adequate for most listeners.

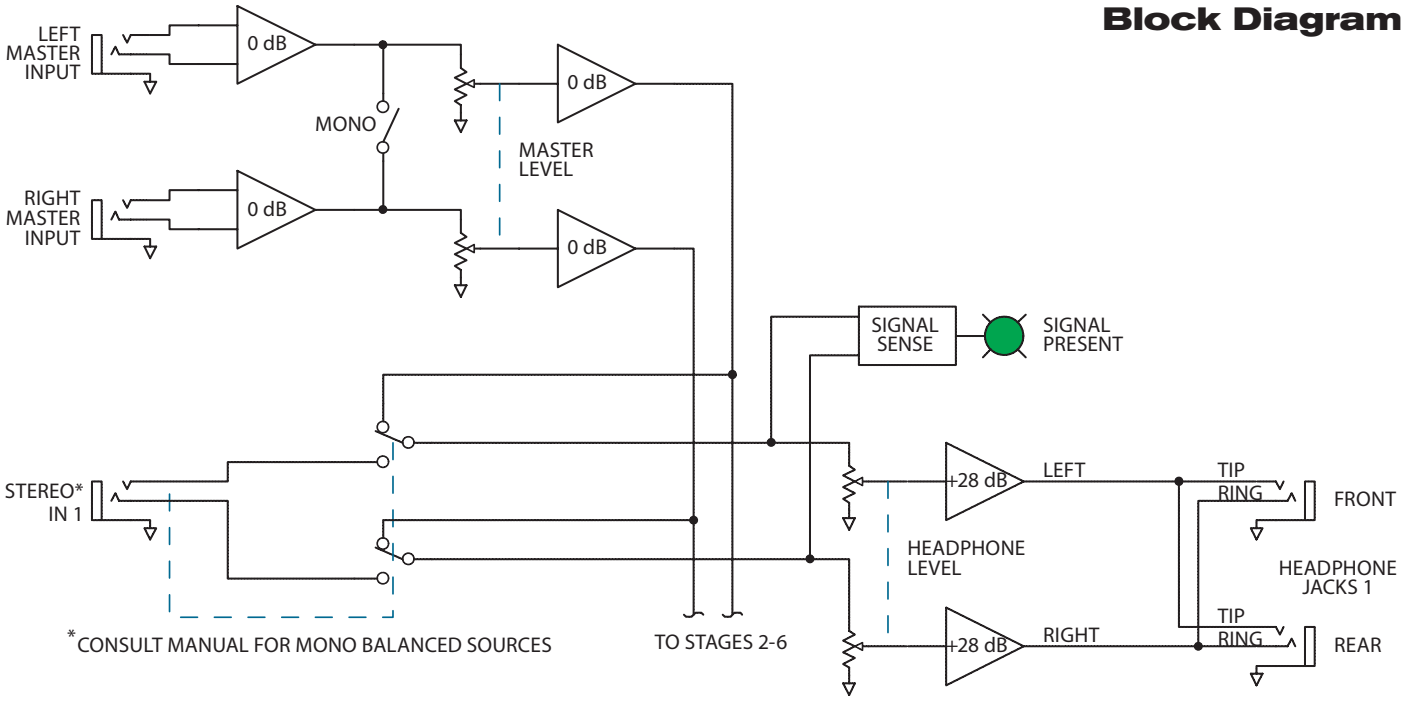
Features

- Six Stereo Headphone Amplifiers
- Master Balanced/Unbalanced Stereo Inputs
- Six Unbalanced Stereo Inputs
- Six Output Level Controls
- Master Input Level Controls
- Stereo/Mono Switch
- Front and Rear Output Jacks
- Internal Universal Power Supply (100-240 VAC)

HC6S Specifications

Parameter	Specification	Limit	Units	Conditions/Comments
Power Output:	1 Channel Driven			Max average rms power, 20-20 kHz
	500	5%	mW	32 Ω headphones
	500	5%	mW	50 Ω headphones
	500	5%	mW	100 Ω headphones
	300	5%	mW	200 Ω headphones
	200	5%	mW	300 Ω headphones
	120	5%	mW	600 Ω headphones
	6 Channels Driven			
	250	5%	mW	32 Ω headphones
	250	5%	mW	50 Ω headphones
	250	5%	mW	100 Ω headphones
	200	5%	mW	200 Ω headphones
	100	5%	mW	300 Ω headphones
	120	5%	mW	600 Ω headphones
	(Note: Above values produce loudness levels of 120 dB in most headphones)			
Headphone Impedance Range	32-600	10%	Ω	For best performance
Inputs: Type	Active Balanced/Unbalanced			
……Connectors	¼" TRS			
……Impedance	20k	1%	Ω	
……Maximum Level	+20	1	dBu	
Outputs: Type	(6) Stereo Amplifiers			(6) Outs front + (6) Outs rear
……Connectors	¼" TRS			Tip = Left, Ring = Right
……Impedance	0.25	typ.	Ω	Headphone Outputs
Overall Gain Range	Off to +20	1	dB	
LED Threshold: Signal Present	-20	1	dBu	Input Level
Ultrasonic Filter	20 kHz, 6 dB/octave	5%	Hz	Linear phase
Frequency Response	20-20 kHz	+0/-3	dB	
THD+Noise @ 1 kHz	0.002	.002	%	150 mW / 200 Ω, 1 channel
THD+Noise 20-20 kHz	0.02	.01	%	150 mW / 200 Ω, 1 channel
IM Distortion (SMPTE)	0.03	.01	%	60 Hz / 7 kHz, 4:1, 150 mW / 200 Ω
Signal-to-Noise Ratio	-96	2	dB	re 150 mW / 200 Ω, A-weighted
Mean Time Between Failure	20,500		Hrs	Mil Hdbk-217D, Section V
Universal Line Voltage	100-240 VAC, 50/60 Hz		VAC	12W
Maximum Power	12		W	
Unit: Conformity	CE, FCC, cULus			
Unit: Construction	All Steel			
……Size	1.75"H x 19"W x 5.3"D (1U)			(4.4 cm x 48.3 cm x 13.5 cm)
……Weight	5 lb			(1.9 kg)
Shipping: Size	4.25" x 20.3" x 13.75"			(11 cm x 52 cm x 35 cm)
……Weight	9 lb			(4.1 kg)
Note: 0 dBu = 0.775 Vrms				

Block Diagram



Application Information

At first glance the HC6S looks like any other headphone distribution amplifier. Indeed, it performs superbly all the basic functions of such an instrument. Two balanced Inputs provide a master stereo signal to six stereo headphone amplifiers, with individual stereo Level controls. The Master Level control allows adjustment of the main stereo Input level for proper matching to any source. In addition, a Stereo/Mono switch converts the stereo Inputs to mono operation when required.

However, several unique features of the HC6S allow performance well beyond the limits of standard headphone distribution amplifiers. Besides the stereo Master Inputs, the HC6S provides separate stereo Inputs for each of the six headphone amplifiers. Whenever a signal is plugged into the individual stereo Input, the Master stereo signal automatically disconnects from that amplifier, allowing the remaining stages to be fed either from the Master stereo Inputs or likewise from another separate input. This feature opens new applications for the HC6S, allowing operation as either a standard distribution amplifier or as six separate amplifiers, or any combination of both. By connecting the six Inputs to a monitor mixing console, or to sub-master sends, or even to a patch bay, the HC6S converts any size studio to a custom headphone monitor mixing system. You now can give each vocalist more of their voice for increased clarity; or add more kick drum to the bassist (without giving everyone else a headache); or let the producer monitor the straight mix all at the same time. This feature proves equally valuable to broadcast facilities, video production studios, language labs and other educational facilities.

The HC6S provides Output jacks on both the front and rear panels. The front jacks (paralleled with the rear jacks) add considerable flexibility and ease of operation. This feature allows permanent rack-mounting while maintaining instant access to any of the Outputs. Cueing becomes a snap; a must for monitor mix adjustments, and allows additional monitoring or routing without the use of a patch bay. Or, for language labs and other demo purposes, this feature means up to 12 headphones may be driven simultaneously.

The HC6S makes a valuable tool for any band wanting to practice anywhere, anytime, at any volume, without disturbing a soul. By connecting the HC6S directly to the mixer outputs and using headphones instead of amps and speakers, the entire band can perform at ear shattering levels, with no feedback, with amazingly cleaner, clearer sound. The HC6S is a very cost-effective alternative to renting a practice studio for every rehearsal.

Rear Panel

Headphone Sensitivity

Headphone manufacturers specify a "sensitivity" rating for their products that is very similar to loudspeaker sensitivity ratings. For loudspeakers, the standard is to apply 1 watt and then measure the sound pressure level (SPL) at a distance of 1 meter. For headphones, the standard is to apply 1 milliwatt (1 mW = 1/1000 of a watt) and then measure the sound pressure level at the earpiece (using a dummy head with built-in microphones). Sensitivity is then stated as the number of dB of actual sound level (SPL) produced by the headphones with 1 mW of input; headphone specifications commonly refer to this by the misleading term "dB/mW." What they really mean is dB SPL for 1 mW input.

Think about these sensitivity definitions a moment: headphone sensitivity is rated using 1/1000 of a watt; loudspeaker sensitivity is rated using 1 watt. So a quick rule-of-thumb is that you are going to need about 1/1000 as much power to drive your headphones as to drive your loudspeakers since both of their sensitivity ratings are similar (around 90-110 dB SPL). For example, if your hi-fi amp is rated at 65 watts, then you would need only 65 mW to drive comparable headphones. (Actually you need less than 65 mW since most people don't listen to their loudspeakers at 1 meter.) And this is exactly what you find in hi-fi receivers—their headphone jacks typically provide only 10-20 mW of output power.

Take another moment and think about all those phones and MP3 players. They sound great, and loud. Why, you can even hear them ten feet away as the teenage skateboarder that ran over your foot escapes.

Power output? About 12 mW.

Architectural Specifications

The headphone console shall have six (6) stereo inputs and two (2) master inputs driving six (6) stereo amplifiers wired to six (6) outputs on the front panel, in parallel with six (6) outputs on the rear chassis. Sufficient output power shall be provided to drive most stereo headphones to levels of 120 dB SPL.

Automatic switching shall be included such that driving any of the separate inputs disconnects that one channel from the main stereo driving bus internally, allowing separate program material to be processed through the driven channel.

Input level controls shall be provided on all inputs with a gain range from off to +28 dB. A stereo/mono switch shall be located on the front panel.

The master inputs shall be active balanced/unbalanced designs terminated with ¼" TRS (tip-ring-sleeve) connectors. The outputs shall be ¼" TRS connectors wired tip-left, ring-right, sleeve-common.

Ultrasonic filters shall be built-in, and LEDs provided to indicate Signal Present conditions on all amplifier inputs.

The unit shall be capable of operation by means of its own built-in universal power supply operating at 100-240 VAC and meet CE requirements. The unit shall be UL and cUL listed. The unit shall be entirely constructed from cold-rolled steel.

The unit shall be a Rane Corporation Model HC6S.

Sound System Interconnection

- **Cause & prevention of ground loops**
- **Interfacing balanced & unbalanced**
- **Proper pin connections and wiring**
- **Chassis ground vs. signal ground**
- **Ground lift switches**

Rane Technical Staff

RaneNote 110

Introduction

This note, originally written in 1985, continues to be one of our most useful references. It's popularity stems from the continual and perpetual difficulty of hooking up audio equipment without suffering through all sorts of bizarre noises, hums, buzzes, whistles, etc.— not to mention the extreme financial, physical and psychological price. As technology progresses it is inevitable that electronic equipment and its wiring should be subject to constant improvement. Many things *have* improved in the audio industry since 1985, but unfortunately wiring isn't one of them. However, finally the Audio Engineering Society (AES) has issued a standards document for interconnection of pro audio equipment. It is AES48, titled *"AES48-2005: AES standard on interconnections —Grounding and EMC practices — Shields of connectors in audio equipment containing active circuitry."*

Rane's policy is to accommodate rather than dictate. However, this document contains suggestions for external wiring changes that should ideally only be implemented by trained technical personnel. Safety regulations require that all original grounding means provided from the factory be left intact for safe operation. No guarantee of responsibility for incidental or consequential damages can be provided. *(In other words, don't modify cables, or try your own version of grounding unless you really understand exactly what type of output and input you have to connect.)*

Ground Loops

Almost all cases of noise can be traced directly to ground loops, grounding or lack thereof. It is important to understand the mechanism that causes grounding noise in order to effectively eliminate it. Each component of a sound system produces its own ground internally. This ground is usually called the audio *signal* ground. Connecting devices together with the interconnecting cables can tie the signal grounds of the two units together in one place through the conductors in the cable. Ground loops occur when the grounds of the two units are also tied together in another place: via the third wire in the line cord, by tying the metal chassis together through the rack rails, etc. These situations create a circuit through which current may flow in a closed "loop" from one unit's ground out to a second unit and back to the first. It is not simply the presence of this current that creates the hum—it is when this current flows through a unit's audio signal ground that creates the hum. In fact, even without a ground loop, a little noise current always flows through every interconnecting cable (i.e., it is impossible to eliminate these currents entirely). The mere presence of this ground loop current is no cause for alarm if your system uses properly implemented and *completely* balanced interconnects, which are excellent at rejecting ground loop and other noise currents. Balanced interconnect was developed to be immune to these noise currents, which can never be entirely eliminated. What makes a ground loop current annoying is when the audio signal is affected. Unfortunately, many manufacturers of balanced audio equipment design the internal grounding system improperly, thus creating balanced equipment that is not immune to the cabling's noise currents. This is one reason for the bad reputation sometimes given to balanced interconnect.

A second reason for balanced interconnect's bad reputation comes from those who think connecting unbalanced equipment into "superior" balanced equipment should improve things. Sorry. Balanced interconnect is not compatible with unbalanced. The small physical nature and short cable runs of completely unbalanced systems (home audio) also contain these ground loop noise currents. However, the currents in unbalanced systems never get large enough to affect the audio to the point where it is a nuisance. Mixing balanced and unbalanced equipment, however, is an entirely different story, since balanced and unbalanced interconnect are truly *not compatible*. The rest of this note shows several recommended implementations for all of these interconnection schemes.

The potential or voltage which pushes these noise currents through the circuit is developed between the independent grounds of the two or more units in the system. The impedance of this circuit is low, and even though the voltage is low, the current is high, thanks to Mr. Ohm, without whose help we wouldn't have these problems. It would take a very high resolution ohm meter to measure the impedance of the steel chassis or the rack rails. We're talking thousandths of an ohm. So trying to measure this stuff won't necessarily help you. We just thought we'd warn you.

The Absolute Best Right Way To Do It

The method specified by AES48 is to use balanced lines and *tie the cable shield to the metal chassis (right where it enters the chassis) at both ends of the cable.*

A balanced line requires three separate conductors, two of which are signal (+ and –) and one shield (see Figure 1a). The shield serves to guard the sensitive audio lines from interference. Only by using balanced line interconnects can you *guarantee* (yes, *guarantee*) hum-free results. Always use twisted pair cable. Chassis tying the shield at each end also *guarantees* the best possible protection from RFI [radio frequency interference] and other noises [neon signs, lighting dimmers].

Neil Muncy[1], an electroacoustic consultant and seasoned veteran of years of successful system design, chairs the AES

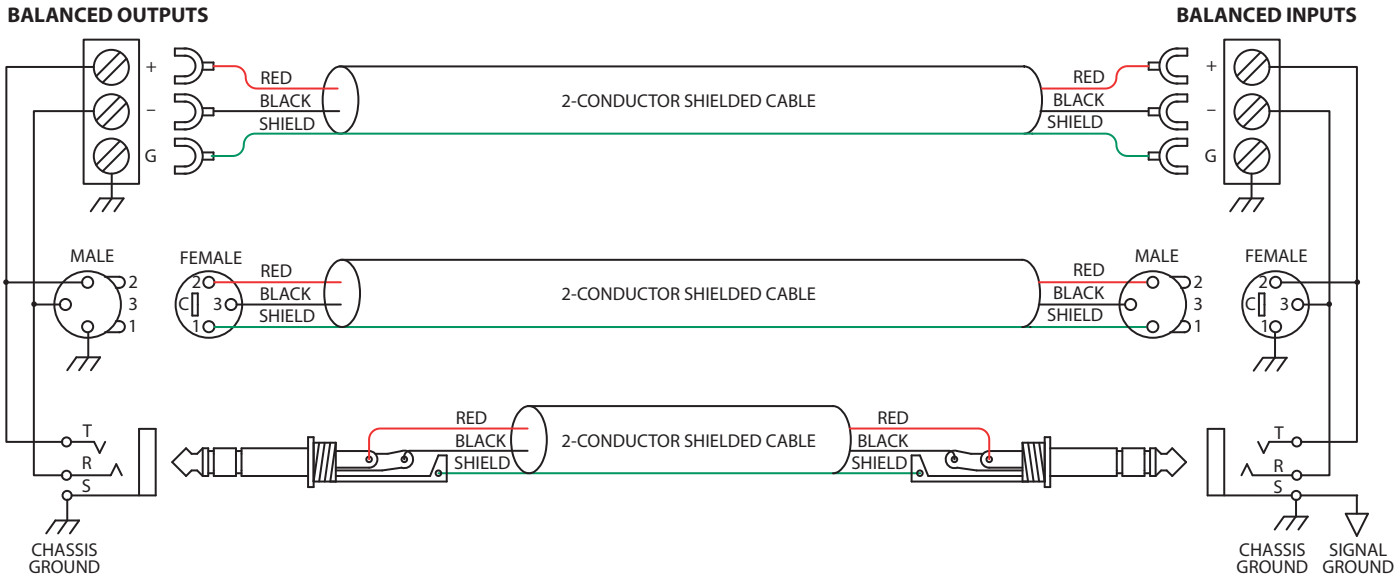


Figure 1a. The right way to do it.

Standards Committee (SC-05-05) working on this subject. He tirelessly tours the world giving seminars and dispensing information on how to successfully hook-up pro audio equipment[2]. He makes the simple point that it is absurd that you cannot go out and buy pro audio equipment from several different manufacturers, buy standard off-the-shelf cable assemblies, come home, hook it all up and have it work hum and noise free. *Plug and play.* Sadly, almost never is this the case, despite the science and rules of noise-free interconnect known and documented for over *60 years* (see References for complete information).

It all boils down to using balanced lines, only balanced lines, and nothing but balanced lines. This is why they were developed. Further, that you *tie the shield to the chassis, at the point it enters the chassis, and at both ends of the cable* (more on 'both ends' later).

Since standard XLR cables come with their shields tied to pin 1 at each end (the shells are not tied, nor need be), this means equipment using 3-pin, XLR-type connectors *must tie pin 1 to the chassis* (usually called chassis ground) — not the audio signal ground as is most common.

Not using *signal ground* is the most radical departure from common pro-audio practice. Not that there is any argument about its validity. There isn't. **This is the right way to do it**. So why doesn't audio equipment come wired this way? Well, some does, and since 1993, more of it does. That's when Rane started manufacturing some of its products with balanced inputs and outputs tying pin 1 to chassis. So why doesn't everyone do it this way? Because life is messy, some things are hard to change, and there will always be equipment in use that was made before proper grounding practices were in effect.

Unbalanced equipment is another problem: it is everwhere, easily available and inexpensive. All those RCA and ¼" TS connectors found on consumer equipment; effect-loops and insert-points on consoles; signal processing boxes; semi-pro digital and analog tape recorders; computer cards; mixing consoles; et cetera.

The next several pages give tips on how to successfully address hooking up unbalanced equipment. Unbalanced equipment when "blindly" connected with fully balanced units starts a pattern of hum and undesirable operation, requiring extra measures to correct the situation.

The Next Best Right Way To Do It

The quickest, quietest and most foolproof method to connect balanced and unbalanced is to **transformer isolate all unbalanced connections**. See Figure 2.

Many manufacturers provide several tools for this task, including Rane. Consult your audio dealer to explore the options available.

The goal of these adaptors is to allow the use of *standard cables.* With these transformer isolation boxes, modification of cable assemblies is unnecessary. Virtually any two pieces of audio equipment can be successfully interfaced without risk of unwanted hum and noise.

Another way to create the necessary isolation is to use a *direct box.* Originally named for its use to convert the high impedance, high level output of an electric guitar to the low impedance, low level input of a recording console, it allowed the player to plug "directly" into the console. Now this term is commonly used to describe any box used to convert unbalanced lines to balanced lines.

The Last Best Right Way To Do It

If transformer isolation is not an option, special cable assemblies are a last resort. The key here is to prevent the shield currents from flowing into a unit whose grounding scheme creates ground loops (hum) in the audio path (i.e., most audio equipment).

It is true that connecting both ends of the shield is theoretically the best way to interconnect equipment –though this assumes the interconnected equipment is internally grounded properly. Since most equipment is *not* internally grounded properly, connecting both ends of the shield is not often practiced, since doing so usually creates noisy interconnections.

A common solution to these noisy hum and buzz problems involves disconnecting one end of the shield, even though one can not buy off-the-shelf cables with the shield disconnected at one end. The best end to disconnect is the receiving end. If one end of the shield is disconnected, the noisy hum current stops flowing and away goes the hum — but only at low frequencies. A ground-sending-end-only shield connection minimizes the possibility of high frequency (radio) interference since it prevents the shield from acting as an antenna to the next input. Many reduce this potential RF interference by providing an RF path through

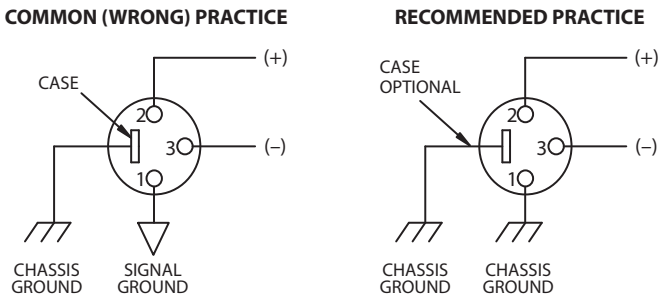


Figure 1b. Recommmended practice.

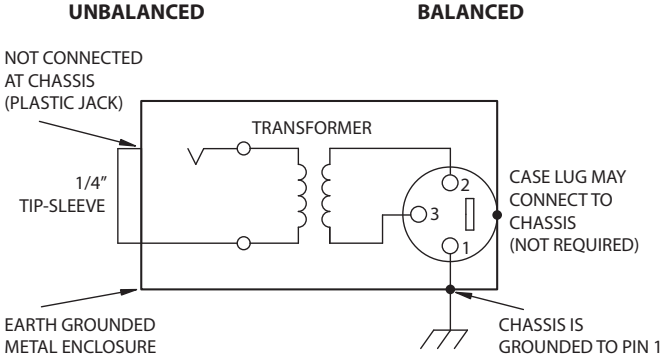


Figure 2. Transformer Isolation

a small capacitor (0.1 or 0.01 microfarad ceramic disc) connected from the lifted end of the shield to the chassis. (This is referred to as the "hybrid shield termination" where the sending end is bonded to the chassis and the receiving end is capacitively coupled. See Neutrik's EMC-XLR for example.) The fact that many modern day installers still follow this one-end-only rule with consistent success indicates this and other acceptable solutions to RF issues exist, though the increasing use of digital and wireless technology greatly increases the possibility of future RF problems.

If you've truly isolated your hum problem to a specific unit, chances are, even though the documentation indicates proper chassis grounded shields, the suspect unit is not internally grounded properly. Here is where special test cable assemblies, shown in Figure 3, really come in handy. These assemblies allow you to connect the shield to chassis ground *at the point of entry*, or to pin 1, or to lift one end of the shield. The task becomes more difficult when the unit you've isolated has multiple inputs and outputs. On a suspect unit with multiple cables, try various configurations on each connection to find out if special cable assemblies are needed at more than one point.

See Figure 4 for suggested cable assemblies for your particular interconnection needs. Find the appropriate output configuration (down the left side) and then match this with the correct input configuration (across the top of the page.) Then refer to the following pages for a recommended wiring diagram.

Ground Lifts

Many units come equipped with ground lift switches. In only a few cases can it be shown that a ground lift switch improves ground related noise. (Has a ground lift switch ever *really* worked for you?) In reality, the presence of a ground lift switch greatly reduces a unit's ability to be "properly" grounded and therefore immune to ground loop hums and buzzes. Ground lifts are simply another Band-Aid® to try in case of grounding problems. It is true that an entire system of properly grounded equipment, without ground lift switches, is guaranteed (yes *guaranteed*) to be hum free. The problem is most equipment is *not* (both internally and externally, AC system wise) grounded properly.

Most units with ground lifts are shipped so the unit is "grounded" — meaning the chassis is connected to audio signal ground. (This should be the best and is the "safest" position for a ground lift switch.) If after hooking up your system it exhibits excessive hum or buzzing, there is an incompatibility somewhere in the system's grounding configuration. In addition to these special cable assemblies that may help, here are some more things to try:

1. Try combinations of lifting grounds on units supplied with lift switches (or links). It is wise to do this with the power off!

2. If you have an entirely balanced system, verify all chassis are tied to a good earth ground, for safety's sake and hum protection. Completely unbalanced systems never earth ground anything (except cable TV, often a ground loop source). If you have a mixed balanced and unbalanced system, do yourself a favor and use isolation transformers or, if you can't do that, try the special cable assemblies described here and expect it to take many hours to get things quiet. May the Force be with you.

3. Balanced units with outboard power supplies (wall warts or "bumps" in the line cord) do *not* ground the chassis through the line cord. Make sure such units are solidly grounded by tying the chassis to an earth ground using a star washer for a reliable contact. (Rane always provides this chassis point as an external screw with a toothed washer.) Any device with a 3-prong AC plug, such as an amplifier, may serve as an earth ground point. Rack rails may or may not serve this purpose depending on screw locations and paint jobs.

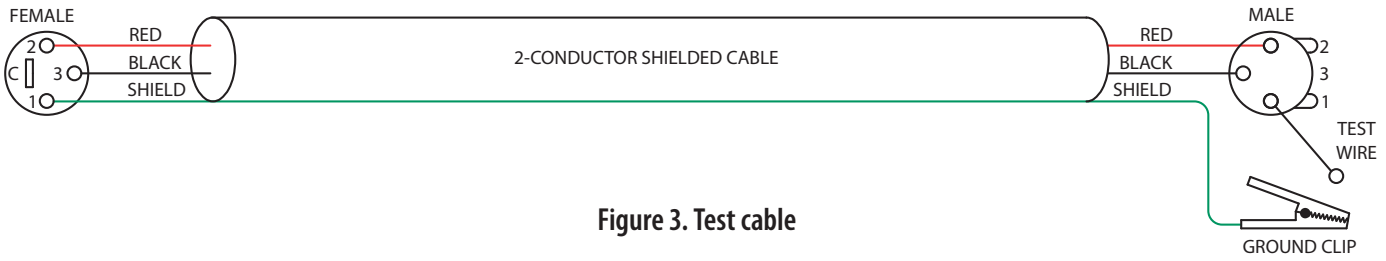


Figure 3. Test cable

Floating, Pseudo, and Quasi-Balancing

During inspection, you may run across a ¼" output called floating unbalanced, sometimes also called psuedo-balanced or quasi-balanced. In this configuration, the sleeve of the output stage is not connected inside the unit and the ring is connected (usually through a small resistor) to the audio signal ground. This allows the tip and ring to "appear" as an equal impedance, not-quite balanced output stage, even though the output circuitry is unbalanced.

Floating unbalanced often works to drive either a balanced or unbalanced input, depending if a TS or TRS standard cable is plugged into it. When it hums, a special cable is required. See drawings #11 and #12, and do not make the cross-coupled modification of tying the ring and sleeve together.

Winning the Wiring Wars

- Use balanced connections whenever possible, with the shield bonded to the metal chassis at both ends.
- Transformer isolate all unbalanced connections from balanced connections.
- Use special cable assemblies when unbalanced lines cannot be transformer isolated.
- Any unbalanced cable must be kept under 10 feet (3 m) in length. Lengths longer than this will amplify all the nasty side effects of unbalanced circuitry's ground loops.

Summary

If you are unable to do things correctly (i.e. use fully balanced wiring with shields tied to the *chassis* at both ends, or transformer isolate all unbalanced signals from balanced signals) then there is no guarantee that a hum-free interconnect can be achieved, nor is there a definite scheme that will assure noise-free operation in all configurations.

References

1. Neil A. Muncy, "Noise Susceptibility in Analog and Digital Signal Processing Systems," presented at the 97th AES Convention of Audio Engineering Society in San Francisco, CA, Nov. 1994.
2. *Grounding, Shielding, and Interconnections in Analog & Digital Signal Processing Systems: Understanding the Basics*; Workshops designed and presented by Neil Muncy and Cal Perkins, at the 97th AES Convention of Audio Engineering Society in San Francisco, CA, Nov. 1994.
3. The entire June 1995 AES Journal, Vol. 43, No. 6, available $6 members, $11 nonmembers from the Audio Engineering Society, 60 E. 42nd St., New York, NY, 10165-2520.
4. Phillip Giddings, *Audio System Design and Installation* (SAMS, Indiana, 1990).
5. Ralph Morrison, *Noise and Other Interfering Signals* (Wiley, New York, 1992).
6. Henry W. Ott, *Noise Reduction Techniques in Electronic Systems*, 2nd Edition (Wiley, New York, 1988).
7. Cal Perkins, "Measurement Techniques for Debugging Electronic Systems and Their Instrumentation," *The Proceedings of the 11th International AES Conference: Audio Test & Measurement,* Portland, OR, May 1992, pp. 82-92 (Audio Engineering Society, New York, 1992).
8. Macatee, *RaneNote*: "Grounding and Shielding Audio Devices," Rane Corporation, 1994.
9. Philip Giddings, "Grounding and Shielding for Sound and Video," *S&VC*, Sept. 20th, 1995.
10. AES48-2005: *AES standard on interconnections — Grounding and EMC practices — Shields of connectors in audio equipment containing active circuitry* (Audio Engineering Society, New York, 2005).

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To Input

From Output

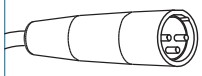
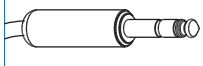
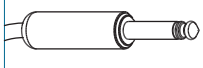
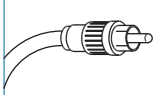
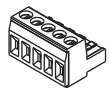
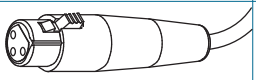
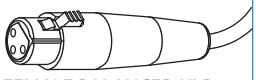
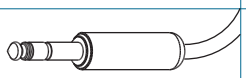
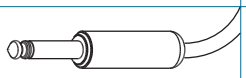
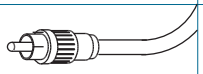
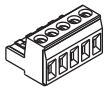
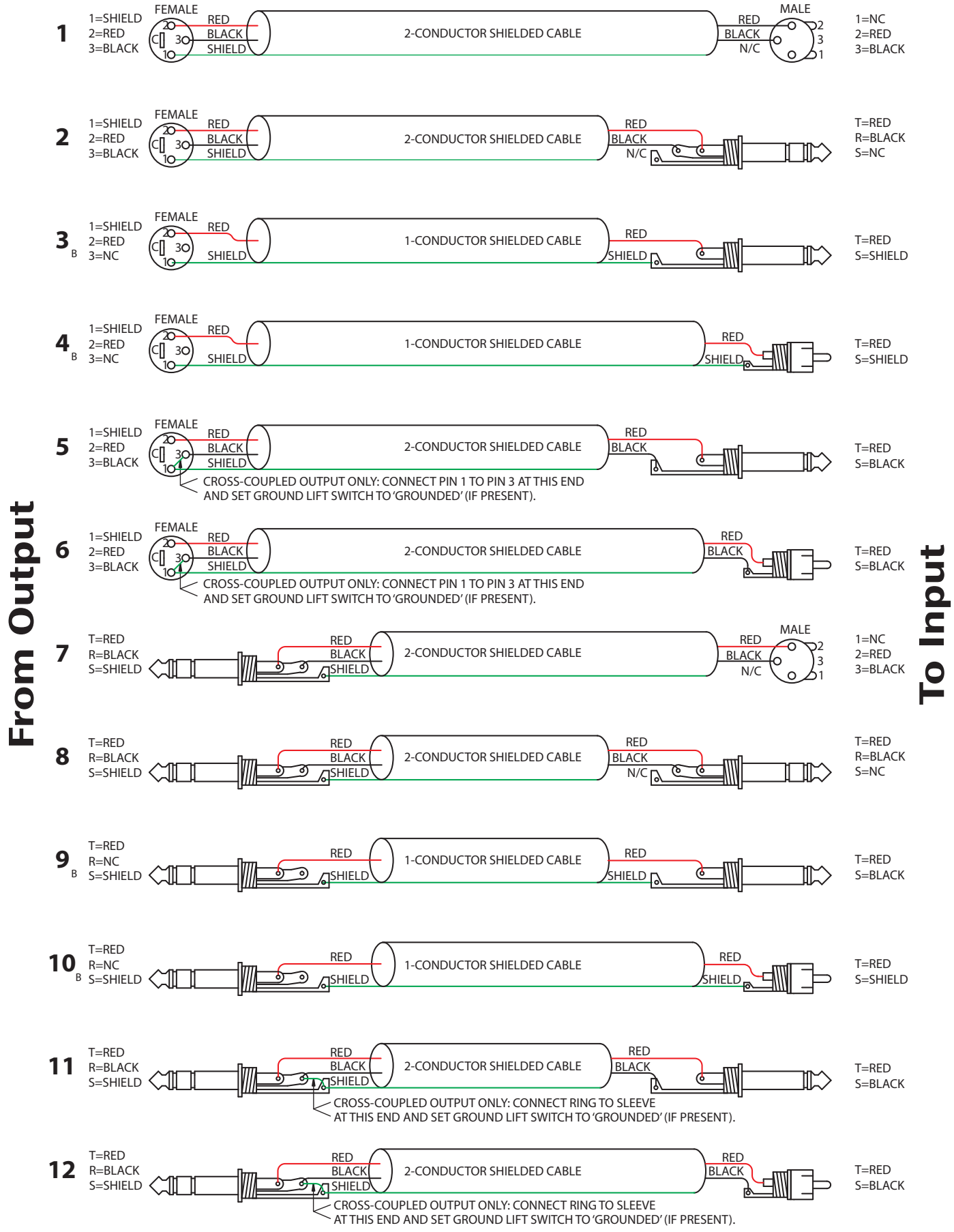
CABLE CONNECTORS	 MALE BALANCED XLR	 ¼" BALANCED TRS (TIP-RING-SLEEVE)	 ¼" OR 3.5mm UNBALANCED TS (TIP-SLEEVE)	 UNBALANCED RCA	 BALANCED EUROBLOCK
 FEMALE BALANCED XLR (NOT A TRANSFORMER, NOR A CROSS-COUPLED OUTPUT STAGE)	1	2	3 B	4 B	+ to + − to − SHIELD NC
 FEMALE BALANCED XLR (EITHER A TRANSFORMER OR A CROSS-COUPLED OUTPUT STAGE)	1	2	5	6	+ to + − to − SHIELD NC
 ¼" BALANCED TRS (NOT A TRANSFORMER, NOR A CROSS-COUPLED OUTPUT STAGE)	7	8	9 B	10 B	+ to + − to − SHIELD ONLY TO EUROBLOCK
 ¼" BALANCED TRS (EITHER A TRANSFORMER OR A CROSS-COUPLED OUTPUT STAGE)	7	8	11	12	+ to + − to − SHIELD NC
 ¼" FLOATING UNBALANCED TRS (TIP-RING-SLEEVE) (SLEEVE IN UNIT = NC)	21 A	22 A	11	12	+ to + − to − GROUND to GROUND
 ¼" OR 3.5 mm UNBALANCED TS (TIP-SLEEVE)	13	14	15 A	16 A	23
 UNBALANCED RCA (TIP-SLEEVE)	17	18	19 A	20 A	23
 BALANCED EUROBLOCK	+ to + − to − SHIELD ONLY TO XLR PIN 1	+ to + − to − SHIELD ONLY TO TRS SLEEVE	24	24	+ to + − to − GROUND to GROUND

Figure 4. Interconnect chart for locating correct cable assemblies on the following pages.

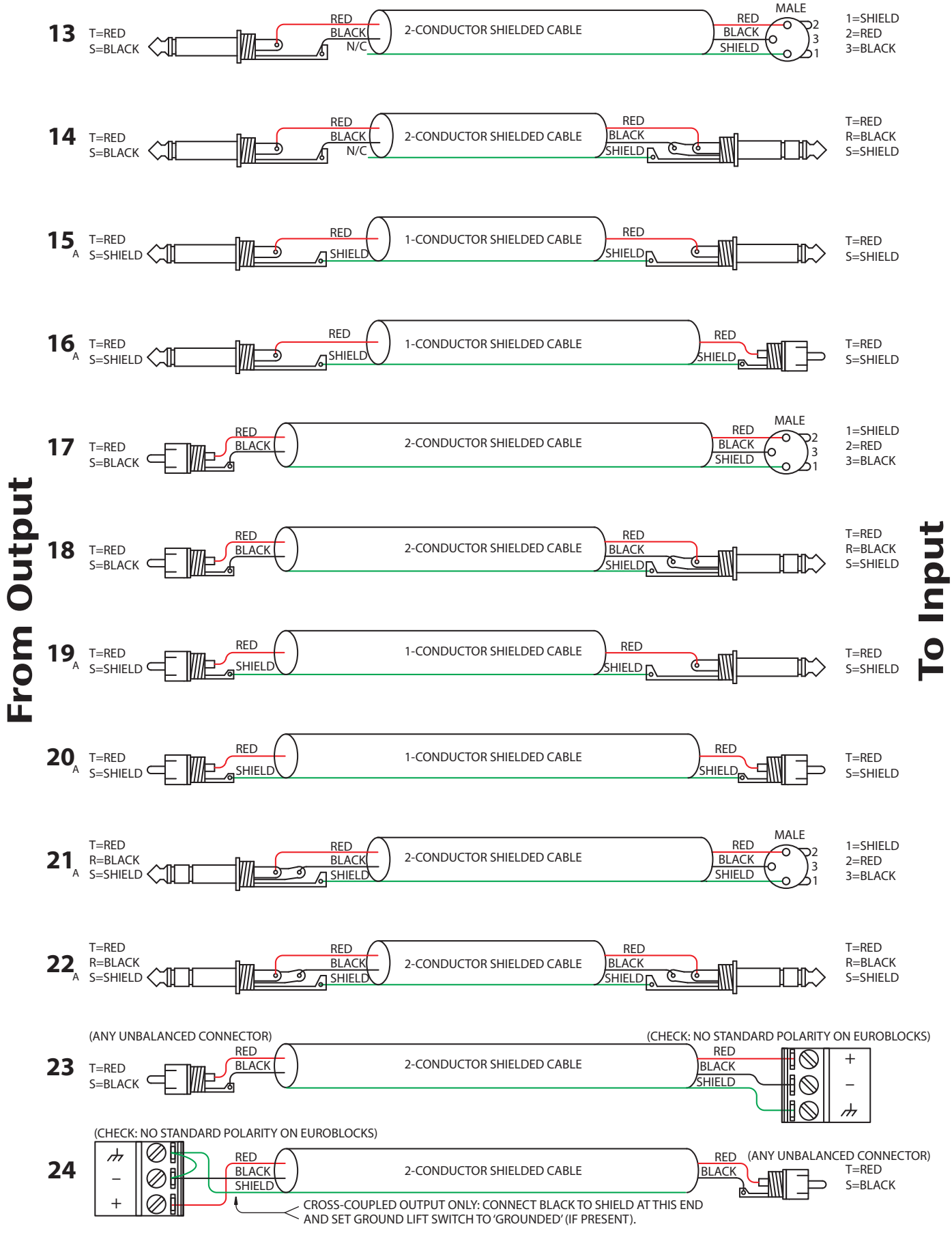
Note: (A) This configuration uses an "off-the-shelf" cable.

Note: (B) This configuration causes a 6 dB signal loss. Compensate by "turning the system up" 6 dB.


From Output
To Input
1
1=SHIELD
2=RED
3=BLACK
FEMALE
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
MALE
RED
BLACK
N/C
1=NC
2=RED
3=BLACK
2
1=SHIELD
2=RED
3=BLACK
FEMALE
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
RED
BLACK
N/C
T=RED
R=BLACK
S=NC
3 B
1=SHIELD
2=RED
3=NC
FEMALE
RED
SHIELD
1-CONDUCTOR SHIELDED CABLE
RED
SHIELD
T=RED
S=SHIELD
4 B
1=SHIELD
2=RED
3=NC
FEMALE
RED
SHIELD
1-CONDUCTOR SHIELDED CABLE
RED
SHIELD
T=RED
S=SHIELD
5
1=SHIELD
2=RED
3=BLACK
FEMALE
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
RED
BLACK
T=RED
S=BLACK
CROSS-COUPLED OUTPUT ONLY: CONNECT PIN 1 TO PIN 3 AT THIS END
AND SET GROUND LIFT SWITCH TO 'GROUNDED' (IF PRESENT).
6
1=SHIELD
2=RED
3=BLACK
FEMALE
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
RED
BLACK
T=RED
S=BLACK
CROSS-COUPLED OUTPUT ONLY: CONNECT PIN 1 TO PIN 3 AT THIS END
AND SET GROUND LIFT SWITCH TO 'GROUNDED' (IF PRESENT).
7
T=RED
R=BLACK
S=SHIELD
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
MALE
RED
BLACK
N/C
1=NC
2=RED
3=BLACK
8
T=RED
R=BLACK
S=SHIELD
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
RED
BLACK
N/C
T=RED
R=BLACK
S=NC
9 B
T=RED
R=NC
S=SHIELD
RED
SHIELD
1-CONDUCTOR SHIELDED CABLE
RED
SHIELD
T=RED
S=BLACK
10 B
T=RED
R=NC
S=SHIELD
RED
SHIELD
1-CONDUCTOR SHIELDED CABLE
RED
SHIELD
T=RED
S=SHIELD
11
T=RED
R=BLACK
S=SHIELD
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
RED
BLACK
T=RED
S=BLACK
CROSS-COUPLED OUTPUT ONLY: CONNECT RING TO SLEEVE
AT THIS END AND SET GROUND LIFT SWITCH TO 'GROUNDED' (IF PRESENT).
12
T=RED
R=BLACK
S=SHIELD
RED
BLACK
SHIELD
2-CONDUCTOR SHIELDED CABLE
RED
BLACK
T=RED
S=BLACK
CROSS-COUPLED OUTPUT ONLY: CONNECT RING TO SLEEVE
AT THIS END AND SET GROUND LIFT SWITCH TO 'GROUNDED' (IF PRESENT).

From Output

To Input



DETAIL A
L-BRACKET MOUNTING
(5 PLACES)

H1 THRU H5

DETAIL B

0.25

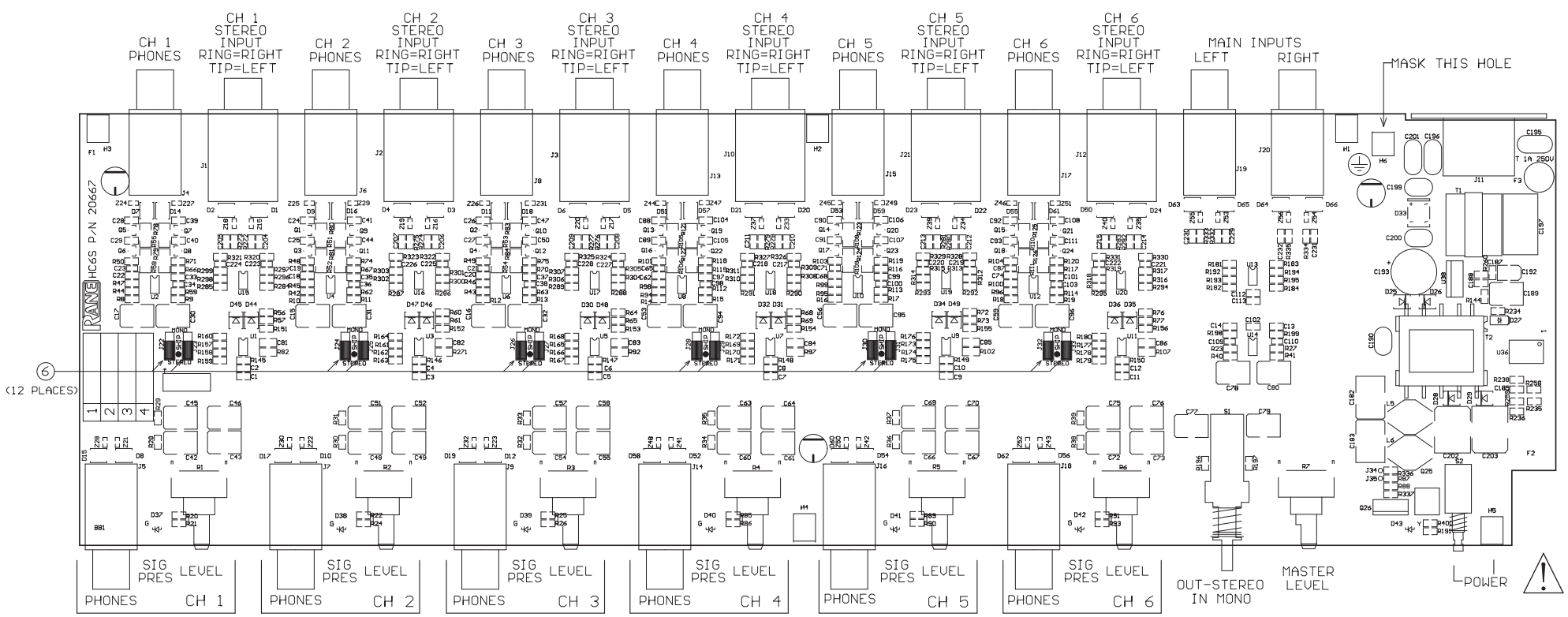
0.1

LED MOUNTING
0.35 TOTAL LED LENGTH
(7 PLACES)
D37 THRU D43

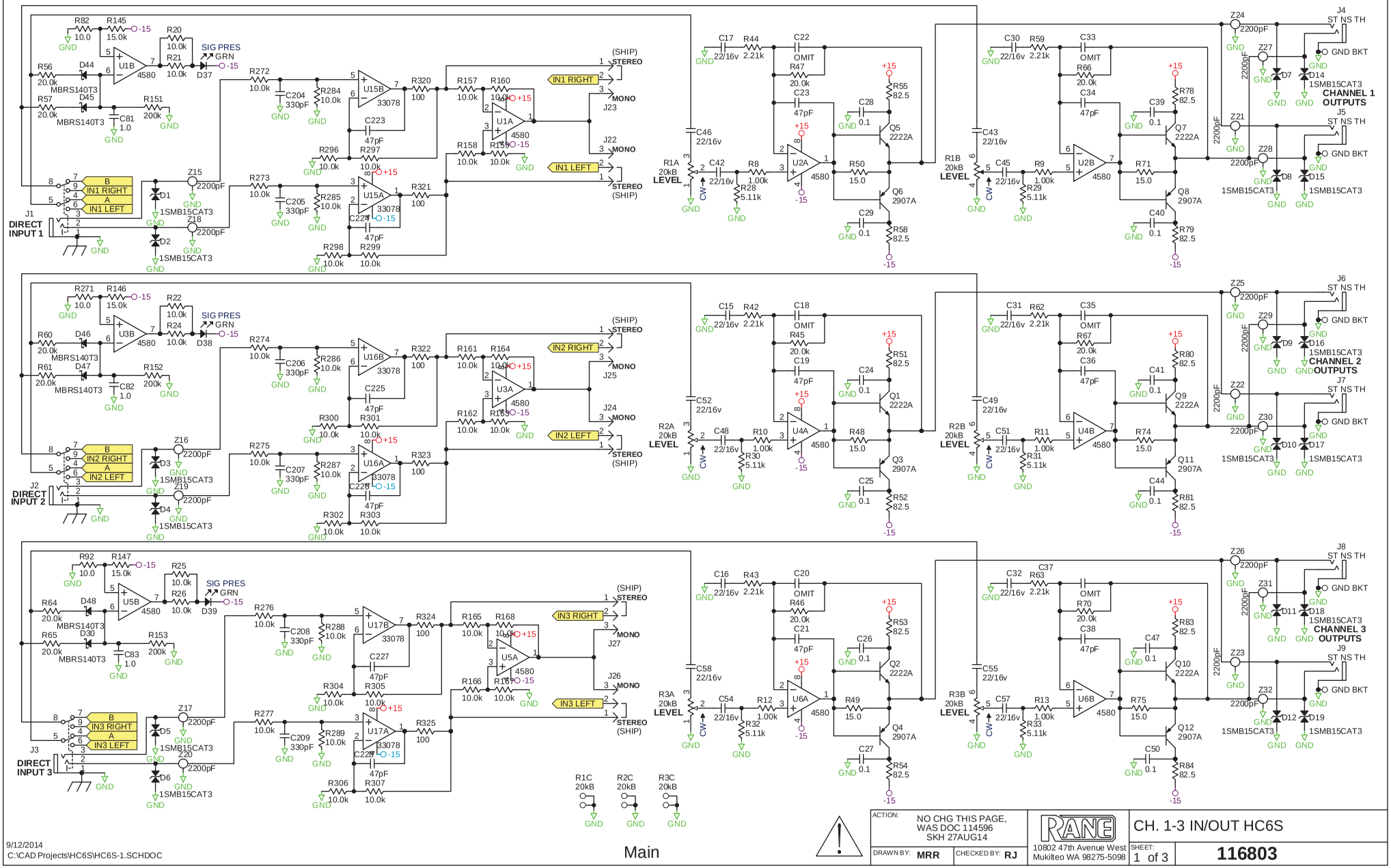
OMIT:

C22,C33,
C18,C35,
C20,C37,
C62,C97,
C68,C99,
C74,C101

114600 FILM 1 OF 5 TOP OVERLAY HC6S



Rane Corp. (425)355-6000
114597 DES HC6S
ACTION: ADDED DIODES ON ALL THE INPUTS AND OUTPUTS, CHG RI PARTS TO SMT 13JAN12 RWJ



ACTION: NO CHG THIS PAGE, WAS DOC 114596 SKH 27AUG14	RANE 10802 47th Avenue West Mukilteo WA 98275-5098	CH. 1-3 IN/OUT HC6S	
DRAWN BY: MRR	CHECKED BY: RJ	SHEET: 1 of 3	116803

9/12/2014
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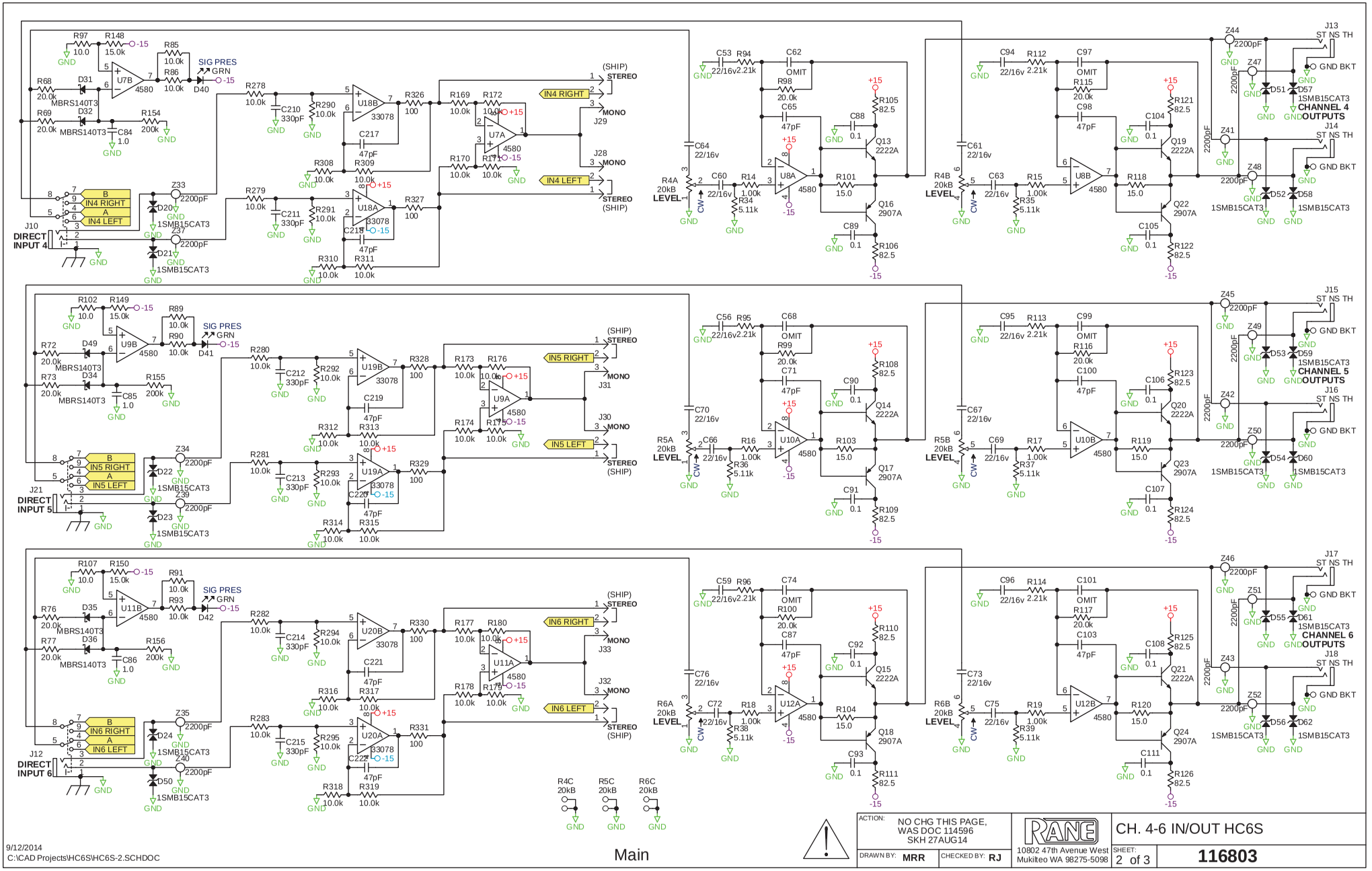

Main

ACTION:	NO CHG THIS PAGE, WAS DOC 114596 SKH 27AUG14
DRAWN BY:	MRR
CHECKED BY:	RJ

RANE
10802 47th Avenue West
Mukilteo WA 98275-5098

CH. 4-6 IN/OUT HC6S

SHEET: 2 of 3

116803

9/12/2014
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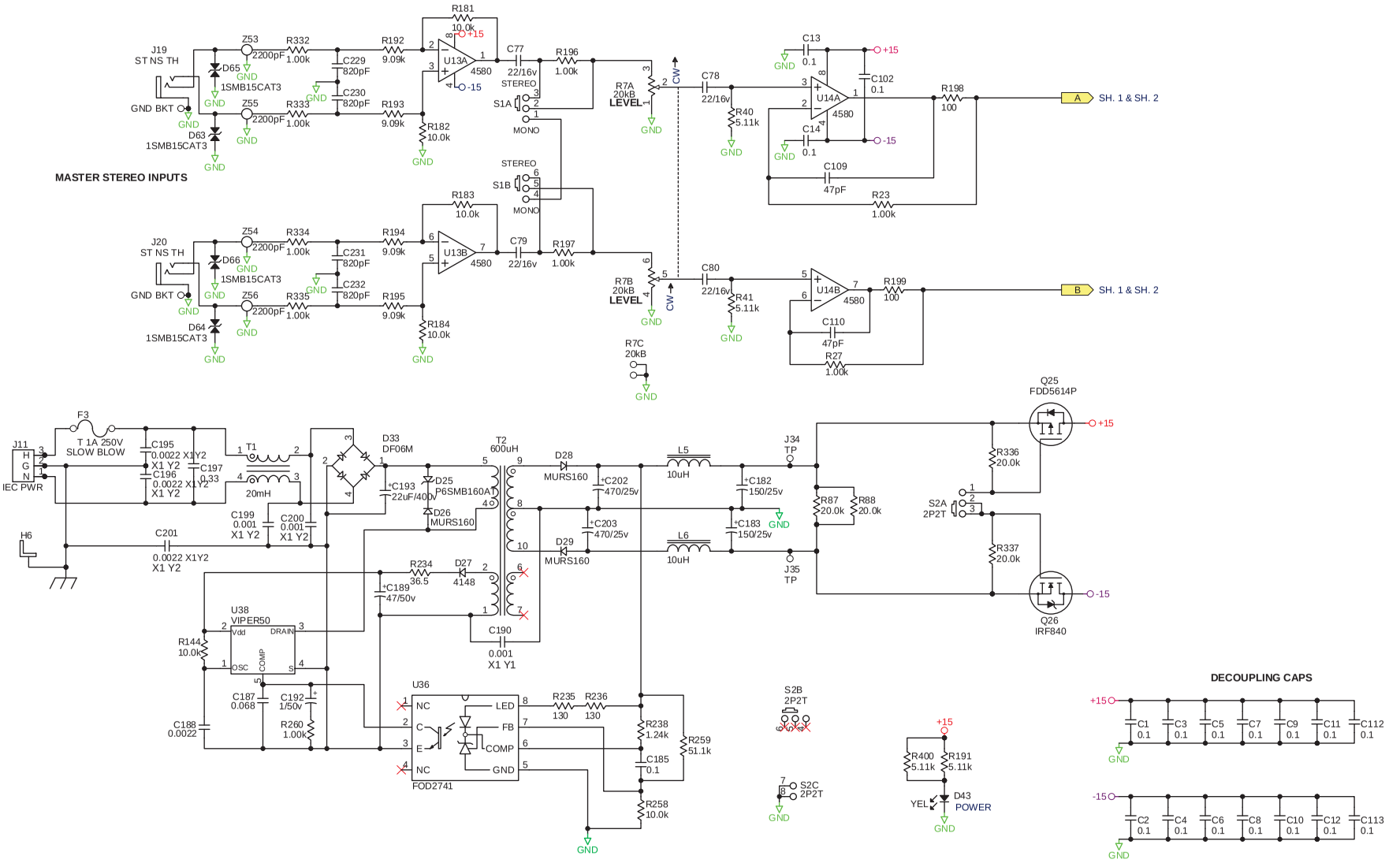

Main

ACTION:	Q26 WAS MTP3055 WAS DOC 114596 SKH 27AUG14
DRAWN BY:	MRR
CHECKED BY:	RJ

RANE
10802 47th Avenue West
Mukilteo WA 98275-5098

MSTR STEREO IN/PWR HC6S

SHEET: 3 of 3

116803

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FACTORY AUTHORIZED SERVICE

Your unit may be serviced by the Rane Factory or any Authorized Rane Service Center. To find a Service Center near you, please call the Rane factory, or check the Rane website. Please do not return your unit to Rane without prior authorization.

Rane Corporation

To obtain service or a Return Authorization, please phone 425-355-6000

or Fax 425-347-7757

The current list of U.S. Rane Authorized Service Centers is found on our website: *www.rane.com/service.html*

LIMITED DOMESTIC WARRANTY

RANE CORPORATION WARRANTS ALL RANE PRODUCTS (EXCEPT THOSE ITEMS CLASSIFIED AS *WEAR PARTS*, AND LISTED ON THE MANUAL-1 PAGE OF EACH OPERATORS MANUAL) PURCHASED IN THE USA AGAINST DEFECTS IN MATERIAL OR WORKMANSHIP FOR A PERIOD OF TWO (2) YEARS. *WEAR PARTS* ARE LIMITED TO A PERIOD OF NINETY (90) DAYS FROM THE INITIAL DATE OF RETAIL PURCHASE FROM AN AUTHORIZED RANE DEALER—WEAR PARTS REQUIRE PROOF OF PURCHASE DATE. This limited warranty extends to all purchasers or owners of the product during the warranty period beginning with the original retail purchase. Rane Corporation does not, however, warrant its products against any and all defects: 1) arising out of material or workmanship not provided or furnished by Rane, or 2) resulting from abnormal use of the product or use in violation of instructions, or 3) in products repaired or serviced by other than authorized Rane repair facilities, or 4) in products with removed or defaced serial numbers, or 5) in components or parts or products expressly warranted by another manufacturer. Rane agrees to supply all parts and labor to repair or replace defects covered by this limited warranty with parts or products of original or improved design, at its option in each respect, if the defective product is shipped prior to the end of the warranty period to any Rane authorized warranty repair facility in the U.S. or to the Rane factory in the original packaging or a replacement supplied by Rane, with all transportation costs and full insurance paid each way by the purchaser or owner.

LIMITED WARRANTY OUTSIDE THE U.S.A.

RANE PRODUCTS ARE WARRANTED ONLY IN THE COUNTRY WHERE PURCHASED, THROUGH THE AUTHORIZED RANE DISTRIBUTOR IN THAT COUNTRY, AGAINST DEFECTS IN MATERIAL OR WORKMANSHIP, THE SPECIFIC PERIOD OF THIS LIMITED WARRANTY SHALL BE THAT WHICH IS DESCRIBED TO THE ORIGINAL RETAIL PURCHASER BY THE AUTHORIZED RANE DEALER OR DISTRIBUTOR AT THE TIME OF PURCHASE. Rane Corporation does not, however, warrant its products against any and all defects: 1) arising out of materials or workmanship not provided or furnished by Rane, or 2) resulting from abnormal use of the product or use in violation of instructions, or 3) in products repaired or serviced by other than authorized Rane repair facilities, or 4) in products with removed or defaced serial numbers, or 5) in components or parts or products expressly warranted by another manufacturer. Rane agrees, through the applicable authorized distributor, to repair or replace defects covered by this limited warranty with parts or products of original or improved design, at its option in each respect, if the defective product is shipped prior to the end of the warranty period to the designated authorized Rane warranty repair facility in the country where purchased, or to the Rane factory in the U.S., in the original packaging or a replacement supplied by Rane, with all transportation costs and full insurance paid each way by the purchaser or owner.

ALL REMEDIES AND THE MEASURE OF DAMAGES ARE LIMITED TO THE ABOVE SERVICES, IT IS POSSIBLE THAT ECONOMIC LOSS OR INJURY TO PERSON OR PROPERTY MAY RESULT FROM THE FAILURE OF THE PRODUCT; HOWEVER, EVEN IF RANE HAS BEEN ADVISED OF THIS POSSIBILITY, THIS LIMITED WARRANTY DOES NOT COVER ANY SUCH CONSEQUENTIAL OR INCIDENTAL DAMAGES. SOME STATES OR COUNTRIES DO NOT ALLOW THE LIMITATIONS OR EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, ARISING BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE, OR OTHERWISE, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO A PERIOD OF TWO (2) YEARS FROM EITHER THE DATE OF ORIGINAL RETAIL PURCHASE OR, IN THE EVENT NO PROOF OF PURCHASE DATE IS AVAILABLE, THE DATE OF MANUFACTURE, SOME STATES OR COUNTRIES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE, COUNTRY TO COUNTRY.

WARRANTY PROCEDURE - Only Valid in the USA

NOTICE! You must complete and return the warranty card or register your product online to extend the Warranty from 2 years to 3 years!

TO VALIDATE YOUR EXTENDED WARRANTY: Use the postcard that came in the box with your unit, or go to *www.rane.com* and click on **New Product Registration**. Fill out the warranty completely, being sure to **include the model and serial number** of the unit since this is how warranties are tracked. If your Rane product was purchased in the USA, mail the completed card or register online with to Rane Corporation within 10 days from the date of purchase. **If you purchased the product outside the USA you must file your warranty registration with the Rane Distributor in that country.** It is advised that you keep your bill of sale as proof of purchase, should any difficulties arise concerning the registration of the warranty card. **NOTICE:** IT IS NOT NECESSARY TO REGISTER IN ORDER TO RECEIVE RANE CORPORATION'S STANDARD TWO YEAR LIMITED WARRANTY.

WARRANTY REGISTRATION is made and tracked by **model and serial numbers only**, not by the purchaser's or owner's name. Therefore any warranty correspondence or inquires **must** include the model and serial number of the product in question. Be sure to fill in the model and serial number in the space provided below and keep this in a safe place for future reference.

WARRANTY SERVICE MUST BE PERFORMED ONLY BY AN AUTHORIZED RANE SERVICE FACILITY LOCATED IN THE COUNTRY WHERE THE UNIT WAS PURCHASED, OR (if product was purchased in the USA) AT THE RANE FACTORY IN THE USA. If the product is being sent to Rane for repair, please call the factory for a Return Authorization number. We recommend advance notice be given to the repair facility to avoid possible needless shipment in case the problem can be solved over the phone. UNAUTHORIZED SERVICE PERFORMED ON ANY RANE PRODUCT WILL VOID ITS EXISTING FACTORY WARRANTY.

FACTORY SERVICE

If you wish your Rane product to be serviced at the factory, **it must be shipped fully insured, in the original packing box or equivalent**. This warranty will **not** cover repairs on products damaged through improper packaging. If possible, avoid sending products through the mail. Be sure to include in the package:

1. Complete return street shipping address (P.O. Box numbers are **not** acceptable).

2. A detailed description of any problems experienced, including the make and model numbers of any other system equipment.

3. Remote power supply, if applicable.

Repaired products purchased in the U.S. will be returned prepaid freight via the same method they were sent to Rane. Products purchased in the USA, but sent to the factory from outside the USA **must** include return freight funds, and the sender is fully responsible for all customs procedures, duties, tariffs and deposits.

In order to qualify for Rane's one year extended warranty (for a total of 3 years parts and labor), the warranty must be completely filled out and sent to us immediately. Valid in USA only.

We recommend you write your serial number here in your owners manual and on your sales receipt for your records.

SERIAL NUMBER:_____ **PURCHASE DATE:**_____

EU Declaration of Conformity

Product Model: HC6S
Serial Numbers: 900000 – 999999
Product Type: Professional Audio Signal Processing

Manufacturer: Rane Corporation
Address: 10802 47th Avenue West, Mukilteo WA 98275-5000 USA

This declaration is issued under the sole responsibility of Rane Corporation.

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/35/EU	The Low Voltage Directive
2014/30/EU	The Electromagnetic Compatibility Directive
2012/19/EU	The Waste Electrical and Electronic Equipment Directive
2011/65/EU	The Restriction of Hazardous Substances Directive
2001/95/EC	The General Product Safety Directive

References to the relevant harmonised standards used in relation to which conformity is declared:

EN60065:2002/A1:2006/A11:2008/A2:2010/A12:2011	Safety for audio, video and similar electronic apparatus.
EN55103-1:2009/AM1:2012	Compatibility of professional electronic A/V apparatus emissions.
EN55103-2:2009	Compatibility of professional electronic A/V apparatus immunity.
EN50581:2012	Technical documentation for RoHS assessment of electronic products.

Additional Information:
Environment E2
CE mark first affixed in 2007

In order for the customer to maintain compliance with these regulations, high quality shielded cable must be used for interconnection to other equipment. No changes or modification of the equipment, other than that expressly outlined by the manufacturer, are allowed. The user of this equipment shall accept full responsibility for compliance with Union harmonisation legislation in the event that the equipment is modified without written consent of the manufacturer.

EN55103-2 Immunity Results: THD+N: 4 dBu, 400 Hz, BW 20 Hz - 20 kHz

Test Description	*Measurement*	*Conditions*
RF Electromagnetic Fields Immunity		
80 MHz - 1000 MHz, 1 kHz AM, 80% depth, 3V/m	<-76 dB	80 MHz - 200 MHz
	<-61 dB	200 MHz - 1000 MHz
Conducted RF Disturbances Immunity		
150 kHz - 80 MHz, 1 kHz AM, 80% depth, 3V rms	<-93 dB	Power Lines
	<-93 dB	Signal Lines
Magnetic Fields Immunity		
50 Hz - 10 kHz, 4.0 - 0.4 A/m	<-84 dB	

Signed for and on behalf of: Rane Corporation
Place of issue: Mukilteo WA USA Date of issue: May 31, 2007
Name: Michaël Rollins Function: Compliance Engineer Signature: 

HC6S

HEADPHONE CONSOLE