

QUICK START

Shredded, this document makes excellent packing material. In its present form, it makes interesting and useful reading. If you run out of patience quickly, at least read this part to make sure you don't exterminate everything within a two mile radius by doing something wrong.

Attach one or two channels of inputs and outputs to the respective connectors on the rear. *This device uses low impedance balanced line drivers. Do not connect the XLR "+" or "-" output pins to ground, as this may cause the power supply to shut down. For unbalanced use, leave the unused output pin ("+" or "-") unterminated.*

With the **RATIO** turned all the way *down* at **1:1**, **THRESHOLD** turned all the way *up* to **20 dBu**, and the **LEVEL** controls in their *center* at **0 dB**, you have an expensive patch cord.

While sending a signal to the MC 22, adjust the **INPUT LEVEL** so the **+4 dBu** LED lights occasionally, but the **OL** LED does not light. Now increase the **RATIO** to something useful, like **2:1** (with the control set at 2, the Ratio is 2:1; at 5, it is 5:1.) Adjust the **THRESHOLD** to the point you want the Compressor to kick in. The **GAIN REDUCTION** meter reads the amount of signal compression.

Both Compressors will activate by the source material applied to either Channel if the **LINK** switch is **ON**. This is the preferred setting for stereo program material.

COMPRESSOR

ACTIVE/BYPASS switch

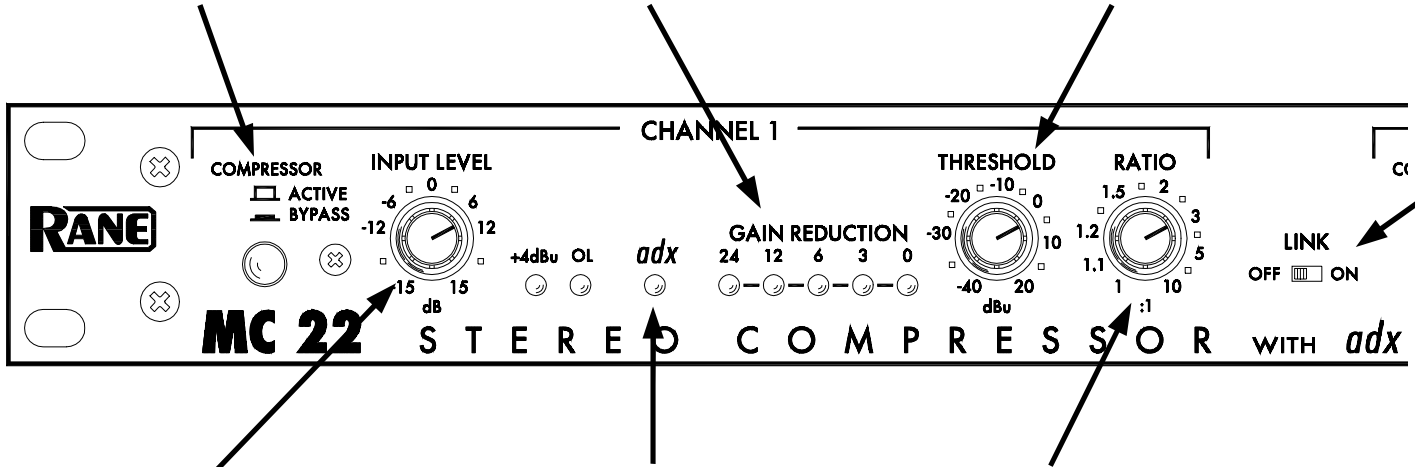
This switch compares compressed and non-compressed signal. There is one for each Channel. The INPUT LEVEL remains active regardless of switch position.

GAIN REDUCTION LEDs

These LEDs show the amount of average signal reduction in dB. This aids in setting the THRESHOLD and RATIO controls by showing how much compression is occurring.

THRESHOLD control

This control sets the point at which the Input signal level causes the Compressor to become active. See Figure 1 on page Manual-4.



INPUT LEVEL control

This controls the overall level. Unity gain is reached at "0". With signal applied, set this control so the +4 dBu LED lights occasionally. If the OL (overload) LED flashes, turn the INPUT LEVEL control down.

adx LED

This illuminates whenever noise reduction is active. This automatic downward expander circuit acts like a gate to keep the system quiet when no signal is present. When the input level drops below -55 dBu, downward expansion occurs at a ratio of 2:1. See Figure 3 on page Manual-5.

RATIO control

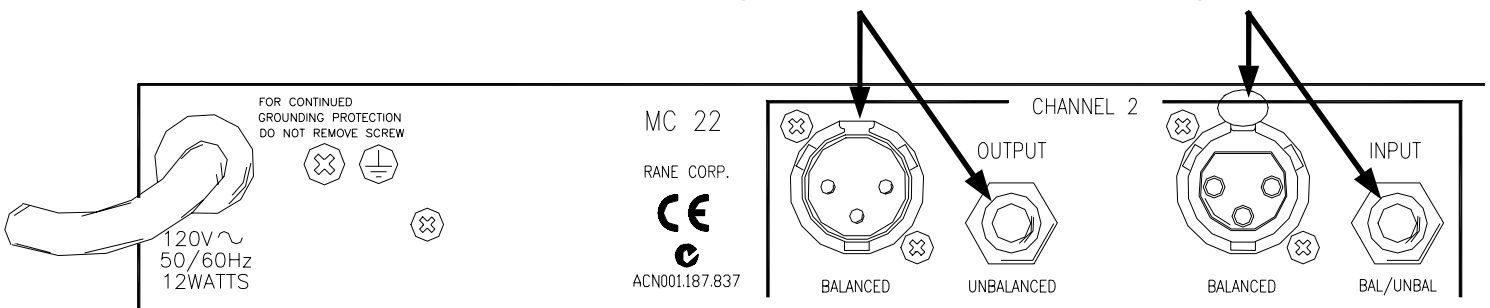
Once the threshold is exceeded, the ratio of input change to output change is determined by this control. The compressor has no effect when set at 1:1. But at 10:1, it takes a 10 dB input signal increase above the Threshold to produce a 1 dB increase in Output Gain. See Figure 2 on page Manual-4.

CHANNEL 2 OUTPUT

Same as Channel 1 Output.

CHANNEL 2 INPUT

Same as Channel 1 Input.

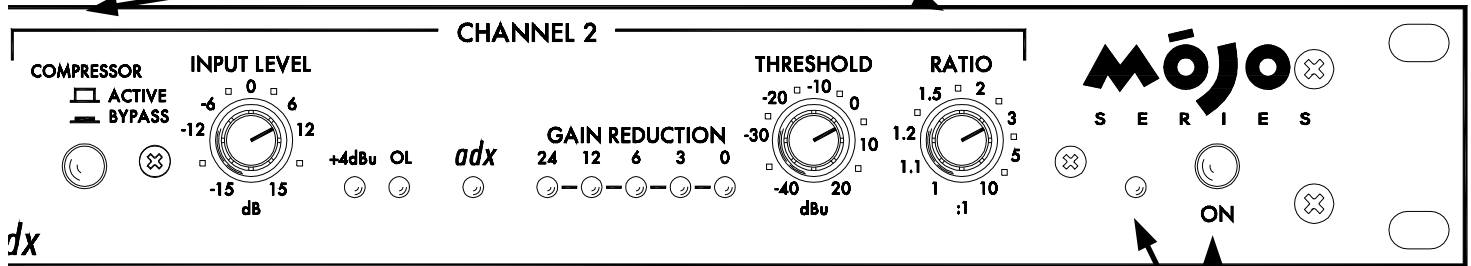


LINK switch

Switch this to ON when using stereo material. This activates both Compressors when either Channel's signal exceeds the set Threshold, preserving stereo imaging.

CHANNEL 2 controls

These duplicate the controls in Channel 1.



Power ON switch and LED

Your basic, straightforward power switch. When the switch is depressed and the yellow LED is lit, the MC 22 is ready to go.

Cable Wiring

In agreement with IEC and AES/ANSI standards, XLR wiring convention is pin 2 Positive (hot), pin 3 Negative (cold), and pin 1 chassis grounded and signal grounded (to allow unbalanced operation). The XLR case is chassis grounded.

CHANNEL 1 OUTPUT

Use either the balanced XLR or the unbalanced 1/4" TS jack. Using both types of Outputs are permissible to drive two devices, such as an amplifier and a recorder. *This device uses low impedance balanced line drivers. Do not connect the XLR "+" or "-" output pins to ground, as this may cause the power supply to shut down. For unbalanced use, leave the unused output pin ("+" or "-") unterminated.*

CHANNEL 1 INPUT

Choose between the balanced XLR or the balanced/unbalanced 1/4" TRS jacks, but only use one. Inserting a 1/4" TS jack will work—however—use balanced lines, especially when connecting cables over 10 feet in length. Consult SOUND SYSTEM INTERCONNECTION on page Manual-10.

CONNECTION INFORMATION

3 PIN XLRS:

PIN 1 = SHIELD, PIN 2 = POSITIVE (+), PIN 3 = NEGATIVE (-)

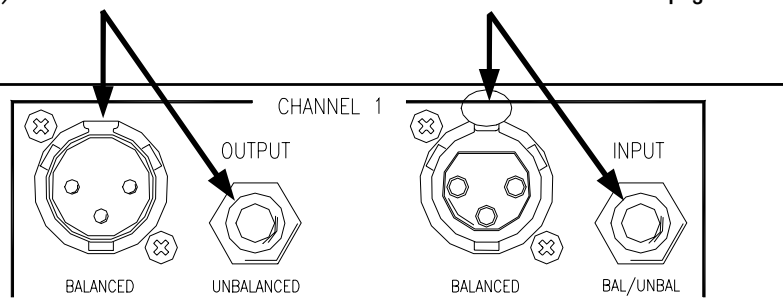
1/4 INCH PHONE JACKS, UNBALANCED:

TIP = HOT (SIGNAL), RING = GROUND, SLEEVE = GROUND

1/4 INCH PHONE JACKS, BALANCED

TIP = POSITIVE (+), RING = NEGATIVE (-), SLEEVE = SHIELD

PLEASE REFER TO OWNERS MANUAL FOR MORE INFORMATION



OPERATING INSTRUCTIONS

A PRIMER

Let's start with what a compressor actually does. No matter how you cut it, this is an automatic volume control. It is a hand on a knob, turning the volume down and turning it up again. The hand is really quick and really accurate, but it's just turning a volume control.

When the input signal reaches a level set by the THRESHOLD control, the compressor begins turning down the signal by an amount determined by the RATIO control. The MC 22, like most compressors, operates by making the loud signals quieter, but does not make the quiet parts louder. However, by keeping the loud signals under control, the entire system may be turned up when necessary to make the quiet parts louder.

PRE-FLIGHT CHECKLIST

Before proceeding, it's a good idea to turn the control knobs to the following positions:

1. LEVEL control 0 dB
2. THRESHOLD control fully clockwise
3. RATIO control fully counterclockwise
4. COMPRESSOR switches .. ACTIVE (out)

This renders the MC 22 with no compression, but allows signal through at unity gain. No change occurs either in the ACTIVE or BYPASS position of the COMPRESSOR switch.

LEVEL

Before making any Threshold adjustments, set the LEVEL control so the +4 dBu LED lights occasionally, and the OL LED does not light. Be aware that changes to the Input Level will affect the Threshold level.

THRESHOLD

The threshold is the point at which gain adjustment begins. When the input signal is below the threshold, the MC 22 acts like a straight wire. When the signal is loud enough to cross the Threshold, the compressor is active and turns the volume down. Various Threshold points are illustrated in Figure 1 below. How much it gets turned down is determined by the RATIO control (shown at 2:1).

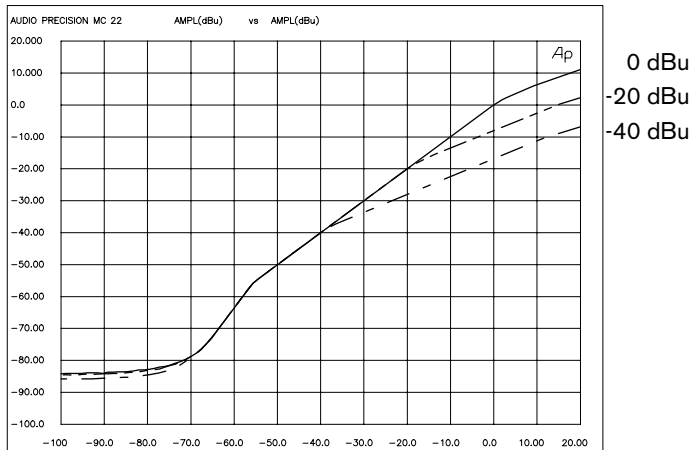


Figure 1. Set to 2:1 Ratio. Thresholds at -40 dBu, -20 dBu, and 0 dBu.

Vertical axis = output level, horizontal axis = input level.

RATIO

Once the threshold is exceeded, the increase in output compared to the input signal increase depends on the RATIO setting. An ordinary preamp set for unity gain or a straight wire has a ratio of 1:1, that is, the output level tracks the input level perfectly. A 2 dB change at the input produces a 2 dB change at the output.

For a 10:1 ratio, a 10 dB blast at the input would rise only 1 dB at the output – heavy compression. Kinder, gentler ratios are in the 2:1 to 3:1 range. Figure 2 illustrates various Ratios.

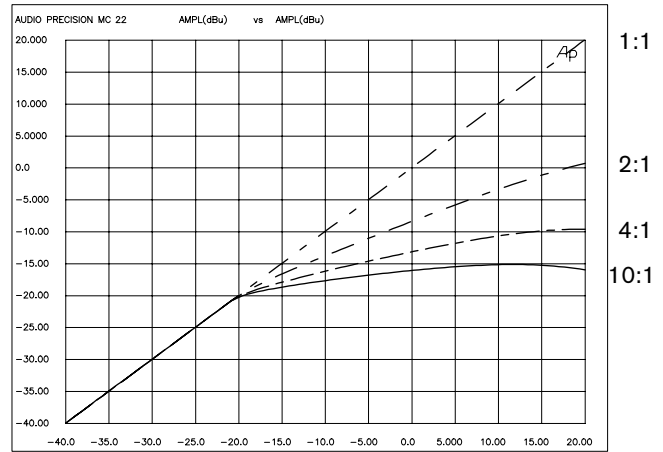


Figure 2. Threshold at -20 dBu. Ratios of 1:1, 2:1, 4:1, and 10:1.

Vertical axis = output level, horizontal axis = input level.

Referring to Figure 2, note that the Ratio indicated is the average over 40 dB of compression. The ratio is initially lower. This action provides a “soft” response which is less audible than hard limiting. For example, the 10:1 ratio response shows an initial ratio of about 6:1 and ends with a ratio of ∞:1.

ATTACK TIME

Attack is the time which passes between the moment the input signal exceeds the threshold, and the moment that the gain is actually reduced. This can be a difficult control to set, so Rane made it easier by pre-setting an attack time of 30 ms/10 dB step, an optimal setting for a wide variety of material.

RELEASE TIME

Release time is the time which passes between the moment the input signal drops below the threshold and the moment that the gain is restored. Another difficult control for the average user to adjust, Rane presets the release rate at 0.3 dB/ms.

LIMITING

A limiter is a special form of compressor set up especially to reduce peaks for overload protection. In other words, it is a compressor with a maximum ratio. A compressor is usually set up to change the dynamics for purposes of aesthetics, intelligibility, or recording or broadcast limitations. Once the threshold of a limiter is reached, no more signal increase is allowed. The MC 22 acts as a limiter when set at a very high ratio of 10:1.

adx NOISE REDUCTION

The *adx* circuit is an automatic downward expander, acting like a compressor running in reverse, making the quiet parts quieter. This is valuable in reducing system background noise. The MC 22 has an automatic expander set at a Ratio of 2:1 that is only active when the input level drops below -55 dBu. The *adx* LED illuminates when the downward expander is active. See Figure 3 to the right.

LINKING IN STEREO

When using the MC 22 as a true stereo processor, with left signal in Channel 1 and right signal in Channel 2, it is recommended to turn the LINK switch ON to prevent large balance and image shifts. While LINKed, both channels attenuate by exactly the same amount when either Compressor works, maintaining correct stereo imaging. For both Channel detectors to contribute, set the controls to similar positions in both Channels when LINKed. The *adx* circuits are not linked.

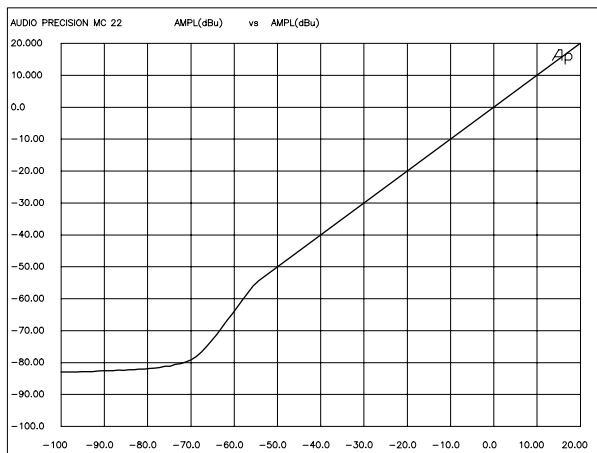


Figure 3. *adx* preset to 2:1 Ratio, Threshold at -55 dBu.
Vertical axis = output level, horizontal axis = input level.

MC 22 APPLICATIONS

TWO CHANNEL COMPRESSOR/LIMITER

In this case, the audio path on channel 1 is completely separate from channel 2, allowing you to use it as a stereo unit *or* for doing two completely different processes to two completely different signals. For stereo use, the front panel LINK switch allows you to link Channels. When either Channel's Threshold is reached, both channels compress equally, preserving the stereo image. The higher of the two Ratio settings will affect both Channels when the first Threshold is reached, and the lesser Ratio setting affects both Channels when the second Threshold is reached.

GUITAR & BASS

Where does the unit go in the signal chain? Well, that depends on how you want it to function. If it's a comp/limiter for the input signal, it would go after the guitar (if the guitar has a line-level output) and before the preamp. If it's to function as a limiter to protect the speakers in the rig, it would go after the preamp and before the power amp. Another method is to insert the unit in the effect loop of the preamp. This allows the bass signal to be affected by the pre-amp first, then the comp/limiter, and then sent to the power amp. This can be desirable with tube pre-amps.

RECORDING

Use it on bass guitar, piano, drums, or vocals—as an effect or to tailor dynamic range for a particular recording medium. Patch it between line-level devices or in your mixer inserts or “loops”. The MC 22 gives you more control and a less tortured sound, and keeps instruments sounding “up-front.” In digital recording, compress an extremely wide dynamic range into a signal that won't go into digital overload, i.e. severe clipping. This is really valuable during a live digital recording when you just don't know how loud it may get, and digital distortion can ruin an otherwise good take. Set both the THRESHOLD and RATIO relatively high, just enough to limit the peaks.

Of special interest are instruments which have large level differences in their tonal ranges. String pops on a bass are one example, shrill peaks on a flute are yet another. The higher tones require more breath and can seem much louder than lower pitches. Another good application would be a drum mix or vocal submix.

LONG DISTANCE LINE DRIVER

The MC 22 is excellent as a line level amp for driving long lines (from the mixer to the stage for instance). With the COMPRESSOR switch in the BYPASS position, the INPUT LEVEL control and the output amplifiers remain in the circuit. This provides a very low distortion, low noise line driver. Balanced XLR connections are recommended for the long run from the MC 22's outputs. A balanced piece of equipment (equalizer or amplifier) must be used at the receiving end of this long line.

For unbalanced systems, use the 1/4" inputs on the MC 22 and use the balanced XLR outputs to run the long distance. See the SOUND SYSTEM INTERCONNECTION section for proper cable wiring.

SOUND SYSTEM WITH COMPRESSION

Let's run a stereo system with compression (see Figure 1 on the next page). For this example, we use a Rane Mojo MX 22 2-Way Crossover and a Mojo MQ 302 Stereo Equalizer along with the MC 22 Stereo Compressor. Patch the MC 22 Compressor Inputs from the program source or mixer outputs, and send the MC 22 Outputs to the system equalizer (if you have one), and then on to the crossover inputs (if you have one). Set the equalizer and crossover Inputs to unity gain. Set the LINK switch to ON, and adjust the THRESHOLD and RATIO controls to keep the entire system dynamic range under control. Locating the compressor before the equalizer results in correct spectral balance during compression.

DRIVER PROTECTION

To individually limit Low and High drivers in a biamped system, connect the Crossover Low Output into one MC 22 Input, and the High Output into the other MC 22 Input. The MC 22 Outputs go right to the respective low and high frequency power amplifier inputs (see Figure 2 on the next page). Be sure the LINK switch is OFF. Set the RATIO controls to 10:1.

Assuming your input signal has peaks in excess of -20 dBu, you should be able to rotate the THRESHOLD controls and see some GAIN REDUCTION meter action. You should begin to hear the difference. Leave these controls at whatever level is appropriate for your application. For the most precise settings, see the section below.

DRIVER PROTECTION FINE TUNING

1. Determine the driver's maximum continuous average power rating in watts (W) (specified by the manufacturer).
2. Determine the driver impedance "z" in ohms (specified by the manufacturer).
3. Using the data in steps (1) and (2) above, calculate the maximum signal level in dBu that the driver can handle.
Max dBu = $20 \cdot \log(\sqrt{(w \cdot z)}/.775)$.
4. Determine the gain of the amplifier in dB (if the amplifier has a level control, you may wish to measure the gain). If, i.e., you put 1V in, how many volts come out? Then convert to dB (20 log gain).
5. Subtract the gain of the amplifier in dB from the answer in step (3) to obtain the correct Threshold setting for the MC 22.
6. Set the MC 22 Ratio to 10:1.

NOTES:

Any change in amplifier sensitivity setting will effect the power limit to the driver.

If the MC 22 is placed just before the amplifier, no other system levels will effect the power limit setting.

Example:

1. Driver power rating: $w = 100$ watts.
2. Driver impedance: $z = 4$ ohms.
3. $20 \cdot \log(\sqrt{(w \cdot z)}/.775) = 28.2$ dBu.
4. Amplifier gain is 30 dB (1 V in equals 31.6 V out).
5. Set the MC 22 THRESHOLD control to $28.2 \text{ dBu} - 30 \text{ dB} = -1.8 \text{ dBu}$.
6. Set the MC 22 RATIO control to 10:1.

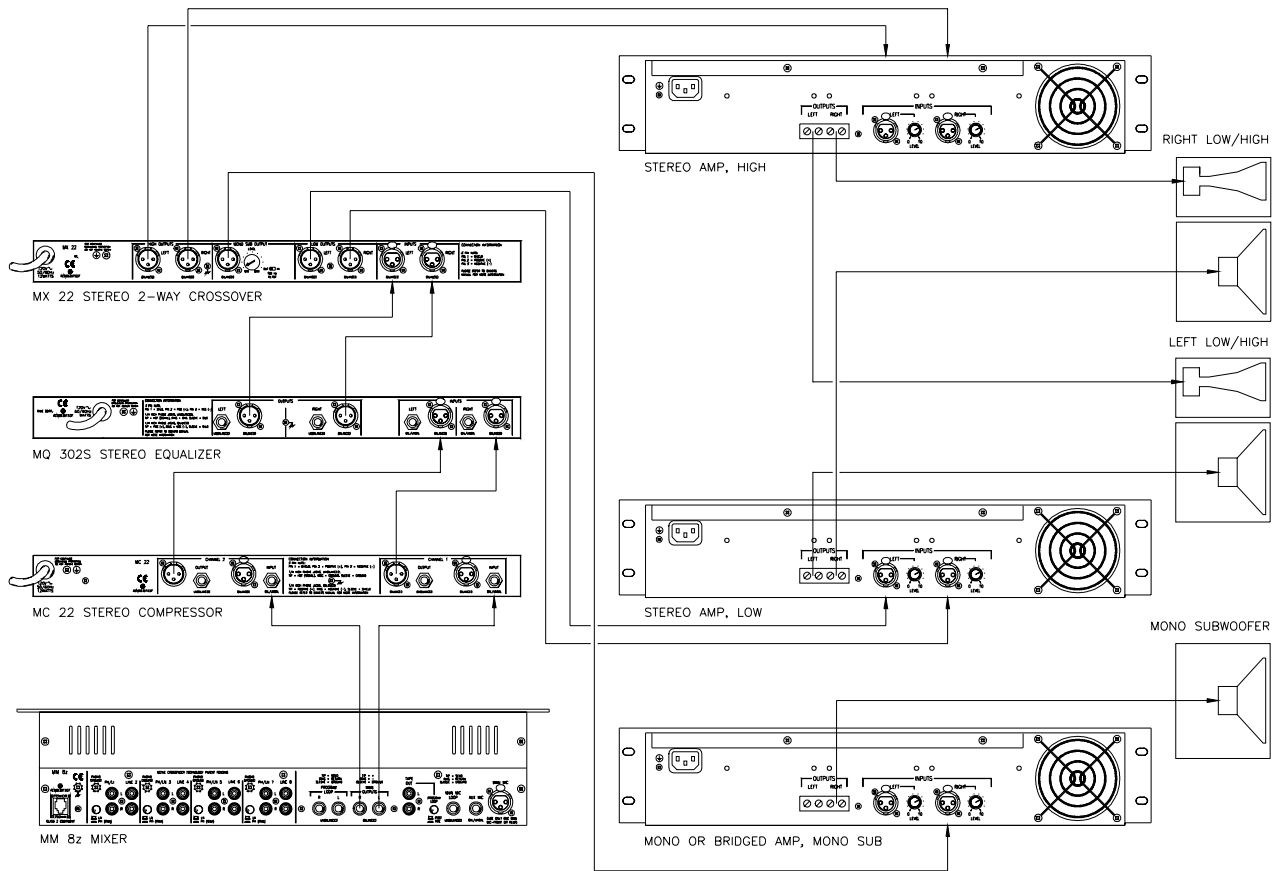


Figure 1. Sound system with compression example

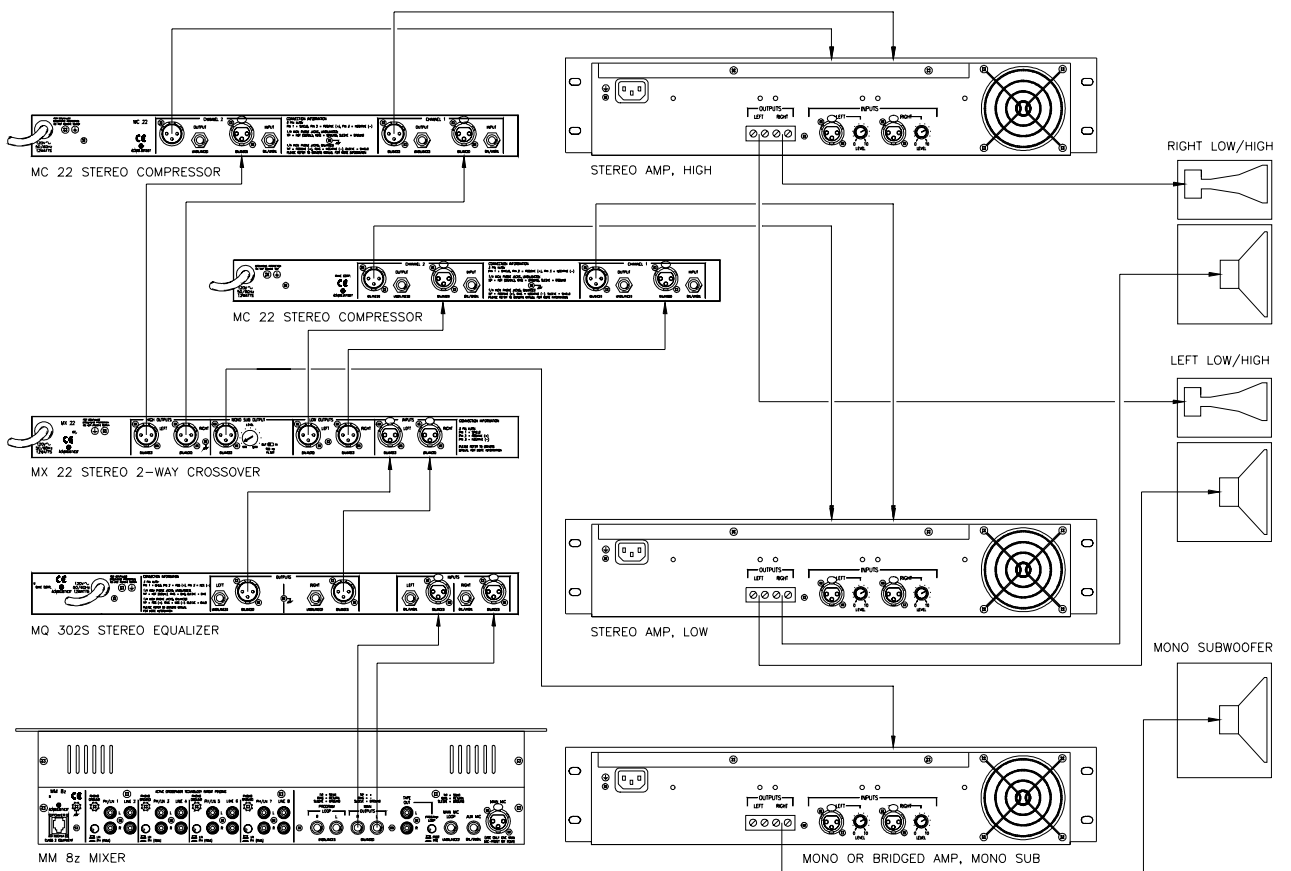


Figure 2. Sound system with Driver protection.

SOUND SYSTEM INTERCONNECTION

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.*)

THE ABSOLUTE BEST RIGHT WAY TO DO IT

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. 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].

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**. Your audio dealer can recommend such a transformer.

The goal of transformer 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). Do not be tempted to use 3-prong to 2-prong "cheater" adapters to lift grounds. This is a dangerous and illegal practice.

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 can create 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 a matter of personal preference and should be religiously obeyed; choose inputs or outputs and always lift the side you choose (our drawings happen to disconnect the outputs). 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 one-end-only shield connection increases the possibility of high frequency (radio) interference since the shield may act as an antenna. Many reduce this potential RF interference by providing an RF path through a small capacitor (0.1 or 0.01 microfarad ceramic disc) connected from the lifted end of the shield to the chassis. 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.

See the following page for suggested cable assemblies for your particular interconnection needs. Find the appropriate output configuration from either your mixer output or the MX 22 output (down the left side), and then match this with the correct balanced or unbalanced input to the MX 22 or the amplifier (down the right side.) An "off-the-shelf" cable may be available or modifiable. Soldering should only be attempted by those trained in the art.

SUMMARY

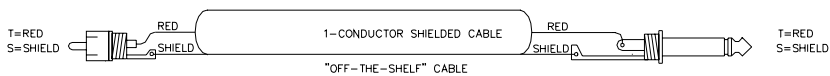
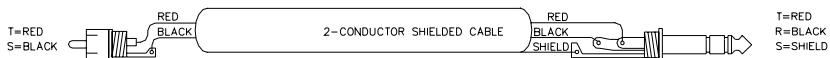
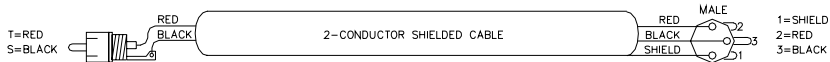
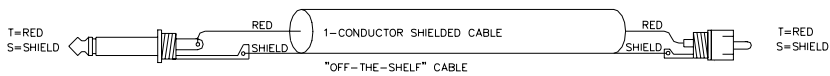
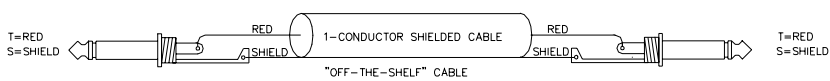
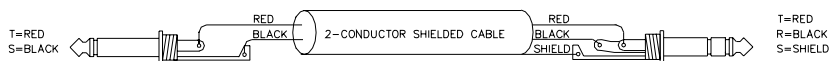
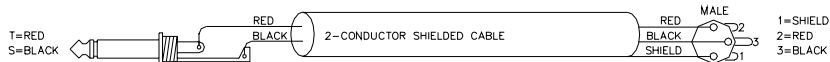
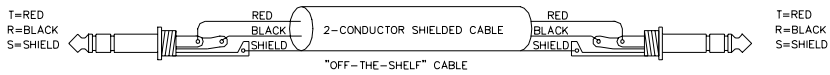
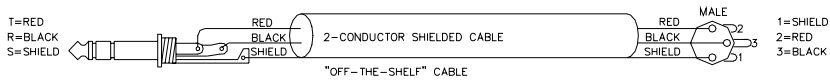
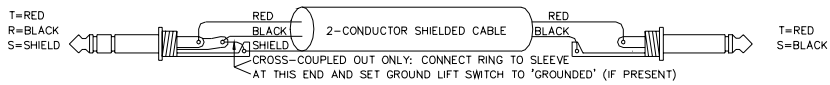
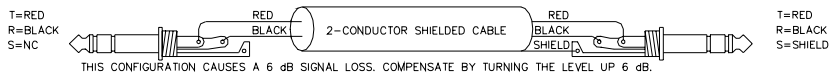
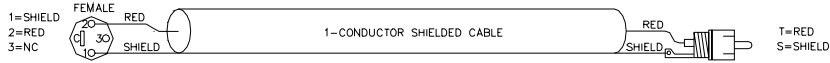
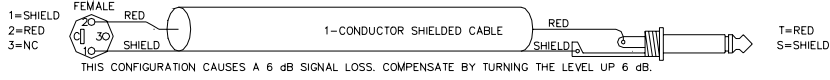
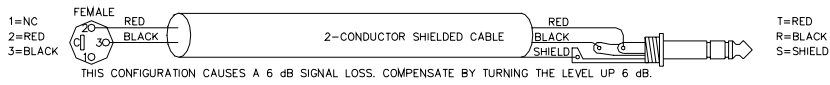
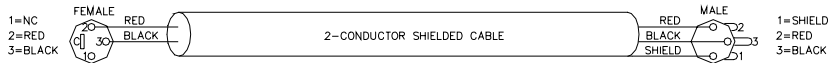
If you are unable to do things correctly (i.e. use fully balanced wiring with shields tied to the *chassis* at the point of entry, or transformer isolate all unbalanced signals from balanced signals) then there is no guarantee that a hum free interconnect can be achieved, nor is there a definite scheme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

WINNING THE WIRING WARS

- Use balanced connections whenever possible.
- 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 ten feet (three meters) in length. Lengths longer than this will amplify the nasty side effects of unbalanced circuitry's ground loops.

This information was condensed from Rane Note 110, "Sound System Interconnection". If you would like the complete note, call or email the factory, download it from Rane's web site (addresses on page Manual-12), or ask your dealer for a copy.

VARIOUS XLR & 1/4" CABLE ASSEMBLIES



FROM OUTPUT

TO INPUT

MOJO GLOSSARY

balanced line The recommended method of interconnecting audio equipment. A balanced line requires three conductors: a twisted-pair for the signal (positive and negative) and an overall shield. *The shield must be tied to the chassis at both ends for hum-free interconnect.*

bandwidth *Abbr. BW* The numerical difference between the upper and lower -3 dB points of an audio band.

clipping What occurs when a unit tries to produce a signal *larger than its power supply*. The signal takes on a flat-topped, or *clipped* shape. When an amplifier tries to go above its max power, it *clips*.

compressor A signal processing device used to *reduce the dynamic range* of the signal passing through it. For instance, an input dynamic range of 110 dB might pass through a compressor and exit with a new dynamic range of 70 dB. The modern usage for compressors is to turn down (or reduce the dynamic range of) just the loudest signals. Other applications use compressors to control the *creation* of sound. When used in conjunction with microphones and musical instrument pick-ups, compressors help determine the final timbre by selectively compressing specific frequencies and waveforms.

connectors Audio equipment uses different styles:

RCA An *unbalanced* pin connector commonly used on consumer and some pro equipment; aka *phono plug*

XLR A 3-pin connector common on pro audio equipment.

Preferred for *balanced line* interconnect; aka *Cannon plug*

¼" TRS 1. *Stereo* ¼" connector consisting of *tip* (T), *ring* (R), and *sleeve* (S) sections, with T = *left*, R = *right*, and S = *ground/shield*. 2. *Balanced* interconnect with the pos & neg signal lines tied to T and R respectively and S acting only as an overall shield. 3. *Insert loop* interconnect with T = *send*, R = *return*, and S = *ground/shield*. [Think: *ring, right, return*]

¼" TS *Mono* ¼" connector consisting of *tip* (T) [signal] and *sleeve* (S) [ground & shield] for *unbalanced* wiring.

constant-Q equalizer (also **constant-bandwidth**) The bandwidth remains constant for all boost/cut levels. Since Q and bandwidth are interrelated, the terms are fully interchangeable.

decibel *Abbr. dB* (named after *Alexander Graham Bell*). The preferred method and term for representing the *ratio* of different audio levels. Being a ratio, *decibels have no units*. Everything is relative. So it must be relative to some *0 dB reference point*. A suffix letter is added to distinguish between reference points:

0 dBu A reference point equal to 0.775 V

+4 dBu Standard pro reference level equal to 1.23 V

0 dBV A reference point equal to 1.0 V

-10 dBV Standard reference level for consumer and some pro audio use, equal to 0.316 V. *RCA* (phono) connectors are a good indicator of units operating at -10 dBV

dynamic range The ratio of the loudest signal to the quietest signal in a unit or system as expressed in *decibels* (dB).

expander A signal processing device used to *increase the dynamic range* of the signal passing through it. Expanders complement compressors. For example, a compressed input dynamic range of 70 dB might pass through an expander and exit with a new *expanded* dynamic range of 110 dB. Modern expanders usually operate only *below a set threshold point*, i.e., they operate only on low-level audio. The term *downward expander* describes this application type.

ground Any electrical reference point for measuring voltage levels. Usually a large conducting body, such as the earth or an electric circuit connected to the earth. Chassis should always be at earth potential. **WARNING: SHOCK HAZARD** Never use an AC line cord ground-lift adapter or cut off the 3rd pin. It is illegal and dangerous.

headroom The level in dB between the typical operating level and *clipping*. For example, a nominal +4 dBu system that clips at +20 dBu has 16 dB of *headroom*.

hum Unwanted sound contaminating audio paths due to EMI (electro-magnetic interference) caused by AC power-lines & transformers getting into unbalanced, poorly shielded, or improperly grounded connecting cables. Hum has a definite smooth (sine wave) repetitive sound based on the harmonics of 50/60 Hz such as 100/120 Hz and 150/180 Hz.

interpolating Term meaning to insert between two points. If a graphic equalizer's adjacent bands, when moved together, produce a smooth response without a dip in the center, they are *interpolating* between the fixed center frequencies.

levels Terms used to describe relative audio signal levels:

mic-level Nominal signal coming directly from a microphone.

Very low, in the microvolts, and requires a preamp with at least 60 dB gain before using with any *line-level* equipment.

line-level Standard +4 dBu or -10 dBV audio levels.

instrument-level Nominal signal from musical instruments using electrical pick-ups. Varies widely, from very low *mic-levels* to quite large *line-levels*.

limiter A compressor with a fixed *ratio* of 10:1 or greater. The dynamic action prevents the audio signal from becoming larger than the *threshold* setting.

Linkwitz-Riley crossover The most preferred active crossover design. It features steep 24 dB/octave slopes, in-phase outputs, and flat amplitude response. Due to the in-phase outputs the acoustic lobe resulting when both loudspeakers reproduce the crossover frequency is always on-axis (not tilted up or down) and has no peaking.

noise 1. *Interconnect*. Unwanted sounds contaminating audio paths. RFI (radio frequency interference) caused by broadcast signals leaking into unbalanced, poorly shielded, or improperly grounded connecting cables. Also by light dimmers, motor controls and computers. 2. *Music*. A random mix of audio frequencies not harmonically related, sounding like radio static.

polarity A signal's electromechanical potential with respect to a reference. For example, a microphone has *positive polarity* if a positive pressure on its diaphragm results in a positive output voltage. **polarity vs. phase shift:** *polarity* refers to a signal's *reference* NOT to its *phase shift*. Being 180 degrees *out-of-phase* and having *inverse polarity* are DIFFERENT things. We wrongly say something is *out-of-phase* when we mean it is *inverted*. One occurs over a period of *time*; the other occurs instantaneously.

Q (upper-case) Quality factor. Defined to be the ratio of the center frequency *f* divided by the bandwidth *BW* for a bandpass filter.

signal-to-noise ratio The ratio in dB between a reference level and the noise floor. For example, a signal-to-noise ratio of 90 dB re +4 dBu, means the noise floor is 90 dB below a +4 dBu ref.

unbalanced line An audio interconnect scheme using one wire with an overall shield. The shield must perform two functions: act as the return signal path (*ground*) and to protect the conductor from noise (*shield*). Consequently this method is vulnerable to hum & noise problems.

unity gain A gain setting of one. The level out equals the level in.

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.

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:

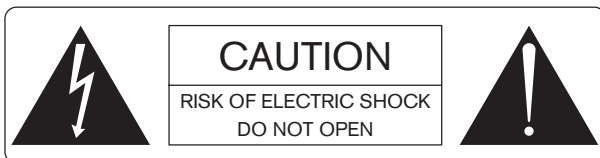
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

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.