How to Combine Personal FM and Classroom Sound Systems:

The Total Auditory Integration Method for Students' Benefit

March 2013

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Abstract

Combining personal FM (PFM) systems and classroom amplification (sound field) technologies in the classroom can have huge educational and social benefits for students with hearing loss or auditory deficits – or it can contribute to their isolation. The key is how they are combined. When connected the right way, students can:

- hear the voices of their peers by way of a pass-around microphone.
- hear multimedia – including movies, sound from educational software, music, and more.
- review recordings of instructional content and class discussion to clarify anything they missed.

In addition to the well-documented social and academic advantages to hearing the teacher's voice consistently and clearly, these features offer a huge advantage for classroom engagement and participation.

In this paper, you'll learn how to easily connect PFM systems and classroom amplification systems in the proper way to fully enrich your students' learning experience.

Introduction

For children with hearing loss or auditory processing disorders, listening and learning in a noisy classroom environment is extremely challenging. A personal FM (PFM) system can solve the bulk of the problem by transmitting the teacher's voice directly to the students, and should be the primary technology for overcoming listening barriers in school. But what about sound from videos or other multimedia played in class? And how well does the student with hearing loss hear their peers during classroom discussions? PFM systems do not yet handle these important aspects of auditory learning well, if at all.

The best way to ensure all students' needs are met auditorily, educationally, and socially is to support them with both PFM systems and properly-designed classroom amplification.

The best way to ensure all students' needs are met auditorily, educationally, and socially is to support them with both PFM systems *and* properly designed classroom amplification.

Only then can students have equal access to all educational content and truly feel on the same level as their peers.

Why Do It?

It is well documented that classroom amplification systems are beneficial for all students – even those with no hearing or auditory deficits. In just one example, Chelius (2004) reported that students in grades 1, 3, 4, and 5 in amplified classes achieved better standardized test scores in early literacy and in reading fluency than students in unamplified classrooms did.*

Students with hearing loss can have access to these benefits when hearing-health professionals integrate their PFM systems with classroom amplification. For example, interfacing the two technologies can:

**This and many other research references are available at www.gofrontrow.com/classroom/case-studies.*

Keep your students with hearing loss connected to the rest of the class.

One-to-one PFM systems are almost universally available to students with hearing loss, so the biggest challenge isn't hearing the teacher – it's hearing classmates. That's because PFM systems excel at clarifying the teacher's voice, but do a poor job of transmitting what's happening throughout the rest of the classroom – if they do so at all. For example, if Erin is reading a story aloud to the class, Becky — who has a hearing loss and sits on the other side of the room — may miss a significant portion of Erin's story and the class discussion. She may feel alienated and hesitant to participate in a conversation she cannot follow.

By adding classroom amplification to the PFM systems, however, Becky's hearing health-care professional makes it possible for Erin to talk into a pass-around microphone that also transmits sound directly to Becky's personal receiver. As this microphone gets passed around to various students, Becky isn't just hearing her teacher; now she's hearing all of her classmates too. Because most classroom audio systems aren't limited to allowing one talker at a time like some PFM systems are, Becky can participate in natural peer-to-peer discussions in a way that she wasn't able to do with her PFM system alone. This can have a profound effect on her confidence, enjoyment of class, and academic performance.

The benefit of student microphones doesn't stop with Becky either; as research indicates, all students will benefit from an enhanced audio signal when it comes to language understanding and acquisition. The psychosocial benefits that come from feeling important, heard, and listened to when speaking in a microphone should not be ignored.

While a large part of the school day centers around verbal instruction from the teacher, students also spend a significant amount of time learning through technology.

Ensure your students have access to all classroom multimedia.

While a large part of the school day centers around verbal instruction, students also spend a significant amount of time learning through technology. Interactive whiteboards, DVDs, streaming video, iPods, and other multimedia sources are commonplace tools for enriching learning.

The only way to ensure everyone has equal access to the audio coming from these devices is to incorporate classroom amplification. Without it, only those kids with healthy hearing will be able to consistently understand the content. Even for them, sound quality will be sacrificed since any of the small loudspeakers typically attached to interactive whiteboards or laptops can't properly and evenly project sound throughout an entire classroom.

For students with hearing loss, properly integrating classroom amplification is even more critical because it is the only practical method for giving them access to all the educational content required for the class.

"Level the playing field" for students with hearing loss.

Even with excellent PFM equipment, students with hearing loss or auditory processing disorders often

have to work much harder to understand the lesson. Classroom amplification provides an opportunity to record all class content for students to review at their own pace — clarifying any details or shades of meaning they may have missed.

Universal design supports mainstreaming.

Students like Becky often feel uncomfortably different from other kids — and having the teacher wear a microphone to accommodate her alone can make this worse.

Classroom amplification gives Becky the auditory clarity she needs to keep up with the rest of the class in a universally-designed environment where the teaching tools benefit everyone without stigma. When classroom amplification is used, students recognize that using microphones is normal and helpful. The classroom becomes less restrictive – both educationally and socially — now that every student participates both in hearing and in being heard.

Indeed, there are fewer special education referrals when classroom amplification is used. In a study conducted in the Oconto Falls School District in Wisconsin, special education referrals fell from an average of 7.72% between 1989 and 1998, to 4.6% from 1998 to 2000 where classroom amplification systems were installed in all Kindergarten to grade five classrooms district-wide (Flexer and Long, 2004).

For teachers, the benefits of integrating PFM systems and classroom amplification systems are just as significant. For example:

Teachers can maximize their whole-class instruction time.

Studies have shown that when classroom amplification is used, there is less need for teachers to repeat instructions to individual students. That's because when students can hear the lesson better, they become more engaged in it.

In a 2007 study of nearly 1,200 K-3 students in New Brunswick, Canada (entitled "Evaluating Sound Field Amplification Technology in New Brunswick Schools"), results confirmed that in classes with classroom amplification, students were more attentive and more focused because they could hear better. While the teacher was talking, they spent less time talking to their peers and more time listening. When the hand-held microphone was given to them to pass around, it increased the participation of shy and quiet children and built their confidence. In contrast, over the course of the study in unamplified classrooms, there was a significant drop in student response rate to statements directed to them.

The technology supports teachers as coaches, not just lecturers.

In the interest of building student engagement and participation, the archaic pedagogical model of a teacher standing at the front of the class and talking to students is being replaced with teachers talking *with* students. Using their wireless microphone, teachers can move freely within the room and interact with students as they collaborate on and discuss various projects.

The teacher only has to wear one microphone.

Combining PFM and classroom amplification technologies does not mean that teachers have to wear two microphones. The teacher simply wears one microphone (the classroom amplification microphone) that

directly or indirectly broadcasts to both the classroom speakers as well as the PFM receiver simultaneously. With just a press of a button, the teacher can reach all students – those with hearing loss and those without.

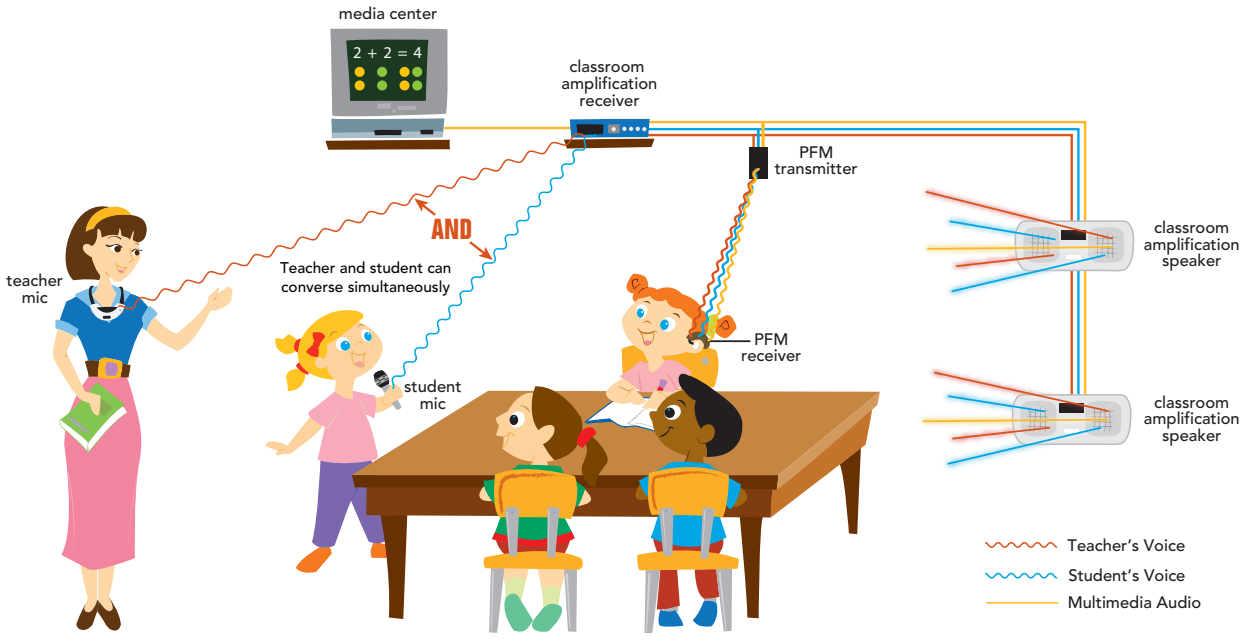
How It's Done:

There are two standard methods for integrating classroom audio with PFM; however, they are not equally effective so it's important to select the solution that achieves the best balance between management ease and student access to the broadest range of classroom content. The first method – Microphone Restricted Integration (or "Matching") – allows for the teacher's voice and one other audio source to be transmitted directly to the student's PFM system. However, since matching only works with FM systems, channel management issues may arise and, dependent upon the manufacturer's system you are using, multimedia integration may also be lost.

The second and more effective method is Total Auditory Integration (or "Patching"). With this method, multiple audio sources can be connected at one time, so the student with hearing loss can hear the teacher's voice, other students' voices, and audio from multimedia sources. Since patching can be done with infrared (IR) systems, channel management is not an issue – a school can be outfitted with an unlimited number of systems. Patching may also be done with FM-based sound field systems but attention must be paid to selected channels for potential interference.

Total Auditory Integration:

- This preferred method sums all audio from the teacher, the students, and multimedia sources **before** sending it to the student's receiver.
    - The classroom amplification receiver's Audio Output is connected via a cord to the PFM transmitter's Audio Input jack.
    - The PFM transmitter then sends all audio to the PFM receiver.
    - Advantage: Ensures your special needs students have access to *all* audio; recording is possible.
    - Disadvantage: Connecting a PFM transmitter is required.



Total Auditory Integration is the preferred method of integrating sound field and PFM systems as it keeps students connected to ***everything*** *– including the teacher's voice, multimedia, and peer-to-peer discussions.*

Tear out and keep for easy reference.

How to Easily Connect a Personal FM System to a Classroom Audio System

Step 1: Connect an audio cable to the classroom audio receiver output jack. If recording, first connect a splitter cable (**1a**), then attach the audio cable (**1b**).

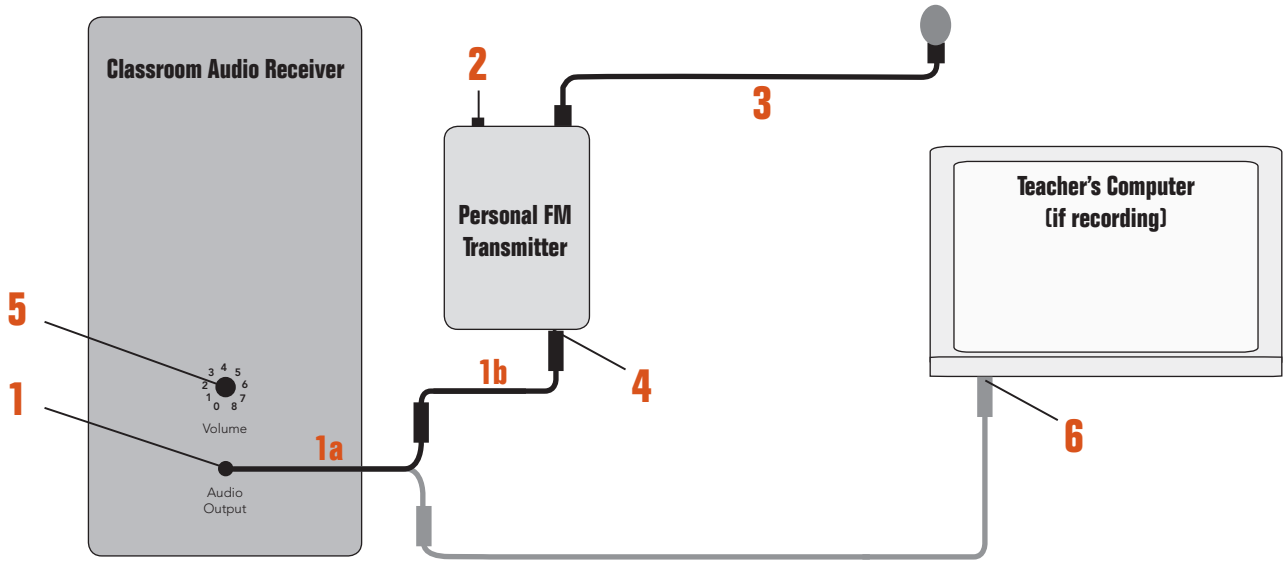
Step 2: Turn on the student's PFM transmitter. Press the transmitter's mic mute switch for best results.

Step 3: Straighten the microphone cord (or optional antenna).

Step 4: Connect the audio cable to the transmitter audio in jack (or, if using Amigo T30, the mic jack). See **Tips** below.

Step 5: Set audio output volume on classroom receiver as recommended in **Tips** below, or as desired by student.

Step 6: If recording, connect a second audio cable from the splitter to the audio in (microphone) jack of a computer. Follow recording software instructions.



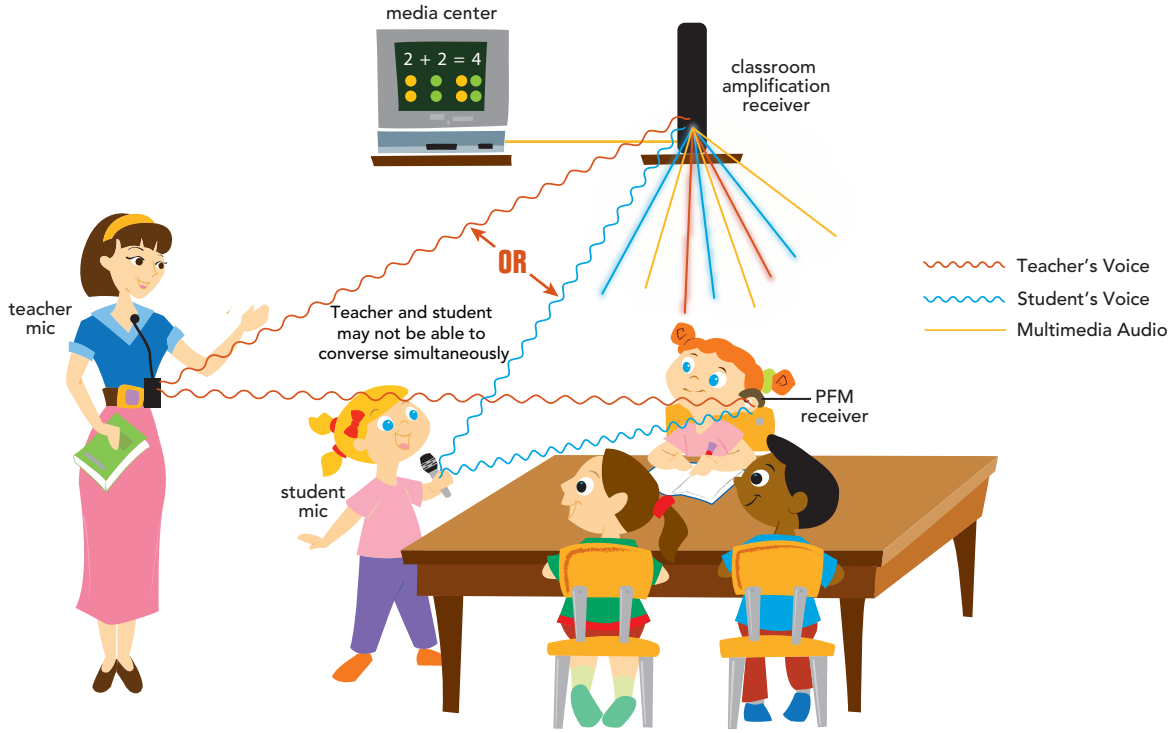
Tips for Specific PFM Transmitters and Classroom Amplification Receivers:

	Oticon Amigo T5	Oticon Amigo T10	Oticon Amigo T30	Phonak Campus S/SX	Phonak Inspiro	Phonak EasyLink (SmartLink+, ZoomLink+, EasyLink+):
On PFM transmitter, connect cable to...	Audio In (3.5mm)	Audio In (3.5mm)	Mic In (2.5mm)	Audio In (3.5mm)	Audio In (3.5mm)	Audio In (3.5mm)
Notes		• Turn the transmitter OFF (don't worry; it will detect the audio signal and transmit)	• Skip Step 3 – patch cord acts as antenna • Note that the Mic In jack is 2.5mm — an adapter may be needed	• Turn capsule on MM8 lapel mic to 'X' to mute the mic	• Phonak disables "Dynamic FM" when connected to classroom amplification • Audio Input setting must be set to "iPod nano" from "General" • Settings > Audio input > iPod nano	• Link+ transmitters require a separate adapter to connect the audio cord (see User Manual) • Turn the transmitter on first, then connect for best results
Suggested Classroom Audio Output Settings (adjust as needed for student preference)						
FrontRow Juno	8	8	1 / 2.5*	8	7 / 8*	8
FrontRow Lasso	5 / 7*	3 / 5*	1 / 2*	7 / 8*	7 / 8*	7 / 8*
FrontRow Pro Digital	Half / Three Quarters*	Half / Three Quarters*	Low / One Quarter*	Half / Three Quarters*	Half / Three Quarters*	Half / Three Quarters*
FrontRow ToGo	Half / Three Quarters*	Half / Three Quarters*	Low / One Quarter*	Full	Full	Full

**A higher output setting may be needed if using a splitter cable for recording*

Microphone-Restricted Integration:

- Uses the teacher's transmitter to transmit directly to the classroom amplification receiver and the student's PFM device simultaneously.
    - o This method only works with FM-based classroom amplification systems with compatible PFM frequencies.
    - o The teacher's transmitter must be on the same channel as both the PFM receiver and the classroom amplification receiver. In the case of the Phonak Digimaster, an additional synchronization step is required to pair the teacher transmitter with the classroom amplification receiver on a different band/channel.
    - o Advantage: No connection of a PFM transmitter is required.
    - o Disadvantage: The student will only hear the teacher's voice — not multimedia audio. Those models (in particular, the Phonak Digimaster) that do allow the student with hearing loss to hear other students permit only one active mic at a time: this can limit natural discussions in a classroom setting. In addition, FM channel pairing and management must be considered to avoid potential channel overlap and interference.



Microphone-Restricted Integration allows the teacher to transmit his/her voice directly to the student with hearing loss ***and*** *the classroom amplification receiver. However, it does not allow the student to hear multimedia audio.*

If you must use the Microphone-Restricted Integration method, here is how to do it:

1. Ensure your teacher mic, PFM receiver and sound field receiver are all tuned to the same frequency (only available on FM-based systems). Please see the channel matching chart in Appendix 1.
   If using a Phonak Digimaster system, a separate pairing step is required. (See User Manual).
2. Once reconfigured, turn your classroom amplification receiver on and off to re-set.
3. The teacher may now use the transmitter. The teacher will be heard by the entire class as well as by the student with hearing loss directly through their personal system. (Student voices and multimedia audio may not be heard by the student with hearing loss).

Types of Classroom Amplification

There are two main types of classroom amplification systems: Infrared (IR) and FM. The features/benefits for each are noted below:

	FM (Radio)	Infrared
Main advantage	Simpler installation, no drop out, indoor/outdoor	No channel management, generally better audio bandwidth
Main disadvantage	Each classroom needs at least one unique channel; potential for outside radio interference	More involved installation
Number of useable soundfield systems per school	Depends on available channels and external interference sources (cordless phones, WiFi, Bluetooth, car alarms in the case of 2.4GHz; television or wireless PA systems in the case of 216MHz)	Unlimited
Choose when	Tech integration is important	More than 6 systems/school or plan to outfit entire school
Avoid if	Many systems will be used nearby, channel management resources are limited	Gym or other very large space; walls don't exist between classrooms

In addition to transmission type, schools can choose from a number of different speaker configurations, depending on their needs:

	Ceiling or Wall	Line Array	Flat-Panel
Features	Speakers are placed strategically throughout the classroom to ensure maximum sound coverage	A group of speaker elements arrayed in a straight line, closely spaced and operating with equal amplitude and in phase	A single-speaker unit consisting of one or more small drivers mounted to a single plastic panel
Advantages	Clear, distortion-free sound is spread uniformly around a classroom, resulting in less feedback and no hot spots	No installation required, can be moved from class to class with the identified student, more uniform speech range coverage than a flat-panel device	No installation required, can be moved from class to class with the identified student
Disadvantages	Installation is required	Slightly less-even coverage than fully-installed system	Poor sound quality; doesn't adequately cover a classroom; distortion hot spots and feedback are common

What to Look for in a Classroom Amplification System

Aside from compatibility with PFM systems, some factors that you'll want to consider in selecting the right classroom amplification system are:

Equal Classroom Sound Distribution

In today's classrooms it is very rare for any student to be sitting in the same chair all day long. For this reason, it is imperative that your entire classroom have equal sound distribution. This requires a multi-speaker solution — either a line array or, ideally, a distributed speaker system to ensure equal coverage throughout the room. Line arrays (like the FrontRow ToGo, Juno, and Phonak DigiMaster) give a good balance of sound coverage and portability, having measurable dispersion patterns that minimize signal drop off in a highly transportable housing. This, by the way, is the reason line arrays are used in auditoriums and concerts instead of flat-panel speakers. Flat panels and other point sources tend to produce feedback-vulnerable "hot spots," which over-amplify regions near the speaker in an attempt to reach the farthest listeners.

Performance

- Obviously, a clear, distortion-free signal is important for all of your students. Be aware that looking at specification sheets is usually not a good enough indicator of the actual sound quality of the product. **Most good manufacturers offer some type of free evaluation period.** Ask for a side-by-side demonstration and listen to the products yourself and with the teachers who will be using the equipment.
- Some manufacturers offer **features that can improve speech comprehension**. For example, the FrontRow OptiVoice feature emphasizes consonant sounds to help improve intelligibility.
- You may want to consider choosing a system with **automatic feedback suppression** — especially in single-speaker models where higher output levels and limited speaker locations may create problems — to help eliminate harsh interruptions.
- **Multiple speakers or line arrays** provide the most even sound coverage, even in large rooms. Single-speaker solutions (e.g., flat panels, small portable units) are convenient to move and often less expensive, but don't provide the most even sound coverage.
- Because these products are used with children, **durability is a factor for consideration.** In recent years, a number of brands have emerged that are simply sourcing inexpensive karaoke products in Asia. The build quality of really inferior products will be apparent to the naked eye, but the manufacturers you are considering should be able to demonstrate that they have high-quality (and socially responsible) design and manufacturing processes in place. Look for things like evidence of ISO qualification, reliability testing, a strong warranty, and other signs that the company is focused on quality.

Accessories to Encourage Participation

A student pass-around microphone is a must to ensure students with hearing loss can hear their peers and join in on the conversation. Manufacturers are getting better at designing microphones specifically for children rather than just re-purposing adult karaoke microphones. Look for ones that are durable and manageable for kids.

A few systems today are available with **multiple student microphones** — one for each student table, for example. This can further save time and improve usage.

Simplicity and Comfort

- Teachers will be wearing their microphones all day, so choose one that is **light and comfortable.**
- **Teachers have been observed using the transmitter mute button up to 30 times per day**, so select teacher microphones that make this easy to find and use by touch alone.
- Even though boom microphones provide the best sound quality, **most teachers find even sleek boom microphones uncomfortable and unattractive.** Keep this in mind when considering long-term usability of a particular solution. Some manufacturers offer transmitters that can be either worn around the neck (i.e., without a boom mic) or can also accept a boom microphone. If you want to push for boom mic usage you may want to choose a mic that gives you this flexibility and go with 'Plan B' if you meet resistance.
- You probably know from PFM experience that most teachers have very little time or patience for overly-complex gadgets. In general, **the number of knobs and switches on the transmitter and receiver is in direct proportion to the amount of time you'll have to spend in training, retraining, and troubleshooting.** You'll be better off choosing a classroom amplification system that minimizes the buttons. The good news is, there are a number of simple, yet good options available — some even let the teacher use just one button.

Minimal Installation

Only a few years ago, the responsibility for installing and maintaining classroom amplification systems almost always fell on the audiologist or speech-language pathologist. These days, it's increasingly common to have these fall under the purview of the district technology director. If you are concerned about having to install or move a classroom amplification system, there are a number of no- or low-installation options that don't necessarily compromise sound quality. **Your first choice for balancing the conflicting demands of no-toolbelt-required setup with good sound coverage should be line arrays.** These do a generally excellent job of maintaining good and even speech intelligibility, and they set up in minutes. You should probably avoid flat-panel speakers if you are concerned with coverage, however: when it comes to measured intelligibility indices, they don't compare well with multi-speaker or line array configurations (see http://gofrontrow.com/files/documents/research/Whitepaper-(LightSpeed-flatpanel-speakers).pdf).

You should probably avoid flat-panel speakers if you are concerned with coverage.

Full Multimedia Integration

The ability to run *all* classroom media through your classroom amplification system to deliver better audio to the whole class – and straight to your students with hearing loss — is a crucial benefit of combining these technologies. That's why it's important to select a classroom receiver that not only accepts multiple secondary inputs (e.g., DVD player, computer) but also offers **a mixed output for connection to the PFM transmitter.** Most do, but there are still a few models that do not offer this important feature, so don't leave this off your checklist!

Recording Capability

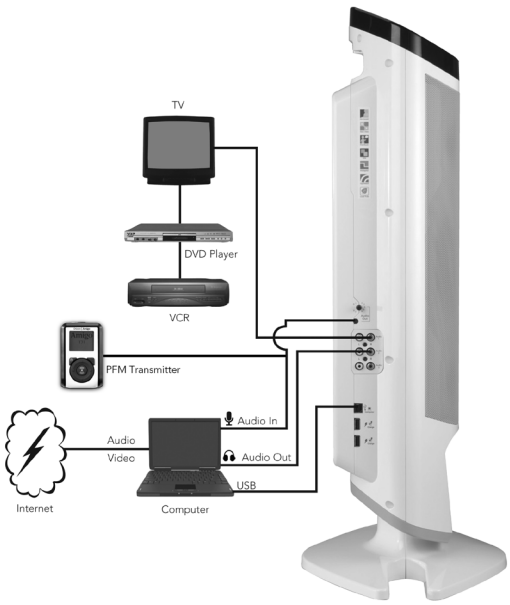
Lesson capture (sometimes called "screencasting") is a powerful new tool for reinforcing instruction for students with hearing impairment. Quite simply, it's a recording of all classroom audio (teacher, students, multimedia) plus any visuals from the teacher's computer screen — available online to the student for review, clarification, homework help, and test preparation. FrontRow's Juno product stands out in this regard, since it fully automates the process (thereby greatly increasing teacher compliance).

Integrating Classroom Amplification and PFM Systems with Other Classroom Technology

Many materials viewed by students – streaming videos, news clips, etc. – have an audio component as well as a visual one. Unfortunately, projectors and computer speakers just aren't up to the task of amplifying the whole classroom, let alone your students with hearing loss. By running all audio through your classroom amplification system, the system becomes the hub for all classroom media devices and ensures that everyone has equal access to the full audio experience.

Through this technology integration, your students with hearing loss will be able to hear and do things that they weren't able to before, such as:

- Properly view movies.
- Listen to music and other audio.
- Participate and engage in interactive whiteboard lessons.
- Access online recordings of classroom content.
- Engage in global learning activities, such as placing video conference calls with Skype, Adobe Connect, or Elluminate.



Many classroom amplification systems can support at least some level of multimedia integration, but it's important to choose one with enough connection jacks to work with a variety of classroom technologies simultaneously.

A typical example of the kinds of connections your classroom amplification system should be able to make to other technologies. A computer, DVD player, and MP3 player are common requirements.

What to Look for in a PFM System

PFM systems help to improve signal-to-noise ratio and overcome background noise, distance to sound source, and/or reverberation that can interfere with clear speech understanding. For younger students, speech understanding is critical to language development, learning, and socializing.

Just as with classroom amplification, quality and performance are key. Look for:

Speech Intelligibility Features

Advanced digital sound processing in order to provide clearer access to vital speech.

Maximum Speech Bandwidth

Research has shown that children with hearing loss can benefit from additional high-frequency information available with broader bandwidth (Kortekaas & Stelmachowicz, 2000). With a broader bandwidth, transmitters can make the soft consonants stand out more clearly. Look for models that have an audio bandwidth for speech in the range of 7500 Hz and higher.

Simplicity and Ease of Use

Just as with classroom amplification systems, you'll want to keep the convenience to your teachers as a priority when choosing PFM systems. Keep it simple and comfortable.

Easy Channel Management

A number of options are available today that offer full programming and fitting capabilities in the palm of your hand – such as pre-programmed channels to take the work out of channel management by creating a prioritized channel list.

Upgrade Capability

The software offered by leading PFM manufacturers changes regularly, so you should look for devices with a USB port for easy upgrading of software, and access to new features that will keep your PFM system efficient and cost-effective.

Versatile, Compatible Equipment

Unless you're in tight control of your students' hearing aid choice, you should look for PFM solutions that work with a broad range of behind-the-ear (BTE) instruments, cochlear implant (CI) processors, and other brands of receivers and transmitters, without compromising signal durability or sound quality. Most major brands offer solutions that can handle the typically unpredictable variety of devices that will appear on your students' ears.

Reliability & Service

- Accident-proof, moisture-repellent transmitters.
- Batteries should last approximately 10 hours and come with fail-safe charging.
- Quick turnaround time if units need factory repair.

Conclusion

For a rich and engaging learning experience, your students with hearing loss can benefit most from a PFM system properly *integrated* with classroom amplification. The Total Auditory Integration method effectively ensures your special needs kids are connected on all levels – enabling them to hear their teacher better, engage in every lesson, catch all the conversation, and feel included with their peers.

Appendix 1 – 216 Frequency Compatibility (significant only if using the Microphone-Restricted Integration method)

216 MHZ FREQUENCY	Oticon T5	Oticon T10	PHONAK	OTICON AMIGO T20/T21/T30/T31	PHONIC EAR RADIUM SF	FRONTROW TOGO SF
215.9875			N31			
216.0125	01	1	N01	01		
216.0375	02	2	N02	02		
216.0750	42	42		42	42	42
216.0875	04		N04	04		
216.1125	05		N05	05		
216.1875	08		N08	08		
216.2125	09		N09	09		
216.2250	45	45		45	45	45
216.2750	46					46
216.2875	12	12	N12	12		
216.2750					46	
216.3125	13		N13	13		
216.3250					47	47
216.3750	48	48		48	48	48
216.3875	16		N16	16		
216.4125	17		N17	17		
216.4375	18		N18	18		
216.5125	21		N61	21		
216.5250	51	51		51	51	51
216.5375	22		N62	22		
216.5750	52		N52	52		52
216.5875	24	24	N64	24		
216.6125	25		N65	25		
216.6250	53					53
216.6750	54			54		54
216.6875	28		N68	28		
216.7125	29		N69	29		
216.7250	55		N55	55		55
216.7750	56					56
216.7875	32	32	N72	32		
216.8125	33		N73	33		
216.8250	57	57	N57	57		57
216.8750	58				58	58
216.8875	36		N76	36		
216.9125	37	37	N77	37		
216.9625	39		N79	39		
216.9750	60	60	N60	60		
216.9875	40	40	N80	40		
217.0125			N32			
217.1875			N33			
217.2875			N34			
217.4375			N35			
217.5875			N36			
217.7875			N37			
217.9875			N38			
218.0125			N39			
218.1875			N40			
218.2875			N41			
218.4375			N42			
218.5875			N43			
218.7875			N44			

Appendix 2 – 173 Frequency Compatibility (Australia)

(significant only if using the Microphone-Restricted Integration method)

173 MHZ FREQUENCY	Oticon T5	Oticon T10	PHONAK	OTICON AMIGO T20/T21/T30/T31	FRONTROW TOGO SF	FRONTROW TEMPO SF
169.4375			H41			
169.6750			H45			
169.7250			H38			
169.7750			H46			
169.8250			H39			
173.0000	A1		H96			
173.0100	A8		H91	A8		
173.0500	A2					
173.1000	A3		H92			
173.1500	A4					
173.2000	A5		H93			
173.2500	A6					
173.3000	A7		H94			
173.3400	12					
173.3500	13		H01		13	13
173.4000	15	15	H02	15	15	15
173.4300	16					
173.4500	17				17	
173.4600	18					
173.4650	19		H03			19
173.4900	20					
173.5000	21				21	
173.5200	22					
173.5450	23		H04			23
173.5500	24				24	
173.6000	25				25	
173.6400	26	26	H05	26		26
173.6500	27				27	
173.6950	28		H11			28
173.7000	29				29	
173.7500	30				30	
173.7550	31		H95			31
173.7750	72		H12			
173.8000	32				32	
173.8125	91		H35			91
173.8250	33		H13			
173.8500	34				34	
173.9000	35				35	35
173.9500	36		H14		36	36
173.9625	93		H34			
173.9900	69	69	H33	69		
174.0000	37				37	37
174.0500	38				38	38
174.1000	40		H47		40	
174.1200	41	41	H16	41		41
174.1250			H85			
174.1750			H77			77
174.1850			H17			
174.2250			H86			86
174.2700			H18			
174.2750			H87			87
174.3000			H48			
174.3250			H78			
174.3600			H19			78
174.3750			H88			88
174.4150	51	51	H20	51		
174.4250			H89			89
174.4750			H79			79
174.5250			H90			90
174.6000	55	55	H06	55		55
174.6500			H57			57
174.6750			H07			
174.7000	2	2	H27	2		59

Appendix 2 – 173 Frequency Compatibility (Australia) continued

173 MHZ FREQUENCY	Oticon T5	Oticon T10	PHONAK	OTICON AMIGO T20/T21/T30/T31	FRONTROW TOGO SF	FRONTROW TEMPO SF
174.7700	61	61	H08	61		61
174.7750			H81			
174.8500						63
174.9000						65
174.9500						66
175.0000			H67			67
175.5000			H25			94
175.6000			H26			95
175.7000			H27			2
175.8000			H28			9
175.8500						97
175.9000			H29			
175.9500						10
176.0000	11	11	H30	11		11

Appendix 3 – 173 Frequency Compatibility (New Zealand)

173 MHZ FREQUENCY	Oticon T5	Oticon T10	PHONAK	OTICON AMIGO T20/T21/T30/T31	FRONTROW TOGO SF	FRONTROW TEMPO SF
169.4375			H41			
169.6750			H45			
169.7250			H38			
169.7750			H46			
169.8250			H39			
173.0000	A1		H96	A1		A1
173.0100	A8		H91	A8		
173.0500	A2			A2		A2
173.1000	A3		H92	A3		A3
173.1500	A4			A4		A4
173.2000	A5		H93	A5		A5
173.2500	A6			A6		A6
173.3000	A7		H94	A7		A7
173.3400	12			12		
173.3500	13	13	H01	13	13	13
173.4000	15	15	H02	15	15	15
173.4300	16			16		
173.4500	17			17	17	
173.4600	18			18		
173.4650	19	19	H03	19		19
173.4900	20			20		
173.5000	21			21	21	
173.5200	22			22		
173.5450	23	23	H04	23		23
173.5500	24			24	24	
173.6000	25			25	25	
173.6400	26	26	H05	26		26
173.6500	27			27	27	
173.6950	28	28	H11	28		28
173.7000	29			29	29	
173.7500	30			30	30	
173.7550	31	31	H95	31		31
173.7750	72		H12			
173.8000	32			32	32	
173.8125	91		H35	91		91
173.8250	33	33	H13	33		33
173.8500	34			34	34	
173.9000	35			35	35	35
173.9500	36	36	H14	36	36	36
173.9625	93		H34	93		93
173.9900	69	69	H33	69		69
174.0000	37			37	37	37
174.0500	38			38	38	38
174.1000	40	40	H47	40	40	

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