RANE

CP64S

COMMERCIAL PROCESSOR
INSTALLATION GUIDE

Contents

Schematics are downloadable at rane.com/cp64s.html

22281

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

CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN

ATTENTION: RISQUE DE CHOCS ELECTRIQUE - NE PAS OUVRIR

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.

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

CAUTION
RISK OF ELECTRIC SHOCK DO NOT OPEN

ATTENTION: RISQUE DE CHOCS ELECTRIQUE - NE PAS OUVRIR

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 détecté 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.

CP64S
COMMERCIAL PROCESSOR

RANE
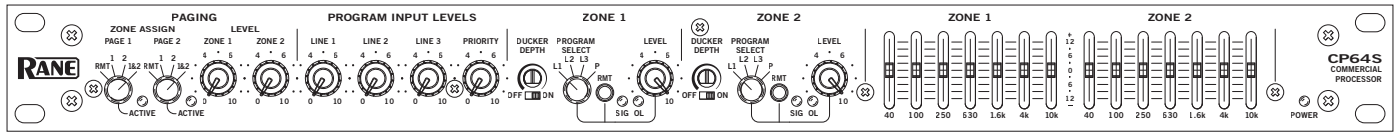
Quick Start

If you were the type that cheated on school book reports by just skimming through the reading assignments, then this page is for you! It gives you not quite enough information to *really* know what you're doing. But, if you follow the recommended set up procedure, you should get at least a "B." *Keep the amplifiers and the CP64S turned off until all connections are made.*

INTERNAL SETTINGS

Access to the following internal controls requires removal of the top cover. All internal settings should be complete before you install the CP64S, before you attach the power cable. The factory default settings work for many applications. However, you may need to change one or more for your system. See "Internal Adjustments" on page 9 if you want to change these defaults:

- Each Page Input has a 15 volt Phantom Power switch. The default is *off*.
- The Page Priority switch assigns priority override to *Page 1, Page 2* or *NO* (none). The default is *Page 1*. If a Page has priority, it overrides the non-priority Page in the Zone(s) it is assigned. The *NO* priority setting allows the Pagers to mix.
- Each Page Input may sum with the Program Pre- or Post-VCA. When set to Pre-VCA, Zone Level, EQ and Limiter circuits act upon the Page. When summed Post-VCA, the Page is not influenced by Zone Level, EQ or Limiter circuits. The default is *Post-VCA*.
- The Zone 1 Stereo/Mono switch default is *Stereo*.
- There are two internal trim controls for the Program Priority detector. The Program Priority Threshold trim has a range of -∞ to -35 dBu with a default of *-50 dBu*. The Program Priority Release Time has a range of 2 to 20 seconds. The default is *12 seconds*.

PAGE INPUTS

Connect Page Inputs to the Euroblock on the rear panel and select the appropriate **MIC** or **LINE** switch position for each. First, set the gain with the Page **TRIM** control, then set the Page **DETECT THRESHOLD** and finally the Page Zone **LEVEL**.

PROGRAM INPUTS

Connect Program sources to the RCA **PROGRAM INPUTS**. If you have a priority program, like a jukebox, connect it to the **PRIORITY** Input. The Program **PRIORITY ASSIGN ZONE** switch assigns priority override to *Off, Zone 1, Zone 2*, or *Both*. In the Zone(s) that it is assigned, the priority program is automatically selected when signal is detected.

EXPAND OUTPUTS

Wire the **EXPAND OUTPUT** Euroblock for each Zone as required. These are cross-coupled line drivers and may be used balanced or unbalanced. Each Expand Output can be *Page*-only, *Program*-only or its *Zone* signal. The *Zone* source will *not* include the Page if the Page is summed Post-VCA. Page is always available from the *Page* source.

ZONE OUTPUTS

Wire the two **ZONE OUT** Euroblocks as required. These are cross-coupled line drivers and may be used balanced or unbalanced. Set the **LIMIT** threshold as required.

ZR1 REMOTE

You may use one or two optional ZR1 Remotes (sold separately) with each CP64S. If you use the ZR1, wire it to the rear **REMOTES** Euroblock as shown on page 11. If a ZR1 remote is not ideal, any simple switch closure to ground will work for the D0 and D1 pins. These pins are TTL compatible (0 to 5 VDC). The logic is inverse Gray Code. Any ground referenced 5 volt DC control may be used as the input to V_1 or V_2. Do *not* ground the Vr_1 or Vr_2 pins.

SETUP ADVICE

The CP64S is *very* versatile. While this makes a large number of system applications possible, it also results in complexity. For this reason, it is *important to use an organized approach for setup and calibration.* Please read and follow the "Recommended Calibration Procedure" on page 13. This will avoid problems and reduce the need to increase our collective phone bills.

WEAR PARTS: This product contains no wear parts.

Block Diagram

PROGRAM INPUTS

LINE 1 — LEFT / RIGHT — 0 dB
LINE 2 — LEFT / RIGHT — 0 dB
LINE 3 — LEFT / RIGHT — 0 dB
PRIORITY — LEFT / RIGHT — 0 dB

ZONE 2 INPUT SELECTOR
ZONE 1 INPUT SELECTOR

6 dB

DEPTH −50dB / −6dB
PAGE DUCKER ON/OFF

SIG OL
PROGRAM / ZONE / PAGE

6 dB ZONE 2 EXPAND + −

Z2 LIMIT THRESHOLD −20dB / +20dB

7-BAND EQ

Z2 VC

6 dB ZONE 2 + −

Z2 PAGE
Z2 PRE PAGE
Z2 POST PAGE

MONO *

7-BAND EQ
Z1 VC
6 dB ZONE 1 LEFT + −

SIG OL
PROGRAM / ZONE / PAGE
6 dB ZONE 1 EXPAND + −

Z1 LIMIT THRESHOLD −20dB / +20dB

7-BAND EQ
Z1 VC
6 dB ZONE 1 RIGHT + −

Z1 PAGE
Z1 PRE PAGE
Z1 POST PAGE

PRGM PRIORITY RELEASE TIME 12→4 SEC. *
−60dBu / −35dBu PRGM PRIORITY THRESHOLD *

A B COM Z1 Z2
PRIORITY ASSIGN OFF / Z1 / Z2 / BOTH

11	OFF
10	Z1
01	Z2
00	BOTH

(ACTIVE LOW)
REMOTE ZONE ASSIGN P1 / P2

PAGE ASSIGN P1 / P2

LOCAL ZONE ASSIGN (FRONT PANEL)

11	RMT
10	Z1
01	Z2
00	BOTH

PAGER ASSIGN LOGIC

PAGE DUCKER

P1 / NONE / P2 PAGE PRIORITY *

GRAY CODE

11	CH 1
10	CH 2
01	CH 3
00	CH 4

(ACTIVE LOW)

PROGRAM SELECT

REMOTE Z1 / Z2
LOCAL (FRONT PANEL) Z1 / Z2

CHANNEL SELECT LOGIC

AUTO FADE
RMT SEL

Z1 VC Z2 VC

ZONE 1 RMT/LOCAL +5 RMT
ZONE 1 LEVEL RMT / LOCAL (FRONT PANEL)
ZONE 2 RMT/LOCAL +5 RMT
ZONE 2 LEVEL RMT / LOCAL (FRONT PANEL)

PAGE INPUTS

PAGE 1 + −
PAGE 2 + −

15V PHTM PWR *
MIC/LINE 30dB PAD
TRIM 30 TO 60dB

P1 ACTIVE
P2 ACTIVE

PAGE 1 DETECT SENS. −∞ / +4dB DET
PAGE 2 DETECT SENS. −∞ / +4dB DET

P1
P2

PAGE BRIDGE

PAGE OL

OR

Z1 PAGE LEVEL
Z2 PAGE LEVEL

Z1 PAGE
Z1 PRE PAGE
PRE/POST VCA *
Z1 POST PAGE
Z2 PRE PAGE
PRE/POST VCA *
Z2 POST PAGE
Z2 PAGE

* INTERNAL CONTROLS

CP64S
COMMERCIAL PROCESSOR

General Description

The CP64S is a versatile commercial preamplifier designed for use in restaurants, bars, health clubs and offices. The CP64S is capable of serving two independent Zones. Two gated Paging inputs and four Program inputs are provided. Ports are provided for expansion of Page, Program or Zone signals. Four levels of priority are supported:

- Priority Page
- Non-Priority Page
- Priority Program
- Non-Priority Program

The versatility of the CP64S allows a wide variety of system configurations while providing simple and intuitive controls.

Two gated Paging Inputs capable of receiving mic or line level input are provided. Each features independent Mic/Line Pad, Gain Trim, detector Threshold, Zone Assign and Zone Level controls. Internally selectable phantom power is provided for each input. Each Paging input may be summed Pre- or Post-Zone Level control to allow setting Paging Level independent of Zone Level. An internal Paging Priority switch allows a "master" pager to override non-priority paging in its assigned zones, while allowing true dual zone independent paging. If no Paging Priority is selected, the Paging inputs mix together for applications like karaoke.

Four stereo Program inputs are provided with independent Input Level controls. Any one of the four Program inputs may be independently assigned in each Zone. One of the Program inputs is a gated Priority Program input. When signal is detected at its input, it overrides any non-priority Program selection in the assigned Zones. The Priority detector features internal, adjustable Threshold and Release-Time controls.

The CP64S has two Zone outputs: Zone 1 is stereo: Zone 2 is mono. Each Zone features independent:

- Level
- Program Select
- Ducker On/Off
- Ducker Depth
- Servo-Locked-Limiter™
- 7 Band EQ (±12 dB)

Versatile wired remote control interface ports are provided for Paging assignment, Zone Level and Zone Program source selection. The ZR1 Source and Volume remote control is available as an accessory.

Features

- Two fully independent gated Mic/Line Paging Inputs
- Paging Priority Assign
- Page Ducking
- Page / Program / Zone Expansion
- Three stereo Program Inputs

- One gated stereo Priority Program Input
- 7-Band graphic EQ for each Zone
- Servo-Locked-Limiter™ for each Zone
- Optional ZR1 Remote Zone Level/Program Select Remote
- Universal Internal Power Supply (100-240 VAC)

Front Panel
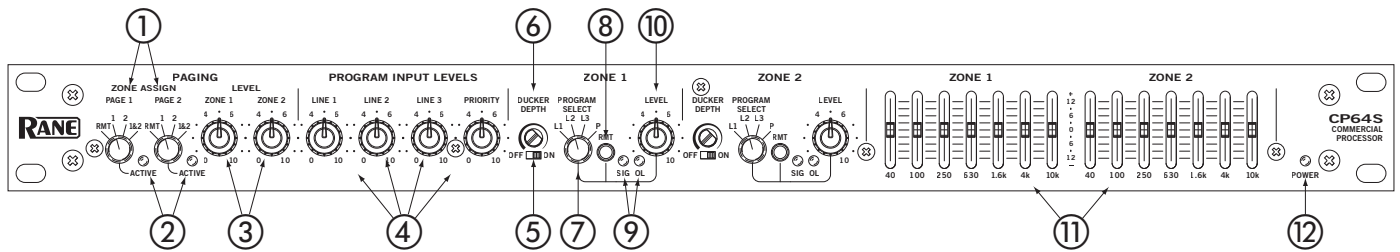
① **PAGING ZONE ASSIGN** switches select the zone(s) a page signal is sent to. The RMT position activates the rear panel RMT ZONE ASSIGN port, allowing a wired switch to assign the active page Zone(s).

② **ACTIVE** indicators light when a page input signal reaches the Page Detect Threshold (see rear panel). *Note that a page is always Active when its Page Detect Threshold is set to minimum.*

③ **ZONE 1 and ZONE 2 PAGING LEVEL** controls adjust (as you guessed) the Paging Level in each Zone.

④ **PROGRAM INPUT LEVELS** allow independent adjustment of the "stereo" level for each Program Input.

⑤ **DUCKER OFF/ON** switches turn the Ducker ON or OFF for each Zone.

⑥ **DUCKER DEPTH** controls allow setting Ducker Depth (the amount of Program attenuation during a Page) from 50 dB (ccw) to 6 dB (cw) for each Zone.

⑦ **ZONE PROGRAM SELECT** switches assign one of four Program Inputs to each Zone.

⑧ **ZONE RMT** switches, when pushed *in*, enable the Remotes port for a Zone. This turns control of Zone Level and Zone Program Select over to the Remotes port. Front panel Zone LEVEL and Zone PROGRAM SELECT controls are *inactive* when RMT is selected. Two optional wired ZR1 remotes may be connected to the Remotes port. *An object smaller in diameter than the switch button is required to engage the recessed RMT switches.*

⑨ **ZONE SIG and OL** indicators show SIGnal present at -20 dBu and OverLoad at -16 dBu (4 dB before clipping) respectively. Signal indicators are located *pre-EQ and pre-VCA.*

⑩ **ZONE LEVEL** controls adjust the overall Level for a given Zone.

⑪ **ZONE Graphic EQ** controls are provided for each Zone. Zone 1 controls are "stereo," with each slider controlling the response of both Left and Right channels. These controls allow ±12 dB adjustment of seven ISO center frequencies on two octave centers.

⑫ **POWER** indicator lights when the CP64S is connected to its needed electrical power. See ⑪ on the rear panel.
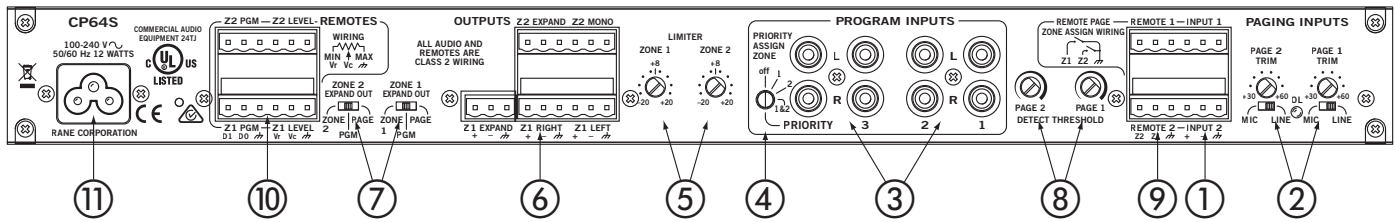
① **PAGING INPUT** Euroblock connectors may be operated balanced or unbalanced. See "CP64S Connections" on page 10. If either page mic needs phantom power, see "Internal Adjustments" on page 9.

② **PAGE 1 and PAGE 2 INPUT MIC / LINE** switches select 30 dB Input Pads when set to LINE. *Phantom Power (if enabled) is disabled when LINE is selected.* If either page mic needs phantom power, see "Internal Adjustments" on page 9.
PAGE 1 and PAGE 2 INPUT TRIM controls adjust Page Input preamplifier gain to match the microphone/source in use, *not* to set the page level in the Zones. The range is 30 dB to 60 dB.
PAGING INPUTS OL indicator lights when either of the Page Input preamplifiers comes within 3 dB of clipping, assisting the setting of these trims.
Page 1 is set at the factory for priority over Page 2. If you want to change this, see "Internal Adjustments" on page 9.

③ Four **PROGRAM INPUTS** are provided. Three are non-priority Inputs. The fourth is a Program PRIORITY Input. When signal is present at the PRIORITY Input, it is *automatically* selected as the Input source in the Zone(s) it is assigned with the Program PRIORITY ASSIGN ZONE switch.

④ **PRIORITY ASSIGN ZONE** switch determines in which Zone(s) the automatic priority override is enabled. *Off* (none), *Zone 1*, *Zone 2* or *Both* are the possible settings. If you do not intend to use the Priority Input as an *automatic override* Input, do *not* assign it with this switch. Use the Zone PROGRAM SELECT switch on the front panel.

⑤ **LIMITER** threshold controls set the maximum output level for each Zone. These circuits are true voltage limiters with a ratio of 15:1. The threshold range is -20 dBu to +20 dBu.

⑥ **OUTPUTS** feature balanced cross-coupled line drivers with a Euroblock connector for each Zone. Zone 1 is stereo. Zone 2 is mono, and both Expand outputs are mono. *When operating cross-coupled line drivers unbalanced, it is* **essential** *to ground the (–) pin.* See "CP64S Connections" on page 10.

⑦ **ZONE EXPAND OUT** switches assign *Page*-only, *Program*-only or *Zone 1 or Zone 2* as the source for each Expand Output.

⑧ **DETECT THRESHOLD** sets the Paging input signal level required to gate a Page *on* and light the front panel ACTIVE indicator. The range is -∞ (on) to +4 dBu.

⑨ **REMOTE PAGE ZONE ASSIGN** port provides connection to contact closures for Zone assignment of the Page Inputs at another location. Follow the wiring on page 12.

⑩ **REMOTES** ports provides connection for two optional ZR1 wired remotes. Each ZR1 remote provides remote control of Zone Level and Zone Program Selection. Follow the wiring for "ZR1" on page 11.

⑪ **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!

Internal Adjustments

There are a number of controls inside the CP64S to configure the system for specific applications. Access to these controls is only required once before initial system setup. Do this *before* the CP64S is installed in a rack or wired into a system. Make sure the power cable is unplugged before removing the top cover to gain access. Refer to the diagram below for control locations.

① ② **Phantom Power** is available for both Page Inputs. If phantom power is required for the intended microphone, then set the appropriate switch to *ON*. *If a Paging Input Mic / Line pad switch is set to LINE, Phantom Power is automatically defeated.*

There are five internal switches related to the two Page Inputs. The dot on the circuit board shows the factory default:

① **Page 1 Phantom Power**	15 VDC	**Default: OFF**		Controls Phantom Power at the Page 1 connector.
② **Page 2 Phantom Power**	15 VDC	**Default: OFF**		Controls Phantom Power at the Page 1 connector.
③ **Page Priority Assign**	P1, NO, P2	**Default: P1**		Selects one of the Page inputs as a Priority Page.
④ **Zone 1 Page**	Sum Pre- or Post-VCA	**Default: Post-VCA**		Page and Program levels are independent with Post.
⑤ **Zone 2 Page**	Sum Pre- or Post-VCA	**Default: Post-VCA**		Page and Program levels are independent with Post.
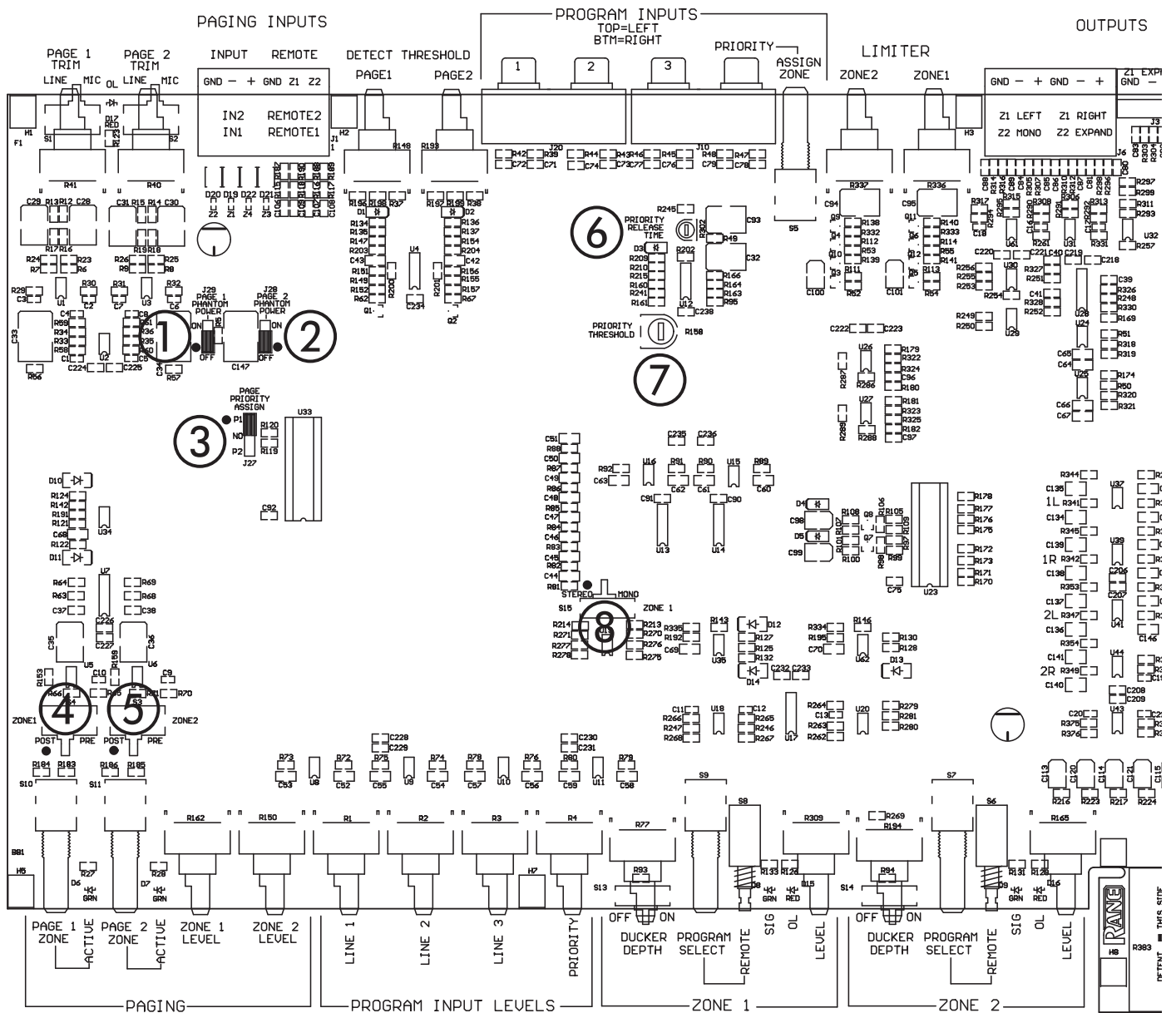
③ **Page Priority Assign** allows you to select one of the Page Inputs as a Priority Page Input. The Priority Pager overrides the non-priority Pager in the Zone(s) it is assigned. The non-priority Pager may still broadcast in any Zone that the Priority Pager is *not* assigned to *or* not currently broadcasting in. If a Page Input is used for emergencies, set it as the Priority Pager. Set the switch to **P1** if you wish Page 1 to have priority over Page 2 (the default setting). If you wish Page 2 to have priority over Page 1, set the switch to **P2**. If **NO** is selected, neither Paging Input has priority and both Pagers may be active at the same time. This allows the Paging Inputs to mix for applications like karaoke or PA.

④ ⑤ The **Zone 1 Page** and **Zone 2 Page** switches allow you to sum Page signals with Program signals "**Pre**" (before) or "**Post**" (after) the VCA. The VCA is used for Zone Level control and Limiting. Therefore, if you require the Page Level to be controlled *independent* of the Program Level, set the switch for that Zone to "**Post**." This is the default setting, and is best for emergency paging. If "**Pre**" is selected, Paging signals sum with Program signals before the VCA. In this instance both Page and Program signal levels *are* affected by the front panel ZONE LEVEL control. Note the following:
- Zone Level, EQ and Limiter circuits *do not* affect Page signals summed Post-VCA.
- Zone Level, EQ and Limiter circuits *do* affect Page signals summed Pre-VCA.
- Page signals are *not* available on the Expand Zone output when summed Post-VCA.
- Page signals are *always* available for the Expand Page output.

There are two internal controls related to the **Program Priority** detector:
⑥ **Priority Release Time** 2 sec to 20 sec (trim pot)
           Default: 12 seconds
⑦ **Priority Threshold**   -∞ to -35 dBu (trim pot)
           Default: -50 dBu
The default settings for the Program Priority detector are chosen for most applications. Detector Threshold settings lower than the default setting of -50 dBu are prone to false triggering unless the source is very quiet. If a source is noisy, you may wish to set the threshold higher to prevent false triggering. The default Release Time is 12 seconds. You may wish to decrease the Release Time if the source is a TV, radio, satellite or other relatively constant signal source. If you have a source like a jukebox, with relatively long search times, you may wish to extend the Release Time.

There is one internal control related to **Zone 1**:
⑧ **Zone 1 Mode**   Mono/Stereo   **Default: Stereo**

CP64S Connections

Do not connect the power cable to the CP64S until all connections are made.

All Input and Output connections are made with Euroblock connectors except for the RCA Program Inputs. When wiring to Euroblocks, a minimum wire gauge of 22 is preferred for reliability (maximum 12 guage). If the ground or shield wire is left shorter, it acts as a strain relief for the other wires. Cable with a flexible jacket is easier to use and less likely to damage the connections. Avoid stripping excess insulation. Inspect wires for nicks that may lead to wire breakage. Fully insert each wire in the appropriate socket and tighten the screw.

Page Input circuits operate balanced or unbalanced. Expand and Zone Outputs are driven by cross-coupled line drivers and operate balanced or unbalanced. For both Inputs and Outputs, wiring is the same. Balanced operation is recommended, and necessary when wire lengths are greater than 10 feet (3 meters). Balanced wiring is (+) to (+), (–) to (–) and shield to shield.

For unbalanced operation, we recommend using *two conductor cable with shield*. The cable is wired to the CP64S the same as for balanced operation. At the *other* end of the cable, connect the (+) wire to signal "hot" and both the (–) *and* shield wires to ground *(important.)*

If you use *single conductor cable with shield*, connect the shield/gnd wire to both the (–) and shield pins at the CP64S. At the *other* end of the cable connect the (+) wire to the signal "hot" and the shield/gnd wire to ground. When unbalanced wiring is used, it is very important for the CP64S and any other unit in the system to have good earth or technical grounds. If a unit is located more than 10 feet (3 meters) away from the CP64S or is of a type that might create grounding problems, use isolation transformers with unbalanced cable.

When operating cross-coupled line drivers unbalanced (i.e., any CP64S Output)*, it is **essential** to ground the (–) pin.*

The four stereo Program Inputs connect to RCA jacks. These Inputs are unbalanced. The same guidelines given above for unbalanced operation apply to these Inputs.

Depending on building grounding, an occasional source of system hum is powering sources and amplifiers on different electrical circuits. Try connecting everything on the same circuit.

See the RaneNote "Sound System Interconnection" on page 19 to answer any uncertainties, especially when using unbalanced sources.
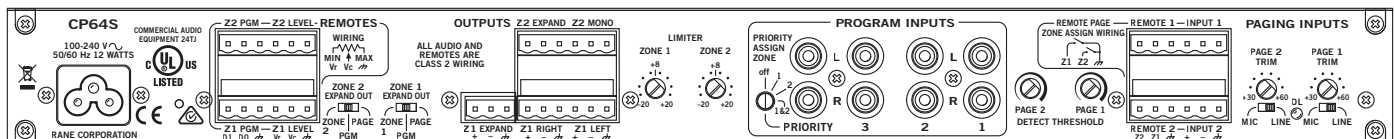
Remote Controls

The CP64S supports wired remotes for *Page Assign*, *Zone Level* and *Zone Source* selection. Wire lengths of up to 1000 feet are possible. A brief list of suitable wire types is provided in the WIRE TYPES section on the next page.

ZR1 ZONE SOURCE / LEVEL REMOTE

The ZR1 remote provides Zone Level and Source Selection, allowing local control from inside the Zone. Two ZR1 remotes may be used (only use *one* in each Zone). If only one of the two controls is used, you may cover the unused control with one of the hole plugs provided in the kit. If you require one ZR1 remote to control both Zones, simply wire the ports in parallel. This may be done with Program Select only, Level only or both. If only one of the two controls is wired in parallel, the other is still available for a second remote.

When paralleling one remote across multiple CP64S's, *all three* control pins *must* be wired, including the shields.

Keep the power cable unplugged to the CP64S until all connections are made. It is important to ensure that the CP64S Remote Ports are not subjected to sustained voltages outside the range of 0 to 5 volts DC or high levels of static. Inputs are protected, however, caution is the better part of… you know. It is a good idea to install the wiring, connect it to the remote assemblies and then make the final connections at the CP64S. Do *not* short Vr_1 or Vr_2 pins to ground. These pins *are* current limited, however, excess heat is generated in the 5 volt supply if a short occurs. *Never subject the Vr_1 or Vr_2 pins to voltages above 5 volts.*
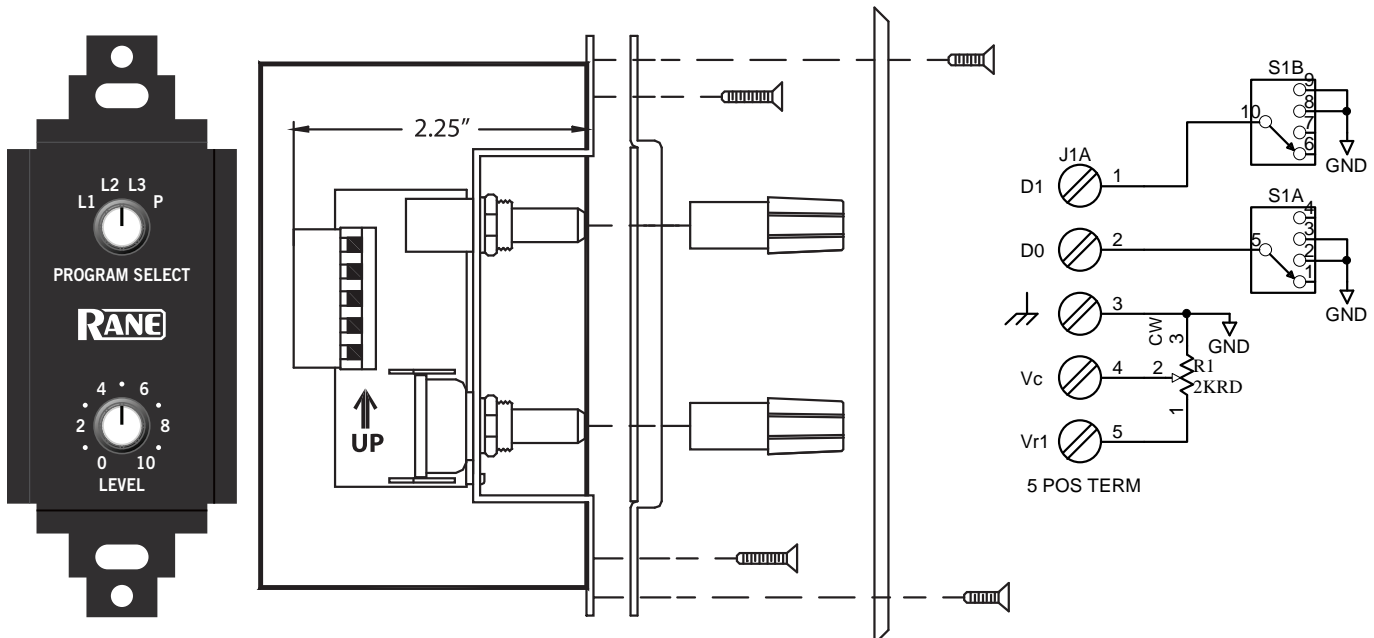
VR1 LEVEL REMOTE

Rane provides the **VR1** Volume Remote for some applications that require a remote level control without the program selector found in the ZR1. It contains the same 2k RD taper pot, and connects as shown in the ZR1 schematic.

With the front panel REMOTE switch, all selection and level is done either on the front panel or at the remote; never both locations. Connecting just a VR1 to the CP64S remote control terminals will allow level adjustment. However without a source selector, the unit will default to source one. If the PRIORITY / L4 INPUT automatic switching is enabled, then the unit will select the L4 signal when present and L1 at any other time. Thus if only a jukebox (P/L4) and other line source (L1) are used, the remote volume control will work just fine.

REMOTE MOUNTING

The ZR1 and VR1 remote assemblies mount in a standard U.S. electrical box with a minimum depth of 2.25". Be sure to note the wire color of each input in order to facilitate correct wiring to the CP64S. Connect each wire to the Euro connector by fully inserting it in the correct socket and tightening the screw. Make sure wires are free of nicks and that the cable jacket is stripped back sufficiently to allow it to lie in the electrical box with the remote assembly inserted. Use the flat head #6 screws supplied with the kit to mount the remote assembly and silk-screened

ZR1 Zone / Level Remote, side view, and schematic

front panel to the electrical box. Note the "UP" arrow screened on the printed circuit board of each remote (mount it pointing *up*).

Install each knob so that the line on the knob is properly aligned with the silk-screening on the front panel of the remote assembly. Install any Decora plate of your choice.

REMOTE PAGE ZONE ASSIGN

Euroblocks provide remote switching of Page Zone Assign for each of the Page 1 and Page 2 inputs. Two momentary (door-bell) switches allow push-to-talk functionality. Push both to page in both zones. If your application requires one of the two Page Assign switches to control both Page 1 and Page 2, simply wire all Page 1 and Page 2 ports in parallel. Only three wires are required for each pair of switches (Z1, Z2 & GND).

Wiring is internal pull-up, active low, switch closure to ground, or 5 volt TTL logic.

11 = Off
10 = Z1 (Zone 1)
01 = Z2 (Zone 2)
00 = Both

**REMOTE PAGE
ZONE ASSIGN WIRING**

Z1 Z2
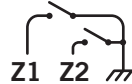
WIRE TYPES

Variations in wire type do not greatly affect the performance of the remote controls. 22-gauge stranded wire with a flexible jacket is recommended. You may use 5-conductor unshielded remote control signal cable for shorter runs (less than 200 feet [60 meters]), or 4-conductor (2 pair) shielded remote control signal cable (use the shield as the ground return) for longer runs (200 to 1000 feet [60 to 300 meters]). The type of wire required is influenced by your installation and local electrical codes.

Rane Corporation does *not* provide or source cable. Please contact your local retail or wholesale outlet, *not* the factory. The following is a short list of suitable cable types:

CONSOLIDATED ELECTRONIC WIRE AND CABLE
Plenum cable:
Unshielded remote control signal cable CAT. # 9896
Shielded remote control signal cable CAT. #9877, CAT. #9852

WEICO WIRE & CABLE INC.
Communication and control cable:
Multiconductor, unshielded CAT. #7606

ALPHA
Communication and control cable:
Multiconductor, unshielded CAT. #1175C

BELDEN
Unshielded remote control signal cable CAT. # 88741
Shielded remote control signal cable CAT. # 88723

Recommended Calibration Procedure

The CP64S is a versatile instrument, allowing it to conform to lots of system applications. The result is complexity. For this reason, it is important be organized in system calibration. Once the internal switches are set and the system connected, take the time for proper calibration. This ordered list of system adjustments will make calibration easy and result in optimum performance. Most important:

- Program Priority Assign *rear panel* **off**
- Limiters *rear panel* **+20 dBu**
- Duckers *front panel* **OFF**
- Page Zone Levels *front panel* **Min**
- Remote Controls *front panel* ***not* selected**
- Paging Zone Assigns *front panel* **1&2 (both)**
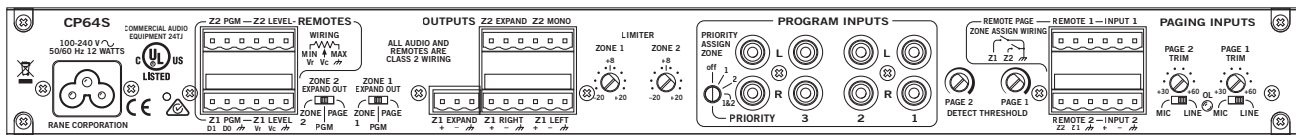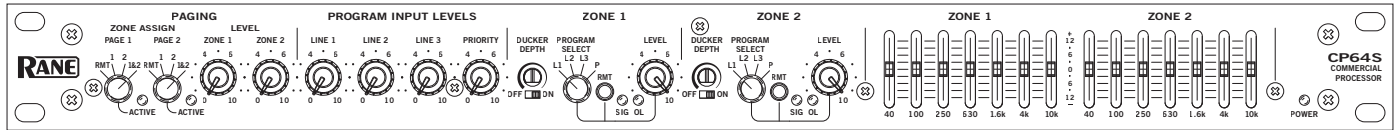
Make sure the power is disconnected!

Control Presets:

Page settings (repeat for second page input):

- Input Pad *rear panel* **MIC or LINE as required**
- Input gain trim *rear panel* **Center (12:00)**
- Detect Threshold *rear panel* **Min (CCW, active)**
- Paging Zone Assign *front panel* **1&2 (both)**
- Paging Level, Zone 1 *front panel* **Min**
- Paging Level, Zone 2 *front panel* **Min**
- Phantom Power *internal* As required. Default Off
- Pre/Post summing *internal* As required. Default Post-VCA
- Page Priority *internal* As required. Default Page 1

Program Input settings:

- Priority Assign Zone *rear panel* **off**
- Program Input Levels *front panel* **Min**
- Priority Threshold *internal* Set to -50 at factory (internal adjust -∞ to -35 dBu)
- Priority Release Time *internal* Set to 12 sec. at factory (internal adjust 2 to 20 sec.)

Zone Settings (repeat for second zone):

- Expand Out *rear panel* As required (Zone/Program/Page)
- Limiter Threshold *rear panel* **CW, +20 dBu**
- Zone Level *front panel* **Max**
- Program Select *front panel* **L1** (if your input is on L1).
- Ducker *front panel* **OFF**
- Ducker Depth *front panel* **Center (about 15 dB)**
- RMT (Remote) *front panel* **Out**
- EQ *front panel* **Flat (center detent position)**
- Stereo / Mono switch *internal* As required (Zone 1 only. Default: Stereo)

System Connections:

- Connect page mics or line-level paging source
- Connect Program sources
- Connect Outputs to amplifiers
- Connect Remotes

You are now ready to calibrate the CP64S…
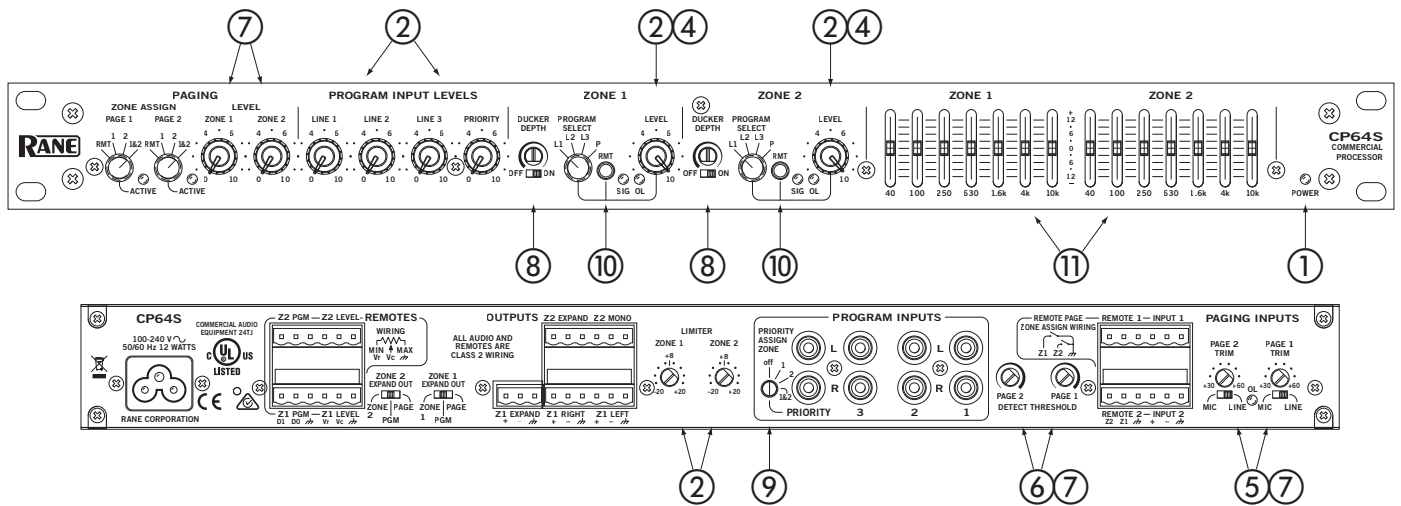
...CP64S Calibration (continued)

① Connect the power cord and verify the **Power** indicator lights.

② Verify **Zone Level** controls are set to Maximum and that you have an active source for each of the Program Inputs you intend to use. Select each **Program Input** and adjust its **Input Level** control to be the very loudest you would *ever* desire.

③ Adjust the rear panel **Zone Limiter** thresholds so that they just start to audibly reduce the output level. This ensures the level in a Zone will never be louder than the maximum level you just set. If you wish one of the Zones to have a lower maximum loudness, lower the **Zone Limiter** threshold accordingly.

④ Turn the **Zone Level** controls down to a comfortable listening level.

⑤ Note that with the **Paging Zone Level** set to minimum, you will not hear the following Page. Speak very loudly (bark) into the Paging Mic. Set the proper preamplifier gain by adjusting the **Page Trim** control (rear panel) so the **Page O**ver**L**oad Indicator (rear panel) just lights. It is important to set the *gain* of the pre-amp *before* setting the **Page Detect Threshold**. Repeat for the second Mic if it is used.

⑥ Speak into the Page Mic in a normal voice and adjust the **Page Detect Threshold** (rear panel) so the **Active** indicator (front panel) lights only when you speak. If the **Page Detect Threshold** is set too low, the Pager may gate *on* due to background sound. Repeat for second Mic if used.

⑦ With an active Program source playing in both Zones, speak into the Page Mic. Adjust the **Zone 1** and **Zone 2 Paging Level** controls (front panel) to provide the correct Page-to-Program mix in each zone. If the **Page Detect Threshold** is set too high, there may be a delay when you start to speak. To correct, lower the **Page Detect Threshold** setting. If a second Page source is used, verify that it has the same level as the first Page source (it should be close). If not, use the **Page Trim** control of the second Page source to adjust its *gain* to match. If you change the gain of the second Page source substantially, be sure to reset the **Page Detect Threshold**.

⑧ Set the **Ducker** switch to **ON**. With an active Program source playing, speak into the Page Mic and adjust the **Ducker Depth** as required. Repeat for both Zones.

⑨ Set the **Program Priority Assign Zone** switch as required (on rear panel). If you do *not* require *automatic* priority program override in a zone, ***do not*** assign it. Instead, use the front panel **Program Select** switch to select the "**P**" program Input as you would any other non-priority input.

⑩ If a remote control is used, select the appropriate **RMT** switch settings on the front panel to verify the remote functions correctly.

⑪ Adjust the Equalizers as required.

...You're all set.

Specifications

Parameter	Specification	Limit	Units	Conditions/Comments
MIC/LINE PAGING INPUTS	Two mono			All controls duplicated for both inputs
..........Input Type	Euroblock			Balanced; Instrumentation amplifier
..........RFI Filter	Yes			
..........Gain range	+30 to +60	2	dB	Continuously adjustable
..........Frequency Response	30 Hz to 40 kHz	+0/-3	dB	Maximum gain
..........Input Referred Noise	-125	1	dBu	Gain: 60 dB, Rs: 150 Ω, BW: 20 kHz
..........CMR	40	min	dB	20 to 20 kHz
..........THD+N	.05	.01	%	Gain: 30 dB, +4 dBu out, 1 kHz, BW: 80 kHz
..........Phantom Power	+15	4%	VDC	Internal switch
..........Mic Input impedance	500	1%	Ω	Each leg to ground
..........Line Pad	30	1	dB	
..........Line Input impedance	14.5k	1%	Ω	Each leg to ground. Defeats phantom power
..........Signal Detector Range	off to +4	typ	dBu	Continuously adjustable
..........Signal Detector Attack	.5	typ	msec	Fixed
..........Signal Detector Release	3	typ	sec	Fixed
..........Overload Indicator	+16	1	dBu	4 dB before clipping.
..........Front Panel Zone Assign	Remote, Z1, Z2, Both			Z1 = Zone 1; Z2 = Zone 2
..........Remote Zone Assign	Off, Z1, Z2, Both			Internal pull-up; Active low; Switch closure to ground or 5 volt TTL logic.
..........Pre/Post Paging assign	Summed with program Pre VCA or Post VCA via Internal switch			
..........Page Priority Assign	P1 (Page 1) NO (none) P2 (Page 2)	1	dBu	Priority pager overrides non-priority pager only in assigned zones; Selecting NONE allows the two pagers to mix.
..........Paging Zone Level Adjust	off to 0		dB	Independent for each Zone
..........Page Remote Selector	11 = Off 10 = Z1 (Zone 1) 01 = Z2 (Zone 2) 00 = Both	1	dBu	Internal pull-up. Active low; Switch closure to Ground or 5 volt TTL logic.
PROGRAM INPUTS	Four stereo			All controls duplicated for all four inputs
..........Input Type	RCA			Unbalanced
..........Input Level adjust	off to 0		dB	
..........Frequency Response	10 Hz to 50 kHz	+0/-3	dB	
..........Input impedance	10 k	20%	Ω	
.....Priority Program Input				
...............Input Detector Range	off to -35	typ	dBu	Internal trim, factory set to -50 dBu
...............Release Time Range	5 to 20	typ	sec	Internal trim, factory set to 12 seconds
...............Attack Time	50	typ	msec	For a 20 dB step; Fixed.
...............Assign	OFF, Z1, Z2 or Both			
EXPAND OUTPUTS				All controls duplicated for both zones
..........Number of Expand Outputs	Two			Z1 & Z2, both mono
..........Expand Selector	Zone Program only Page only			Note: If a Page signal is summed Post-VCA, it is not present on the Expand Zone output. It is available for the Expand Page output.
..........Output Type	Balanced			Cross-coupled; Euroblock connector
..........Gain: Zone	12	1	dB	
...................Page/Program	6	1	dB	
..........Frequency Response	10 Hz to 50 kHz	+0/-3	dB	

Parameter	Specification	Limit	Units	Conditions/Comments
..........S/N	-84	1	dBr	re +4 dBu. BW: 20 Hz-20 kHz
..........THD+N	.05	.01	%	+4 dBu, 1 kHz, BW: 80 kHz
..........Crosstalk	-75	max	dB	1 kHz, Rs: 25 Ω, ch/ch
..........Output impedance	100	1%	Ω	Each leg
..........Maximum Output	+24 dBu	typ		Ri: 2 kΩ
ZONE OUTPUTS				
..........Number of Outputs	Two			Zone 1 Stereo, Zone 2 mono
..........Output Type	Euroblock			Balanced; Cross-coupled
..........Gain: From Program Inputs	12	1	dB	
...................From Page Inputs	6	1	dB	
..........Frequency Response	10 Hz to 50 kHz	+0/-3	dB	
..........S/N	-84	1	dBr	re +4 dBu. BW: 20 Hz-20 kHz
..........THD+N	.05	.01	%	+4 dBu, 1 kHz, BW: 80 kHz
..........Crosstalk	-75	max	dB	1 kHz, Rs: 25 Ω, (L/R or ch/ch)
..........Output impedance	100	1%	Ω	Each leg
..........Maximum Output	+20	typ	dBu	Ri = 600 Ω
..........Signal Present Indicator	-20	typ	dBu	Maximum
..........Overload Indicator	+16	typ	dBu	4 dB before clipping
..........Ducker: Enable	ON/OFF			Independently defeatable for each Zone
...............Depth Range	-50 to -6	typ	dB	Continuously adjustable
..........Limiter: Threshold Range	-20 to +20	typ	dB	Continuously adjustable
...............Attack Time	20	typ	msec	For a 10 dB step; Fixed.
...............Release Time	250	typ	msec	For a 10 dB step; Fixed.
...............Ratio	15:1	typ		Soft knee.
PROGRAM SELECTION				
..........Local (Front Panel)	L1, L2, L3 or P (priority)			Independent for each Zone
..........Zone RMT Selector	11 = L1			Internal pull-up. Active low.
	10 = L2			Switch closure to ground or 5 volt TTL.
	00 = L3			Gray Code logic.
	01 = P			
..........Zone RMT Volume	Attenuation = 64 mV/dB			Control element: 2 kΩ pot, reverse-log taper;
(RMT engaged)	Range 0 V to +5 V (0 dB to -78 dB)			Or any ground referenced 0-5 VDC control.
..........Off Isolation	-80	typ	dB	1 kHz, Rs: 25 Ω
EQ CIRCUITS				
..........Boost/Cut Range	+12 to -12	.5	dB	
..........ISO Center Frequencies	40, 100, 250, 630, 1.6k, 4k, 10k	3%	Hz	Zone 1: Stereo 7-band. Zone 2: Mono 7-band.
..........Filter Bandwidth	2	3%	oct	
UNIT: Conformity	CE, FCC, cULus			
..........Universal Line Voltage	100-240 VAC, 50/60 Hz			12 watts
..........Construction	All Steel			
..........Size	1.75"H x 19"W x 8.5"D			1U (4.4 cm x 48.3 cm x 21.6 cm)
..........Weight	5 lb			(2.3 kg)
Shipping: Size	4.5" x 20.3" x 13.75"			(11.5 cm x 52 cm x 35 cm)
..........Weight	9 lb			(4.1 kg)

Note: 0 dBu = 0.775 Vrms

Example System: Restaurant
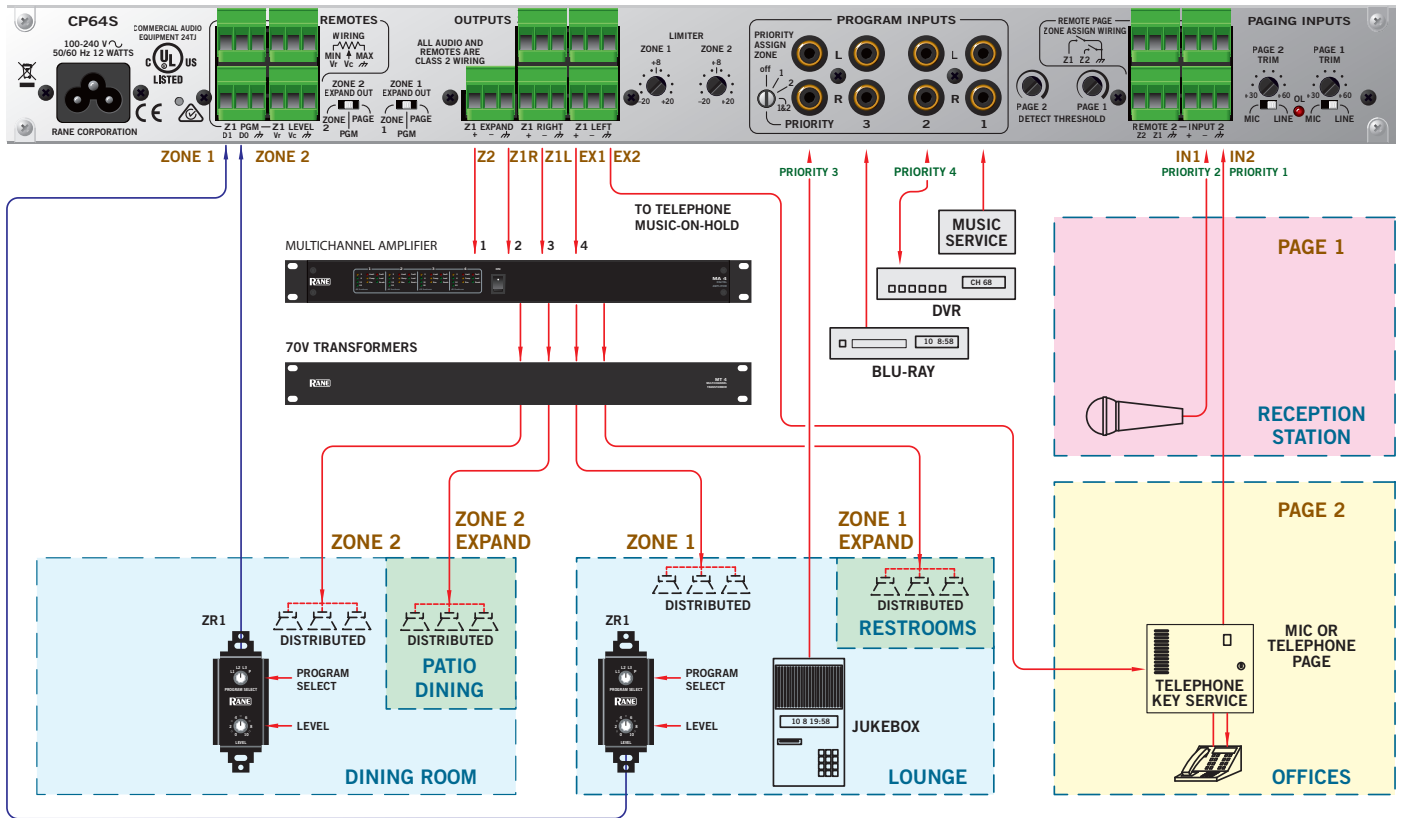
This Restaurant has a Paging mic from reception, emergency phone paging from the office, 4 music sources, with remotes for source selection and volume within the dining room and lounge.

Program Source - Allows the use of up to 4 stereo sources such as TV audio or a Music service.

Jukebox - This Input allows the Jukebox to automatically override the selected Program source when it is turned on.

Page 1 - Is for the receptionist, this is second priority.

Page 2 - Is from a telephone from the office phone system so you can page using your phone, this is first priority.

ZR1 Zone Remote - Allows remote control of Program Selection and Zone Level within the restaurant or lounge.

Zone 1 - Can be stereo if the restroom zone is not used.

Zone 2 - Runs to the dining room and patio.

CP64S
COMMERCIAL PROCESSOR

RANE

Example System: Retail Store

This Store has a Paging mic from the phone system in the office, 4 music sources, and remote controls for source selection and volume within the retail floor and a meeting/demo room.

Program Source - Allows the use of up to 4 stereo sources such as TV audio or a Music service.

Jukebox - This Input allows any source to automatically override the selected program source when it is turned on.
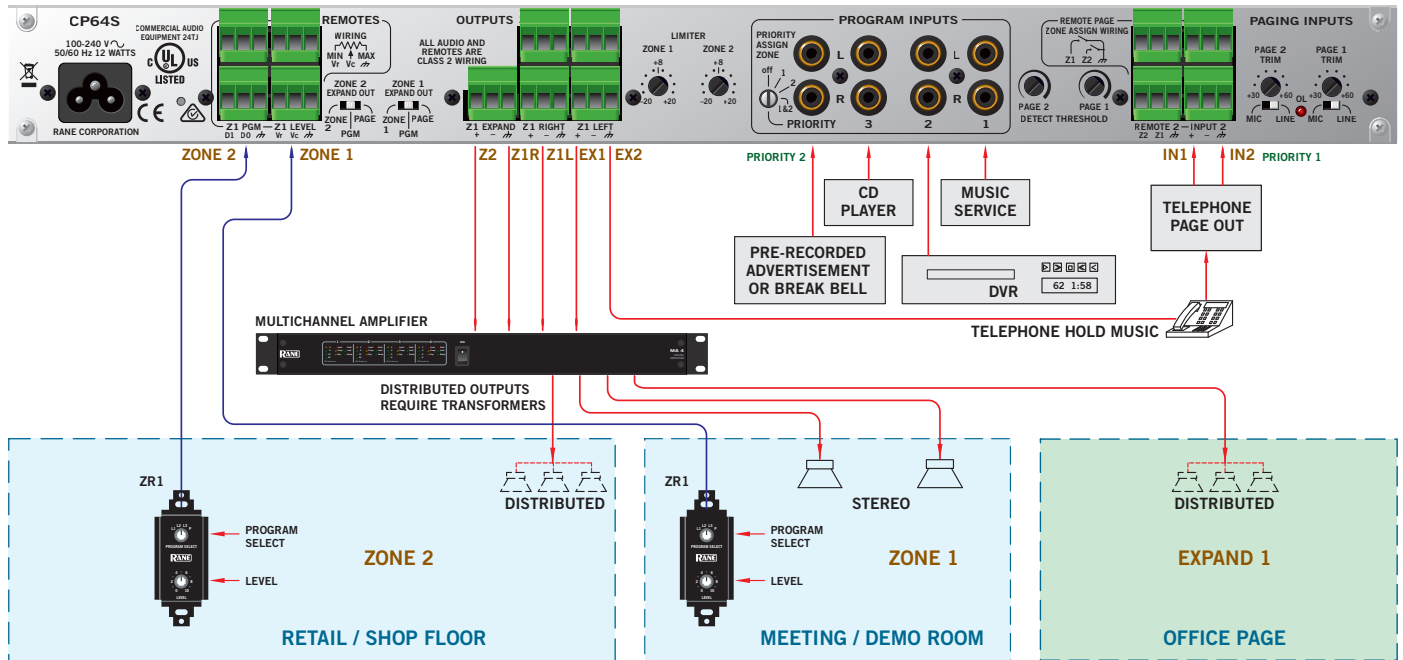
Page - Is from a telephone from the office phone system so you can page using your phone. This has first priority.

ZR1 Zone Remote - Allows independent remote control of music source and level within the store and meeting/demo room.

Zone 1 - Stereo audio in the meeting/demo room.

Zone 2 - Mono to the retail floor speakers.

Sound System Interconnection

- **Cause & prevention of ground loops**

- **Interfacing balanced & unbalanced**

- **Proper pin connections and wiring**

- **Chassis ground vs. signal ground**

- **Ground lift switches**

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.)*

Rane Technical Staff

RaneNote 110
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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
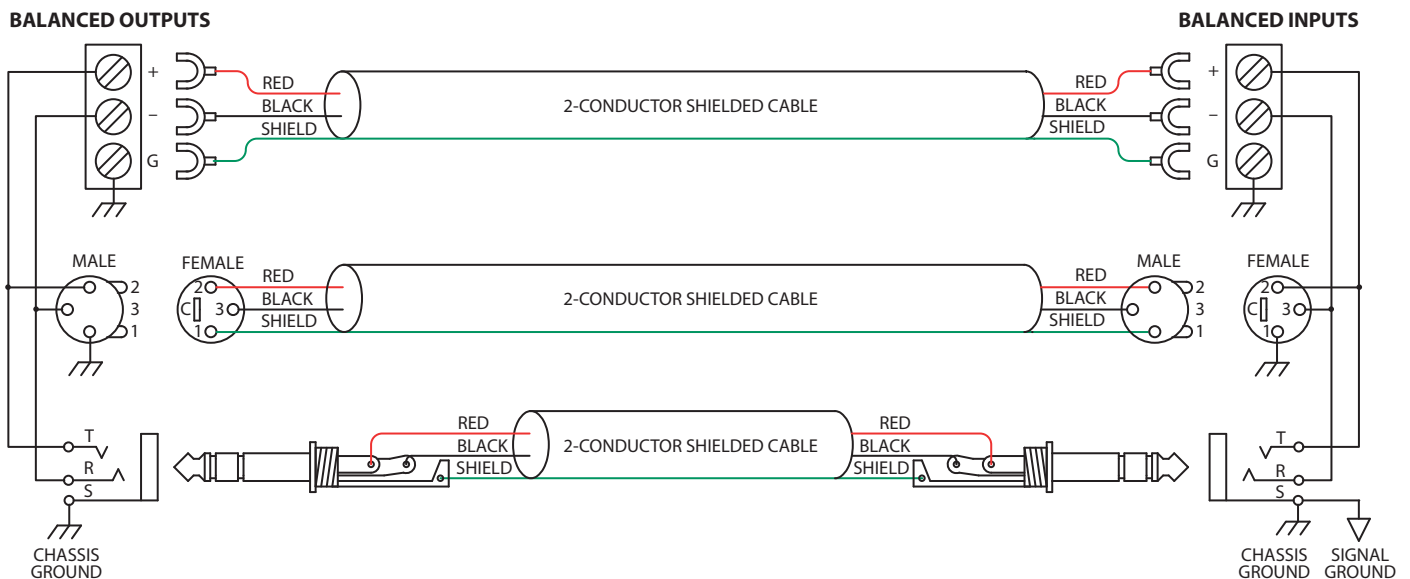
Figure 1a. The right way to do it.

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 everywhere, 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.
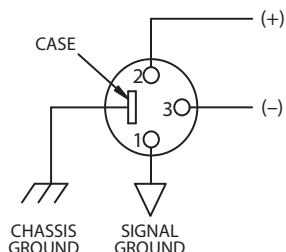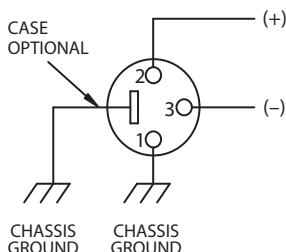
The Next Best Right Way To Do It
The quickest, quietest and most foolproof method to connect balanced and unbalanced is to **transformer isolate all unbalanced connections**. See Figure 2.

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
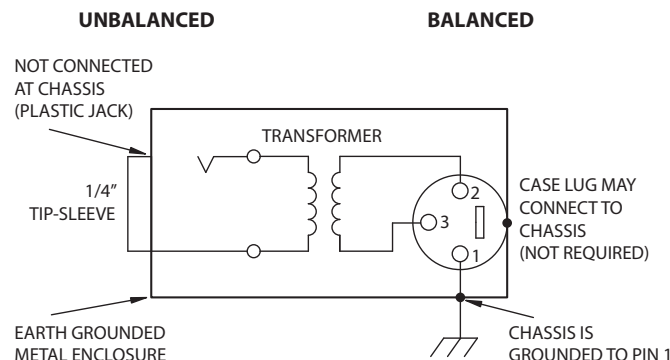

Figure 1b. Recommmended practice.

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.
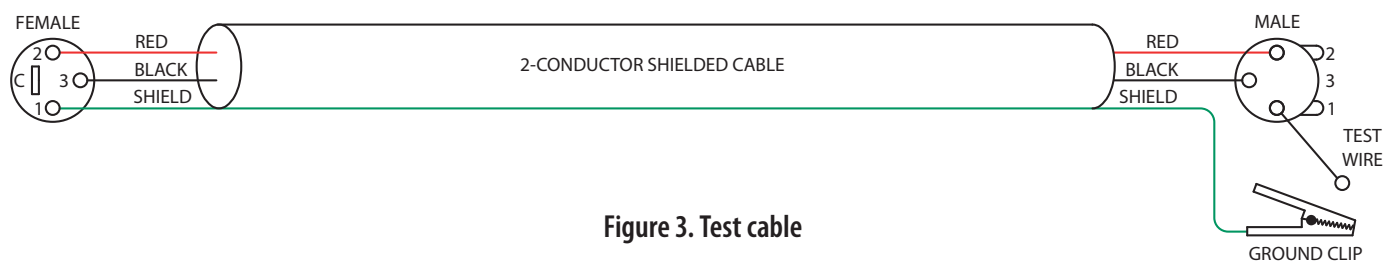

Figure 3. Test cable

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

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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).

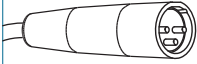*Band-Aid is a registered trademark of Johnson & Johnson*

To Input
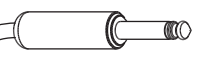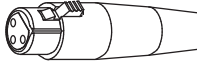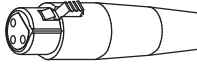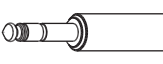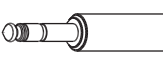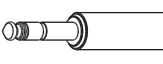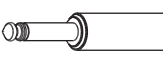
CABLE CONNECTORS	MALE BALANCED XLR	¼" BALANCED TRS (TIP-RING-SLEEVE)	¼" OR 3.5mm UNBALANCED TS (TIP-SLEEVE)	UNBALANCED RCA	BALANCED EUROBLOCK
FEMALE BALANCED XLR (NOT A TRANSFORMER, NOR A CROSS-COUPLED OUTPUT STAGE)	1	2	3 [B]	4 [B]	+ to + − to − SHIELD NC
FEMALE BALANCED XLR (EITHER A TRANSFORMER OR 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

From Output

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
RED
BLACK
N/C
MALE
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
RED
BLACK
N/C
MALE
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).

Interconnection-7

From Output   **To Input**

13 T=RED S=BLACK — RED / BLACK / N/C — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — MALE — 1=SHIELD / 2=RED / 3=BLACK

14 T=RED S=BLACK — RED / BLACK / N/C — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — T=RED / R=BLACK / S=SHIELD

15 A T=RED S=SHIELD — RED / SHIELD — 1-CONDUCTOR SHIELDED CABLE — RED / SHIELD — T=RED / S=SHIELD

16 A T=RED S=SHIELD — RED / SHIELD — 1-CONDUCTOR SHIELDED CABLE — RED / SHIELD — T=RED / S=SHIELD

17 T=RED S=BLACK — RED / BLACK — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — MALE — 1=SHIELD / 2=RED / 3=BLACK

18 T=RED S=BLACK — RED / BLACK — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — T=RED / R=BLACK / S=SHIELD

19 A T=RED S=SHIELD — RED / SHIELD — 1-CONDUCTOR SHIELDED CABLE — RED / SHIELD — T=RED / S=SHIELD

20 A T=RED S=SHIELD — RED / SHIELD — 1-CONDUCTOR SHIELDED CABLE — RED / SHIELD — T=RED / S=SHIELD

21 A T=RED R=BLACK S=SHIELD — RED / BLACK / SHIELD — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — MALE — 1=SHIELD / 2=RED / 3=BLACK

22 A T=RED R=BLACK S=SHIELD — RED / BLACK / SHIELD — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — T=RED / R=BLACK / S=SHIELD

(ANY UNBALANCED CONNECTOR)   (CHECK: NO STANDARD POLARITY ON EUROBLOCKS)

23 T=RED S=BLACK — RED / BLACK — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK / SHIELD — + / − / ⏚

(CHECK: NO STANDARD POLARITY ON EUROBLOCKS)   (ANY UNBALANCED CONNECTOR)

24 ⏚ / − / + — RED / BLACK / SHIELD — 2-CONDUCTOR SHIELDED CABLE — RED / BLACK — T=RED / S=BLACK

CROSS-COUPLED OUTPUT ONLY: CONNECT BLACK TO SHIELD AT THIS END AND SET GROUND LIFT SWITCH TO 'GROUNDED' (IF PRESENT).

©Rane Corporation   10802 47th Ave. W.,   Mukilteo WA 98275-5000 USA   TEL 425-355-6000   FAX 425-347-7757   WEB rane.com

Interconnection-8

DOC 102907

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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.

RANE

Warranty Procedure - Valid in USA only

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 U.S.A., 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 U.S.A. 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 U.S.) AT THE RANE FACTORY IN THE U.S.. 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 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 U.S., but sent to the factory from outside the U.S. 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: CP64S
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	<-84 dB	80 MHz - 200 MHz
	<-63 dB	200 MHz - 1000 MHz
Conducted RF Disturbances Immunity		
150 kHz - 80 MHz, 1 kHz AM, 80% depth, 3V rms	<-85 dB	Power Lines
	<-84 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: April 20, 2007
Name: Michaël Rollins   Function: Compliance Engineer   Signature:

CP64S

COMMERCIAL PROCESSOR

RANE

PAGING INPUTS

PAGE 1 TRIM
+60 OL +30 +60
MIC LINE LINE
MIC LINE

PAGE 2 TRIM
+30 +60 OL MIC
MIC LINE LINE

REMOTE PAGE — REMOTE 1 — INPUT 1
ZONE ASSIGN WIRING
Z1 Z2

REMOTE 2 — INPUT 2
Z2 Z1 ⏚ + −

PAGE 1 DETECT THRESHOLD
PAGE 2 DETECT THRESHOLD

PROGRAM INPUTS

L R — 1
L R — 2
PRIORITY — 3

PRIORITY ASSIGN ZONE
off 1 2 1&2

LIMITER
ZONE 1
+8 −20 +20
ZONE 2
+8 −20 +20

OUTPUTS   Z2 EXPAND   Z2 MONO

Z1 LEFT
+ − ⏚
Z1 RIGHT
+ − ⏚
Z1 EXPAND
+ − ⏚

ALL AUDIO AND REMOTES ARE CLASS 2 WIRING

ZONE 1 EXPAND OUT
ZONE 2 EXPAND OUT

ZONE PAGE PGM
1

ZONE PAGE PGM
2

REMOTES — Z2 LEVEL — Z2 PGM

WIRING
MIN MAX
Vr Vc ⏚

Z1 LEVEL
Vr Vc ⏚
Z1 PGM
D1 D0 ⏚

COMMERCIAL AUDIO EQUIPMENT 24TJ
c UL us
LISTED
CE

CP64S
100-240 V ∿
50/60 Hz 12 WATTS

RANE CORPORATION