

Audion™ 4

Product Features

Four-channel Wide-Dynamic-Range Compression with Dynamic Contrast Detection™

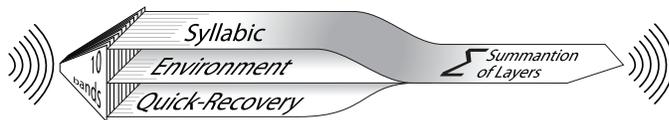
- TRI-mode adaptive time constants to optimize Wide-Dynamic-Range Compression performance in critical environments

Patented Adaptive Feedback Cancelling

- Our proven Adaptive Feedback Cancelling offers high added stable gain and effective anti-entrainment performance

Layered Noise Reduction™

- A state-of-the-art solution to reduction of environmental noise
- Ten noise reduction bands
- Three levels of noise reduction aggressiveness, plus an off setting
- A soft squelch to reduce low-level noise, including microphone noise



Low-Level Expansion

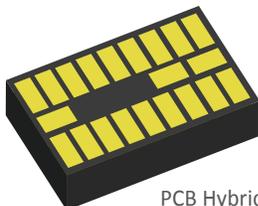
- Gain reduction for low-level sounds

Output Limiting

- Wide band output limiting with adjustable thresholds

Digital Volume Control Compatible

- Two-pin Digital Volume Control port
- Start-up volume control position is programmable
- Use up/down PB switches, rocker or a digital rotary control
- Multi-function Rocker Switch support allows volume control and program change with one user control
- Analog Volume Control Mode also available



PCB Hybrid for Reflow and Hand-wire Applications — [RoHS Compliant](#)

FEATURE DESCRIPTIONS

Adaptive Feedback Canceller (AFC)

The feedback canceller in this amplifier uses unique patented adaptive filtering technology to cancel feedback. This technique is also called phase cancellation. It features faster adapting time, higher added stable gain, and better entrainment resistance. Entrainment is the tendency of a feedback canceller to become confused by tonal sounds. This can cause false whistling and squeaks. The anti-entrainment functions acts to prevent problems caused by single tones, multiple tones, and loud complex sounds. The AFC is effective for feedback problems occurring in the frequency range of 750 Hz to 6750 Hz. The AFC can be enabled or disabled separately in each user memory by programming. Additional information on this feature can be found in the IntriCon technology paper available on the IntriCon web site, or from your IntriCon sales representative.

Automatic Telecoil and M-T-O Switching

A dedicated switching pad is available for applications of automatic telecoil switching or M-T-O switching. This mode is used by attaching a magnetic switch or mechanical switch from the TSW pad to GND. By programming, the 'auto-tcoil' mode is activated and the auto-tcoil program is designated by setting the parameter coilPGM. In the designated auto-tcoil program, the parameters are set to activate the telecoil and adjust other parameters to the desired telecoil performance. When the TSW pad is pulled to GND, the amplifier switches to the program set by coilPGM (typically program 5) and stays there until the TSW pad is open. Then the amplifier reverts to the user memory that was active just before TSW was grounded.

Band Gain Equalizers

Twelve band gain adjusters — equalizers — are available to precisely match fitting targets. Band 1 covers the frequency 250 Hz and below. Bands 2-8 are 500 Hz wide. Bands 9-12 are 1000 Hz wide. Center frequencies of bands are: ~100 Hz, 500 Hz, 1000 Hz, 1500 Hz, 2000 Hz, 2500 Hz, 3000 Hz, 3500 Hz, 4250 Hz, 5250 Hz, 6250 Hz, 7250 Hz. Each band has adjustable gain in 2 dB increments from 0 dB to -30 dB.

Input Modes

There are four single input modes: MIC1, MIC2, TC+, and DAI. When one of these modes is activated, the input pad by that name is active, and all other inputs are turned off. Inputs MIC1 and MIC2 have internal AC coupling capacitors. Inputs DAI and TC+ are DC coupled and usually requires an external AC coupling capacitor. There are two summing modes available: 'MIC1 + DAI' and 'MIC2 + TC+'. There is one fixed directional pattern modes that use the signals from microphones connected to inputs MIC1 and MIC2: Hypercardioid.

Layered Noise Reduction™ (LNR)

Our unique version of noise reduction acts to remove noise in between speech syllables as well as to lower general background noise from the environment. All layers respond to noise of all intensities so it replaces the function of low-level expansion. The LNR function can be set to the following settings: off, low, medium, high. Additional information on this feature can be found in the IntriCon technology white paper titled "Understanding Layered Noise Reduction" (available on the IntriCon website or from your IntriCon sales representative).

Low Battery Warning

When the battery voltage nears the end of life, the amplifier will detect this condition and provide a low battery warning signal. The first warnings begin when the average battery voltage falls below 1.05V. At this time, the amplifier emits three sets of double beeps every 10 minutes. When the average battery voltage falls lower than 0.95V, the amplifier issues six sets of double beeps, and then shuts down the audio output of the hearing instrument. The frequency and loudness of the beep tones are programmed as set forth in the section 'Tone Adjustments.' Low battery warning can be disabled via software.

Low-Level Expansion

The amplifier offers low-level expansion to reduce the effects of microphone noise and low-level environmental noise. The system can be turned on or off by programming. The expansion threshold is 50 dB SPL relative to the input pads, and the expansion ratio is 2:1. The expansion time constants are 25 msec attack time and about 300 msec release time.

Manufacturer's Data Area (Scratch-Pad Memory)

About 94 memory locations are provided to store any hearing instrument and fitting system information that is desired. Each location is 16 bits long. Typical stored items are model code, serial number, calibration constants, version numbers, etc.

Manufacturer's ID

An 8-bit memory location is reserved to store a code called Manf_ID. This code is assigned by IntriCon to each manufacturer that requests a unique code. This can be used to identify hearing instruments of a given manufacturer from others. IntriCon's engineering software called "Slider" will not read and program amplifiers with the Manf_ID set to values other than zero, unless the code has been unlocked using the proper key provided by IntriCon. This prevents undesired changing of hearing instrument parameters.

Multi-function Rocker Switch Support

This mode allows a rocker switch to serve as both a volume control and a program switch. To use the switch as a volume control, the user makes a quick press on the 'up' end of the rocker to increase volume, and on the 'down' end to decrease volume. To change programs, the user presses the 'up' or 'down' ends for a longer duration.

Output Limiting

The maximum power output (MPO) of the amplifier can be limited using the compression limiter. This method of output control does not create harmonic distortion like peak clipping. The MPO can be programmed to settings of Off, 0 dB, -2 dB, -4 dB, -6 dB, -8 dB, -10 dB, -12 dB, -14 dB, -16 dB, -18 dB, -20 dB, -22 dB, and -24 dB (relative to no limiting). The output level will not be affected by the volume control setting, since the limiter is placed right before the output stage and after the VC block.

FEATURE DESCRIPTIONS

Overall Gain

The parameter for overall gain of the amplifier is also called Matrix Gain. It is adjustable in 1 dB steps from 0 dB to -47 dB. Use this parameter to set to set the overall gain of an application, and then use the band gain adjusters to handle frequency shaping. The user VC adjustment will reduce the gain downward starting at the setting of matrix gain. It is important to remember that some values of matrix gain will be too high for a particular application, and the fitting system should insure that these high values are not available at fitting time.

Power-on Options

Two parameters are available to control how the amplifier behaves during power-up. The Power-on Delay controls the length of time the amplifier is muted after the power is applied. It is programmable to values of 3, 5, 10 and 15 seconds. The Power-on Level controls how loud the amplifier is after power on. Parameter values are: Mute, -30 dB, -20 dB, -10 dB.

Preamplifiers

There are two adjustable preamplifiers to handle the four input pads. Preamplifier 0 handles the inputs MIC1 and TC. Preamp 1 handles inputs DAI and MIC2. Each preamp gain is programmable to the settings 0 dB, 12 dB, 15 dB, 18 dB, 21 dB, 24 dB, 27 dB, and 30 dB.

Program Switch Tones

When this feature is enabled by programming, the amplifier will emit beeps every time the SW pad is connected to ground. The number of beeps duplicates the program number being switched into. For example, moving into program 2, two beeps will be heard, and when moving into program 4, four beeps will be heard. The frequency and loudness of the beep tones are programmed as set forth in the section 'Tone Adjustments.'

SDA Programming Port

Communication to and from the amplifier is by means of the so-called SDA port. This port implements a proprietary bidirectional communication protocol with data and clock on the same line. Low-level PC-to-amplifier communication is handled by a dynamic-linked library `audion4.dll` provided by IntriCon. This driver supports the Hi-Pro interface unit, as well as the eMiniTec and NOAHLink.

Contact IntriCon for the latest support information, or check our website at www.intricon.com

Tone Adjustments

The tones used for program switching and low battery warning are created in a tone generator. Available frequency settings are 500, 1000, 1500, and 2000 Hz. Available loudness settings are 60, 66, 72, and 78 dB SPL (input referred).

User Program Memory

As many as five user memories are available to an application. Up to four memories are available by selecting the value of the parameter "number_of_programs" by programming to 1-4. A fifth user memory can be added by activating the auto-tcoil function, and defining the auto-tcoil memory to be 5. Each of the user memories is a unique set of audio parameters. All of these parameters change when the user changes memory. The program change is accomplished by grounding the SW pad of the amplifier. There are two modes for this switch function. The static mode allows changes from Program 1 to Program 2 only. When the SW pad is grounded, the user Program 1 is active. When the SW pad is open, user Program 2 is active. In the momentary mode, every time the SW pad is grounded, the user program is incremented, until the top program is active. The next SW grounding event causes the user program to return to Program 1. Program switch tones will sound if this feature is enabled (see section 'Program Switch Tones').

Volume Control (VC) Function

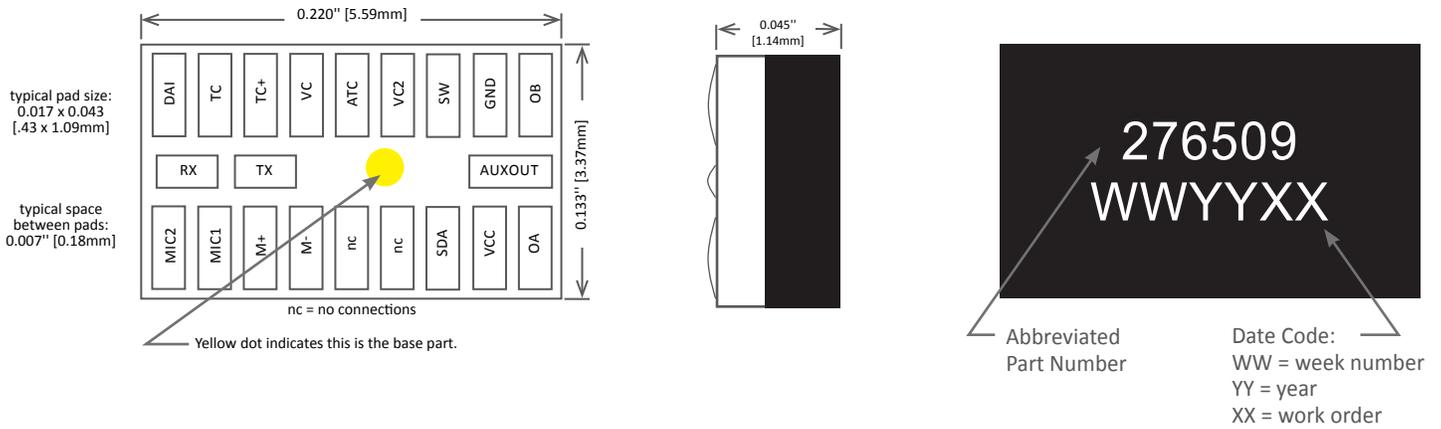
A user VC can be connected to this amplifier, and the function can be configured to match the application. By programming, the VC can be set to digital mode, analog mode or disabled. The range of the VC is programmable to the settings 50 dB, 40 dB, 30 dB, 20 dB, 10 dB. To create an analog volume control, a 100 kohm linear-taper VC (such as IntriCon models 11, 12, 14, 25, 26, and 35) is wired with the center terminal to the VC pad, and the ends of the VC are wired to M+ and GND respectively. The VC mode should be set to analog. To create a digital volume control, there are 2 options. A digital volume control wheel can be connected or 2 pushbutton switches can be used. See the applications page for wiring diagrams for this option. The VC mode should be set to digital.

Wide-Dynamic-Range Compression (WDRC) with Dynamic Contrast Detection™

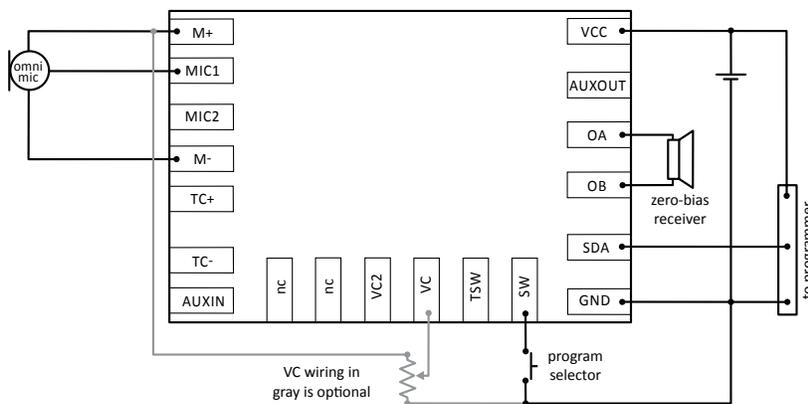
The amplifier uses unique IntriCon technology called Dynamic Contrast Detection in a 4-channel WDRC configuration. The technology is described in detail in the technology white paper titled Two-Channel WDRC with Dynamic Contrast Detection (available on the IntriCon web site, or from your IntriCon sales representative). Compression thresholds settings for each channel range from 40 dB to 70 dB SPL input-referred in 5 dB steps. Compression ratio settings of each channel are 1:1, 1.05:1, 1.11:1, 1.18:1, 1.25:1, 1.33:1, 1.43:1, 1.54:1, 1.67:1, 1.82:1, 2:1, 2.22:1, 2.5:1, 2.86:1, 3.33:1, 4:1. Time constants settings are described in the technology white paper mentioned above. Channel crossover frequencies are at 1.0, 1.14, 1.33, 1.6, 2.0, 2.65, and 4.0.

APPLICATIONS

Audion™ 4 Amplifier PCB Hybrid Part Number 92765-0009—RoHS Compliant

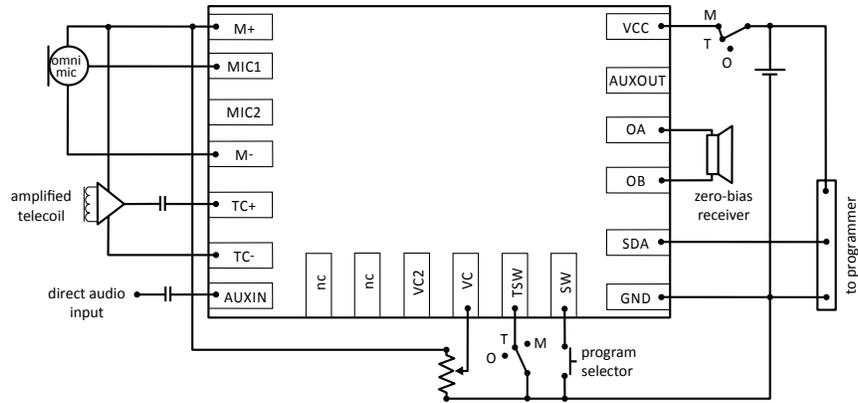


Wiring Schematic for Simple Programmable Application

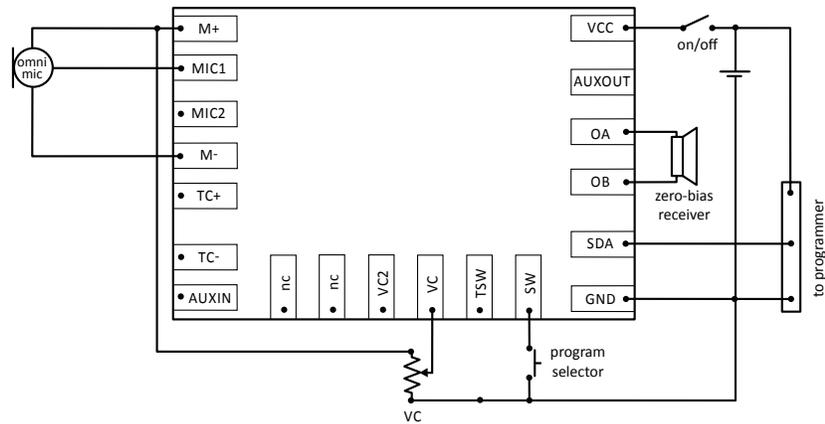


APPLICATIONS

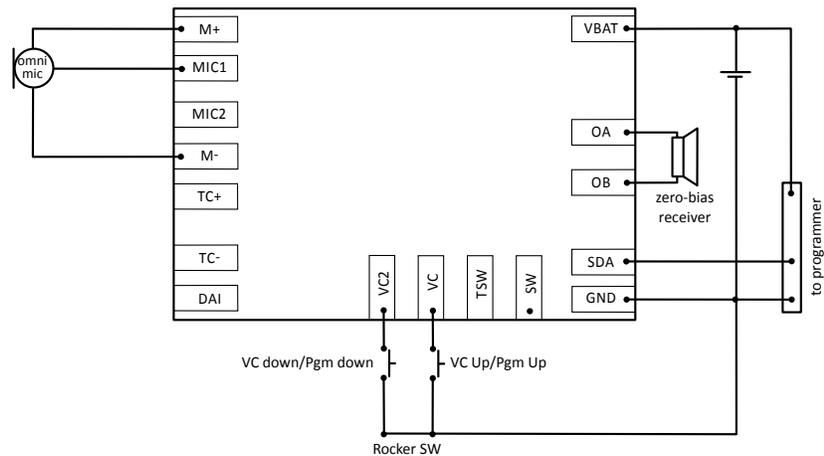
Wiring Schematic with Active Tcoil, VC, DAI, and MTO Switch



Wiring Schematic Showing VC with Switch



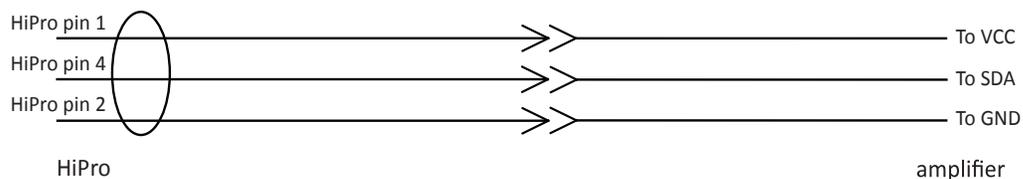
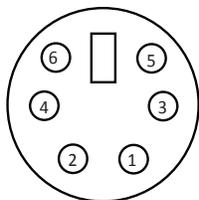
Wiring Schematic Showing Rocker Switch Connections



APPLICATIONS

Programmer Wiring

Pin numbering of the DIN connector on the front of the HiPro, as seen facing the HiPro box



Technical Specifications

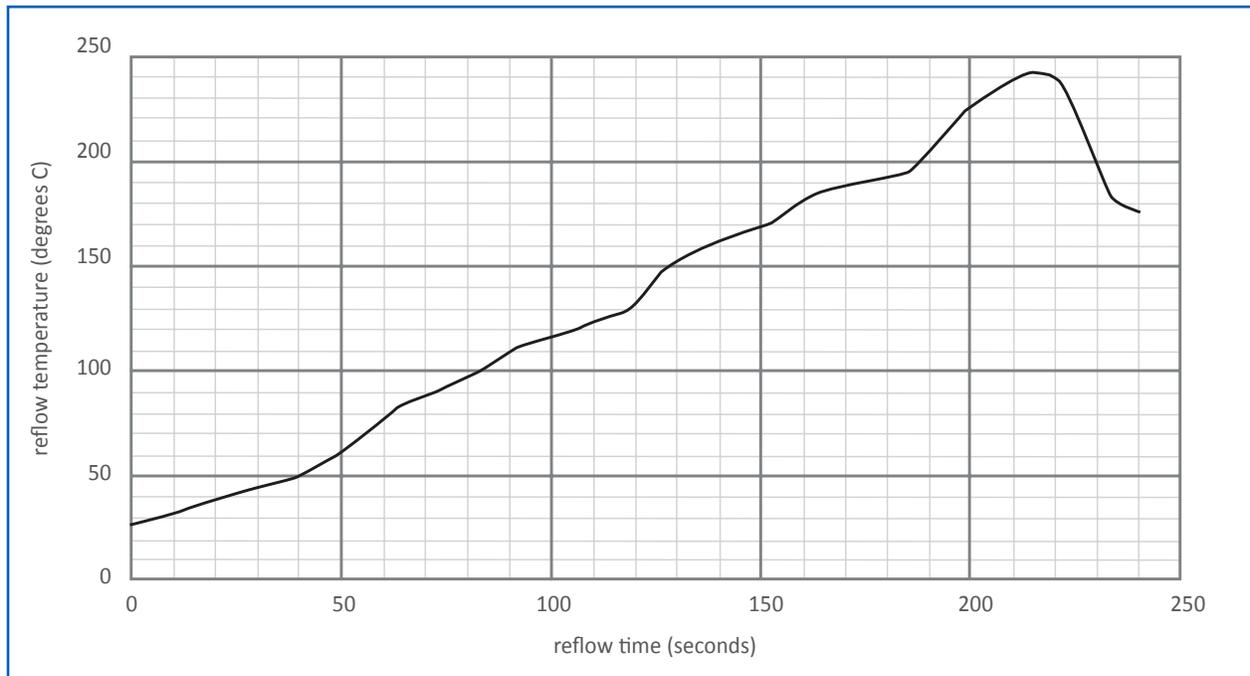
Parameter	Minimum	Typical	Maximum	Units	Condition
Minimum Operating Supply Voltage	1.05	--	1.5	V	
Supply Current, AFC on		TBD		mA	tentative; see NOTE 1
Clock Frequency	2.534	2.560	2.586	MHz	
Sampling Frequency	--	16	--	kHz	
Bandwidth	--	8	--	kHz	
Input Noise	--	4	--	uVrms	bandwidth 200-8000 Hz
Dynamic Range	--	84	--	dB	max input signal with THD < 2%
Output Impedance	--	10	--	ohms	
Maximum Output Drive Current	--	--	25	mA	
Input Impedance	385	550	715	kohms	
Regulator Voltage	0.89	0.95	1.05	V	120uA load
Maximum Regulator Current	100			mA	
PSRR	35	50	--	dB	
Power on Reset Threshold Voltage	0.55	0.7	0.85	V	

NOTE 1: AFC turned on. 2kHz pure tone input at 200 uVrms amplitude. No connections to OA and OB pads.

SOLDERING INFORMATION

Customer Attach Process	Process Parameters	Max Hybrid Temp	Recommended materials to attach hybrid
Hand Solder Wire	Set iron tip temp to 650°–715° F. Max dwell time of 2 seconds. Allow 10 seconds between solder operations.	250° C	Use SAC 305 solder wire
Flip Clip	Reflow in convection oven—see profile below for recommended reflow temperature.	250° C	Print SAC 305 paste onto pads. Flip hybrid onto wet paste and reflow. Alternate method is to apply flux to the pads then flip hybrid onto fluxed pads and reflow. Recommended flux is indalloy tac flux 025 (this is a water soluble flux).

Solder Reflow Temperature Profile
(Lead-free SAC Alloy)



For more information on IntriCon products, visit www.intricon.com or email hearinghealthsales@intricon.com

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This product may be covered by one or more of the following patents, as well as patents pending: 8,355,517; 8,605,927; 8,767,987; D671,218; 9,571,939; 9,832,578; 6,678,386; D525,617; D527,377; D567,232; D588,110; 7,519,193; 8,358,797.

