

Figure 10

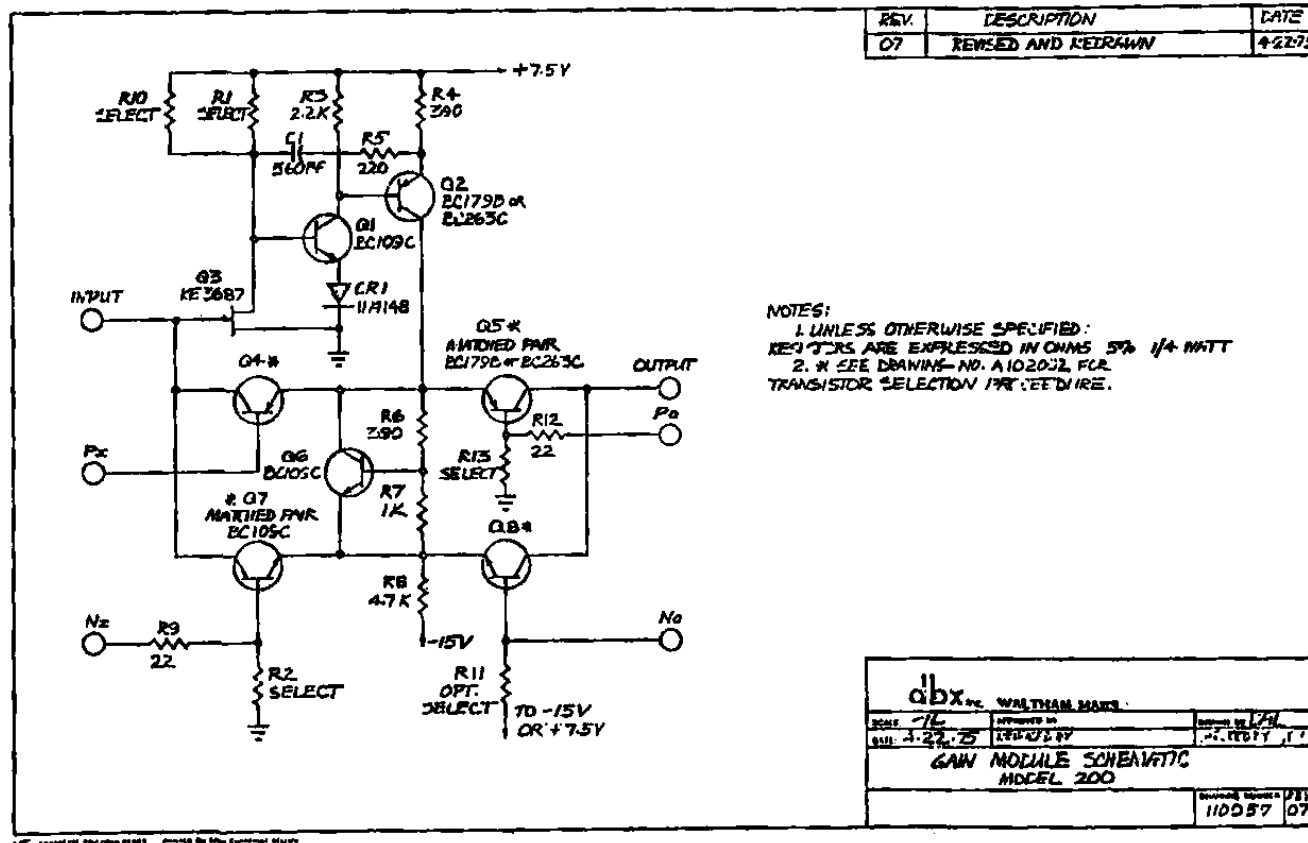


Figure 11

ALLEN, SCOTT [unclear], [unclear]

Re: 202X vs. 202C

The 202X and 202C VCAs are similar in performance and identical in pin configuration. The main differences between the 202X and 202C are in the input and output impedances used (the 202X uses much lower impedances). Further, there is an internal input impedance in the 202X of 1.25k Ω , so the input and output resistors must be skewed by 1.25k to keep the voltage gain 0dB with 0V at the control port (When $E_c=0V$, the current gain is 0dB).

Another difference is in the control-port impedances. If the VCAs are controlled by means of an opamp tied directly to the control port, this will not matter. However, if a resistor is inserted in series with the control port to scale the control voltages, it will need to be changed.

A minor change is in the resistor feeding the symmetry pin (200k in the 202X, and 1M in the 202C). Finally, the 202X consumes more power than the 202C (30mA vs about 5 mA), and it may run warmer as a result.

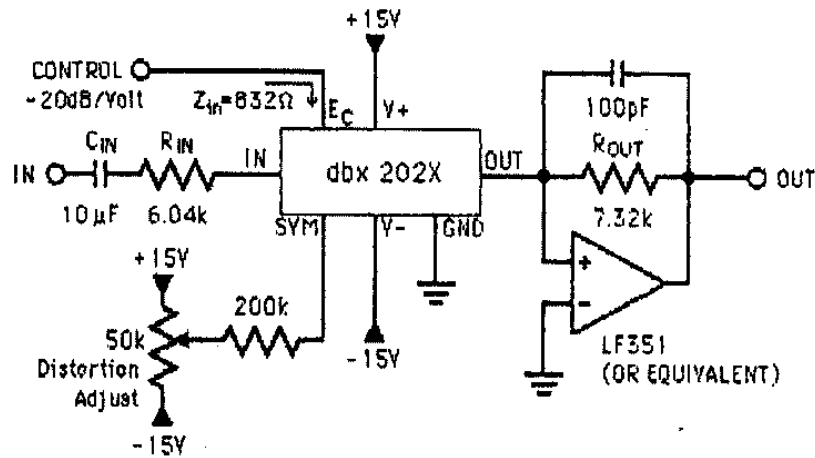
On the following page, you will find typical circuits for the two VCAs.

Regarding the proposed 202XL, the circuit diagram for the 202X will continue to apply. The only difference will be in dc offset at large attenuation factors. When the 202X is turned off to beyond -100dB, there is the possibility of a dc offset of several millivolts. This will not be the case for the 202XL. The new VCA should shut off to -120dB without any difficulty (although there may be more than -120dB of leakage on the PC board itself). [Note that the 202C was originally specified to attenuate down to -100dB.]

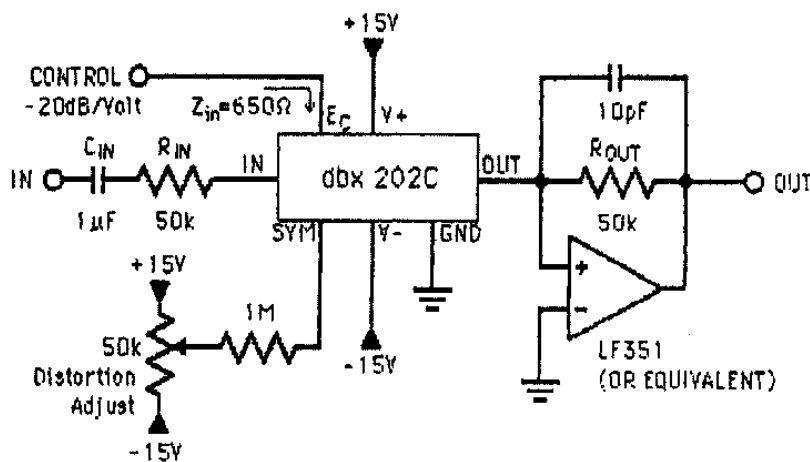
If you have more questions that are not answered here, please fax again.

Regards,
Bill Allen

Typical Circuit Diagram for the dbx 202X VCA



Typical Circuit Diagram for the dbx 202C VCA



2001 VOLTAGE CONTROLLED AMPLIFIER DATA

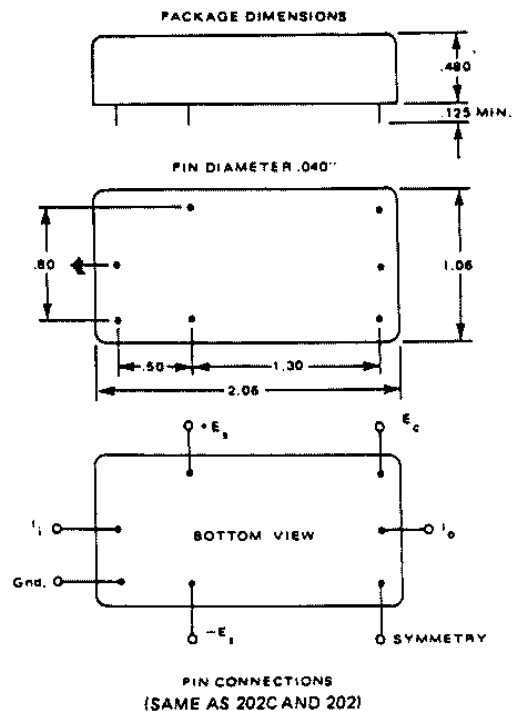
The latest in dbx high technology has resulted in the creation of a low distortion, low noise, high bandwidth voltage controlled amplifier. The 2001 approaches immeasurably low inter-modulation and total harmonic distortion independent of gain, input or output levels. The all-discrete design boasts a minimum gain-bandwidth product of 50 MHz, resulting in full audio bandwidth at 60 dB of gain with complete freedom from slew rate related problems.

The gain versus control voltage characteristics of the dbx Model 2001 are an exponential function (20 dB/volt) allowing the user to easily and accurately program the gain directly in dB.

The dbx Model 2001 is a current in, current out device. By choosing appropriate input and output resistors, the VCA can be optimized to fit the needs of the user. Like all dbx VCAs it is a complete unit requiring a minimum amount of external components.

SPECIFICATIONS

Power Supply	Bipolar 12V to 27V
Gain control range	-100 to +60 dB
Gain control constant	-20 dB/V
T. H. D. at any gain any input or output level	<100 ppm, typically <30 ppm
IM Distortion at any gain	<100 ppm
Output noise, unity gain Rin = Rout = 13K	-87 dBV (ref 1V RMS, 20 kHz Bandwidth)
Frequency response	± 0.02 dB dc to 50 kHz, unity gain +0, -1 dB dc to 20 kHz, +60 dB gain
Tracking accuracy	$\pm 1\%$
Control voltage feedthrough	<10mV, typically <5mV from -100 to +30 dB gain, <20mV to +60 dB of gain





202-C VOLTAGE CONTROLLED AMPLIFIER DATA

This newly designed Voltage Controlled Amplifier offers a significant improvement over currently available models. The 202-C offers lower distortion at the same current and noise levels, thereby increasing the usable dynamic range.

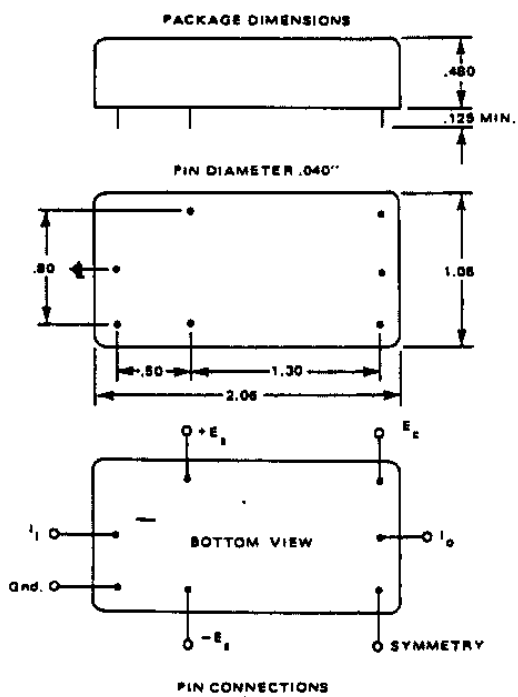
The error correction circuitry built into the 202-C is designed specifically to reduce distortion at higher currents. This is approximately a five times reduction in IM distortion referenced to a standard dbx 202. This is at high signal levels and ± 20 dB of gain.

The improvement in large signal handling capability allows a reduction of input network impedance with no increase in distortion. This can reduce the input noise to even lower levels.

The dbx 202-C Voltage Controlled Amplifier can be utilized in voltage controlled automated consoles, filters, gates, oscillators, test instrumentation, and any other signal modifiers where voltage controlled amplification is desirable.

SPECIFICATIONS

Power Supply	Bipolar $15V \pm 5\%$
Gain range	-100 to +40 dB
Gain control constant	-50mV/dB
Gain at $E_c=0V$	0 dB ± 1 dB
Gain control input R	$650\Omega \pm 5\%$
Distortion at 1 kHz (-20 to +20 dB gain)	
I in + I _o = 10 μ A	.01% typ
I in + I _o = 100 μ A	.03% typ
IM Distortion (60 Hz/7 kHz @ 4:1)	
+ 20 dB gain	.1% typ .15% max
0 dB gain	.05% typ .1% max
Input/Output Noise Current	3×10^{-10} A RMS
Frequency Response	± 0.1 dB Unity Gain to 20 kHz
	± 0.3 dB ± 20 dB Gain to 20 kHz
Tracking accuracy	$\pm 1\%$



Manufactured under one or more of the following U.S. patents: 3,881,818; 3,714,482; 3,798,143; 4,101,849; 4,097,767. Other patents pending.
 4812.5M-800125 Printed in USA

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202 VOLTAGE CONTROLLED AMPLIFIER DATA

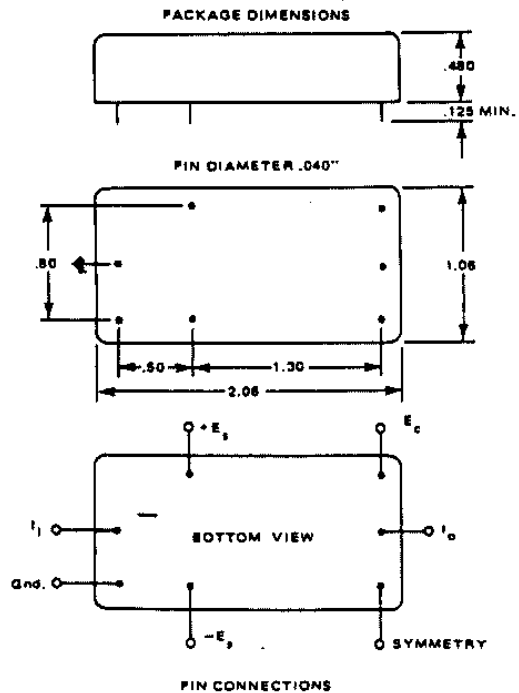
The dbx Voltage Controlled Amplifier offers exceptionally low noise, extreme gain range, low distortion, and high overload capability.

The 202 controls the ratio of current between the input and output ports. The input port is a summing junction (virtual ground). The input current may be set to any desired value for a given input voltage by choosing an appropriate input resistor. The output is a current which must feed a summing junction. Current-to-voltage conversion should be performed by an operational amplifier. The output voltage may be set to any desired value by choosing the proper impedance in the current-to-voltage converter. The ratio of input to output current in decibels is proportional to the control port voltage.

The 202 may be used with linear taper potentiometers to give a linear decibel control characteristic.

SPECIFICATIONS

Supply Voltage	Bipolar $15V \pm 5\%$
Gain range	-100 to +40 dB
Gain control constant	-6mV/dB
Gain at E_c+0V	0 dB ± 1 dB
Gain control input R	$197\Omega \pm 2\%$
Distortion, I_{in} and I_{out}	
$10\mu A$ max, gain -20 to +20 dB:	
2nd harmonic	.03% max
3rd harmonic	.04% max
Input 1 noise (20 kHz nbw)	3×10^{-10} A RMS
Frequency response	± 0.1 dB to 20 kHz
	Unity gain
Tracking accuracy	$\pm 1\%$



Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,798,143; 4,101,849; 4,097,767. Other patents pending.

APPLICATIONS

This circuit is optimized for professional audio applications where maximum input voltages reach about +20 dBV. The audio-band noise of this circuit typically is -98 dBV and the gain is adjustable from -100 dB to +40 dB or more.

The symmetry control should be adjusted for minimum harmonic distortion at unity gain (control voltage = 0 V). This control primarily affects the even-order distortion components.

Note that unlike the case with other dbx VCAs, the input and output resistors are not equal. This is because there is an internal resistance in series with the input pin of 1.25 k-ohms, which adds to the external input resistor. Therefore, for "normal" operation (where 0 volts on the control port corresponds to 0-dB gain), the input resistor should be less than the output resistor by 1.25 k. The formula for gain vs. control is:

$$\text{Gain} = 10^{-E_C}, \text{ or } \text{Gain (in dB)} = -20 E_C$$

The input and output resistors shown can be changed to suit a particular application. If lower noise is desired, the input and output resistors may be decreased at the expense of distortion at high input levels. If more noise can be tolerated, the input and output resistors may be increased, which will reduce the overall distortion.

The capacitor C_f is required to stabilize the output amplifier. The output impedance of the 202X has a capacitive component that will cause the output amplifier to oscillate if C_f is not used.

Care should be taken to prevent excessive noise or ac signals from appearing at the control port. These signals can cause intermodulation distortion or noise modulation due to the multiplicative nature of VCAs.

SPECIFICATIONS

Power-supply voltage	+15 V +10%
Power-supply current	30 mA
Operating temperature	-10 - +65° C
Control-port sensitivity	-20 dB/V
Gain accuracy	+1% of programmed gain
Control-port impedance	832 ohms +2%
Internal input resistance	1.25 k-ohms
Noise	-98 dBV (20-kHz bandwidth)
Distortion: all figures taken using circuit shown with input + output voltage = 5 V rms. With lower (and more typical) voltages, distortion is sharply reduced.	

THD, 1 kHz:

+20-dB gain	0.03% typical, 0.08% maximum
0-dB gain	0.01% typical, 0.02% max
-20-dB gain	0.03% typical, 0.08% max

IMD, 60 Hz + 7 kHz 4:1 (SMPTE)

+20-dB gain	0.1% typical, 0.15% max
0-dB gain	0.01% typical, 0.02% max
-20-dB gain	0.1% typical, 0.15% max



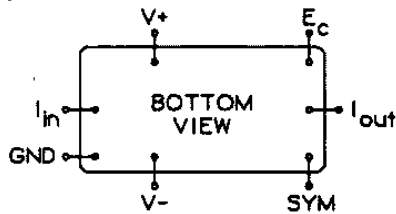
dbx 202X Voltage-Controlled Amplifier

The dbx 202X voltage-controlled amplifier is a high-performance VCA designed for audio or instrumentation applications where low distortion, low noise, and exceptional gain-control characteristics are of primary importance. The 202X has been designed using proprietary integrated-circuit technology, resulting in improved reliability and lower cost.

The 202X is pinout-compatible with all other dbx modular VCAs (202, 202C, 2001). In almost all cases, the 202X can be used in place of other dbx VCAs with only a simple resistor change.

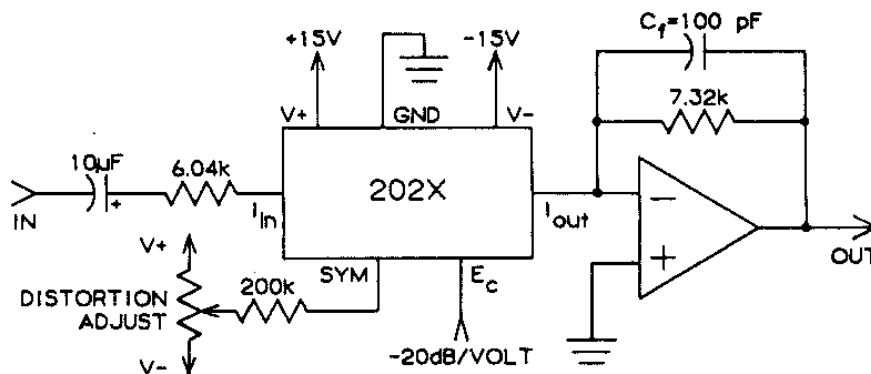
These VCAs may be used in VCF and VCO designs as well as in mixing-console applications including voltage-controlled faders, voltage-controlled panners, voltage-controlled equalizers, and console-automation systems.

The pinout of the 202X is shown below.



- Notes:
- V+, V-: supply connections, nominally $\pm 15\text{ V} \pm 10\%$
 - GND: ground, connected to user's analog ground
 - I_{out}: current-output pin, normally connected to an op-amp current-to-voltage converter
 - I_{in}: current-input pin, normally connected to an input resistor
 - E_c: gain-control voltage, -20 dB/V
 - Sym: symmetry pin, used to adjust for minimum distortion at 0-dB gain

TYPICAL CIRCUIT



APPLICATIONS

This circuit is optimized for professional audio applications where maximum input voltages reach about +20 dBV. The audio-band noise of this circuit typically is -98 dBV and the gain is adjustable from -120 to +40 dB.

The symmetry control should be adjusted for minimum harmonic distortion at unity gain (control voltage = 0 V). This control primarily affects the even-order distortion components.

Note that unlike the case with other dbx VCAs, the input and output resistors are not equal. This is because there is an internal resistance in series with the input pin of 1.25 k-ohms, which adds to the external input resistor. Therefore, for "normal" operation (where 0 volts on the control port corresponds to 0-dB gain), the input resistor should be less than the output resistor by 1.25 k. The formula for gain vs. control is:

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The capacitor C_f is required to stabilize the output amplifier. The output impedance of the 202XL has a capacitive component that will cause the output amplifier to oscillate if C_f is not used.

Care should be taken to prevent excessive noise or ac signals from appearing at the control port. These signals can cause intermodulation distortion or noise modulation due to the multiplicative nature of VCAs.

SPECIFICATIONS

Power-supply voltage	+15 V +10%
Power-supply current	26 mA typical, 34 mA maximum
Operating temperature	-10 to +65 degrees C
Control-port sensitivity	-20 dB/V
Thermal drift of gain-control constant	0.33% of gain per degree C
Gain accuracy, room temperature	+2% of programed gain
Control-port impedance	839.3 ohms ±1%
Internal input resistance	1.25 k-ohms
Noise	-98 dBV (20-kHz bandwidth)
Change in offset w/gain	Less than 1 mV, -120 to 0 dB Less than 3 mV, 0 to +20 dB

Distortion figures are for the circuit shown and input + output voltage = 5 V rms. With lower, more typical voltages, distortion is sharply reduced.

THD, 1 kHz:

+20-dB gain	0.03% typical, 0.05% maximum
0-dB gain	0.01% typical, 0.03% max
-20-dB gain	0.03% typical, 0.05% max

IMD (SMPTE, 60 + 7k Hz 4:1)

+20-dB gain	0.1% typical, 0.2% max
0-dB gain	0.03% typical, 0.12% max
-20-dB gain	0.1% typical, 0.2% max

Specifications are subject to change.



PRELIMINARY

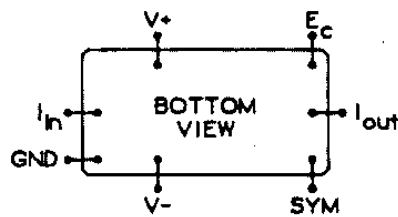
202XL
Voltage-Controlled Amplifier

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The 202XL is pinout-compatible with all other dbx modular VCAs (202, 202C, 2001, 202X). In almost all cases, the 202XL can be used in place of other dbx VCAs with only a simple resistor change.

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 - Sym: symmetry pin, used to adjust for minimum distortion at 0-dB gain

TYPICAL CIRCUIT

