

# LynTec PAC Plus

## MULTI-CHANNEL, MULTI-TIMED, PROGRAMMABLE AUDIO CONTROLLER

for timed level control of MASKING NOISE, PAGING and MUSIC



### Benefits of time/level controlled masking

Adapts to speech privacy requirements, reducing masking noise level at nights and weekends when office population is low. Masking may also be reduced during lunch hour.

Off-hours security is improved when masking is reduced.

Unusual noises become more obvious.

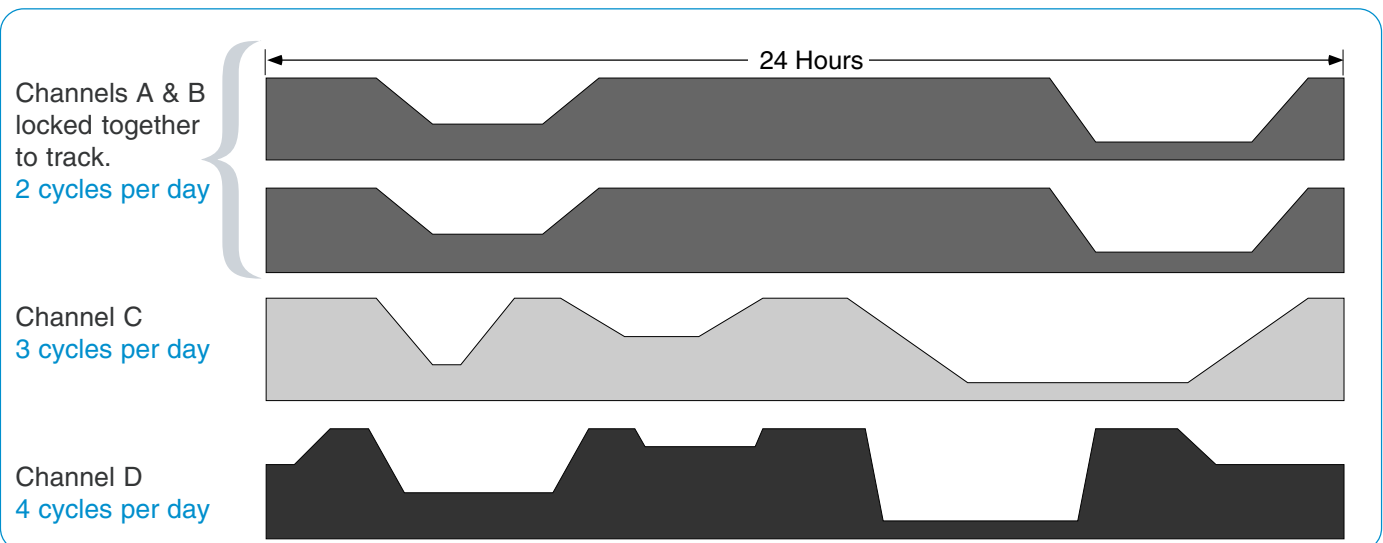
### Benefits of timed music level control

Reduces music levels during off-hours, providing a more adaptive environment.

Provides a control mechanism to conform to urban noise codes for outdoor background music.

### PAC+ Features

- Timed level control of up to 6 channels of *any* program material.
- Up to 4 timed level cycles per channel per day.
- Individual day control for all days, normally used for weekends.
- Fully *FIELD PROGRAMMABLE* from the front panel.
- Attenuation programmable from 0 to 24 dB in 1.5 dB steps
- Level changes are made in 3/8 dB steps for **super-smooth transitions.**
- Channels may be locked together to assure tracking or programmed separately for different time programs.
- Automatic programming lock prevents program tampering, no security covers are needed.
- Built-in pink noise generators optional, 1 to 6 channels of non-coherent pink noise. Two channel masking systems are typical.
- SLO-START** is standard. Automatic slow first-time turn-up of masking noise without costly return trips. Reduces the psychological impact of adding masking noise to occupied space.
- Clock and field programmed time and level entries are totally non-volatile with over 10 years of operation in the absence of power. Clock and RAM assembly is plug-in replaceable.
- Automatic daylight saving time and leap year adjustment. Shipments after 8/05 conform to old (thru 2006) and new (2007) DST protocols.
- At power-up the PAC+ *soft starts*, eliminating instantaneous high level noise when AC returns after a power failure.
- Full input and output transformer isolation for high common mode hum rejection: 5K $\Omega$  bridging inputs, 600 $\Omega$  outputs.
- Stable proven design.
- All solid state, no relays.
- UL & CSA listed power supply attached to reduce rack clutter.



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# Techno Politics of Sound Masking

by Lynn Potter

Open-plan offices offer flexibility at reasonable cost. The furniture, low partitions and carpeting found in open-plan offices are designed to absorb noise. The air conditioning system is also designed to minimize offensive noise.

## Why it's done

A quiet office is a productive atmosphere *until it is populated with people!* Speech privacy then becomes an unsolved opportunity that may be addressed with sound masking.

Sound masking refers to the addition of electronically generated and spectrally shaped noise (not too hissy or rumbly, NC38-NC40) to reduce the intelligibility of speech.

## How it's done

The most basic sound masking system consists of an electronic noise generator, an equalizer to shape the frequency spectrum of the noise, and power amplifiers feeding loudspeakers hidden above a lay-in ceiling.

## The politics of sound masking

Sound masking must be unobtrusive to the people occupying the space. Masking noise is subjective. The shaped pink noise used in sound masking sounds much like air conditioning noise. To the occupants it should seem as natural as the air conditioning noise in their car.

Many people harbor a basic resentment to being managed. The addition of *artificial noise* in the workplace to improve speech privacy and productivity may appear manipulative.

## Easy does it with time control

Successful sound masking must be brought into the workplace *very tactfully* and controlled carefully.

The masking level should be lower at night when the work force is small.

Speech privacy is usually less important than a quieter workplace for the off-peak-hours workers.

It is especially unnerving to return to a fully sound-masked office from a deserted street.

"There's nobody here...why is it so noisy?"

## Better security

Timed level control of masking noise is also important to security personnel.

Off-hours masking should be lower for better detection of unusual security related sounds.

## Introducing sound masking into the workplace

A new facility is the easiest. When people move into new surroundings they expect some adjustment to their new environment. If the air-conditioning noise seems higher than in the unmasked office they moved from, they'll probably get used to it.

Installing masking in occupied space is a bigger challenge. The installation of loudspeakers and the equalization should be done in off-hours to prevent disruption of activities... "Whatcha doin'?" "Uh..., we're puttin' in noise to cover up your gabbin'." [wrong!]

The initial turn-on is best done at a low level with upward adjustments over a period of days to minimize the psychological impact of adding noise to the space.

**LynTec's SLO-START** does this automatically without midnight technician trips.

## Low Cost vs. Low Success

Several technical elements separate low cost masking that may be unsuccessful from a first class masking system that the occupants and management will be pleased with. Proper spectral shaping and consistent level of noise is important to prevent hot or weak spots where the noise is noticeably different, drawing attention to it.

## Level Consistency Important

Level consistency is important for the masking system to be innocuous. The less change heard the better. Loudspeaker coverage is one of the favorite cost-cutting targets in lo-ball masking systems.

Skimping on loudspeaker quantities allows skimping on power amplifiers. This double barreled cost savings usually results in poor masking coverage with obvious variations in noise as you walk through the office or down a hallway. This level scalloping is a dead giveaway that there is something more than air-conditioning noise up there.

Another cost-cutting approach is to mask only

the areas that are causing problems now by pinpointing loudspeaker coverage. When the office is rearranged, this inconsistent technique backfires.

Complete, consistent masking coverage helps deliver the flexibility implied by an open-plan office.

## Two-channel masking systems

If we believe consistency is desirable, then two channel masking is divine. Two channel masking costs little more in large systems than a single channel. Two channels offer two big advantages, redundancy and no phase coherence.

## Redundancy

Two redundant channels feeding crisscross connected loudspeakers provide a no-sweat masking system should one channel fail. It is not unusual for people to start complaining about the room temperature when a single channel masking system quits, since they think the air-conditioning has failed.

## Non-phase-coherent sources

When two non-phase-coherent (separate) noise sources are used, the result is a more open and airy feeling in the sound masked space.

When two sources are used, the instantaneous output of each channel has no phase relationship to the other channel. At any point in time, one loudspeaker diaphragm may be pulling while the adjacent diaphragm is pushing. In the next instant it may be push/push or pull/pull, but they are never in sync for any length of time. (sorta like Congress)

This non-coherence creates an open feeling because you can't localize the source of the noise.

If you can't localize the source or hear level variations in the noise, it must be an integral part of the building... probably just the air-conditioning.

Sound masking is like a toupee: It's a cover-up, but if anyone notices, it's not well done.

If masking goes unnoticed with adequate speech privacy, you've done your job well.

For more information on masking system design and final equalization curves ask for application note:

## MASKING NOISE SYSTEMS A DISCUSSION OF THE FUNDAMENTALS

available from LynTec or as a PDF file at

[www.LynTec.com](http://www.LynTec.com)

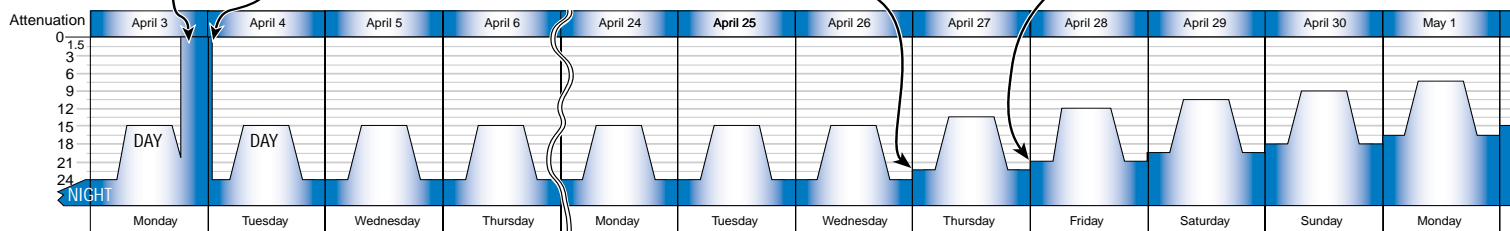
## NOISE and PROGRAM levels controlled by SLO-START plus normal day/night & weekend

After-hours equalization & loudspeaker level adjustments using **Manual level set & Hold.**

Time control returns as soon as **PROGRAM** switch leaves **Hold** position, subject to SLO-START plus the normal day/night cycle.

Tenth 1.5 dB step is removed by SLO-START, nine left.

Ninth 1.5 dB step is removed by SLO-START, eight left.



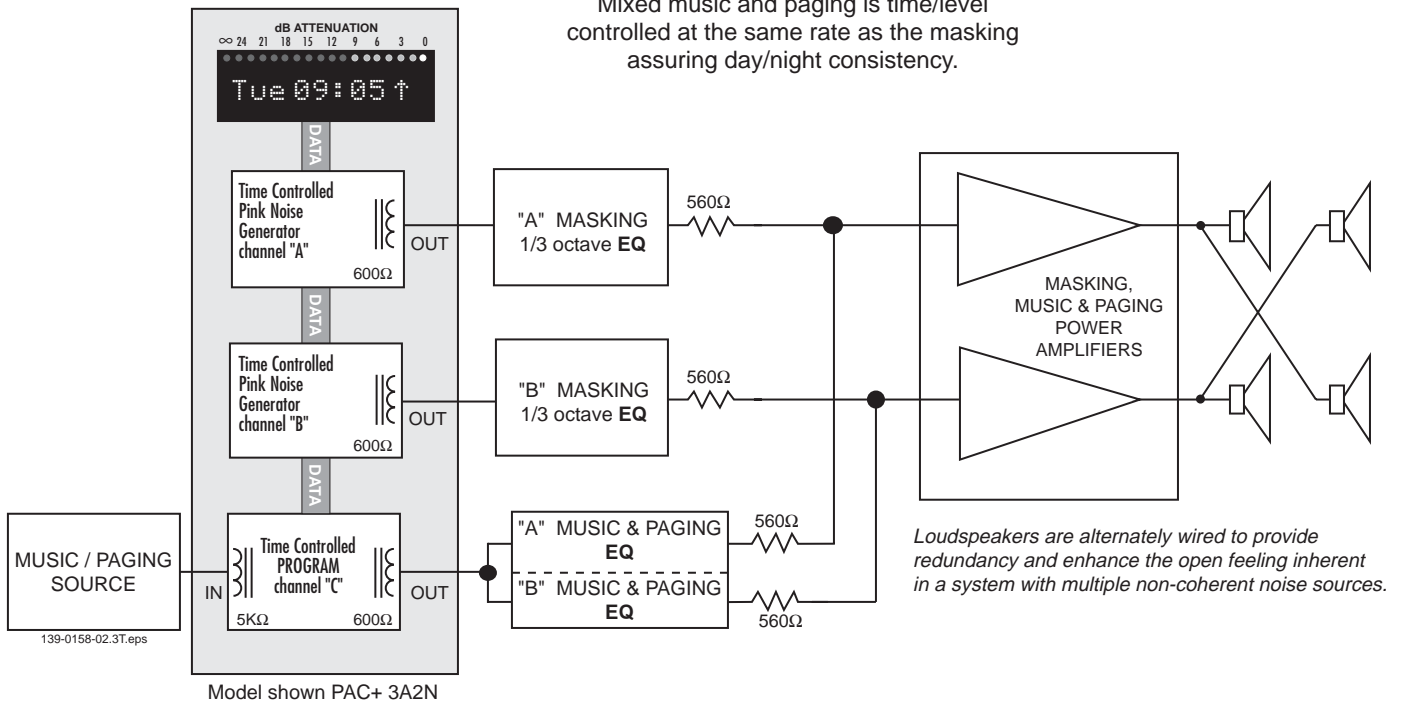
First day of SLO-START.  
Day: -13.5 dB  
Night: -22.5 dB

2nd day of SLO-START.  
Day: -12 dB  
Night: -21 dB

First day of occupancy.  
Day: -7.5 dB  
Night: -16.5 dB

# Typical 2 channel Masking System

Mixed music and paging is time/level controlled at the same rate as the masking assuring day/night consistency.



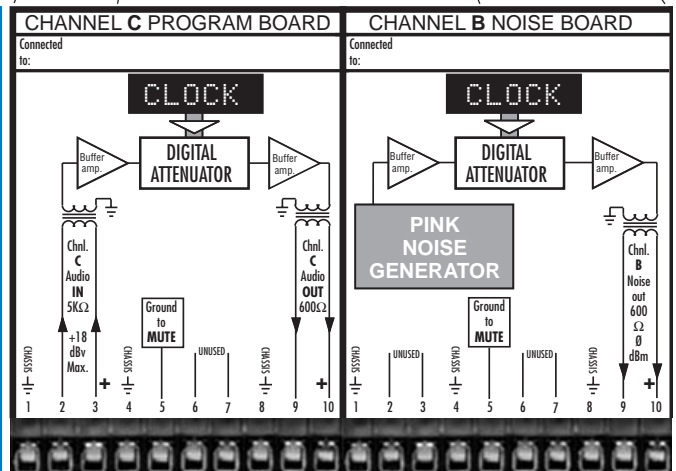
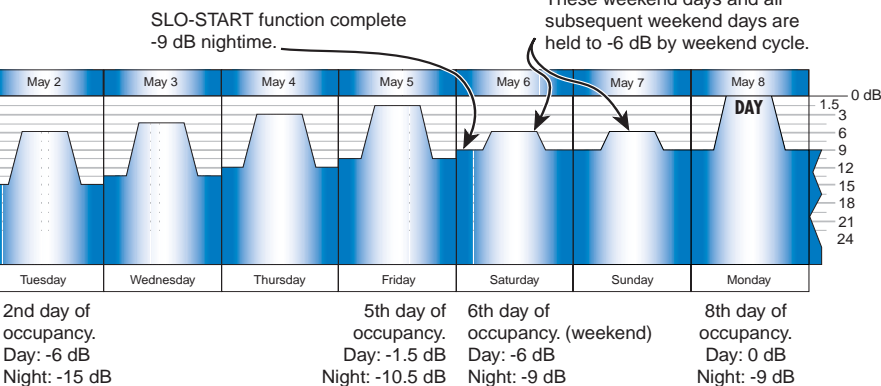
Loudspeakers are alternately wired to provide redundancy and enhance the open feeling inherent in a system with multiple non-coherent noise sources.

REAR VIEW OF PAC+ 3A2N



UL/CSA listed power supply. Attached and out of the way... reduces rack clutter.

## programming



## AUDIO PATH PERFORMANCE

Maximum input level:	6.16 volts RMS sine wave, 20 Hz - 20 kHz. [+18 dBm, 600Ω = output clip point]
Program channel audio input impedance:	5KΩ balanced. (bridging transformer) If noise sources are specified, the inputs are internally connected to noise sources without input bridging transformers.
Maximum output level:	+18 dBm (6.16 volts RMS sine wave, 20 Hz-20 kHz.) [clip point]
Audio output (all channels):	Transformer isolated output to feed 600Ω line. (Typical output impedance is ≈275Ω at 1 kHz.)
Normal operating levels:	
Noise channels:	0 dBm RMS (0.775 volts RMS) [18 dB headroom]
Program channels:	-6 dBm (0.389 volts RMS) [24 dB headroom]
Frequency response (program channels):	±1 dB, 20 Hz - 20 kHz, 0 dBm.
Residual hum & noise:	75 dB or more below maximum output. (20 Hz to 20 kHz)
Added distortion:	Less than 0.5% total harmonic distortion added.
Time controlled attenuation:	Programmable from 0 to 24 dB in 1.5 dB steps.
Transition time:	Time required to make a full programmed level change: Adjustable from 1 to 60 minutes. Default: 30 minutes Field adjustment options: 1, 2, 5, 10, 15, 20, 30, 45, 60 minutes, accessible in Set ATTENUATION position.
Attenuation at 0 step [daytime] (program channels):	0 dB within ±0.1 dB, loaded with 600Ω. (unity voltage gain)
Attenuation accuracy:	±0.17 dB of step setting. 0 to 24 dB
Channel to channel attenuator tracking accuracy:	Within ±0.2 dB. (for stereo applications)
Channel to channel crosstalk rejection:	More than 80 dB.
MUTE:	Each channel is provided with a MUTE terminal. An external contact closure will light the red MUTE LED on the rear and will instantaneously mute that channel's audio.

The MUTE terminal supplies +10v @10 ma. A remote indicator LED may be used in series. (Do NOT use a series resistor) Any number of MUTE lines may be paralleled... each one will source 10 ma.

MUTE may be used in masking systems to mute the masking noise in an emergency, reducing the audio power required for emergency paging.

## OPTIONAL NOISE GENERATORS

Noise generator/s:	Non-coherent pink noise generator/s are optional, located on attenuator boards. The noise is produced by digital simulation with sequence limiting to reduce 'thumping'. The typical cycle time is one minute.
Noise generator output level: (Daytime level)	0 dBm RMS into 600 ohm load. Flat within ±2 dB from 63 Hz to 16 kHz. (As measured with a constant percentage bandwidth analyzer)

## CLOCK & DISPLAY

Controller clock:	Quartz crystal controlled plug-in clock module. Field replaceable.
Expected life:	10 years of un-powered operation.
Battery backup:	Lithium battery built-in to plug-in clock module.
Clock functions:	Automatic leap year. 24 hour time displayed on a low voltage fluorescent, auto-dimmed display.
Daylight Saving Time:	(All units shipped after 8/05 adapted to old & new DST) Automatic daylight saving time advances an hour at 02:00 the first Sunday of April and retards an hour at 02:00 on the last Sunday of October through 2006. Beginning in 2007, automatic daylight saving time advances an hour at 02:00 the second Sunday of March and retards an hour at 02:00 on the First Sunday of November.
	The auto-DST function may be easily disabled for locations not using Daylight Saving Time. When you set the DATE, answer the dialog <b>D1t Svsn?</b> Yes or No.
Clock accuracy:	±1 minute per month. Resolution: 1 minute.

## dB ATTENUATION LEDs

The brightest LED shows the *present* attenuation. The other dimmed LEDs show the *range* of attenuation for the cycle and channel selected.

## PROGRAMMABLE FUNCTIONS

Each channel may be field programmed for up to 4 level cycles per day. A different cycle set may be programmed for each day of the week.

Due to technical progress and product improvement, specifications are subject to change without notice.

## CONTROLS Front panel:

<b>CHANNEL</b> switch:	Selects the channel that is being viewed on the display.
<b>PROGRAM</b> switch:	Selects programmable functions. The active programmable field brightens.  Cycle number / Review: Provides a method to review each cycle's end times, attenuation and transition time.
<b>INCREMENT DISPLAY:</b> ↑	Advances active field.
<b>DECREMENT DISPLAY:</b> ↓	Decrements active field.
<b>SHIFT RIGHT &amp; DONE:</b> →	Shifts active field to the right one character. An additional keystroke when the right-most field is bright enters the information ( <b>DONE</b> ). Entry is confirmed as all fields brighten.
Shift left: ←	Shifts active field to left. After <b>DONE</b> entry, allows resumption of field editing by <i>backing into</i> a single brightened field ready for editing.
<b>LOCK / UNLOCK</b> code: (On rear panel)	System programming is automatically locked out after 4.25 minutes of programming inactivity. The display reverts to current time irrespective of the program switch position and dims to extend display life.


Anyone may determine the program points from the front panel with the **CHANNEL & PROGRAM** switches but all changes are locked out until the **LOCK / UNLOCK** sequence is entered. Unlock code is on back label.

## SLO-START

The **SLO-START** function provides a *slow* automatic turn-up of the masking noise level at initial turn-on. After normal equalization at the daytime level, the Slo-Start *end* date is set to the date you want the system to be at full volume. The Slo-Start *end* date may be set at any future date. If it is set more than 10 days in the future, 15 dB is added to the normal day/night cycles until Slo-Start begins. The normal day to night ratio is maintained throughout the Slo-Start cycle.

Any combination of channels may be slo-started and the completion time may be different for different channels. Example: Channels A & B Slo-Start beginning July 23, 2007 when floor 2 is scheduled to be occupied and reach full daytime level 10 days later when the Slo-Start *end* date is reached. Channels C & D begin their Slo-Start cycle on January 14, 2008 when floor 3 is scheduled to be occupied, ending 10 days later on the 24th. See Slo-Start graphic on inside pages.

## POWER-UP FUNCTION

At initial power-up the PAC+ will start all channels at 24 dB attenuation and increase the level slowly to the programmed level while displaying a  message. A scrolling up arrow indicates the level is increasing. This one minute cycle provides a smooth resumption of masking noise after a power failure. Power glitches or power failures less than 4 seconds long are ignored by the Power Up function.

Brownout resistance: Power supply regulator dropout is <85 volts, 60 Hz A.C. Pink noise output level is maintained down to 85 volts.

## POWER SUPPLY

100-240vac, 47-63 Hz, 30 watts maximum. (4 watts typical)  
Safety ratings: The internally fused switching power supply attached to the side of the PAC+ is UL, CE, CSA and TUV listed.

## FCC DATA

EMI/RFI: The PAC+ meets the class A EMI/RFI requirements of FCC part 15.

## MECHANICAL SPECIFICATIONS

Standard EIA rack mount:	Width: 19.00 inches, Height: 3.5 inches, Depth behind mounting surface: 10 inches max. Extension forward from mounting surface: 0.875 inch max. Weight: 10 pounds max.
Audio connections:	Audio & mute connections are on screw activated terminal strips located on the rear panel.
Power inlet:	IEC 320 receptacle.
Cord supplied:	6 ft., U.S., 3 wire grounded.

## ENVIRONMENTAL SPECIFICATIONS

Maximum relative humidity: 95% non-condensing.  
Operating temperature: 40° F to 120° F

## MODEL NUMBER EXPLANATION

Prefix (all models)	Attenuator Channels	Noise Sources
<b>PAC+</b>	<b>3A</b>	<b>2N</b>

## EXAMPLES

A **PAC+ 3A2N** would have **3** total Attenuator channels, one program channel and **2** built-in Noise generators and built-in SLO-START.

A **PAC+ 6A** would be fully populated with **6** channels of program type Attenuator boards. Usable for any audio program material, the program boards have 5KΩ bridging input transformers and 600Ω output transformers.

Additional channels (up to 6 total) may be field retrofit.