

***MODEL UPAM  
CONSUMER PAGING  
EQUIPMENT  
REFERENCE GUIDE***

**Document No. 999-350-657**

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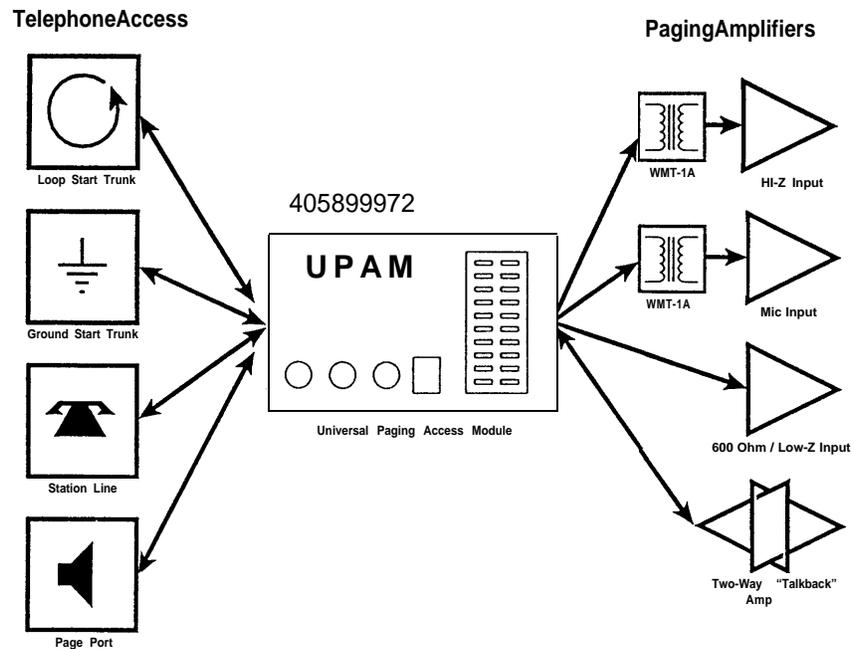
## INTRODUCTION

The AT&T UPAM is a **Universal** Paging Access Module. It is designed to interface a telephone system with a paging system.

### Why an AT&T UPAM?

There are many different paging systems, from many different manufacturers, already installed in the field. Your customer may have a paging system and wants his new telephone system to have access to paging. Or, your customer may want to add a new paging system to his facility and interface it with his telephone system. The UPAM will let your customer access his paging system from his telephone, regardless of the manufacturer. The UPAM is a Universal paging access module and is designed to interface all major telephone systems with practically any paging system available from any manufacturer.

The diagram below shows the UPAM as the interface between the telephone system and the paging system.



## **This Reference Guide Will Help You...**

The goal of this reference guide is to familiarize you with the two basic types of paging systems you are likely to encounter. It describes each type of system so that you can determine which type you are dealing with. Illustrations are provided to show typical equipment.

The reference guide will assist you in determining the best way to connect the UPAM to the paging system by describing the input and output types found on typical paging amplifiers. The reference guide will also discuss other considerations which effect proper installation. Finally, the reference guide provides detailed drawings showing the wiring of the UPAM to the different input types.

### **Connection to the Telephone System**

The connection of the UPAM to the telephone equipment is covered in detail in the installation manual included with the module. Illustrations provided in the installation manual show the connection of the UPAM to the following access points:

- Loop Start Trunk Port Access
- Ground Start Trunk Port Access
- Station Line Access
- Page Port Access

### **Connection to the Paging System**

The connection of the UPAM to the paging system equipment consists of connecting the Paging Output terminals of the UPAM to the appropriate input terminals on the paging system. See the detailed drawings at the end of this reference guide.

## **TYPES OF PAGING SYSTEMS**

Paging systems can vary widely in size, features and equipment.

Paging systems can be large, with one or more amplifiers driving hundreds of speakers, and having ancillary devices such as background music sources, announcement microphones, and tone generators. Or, they can be quite small and self-contained, with no extra features and as few as one speaker (a description of speaker types can be found later in this document).

Even though there may be a large difference in the configurations of a paging system, they all fall into one of two basic categories:

- **Central-amplified paging system**
- **Self-amplified paging system**

### **Central-Amplified Paging Systems**

Central-amplified paging systems use a high-power amplifier or amplifiers to distribute the paging audio. These can be “one-way” amplifiers, distributing the page from the telephone to the speakers, or “talkback” amplifiers, which allow talkback from the speaker to the telephone.

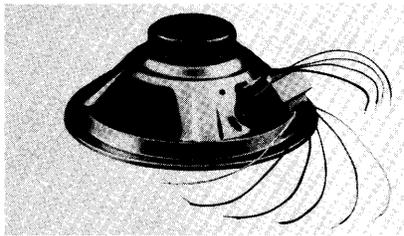
The amplifiers in a central-amplified paging system usually provide multiple inputs, such as for background music and one or more microphones. Some amplifiers provide priority or precedence functions whereby one input is muted (turned off) when another input becomes active.

Central-amplified paging systems are often referred to as 25 volt or 70 volt systems. This is because the paging system speakers are driven from a 25 volt or 70 volt output tap on the paging system amplifier. The output tap provides a maximum of 25 volt or 70 volt AC regardless of the power rating of the amplifier.

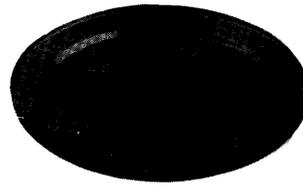
The speakers used in central-amplified paging systems are known as “cone-type” or “horn-type” speakers. Cone-type speakers are usually mounted in ceilings, on grilles, or on walls in enclosures called baffles. Horn-type speakers usually include a mounting pedestal which permit the speakers to be aimed. Each speaker has a small transformer to adapt it to the high-voltage (25V/70V) amplifier output. This transformer has a number of different “power taps” that allow the user to select the maximum amount of power that the speaker will consume (volume controls or pads may be included to allow the user to lower the volume).

Central-amplified paging system output taps and line-matching transformers are discussed in more detail in the Central-Amplified System Considerations section of this reference guide

#### Central-Amplified Paging System Equipment



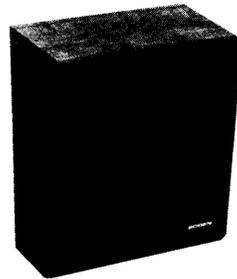
Cone speaker with  
line-matching  
transformer



Ceiling grille



Horn-type speaker  
with mounting base



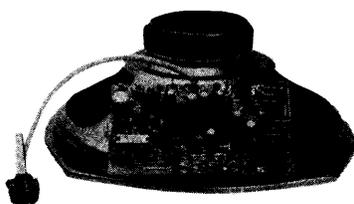
Wall-baffle

## Self-Amplified Paging Systems

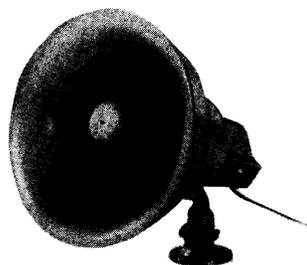
Self-amplified systems use what is referred to as self-amplified “cone” speakers or self-amplified “horn” speakers. These speakers resemble those used in central-amplified systems, except that each has a small amplifier attached or built-in. The amplifier is usually rated from 1 to 15 watts and drives only the speaker to which it is attached. Each amplified speaker usually has its own volume control.

Self-amplified systems usually use 24 volt power supplies to power the individual speaker-mounted amplifiers. Depending upon the power rating of the speakers, a power supply may be able to drive many speakers. In some cases, a small buffer amplifier is used to supply an adequate signal to drive a large number of amplified speaker inputs.

### Self-Amplified Paging System Equipment



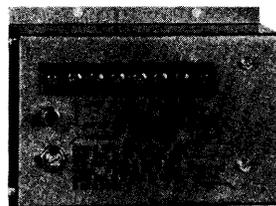
Self-amplified cone-type speaker



Self-amplified horn-type speaker



Power supply



Typical buffer amplifier

## CENTRAL-AMPLIFIED PAGING SYSTEM INPUTS

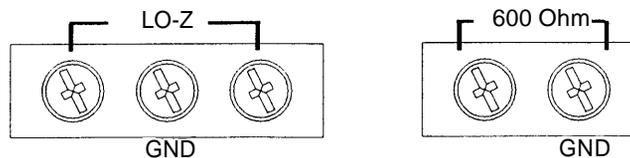
The inputs on a centrally-located amplifier may include:

- 600-ohm inputs, also known as a Lo-Z (low-impedance), balanced or unbalanced inputs.
- AUX (Auxiliary) inputs.
- MIC (Microphone) inputs, either Hi-Z (high-impedance) or Lo-Z.

In practice, the types of connector (and its labelling) for each of the above inputs may not be standard from manufacturer to manufacturer (or even from product to product for one given manufacturer). Even so, this does not usually make input identification difficult, since an input type can normally be determined by noting the manufacturer's labeling and the type of connector.

### 600-ohm/Lo-Z inputs

600-ohm/Lo-Z inputs can be two screws on a terminal strip, although an RCA phono jack or modular telephone jack are sometimes used. These inputs can be balanced (or floating), usually by means of a transformer, or unbalanced where one terminal is connected to the amplifier ground\*. They are usually labelled LO-Z or 600 Ohm as shown below (the GND terminal on Lo-Z inputs is used to ground the shield of a shielded cable). The signal voltages required for these inputs are generally equal to those found on telephone lines. Balanced inputs are more desirable since they eliminate instances of hum-producing ground loops.



600 Ohm



Phono Jack

\*Read the paragraph on background music in Other Considerations when connecting the UPAM to an unbalanced input.

On some amplifiers, especially those designed for telephone paging applications or talkback applications, the 600-ohm terminals may be labelled TEL LINE or TIP/RING as shown below.



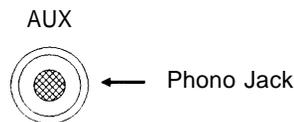
These inputs are balanced with no ground connection, since simple twisted-pair is the intended hook-up cable.

On most amplifiers intended for telephone paging, the 600-ohm or Lo-Z input is the “main” input for the amplifier and the one to which the UPAM should be connected. To install the UPAM, simply connect the PT and PR terminals of the UPAM to the input terminals of the amplifier. A typical Lo-Z Input connection diagram is shown in the illustration on page 16.

**Important: Remember that a 600-ohm/Lo-Z input is NOT the same as a Lo-Z Microphone input.**

### Hi-Z (AUX) Inputs

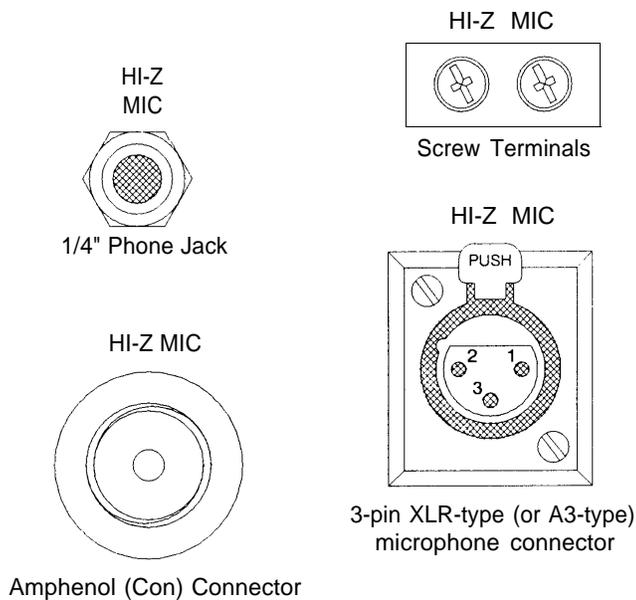
Hi-Z inputs are generally RCA phono jacks labelled AUX, as shown below, and are usually used to connect to music sources (sometimes screw terminals are used). They require input signal voltages equal to those found on most home stereo equipment. These levels are usually greater than those found on telephone lines. When you connect the UPAM to this input type, it is good practice to use an “impedance-matching” step-up transformer, such as the WMT-1A transformer included with the UPAM kit.



If an amplifier has no Lo-Z/600-ohm inputs, but provides an AUX input and microphone inputs, it is better to connect the UPAM to the AUX input. A typical Hi-Z AUX wiring diagram is shown in the illustration on page 17.

### Hi-Z Microphone Inputs

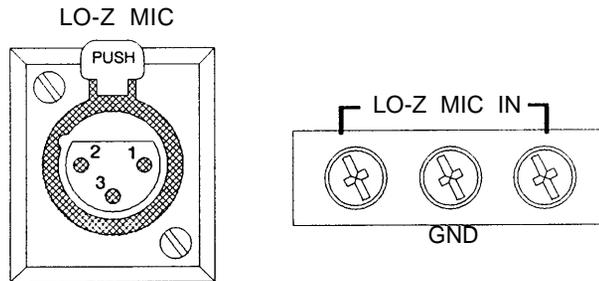
Hi-Z Microphone inputs are generally 1/4" phone jacks, screw terminals or 3-pin XLR-type (or A3-type) connectors labelled Hi-Z MIC as shown below (only 2-pins are used on 3-pin connectors in Hi-Z applications). On older equipment, an amphenol (con-type) connector is sometimes found. Hi-Z microphone inputs are very sensitive and signal voltages found on telephone lines may very often overload these inputs. Therefore it is necessary to attenuate these signals to make them more compatible. This can be accomplished using the WMT-1A accessory and selecting its "microphone" jumper position (see instructions included with the WMT-1A accessory).



Hi-Z microphone inputs are a particularly bad choice for use in a paging system because of noise pickup and their inherent tendency to receive local am radio broadcasts if they are connected to long input leads. The large variety of input connector types also makes adapting to this input difficult.

### Lo-Z Microphone Inputs

Lo-Z microphone inputs are generally 3-pin XLR-type (or A3-type) connectors, although screw terminals are also used. These connectors are usually labelled Lo-Z MIC, as shown below. These inputs are always balanced, with 2 pins used to receive the signal and the third pin normally tied to ground and used for shielding purposes. Lo-Z microphone inputs are the most sensitive of all inputs generally found on central amplifiers and require the use of the WMT-1A accessory as described previously for Hi-Z Microphone Inputs.



3-pin XLR-type (or A3-type) microphone connector

Due to the high sensitivity of microphone inputs, they should only be used as a last resort. The Lo-Z input is the more desirable of the two because it is less susceptible to noise pickup and has a more standard type of input which is easier to adapt to. A typical Microphone wiring diagram is shown in the illustration on page 18.

## CENTRAL-AMPLIFIED PAGING SYSTEM CONSIDERATIONS

### Output Taps

The amplifier in a central-amplified paging system usually has a number of different “output taps”. Connections to the taps are normally made to a bank of screw terminals, although RCA-type phono jacks are used in some cases. On screw-type terminals, there is usually one terminal labeled COM (for common), to which all the other taps are referenced. One side of the speaker network is always connected here while the other side is connected to one of the specific taps. The following lists the most commonly available taps on centrally located amplifiers.

- 25V – This output produces a maximum of 25 volts (as measured on an AC voltmeter) regardless of the power rating of the amplifier. Connection to the speaker network is made between the COM and 25V terminals.
- 70V – This output produces a maximum of 70 volts (as measured on an AC voltmeter) regardless of the power rating of the amplifier. Connection to the speaker network is made between the COM and 70V terminals.
- 4-, 8- or 16-ohm – The maximum voltage varies with the power rating of the amplifier, but is significantly lower than what is available from the 70V and 25V taps. Connections to the speaker(s) is made between COM and the required tap. These outputs are not used in most paging systems, but may be used in certain applications to drive a small number of high power speakers.

Almost every central-amplified paging system will use the 70V output (some institutions are required, by the electrical code, to use the lower voltage, 25V, tap). This is to reduce the amount of power that is lost in the lines supplying the speaker – commonly known as “line loss”.

## **Line Loss**

The amount of power a speaker consumes is determined by the current flowing through it times the voltage across it, therefore, any voltage lost in the speaker lines will reduce the power available for the speaker, and the efficiency of the paging system. To maximize efficiency, the voltage drop across the speaker lines must be reduced.

Ohm's law states that the voltage drop across a wire is equal to the resistance of the wire times the current flowing through it. Since it may not be possible to change the resistance of the speaker wires to lower the voltage drop, the current flow in them will have to be reduced. Of course we must remember that since speaker power is the product of the both the speaker current and voltage, we cannot reduce one without raising the other proportionately.

Therefore, if a high voltage signal is used to drive the speaker, the current flowing through the speaker and the lines will be low, reducing the voltage drop and making the system more efficient. For this reason, most paging systems use the 70V output tap.

## **Speakers**

Cone- and horn-type speakers differ both in construction and performance, but are identical from an electrical point of view.

Cone-type speakers produce a smooth, natural sound for indoor use in low to moderate noise environments.

Horn-type speakers produce a sharp, "tinny" sound which provides good intelligibility in high noise areas. They are more efficient than cone speakers, producing a louder sound for the same amount of power consumed, and are typically weather resistant for outdoor use.

### **Line-matching transformer**

The line-matching transformer used on both central-amplified speaker types has a number of different “power taps” that allow the user to select the maximum amount of power that the speaker will consume. On cone speakers these taps are normally screw terminals or individual wires and, just like the amplifier outputs, there is a common lead to which all the other taps are referenced. Generally, on horn speakers, only two terminals are available for connection and a built-in rotary switch is used to select the speaker loading. Note that for proper phasing, the common lead on the amplifier is connected to the common leads on the speakers. It is important to note that the load that a speaker presents to an amplifier is the amount of power that the speaker will require from the amplifier when operating at full volume. If the total of all the speaker loads is greater than the power capability of the amplifier, the amplifier may overheat and shut off to protect itself.

## **SELF-AMPLIFIED PAGING SYSTEM CONSIDERATIONS**

Generally, the input impedance on a self-amplified speaker is 600-ohms. When the inputs of many speakers are connected (in parallel) to the paging signal source (in most cases a UPAM), the combined paralleled impedance may be too low for the signal source to drive. This could lower the maximum volume of the system below acceptable levels. For example, if 10 self-amplified speakers are used in a paging system, their combined input impedance will be 60 ohms (ten 600-ohm inputs in parallel). Since the output impedance of the UPAM is 600 ohms, this 60-ohm impedance would allow only 10% of the usual UPAM output signal to reach the inputs of the self-amplified speakers. To solve this problem, most self-amplified speaker manufacturers offer buffer amplifiers which can supply an adequate signal for a large number of paralleled self-amplified speakers. Connect the PT and PR terminals of the UPAM to the input terminals of the buffer amplifier. The output of the buffer amplifier feeds the amplified speaker inputs.

Connections to the self-amplified speakers are generally made to screw terminals or, in the case of a horn speaker, to wires protruding from the base (in cone speakers, these are usually found on the built-in amplifier's printed circuit board). Self-amplified speakers generally have individual volume controls (protected or exposed).

The input signal to the self-amplified speaker is equivalent to that found on telephone lines, therefore cross-talk is not a problem if the lines are run alongside telephone wire. Even though the amplifier is mounted on its speaker, there is still a voltage-drop problem associated with self-amplified speakers; since a self-amplified speaker must be supplied with operating voltage, a voltage drop in the supply lines may become an important factor when the power supply is located at a distance from the speaker. Unfortunately, the only way to address this problem is to reduce the distance between the power supply and the speaker, or reduce the resistance of the supply lines. See the illustration on page 19.

## OTHER CONSIDERATIONS

### Background Music

The UPAM provides an input for background music which will automatically mute the background music signal supplied to the amplifier when a page is made. This input also includes a volume control for adjusting the loudness of the background music over the paging system. It is highly recommended that this input be used to provide the background music function to all amplifier types.

#### **Important Note:**

When the UPAM is to be connected to an unbalanced amplifier input, **the PR terminal on the UPAM must be connected to the grounded amplifier terminal.** Reversing the UPAM output connections may short the background music source's output.

### Volume Controls

There are usually a number of volume controls on central-amplified paging system amplifiers. These normally consist of a MASTER volume control and individual controls for each of the inputs. It is normal practice to adjust the mix between different inputs using the individual controls and then set the overall volume of the paging system with the MASTER control.

### Microphone Precedence

Some amplifiers provide microphone precedence, whereby an input will be muted (turned off) by an external contact closure. In some systems this is used to mute background music, however, when using the UPAM, this method should be abandoned in favor of using the UPAM's background music input.

## **Input Phasing for Multiple Amplifiers**

In some large central-amplified paging systems, more than one amplifier is required. In this case, the inputs of each amplifier should be connected in parallel to the output terminals of the UPAM. Be careful not to reverse the connections to any of the amplifiers because this may cause distorted sound.

## **Tone Controls and Lo-Cut Switches**

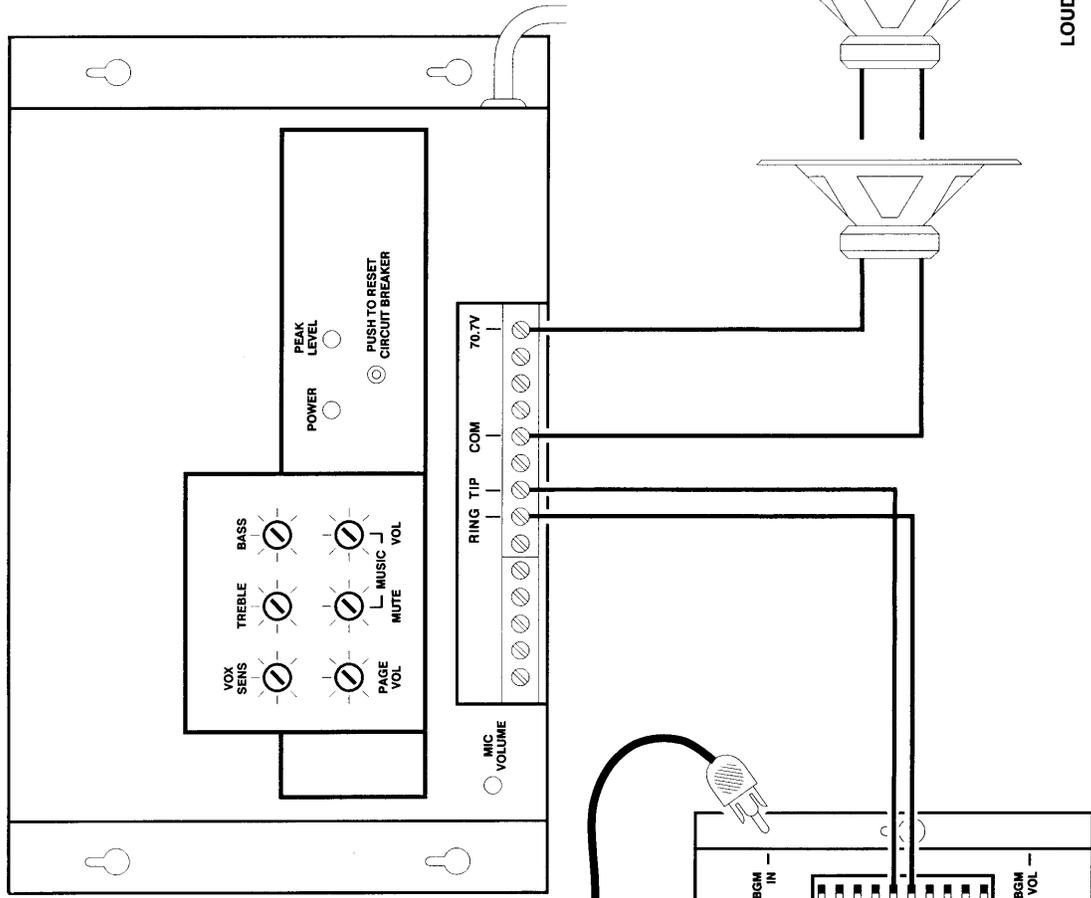
Tone controls are used to adjust sound quality. Generally speaking, intelligibility is improved by increasing the high frequency (treble) response. Low frequencies (bass) tend to lower the intelligibility and “muddy” the sound. The paging system sound should be natural, therefore restraint should be exercised when adjusting these controls.

The Lo-Cut switch found on some amplifiers is used to reduce the low-frequency (bass) response when using horn-type speakers. Horn speakers can be damaged by excessive low frequencies.

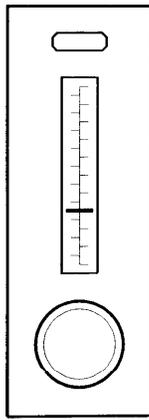
## **Stand-Alone Telephone Paging Systems**

Please be aware of self-contained, customer-owned paging systems. This is a paging system originally installed with its own dedicated telephone(s) or telephone handset(s) (example – ITT Terryphone). These systems were not designed to work in conjunction with a telephone system – they were designed to stand alone. These systems should be avoided as possible candidates for interfacing. There is no compatibility for a telephone system page port access.

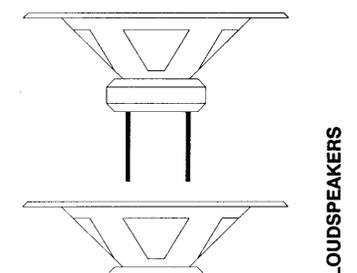
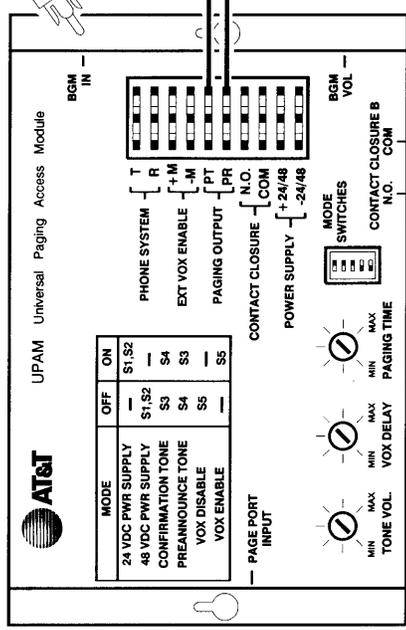
PAGING AMPLIFIER WITH 600 OHM TELEPHONE INPUT



BACKGROUND MUSIC SOURCE

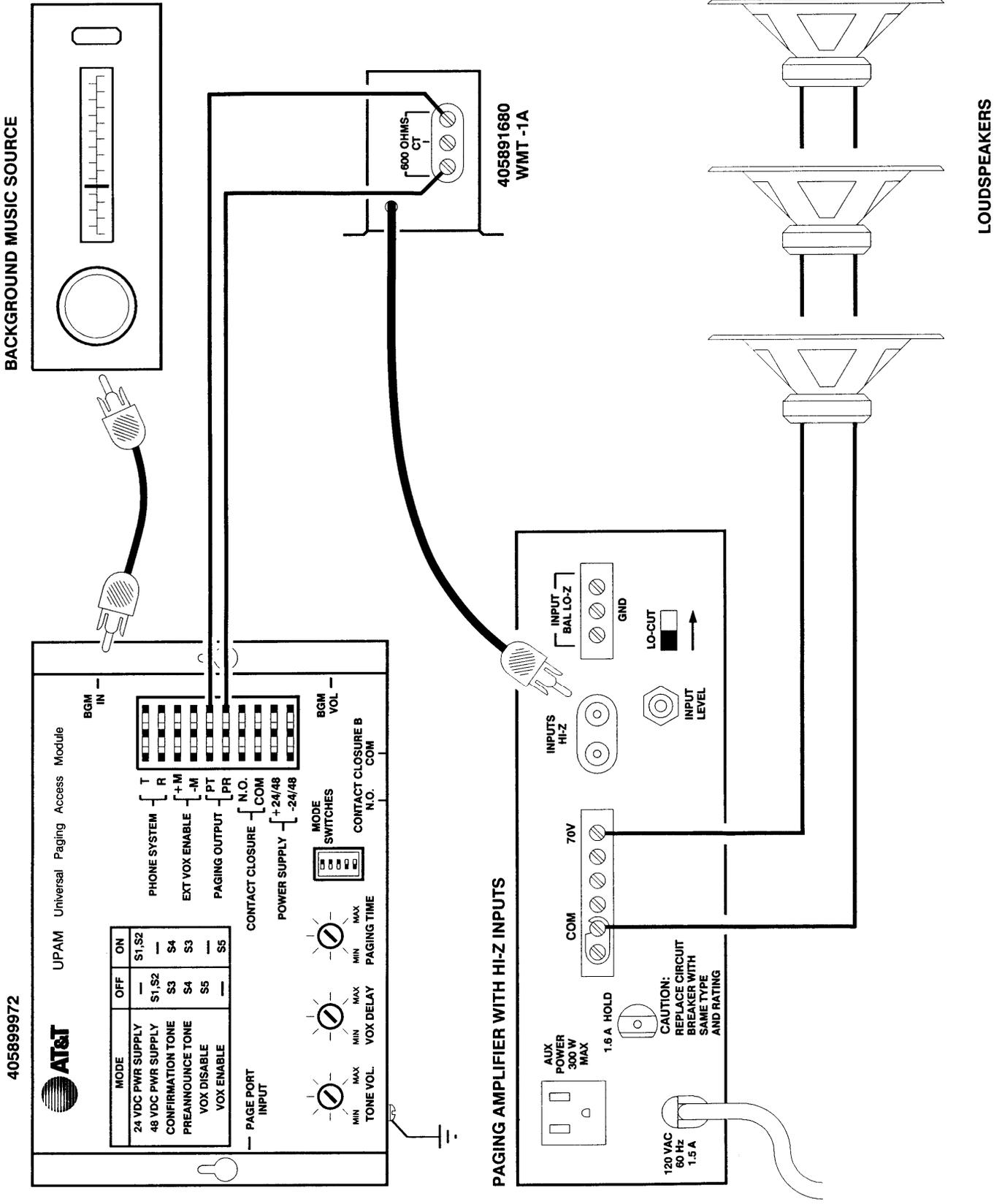


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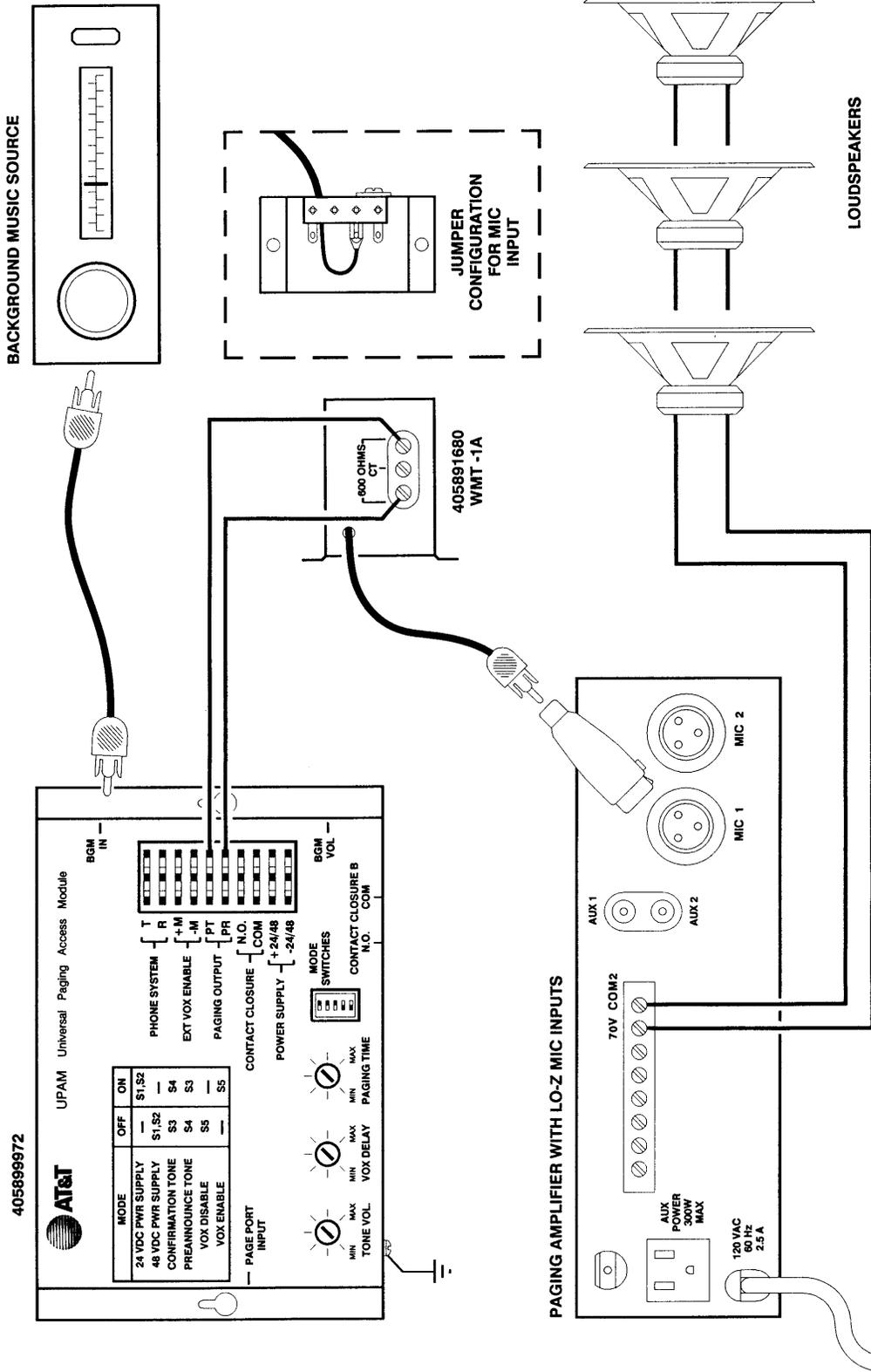


LOUDSPEAKERS

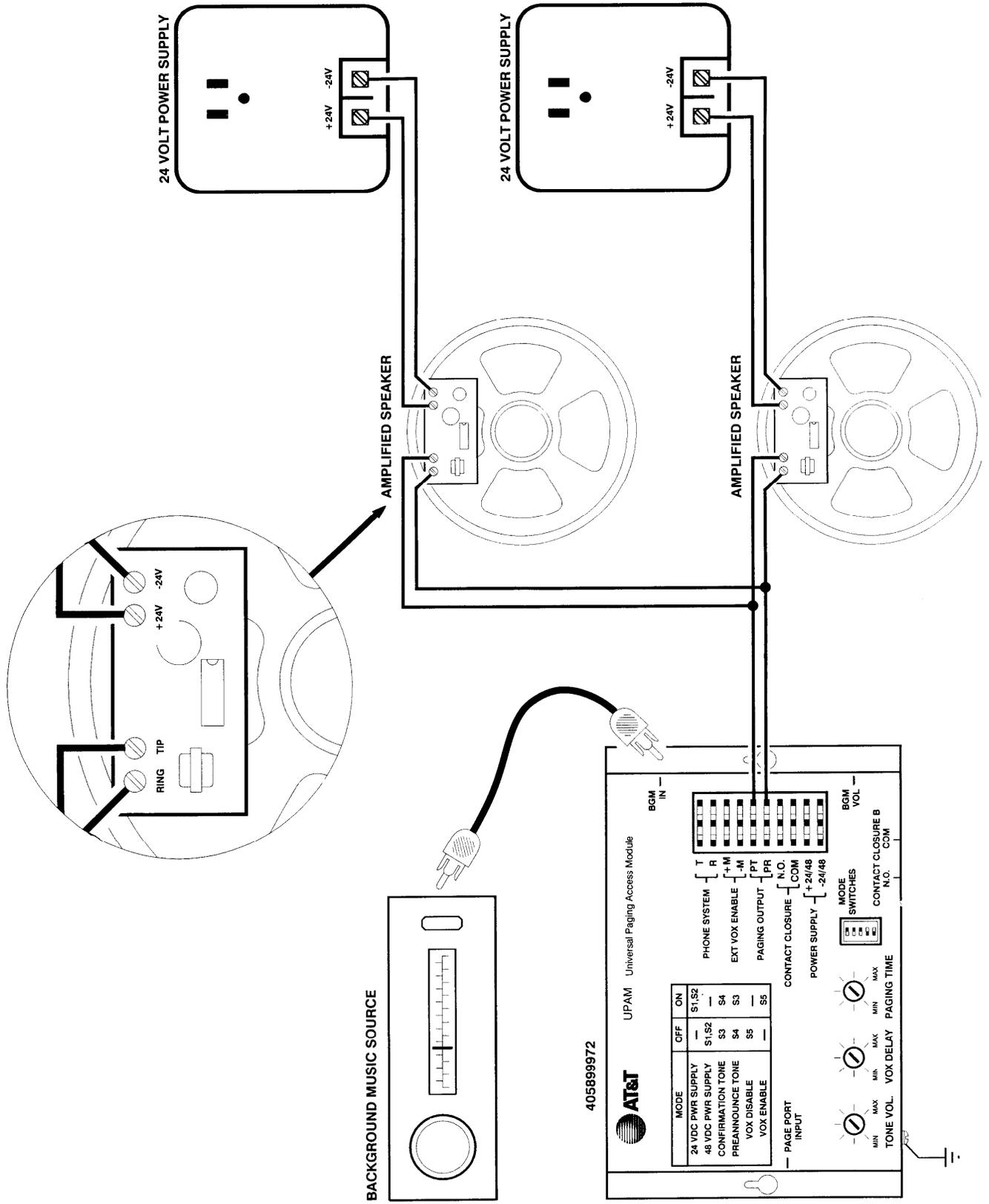
Wiring Diagram – UPAM Connected To Lo-Z Input



Wiring Diagram – UPAM Connected To Hi-Z (AUX) Input



Wiring Diagram – UPAM Connected To Microphone (MIC) Input



Wiring Diagram – UPAM Connected To Self-Amplified Speaker System





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