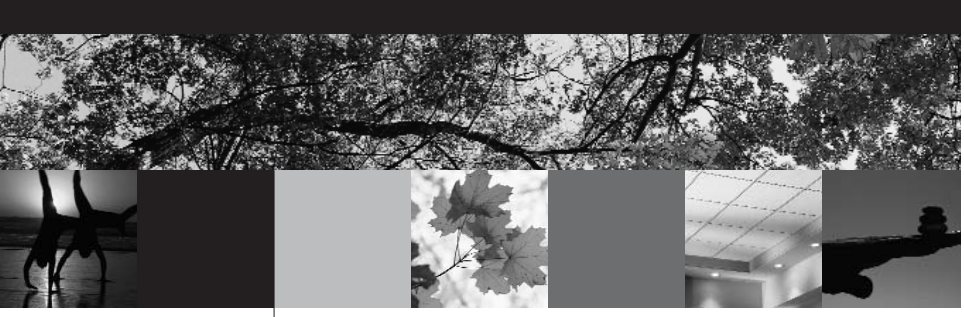


CEILING SYSTEMS

[Between us, ideas become reality.™]

ceilings®

sound systems

Installation Manual

TRI-PAK™ TR-230

Armstrong®

IMPORTANT SAFETY INSTRUCTIONS

CAUTION: DO NOT OPEN
RISK OF ELECTRIC SHOCK

ACIA: RISQUE DE CHOC ÉLECTRIQUE-NE PAS OUVRIR

The symbols shown above are internationally accepted symbols that warn of potential hazards with electrical products. The lighting flash with arrow point in an equilateral triangle means that there are dangerous voltages present within these units. The exclamation point in an equilateral triangle indicates that it is necessary for the user to refer to the owner's manual.

These symbols warn that there are no user serviceable parts inside these units. Do not open these units. do not attempt to service the unit yourself. Refer all servicing to qualified personnel. Opening the chassis for any reason will void the manufacturer's warranty. Do not get the unit wet. If liquid is spilled on the unit, shut it off immediately and take it to a dealer for service. Disconnect the unit during storms to prevent damage.

WARNING:
CLASS 2 WIRING MUST BE USED.

AVERTISSEMENT : UTILISER CÂBLAGE DE CLASSE 2

Make all wiring connections prior to AC connection and power up.

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 FOR YOUR PROTECTION
PLEASE READ THE FOLLOWING:

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 dry cloth.
7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8) Do not install near any heat sources such as radiators, heat 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 the third prong are 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 from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11) Only use attachments/accessories specified by the manufacturer.
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.

TABLE OF CONTENTS

SECTION 1: INTRODUCTION

The TRI-PAK™ TR-230 is a high quality, two channel digital audio system delivering any combination of music, paging, and sound masking applications – either as two separate zones or as a single 2-channel zone – into commercial buildings.

The DSP-based unit delivers two 30 watt channels to selectable outputs at 25 volt, 70 volt, or 100 volt. Two uncorrelated, on-board digital noise generators provide masking signals at either -4 dB per octave or NC40 via switch selection. A comprehensive telephone paging interface for local and remote access is provided with optional talk-back. Multiple line/music level inputs are provided. Switch selectable equalization for room effects and Armstrong P-25 and E-5 speakers is also built in.

When you need more than two channels of paging or music, two balanced line outputs for system expansion of the primary TR-230 are included.

The TR-230 is compatible with the Armstrong A2001 and D2001 digital signal processors (the TR-230 can drive either unit, but can be a down-stream unit for only the A2001 model), as well as with other commercial audio systems (speakers and electronics).

1.1 CHECK CONTENTS

Read and verify the following list of TR-230 carton contents:

- (1) TR-230 electronics unit
- (1) Installation Manual
- (1) 2-pin terminal block plug (for AHJ)
- (4) 3-pin terminal block plugs (for page and balanced line out)
- (2) large 3-pin terminal block plugs (for speaker outputs)
- (2) small 4-pin terminal block plugs (for output voltage select)
- (1) 4-pin terminal block plug (for phone system input)
- (2) 5-pin terminal block plugs (for music/line inputs)
- (1) AC power cord
- (2) ears for optional rack mounting
- (1) metal “E” bracket for optional vertical or horizontal wall mounting
- (4) rubber, stick-on feet for shelf mounting

1.2 CHECK MECHANICAL AND ELECTRICAL REQUIREMENTS

Read the following electrical and mechanical requirements for your i-ceilings system components.

Electrical:

Mains power:	100 – 240 VAC, 50-60 Hz
Maximum Power Consumption:	85 W
Fuse:	1 Amp, Fast Acting

Mechanical:

Dimensions:	1.75"(h) x 19"(w) x 8.5"(d)
Weight:	8 Lbs.
Ambient Temperature*:	< 86° F (30°C)
Storage Temperature:	0° - 50° C (32°-122° F)

*Mounted in EIA rack with 1RU panel space above and below unit

1.3 FAMILIARIZE YOURSELF WITH THIS EQUIPMENT

Read all sections related to circuit description, installation guide and panel descriptions to gain a complete understanding of all inputs, outputs and switches prior to installation.

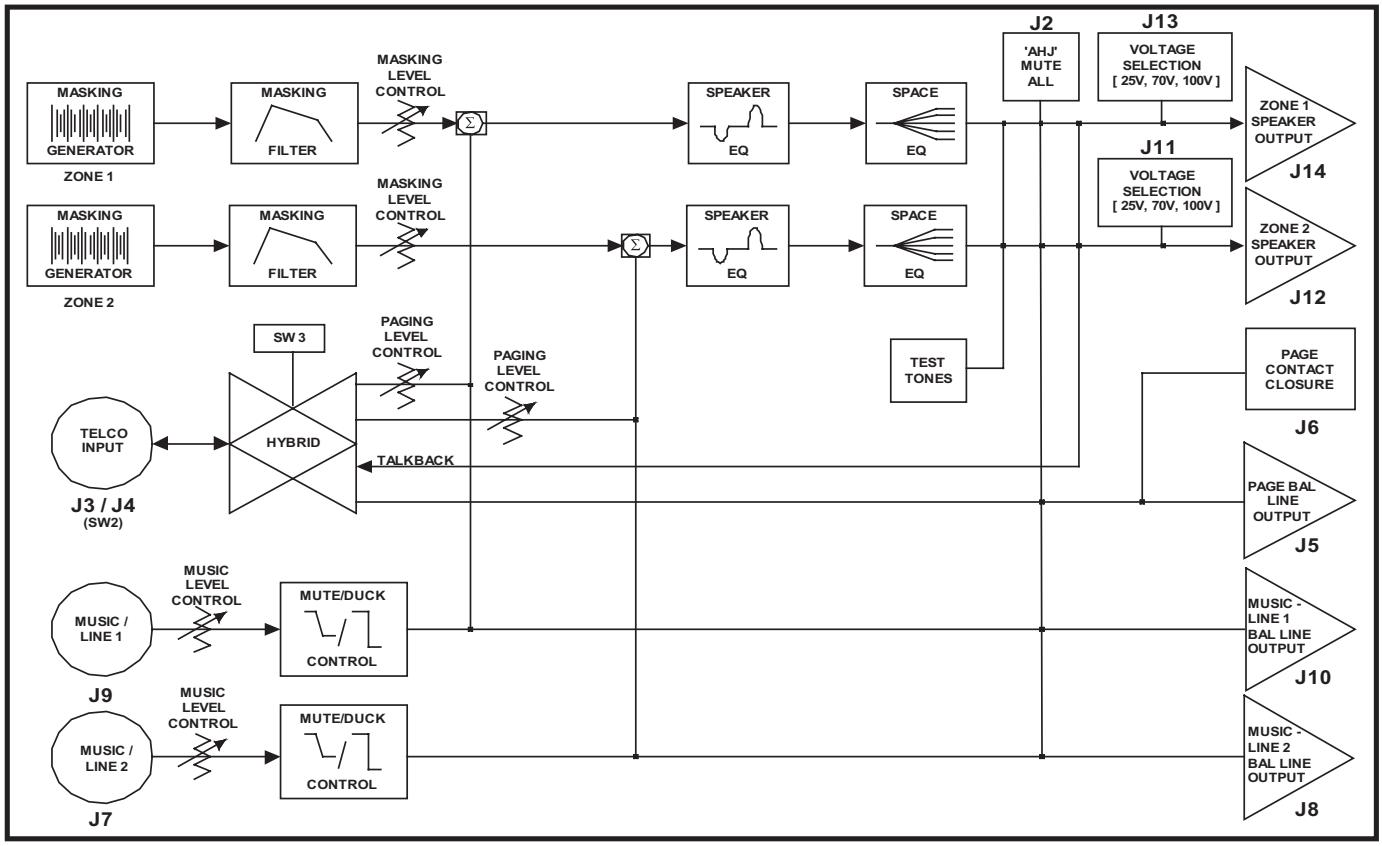
1.4 USEFUL TOOLS

The following tools may be helpful for proper installation of this unit:

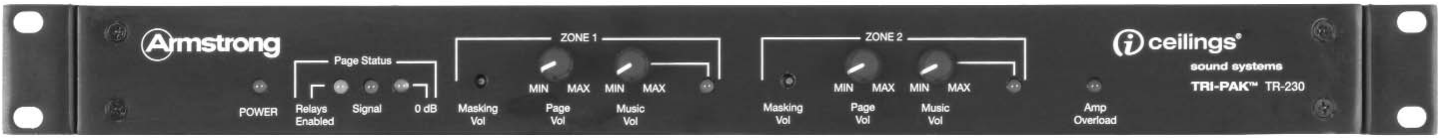
- Flat / Phillips blade screwdriver
- Wire strippers (16 AWG to 24 AWG)
- Multimeter
- Telephone test set (for paging applications)
- Portable 25V/70V/100V speaker
- SPL meter

SECTION 2: BLOCK DIAGRAM AND PANEL DESCRIPTIONS

BLOCK DIAGRAM:



FRONT PANEL:



REAR PANEL:

SECTION 2: FRONT PANEL

POWER LED:

"Green" indicates power is on.

AMP OVERLOAD LED:

"Red" indicates amp is clipping.

PAGE STATUS LED's:

RELAY ENABLED: "Amber" indicates relay input contact is activated when page is enabled.

SIGNAL: "Green" indicates presence of telephone or microphone signal.

0 dB: "Amber" indicates signal level has reached 0 dBu.

ZONE 1 AND ZONE 2:

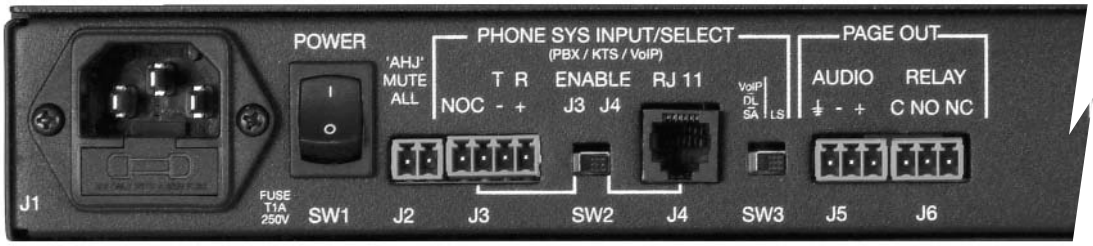
MASKING VOLUME: Tamper-proof recessed volume control to set appropriate signal level. Use small flat head screwdriver.

PAGING VOLUME: Page volume control via accessible knob to adjust paging volume in each zone.

MUSIC VOLUME: Music volume control via accessible knob to adjust background music volume in each zone.

MUSIC LED: "Green" indicates music signal is present.

SECTION 2: REAR PANEL



AC POWER [J1]:

AC input connection with on/off switch [SW1]

AHJ INPUT [J2]:

Authority Having Jurisdiction for local fire authority requirements to mute all audio [no polarity].

TELEPHONE SYSTEM INPUT [J3]:

Terminal block for discrete connection of telephone input with Normally Open [NO], Common [C], tip [-] and ring [+] terminations.

TELEPHONE SYSTEM INPUT/SELECT [SW2]:

Manual slide switch for selection of J3 terminal block or RJ11 termination of phone system page input.

TELEPHONE SYSTEM INPUT [J4]:

RJ11 connector

PAGE OUT [J5 AND J6]:

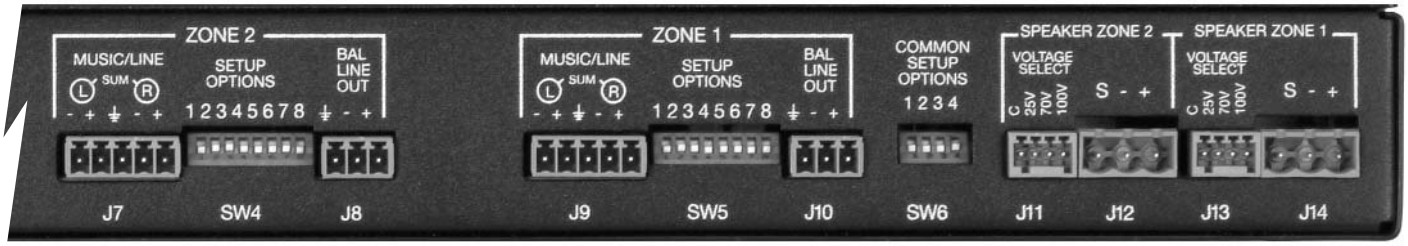
Audio signal [J5] and relay [J6] for extension to auxiliary paging equipment.

This is for voice telephone page and DTMF output only and will not pass masking or music signals to a secondary unit.

TELEPHONE SYSTEM PAGE INPUT/SELECT [SW3]:

Manual slide switch for selection of telephone line type: VoIP (Voice over Internet Protocol), DL (Dry Loop), and SA (Station Access and Centrex); or LS (Loop Start).

SECTION 2: REAR PANEL



MUSIC / LINE [J7 and J9]:

Music, line level, and line level microphone input.
Note: Music will automatically sum to speaker zones 1 and 2 with DIP position 3 up on SW6. (See Figure 12 on page 23.)

ZONE SETUP OPTIONS [SW4 and SW5]:

Individual setup options for zones 1 and 2. See section 3 for truth table.

BALANCED LINE OUTPUTS [J8 and J10]:

Voice page and music line level output to auxiliary amplifiers and processors.
NOTE: Masking signal and all EQ options will not pass. (See block diagram for further details.)

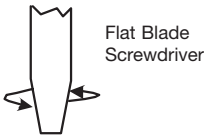
COMMON SETUP OPTIONS [SW6]:

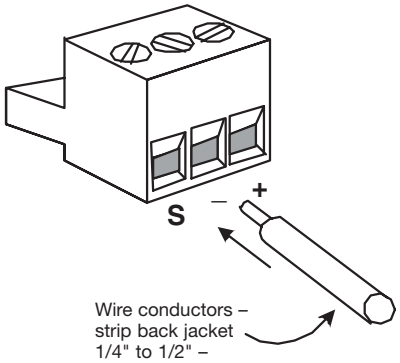
Feature options common to zones 1 and 2. See section 3 for truth table.

SPEAKER ZONES 1 AND 2 [J12 and J14]:

Power output to speakers @ 25V, 70V or 100V.

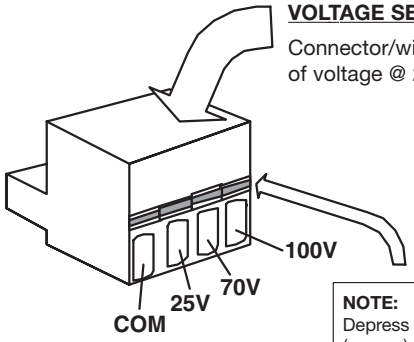
SPEAKER WIRING [J12 and J14]:



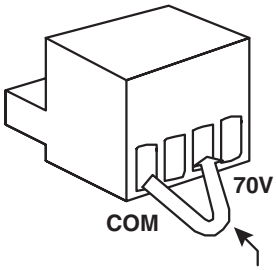


VOLTAGE SELECT [J11 and J13]:

Connector/wire jumper selection of voltage @ 25V, 70V or 100V.



NOTE:
Depress center spring actuator (orange) to insert wire loop.



CAUTION:
VOLTAGE SELECT IS NOT A SPEAKER OUTPUT - DO NOT CONNECT SPEAKERS TO J11 OR J13 !

FACTORY PRESET @ 70V

SECTION 3: TRUTH TABLES AND FACTORY DEFAULT SETTINGS

ZONE 1 AND 2 SETUP OPTIONS:

ZONE SETUP OPTIONS							
Switch Number							
1	2	3	4	5	6	7	8
Off	Masking "Off"						
On	Masking "On"						
	Off	Off	Off	Normal Space Equalization			
	Off	Off	On	-1.5 dB Space Equalization			
	On	Off	On	-3.0 dB Space Equalization			
	Off	On	On	+1.5 dB Space Equalization			
	On	On	On	+3.0 dB Space Equalization			
				Off	Off	No Speaker EQ	
				On	Off	E-5 Speaker EQ	
				Off	On	P-25 Speaker EQ	
					On	Muting of music on page	
					Off	20 dB Ducking of music on page	
						Off	Talkback "Off"
						On	Talkback "On"

Factory Default Settings: (DIP Switches 1-8 all down)

- Masking off
- Normal space EQ
- No speaker EQ
- Duck music on page
- Talkback off

NOTE: Do not select the up position on both 5 and 6. This setting is for a different speaker EQ specific to an Armstrong product available outside of North America.

COMMON SETUP OPTIONS:

COMMON SETUP OPTIONS				
Switch Number				
1	2	3	4	
Off	-4dB noise source filter			
On	NC40 noise source filter			
	Off	10 Second Station Access paging timeout		
	On	5 Second Station Access paging timeout		
		Off	Normal Line Inputs 1 and 2	
		On	Sum Line Inputs 1 and 2	
			Off	Test Tone Off
			On	Test Tone On

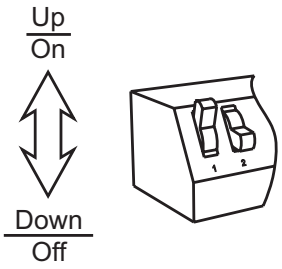
Factory Default Settings: (DIP Switches 1-4 all down)

- -4dB noise source filter (masking signal)
- 10 second Station Access paging timeout
- Normal line inputs
- Test tone off

OTHER FACTORY DEFAULTS:

Speaker zone 1 and 2 voltage selection is factory set at 70V.

HOW TO SELECT OPTIONS USING THE DIP SWITCHES:



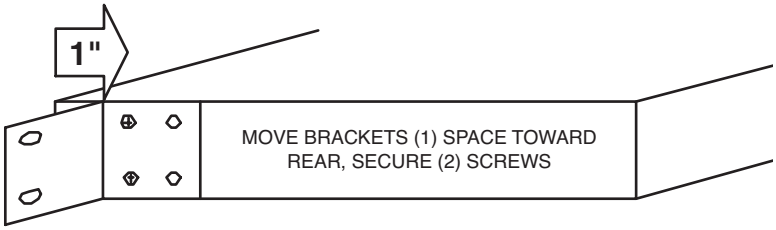
The zone and common setup options are selected via DIP switches which can be accessed with a small screwdriver. In the truth tables, “on” means “up,” and “off” means “down.”

SECTION 4: INSTALLATION AND MOUNTING OPTIONS

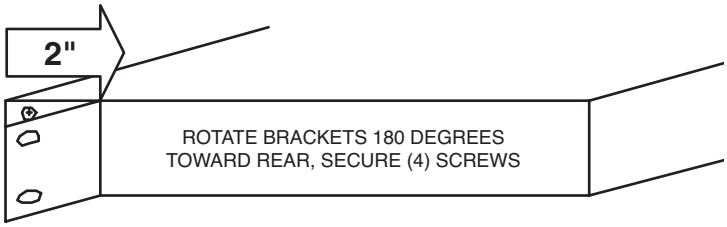
RACK OR CABINET MOUNTING OPTIONS:

Use the two adjustable mounting brackets for the following mounting options in racks or cabinets:

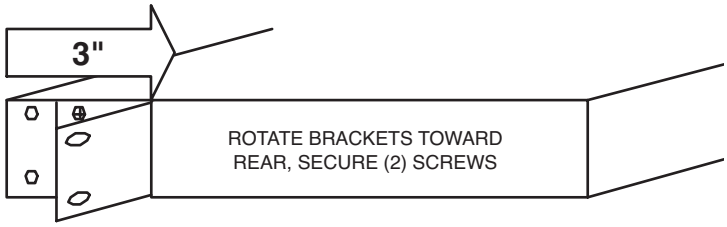
(1) FLUSH WITH FRONT CABINET RAIL (as shown in photo above and diagram to the left)



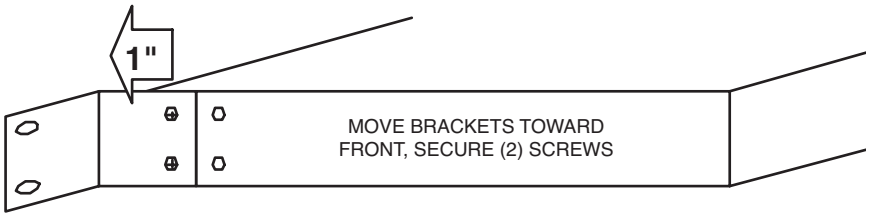
(2) FRONT PANEL IS FORWARD 1" IN RACK



(3) FRONT PANEL IS FORWARD 2" IN RACK



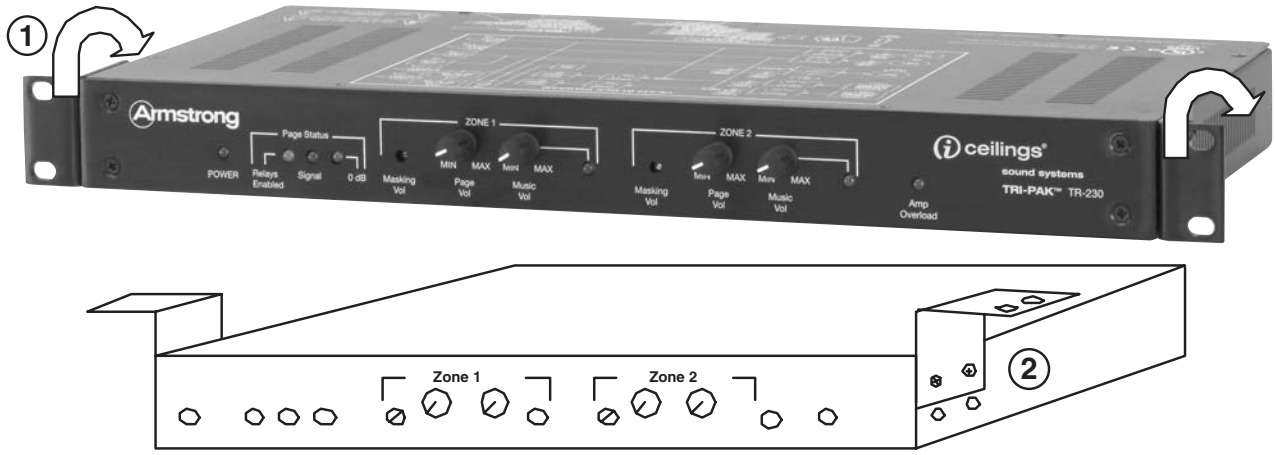
(4) FRONT PANEL IS FORWARD 3" IN RACK



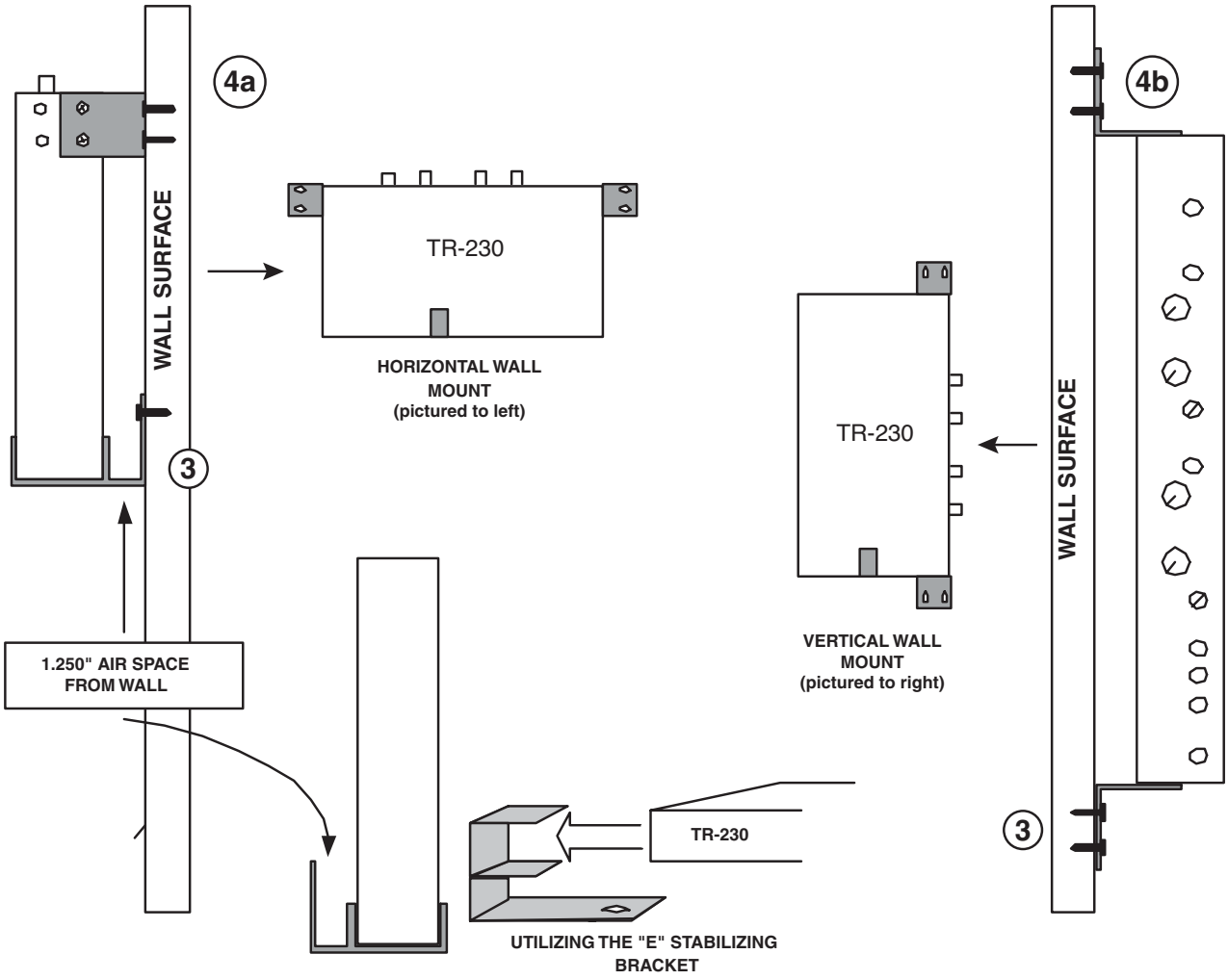
(5) FRONT PANEL IS BACK 1" IN RACK

SECTION 4: INSTALLATION AND MOUNTING OPTIONS

WALL MOUNTING OPTIONS:



1. Rotate mounting brackets toward top of unit.
2. Secure with two screws on each side. NOTE: This provides 1.25" of air ventilation space from the wall surface and facilitates ease of reading front panel controls.
3. Secure stabilizing “E” bracket to wall with single screw and fit TR-230 in either vertical or horizontal mode.
4. Secure side mounting brackets to wall — either horizontally (a) or vertically (b) — with two screws per side.



SECTION 5A: QUICK START APPLICATION GUIDE

5A. QUICK START

5A.1. SOUND MASKING ONLY

Step 1: Turn down masking volume controls on front panel full counter clockwise with small flathead screwdriver.

Step 2: Make following DIP switch selections on SW4, SW5 and SW6 on rear panel:
- Select "masking on" by putting DIP switch 1 up in SW4 and SW5.
- Select a noise type (–4dB or NC40) on position 1 of SW6.
- Select appropriate speaker type on positions 5 and 6 of SW4 and SW5 (P-25, E-5, or flat).

Step 3: Wire and connect speakers to appropriate zones in J12 and J14 connectors.
NOTE: The Factory Default is 70V output.

Step 4: Plug in AC power to J1 and turn power SW1 switch to "on" position. Verify that power LED on front panel is green.

Step 5: Slowly turn up masking volume controls to appropriate level – listen for noise and measure the level as required. **NOTE**: Masking levels are typically in the range of 42-43 dBA SPL in closed plan spaces and 47-48 dBA SPL in open plan spaces.

5A.2. PAGING ONLY

Step 1: Turn down paging volume controls on front panel full counter clockwise.

Step 2: Make following DIP switch selections on SW4, SW5 and SW6 on rear panel:
- Select appropriate speaker type in positions 5 and 6 of SW4 and SW5.
- Place Test Tone on via position 4 of SW6.

Step 3: Select the device for Paging Input (Telephone or Amplified Microphone) and make the following selections and connections:

TELEPHONE **(see pages 16-17 for diagrams):**
- Select the telephone system line type (Station Access, Centrex, VoIP, Loop Start, Dry Loop) on SW3.
- Select connection type RJ11 (J4) or terminal block (J3) on SW2.
- Connect telephone line to J3 or J4.

AMPLIFIED MICROPHONE **(see pages 19-20 for diagrams):**
- Select terminal block J3 position on SW2.
- Wire to J3 with 2 pair/4 wire as indicated (NO=Normally open, C=Common, + and -).

Step 4: Wire and connect speakers to appropriate zones on J12 and J14.

Step 5: Plug in AC Power to J1 and turn SW1 on. Verify power LED is green.

Step 6: You should now hear the on-board test tone. Remove test tone from SW6, position 4 (turn switch down to "off"). Initiate page from telephone (Digits 1, 2 or 3 for Zone 1, 2, or All-Call) or Microphone. Slowly turn up Paging volume controls for each zone.

SECTION 5A: QUICK START APPLICATION GUIDE

5A.3. MUSIC ONLY

Step 1: Turn down music volume controls on front panel full counter clockwise.

Step 2: Make following DIP switch selection on SW4, SW5 and SW6 on rear panel:
- Select appropriate speaker type on positions 5 and 6 of SW4 and SW5.

Step 3: Connect music source to Music/Line inputs connectors on J7 and J10. Wire as follows: Shield to -, Positive to + terminals.
NOTE: The TR-230 automatically sums Stereo input, to Mono for each channel. Wire the – and + leads to the respective L and R terminals in the J7 and J10 positions.

Step 4: Wire and connect speakers to appropriate zones on J12 and J14.

Step 5: Plug in AC power to J1 and turn SW1 up to on. Verify power LED is green.

Step 6: Slowly turn up music volume control for each zone.

5A.4. COMBINED APPLICATIONS (MUSIC, PAGING AND MASKING)

Each application is independently controlled and can be implemented in any combination, such as:

1) paging and masking
2) music and masking
3) paging and music
4) music, paging and masking

To set up these combined applications, follow the appropriate directions above for each single application. As you go from one application to the next, you will not need to re-select the “speaker type” options already chosen.

SECTION 5B: SOUND MASKING APPLICATION GUIDE

The TR-230 provides Sound Masking via two uncorrelated built-in noise generators and includes a choice of two pre-filtered noise signals – the industry recognized NC40 or a - 4 dB per octave spectra. Additionally, both speaker response EQs and space effect EQs are provided to simplify the process of achieving speech privacy with a non-intrusive masking sound of good tonal quality.

5B.1. APPLICATION LAYOUTS:

This unit can be used to supply any of the following masking applications:

1) Two uncorrelated masking signals in a single architectural zone for open plan masking using an A and B speaker layout. (**NOTE**: This layout gives the best level of uniformity throughout the installed space.)

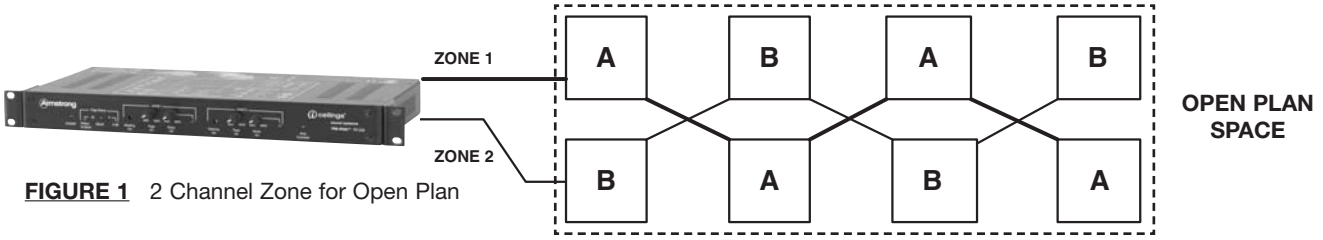


FIGURE 1 2 Channel Zone for Open Plan

NOTE: A-B masking as depicted above will result in a single zone paging system accessed by DTMF code 3 for an 'ALL CALL PAGE'

2) Two separate masking signals in two separate architectural zones for closed plan masking (**NOTE**: This layout is often used for dissimilar closed room sizes and/or surface treatments, such as for offices and conference rooms separately.)

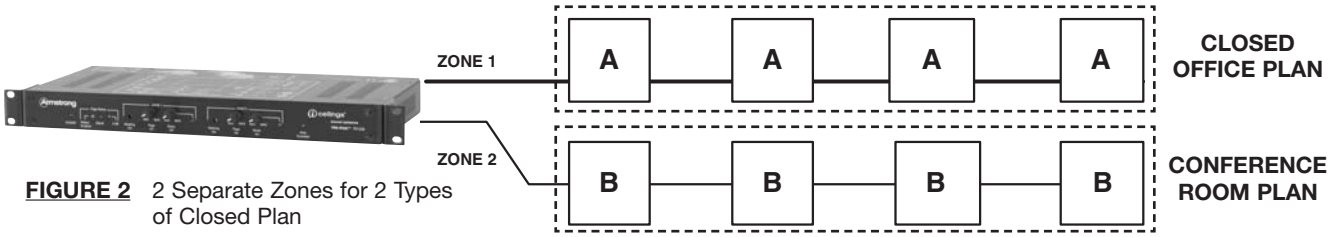


FIGURE 2 2 Separate Zones for 2 Types of Closed Plan

3) Two separate masking signals in two separate architectural zones for a closed plan and an open plan. (**NOTE**: Open plan performance will not be as good as achieved in Figure 1 above, since only one signal is used throughout the open space.)

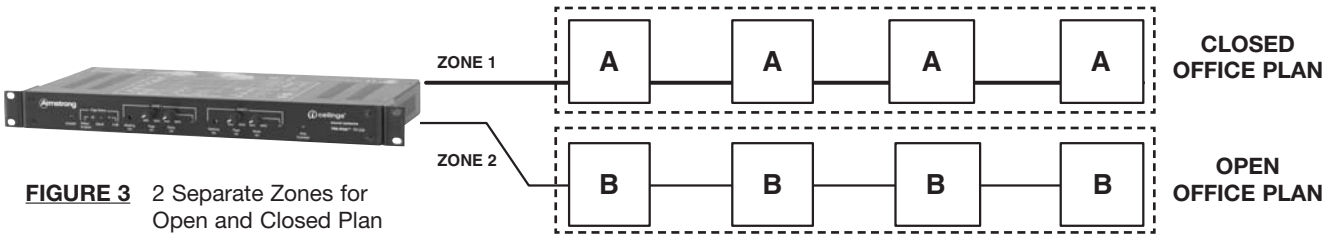


FIGURE 3 2 Separate Zones for Open and Closed Plan

SECTION 5B: SOUND MASKING APPLICATION GUIDE

5B.2. FACTORY DEFAULT SETTINGS

The factory default settings for sound masking are the same for both speaker outputs, which are labeled Zone 1 and Zone 2 on page 5. These default settings (as listed in page 6 for SW4, SW5, and SW6) are as follows:

- Masking sound OFF
- No speaker EQ
- Normal space EQ
- - 4 dB per octave noise pre-filter

5B.3. OPEN PLAN SET-UP PROCEDURE

For an open plan application, it is usually recommended to use two uncorrelated masking signals in a single architectural zone with the P-25 model i-ceilings® speaker in an A and B speaker layout pattern. The set-up process is as follows:

1) Install P-25 speakers according to Figure 1, alternating A and B in a square or diamond pattern.

2) Turn the masking volume down on the front panel for both zones. It takes a small flat bladed screwdriver to adjust the tamper-proof control.

3) Turn on masking signal with DIP switch 1 on SW4 and SW5, where “up” means masking is on.

4) Set the desired masking signal with DIP switch 1 on SW6. “Down” is for the – 4 dB noise signal and “up” is for the NC40 noise signal.

5) Set the speaker EQ for the P-25 with DIP switches 5 & 6 on SW4 and SW5, where the combination of 5 “down” and 6 “up” is for the P-25 speaker. (This setting provides an inverse P-25 frequency response thus making the system flat relative to the speaker.)

6) Leave the space effects EQ at the default setting (normal) since an open plan space probably has low space effects due to the sound at the listener being primarily direct sound from the speakers.

7) Turn the masking volume up on the front panel for both zones, being careful to have the same level on each zone. Using a sound level meter (SLM), measure the sound in a cubicle or occupant seating area, adjusting the level until the masking is approximately 48 dBA. Repeat this measurement under a few A speakers and B speakers to ensure that each zone is set at the same level.

8) You may choose to switch the space effect EQ to +1.5 to -1.5 or adjust the masking signal to sound most pleasant or balanced to your ear. If either of these settings are chosen, you will need to recheck the level in several occupant spaces and readjust the level to 48 dBA.

SECTION 5B: SOUND MASKING APPLICATION GUIDE

5B.4. CLOSED PLAN SET-UP PROCEDURE

For a closed plan application, it is usually recommended to use a single masking signal in a single architectural zone with the P-25 model i-ceilings speaker installed (one to a room for rooms up to 20' x 20'). **NOTE**: For larger rooms, where four or more P-25 speakers may be needed, it may be appropriate to use a 2 channel, 1 zone layout instead.

The set-up process for typical closed plan applications is as follows:

1) Install P-25 speakers according to Figure 2.

2) Turn the masking volume down on the front panel for both zones. It takes a small flat bladed screw driver to adjust the tamper proof control.

3) Turn on masking signal with DIP switch 1 on SW4 and SW5, where “up” means masking is on.

4) Set the desired masking signal with DIP switch 1 on SW6. “Down” is for the – 4 dB noise signal and “up” is for the NC40 noise signal

5) Set the speaker EQ for the P-25 with DIP switches 5 & 6 on SW4 and SW5, where the combination of 5 “down” and 6 “up” is for the P-25 speaker. (This setting provides an inverse P-25 frequency response thus making the system flat relative to the speaker.)

6) Set the space effect EQ with DIP switches 2, 3, 4 on SW4 and SW5, where the settings are listed in the truth tables on page 6, for each zone separately. Choose the settings as follows:

   - Normal: average sized room furnished in an average way [10x10x9 ft, standard acoustical ceiling (NRC .60), standard commercial grade carpet]
   - + 3 dB: large room furnished with lots of sound treatment [20x20x9 ft, high-performance ceiling (NRC .75), fiberglass wall panels (NRC .85) on 2 walls, standard commercial grade carpet]
   - +1.5 dB: large room furnished with some sound treatment [16x16x9 ft, standard acoustical ceiling (NRC .65), Mineral fiber wall panels (NRC .50) on one wall, standard commercial grade carpet]
   - – 1.5 dB: small room furnished with little sound treatment [8x8x9 ft, standard acoustical ceiling (NRC .50), no wall treatment, standard commercial grade carpet]
   - – 3.0 dB: small room with no sound treatment [8x8x9 ft, drywall surfaces, thin carpet]

7) Turn the masking volume up on the front panel for each zone separately. Using a sound level meter (SLM), measure the sound at an occupant seating area, adjusting the level until the masking is approximately 43 dBA. Repeat this measurement in a couple locations to ensure that each zone is set properly.

5B.5. MIXED PLAN SET-UP PROCEDURE

Follow the previous procedures, using only one zone for the open plan and one for the closed plan, according to Figure 3.

SECTION 5C: PAGING APPLICATION GUIDE

The TR-230 provides two independent 30 watt zone outputs for voice paging.
Paging is accomplished using telephone and/or microphone sources with the following options:

- Single zone or All-Call paging
- Duck or mute music during page
- Hands-free talkback
- DTMF decoding for zone page access

Paging can be provided over both music and masking.

Page expansion is accomplished via a balanced line output per zone for stacking additional TR-230 systems, auxiliary paging equipment and amplifiers. Remote OPX (off-premise extension) paging via the Public Switched Telephone Network (PSTN) is achieved via the balanced paging output.

5C.1. PAGING VIA TELEPHONE

The TR-230 provides a comprehensive built-in telephone interface circuit for direct connection to most PBX (Private Branch Exchange), KTS (Key Telephone System), Centrex, and VoIP (Voice over Internet Protocol) systems. Tip and Ring connection is provided for all of the following: Station Access, Loop Start Trunks, and Dry Loop (600 Ohm) inputs. For convenience, input is made either through an RJ11 modular or terminal block connector which is selected by a manual slide switch (SW2).

INTERCONNECTION / INSTALLATION STEPS

Select the line type provided by the telephone system. Determine which connection method should be used and move the SW2 switch to J3 or J4. Set the SW3 switch to match the telephone line interface: “VoIP/DL/SA” are for Dry Loop, Station Access and VoIP. “LS” is for Loop Start.

Once the telephone line selection is made, plug the connector into the selected J3 or J4 input.

NOTE: Connections to the J3 input are (L to R):

- Pin 1 is normally open (NO)
- Pin 2 is common (C)
- Pin 3 is Tip / -
- Pin 4 is Ring / +

These inputs correspond to the following color code:
Red conductor = Tip / -
Green conductor = Ring / +

STATION ACCESS OR CENTREX access requires a time out. A 5 or 10 second timeout is a forced disconnect triggered by the lack of audio or voice page signal for the pre-determined amount of time (5 or 10 seconds). So, choose a 5 or 10 second timeout option on SW6, position 2 for your application. You can page as long as you want, but when the signal stops, a forced disconnect will occur after 5 or 10 seconds.

For a 5 second timeout, put position 2 switch in the ON mode. For a 10 second timeout, put position 2 switch in the OFF mode. **NOTE:** The factory default setting is 10 seconds.

If you are experiencing any problems getting locked out by a PBX system, try using the 10 second timeout.

Make speaker line connections to the Zone 1 and/or 2 output connection blocks (J12 and J14). Ensure all speaker conductors are secure and speaker tap settings are correct.

Installation Tips:

- The TR-230 provides an optional **TEST TONE** to verify the integrity of cabling, wiring connections and speaker tap settings. Turn the test tone on by selecting the SW6 switch and placing position 4 in the ON position. Remove the tone by switching 4 to the OFF position. The factory default setting is OFF.
- The TR-230 telephone interface accommodates direct connection of a standard telephone test set (Butt Set) or a single line telephone for simple verification of paging. Set the SW3 switch to LS (Loop Start). Plug test set or phone into the J4 input connector and page using the dial plan described below.

Attach the power cord to the TR-230 AC mains connector J1 and turn SW1 up for on. The front panel **PAGE STATUS** and Power LED's will illuminate as follows:

- **Power =** "Green" indicates power is on
- **Page Signal =** "Green" indicates presence of telephone or microphone signal.
- **0 dB =** "Amber" indicates signal level.
- **Relay Enable =** "Amber" indicates relay input contact is activated when page is enabled.
- **Amp overload =** "Red" indicates amp is clipping.

The **DTMF** dial plan for zone paging is a single digit, fixed steering plan with three options:

- 1 for Zone 1
- 2 for Zone 2
- 3 for All-Call

NOTE: THIS DIAL PLAN IS FIXED AND CANNOT BE CHANGED.

The TR-230 provides a momentary confirmation tone indicating the unit is ready to dial for paging zone selection. A secondary confirmation tone will follow indicating a ready to page status.

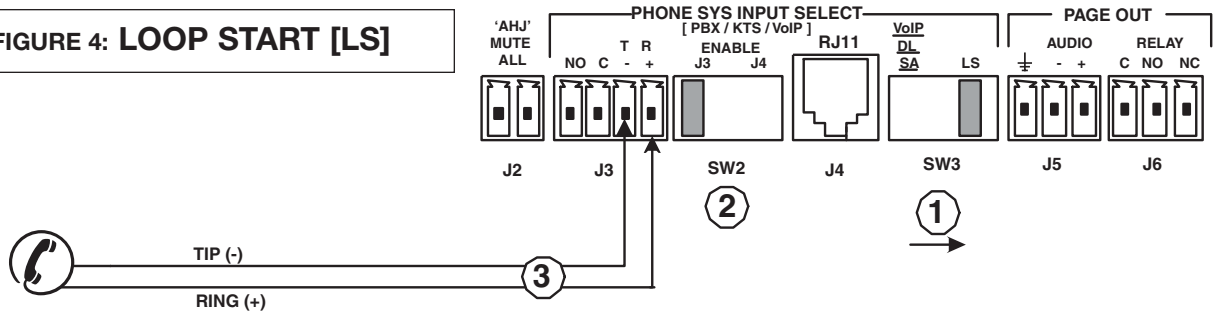
PAGING VOLUME controls are accessed on the front panel for both Zones 1 and 2 and can be adjusted during the installation and tuning of the system.

See figures 3-6 on the next two pages for additional detail on the various possible telephone paging connections.

SECTION 5C: TELEPHONE PAGING DIAGRAMS

SINGLE TELEPHONE / TEST SET (BUTT SET)

FIGURE 4: LOOP START [LS]



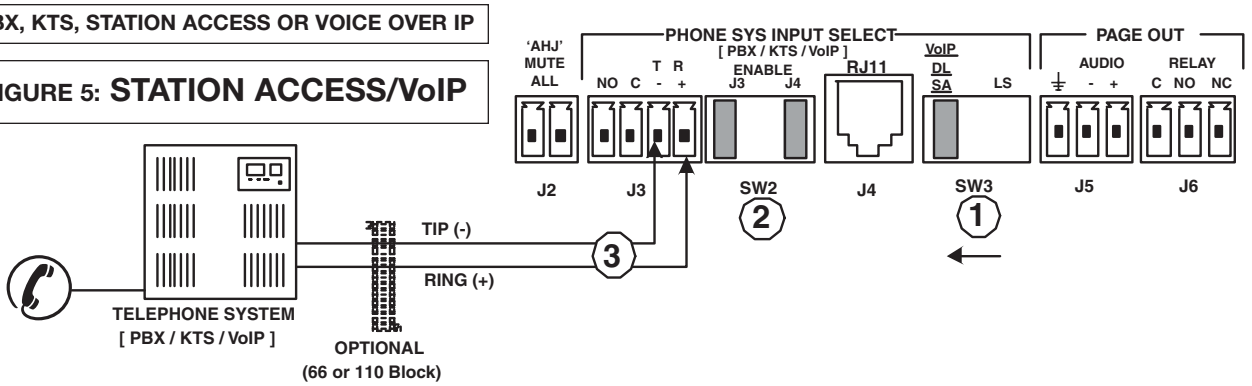
(1) Select loop start access by moving SW3 to LS on right side.

(2) Set SW2 to select terminal block J3 (as shown) or RJ11 J4.

(3) Terminate tip (-) and ring (+) conductors to J3 (as shown) or to J4.

PBX, KTS, STATION ACCESS OR VOICE OVER IP

FIGURE 5: STATION ACCESS/VoIP



(1) Select station access/VoIP by moving SW3 to SA/VoIP on left side.

(2) Set SW2 to select terminal block J3 (as shown) or RJ11 J4.

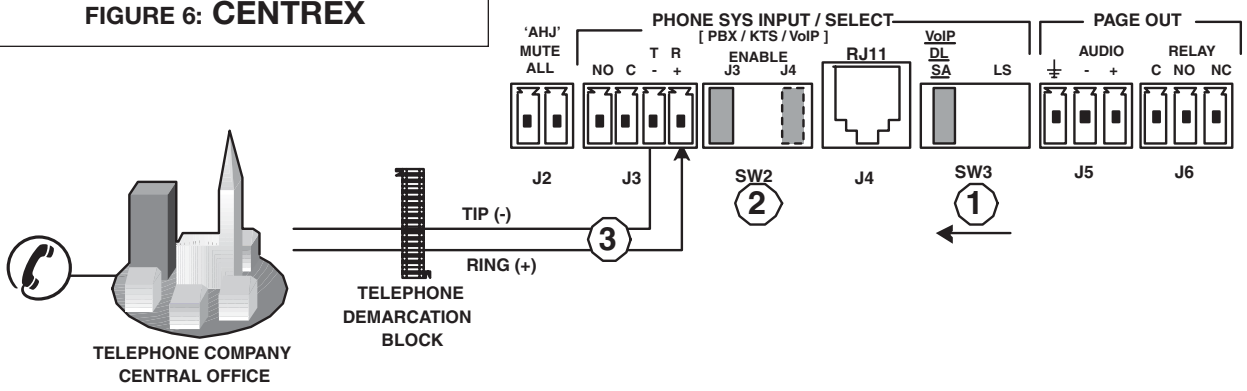
(3) Terminate tip (-) and ring (+) conductors to J3 (as shown) or J4.

CAUTION: In Station Access mode, some PBX systems may output dial tone upon hang-up. This would result in dial tone heard over the paging system speakers. To avoid this, check with the telephone system specialist at the customer site, or ask the customer to check with their PBX provider, for the availability of a Loop Start trunk or a Dry Loop (two pair) connection instead of Station Access. If either of these are available, use one for the TR-230 paging connection, and set it up according to the diagrams found above or on the following page, respectively.

If this change is not possible, you can still avoid the audible dial tone by using a line level microphone in any of the configurations shown on pages 19-20.

SECTION 5C: TELEPHONE PAGING DIAGRAMS

FIGURE 6: CENTREX

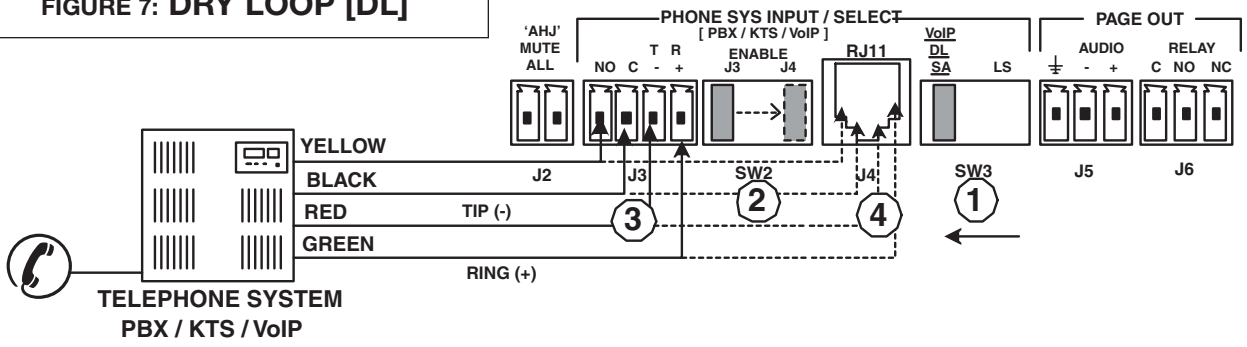


(1) Centrex lines operate in similar mode to station access, therefore, select station access by moving switch SW3 to left.

(2) Set SW2 to select terminal block J3 (as shown) or RJ11 J4.

(3) Terminate tip (-) and ring (+) conductors to J3 (as shown).

FIGURE 7: DRY LOOP [DL]



(1) Select Dry Loop (DL) by moving switch SW3 to left.

(2) Set SW2 to select terminal block J3 (as shown).

(3) Terminate J3 connector as follows: yellow to NO (normally open), black to C (common), red to tip (-) and green to ring (+).

(4) Alternatively, terminate modular RJ11 as follows: yellow to NO (normally open), black to C (common), red to tip (-) and green to ring (+). **NOTE**: SW2 switch must be set to the right for this connection (shown above as dotted lines).

5C.2. PAGE EXPANSION

TELEPHONE SYSTEM PAGING TO A SECOND TR-230 OR ADDITIONAL AMPLIFIER(S)

The TR-230 has one balanced line output per zone. Connect each balanced line output to the corresponding input of the secondary TR-230 or amplifier. This will allow each zone page to pass from the primary to the secondary device(s). **NOTE**: the Page Volume knob of the primary unit will control the output from the primary unit, and the Music Volume knob of the secondary unit will control the output from the secondary unit.

Select the primary telephone interface connection (SW2 and SW3) and make appropriate connections (J3 or J4). Connect J8 and J10 of the primary TR-230 to J7 and J9 of the secondary TR-230 or to the line inputs of an additional amplifier. See figures 8 and 9 below.

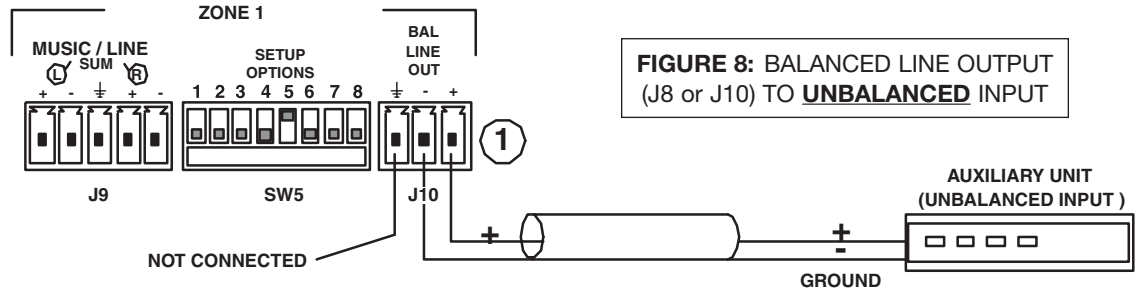


FIGURE 8: BALANCED LINE OUTPUT (J8 or J10) TO **UNBALANCED** INPUT

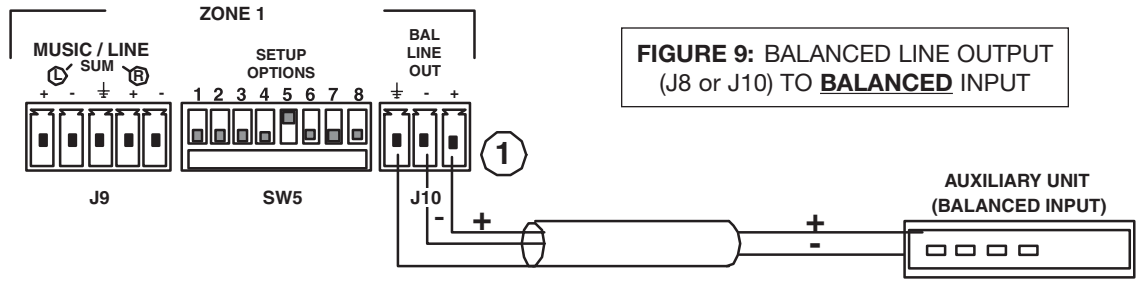


FIGURE 9: BALANCED LINE OUTPUT (J8 or J10) TO **BALANCED** INPUT

NOTE: J8 AND J10 WILL NOT PASS MASKING SIGNAL — PAGE AND MUSIC ONLY.

TELEPHONE SYSTEM PAGING TO ARMSTRONG A/D2001 PROCESSORS AND AUXILIARY EQUIPMENT

Select the primary telephone interface connection (SW2 and SW3) and make appropriate connections (J3 or J4). Connect SHIELDED TWISTED PAIR cable (24AWG or thicker) to the Page Out Audio (J5) terminal block of the primary unit. This cable connects to the J10 input block on the A/D2001 processor. Connect the Page Out Relay (J6) of the primary unit to the J11 input block on the A/D2001 processor, matching the C and NO connections of the TR-230 with the C and + connections of the A/D2001.

One of the TR-230 zones will need to be reserved as the gateway to the A/D2001 and/or other auxiliary equipment. It is not recommended to use masking or music on this dedicated TR-230 zone. For example, if Zone 1 is reserved for this paging expansion: turn all pots down, turn masking off, and make connections as specified in the preceding paragraph. To page the A/D2001, make a page to the TR-230 and press **1** to access the secondary processor. After the confirmation tone, page the A/D2001 using the appropriate dialplan. **NOTE**: DTMF will not be routed to the secondary device until after the confirmation tone, and no additional confirmation tones will occur after the A/D2001 dial plan is entered.

PAGING EXPANSION VIA PSTN TO OTHER TR-230S OR A/D2001 PROCESSORS

A **dedicated telephone** line from the PSTN will need to be connected to the processor paging section.

5C.3. PAGING VIA MICROPHONE

The TR-230 requires a line level pre-amplified microphone providing a nominal 0 dBu output and contact closure (normally open). Any microphone should work if used in conjunction with an external mic pre-amp that provides the nominal 0 dBu output. Microphones with built-in DTMF output can be connected to the J3 input connector (see Figure 10). Microphones with "push buttons" or "push to talk" control can be utilized by connecting to the J7 and J9 inputs (see Figure 11).

Connection of any **LINE LEVEL MICROPHONE** output is achieved by connecting to the J7 or J9 input connectors. Single zone or All-Call pageing are connected as follows (See Figure 11):

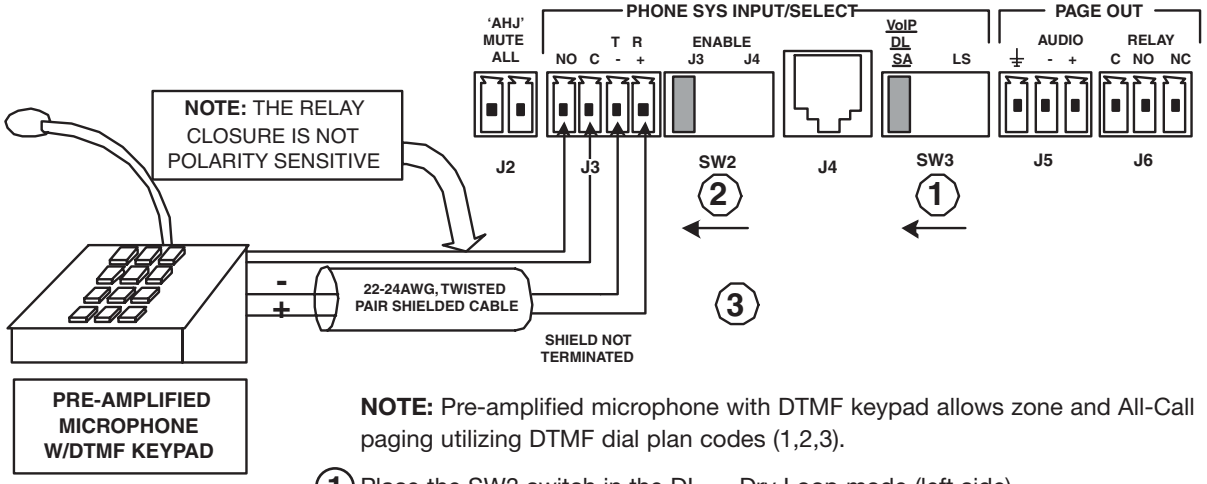
- Microphone + signal goes to either L+ or R+ of J7 for Zone 2 or J9 for Zone 1 access.
- Microphone - signal goes to either L- or R- of J7 for Zone 2 or J9 for Zone 1 access.

NOTE: Once you've connected to the J7 and J9 inputs, you have the ability to **SUM** these outputs to achieve an **All-Call Page** by selecting the "SUM inputs of Line 1 & 2" in the SW6 switch. Select position 3 and place in the ON mode for an All-Call page. Once you've selected the SUM feature, the TR-230 will not provide single zone paging access. The factory default is in the OFF mode.

Connection of a **DTMF MICROPHONE** to fully utilize zone paging requires connecting to the J3 block via 4-conductor cable as follows (See Figure 10 below):

- Microphone + signal connects to J3 "R" (Ring / +)
- Microphone - signal connects to J3 "T" (Tip / -)
- Microphone relay output (2 conductors) connects to NO (Normally Open) and C (Common). This relay is not polarity sensitive.

FIGURE 10: PAGING VIA PRE-AMPLIFIED MICROPHONE WITH TELEPHONE KEYPAD



NOTE: Pre-amplified microphone with DTMF keypad allows zone and All-Call paging utilizing DTMF dial plan codes (1,2,3).

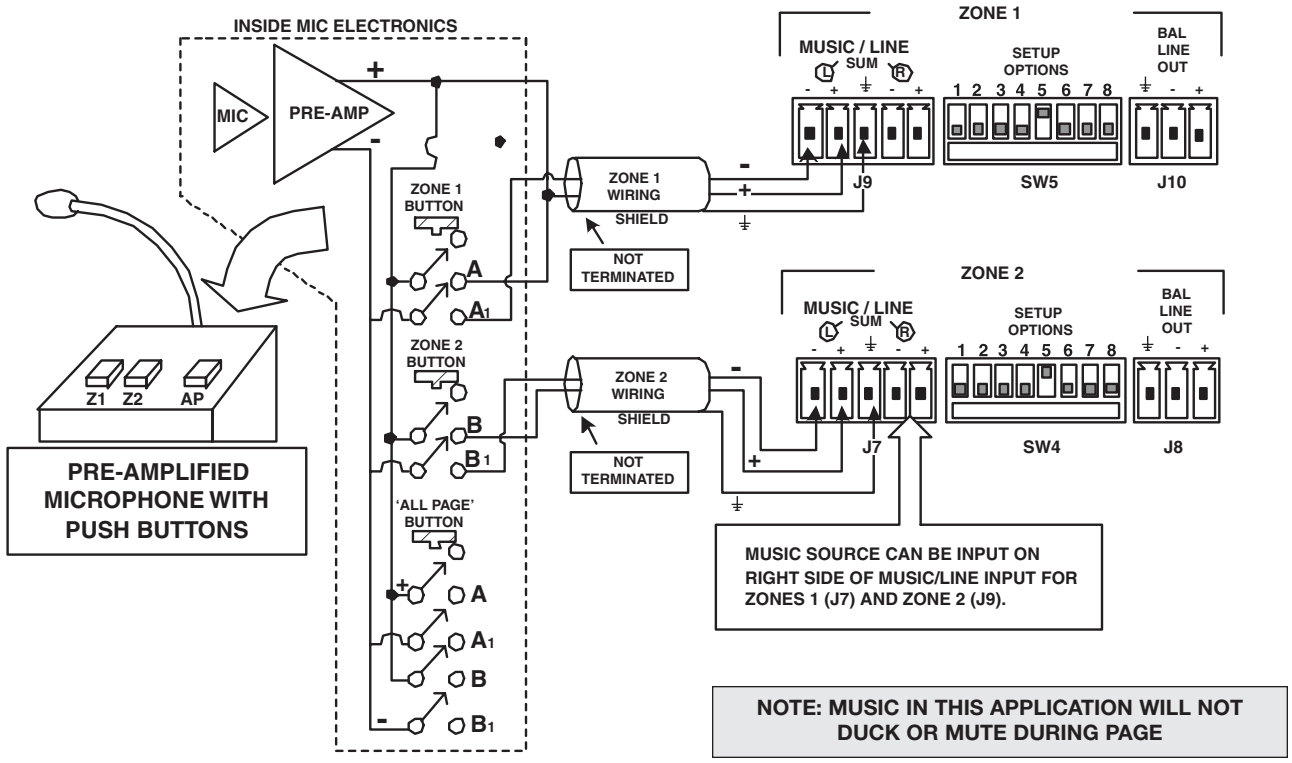
(1) Place the SW3 switch in the DL — Dry Loop mode (left side).

(2) Set the SW2 switch to enable the J3 terminal block (left side).

(3) Terminate the tip (-) and ring (+) and normally open (NO) and common conductors to J3 as shown. Note the shield is not terminated to the TR-230.

SECTION 5C: MICROPHONE PAGING DIAGRAMS

FIGURE 11: PAGING VIA PRE-AMPLIFIED MICROPHONE WITH PUSH BUTTON SWITCHES



5C.4. PAGING WITH TALKBACK

The TR-230 talkback function provides a “hands free” intercom wherein the designated loudspeaker provides paging and music but also enables the speaker to function as a microphone. This function is activated in SW4 (Zone 2) and SW5 (Zone 1) as follows:

To enable talkback, turn switch positions 7 and 8 of either SW4 or SW5 UP to the “ON” position (this will enable talkback and mute music during a page). To disable talkback, place switches in the “OFF” position.

INSTALLATION TIPS:

- Talkback is not recommended for use with more than one enabled speaker per zone. If talkback is utilized in a zone with more than one speaker, wire an in-line diode to all non-talkback speakers.
- Some Station Access configurations may not be capable of running talkback effectively (dial tone placed at the speaker on hangup). Therefore, using talkback with Station Access is not recommended.

CAUTION: Speaker cable connecting to an enabled talkback speaker MUST be a **SHIELDED TWISTED PAIR** of 24 AWG or thicker.

> **NOTE**: Talkback is not recommended for use in masking applications.

SECTION 5D: MUSIC APPLICATION GUIDE

The TR-230 allows multiple music sources to be used for background or foreground music. Music can be muted or ducked in either channel during a page through the proper selection of switch options. Primary MUSIC inputs are made via the J7 (Zone 2) or J9 (Zone 1) rear panel connectors using 5-pin terminal block connectors. Music inputs automatically sum the right and left channels of a stereo source providing a mono output per zone. Music volume controls are provided for each channel on the front panel.

INTERCONNECTION / INSTALLATION STEPS:

Pre-wire the 5-pin terminal block connector (+, -, ⏚ ,+,-) for each channel to be used (J7 and J9). If necessary, cut off all music source connectors such as RCA plugs. Strip the conductor jacket back allowing at least 1/8" bare copper conductor for insertion into the appropriate connector slot. Use a flat blade screwdriver to insure proper termination of each conductor.

Caution: When stripping the cable jacket, ensure that no cuts or nicks exist on copper conductor.

When cutting off the RCA plug connector from a music source, you must connect the shield to the (-) terminal and the hot lead or center conductor to the (+) terminal. There is no termination to the ground terminal for RCA plugs.

NOTE: The TR-230 automatically sums **STEREO MUSIC** to mono. Remove the left and right RCA plug connectors from the music source and connect the conductors as follows: Shield to the - terminal and the hot conductor to the (+) terminal to their respective left or right channels.

Insert the 5-pin connector into the Music Input positions J7 and J9 in the rear panel as required.

If **MUTING MUSIC** during a page is desired, you'll need to select the appropriate DIP switch in rear panel position SW4 for Zone 2 and SW5 for Zone 1. To enable **MUTING**, place switch position 7 in the ON or up position. (**NOTE:** The factory default setting is music set at a 20 dB duck during a page.)

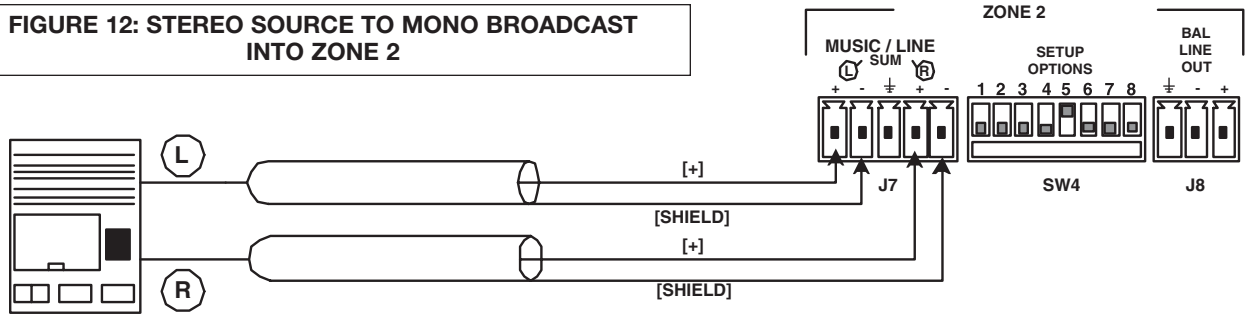
Wire speaker(s) to the appropriate TR-230 speaker output blocks (J11 and J12) and turn the AC power ON. Audio from the installed music source will play. Adjust **MUSIC VOLUME CONTROL** knobs on the front panel for each zone utilized.

The TR-230 allows **MULTIPLE MUSIC SOURCES** to be connected to the J7 and J9 inputs for simultaneous routing of music. Follow the interconnection / wiring guidelines.

The TR-230 allows **STEREO MUSIC INPUT** sources to be routed out as a **STEREO OUT** by utilizing both Zone 1 and Zone 2 for your respective Left and Right stereo channels.

SECTION 5D: MUSIC DIAGRAMS

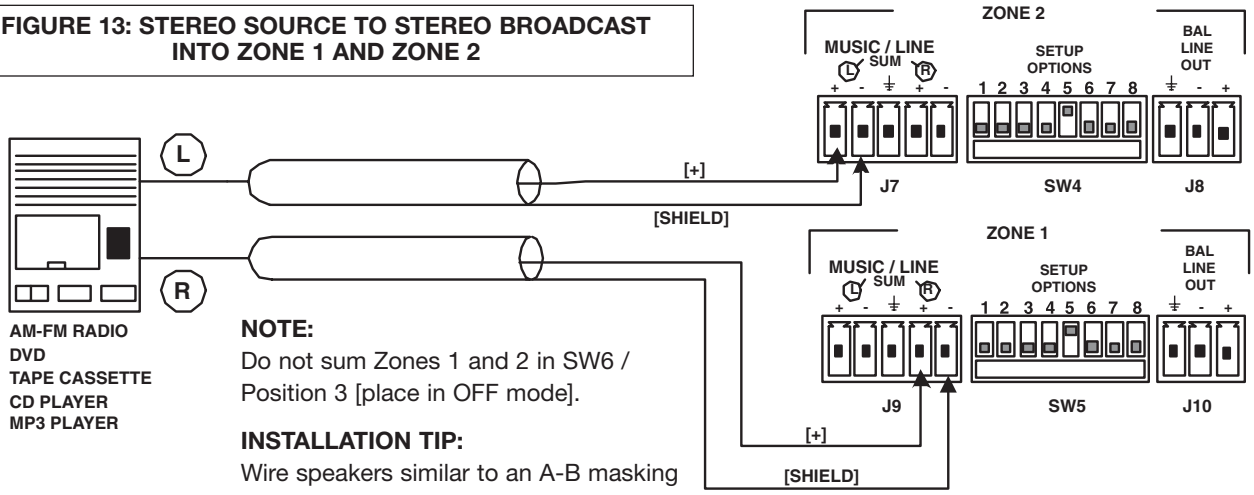
FIGURE 12: STEREO SOURCE TO MONO BROADCAST INTO ZONE 2



NOTES:

- An unbalanced music source can be connected to TR-230 as shown.
- An additional unbalanced source can be connected to the J9 (Zone 1) position, wired in the same method as shown above.
- Alternatively, the same music source can be routed to Zone 1 and Zone 2 by utilizing the sum function in SW6 / Position 3. Additional cabling is not required.

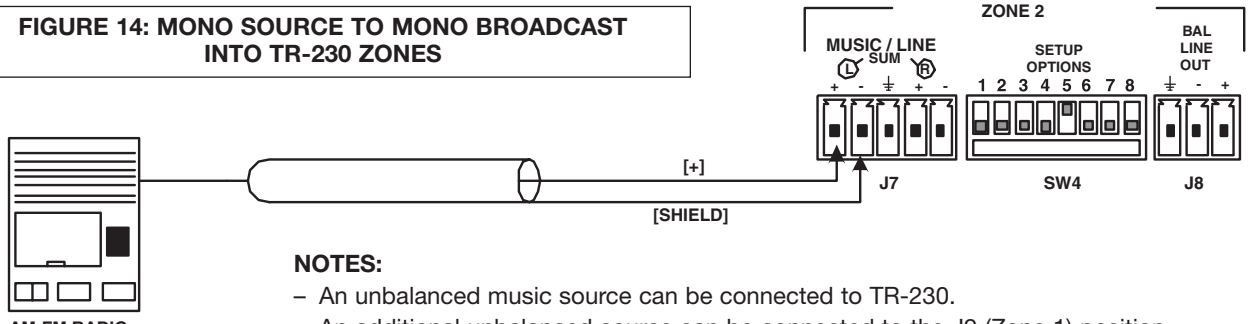
FIGURE 13: STEREO SOURCE TO STEREO BROADCAST INTO ZONE 1 AND ZONE 2



NOTE:
Do not sum Zones 1 and 2 in SW6 / Position 3 [place in OFF mode].

INSTALLATION TIP:
Wire speakers similar to an A-B masking system wherein Zone 1 is the left channel and Zone 2 is the right channel.

FIGURE 14: MONO SOURCE TO MONO BROADCAST INTO TR-230 ZONES



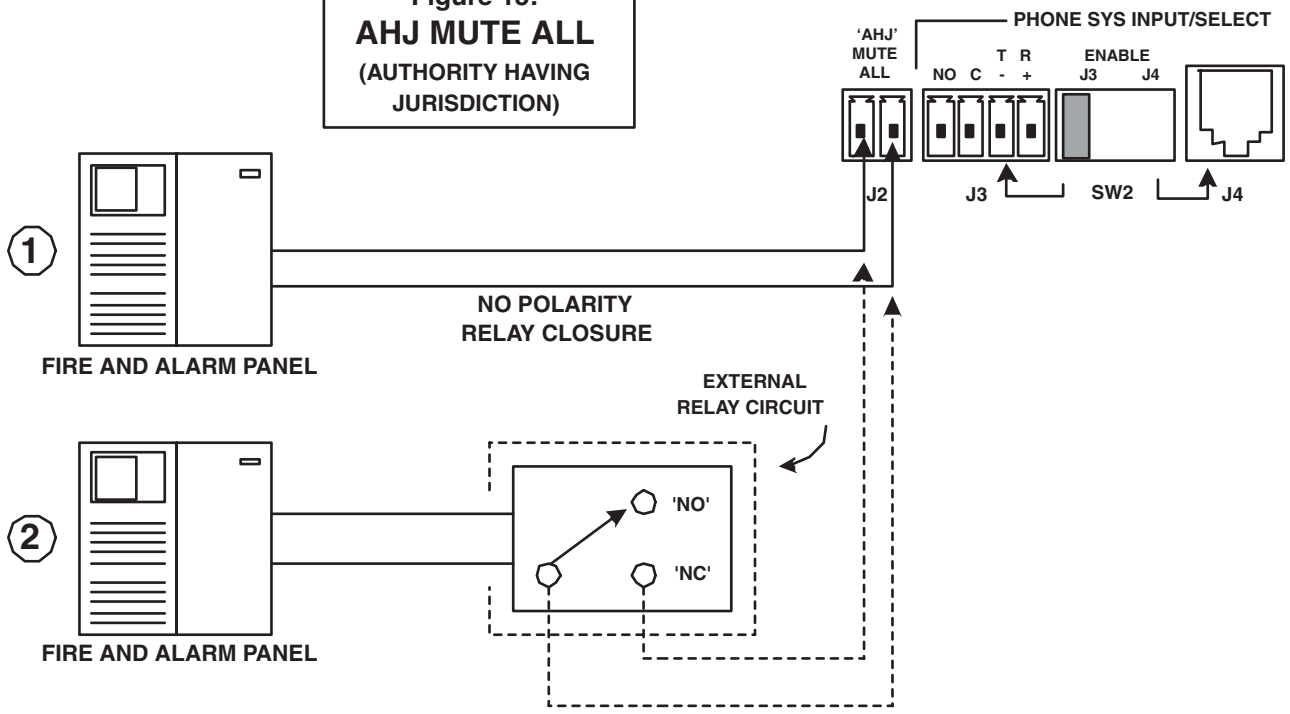
NOTES:

- An unbalanced music source can be connected to TR-230.
- An additional unbalanced source can be connected to the J9 (Zone 1) position as shown above.
- The same music source can be routed to Zone 1 and Zone 2 by utilizing the sum function in SW6 / Position 3. Additional cabling is not required.

SECTION 5E: AHJ/MUTE ALL APPLICATIONS

The TR-230 provides a contact closure on the back panel (J2) for automatic muting of all audio signals (masking, paging, and music) to meet local codes. See Figure 15 below.

Figure 15:
AHJ MUTE ALL
(AUTHORITY HAVING JURISDICTION)



(1) Normal contact closure from life safety panel

(2) Fire alarm system provides a 24V drop out output to trigger relay circuit

SECTION 6: TECHNICAL SPECIFICATIONS

PRODUCT APPROVALS

- UL Listed
- CE Approved
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
- This product meets the requirements of 47 CFR Part 68. US: ARI OT 07B D230

FREQUENCY RESPONSE

Music/Line input.....50 Hz to 18 kHz
Telco input .....250 Hz to 4 kHz

DYNAMIC RANGE

90 dB typical

LEVELS

Nominal operating level .....0 dBu

Maximum line input levels .....+20 dBu

Analog balanced line outputs:

- Nominal output level .....0 dBu
- Impedance.....<100 Ω
- Maximum output level.....+20 dBu

INPUT IMPEDANCES

Music/Line.....> 10k Ω
Telco.....600 Ω nominal

NOISE SOURCES

Peak to average ratio: 8 dB

CROSSTALK

Better than -55 dB @ 1kHz

TELEPHONE LINE TYPES

Dry Loop, Loop Start, Station Access, Centrex, VoIP

- DTMF range..... - 12 dB to + 12 dB
- Audio range ..... - 20 dB to + 10 dB
- Ringing Voltage..... 14 VAC to 105 VAC
- Station Access..... Adjustable timeout trip at - 20 dBm
- Dry Loop Start ..... 20 to 100 mA detection
- Loop Start..... - 15 dBm to + 4 dBm activated with closure
- Page Duck ..... - 20 dB fixed or Mute switch selectable
- Station Access Timeout ..... Selectable at 5 or 10 seconds

POWER

30 W per channel (2 channels); selectable 25 V, 70 V, or 100 V

FREQUENCY RESPONSE

Speaker output .....70 Hz to 20 kHz
Balanced line output.....20 Hz to 20 kHz

DISTORTION

0.1% THD+N

D/A CONVERTER

24-bit Sigma Delta

MAXIMUM POWER CONSUMPTION

85 W

SECTION 7: TROUBLESHOOTING GUIDE

Please follow these tips ***before*** calling Armstrong TechLine.

A. Review and follow all instructions in this manual.

B. Verify that there is a minimum distance of 1.5" vertical clearance between each piece of equipment (amplifiers, controllers, auxiling equipment) to improve heat dissipation.

C. Before connecting any wire, power up the TR-230 and verify that the power LED remains on and is green. If not, power down and wait 1-2 minutes. Repeat this step. If this condition does not clear up, you'll need to replace the unit.

D. Before terminating the speakers or speaker runs, verify the wire is clear of shorts, opens, cross-wires and/or Tip-Ring to ground on the telephone input. Use appropriate equipment (i.e. a Multimeter) to test.

E. If you hear nothing, and expect to, use the Test Tone feature to check that all the speakers are wired correctly to the unit.

F. If volume is too loud or too soft, check that speaker input/output voltages match.

G. If output sounds odd, check to be sure that the left and right input signals are not wired into + and - inputs, respectively.

H. If Talkback is selected and music cuts in and out, make sure that music has been muted (see page 21).

I. If dial tone is heard over the paging system speakers, this may be the result of the type of PBX system used in Station Access mode. See page 16 for tips on how to resolve this situation.

J. If you are still experiencing difficulty, please call TechLine at **1-877-ARMSTRONG (1-877-276-7876).**

NOTES:

SECTION 8: GLOSSARY OF TERMS

AHJ	Authority Having Jurisdiction (normally the local Fire Department)
ASTM	American Society for Testing and Materials
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers based in Atlanta GA.
AWG	American Wire Gauge. The higher the number, the thinner the wire.
CE	European Commission for Standardization (European Union)
CENTREX	Business telephone service provided from telephone Central Office
dB / dBu / dBV	dB is a logarithmic unit named for Alexander G. Bell. dBu and dBV are measures of relative voltage level referenced to 0.775V rms for dBu and 1V rms for dBV.
DSP	Digital Signal Processor
DTMF	Dual Tone Multi Frequency, commonly referred to as “Touch Tone”
DUCKING	Lowering level of background music below that of an incoming page
E-5	Armstrong ESSENTIALS model speaker panel
EIA	Electronic Industry Association (based in Washington DC)
FCC	Federal Communications Commission
IEC	International Electrotechnical Commission (based in Geneva, Switzerland)
P-25	Armstrong PRIVACY model speaker panel
PSTN	Public Switched Telephone Network
RMS	Root Mean Square
SPEECH PRIVACY	Refers to the lack of speech intelligibility from adjacent talkers. Several levels of speech privacy are defined in the ASTM standards covering a range from Confidential privacy meaning speech sounds can be heard but not understood, to Normal privacy meaning that speech can be occasionally heard and understood but is generally non-intrusive, to Poor privacy wherein all adjacent speech can be heard and understood. These levels can be related to ranges of a “Privacy Index” (PI) representing each level of speech privacy.
TIA	Telecommunications Industry Association
UL	Underwriters Laboratories (based in Northbrook, Illinois)
VoIP	Voice over Internet Protocol

SECTION 9: WARRANTY INFORMATION

There is a one (1) year warranty for the following i-ceilings® Electronic Units: Models A2001 Processor and Models TR-230 and TS-110 TRI-PAK units.

Please read the following terms carefully, as they are affected by the installation conditions as well as Armstrong's obligations and conditions which must be met to trigger them. Armstrong does not assume nor does it authorize any person to assume or extend on its behalf any other warranty obligation or liability.

Armstrong's i-ceilings sound systems electronic units – Model A2001Processor and Models TR-230 and TS-110 TRI-PAK units ("electronic units") are warranted for a period of one (1) year from the date of shipment to the customer. During such warranty period the electronic units shall be free from defects in materials or factory workmanship so that the electronic units shall substantially conform to the Armstrong specifications. This warranty applies to all first quality products. This limited warranty is subject to further conditions outlined below.

All electronic units shall be installed and used in accordance with Armstrong specifications in effect at the time of installation.

Armstrong will not be responsible for defects caused by improper or unreasonable use, water intrusions, lightning, or malfunctions when electronic units have been modified or operated in excess of their rated capacities, altered, serviced, or installed in an other than workman-like manner.

This limited warranty is void if the label bearing the electronic unit's date of manufacture is removed or defaced.

You must notify Armstrong of any electronic unit failure covered by this warranty within 30 days of first observation of failure by writing to the following address: Armstrong World Industries, Inc. Post Office Box 3001, Lancaster, Pennsylvania 17604, or call us at 1-877-ARMSTRONG. After an inspection has been conducted by Armstrong, a written authorization to return must be issued by Armstrong prior to any return.

Electronic units returned and found to be defective, in Armstrong's sole judgment, will either be replaced (replacement products may be remanufactured or reconditioned devices) or repaired without charge. The replaced or repaired electronic unit is warranted for the remainder of the original warranty period.

The foregoing constitutes the entire obligation of Armstrong World Industries, Inc., and there are no other warranties expressed or implied, including any warranty of merchantability or fitness for any purpose whatsoever. Liability is limited to the above, and Armstrong World Industries, Inc., shall in no event be liable for incidental or consequential damages other than to replace or repair the electronic unit(s) itself.

Please Note: Some jurisdictions do not allow exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you.

Reference to Armstrong in this section shall mean, for the United States: Armstrong World Industries Inc., Armstrong Building Products, P.O. Box 3001, Lancaster, PA 17604; and shall mean, for Canada: Armstrong World Industries Canada Ltd., Armstrong Building Products, 6911 Decarie Blvd., Montreal, Quebec H3W 3E5.

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NOTES:

Contact **TechLine™ at 1-877-ARMSTRONG**
(1-877-276-7876)
with questions or for technical assistance.

Patents pending. Features and specifications subject to change without notice.

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