

AM670 Limiter

Operating Manual



ANAMOD
ANALOG MODELING

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AM670 Condensed Operating Instructions



Input Gain The INPUT controls are continuously adjustable from -15dB to +15dB. Unity gain is at the center position.

Threshold The THRESHOLD controls are continuously adjustable from 0 (off) to 10 (maximum limiting).

Time Constant Eight position rotary switch for selecting one of eight preset combinations of attack and release time. Time constants get progressively slower as the preset number increases. Presets 5 and 6 are multi-slope (auto).

Meter Three position rotary switch for selecting Input level (IN), Gain Reduction (ZERO) or Output level (OUT).

Zero Screwdriver-adjustable trim controls for setting the meter to zero when indicating Gain Reduction.

In/Bypass Engaging the IN pushbutton puts the AM670 into the signal path, and the meter illumination brightens. When the switch is out, the unit is in hard bypass. Hard bypass is the default mode when ac power is turned off.

AGC Switch for selecting one of three modes of operation. LEFT/RIGHT indicates dual mono (split). STEREO links the sidechains of the left and right channels. LAT/VERT encodes and decodes the left and right channels for Mid-Sides (M-S) Limiting.

ON AC power switch. The meters are dimly lit when ac power is applied, but channels are in bypass. The neon lamp indicates when the unit is on.

REAR PANEL

I/O The XLR input and outputs are active-balanced with pin 2 hot. To operate the outputs unbalanced, pin 3 MUST be grounded.

AC Standard 3 pin IEC ac inlet. The ac line voltage for the AM670 is internally set at the factory. It is indicated on the rear panel.

AM670 Limiter

Features

- Classic Fairchild Variable-Mu compression profile and vintage tone
- Six 670 time constants plus two vocal-friendly variations
- New and unique GRC (Gain Control Computer) technology
- Three modes of compression: Dual Mono, Stereo, and Mid-Sides (M-S)
- All analog signal path with no latency or digital conversion

Introduction

Thank you for purchasing the AnaMod AM670 Limiter, a unique audio processor that is designed to simulate the characteristics of the Classic Fairchild 670 Limiter. It is an all-analog product, and can be used as a creative tool for tracking, mixing, and mastering. In short, it can be used anywhere you'd want the distinctive sound of the Fairchild Limiter.

The Fairchild 670 Limiter is arguably one of the most famous and sought-after stereo compressors ever made. The magical way it adds density and dimension to a track or a mix has been demonstrated on many of the best-sounding records made in the last 50 years. For buss compression, the 670 Limiter is the standard by which all others are judged. The AM670 is a faithful recreation of the classic sound and compression profile of the 670, using the AnaMod™ process to model the complex tube circuitry of the 670 and implement it entirely in the analog domain. Unlike a digital plug-in or processor-based outboard gear, there is no latency, and no A/D or D/A conversions to compromise the sound. All the functions of the original 670 have been condensed into three rack spaces.

Like the Fairchild 670, the AM670 has Left/Right (dual mono), and Lat/Vert (M-S encode/decode) modes of dynamics processing. In addition, the AM670 also has a Stereo mode, which links sidechains of the two channels.

What is the AnaMod Process?

The AM670 Limiter uses the AnaMod Process™ for modeling complex analog circuitry entirely in the analog domain. What exactly is the AnaMod Process™?

In simple terms, it's a way of taking the same analysis one would use to create a digital plug-in, but using it to create analog hardware that does the same thing. Instead of writing software code to describe how a complex audio system behaves, we developed special analog building blocks that are 'coded' to emulate the behavior of the audio system. These building blocks are used to simulate frequency response, distortion, dynamic response, and all the other parameters that define exactly what an audio signal is. Long before digital computers existed, complex mathematical calculations were done using analog computers. They consisted of analog circuitry that was 'programmed' by adjusting analog circuit parameters. For example, the first atomic bomb, which was developed in the early 1940s, was designed using analog computing techniques. Here, we've taken this process one step further, by developing programmable audio building blocks and grouping them together to form an "audio analog computer". It is 'programmed' by choosing component values, rather than writing lines of software code. The AM670 features the AnaMod GRC, or Gain Control Computer, to accurately recreate the classic compressions curve of the Fairchild 670.

While the analysis used for an AnaMod model might be the same as used in a digital model, we believe there are distinct advantages to using the AnaMod process for audio. Unlike digital plug-ins or processor-based outboard gear, The AnaMod process has no latency, and no A/D or D/A conversions to compromise the sound. The result is a faithful recreation of the original response, without using the original analog hardware, or digitizing the audio.

Unpacking

The unit was carefully packed at the factory to protect against damage in transit. Nevertheless, be sure to inspect the unit and shipping carton for any signs of damage that may have occurred during shipment. If there is any damage, please notify your distributor immediately for further instructions. It's also a good idea to save the carton and packing materials should you ever need to return the unit for repair. The shipping carton should contain the following three items: the AM670, an IEC 3 prong power cord, (US only) and this operating manual.

Mounting

The AM670 uses three EIA-standard rack spaces, and can be mounted in any standard 19 inch (483mm) equipment rack. If the AM670 is mounted in a mobile rack or road case, it is important that the rear of the chassis is supported to prevent possible damage from mechanical shock and vibration. Excessive shock and vibration can cause damage or premature failure. Please avoid rough handling.

Ventilation

For proper operation, it is important that adequate ventilation is provided. Heat generated inside the unit is radiated out through the ventilation holes in the top panel. Do not block these vents. Never operate the AM670 inside a road case where ventilation is blocked.

Power Requirements

The AM670 is equipped with a 3-prong IEC power connector and detachable cord. Never operate the AM670 with the ground on the power cord defeated. Unless otherwise stated, this unit operates from 115-120V/60 Hz only. Before the unit is plugged in, make sure the AC voltage is correct. The AC fuse is accessible from inside the bottom panel, and is rated at 1.0A/250V (3AG). To check or replace the fuse, make sure the unit is unplugged.

Servicing

The user should not attempt to service the AM670 beyond that described in this manual. Never remove the covers until the unit has been disconnected from the AC power source, and all circuits inside have been allowed to discharge for a period of at least 1 minute. Some components can become hot once the unit has been turned on, and they should not be touched until they have cooled to room temperature. To reduce the risk of fire or electrical shock, do not expose to rain or moisture, or operate it where it is exposed to water. Since potentially lethal voltages are present inside the unit, it should be opened only by qualified service personnel. Refer all servicing, or any questions about servicing, to AnaMod LLC.

Hookup

Please refer to the rear panel layout (see the Condensed Operating Instructions) for the location of the inputs, outputs and ac power. Make all connections to the AM670 before applying power.

Inputs and Outputs

On the right hand side of the rear panel are the XLR input and output jacks for channels 1 and 2. Connect line-level sources to the AM670 using standard balanced XLR cables. Pin 1 = ground. Pin 2 = + (positive phase), pin 3 = - (negative phase). Do not connect the outputs of the AM670 to an input that has +48V phantom power applied to it. NOTE: For unbalanced operation of the outputs, pin 3 MUST be grounded!

AC Power

- On the left side of the rear panel is the IEC input socket. Connect to a 120V/60Hz receptacle (or 230V/50Hz if configured for overseas use) with the 3 prong IEC power cable supplied with the AM670. The correct AC input voltage for the AM670 is set at the factory and is clearly labeled on the

rear panel. For safety reasons, do not lift the ground on the power plug by using a 3-to-2 ground lift adapter.

- Turn on the power to the unit using the AC power switch located on the upper left-hand side of the front panel. The amber power indicator will illuminate.

Operation

While the operation of the AM670 may appear to be rather straightforward, there are a few features that may differ from what you're accustomed to seeing on other dynamics processors. You may find it useful to refer to the Condensed Operating Instructions at the beginning of this manual to quickly identify the operation of the front panel controls. However, we suggest you read through this section to take advantage of all its features, and to make sure you are operating the AM670 in the way most appropriate for the type of dynamics processing you're doing.

Please refer to the front panel layout (see the Condensed Operating Instructions) for the location of all switches and controls discussed below.

Front Panel

The AM670's front panel contains all of the necessary user controls. There is a VU meter and meter switch for each channel to indicate the amount of Gain Reduction in dB, as well as Input and Output levels. There is also one control for each channel that sets the input level, and one control for each channel that sets the threshold for limiting. Lastly, there are two rotary switches which set the side chain's preset time constants for each channel, and one push-on / push-off switch for each channel which is a hard (relay) audio bypass.

METER

This 3 position switch allows you to monitor the INPUT level (IN), GAIN REDUCTION (ZERO), or OUTPUT level (OUT) on the VU meter for each channel. Unlike the metering in the Fairchild 670, the gain reduction meter in the AM670 gives a very accurate indication in dB of the amount of compression. The input and output levels are referenced to 0VU = +4 dBu.

INPUT GAIN

The INPUT controls determine the gain of the input stages for Channel 1 and 2. The INPUT is continuously variable from -15 dB to +15 dB, with unity gain (0 dB) at the 12:00 position. Use the INPUT to set the overall operating level of the AM670, as indicated by the VU meters on the front panel. Like the Fairchild 670, the INPUT level determines how linear or non-linear the compression process will be. As the INPUT level is increased, harmonic distortion increases and becomes more apparent, which can be used as a creative tool.

THRESHOLD

The THRESHOLD control determines the amount of gain reduction applied to the input signal. It raises or lowers the gain of the AM670's sidechain circuit for each channel, from off (0) to maximum (10). Full counter-clock-wise (CCW) sends no audio to the sidechain. Increasing the THRESHOLD level steadily increases the amount of limiting.

AGC

The three position AGC (Automatic Gain Control) switch selects the mode of operation. LEFT/RIGHT is split, or dual mono operation, where the two channels operate independently. In STEREO, the sidechain signals are combined, so the gain reduction of both channels track in stereo. The Input, Threshold, and Time Constant controls must be set to the same positions for proper operation. The LAT/VERT mode engages the M-S matrix, which allows independent limiting of the sum (Mid) and difference (Sides) components of the stereo field.

TIME CONSTANT

These two 8 position rotary switches select from 8 preset time constants for each channel, which are used by the sidechain circuits to control the limiter's response. The first 6 presets are combinations of attack/release times that progress from fast/fast to slow/slow. The last two settings are program dependent (Auto mode), with multi-stage release times. A complete listing of the actual attack and release times for each preset are listed on the Specifications page below.

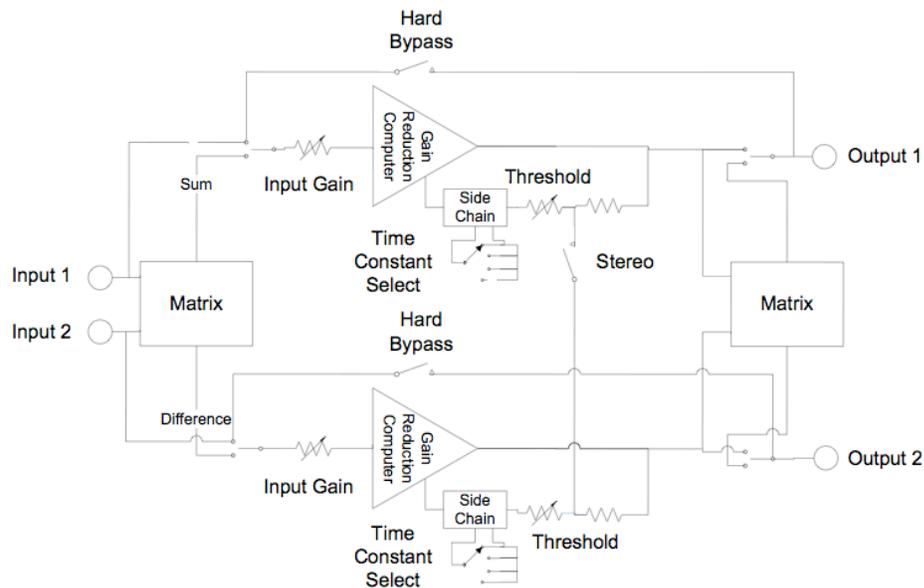
IN/BYPASS

These two switches allow the user to place the AM670 in the signal path or remove it entirely. When the pushbutton switch is latched in the IN position, the limiter is enabled and the meter dial is fully illuminated. In the OUT position, the audio output is connected directly to the audio input via a relay (hard bypass) and the meter dial is dimly illuminated.

ZERO

These two screwdriver-adjustable trim controls are used to set the meter to zero when it is indicating gain reduction. Small drift of the meter zero position as the unit warms up is normal. These controls are preset at the factory and will likely never need adjustment.

Block Diagram of the AM670



AM670 Signal Flow

The sidechain block consists of a full-wave rectifier and time constant circuitry. The Time Constant selection switch can choose 6 single slope attack and release time constants (see Specifications later in this manual), or two multi-slope time constants. Position 5 is a dual slope time constant while position 6 is a triple slope constant. Other functions include an input gain control and a hard bypass. As shown in the diagram (above), the input control has no effect when the unit is in bypass.

The Matrix encodes and decodes the Left/Right signals for Mid-Sides (M-S, or sum-difference) processing in the Lat/Vert Mode. In this mode the top channel controls the mid (sum) channel, and the the bottom channel controls the side (difference).

Using the AM670

It is important to first connect the XLR cables to the input and output XLR connectors on the rear panel of the AM670 before proceeding with the next steps. It is also important to provide a program signal to the input, to be monitoring the output, and to have the AM670 powered on for the next steps.

To process audio using the AM670, press the IN buttons so they are latched in. The meter faces will illuminate brightly indicating that the AM670 is actively processing audio. When the IN switches are released, the meters will appear dimly lit and the input signals will be connected to the output XLRs via a relay.

With the Input Gain controls set to the center (0 position) and the Threshold controls set to 0, the AM670 will be processing audio roughly at unity gain. By rotating the threshold controls clockwise, the AM670 may show that it is reducing the gain, as observed on the gain reduction meter, of the input signal if the input signal is sufficient. By adjusting both the Input Gain and Threshold controls, it is possible to set both the output level of the AM670 and the amount of desired limiting. It may take some practice to perform this operation quickly.

The AM670 limiter has many uses in recording and live sound applications. Some of the suggested uses include:

Vocal Compressor: The Fairchild 670 is usually the first choice for many professionals for limiting vocals. Time constant positions 2A and 2B provide an even more useful release time than position 2 for vocals.

Typical gain reduction experienced during the recording of vocals ranges from 3 dB to almost 10 dB. The AM670 will perform this limiting task very transparently.

Bass Limiter: Unfortunately, most bass guitars suffer from noticeable unevenness in their output level from string to string. This problem is typical and usually requires some sort of audio leveling. To use the AM670 with bass guitar, adjust the time constant to be anywhere between 1 and 2B. Position 3 may be too slow to catch the attack of the bass note, which may be desirable in some situations. The amount of gain reduction will be determined by the level of unevenness in the bass track.

Kick Drum Limiting: Some drummers don't control their kick drum level well. Use time constant 1 on the AM670 to limit the kick drum level. Set the gain reduction to only occur on the loud, problematic parts.

Drum Overhead Compressor: It has become popular to compress drum overhead mics to bring out the ambiance of the room sound. The AM670 can work well for this. Choose a time constant to suit the tempo of the drumming. Add an amount of gain reduction to taste.

Acoustic Guitar Compressor: Using the AM670 to compress acoustic guitar can really add "presence" to the track. Typically the vocal compression settings work well for transparent compression. For more extreme settings, try using the multi-slope time constants 5 or 6 with a fair amount of gain reduction or the faster time constants with a larger amount of gain reduction.

Piano Compressor: The effect of over-compressed piano is well known to anyone who has listened to piano on a Beatles recording. To obtain this sound, adjust the time constants to work for the tempo of the music and add a good amount of gain reduction. The multi-slope time constants 5 and 6 can also be useful in this application.

Buss Compression: The AM670 limiter tracks extremely well in stereo due to the high precision of the GRC. It may be used on the stereo buss of a mix with good results. Interesting time constants for leveling are the multi-slopes 5 and 6. Adjust the gain reduction for at least a few dB of limiting on the louder sections.

These are only suggestions. You should try all possible combinations to obtain your desired results.

Historical Information

The original Fairchild 660 mono compressor (the predecessor of the stereo 670) was designed by Estonian-born Rein Narma. As a refugee from Soviet Russia during the post war years, Rein worked for the U.S. army as a recording and broadcast engineer. He later joined Gotham Audio in New York as the head of their product development team.

During his tenure at Gotham he was sent to fix Les Paul's 8-track Ampex tape machine in New Jersey. He talked Les Paul into allowing him to build a mixing console and limiter for Les Paul's studio.

Apparently he did this with good results. Les Paul, being a friend of Sherman Fairchild, made the introduction of Rein Narma to Sherman Fairchild, who decided to license the limiter design from Narma. The rest is history.

AM670 Specifications

Circuit Type:	audio analog Gain Reduction Computer (GRC)
Input Sensitivity:	+4dBu
Input Impedance:	20k Ω , balanced
Output Type:	balanced, with level compensation for unbalanced operation
Output Impedance:	less than 50 ohms
Max. Output Level:	+21dBu into 600 Ω load
Freq. Response:	+/- 1 dB from 40 Hz to 15 kHz
Noise Level:	better than 73 dB below +4dBu, 0-30 kHz
Limiting Noises:	same level as a vintage 670 with GE five star 6386 tubes and properly balanced
Distortion:	level- and compression-dependent
Compression Ratio:	variable from 1:1 to 20:1, level dependent
Gain Control Modes:	Left/Right: Dual Mono (split) operation Stereo: Left and Right sidechains are linked Lat/Vert: Left and Right channels are Mid-Side (M-S) encoded, compressed separately and decoded back to Left/Right
Time Constants:	1-6 are the classic 670 time constants 2a and 2b are variations on #2

Position	Attack Time	Release Time
1	0.2ms	0.3s
2	0.2ms	0.8s
2a	0.2ms	1s
2b	0.2ms	2s
3	0.4ms	2s
4	0.8ms	5s
5	0.4ms	Auto, as in 670 #5
6	0.2ms	Auto, as in 670 #6

General

Power:	120V or 240Vac, 25W
Dimensions:	3U enclosure, 19" x 5.25" x 7.5" (48.2 x 13.3 x 19.1 cm)
Weight:	9.1 lbs (4.1kg)

Note: Standard operating level is +4dBu = 1.228v = 0VU.
Unless otherwise stated, all measurements are referenced to +4dBu, 0-80 kHz bandwidth.
All specifications are subject to change without notice.

Limited Warranty

AnaMod LLC warrants to the first purchaser of a new AnaMod AM670 that the unit is free of manufacturing defects in materials and workmanship for a period of one (1) year from the date of purchase. AnaMod LLC's sole obligation under this warranty shall be to provide, without charge, parts and labor necessary to remedy defects, if any, which appear within one (1) year from the date of purchase. All warranties expressed or implied made by AnaMod LLC, including warranties of merchantability and fitness, are limited to the period of this warranty. AnaMod LLC is not responsible for indirect, incidental or consequential damages arising from the use or failure of this product, including injury to persons or property.

This warranty does not cover damage due to: misuse, abuse, modification, accident or negligence. The warranty does not apply if the unit is repaired or altered by persons unauthorized by AnaMod LLC in such a manner as to injure, in AnaMod LLC's sole judgment, the performance, stability or reliability of the unit. The warranty does not apply if the unit is connected, installed or used otherwise than in accordance with the instructions furnished by AnaMod LLC,

If the equipment requires warranty repair, return authorization must be obtained from AnaMod LLC prior to shipment. Equipment should not be shipped to AnaMod LLC until return authorization and the proper shipping address is obtained from us. The equipment (with all its components parts and connecting cables) must be suitably packaged, and must also include a note with the owner's name, address, telephone number and a description of the reason for return. The owner pays two-way shipping (we recommend UPS), and we suggest that the shipment be insured for its full value.

This limited warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for us any liability in connection with the sale of our products than set forth herein. This limited warranty gives you specific legal rights, and you may also have other rights which vary from state to state.