The Orban 424A Gated Compressor/ Limiter/De-Esser

The Studio Optimod

Performance Highlights

- ☐ Intuitive and natural operation
- ☐ Adjustable attack time, release time, and compression ratio permit extremely natural processing or special effects
- ☐ Selectable linear (general purpose) or exponential (special purpose) release time characteristics
- ☐ Defeatable gate with adjustable threshold causes gain to move slowly toward user-adjustable value during pauses, preventing noise rush-up, pumping, or breathing
- ☐ Major controls interact to speed setup by keeping output levels relatively constant as controls are adjusted
- ☐ **Separate** compressor/limiter and de-esser control loops, each with optimized, program-controlled parameters
- ☐ Better than 25dB de-ess gain reduction available **in addition to** 25dB compressor/limiter gain reduction
- ☐ True peak-reading VCA LEVEL meter
- ☐ True peak-reading GAIN REDUCTION meter
- ☐ De-esser characteristics similar to highly-accepted Orban dedicated de-essers
- ☐ Low-distortion operation achieved using clean class-A VCA and distortion-cancelling control circuitry

Plus

- ☐ Rugged all-metal 19" rack mount package for ruggedness, roadworthiness, RFI shielding. Industrial-grade parts and construction
- ☐ Highly cost-effective; available in mono (model 422A) or stereo (model 424A)
- ☐ Multiple channels can be connected to track together
- ☐ Extensive RFI supression
- ☐ Balanced inputs and outputs, and 115/230V 50-60Hz power supply standard

THE 422A IS A SINGLE-CHANNEL VERSION OF THIS PRODUCT

The Model 422A/424A:

A multi-function Compressor/Limiter/De-Esser featuring exceptional versatility and ease of operation

Preface

We're about to say a lot about our 424A: we're proud of it. But no long essay can describe the bottom line—what it sounds like, and how it feels to use it. Comparisons of specifications and descriptions of new control techniques cannot describe the elusive and magical relationship between engineering and hearing.

This brochure should answer questions you might have about why the 424A is such a good-sounding and easy to use product. But when you get right down to it, the best way to appreciate its advanced design is to A/B it against your current favorite. Using it and listening to it are what really count!

The Orban 424A: It Had To Be Better, Or We Wouldn't Have Bothered

There are a lot of production limiters out there. Old favorites. Pretenders to the throne. The competition is fierce, and the market fragmented. So when Orban set out to design a significant new production limiter, we knew it had to be superior.

Fortunately, when we undertook the 424A R&D project, we had seven years of experience behind us. Enough to capture the Number One slot in the broadcast signal-processing market. Ask any FM broadcast engineer what the industry-standard limiter is, and he's likely to tell you it's our OPTIMOD-FM.

We've developed the technology—the **magic** which makes a compressor/limiter sound right, feel right, and operate quickly and intuitively. That's important in today's economic climate, where audio professionals demand fast, superlative results in recording studios, in broadcast production studios, and on the road doing demanding sound reinforcement work.

The result of our research and experience is the model 424A—a Gated Compressor/Limiter/De-esser with versatile features for production, and with a natural, transparent sound that has to be heard to be appreciated.

Our goal was to build a device which would produce the desired sound upon adjustment of a **minimum** number of controls. And, readjustment of one control should not require the corrective readjustment of others. We achieved this goal by making the ATTACK TIME, RELEASE TIME, and COMPRESSION RATIO controls interact with each other and with the threshold of limiting. For example, slower attack times permit more overshoots, so the threshold of limiting is automatically lowered to compensate. The result: you can concentrate on getting the **sound;** the mechanics largely take care of themselves.

The Un-Trendy Limiter

Most of the advertising buzzwords applied to AGC units are irrelevant to the essential listening qualities of these devices. Simultaneously, many of the truly important issues of AGC design (many of which are quite subtle and not easily reduced to buzzwords) seem to be unknown to, or ignored by, others.

The 424A is a very un-trendy device, in that it uses feedback control, an averaging detector, and a conventional "hard knee" static compression curve. Why?

For starters, because the type of detector (whether true-RMS, "linear-integration" averaging, or whatever) is essentially irrelevant, since far more variation results from simply changing the attack time than from changing the detector type. Similarly, the desirability of a consistent output as read on a VU meter is questionable, since VU meter readings have only the most casual correlation to psychoacoustical loudness.

Feedback control circuitry has been accused of hiding the vices of inferior VCA's while introducing instability and high amounts of distortion. Our VCA has nothing to hide, our loop is totally stable, and our measured THD is significantly better than most others on the market—feedback or feedforward. We use feedback because our ears tell us that, properly implemented, it creates a control loop dynamic response which simply **sounds better.**

The "soft knee" compression ratio characteristic promoted by others is a way of making a compressor sound innocuous by "sneaking up" upon high ratios over the course of many dB. Low ratios always sound more graceful than high ratios. In a "soft-knee" compressor, mostly low ratios are used. No wonder the sound of the compressor is improved! Alas, the price exacted is lost loudness and inconsistent level control. This may be fine for certain applications, but not if you're trying to persuade a wide dynamic range vocal to cut through a heavy instrumental backing, or if you're trying to make anything audible at all times.

What then, **does** make a good-sounding compressor/limiter? Primarily, the dynamic response of the control loop. In the 424A, attack and release times are always "automatic" (i.e., program-controlled); the ATTACK TIME and RELEASE TIME controls merely scale the processes faster or slower without giving up the advantages of the program control.

If a slower attack time is chosen, an automatic gain-riding (AGC) function is achieved. Faster attack times introduce more peak limiting. So, depending on attack time, the 424A can serve as a compressor, limiter, or both simultaneously.

What Makes The 424A So Special?

The Orban 424A has a real compression ratio control for those few times when you want to maintain some **real** dynamic range. However, you will probably be astonished at the "openness" and **apparent** dynamic range available even at the "infinite" ratio. You may be even more astonished when you discover the apparent loudness increase achieved without the usual side effects. Virtually any competent compressor can sound natural if it is quiet enough (i.e., if it doesn't actually work very hard). **The real magic is sounding loud and natural simultaneously, as the 424A does.**

After you've lived with a 424A for a while, we suspect that the dust will build up on the ratio control as you realize that, finally, here is a compressor which doesn't have to be cranked back to a 2:1 or 4:1 ratio (whether manually, by choice, or involuntarily, by means of a "soft knee") to sound good! For those of you who won't give up the "soft knee" no matter what, we've hedged our bets: you'll be pleased to know that at the lower settings of the 424A RATIO control, the ratio increases as more gain reduction is used.

There is also control over the **shape** of the release characteristic. Ordinarily, the release characteristic is "linear." (Recovery, in the absence of program material, proceeds at a constant number of dB per second.)

A switch-selectable "exponential" release shape is also provided for special applications. This forces the release to start slowly and to increase in speed as it proceeds.

While it sounds substantially less natural than "linear" on most program material, it can be useful when gain-riding wide-dynamic range single tracks (like vocalists) where the "open" sound of a slow release time is desired, yet quick gain-riding is necessary to make levels more consistent.

The IDLE GAIN control is a unique and unusually useful new feature. This control sets the gain of the compressor when it is in the "idle" mode. (When the compressor is manually defeated by operation of the DEFEAT switch, or, when it is gated by low-level audio or silence.)

In either case, the gain will move smoothly toward a value specified by the setting of the IDLE GAIN control—quickly after manual compressor defeat, and more slowly under gated conditions.

If the IDLE GAIN control is set close to the average gain reduction, then, upon resumption of ordinary compression, there will be minimum gain change in the VCA, and therefore minimum audible side effects will occur. The feature is extremely useful in preventing noise or tape hiss from being pumped up, and in facilitating smooth manual switching of the COMPRESSOR OPERATE/DEFEAT switch during program. Its effect is usually substantially smoother than that of a conventional noise gate.

The OUTPUT TRIM control can be used to force some peak clipping in the VCA in applications requiring tight control of peak levels (like the protection of a broadcast STL), thus controlling fast peaks without need for extremely fast attack times (which almost invariably cause more audible degradation than a modest amount of overshoot clipping). Conveniently, the peak-reading VCA LEVEL meter not only allows you to adjust the 424A to **clip if you want it to,** but also makes it easy to **avoid clipping entirely** if that is your goal.

About Distortion And VCA's

In any compressor/limiter, the static nonlinearities of the VCA are ordinarily totally overshadowed by the dynamic distortions caused by literally intermodulating the input signal by a rapidly varying control voltage. Sometimes such distortion is heard as additional unwanted spectral components, such as traditional harmonic and IM distortion. At other times, it is perceived as unnatural modulations of the signal peculiar to AGC devices such as "pumping," "hole-punching," "shivering," and a whole bunch more which no one has bothered to name, but which most musically-sensitive people can easily hear!

In the Orban 424A, nonlinear control voltage smoothing results in singularly favorable **dynamic** distortion properties. Our proprietary VCA complements this low dynamic distortion by slewing quickly, having "soft" low-order static distortion which is well below the threshold of audibility (due, in part, to class-A operation), and having noise performance which does not deteriorate as the amount of gain reduction increases.

The Final Coup: A Full-Function De-Esser

Finally, our de-esser. The VCA used in the 424A has **two** gain-control inputs. This means that we can add a **no-compromise** de-ess function which is essentially **independent** of the compressor/limiter. As we have proven in our dedicated de-essers, the optimum attack times and release times are quite different for the compressor/limiter and de-esser functions. In the 424A, each function is independently optimized.

The de-esser section of the 424A sounds about the same as our popular dedicated de-essers. It controls sibilance levels by quick broadband gain reduction when excessive "ess" energy is detected. In this way, any low-frequency IM distortion is reduced along with the "ess," and coloration of the "ess" sounds does not occur. One extra benefit of the de-esser section of the 424A is that it can effectively de-ess sibilant vocals which have already been **mixed** with other program, and, in this application, effectively acts more like a high-frequency limiter.

The only essential difference between the 424A de-esser and the Orban dedicated de-essers is that the 424A lacks the dedicated de-essers' ability to provide constant de-essing regardless of input level. In the 424A, this does not create a problem since it was assumed that the input to the de-esser section would be compressed by the 424A's compressor/limiter and would therefore be at a constant level. LED's indicating NORMAL/HEAVY de-essing allow the SENSITIVITY control of the de-esser to be readily adjusted.

Mono, Stereo, Or Dual-Channel

A STEREO COUPLING switch allows you to operate the two channels of the 424A independently or in stereo. In stereo, the channels will typically track within ±0.5dB. Rear-panel coupling terminals allow tracking an unlimited number of channels together.

Applications

The 424A can be applied anywhere that current compressors, limiters, and/or de-essers are used, since its versatility does not limit it to a single "sound," but instead lets it operate as a smooth, gentle compressor, a peak limiter, a de-esser, or any combination of these — all with a singular absence of undesirable artifacts.

This means that the unit can be used in recording studios, in broadcast production studios, ahead of broadcast studio-transmitter links, in sound reinforcement, and in video production and sweetening. It is an ideal all-in-one vocal processor, combining the necessary AGC and de-esser functions. It also shines when smoothly handling **mixed** program material — making it excellent for preparing cassette duplicating masters, or protecting tape recorders and cart machines from overload in tight time-pressure situations in broadcast and recording. Simultaneously, its versatile, wide-range setup controls make it a natural for processing single instrumental or vocal tracks in studios. Exploitation of the VCA clipping feature can result in substantially more natural peak limiting than most simple "limiters" can provide, resulting in improved performance when protecting broadcast STL's or power amplifiers in sound reinforcement systems.

Summary

The 424A "Studio Optimod" is the answer to many engineers' dreams. It combines a compressor, limiter, and de-esser in a most versatile way. Because its controls interact in a carefully human-engineered manner, it is easy and graceful to operate. Yet full flexibility is there to get the sound just right.

The professional audio and broadcast world has lived happily with "old favorite" limiter/compressors for a long time. If you examine the features, sound, performance, and price of our new "Studio Optimod" Model 422A/424A, we think you will agree that it is the new standard in dynamic range control. But we don't expect you to take our word for it. The proof is in the **listening.** We feel confident that once you A/B our unit against any of your current favorites, you will find a place for it in your rack. It's that good. A truly superior device, at the right price, at the right time.

Rest assured that with your new 422A/424A, you will continue to receive all the other things that you've come to expect from Orban products over the years — quality construction, comprehensive operating and service manuals, and unequalled customer service.

SPECIFICATIONS

INPUT
Impedance: greater than 10 k ohms active balanced; RF suppressed
LEVEL: −15dBm produces 10dB gain reduction with ATTACK TIME control centered, INPUT ATTEN control fully CW, and RATIO control at infinity-to-one

OUTPUT
Impedance: approximately 100 ohms, electronically balanced to ground; RF suppressed
Level: +4dBm nominal; absolute peak overload occurs at +26dBm

FREQUENCY RESPONSE
±0.25dB 20-20,000 Hz below limiting and de-esser thresholds

COMPRESSOR/LIMITER SECTION
Attack Time: manually adjustable in approximate range of 500us to 200ms; automatically scaled by program content
Release Time: adjustable in approximate range of 0.8dB/sec to 20dB/sec; automatically scaled by program content. Switch-selectable LINEAR and EXPONENTIAL release shapes.
Compression Ratio: adjustable from 2:1 to infinity-to-one at threshold. Lower ratios automatically increase beyond threshold.
Range Of Gain Reduction: 25dB
Tracking Of Multiple Channels: ±0.5dB
Total Harmonic Distortion (ATTACK and RELEASE TIME controls centered; infinite RATIO; 15dB gain reduction): less than 0.03% @1kHz. Typically 0.11% @20Hz; 0.02% @100Hz; 0.01% @1kHz; 0.04% @10kHz.
SMPTE IM Distortion (controls set as above; 60/7000Hz 4:1; 15dB gain reduction): typically 0.05%

DE-ESSER SECTION
Attack Time: approximately 1 ms
Release Time: approximately 30 ms
Harmonic Distortion: less than 0.05% THD introduced by de-essing action @10kHz
Available Gain Reduction: greater than 25dB

SYSTEM NOISE
RMS noise in 20-20kHz bandwidth better than 85dB below output clipping threshold for any degree of gain reduction; 90dB typical.

OPERATING CONTROLS
Compressor/Limiter
INPUT ATTENUATOR
COMPRESSION RATIO
ATTACK TIME
RELEASE TIME
RELEASE SHAPE
GATE THRESHOLD
OUTPUT TRIM
IDLE GAIN
COMPRESSOR/LIMITER OPERATE/DEFEAT
OUTPUT LEVEL (REAR PANEL)
De-Esser
THRESHOLD
DE-ESSER OPERATE/DEFEAT
General
STEREO COUPLING (424A only)
POWER ON/OFF

INDICATORS
Compressor/Limiter
GAIN REDUCTION METER
GATED LED
VCA LEVEL METER
De-Esser
NORMAL De-essing LED
HEAVY De-essing LED

Power Requirement
115/230 VAC ±10%; 50-60Hz. U-ground power cord attached; RF suppressed

Dimensions
19" (48.3cm) wide x 3.5" (8.9cm/2 units) high x 10" (25.4cm) deep

Operating Temperature
0-45 degrees C

Warranty
One year, parts and labor. Subject to limitations set forth in our Standard Warranty Agreement.

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Orban 424A

Hugh Ford

MANUFACTURER'S SPECIFICATION

Input
Impedance: >10 kΩ active balanced, RF suppressed.
Level: —15 dBm produces 10 dB gain reduction with ATTACK TIME control centered, INPUT ATTEN control fully CW, and RATIO control at ∞ :1.

Output
Impedance: approximately 100 Ω, electronically balanced to ground, RF suppressed.
Level: +4 dBm nominal, absolute peak overload occurs at +26 dBm.

Frequency response: ±0.25 dB 20 Hz to 20 kHz below limiting and de-esser thresholds.

Compressor limiter section
Attack time: manually adjustable in approximate range of 500 μs to 200 ms, automatically scaled by programme content.
Release time: adjustable in approximate range of 0.8 dB/s to 20 dB/s, automatically scaled by programme content; switch-selectable LINEAR and EXPONENTIAL release shapes.
Compression ratio: adjustable from 2:1 to ∞ :1 at threshold; lower ratios automatically increase beyond threshold.
Range of gain reduction: 25 dB.
Tracking of multiple channels: ±0.5 dB.
Total harmonic distortion: (attack and release time controls centered, infinite RATIO, 15 dB gain reduction): less than 0.03% at 1 kHz; typically 0.11% at 20 Hz, 0.02% at 100 Hz, 0.01% at 1 kHz, 0.04% at 10 kHz.
SMPTE IM distortion (controls set as above 60/7000 Hz 4:1, 15 dB gain reduction): typically 0.05%.

De-esser section
Attack time: approximately 1 ms.
Release time: approximately 30 ms.
Harmonic distortion: less than 0.05% total harmonic distortion introduced by de-essing action at 10 kHz.
Available gain reduction: greater than 25 dB.

System noise
RMS noise: 20 Hz to 20 kHz bandwidth better than 85 dB below output clipping threshold for any degree of gain reduction, 90 dB typical.

General
Power requirements: 115/230 VAC ±10%, 50 to 60 Hz; U-ground power cord attached, RF suppressed.
Dimensions (whd): 19 × 3.5 × 10 in (483 × 89 × 254 mm).
Operating temperature: 0-45°C.

Manufacturer: Orban Associates Inc, 645 Bryant Street, San Francisco, CA 94107, USA.
UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA.

THE Orban *424A* is the twin-channel version of the Orban *422A* gated compressor/limiter/de-esser. Other than the facility for stereo linking the two units have identical channels. There are two distinct sections of the unit, the compressor/limiter section and the de-esser section. The latter has two controls for each channel, a self illuminating in/out switch and a potentiometer controlling the sensitivity and labelled 'less' or 'more' de-essing. This is associated with red and yellow LEDs for each channel which are illuminated for heavy or normal de-essing respectively.

In the stereo unit the channel controls are in vertical array with two illuminated horizontal meters to the left of the panel indicating the current gain reduction with 5 dB calibration points up to 25 dB gain reduction. There follows the input level and the compression ratio potentiometers calibrated from 2:1 to ∞ :1. Potentiometers form the conventional attack and release time controls, however an unconventional feature is that the shape of the release envelope may be switched to linear or the conventional exponential shape. Using these controls the operation of the compressor/limiter is quite conventional with a fixed threshold, there being no need to use the more 'clever' features that follow.

The next feature is the 'gate' function which bears no relation to a conventional noise gate. In normal compressor/limiters the release time can cause noise breathing at the unit's gain increases when the release time is relatively fast. The gate function in the Orban *424A* is intended to overcome this problem.

As the gain increases on release, the Orban first follows the release envelope set with the release time control and the release envelope switch, however with the gate function in circuit the gain increase envelope switches to a fixed long release time as a preset threshold is reached. This long time constant removes noise breathing effects.

A single potentiometer for each channel sets the gate threshold over a wide range with an adjacent green LED being illuminated as the gate function passes the preset threshold.

To the right of the gate function two further illuminated meters show the VCA level on VU meter type scales, the VCA level being the output level from the VCAs which is fed to the line outputs via the rear panel gain controls. The level trim potentiometers on the front panel having a ±10 dB nominal range and feeding the VCA control inputs.

Next there is a potentiometer for each channel identified as 'idle gain'. This performs two functions. Firstly with the compressor/limiter switched out of circuit the idle gain control sets the unit's gain by introducing a fixed amount of

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and thus the level as shown in **Fig 3** which was plotted at maximum de-essing. Changing the de-esser's sensitivity purely shifted the level at which these characteristics occurred.

Noise

Noise in the output remained constant with all control settings except the gain trim control which had a relatively minor effect. **Table 1** shows the noise in the outputs, both of which were identical, referred to the output clipping level versus gain reduction.

This very good performance was completely free from power line hum components or other unwanted effects.

Distortion

In the straight through mode with the compressor/limiter and the de-esser switched out second and third harmonic distortion was less than 0.01% from 20 Hz to 20 kHz at 0 dBm, in and out. Increasing the levels to +10 dBm only produced a mild increase in the third harmonic at high frequencies, reaching 0.03% at 20 kHz.

With the compressor in action the harmonic distortion varied little with compression ratio or the degree of compression, typical results being shown in **Fig 4** for the mid setting of the attack and release time controls. This excellent performance was also reflected in the CCIF twin tone intermodulation distortion performance a typical example of which is shown in **Fig 5**.

Attack and release

The attack time control had a wide range allowing the attack time for effective complete compression to be varied from 500 μs to 800 ms with a mid point setting of 2 ms. Similarly the normal release time could be varied from 200 ms to 9 s with a mid point of 2 s. The shape of the release envelope remained constant with the degree of compression being exponential or linear depending upon the setting of the shape switch. The effect of this is shown in **Fig 6**.

When using the gate function the release from the gated condition was slow as shown in **Fig 7** and remained exponential irrespective of the setting of the shape switch.

The compression characteristics are shown in **Fig 8** for ∞:1, 4:1 and 2:1 where the measured ratios are slightly above those specified. These characteristics held irrespective of other control settings including the shape switch.

Other matters

Crosstalk between the channels was negligible at less than −100 dB below 6 kHz. Tracking of the channels was within 0.5 dB under static conditions over the full available 25 dB of gain reduction.

The gain reduction meters were sensibly accurate with their time constants depending upon the attack and release time settings etc. Similarly the VCA output meters were accurate with 0 dB indication corresponding to a maximum output of +16 dBm depending upon the setting of the rear panel gain controls.

Summary

In addition to the measured performance being very good the subjective impressions of the unit were excellent.

This product has many novel and highly practical features all of which are quite simple to use but need not be used if simplified operation is required.

Overall a very good compressor/limiter, well made and easy to service. ■

TABLE 1

Measurement method	Gain reduction 0 dB	10 dB	20 dB
22 Hz to 22 kHz RMS	−86.0 dB	−88.5 dB	−88.5 dB
A-weighted RMS	−89.5 dB	−92.0 dB	−92.5 dB
CCIR-weighted RMS	−81.5 dB	−83.0 dB	−84.0 dB
CCIR-weighted quasi peak	−77.0 dB	−79.0 dB	−80.5 dB
CCIR/ARM ref 2 kHz	−88.0 dB	−90.0 dB	−91.0 dB

FIG 5 ORBAN 424A IM DISTORTION WITH MID ATTACK AND RELEASE SETTINGS

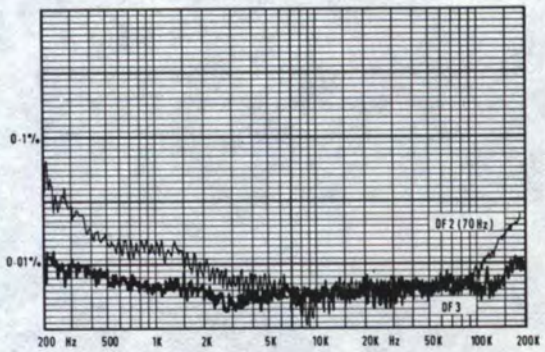


FIG 6 ORBAN 424A RELEASE FROM 10dB COMPRESSION

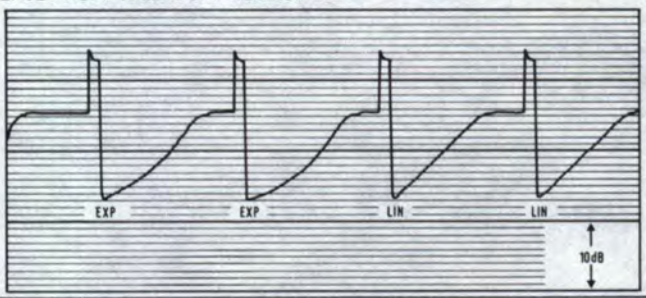


FIG 7 ORBAN 424A RELEASE FROM GATED CONDITION

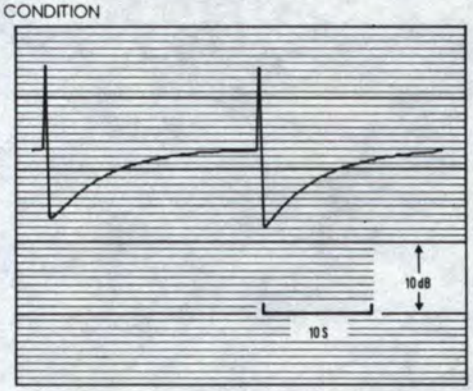
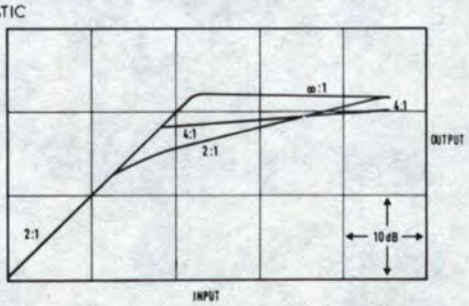
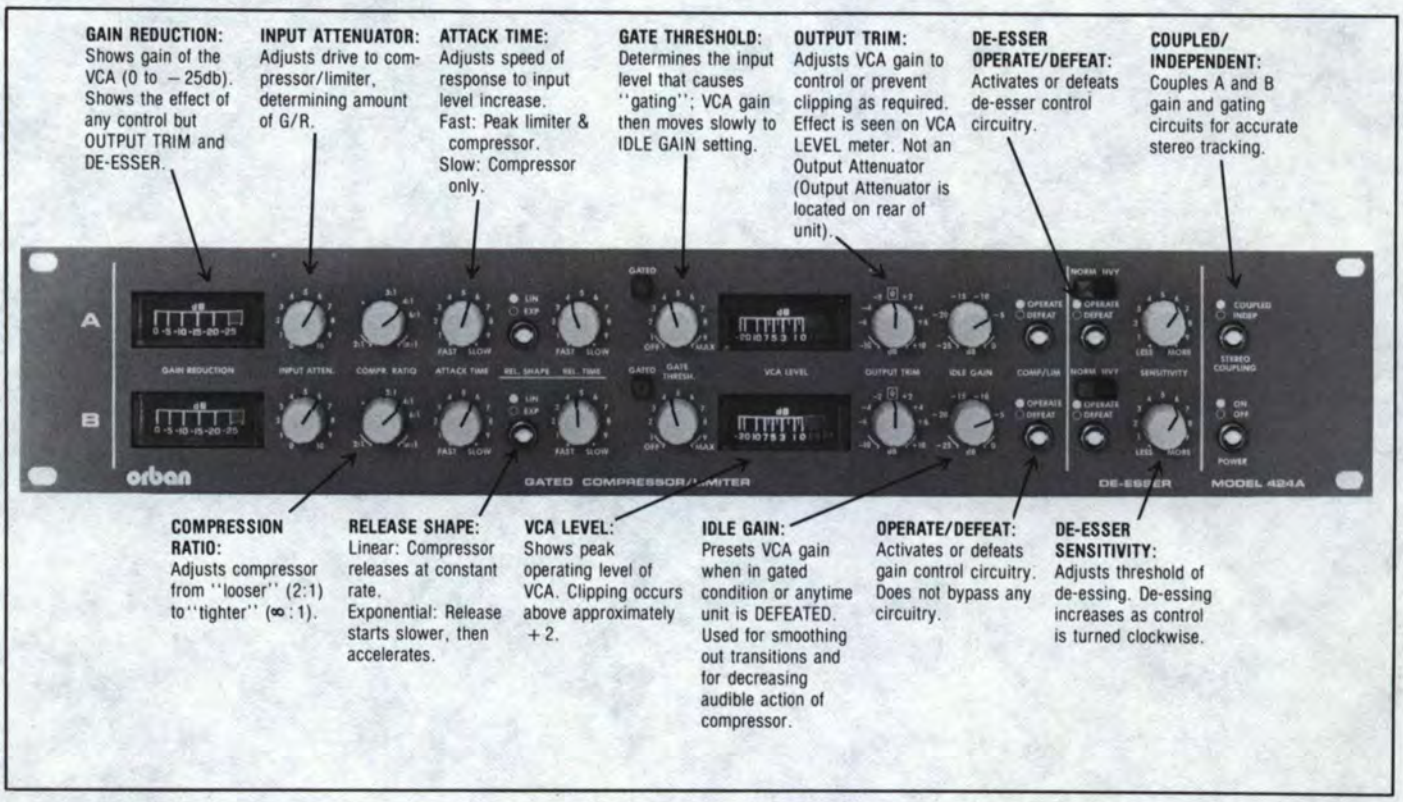


FIG 8 ORBAN 424A COMPRESSION CHARACTERISTIC



JOHN MONFORTE

The Orban 422A/424A Gated Compressor/Limiter/ De-Esser



THE ORBAN 422A/424A is an all-purpose level-control device, intended for recording, mastering and broadcast applications. Our test sample was the 424A two-channel version, which includes a control-signal voltage coupling switch for stereo tracking of the channels. As its name indicates, Orban has designed the unit to be a multi-function gain-control processor, capable of controlling any signal with a minimum of audible side-effects.

For the most part they have succeeded, and, as far as I can tell, this unit allows the user to control more side-chain parameters than any other unit available. This flexibility, however, comes at a price. In order to achieve this high degree of versatility, the user must attend to a lot of knobs, some of which are interactive, and time must be spent to fine-tune for the desired sound.

After some practice and experimentation, it is possible to achieve almost any amount of limiting with virtually no residual pumping or breathing for almost any input signal. Conversely, in the hands of someone who doesn't understand the principles behind deriving a good control-loop signal, it is very easy to make strange sounds that are very offensive to the ear.

John Monforte is on the faculty of the University of Miami's Music Engineering Program.

THE REAR PANEL

The 424A comes in a 19-inch rack mountable chassis that uses 3½ inches of rack space. It can be powered by 115- or 230-volt mains and the voltage is easily selected by a recessed rear-panel switch. The inputs and outputs are accessible on rear-panel terminal strips, as is common with all Orban devices. Distinction is made here between chassis ground and signal ground, so the 424A can be installed obeying the grounding requirements of the user's system. The input is a direct-coupled differential amplifier with an input impedance of 20 kohms.

Because of its differential nature, the input level control is located after the amplifier. This leaves a possibility that with a large input signal (over 15 volts peak), the input amplifier could overload, causing unintended dynamic range reduction. If for some reason the signal feed comes from a point after a power amplifier (such as in a musical instrument or a distributed sound system), an input attenuator must be used to avoid this distortion.

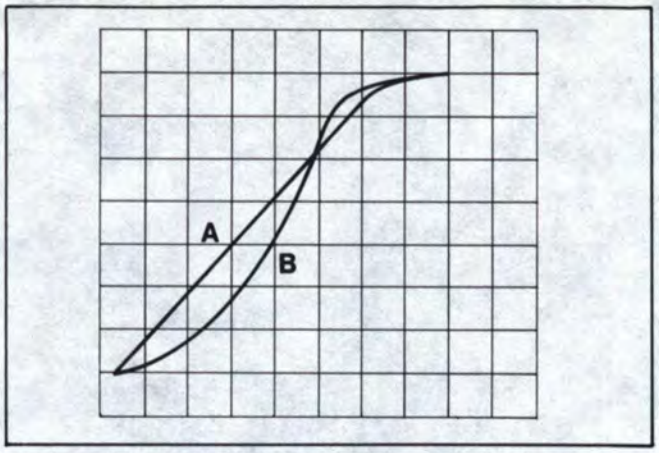


Figure 1. A plot of linear (A) and exponential (B) release settings.

The output is also both active and differential, with a source impedance of about 100 ohms, capable of driving a 600-ohm load to over 24 dBm without changing the frequency response with a change in termination. It is also possible to use one side of the output for a single-ended system, with a corresponding loss of headroom. The output is also capable of surviving a short circuit either to ground or to the other leg of the line.

For those who wish to equip their unit with XLR-type connectors, Orban has thoughtfully provided pre-punched holes behind a small rear-panel access cover that allows the user to install his own connectors on the chassis.

Also appearing on the rear-panel terminal strips are the

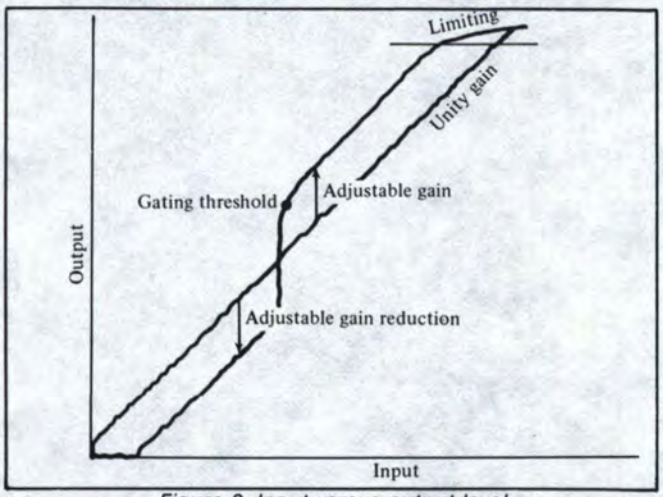


Figure 2. Input versus output level.

gating and gain-reduction signals. These can be used to couple other 422A or 424A systems, or—with a little ingenuity and some buffer circuits—a remote gain reduction meter could be rigged for broadcasters requiring this information at the transmitter site. Output level controls are also found on the rear panel. At first glance it may seem strange to find this control here—where it is out-of-reach for routine on-session use. On other limiters it is usually necessary to adjust the output level to make up the differences caused by the limiting action. Orban, however, uses the VCA gain trim on the front panel to perform this function. This optimizes the signal level at the VCA, which is inherently the device with the least dynamic range capability. This in turn optimizes the gain structure of the limiter for the best noise and distortion charactertistics.

THE FRONT PANEL

The front panel is the familiar powder-blue color common to all Orban products, with white silk-screened lettering that—if past experience with Orban devices is any indication—is very durable. White collet knobs are used throughout, and each is clearly marked with a black line that extends to the front of the knob, so it is very easy to see the settings at a distance. Winkeye pushbuttons are used to clearly indicate the status of a switch, without using indicator lamps. In fact, the only lamps used are on the meters. Orban states that these lamps are operated well below rated conditions, insuring a long life span. This is particularly beneficial, since replacing a lamp is a fairly complicated task, requiring extensive disassembly.

The front panel layout is quite logical, and tends to follow the signal flow from left-to-right. On the extreme left is the gain-reduction meter, which displays the control voltage used by the VCA. Next is the input attenuator that, besides controlling the level to the VCA, adjusts the level to the level-sensing circuitry that develops the control voltage. This means that, by default, the knob also controls the limiting threshold. This is followed by a compression ratio control that smoothly adjusts between 2:1 and infinity. Two more knobs adjust the attack and release times, with a switch added to choose between linear and exponential release rates, as shown in FIGURE 1.

CONTROLS

The right half of the front panel contains the controls that make the 424A unique and versatile. First is the gate threshold control. This is not a noise gate as normally encountered in studio effects racks. This control prevents the limiter from raising the residual noise of a quiet channel to 0 VU while trying to gain-ride the signal. The threshold level is adjusted such that the gating indicator LED comes on in the absence of signal. The attack and release of this gate is not controllable. The recovering time is set by the release time control, and may not be the rate desired by the user for this function. Careful adjustment is necessary to avoid pumping.

Since this action of the gate is affected by input level, release time and VCA idle gain, I found it preferable to set this control last. Until then, it is easily defeated by setting the knob fully counterclockwise. Next to this control is the peak-reading VCA level meter, which will indicate how much headroom is left in the VCA. It is paired with an output trim control which sets the VCA signal level without disturbing the gain reduction parameters selected by the other controls.

This is followed by an idle gain control which determines the VCA gain when the limiter is defeated or gated. This allows for a smooth transition when the unit is activated and deactivated. Next to this is the defeat switch that deactivates the control voltage signal to the VCA. Because of the idle gain requirements, this switch does not bypass any circuitry.

The last section is a de-esser that operates independently of the compressor/limiter section. It is activated by a switch and adjusted with a sensitivity control. Unlike Orban's dedicated de-essers, the amount of de-essing is dependent on the absolute signal level. To ameliorate this problem, the de-esser is located after the compressor/limiter functions. Orban recommends using this on vocals that have already been mixed into the program. The de-esser tends to be very tricky to use, and it may leave audible discontinuities in the program level, with attack and decay times that are unrelated to the limiter settings. It is conceivable tha its use would be beneficial on certain types of program material, and I will be the first to admit that my tests with program material may not have included a selection broad enough to include examples that demonstrate the effectiveness of the device.

A very complete manual is included. Along with the standard installation and operation instructions, a thorough maintenance section describes disassembly procedures, gives trouble-shooting tips, and explains the procedures necessary to calibrate the unit and verify its specifications. Included with the schematic is a complete parts list, giving Orban part numbers as well as suggesting alternate sources. The documentation carefully notes which components are selected and which will require system realignment when replaced.

In addition to all this, Orban unabashedly explains the circuitry used, giving detailed description of the concepts included and the techniques used to realize them. The more proprietary elements are epoxy-encapsulated modules that are treated as components. These include the timing module used for the attack and release functions, and the de-esser module which generates the control voltage required for that function. All things considered, it is rare to find documentation so complete. One can only suspect that a carefully written manual is a consequence of an equally meticulous design effort.

DESIGN CONSIDERATIONS

Anyone who uses limiters, and I assume all readers of **db** are included in this group, can appreciate the difficulty of designing such a device. Obviously, it is necessary to design a signal path that is low in noise and distortion, while allowing some sort of gain control—perhaps 20 to 30 dB. Orban has done this using operational transconductance amplifiers in a very clever two-quadrant multiplier/divider arrangement. That, however, is the trivial part. A limiter also includes a side chain, or level-sensing circuit, that takes the signal and attempts to map out its envelope. If such a circuit is designed to follow the brisk transient wavefronts of percussion instruments, it will also tend to follow individual cycles of a low-frequency instrument such as a bass guitar. The limiting in the latter application actually alters the waveshape, causing distortion. A circuit that tries to ride gain on the crescendos and decrescendos of program material will tend to make an inhaling vocalist sound like a hurricane. If designed to follow the sharp asymmetrical leading edge of a piano note, it will also add tremolo to a legato stringed instrument. In answer to these varying requirements, Orban has made as many parameters as possible available to the user, to customize the limiter to the signal at hand. Of course, as I have mentioned before, this means that it takes much more than a patch cord to get good results. To me, this flexibility is welcome, and, in my opinion, Orban could also have added a variable threshold control for the limiting function and adjustable attack and release times for the gating circuits. I imagine such an idea may have been considered, but a device bristling with knobs that each require careful attention will tend to consume expensive studio time.

Another difficult design aspect of a limiter is the need to predict the signal's crossing of the limiting threshold in time to adjust the VCA gain to insure the output does not exceed the selected level. This seemingly impossible task has been accomplished by Orban in a very elegant fashion. The level-sensing circuit predicts the future of a signal by examining its recent past history, and subsequently tweaks the attack and release time settings to anticipate the oncoming burst and its duration. For this reason, the attack and release controls are not calibrated in units of time. Instead, a 1-to-10 scale reflects the fact that some control has been left to internal circuitry.

By now, I imagine that there is a certain percentage of readers out there who are saying, "I don't care if the front panel is international orange with lavender knobs and lithium-incapsulated setscrews. What does the damned thing sound like?"

For this part of the review, I use my most elaborate piece of test gear. Our university recording studio has about forty first engineers, and almost as many second engineers. I only need to tell them that under no circumstances must they use this device, and by 8:00 am the next day I'll have enough comments to complete this report.

THE VERDICT

First up was some mixed program material. With or without wide dynamic contrasts, selection of satisfactory settings for a variety of sounds was easy, and they depended a great deal on the characteristics of the lead instrument. Individual tracks were more difficult. A floor tom needed careful selections for release time and gate threshold. If these were wrong, it would seem to ring excessively. Piano, bass guitar, brass, synthesizer, and organ were all effectively controlled with substantially different settings on all controls. High-hat seemed to cause the de-esser some difficulty. When the sensitivity contol was turned down enough to prevent a fluttering sound, it was almost completely dormant. Surprisingly enough, vocals were not that well tamed by the de-esser. It seems the action was much more exaggerated at high levels, leaving a choppy, modulated sound to the signal. However, Orban is careful to note that this is not the same circuit used in their highly acclaimed dedicated de-essers, and the user needs to listen critically. Nevertheless, the addition of the de-esser option adds no complexity to the main signal path when defeated, and is conceivably useful on some material.

FIGURE 2 is a plot of input versus output level, using the swept amplitude mode on an Amber 4400a Test Set. At very low levels, the gating function reduced the level while keeping the below-threshold compression ratio at 1:1. System gain was increased for input signals above threshold level while maintaining the 1:1 compression ratio. Beyond the limiting threshold, the output level increases very slowly.

Overall, the Orban 422A/424A should prove to be a system of diverse capabilities, able to tackle the widest variety of material—once the user masters its operation. In addition, its solid construction and excellent service documentation should insure years of reliable operation. Such qualities are typical of timeless designs that tend to retain their value long after the accountants have depreciated them away.

Now that I've gotten the attention of your accountant, I should mention the price. It's $989.00. ■