

421m AGC-Leveler

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421m

 **Symetrix**

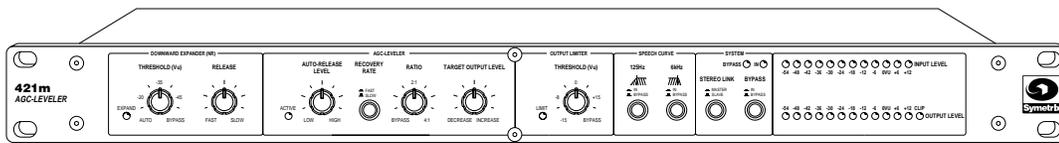
The Symetrix 421m is a wide-range AGC-Leveler, a peak limiter, and a downward expander that features a microphone preamp, eliminating the need for a separate outboard microphone preamp in some applications. The 421m reduces the dynamic range of its input signal by the amount of its ratio setting. That is, if the ratio setting is 2:1, then 40 dB of input range turns into 20 dB at the output. A fast peak limiter puts an absolute ceiling on the output level so you know that peaks are held to the level that you set. A downward expander reduces the gain when signal levels fall too low to process, reducing the noise buildup at low signal levels. Speech filters allow a reduction of reduction the bandpass of the 421m to minimize feedback or amplifier power waste caused by spurious out-of-band signals.

AGC-Levelers can be used anywhere that you might need to reduce the dynamic range of an audio signal over a wide range of signal levels. Possible applications include: tape duplication (especially cassette), driving telephone lines, driving broadcast or STL transmitters, podium or lectern microphones, paging systems, unattended sound systems, and music recording.

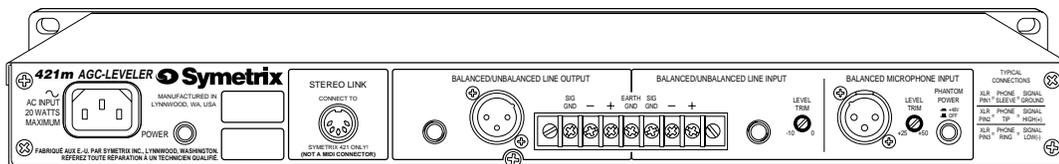
The 421m is listed by Underwriters Laboratories Inc. (UL). Samples of this product have been evaluated by UL and meet the applicable UL Standards for Safety.

We recommend that you read this manual from cover to cover. Somewhere between the confines of the two covers you should find the answers to most of your questions. If not, please feel free to contact our Customer Service department via phone, fax, or e-mail for answers to your questions. The numbers are:

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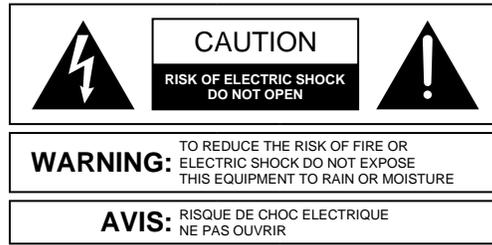
Front panel



Rear panel

421m

Equipment Markings



SEE OWNERS MANUAL. VOIR CAHIER D'INSTRUCTIONS.
 No user serviceable parts inside. Refer servicing to qualified service personnel.
 Il ne se trouve à l'intérieur aucune pièce pouvant être réparée l'utilisateur.
 S'adresser à un réparateur compétent.

The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user of the presence of uninsulated “dangerous voltage” within the product’s enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons. The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product (i.e. this manual).

Caution *To prevent electric shock, do not use the polarized plug supplied with the unit with any extension cord, receptacle, or other outlet unless the blades can be fully inserted.*

Terms

Several notational conventions are used in this manual. Some paragraphs may use **Note**, **Caution**, or **Warning** as a heading. Certain typefaces and capitalization are used to identify certain words. These are:

- Note** Identifies information that needs extra emphasis. A **Note** generally supplies extra information to help you to better use the 421m.
- Caution** *Identifies information that, if not heeded, may cause damage to the 421m or other equipment in your system.*
- Warning** **Identifies information that, if ignored, may be hazardous to your health or that of others.**
- CAPITALS** Controls, switches or other markings on the 421m’s chassis.
- Boldface** Strong emphasis.

Important Safety Instructions

Please read and keep these instructions. Heed and follow all warnings and instructions. Install in accordance with the manufacturer’s instructions.

Power Source This product is intended to operate from a power source that does not apply more than 250V rms between the power supply conductors or between either power supply conductor and ground. A protective ground

connection, by way of the grounding conductor in the power cord, is essential for safe operation.

Grounding The chassis of this product is grounded through the grounding conductor of the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle before making any connections to the product. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation. **Do not defeat the safety purpose of the grounding plug.** The grounding plug has two blades and a third grounding prong. The third prong is provided for your safety. When the provided plug does not fit your outlet, consult an electrician for replacement of the obsolete outlet.

Danger from Loss of Ground If the protective ground connection is lost, all accessible conductive parts, including knobs and controls that may appear to be insulated, can render an electric shock.

Proper Power Cord Use only the power cord and connector specified for the product and your operating locale. Use only a cord that is in good condition. **Protect the power cord** from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

Proper Fuse The user accessible fuse is a part of the IEC AC inlet connector. The fuseholder accepts 5 x 20mm diameter fuses. For 117VAC operation, the correct value is 0.25A, 250VAC, standard. For 230VAC operation, the correct value is 0.125A, 250VAC, standard.

Operating Location **Do not operate this equipment under any of the following conditions:** explosive atmospheres, in wet locations, in inclement weather, improper or unknown AC mains voltage, or if improperly fused. Do not install near any heat source such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat. Unplug this apparatus during lightning storms or when unused for long periods of time.

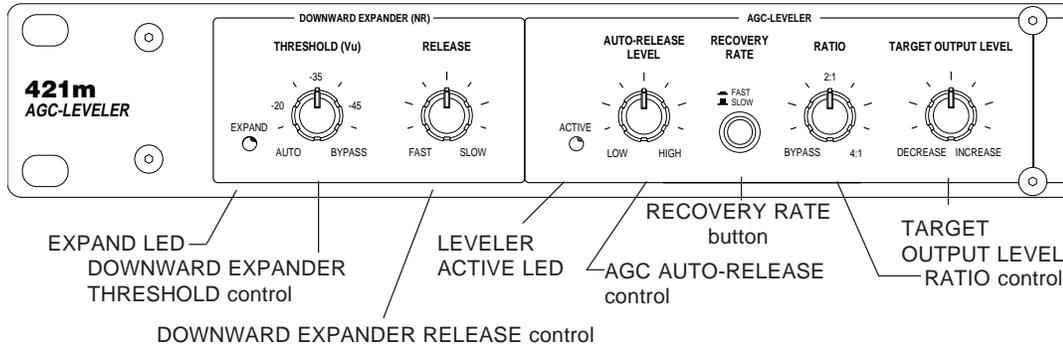
Stay Out of the Box To avoid personal injury (or worse), do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed. Only use accessories specified by the manufacturer. Clean only with a damp cloth.

User-serviceable parts There are no user serviceable parts inside the 421m. In case of failure, refer all servicing to the factory. Servicing is required when the 421m has been damaged in any way, such as when a 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.

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This chapter provides a basic overview of the 421m by describing the input and output connections, power connection, operating controls, and front panel LED indicators.

Front panel view (left)



DOWNWARD EXPANDER THRESHOLD - Determines the level below which the downward expander operates, which reduces the gain at a 1:2 dB ratio.

At the max CCW setting of the control, the threshold setting is automatic; determined by the setting of the AUTO-RELEASE control. In this case, the downward expander acts more like a gate (very high ratio) NOTE: the silence detector thinks that acoustic feedback is silence!

At the max CW setting, the threshold setting is low enough that all signals are above threshold, therefore the expander is bypassed.

DOWNWARD EXPANDER RELEASE - Determines the rate of decay for the downward expander.

EXPAND LED - Tells when the downward expander is active.

LEVELER ACTIVE LED - Indicates the leveling activity. If the LED is off, then the gain of the AGC-Leveler is frozen at the last setting. The signal level where the gain is frozen is determined by the AUTO-RELEASE LEVEL control.

AUTO-RELEASE LEVEL - Determines the level that the input signal must exceed to allow the AGC-Leveler to respond. If the signal level is below this threshold (active LED OFF), then the AGC gain is frozen and the AGC allows the signal level to fall to zero. This keeps the AGC-Leveler from “undoing” fades, etc.

Another way to understand this control is to think of it in terms of the minimum signal level required to make the AGC-Leveler try to maintain the Target Output Level. Once the signal falls below the AUTO-RELEASE setting, the AGC-Leveler allows the signal to decrease. When the input signal exceeds the AUTO-RELEASE setting, the AGC-Leveler once again tries to maintain constant output level.

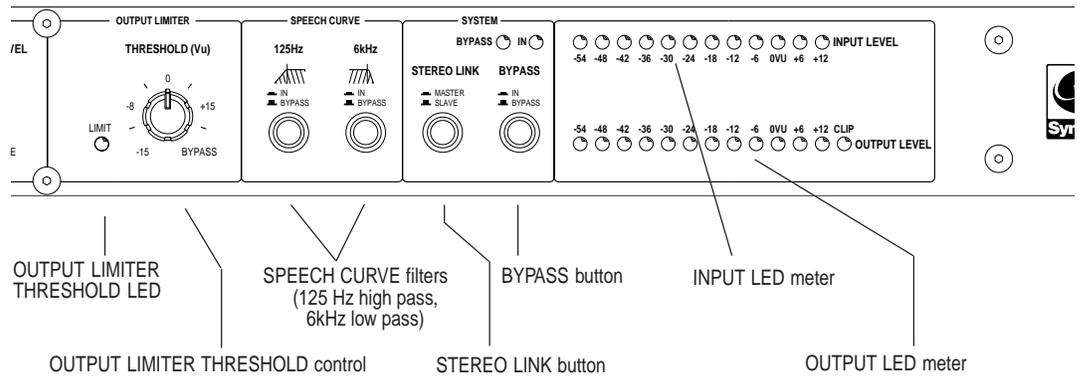
RECOVERY RATE - Sets the basic recovery-time. Fast for speech, slow for music or music/speech. Fast might work for music in special applications.

RATIO - Determines the input/output ratio. This control instructs the 421m how aggressively you want to maintain the target output level. Using a 2:1 ratio, a 2dB drop in the input level results in a 1dB drop at the 421m's output. With a 4:1 ratio, a 4dB drop at the input is limited to a 1dB decrease at the output. The 421m computes the additional make-up gain needed for the ratio setting and applies it to the VCA so that the output level doesn't change with the setting of the ratio control.

TARGET LEVEL - Sets the desired output level.

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Front panel view (right)



OUTPUT LIMITER THRESHOLD LED - Indicates peak limiting activity.

OUTPUT LIMITER THRESHOLD - Sets the threshold of the peak (ceiling) limiter. This works in conjunction with the leveler's ratio and target output level controls. The 421m will not allow the peak limiter to be set higher than the setting of the target output level control. If you think about it, it would make no sense if you allowed peaks past the target output level.

SPEECH CURVE FILTERS - The high pass filter (button on the left) has a 12 dB/octave rolloff and the low pass filter (button on the right) rolls off at 24 dB/octave.

STEREO LINK - Sets the master/slave relationship between 2 units. The normal setting is IN.

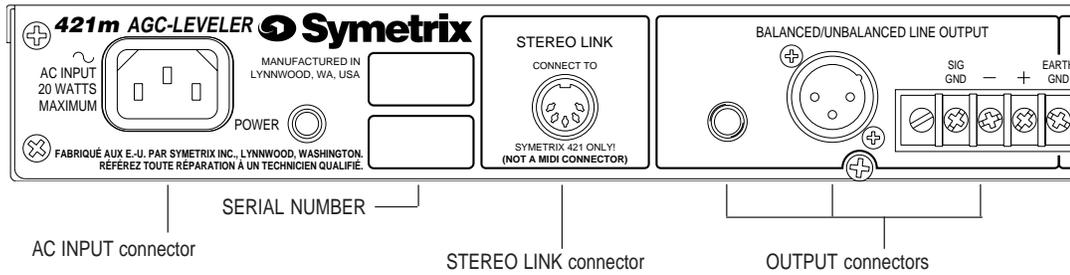
BYPASS BUTTON - This control hard-wire bypasses the 421m. If STEREO LINKED, all linked (slave) units revert to bypass when the bypass button on the master unit is out. On any individual slave unit that has been STEREO LINKED (STEREO LINK button OUT), this button has no effect.

INPUT LED - This meter indicates the input signal level to the 421m. It is a VU calibrated peak reading meter.

OUTPUT LED - This meter indicates the output signal level of the 421m. It is a VU calibrated peak reading meter.

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Rear panel view (left)



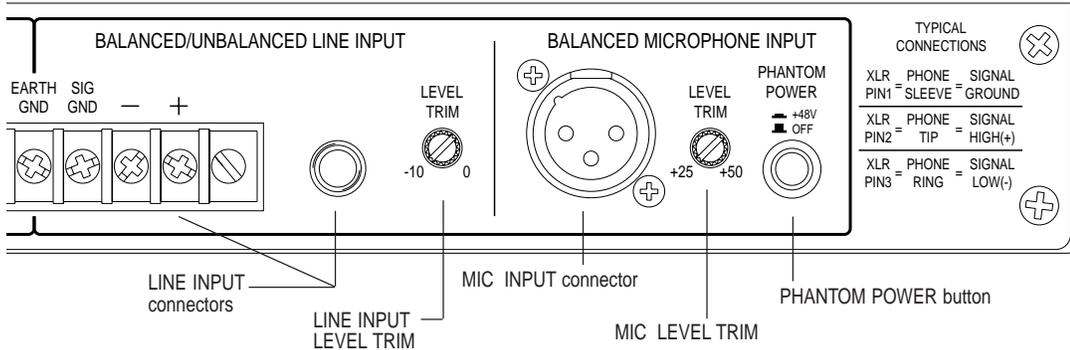
AC INPUT - This connector accepts nominal AC power sources of 115 volts or 230 volts [see Appendix A (Specifications) for voltage tolerance ranges]. See chapter 4 (Installation) for details on the detachable (IEC) power cable.

SERIAL NUMBER - Write this down in a safe place (how about the front of this user's guide?). While you're at it, do us a favor and return your completed warranty card. Not only does it establish your warranty, it helps give us a clue to your future equipment wants, needs, and desires.

STEREO LINK - This 5-pin DIN female connector is used to link two 421 ms for stereo operation. Refer to the STEREO INTERCONNECT section on page 6 for additional information.

OUTPUT CONNECTORS - These are electronically balanced, line level, low impedance outputs. XLR pin 1 is ground, pin 2 is high, and pin 3 is low. The ¼" connector tip is high, ring is low, and sleeve is ground. The screw terminal output is wired in parallel to the ¼" and XLR connectors.

Rear panel view (right)



LINE INPUT - These connectors are electronically balanced, line level, bridging inputs. The ¼" connector tip is high, ring is low, and sleeve is ground. The screw terminal input is wired in parallel to the ¼" connector.

MICROPHONE INPUT - This connector is a balanced, low impedance input. The female XLR pin 2 is high, pin 3 is low, and pin 1 is ground.

MIC LEVEL TRIM - Adjusts the gain of the microphone preamp from a minimum of 25dB to a maximum of 50dB.

PHANTOM POWER - Applies or removes microphone phantom power at the MICROPHONE INPUT connector.

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Before you plug the 421m into a wall socket, carefully read the information in the following chapter.

AC Line Connection

A sticker on the right end of the unit (as viewed from the front) indicates the nominal voltage setting for the unit as it left the Symetrix factory. If this does not correspond to the voltage setting for your locale then do not attempt to apply power to the 421m. Instead, return the unit to your local Symetrix distributor for modification or replacement.

The 421m is shipped from the Symetrix factory with a detachable AC power cable (IEC standard) included. Depending on the intended destination, the power plug is either the US type (intended for 115VAC use), or the Europlug type. If the power cable's plug is not right for your locale, then please contact your local Symetrix distributor for the proper cable.

Once you have determined that the 421m's operating voltage matches that of your locale and you are ready to begin, follow these steps:

1. Plug the socket end of the power cable into the recessed AC power receptacle on the back of the 421m.
2. Plug the other end of the power cable into a three-hole grounded outlet or power strip.

Warning: The 421m is intended to be electrically grounded. It has been provided with a three-wire grounding plug - a plug that has a third (grounding) pin. This plug will fit only a grounded AC outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact a licensed electrician to replace the outlet with a properly grounded outlet. Do not defeat the purpose of the grounding plug!

Mounting In An Equipment Rack

The 421m occupies one rack space (1U) in a standard equipment rack with a width of 19" (48.3cm), a depth of 6.5" (16.8cm), and a height of 1.75" (4.45cm). Allow at least 4" (10.16cm) behind the unit for the protrusion of connectors. We recommend you take care not to mount the 421m next to devices that emit large electromagnetic fields, such as audio power amplifiers. To do so may compromise the noise performance of the 421m. The 421m has been designed to conform to mechanical guidelines as described in EIA Standard RS-310-C and IEC Recommendation 297.

Audio Input Connections

The 421m's line input connections are via a standard ¼" phone jack, and barrier terminals. The 421m's microphone input connection is an XLR female. For optimum system performance we recommend that the 421m be connected to balanced signals. If this is not practical in your situation, then you may connect to unbalanced sources.

Audio Output Connections

The 421m's audio output connections are via standard male XLR jack, ¼" phone jack, and barrier terminals located on the rear panel. For optimum system performance we recommend that the 421m be connected to balanced devices. If this is not practical in your situation, then you may connect to unbalanced devices.

Use any combination of the input and output connections. All of the input connections are paralleled. The XLR output connector and the balanced screw terminal outputs are paralleled. The unbalanced output is paralleled from the + screw terminal output. The 421 wants line level signals, such as those found at the output of a CD player, cassette machine, mixer output, mixer channel insert jack, etc.

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Stereo Interconnect

To stereo-link two 421m's, interconnect the STEREO LINK jacks found on the rear panels of the units using a five-pin DIN male to DIN male patch cord (Symetrix p/n 037010). This looks like a MIDI cable, and a MIDI cable may actually work if all five pins are actually connected to each other.

Note: Although the stereo-interconnect cable looks like a MIDI cable, it isn't. There is nothing remotely resembling MIDI inside or between two 421m's. If you connect either connector to a MIDI device, it probably won't harm anything, but it definitely won't work.

Decide which unit is the master and which unit is the slave (using force only if absolutely necessary) and set the front panel MASTER/SLAVE switches accordingly. In stereo-mode the slave unit's controls are disabled and only the master unit controls affect operation. The following diagram shows how to stereo-link two 421m's.

Note: If there is no master unit connected via the Stereo Link connectors, the slave unit (any unit with its MASTER/SLAVE switch in the OUT position) remains in bypass mode, regardless of the setting of its bypass switch.

421m

Initial Setup

Set the front panel controls as follows:

DOWNWARDEXPANDER THRESHOLD	Bypass
DOWNWARDEXPANDER RELEASE	Straight up
AGC-LEVELER AUTO-RELEASE LEVEL	Straight up
RECOVERY RATE	In
RATIO	4:1
TARGET OUTPUT	Straight up
SPEECH CURVE (125Hz)	Out
SPEECH CURVE (6kHz)	Out

Apply an input signal to the 421m. Observe the input and output meters; there should be activity. The input meter reads the actual input signal. The output meter reads the actual output signal. Both meters are peak responding and are calibrated in VU (0 VU = +4 dBu = 1.23V RMS).

Set the AGC-Leveler by first adjusting the TARGET OUTPUT LEVEL control for the output level required. Next, decrease the setting of the RATIO control until you obtain the desired amount of dynamic range reduction. Speech tolerates higher ratios than music. Use a higher ratio (4:1) for stronger leveling action. The difference between the two meters shows what the 421m is doing. Remember that a 1:1 ratio setting amounts to BYPASS for the AGC-Leveler. Set the RECOVERY RATE button as required by the program material (starting point: FAST = speech, SLOW = music, SLOW = speech and music).

In sound reinforcement applications, set the AUTO-RELEASE LEVEL control to limit the pickup “range” of the microphone. Lower (more CCW) settings will increase the pickup range (the level setting is lower, therefore the AGC-Leveler will track lower level signals), and higher settings will force the user to be more “on-mike.”

In recording, broadcast or tape duplication applications, the AUTO-RELEASE LEVEL control sets the minimum signal level that the AGC-Leveler will track. If the input signal is music with a long fade, the AGC-Leveler interprets the fade as a decrease in signal level and raises the gain to try to maintain the level set by the TARGET OUTPUT LEVEL control. In effect, the AGC-Leveler “undoes” the fade, which may or may not be allowable. The AUTO-RELEASE LEVEL control sets how far the signal level can fall before the AGC-Leveler stops trying to raise the gain. More CCW settings lower this level, which may be what you want if you’re trying to recreate the long piano chord heard at the end of the Beatles song, “A Day In The Life”.

Set the downward expander during program pauses to minimize noise buildup by adjusting the Threshold control until the expand activity LED illuminates. Set the RELEASE control for the desired release rate.

Use the AUTO position of the DOWNWARD EXPANDER THRESHOLD control for situations where the input signal is noisy (hum, hiss, or feedback). In AUTO mode the expander tracks the AGC-Leveler’s internal auto-release monitor. When the AGC-Leveler releases, the expander begins working at the rate set by the RELEASE control. If the input signal contains acoustic feedback, and nothing else above the auto release hold, the auto-release monitor ignores it, which effectively stops the feedback before it has a chance to grow into something potentially damaging.

Set the OUTPUT LIMITER by adjusting the THRESHOLD control either for the absolute maximum output level desired (as read on the threshold control’s panel scale) or as indicated on the peak-responding output meter.

Set the SPEECH CURVE buttons as necessary and as required by the situation. The 125Hz button removes “boominess” and some of the proximity effect caused by close-talking a single-D cardioid microphone (such as a Shure SM-58), without making voices sound thin. The 6kHz button removes sibilance and high-frequency feedback without causing “telephone voice.”



Note: Do not use pink noise or sine-waves for setup. It simply will not work (the ARM circuitry will think your signal is noise). Use speech or music.

Helpful Hints

Microphone Techniques

Note: The ability of the expander to discriminate between wanted and unwanted signals is partially determined by mic technique. Be particularly careful of high frequency sounds entering the side or rear pattern of a cardioid mic. Most cardioid mics exhibit a sharply rising off-axis response characteristic at higher frequencies. Check the off-axis curves in the manufacturer's literature. If there's only a 3dB - 6dB difference between the on-axis (frontal) response and the off-axis (side) or rear response in the 5kHz to 10 kHz region, high frequency sounds will be picked up by the mic, thereby possibly preventing the downward expander from reducing unwanted sounds.

Use the mic's directional pattern to keep unwanted sources as far off-axis as possible. Do everything you can to discriminate against unwanted sounds through good mic technique. The sounds picked up by an individual mic must be primarily the sound of the desired signal or the 421m's downward expander won't be able to discriminate between signal and noise.

Optimizing Control Settings

When searching for optimum control settings, here are a few rules to follow:

AGC-LEVELER: The FAST setting of the RECOVERY RATE button is best suited for speech signals. Use the SLOW setting for musical or noisy signals or if you want the gain changes to be as unobtrusive as possible.

The RATIO control determines how much of the input signal's dynamic range makes it to the output. We recommend starting at 4:1, so you can clearly hear the effect, and then reduce the ratio if necessary.

AUTO-RELEASE LEVEL (ARL): This control determines the signal level needed to cause gain release in the AGC-Leveler. A suggested method of setting it is, with no signal present, increase the setting of the ARL control until the green ACTIVE LED extinguishes. Then, further increase the control setting slightly.

For musical signals use the SLOW setting of the RECOVERY RATE button. Set the AUTO-RELEASE LEVEL control so that the ACTIVE LED is extinguished during low level musical passages, fade-outs, or moments of silence.

DOWNWARD EXPANDER: When using the AUTO setting of the downward expander, first set the AUTO-RELEASE LEVEL control in the AGC-Leveler section. Then use the expander's RELEASE control to prevent expander action during short pauses.

General PA System Considerations

In a public address system, it is important to ensure that feedback cannot occur when the AGC-Leveler reaches a state of maximum gain; for instance, when the 421m is trying to boost the volume of a very quiet voice. Avoid this by talking into the mic just loud enough for the ACTIVE LED to light. If you hear feedback, then raise the AUTO-RELEASE LEVEL until the feedback dies. Lowering the RATIO will also help. Remember: The ACTIVE LED does not *have* to be on constantly while signal is present. In fact, depending on your circumstances, you may elect to set the AUTO-RELEASE LEVEL high enough to prevent the 421m from responding to all soft voices.

Stereo Link And Bypass Switching

The STEREO LINK and BYPASS buttons interact. In stereo mode, the designated master unit takes over all functions for both units, including in/bypass switching.

If the STEREO LINK button is in the out position, the 421m is in slave mode which means the 421m gets its commands via the link cable from the master unit.

Note: If a 421m is placed in SLAVE mode and is not connected to another 421m via a linking cable, the unit will remain in BYPASS mode regardless of the setting of its BYPASS button. If there is a master unit connected, then the BYPASS button on the master determines the status of the slave.



An AGC-Leveler has many applications in recording studios, auditoriums or theatres, commercial or industrial PA systems, tape duplication systems, and broadcast. Here follows a small sample of applications.

Broadcast Telephone Line Driver

At sometime or another every broadcast engineer ends up having to send audio down a telephone line. Of course, you need to keep levels hot, but if you hit the line too hard the phone company frowns. It's good practice to ensure that there is a hard limit to any signal that ends up going down a phone line. The 421m is well suited to the task of unobtrusive, yet unyielding control of audio levels.

As a starting point, use the SLOW recovery rate, low RATIO (2:1), and a low AUTO-RELEASE LEVEL. Set the TARGET LEVEL control for the desired average level into the line, and then dial in enough peak limiting to keep the peaks under control. You may want to back the TARGET LEVEL off slightly so that you don't need as much peak limiting. Peak limiters are more inaudible if you only limit occasional peaks.

Conference or Courtroom Recording

If you're recording conferences or courtroom proceedings, you are faced with the same problem at the lectern microphone; i.e., some people speak too softly while others are too loud. If possible, install a separate 421m on each microphone and feed the outputs of the 421m's into the line inputs of your mixer.

If separate 421m's for each mic are not an option, then place a single 421m between the mixer output and the input of the tape recorder.

Foreground Music

The CD changer has propelled canned music into a new era. The problem, of course, is the wide dynamic range of CD's coupled with the fact that different CD's are mastered at diverse and unpredictable levels. Most CD's simply have too much range for foreground or background music applications. The 421m helps reduce the overall dynamic range, while retaining some semblance of the music's original dynamics. You can link two units together for stereo if desired.

There's probably no need to use the downward expander in this application, so turn the THRESHOLD control to the BYPASS position. Set the AGC-Leveler RATIO to 2:1 and use the SLOW recovery rate setting. Set the AUTO-RELEASE LEVEL to 9:00 o'clock or lower. Experiment with the PEAK LIMITER threshold, and use the PEAK LIMITER only if necessary.

Americans with Disabilities Act

The American Disabilities Act (ADA) of 1990 (Public Law 101-336) affects any of us who supply equipment to or operate public gathering places. There are five major aspects (Titles) to this law, all of which have staged implementation dates.

Title I deals with employment issues, Title II deals with public services, Title III deals with public accommodations and services operated by private entities, Title IV deals with telecommunications, and Title V deals with miscellaneous issues. Of particular interest to sound system providers or installers is Title III, which says that many of the places where you find sound systems must provide assisted listening devices for persons with sensory impairment. Some of the solutions employed are: headphone jacks at certain seats, low powered AM or FM transmitters broadcasting to Walkman (R) type radios or to facility-supplied radios, and infrared transmission systems. Regardless of the transmission method, these systems all require a signal of reduced dynamic range so that the users can hear both the softest and loudest parts of a performance. The 421m is ideally suited to this application. Try moderate to high ratios (2:1 and up), and long release times. Pick an AUTO-RELEASE level that keeps the AGC action somewhat unobtrusive. Use the peak limiter to keep the transmitter out of clipping.

421m

Lectern-Mounted Microphones

A common and thoroughly vexing problem is that of the ubiquitous lectern microphone. A staple of hotels, public meeting places, courtrooms, and churches, the podium microphone gets used and misused by one and all.

Anyone who uses a microphone has their own idea of how and where to place the microphone (relative to their lips, of course) and how they should speak into it. Some get their cues from TV (which any self-respecting audio person knows is usually wrong), and some just make it up as they go. Some stick the mike near their navel, just like on TV (or is it that TV-news-types have their vocal chords somewhere new?), and others try to use it for a snack. You get the idea. What this means to you is roller-coaster audio levels. Try the 421m. It will do for a lectern or other announce microphones what no compressor has ever done before: consistent audio levels *with* increased freedom from feedback.

Some hints: use moderate ratios (3:1 to 4:1) unless you want a really “in your face” sound. Use either or both of the speech filter switches. The AUTO-RELEASE LEVEL affects the size of the microphone’s “pickup circle.” More CCW settings expand the circle, allowing the 421m to raise lower level voices more (remember, it won’t keep them from sounding distant or off-mike!). Higher settings restrict the pickup range of the microphone, so a weak talker won’t be picked up as well unless they move-in on the microphone to cause the gain to readjust to their voice level. In noisy environments, try a higher (more clockwise) setting. You can use the downward expander in AUTO mode to gate the mike off when idle. Ensure that the TARGET OUTPUT LEVEL isn’t high enough to cause feedback when the AGC-Leveler has fully engaged (you can force a release by quickly turning the AUTO-RELEASE LEVEL control and then returning it to its former setting).

Live PA

Have you ever mixed live sound for someone who just can’t play at the right level? They’re usually too soft when playing rhythm, and too loud when playing leads. A 421m can help you out. Connect the 421m into the mixer’s channel insert jack, use a relatively low RATIO setting, use the expander if you need to. Remember that lower ratio settings allow for more dynamics than the higher settings which means more difference between soft and loud. This trick also works on microphones that are sung into and used for announcements. The 421m keeps the announcements audible without the worry of forgetting to bring the fader down during a song. Again, use a low RATIO setting around 2:1. If you try this on a submix, be careful because the large number of microphones involved makes it that much easier to push the sound system into feedback.

Mixdown

You can use the 421m during mixdown for a number of different things. For *voiceover’s* let the 421m ride the level of the announcer, while you set the basic announcer to music-bed ratio, or, let the 421m ride the music-bed, while you ride the announcer’s level. Process *background vocals* with the 421m. It will keep them consistently hot, without making them sound squashed (unless that’s what you want). Try using the 421m on *individual instruments* as a way of keeping their level more consistent without radically altering their timbre.

Paging Systems

Just like the poor lectern mike, paging systems suffer from the same ills. It really doesn’t matter if the audio begins life in a telephone system, or if you have a dedicated paging mike. Every user has their own idea of how to use the mike. You can fight them and win with the 421m AGC-Leveler.

Secondary Sound System Feeds

Many sound systems derive secondary feeds for ancillary systems that serve related areas of a facility. In arenas or large stadiums this might be the outer concourses, PA shadow zones, concession areas, rest rooms, dressing rooms, etc. In a church it might be the lobby or cry room. In a TV studio, it could be the IFB (interrupted foldback) system.

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Tape Duplication

Anytime you change recording media, especially between a professional format and a consumer format (how about DAT to consumer cassette?), patch a 421m into the recording chain to perform a gentle squeeze to match the signal level to the input of the next device and peak limiting. Try 2:1 RATIO; set the TARGET OUTPUT LEVEL control for the average level that you need and use the limiter to control the peaks.

Many churches record the Pastor's message (sermon) and make it available on tape by the end of the service. Considering the speed with which this must occur, a 421m might be just the thing to keep the average levels hot, while still preventing overload.

Teleconferencing

Many teleconference users want to record the content of the conference. Of course, audio levels are all over the map (one participant shouts, another is timid...). Try a 421m between the audio mixer and one track of the tape machine, and another between the telephone interface and another track of the tape machine. Using separate 421m's and separate tape tracks will help if and when someone tries to transcribe the conference. Keeping things separate also helps negate the 421m's tendency to bring the telephone interface's leakage (trans-hybrid loss) up to the same level as the caller, which isn't a good idea. The 421m helps by keeping the signal levels more consistent from caller to caller, which is a good idea.

Theatre and Auditorium Cue Systems

An auditorium cue system consists of a microphone(s) mounted in the audience area of a theatre or auditorium that feeds an amplifier that drives speakers located in the backstage areas of the hall. The potential dynamic range in this application is tremendous, ranging from an empty room to an audience on their feet making a plea for an encore.

A 421m, in conjunction with close miking of the person calling the cues, can work wonders keeping this sort of system under control; keeping the level high enough to be audible, and low enough to not be annoying. The downward expander can reduce the level when the room is very quiet, to eliminate electronic noise, yet open up if someone speaks.

Post Production

A 421m can be invaluable in post production. How about:

Use the 421m when *transferring* location sound tapes. If you keep the ratio low, you'll gain consistency with a minimum loss of dynamic range.

Use multiple 421m's to keep various *mix* elements audible...Try one on *FX* or *Foley*, and on dialog.

If you're creating something that will be heard in a specific environment, consider using a 421m to preprocess your mix for that environment. For instance, suppose you're making a point-of-purchase video that will be heard in a noisy department store, over a semi-ordinary television set. With your mixer or an outboard EQ, give the dialog a good dose of 2.5k to 5k presence boost to make it cut through the noise. Then process the overall mix through the 421m with a 3:1 ratio. This will keep the overall level hot but consistent, and the combination of presence boosting and overall level control will make your product audible in spite of the adverse environment in which it is represented.

Be sure to check the previous section entitled "Mixdown" for additional tips and hints.

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421m Specifications

Connectors

Line Inputs	¼" TRS jack and screw terminals, 20k Balanced Bridging
Mic Input	XLR-female, 10k Balanced Bridging
Outputs	XLR-male, screw terminals, 200 Ohm Source Impedance, Differentially Balanced, +23 dBm maximum level
Bypass	TS phone, Unbalanced, +18 dBm maximum level
Sidechain	Relay controlled, hard-wire bypass in power off and bypass conditions
	TRS phone, Unbalanced Send and Receive, 1000 Ohm Source Impedance, 10k Input Impedance
	Tip=Receive, Ring=Send

Downward Expander

Ratio	1:2
Threshold	-50VU (bypass) to -20VU (Auto Threshold)
Attack Time	1 ms
Release Time	Program dependant, 0.3 - 3.5 seconds depending on amount and duration

AGC-Leveler

Ratio	1:1 to 4:1
Auto Release Threshold	-70 dBu to -30 dBu
Attack Time	approximately 1 ms
Release Time	Program dependant, 500 ms - 5 seconds depending on amount and duration

Target Output

Range	+20 dB
Peak Limiter Ratio	10:1
Threshold	-15VU to +23VU (bypass)
Attack Time	1 ms for 90% gain reduction
Release Time	0.8 seconds

Mic Preamp

Gain Range	+15 dB to +45 dB
Impedance	10k Ohms
Max Input Level	+8 dBu
THD+Noise (gain control fully clockwise)	-85 dBu
Phantom Power	48V (±2)
CMRR	>80 dB (10 Hz - 20 kHz)

Sonics

Frequency Response	20 to 50 kHz, +4 dBm (+0, -1 dB), (+0, -3 dB mic)
Harmonic Distortion	<0.05% 20 Hz to 20 kHz, +4 dBm, 30 kHz bandwidth
	Typically <0.01% @ 1000 Hz
Residual Noise	-90 dBu, 20 kHz noise bandwidth, rms responding meter

Speech Curve

Type	Switch selected cutoff filters allow tailoring LF and/or HF response for speech applications
Frequencies	LF=125 Hz, 12 dB/octave; HF=6 kHz, 24 dB/octave

Input/Output Metering

Type	LED Bar Graph, 12 steps + clip
Range (min to max)	66 dB
Ballistics	Peak
Calibration	0 dB=0VU=+4 dBm=1.23V

Physical

Size (hwd)	1.72 x 19 x 6.25 inches, 4.37 x 48.26 x 15.875 centimeters
Shipping Weight	8 lbs (3.63kg) net

Electrical

Connector	EC 3-pole
Power Requirements	117V nominal, 107 to 125V AC, 50 to 60 Hz, 10 watts 220V AC, 50 Hz, 10 watts

Note: The maximum operating ambient temperature is 25 degrees C.

421m Architects and Engineers Specifications

The Automatic Gain Control (AGC) shall be a single channel model that reduces the dynamic range of wide range, wideband audio signals, providing peak limiting, downward expansion and bandpass limiting filters. The AGC shall occupy one rack space (1U).

The AGC shall be capable of controlling audio signals ranging from -70 dBu to +24 dBu and reducing their range by an input/output ratio ranging from 1:1 to 4:1. The input/output ratio shall be adjustable via a front-panel control. Fast/slow response speed switching shall be provided to accommodate speech and music sources. A target output level control shall be provided to shift the level of the output signal over a nominal ±20 dB range. The release time of the AGC shall be controlled by the presence of input signal and the signal sensor shall be capable of discriminating between music/speech and random noise or pure tones. The threshold level of the signal sensor shall be adjustable via a front panel control and the presence of signals above the threshold setting shall be indicated via a green LED.

The AGC shall also contain an integral peak limiter having at least a 10:1 ratio and adjustable threshold level. A green LED indicator shall be provided to indicate peak limiter activity. The peak limiter threshold shall determine the absolute maximum output amplitude of the AGC-Leveler regardless of other conditions.

The AGC shall also contain an integral downward expander having a 1:2 expansion ratio with threshold and release time controls. Furthermore, the downward expander shall be capable of operating automatically via the signal sensor circuitry. A green LED indicator shall be provided to indicate downward expander circuit activity.

Bandpass limiting filters shall be provided having a lowpass characteristic of 24 dB/octave at 6 kHz and a highpass characteristic of 12 dB/octave at 125 Hz. Both filters shall be capable of being used individually or simultaneously.

The AGC shall provide identical peak responding input and output level meters. These meters shall be capable of responding to signals ranging from -54 VU to +12 VU (-50 dBu to +16 dBu). An output clipping indicator shall be provided.

The AGC shall provide facilities for stereo-coupling two units via a shielded 5-pin DIN male-to-male cable. A front panel switch shall designate which unit is the master and which unit is the slave.

The line level inputs shall be active balanced bridging designs terminated with ¼" TRS female and screw terminals. The mic level input shall also be an active balanced bridging design using a three pin XLR female (AES/IEC standard wiring). The input circuitry shall incorporate RFI filters. The outputs shall be active balanced designs having equal source impedances and terminated with 3-pin XLR (AES/IEC standard wiring) and screw terminals. A separate ¼" TRS jack shall provide an unbalanced output.

The balanced line level inputs shall accommodate +24 dBu signals without distortion, and the balanced outputs shall be capable of delivering +23 dBm into a 600-ohm load. The mic level input shall accommodate +8dBu signals. There shall be separate gain trim controls for the mic and the line inputs and the mic input shall provide 48v phantom power.

Overall frequency response shall be 20 Hz to 20 kHz, ±1dB, measured at +4 dBm output. There shall be no more than 0.02% harmonic distortion, measured under the following conditions: +4 dbu input, +4 dBm output, BYPASS switch out, 1000 Hz. Residual noise output shall be no greater than -90 dBm, measured with a 20 kHz noise bandwidth.

When the unit is inoperative (either by loss of power, or via the BYPASS switch), the inputs and outputs shall be wired together. There shall be no transients transmitted to the output terminals during either turn-on, turn-off, or bypass operation (unless something upstream generates transients).

Access to the AGC's sidechain shall be provided via a single ¼" TRS female connector. The ring connection shall be the sidechain output and the tip connection shall be the sidechain return.

The AGC shall be capable of operating by means of its own built-in power supply connected to 115V nominal ac (105 to 130V) 50/60 Hz (230V nominal, 210 to 260V ac, 50 Hz where applicable). The AGC shall be listed by Underwriters Laboratories Inc. (UL) or other equivalent nationally recognized safety testing agency.

The unit shall be a Symetrix Incorporated model 421m AGC-Leveler.

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No output signal:

Check cables and connections.

Determine that there really is a signal coming from the source and that it is getting to the 421m.

Verify cables by patching input and output connections together at the unit.

Check for AC power presence.

Check input by plugging headphones halfway into the sidechain jack and listening for input signal (this verifies that the unit is receiving signal).

Check output by plugging headphones into output jack.

Check downward expander threshold setting; it may be too high for the current signal level.

Stuck in bypass mode:

Check setting of the STEREO LINK button. In single unit (mono) systems, on independently operating units and on master units, the switch should be in the IN position.

No limiter action:

Check the threshold control setting. Signal levels may be too low. Don't try to calibrate with sine waves. Use speech or music.

Distortion:

Is the incoming signal already distorted? Listen “up stream” from the 421m (or manually place the unit in BYPASS mode) to determine that you are feeding it a clean signal.

Buzz in the output:

Check input and output connector wiring.

Check for ground loops between interconnected system equipment.

Are all system components on the *same* AC ground?

Noise (hiss):

Check input signal levels and input level control settings. The input may be too low in level. If so, boost the signal from your console or input source.

Is the input signal already noisy? Listen “up stream” from the 421m to determine if you are feeding it a clean signal.

The 421m doesn't power up or doesn't respond properly:

Consult a qualified service technician or the Symetrix factory.

Note: Repeated fuse blowing is a sure sign of electronic distress. Unplug the unit and make arrangements for repair.

Warning: **The fuse is located internally and lethal voltages are present inside the chassis. The fuse is not considered user-serviceable. If the fuse is blown, the 421m probably needs repair.**

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421m Limited Warranty

Symetrix, Inc. expressly warrants that the product will be free from defects in material and workmanship for one (1) year. Symetrix's obligations under this warranty will be limited to repairing or replacing, at Symetrix's option, the part or parts of the product which prove defective in material or workmanship within one (1) year from date of purchase, provided that the Buyer gives Symetrix prompt notice of any defect or failure and satisfactory proof thereof. Products may be returned by Buyer only after a Return Authorization number (RA) has been obtained from Symetrix. Buyer will prepay all freight charges to return the product to the Symetrix factory. Symetrix reserves the right to inspect any products which may be the subject of any warranty claim before repair or replacement is granted. Symetrix may, at its option, require proof of the original date of purchase (dated copy of original retail dealer's invoice). Final determination of warranty coverage lies solely with Symetrix. Products repaired under warranty will be returned freight prepaid via United Parcel Service by Symetrix to any location within the Continental United States. Outside the Continental United States, products will be returned freight collect.

The foregoing warranties are in lieu of all other warranties whether oral, written, express, implied or statutory. Symetrix, Inc. expressly disclaims any IMPLIED warranties, including fitness for a particular purpose or merchantability. Symetrix's warranty obligation and buyer's remedies hereunder are SOLELY and exclusively as stated herein.

This Symetrix product is designed and manufactured for use in professional and studio audio systems and is not intended for other usage. With respect to products purchased by consumers for personal, family, or household use, Symetrix **expressly disclaims all implied warranties including but not limited to warranties of merchantability and fitness for a particular purpose.**

This limited warranty, with all terms, conditions and disclaimers set forth herein, shall extend to the original purchaser and anyone who purchases the product within the specified warranty period.

Warranty Registration must be completed and mailed to Symetrix within thirty (30) days of the date of purchase.

Symetrix does not authorize any third party, including any dealer or sales representative, to assume any liability or make any additional warranties or representation regarding this product information on behalf of Symetrix.

This limited warranty gives the buyer certain rights. You may have additional rights provided by applicable law.

Limitation of Liability

The total liability of Symetrix on any claim, whether in contract, tort (including negligence) or otherwise arising out of, connected with, or resulting from the manufacture, sale, delivery, resale, repair, replacement or use of any product will not exceed the price allocatable to the product or any part thereof which gives rise to the claim. In no event will Symetrix be liable for any incidental or consequential damages including but not limited to damage for loss of revenue, cost of capital, claims of customers for service interruptions or failure to supply, and costs and expenses incurred in connection with labor, overhead, transportation, installation or removal of products, substitute facilities or supply houses.

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Servicing the 421m

If you have determined that your 421m requires repair services and you live *outside* of the United States, please contact your local Symetrix dealer or distributor for instructions on how to obtain service. If you reside in the U.S. then proceed as follows.

Return authorization

At the Symetrix factory, Symetrix will perform in-warranty or out-of-warranty service on any product it has manufactured for a period of five years from date of manufacture.

Before sending anything to Symetrix, please contact our Customer Service Department for a Return Authorization (RA) number. The telephone number is (425) 787-3222, Monday through Friday, 8AM (800 hours) through 4:30 PM (1630 hours), Pacific Time.

In-Warranty Repairs

To get your 421m repaired under the terms of the warranty:

1. Call us for an RA number.
2. Pack the unit in its original packaging materials.
3. Include your name, address, daytime telephone number, and a brief statement of the problem.
4. Write the RA number on the outside of the box.
5. Ship the unit to Symetrix, freight prepaid. We do *not* accept freight collect shipments.

Just do these five things, and repairs made in-warranty will only cost you one-way freight charges only. We'll pay the return (surface) freight.

If you choose to send us your product in some sort of flimsy packaging, we'll have to charge you for proper shipping materials. If you don't have the factory packaging materials, then do yourself a favor by using an oversize carton, wrap the unit in a plastic bag, surround it with bubble-wrap, and place it in the box surrounded by Styrofoam peanuts. Be sure there is enough clearance in the box to protect the rack ears (you wouldn't believe how many units are returned with bent ears). We won't return the unit in anything but Symetrix packaging for which we will have to charge you. Of course, if the problem turns out to be operator inflicted, you'll have to pay for both parts and labor. In any event, if there are charges for the repair, you will pay for the return freight. All charges will be COD unless you have made other arrangements (prepaid, Visa or Mastercard).

Out-of-Warranty Repairs

If the warranty period has passed, you'll be billed for all necessary parts, labor, packaging materials, and freight charges. Please remember, you must call for an RA number before sending the unit to Symetrix.

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 **Symetrix**



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