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 **Symetrix**
Model 422
Stereo AGC/Leveler
User's Guide

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1 Introduction

Congratulations on your decision to use a Symetrix model 422 Stereo AGC/Leveler. The 422 has been designed to give professional audio users unequaled performance, ease of use, and reliability. This manual will guide you through installation and operation of the 422, and provide valuable tips on how to interface with other equipment in your system.

The 422 is a singular solution for controlling unpredictable stereo (or monaural) audio levels in a wide variety of audio systems. Application environments include broadcast, recording, tape duplication and installed foreground and background systems just to name a few. The 422 excels at subtly and unobtrusively bringing level divergent audio into a 'target window', resulting in greater intelligibility and informational perception. Unlike compressor/limiters, which are effective at reducing sounds that are too loud (pushing down from the top only), the 422 provides both downward compression and upward leveling by gently adding gain to low level signals until a target level is reached.

The 422 employs advanced analog signal processing technology executed with high quality industrial grade components to meet, or exceed, the highest professional audio industry standards in terms of headroom, low noise and distortion, and superb sonic qualities.

The 422's logical control panel holds no hidden surprises. The product is easy to learn and simple to use. In the sections that follow, you'll find information on installation, operation, and specific applications of the 422. We follow this with a troubleshooting guide, warranty and service information, and detailed specifications.

As with all Symetrix products, the 422 is intended to provide you with years of trouble free use. Our company is committed to excellence in product design, manufacturing, and customer satisfaction. Please do not hesitate to contact us with your questions or comments.

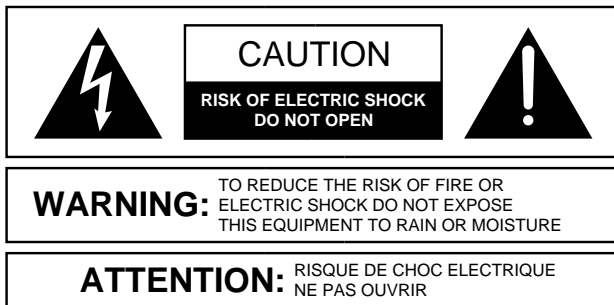
2 Safety Information

Operator safety summary

The information in this summary is intended for persons who operate the equipment as well as repair personnel. Specific warnings and cautions are found throughout this manual wherever they may apply; they do not appear in this summary.

The notational conventions used in this manual and on the equipment itself are described in the following paragraphs.

Equipment markings



No user serviceable parts inside. Refer servicing to qualified service personnel.
 Il ne se trouve a l'interieur aucune piece pouvant etre reparaée l'usager.
 S'adresser a un reparaateur 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 422 (i.e. this manual).

Caution

To prevent electric shock, do not use the polarized plug supplied with the 422 with any extension cord, receptacle, or other outlet unless the blades can be fully inserted to prevent blade exposure.

Terms

Several notational conventions are used in this manual. Some paragraphs may use Note, Caution, or Warning as a heading. These headings have the following meaning:

- Note** Identifies information that needs extra emphasis. A Note generally supplies extra information to help you to better use the 422.
- Caution** Identifies information that, if not heeded, may cause damage to the 422 or other equipment in your system.
- Warning** Identifies information that, if ignored, may be hazardous to your health or that of others.

In addition, certain typefaces and capitalization are used to identify certain words. These are:

- CAPITALS** Controls, buttons or other markings on the 422's chassis.
- Boldface** Strong emphasis.

Other safety information

Power source

This product is intended to operate from a power source that does not apply more than 255V 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.

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. Use only a cord that is in good condition.

Proper fuse

The power line fuse is mounted internally and is not considered user serviceable. The fuseholder accepts American sized fuse (1/4 inch diameter) or European sized fuses (5mm diameter). For 117 VAC operation, the correct value is 1/2A, 250VAC, fast blowing (Bussman type AGC). For 230VAC operation, the correct value is 1/4A, 250VAC, slow blowing (Bussman type MDL or GDC).

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.

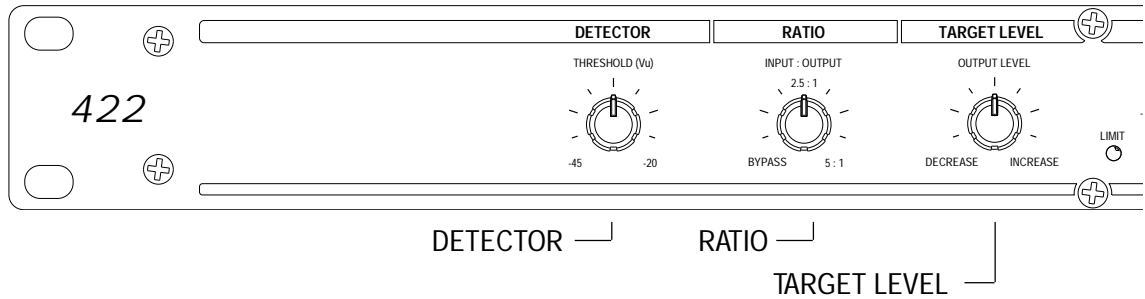
Stay out of the box

To avoid personal injury or injury to others, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

3 Summary Product Description

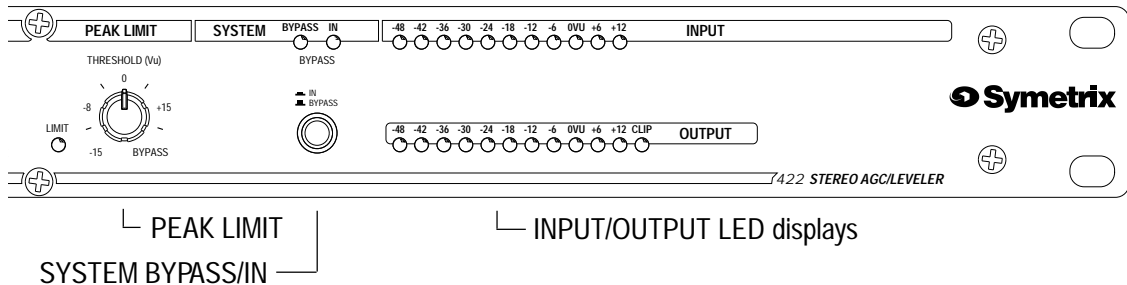
This chapter provides a basic overview of the 422 by describing the input and output audio connections, power connection, operating controls, and front panel LED indicators. Use this information to acquaint yourself with the product. Chapter 4 (Installation) gives details on installing the 422 in your system, and Chapter 5 (Operation) gets into specific applications and operation of the 422 in detail.

Front panel view (left)



- The DETECTOR establishes an audio reference for the purpose of discriminating between noise and useful audio. The 422 will not attempt to apply leveling (upward gain increases) to signals that fall below the detector threshold.
- The RATIO control sets the amount of downward compression for signals exceeding the target level as well as the amount of upward leveling for signals below the target level.
- The TARGET LEVEL control establishes a nominal gain goal. For signals below the target level the 422 adds gain and boosts them upward. Signals above the target level are reduced in gain (downward towards the target).

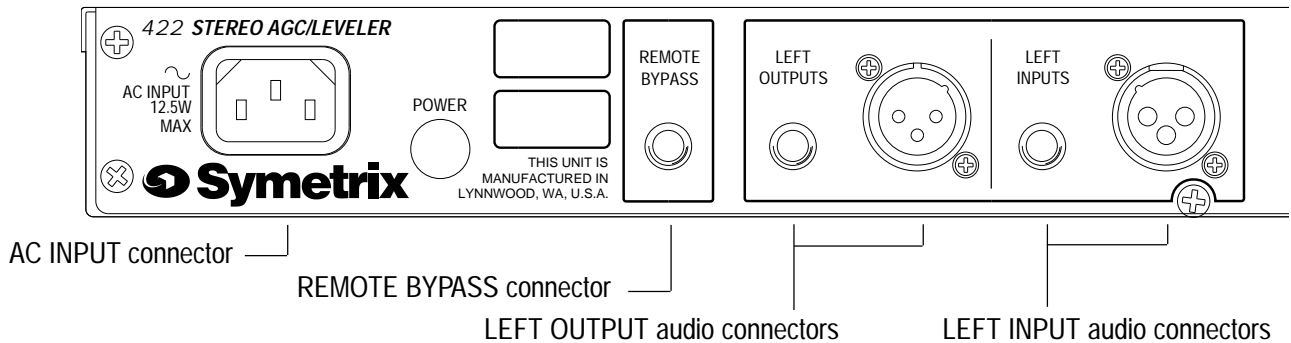
Front panel view (right)



- The PEAK LIMIT control determines the level at which peak limiting gain reduction begins. Signals exceeding this threshold will be reduced by a ratio of approximately 15:1 (an increase of 15dB at the input results in only 1 dB increase at the output).
- The BYPASS/IN button activates relays which route the 422 input signals directly from the input connectors to the output connectors when in the BYPASS position.

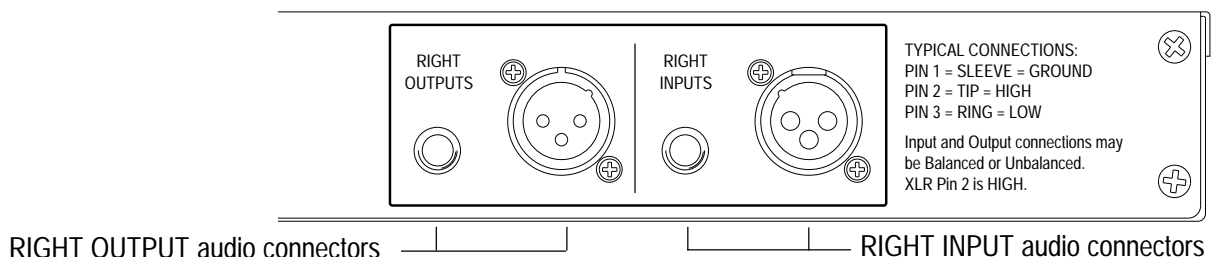
The INPUT/OUTPUT LED displays indicate the higher of either left or right channel calibrated in VU (volume units). ('0' VU=+4dBu).

Rear panel view (left)



- The AC INPUT connector accepts nominal AC power sources of 117 volts or 230 volts [see Appendix A (Specifications) for voltage tolerance ranges]. See chapter 4 (Installation) for details on the detachable (IEC) power cable.
- The REMOTE BYPASS connector provides for the control of the BYPASS/IN function via a remote contact closure. See Appendix B, REMOTE BYPASS WIRING, for details.
- The LEFT INPUT audio connectors are electronically balanced, bridging, line level inputs. XLR pin 1 is ground, pin 2 is high, and pin 3 is low. The 1/4" connector's sleeve is ground, ring is low, and tip is high.
- The LEFT OUTPUT audio connectors are electronically balanced, low impedance, line level outputs. XLR pin 1 is ground, pin 2 is high, and pin 3 is low. The 1/4" connector's sleeve is ground, ring is low, and tip is high.

Rear panel view (right)



- The RIGHT INPUT audio connectors are electronically balanced, bridging, line level inputs. XLR pin 1 is ground, pin 2 is high, and pin 3 is low. The 1/4" connector's sleeve is ground, ring is low, and tip is high.
- The RIGHT OUTPUT audio connectors are electronically balanced, low impedance, line level outputs. XLR pin 1 is ground, pin 2 is high, and pin 3 is low. The 1/4" connector's sleeve is ground, ring is low, and tip is high.

Note For optimum immunity to noise and radio frequency interference we highly recommend connecting the 422 to balanced equipment, where possible. If this is not possible, unbalanced connections are OK. Unbalanced connections via tip-sleeve (mono) 1/4" plugs are easy to make via the 422's 1/4" input and output connectors.

4 Installation

Before you plug the 422 into a wall socket, carefully read the information in the following chapter.

AC Line connection in countries outside of the European Community

A sticker on the right end of the unit 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 422. Instead, return the unit to your local Symetrix distributor for modification.

The 422 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 117vac 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 422'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 422.
- 2 Plug the other end of the power cable into a three-hole grounded outlet or power strip.



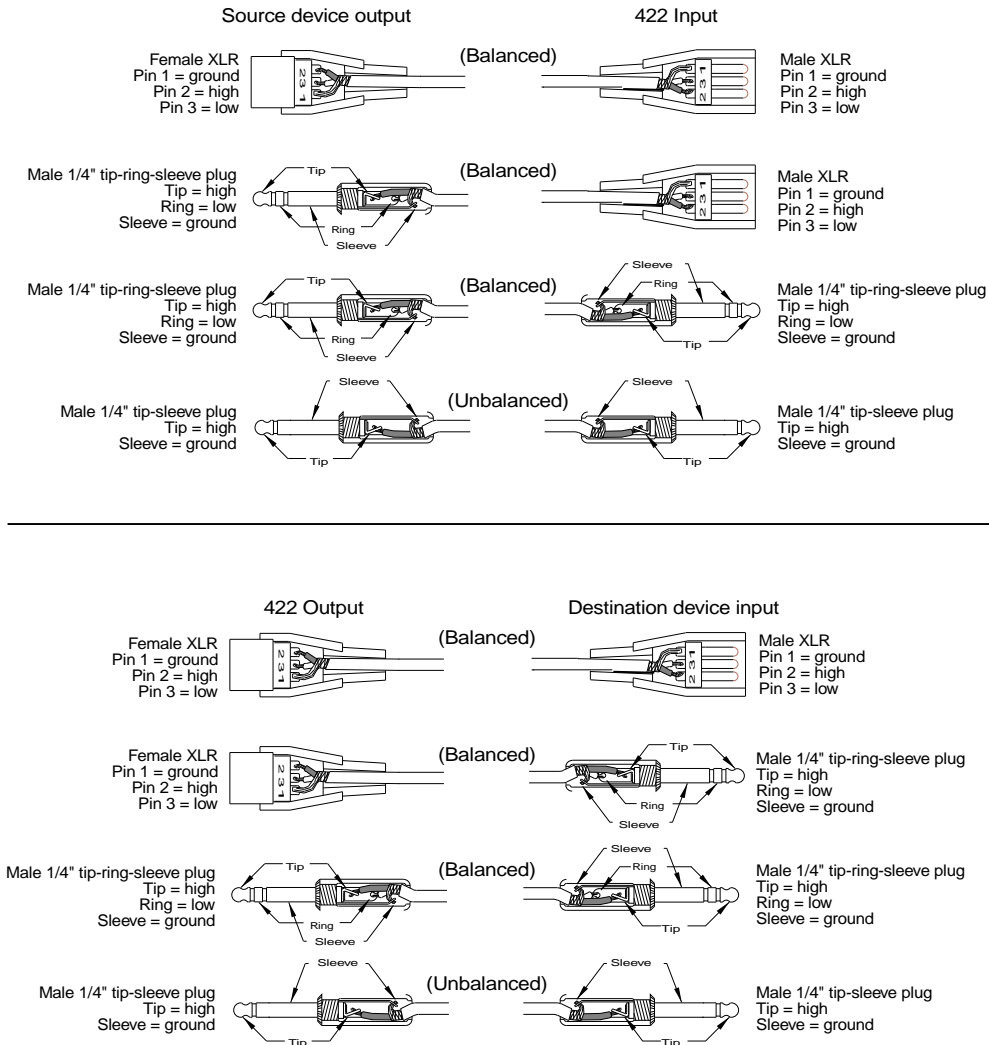
WARNING The 422 is intended to be electrically grounded. It has been provided with a three-wire grounding plug - a plug that has a third (grounding) pin. This plug will fit only a grounded AC outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact a licensed electrician to replace the outlet with a properly grounded outlet. Do not defeat the purpose of the grounding plug!

Mounting in an equipment rack

The 422 occupies one rack space (1U) in a standard equipment rack with a width of 19" (48.3cm), a depth of 7.5" (19.1cm), 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 422 next to devices that emit large electromagnetic fields, such as audio power amplifiers. To do so may compromise the noise performance of the 422. The 422 has been designed to conform to mechanical guidelines as described in EIA Standard RS-310-C and IEC Recommendation 297.

Recommended audio cable wiring

For optimum system performance we recommend that the 422 be connected to balanced signal sources. If this is not practical in your situation, then you may connect to unbalanced sources. The following diagram illustrates recommended cable wiring practices.



5 Operation

This section describes in detail the functions of the 422's front panel controls and LED indicators.

The TARGET LEVEL control

When setting up the 422, this is generally the control that you should adjust first. The TARGET LEVEL control does just what the name implies. It establishes the volume where you want it. Technically, the control sets a threshold. Incoming signals that exceed this threshold are compressed downward towards the threshold. Incoming signals below the threshold are expanded (leveled) upward towards the threshold. The 422's output is a reduced dynamic range replica of its input, 'centered' around the target level.

As you adjust the TARGET LEVEL control, it's very easy to see and hear the results. A quick glance at the OUTPUT level VU meter will show you the exact effects of increasing or decreasing TARGET LEVEL.

The DETECTOR control

The DETECTOR control increases or decreases the sensitivity of the 422 to low level audio signals and noise. As you turn this control counterclockwise, the 422 'reaches down' and increases the gain of low level audio and/or noise. The optimum setting of this control is entirely dependent upon the nature of the audio that the 422 is processing. For example, if the audio source is relatively clean and quiet (like a CD), the position of the DETECTOR may be noncritical. To greatly increase the volume of the low level signals on the CD, try a full counterclockwise setting of the control (-45). On the other hand, if you try the same extreme setting with a noisy cassette recording, you may not find the results to be pleasing. If you're processing a very noisy source, then turn the detector control clockwise towards the -20 setting until the desired sound is achieved.

If you're unsure of where to position the DETECTOR control, then start with it straight up in the twelve o'clock position. We've found this to be a good compromise for unpredictable audio sources.

The RATIO control

The RATIO control is used to increase or decrease the degree of leveling. At high ratios, the program density increase results in a more 'present' or 'up front' sound. At low ratios, the 422 performs subtle, yet effective, automatic gain riding. At a setting of 5:1 (maximum) the effect of the 422 AGC/leveling process is very audible.

The optimum setting of this control is usually dictated by the particular type of material one is processing, and the desired effect. For example, if the 422 is part of a foreground/background music/paging system in a high ambient noise environment, a higher ratio will produce maximum intelligibility. As part of a broadcast chain, where the process itself must be as subtle as possible, a 2.5:1 or lower ratio is advisable.

If you're unsure of where to position the ratio control, then we suggest you start in the twelve o'clock position and make upward and downward adjustments from there as you listen and evaluate the results.

The PEAK LIMIT control

The PEAK LIMIT control sets an absolute 'ceiling' threshold level to which the maximum output level is limited. The control is calibrated in VU (volume units). The PEAK LIMITER is useful in any application where it is desired to prevent overload of subsequent system components. This may include applications such as high volume music systems in clubs and theatres, or transmission line applications such as AM/FM radio and television.

When the control is turned to its full clockwise rotation, the PEAK LIMITER is bypassed. As the control is rotated counterclockwise, the threshold is moved lower and the resultant limiting can be observed as a reduction in overall output level on the OUTPUT LED meter.

The optimum setting for the PEAK LIMIT control is most often correlated directly to requirements of 'downstream' system components. If you're unsure of where to set the control, then you may want to try this: observe the OUTPUT level display and note the average output level, then adjust the PEAK LIMIT control 10-12dB above the average output level. Set this way, the peak limiter will provide protection without over limiting the signal. The LIMIT LED should only come on occasionally. If it stays on constantly then you're applying too much limiting and should turn the PEAK LIMIT control clockwise to reduce the amount of limiting. If you do not have a clearly identified need to peak limit your signal, then we recommend that you turn the PEAK LIMIT control to the fully clockwise BYPASS position.

The SYSTEM BYPASS/IN button

The BYPASS/IN button places the 422 in either BYPASS or IN(circuit) modes. In BYPASS mode the incoming signals are directly routed (via relays) to the 422's outputs, thereby bypassing any internal circuitry. In BYPASS mode the front panel rotary controls have no effect on the operation of the 422. A red LED indicates BYPASS status, while a green LED indicates IN status.

The INPUT and OUTPUT level meters

The INPUT and OUTPUT level meters are calibrated in VU (volume units). The meters read the greater of either left or right channel signal levels. The meters give an indication of absolute signal levels, and show the exact relationship between input and output signals as a result of various settings of the 422's controls.

6 Troubleshooting

Solutions to common problems

There is no output signal

- ⌚ Check the AC power connections to the 422.
- ⌚ Check input and output cables and connections.
- ⌚ Determine that there really is a signal coming from the source and that it is getting to the 422.

Distortion in the output signal

- ⌚ Check the input signal. Is it overdriving the 422's input?
- ⌚ Is the incoming signal already distorted? Listen 'up stream' from the 422 (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? Disconnect the inputs from the 422 and listen for noise at the output. If the noise is gone, then the problem is prior to the 422.

Less common problems

The 422 doesn't power up or doesn't respond properly.

- ⌚ Consult a qualified service technician or the Symetrix factory.

The 422 is not plugged in, but works great anyway.

- ⌚ Consult your doctor or therapist.

7 Warranty and Service

The Symetrix 422 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 carried out. 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 or substitute facilities or supply houses.

Servicing the 422

If you have determined that your 422 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 (206) 787-3222, Monday through Friday, 8AM (800 hours) though 4:30 PM (1630 hours), Pacific Time.

In-warranty repairs

To get your 422 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 cost you only one way freight charges. We'll pay the return freight.

If you choose to send us your product in some sort of flimsy, non-Symetrix 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 box. 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 costs, 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.

A Specifications

appendix

Architects and engineers specifications

The Automatic Gain Controller (AGC/Leveler) shall be a stereo model that reduces the dynamic range of wide range, wideband audio signals and provides peak limiting. The AGC shall occupy one rack space (1U).

The AGC/Leveler shall be capable of controlling audio signals ranging from -40dBu to +24dBu and reducing their range by an input/output ratio of from 1:1 to 5:1. 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 and nature of input signals.

The AGC/Leveler shall also contain an integral peak limiter having at least a 15:1 ratio and adjustable threshold level. A red 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/Leveler shall provide identical peak responding input and output level meters. These meters shall be capable of responding to signals ranging from -48VU to +12VU (-44dBu to +16dBu). An output clipping indicator shall be provided.

The inputs shall be active balanced bridging designs terminated with 3-pin XLR (AES/IEC standard wiring) female and 1/4" (tip-ring-sleeve) jacks.

The outputs shall be active balanced designs terminated with 3-pin XLR (AES/IEC standard wiring) male and 1/4"(tip-ring-sleeve) jacks.

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

When the unit is inoperative (either by loss of power, or via the BYPASS switch), the inputs and outputs shall be wired together. A REMOTE BYPASS facility shall be provided whereby an external contact opening shall force the AGC/Leveler into BYPASS mode.

The AGC/Leveler shall be capable of operating by means of its own built-in power supply connected to 117V nominal ac (105 to 130V) 50/60 Hz and 230V nominal ac (207 to 253V ac). The AGC/Leveler shall be listed by Underwriters Laboratories, Inc. (UL) .

The AGC/Leveler shall be a Symetrix, Incorporated model 422 Stereo AGC-Leveler.

Technical specifications

Audio

Inputs	Stereo, balanced bridging or unbalanced
Outputs	Stereo, balanced or unbalanced
Maximum input level	+24dBu
Maximum output level	+22dBu into 600 ohms
Frequency Response	20Hz-20kHz, ± 1 dB
THD+noise	.05%, 0dBu in, 10dB gain reduction, 1kHz
Output Noise	-90dBu, broadband
Dynamic Range	>110dB
Crosstalk	- 60dB , +20dBu in, 20Hz-20kHz
Input common mode rejection	>40dB @ 1kHz
AGC Detector range	-41dBu to -21dBu
Ratio	1:1 to 5:1
Target level range	40dB
Limiter Threshold	-15dBu to +25dBu
Limiter Ratio	>15:1

Physical

Input connectors	1/4" tip-ring-sleeve, XLR, & RCA
Output connectors	1/4" tip-ring-sleeve,XLR, & RCA
Polarity	tip of input jack is high, ring is low, sleeve is ground tip of output jack is high, ring is low, sleeve is ground
Chassis size	1.75"H x 19"W x 5.75D
Shipping weight	4.45cmH x 48.3cmW x 14.61cmD 8lbs, 3.63kg

Electrical

Power	117V ac, nominal, 105-130V ac ,50-60Hz 230V ac, nominal, 207-255V ac, 50Hz
Power Consumption	12 watts

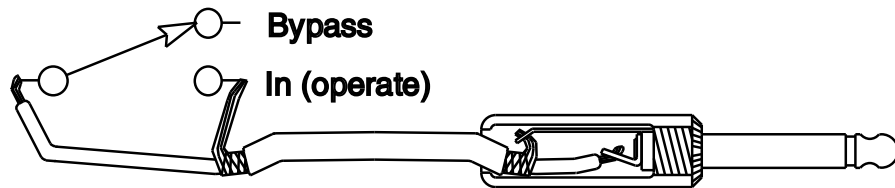
In the interest of continuous product improvement, Symetrix, Inc. reserves the right to alter, change, or modify these specifications without prior notice.

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B REMOTE BYPASS wiring

appendix

For those installations that may require remote bypassing of the 422's functions, a rear panel jack has been provided to accept an external switch for this purpose. The external switch should be a high quality, industrial grade, single pole, double throw toggle switch. We highly recommend that shielded wire be used to connect the switch to the 422 so as to minimize the possibility of introducing any radio frequency interference into the 422. The external 1/4" audio plug should be of the tip-sleeve type (often referred to as a 'mono' plug). The following diagram illustrates recommended wiring practice.



User supplied remote bypass circuitry

The cable should be wired as shown above and as described below:

- 1) The tip of the 1/4" plug is soldered to one end of the 'signal' wire of a coaxial cable.
- 2) One end of the shield of the coaxial cable is soldered to the sleeve of the 1/4" plug.
- 3) The other end of the 'signal' wire is soldered to the common terminal of a single pole, double throw switch.
- 4) The remaining shield is soldered to either of the remaining terminals of the switch (one terminal remains unconnected).