IntriCon
The Body-Worn Device Company

Audion™ 8

Product Features

Voice Prompts

- Available for Start-up Program, Active Program, Minimum/Maximum Volume Control Position and Low Battery warning
- Choose from the IntriCon standard prompts or create and load your own custom prompts

Third-Generation Reliant™ Adaptive Feedback Cancelling

- Faster adapting speed means less whistling, even when things move around the ear
- More Added Stable Gain

Layered Noise Reduction™

- Our Layered Noise Reduction technology continues to be a state-of-the-art solution to reduction of environmental noise.
- 12 noise reduction bands
- 17 dB cut setting available for extreme noise situations
- Extended frequency range of action to 7750 Hz
- Soft-squelch reduces low-level noise, including microphone noise

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

- Three-mode adaptive time constants to optimize Wide-Dynamic-Range Compression performance in critical environments
- Compression ratio and threshold adjustable independently in each channel
- Maximum Power Output compression limiting is also adjustable independently in each channel

Adaptive Directional Microphone Processing

- Automatically switches from Omni to Directional when environment changes
- Eliminates extra 'directional' user program and need for user activation

Event Data Logging

- Elapsed-time clock will record the time the amplifier has been operating since it was made
- Events are recorded and 'time stamped'
- User events: power-on events, volume control change, program change, low battery events
- All events will be logged in a buffer available to the fitting system
- Fitting system can present the data to help the dispenser understand usage patterns

Digital Random Noise Generator

- Digital generation of random noise gives a clean noise sound for masking use
- Noise is injected at the input, so it can be shaped by the existing EQ gain adjusters
- Can be used in mixed-mode applications: one program for masking, and another program for hearing instrument use

AutoSave for Program and Volume Control Position

- When enabled the active program and current Volume control position are saved to Electrically Erasable Programmable Read-Only Memory (EEPROM) after receiving a program or volume control change event. These save values are then used as default starting program and volume control position

Digital Volume Control Compatible

- Two-pin Digital Volume Control port
- Start-up volume control position is programmable
- Use pushbutton switches or a digital rotary control
- Analog Volume Control Mode also available

OA	VBAT	SDA	I2C	Vdbl	M-	M+	MIC1	MIC2
RBAT						CLK		DAT
OB	GND	SW	VC2	TSW	VC	TC+	TC-	DAI
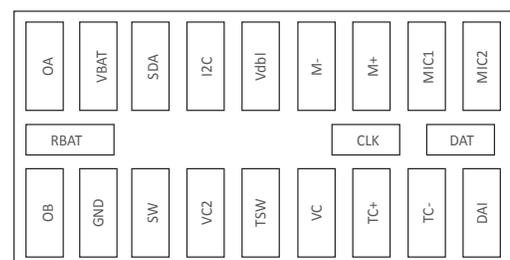
Reflowable PCB Package

Adaptive Directional

The adaptive directional feature eliminates the need for a dedicated 'directional' user program needing manual activation. There are three adaptive directional input options available; adaptive cardioid, adaptive supercardioid or adaptive hypercardioid. The directional inputs can be selected in each program based on the polar pattern desired. The adaptive directional modes can be selected to allow the hearing instrument to automatically adapt from an omni mode to the selected polar pattern when the environment noise level rises above a configurable threshold. The available thresholds settings are low, mid, high, and highest.

Automatic Telecoil and MTO 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 autotcoil 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.

Autosave

The Autosave option enables the writing of Current Program and VC position to EEPROM. If the program memory switch is activated or the VC position changes, an event flag is set telling the processor to save these value to EEPROM. These values are then used as the default program and VC position the next time the device is powered on.

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, 500, 1000, 1500, 2000, 2500, 3000, 3500, 4250, 5250, 6250, 7250 Hz. Each band has adjustable gain in 2 dB increments from 0 dB to -40 dB.

Event Data Logging

The data logging feature stores information associated with the following 4 events: Startup, Volume Control (VC), Push Button (PB), and Low Battery Warning. This allows monitoring of such things as daily usage, battery life, number of times user adjusts VC, or adjusts the active program. A definition of the Events and their associated status is as follows:

Startup Event = 1:
The startup event has two - 24 bit status words associated with it and it occurs whenever the device is powered on. The two words are a 24 bit Event Status and a 24 bit real time clock using this format:

Event status format:
EEEE EEEP PVVV VV00 0000 0000 E = 7 bit event code
Startup event code = 1
P = 2 bit Active program setting
V = 5 bit VC position setting

Real Time Clock: 24 bit counter where each count is 10 min

VC event = 2,
PB event = 3,
Low Batt Warning event = 4:
All these events have one 24 bit status word associated with them

Event status format:
EEEE EEEP PVVV VVCC CCCC CCCC E=7 bit event code
P = 2 bit Active program setting
V = 5 bit VC position setting
C = 10 least significant bits of the real time clock

Indicator Adjustments

Voice prompts or tones can be used as indicators for program switching and low battery warning. The voice prompts and tones are output referred. Available frequency settings for the tone option are 500 Hz, 1000 Hz, 1500 Hz, and 2000 Hz. Available loudness settings are 70 dB SPL, 75 dB SPL, 80 dB SPL, 85 dB SPL, 90 dB SPL, 95 dB SPL, and 100 dB SPL.

Input Modes

There are four single input modes: Microphone 1, Microphone 2, Telecoil (TC+), and Direct Audio Input (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, MIC2 and TC+ have internal AC coupling capacitors. Input DAI is DC coupled and usually requires an external AC coupling capacitor. One input mode is for the Digital Noise Generator source.

There are three summing modes available:
MIC1 + DAI
MIC1 + TC+
MIC1 + Noise Generator

There are 3 fixed directional pattern modes that use the signals from microphones connected to inputs MIC1 and MIC2:
Fixed Directional - Cardioid
Fixed Directional - Supercardioid
Fixed Directional - Hypercardioid

There are three adaptive directional pattern modes that use the signals from microphones connected to inputs MIC1 and MIC2:
Adaptive Directional - Cardioid
Adaptive Directional - Supercardioid
Adaptive Directional - Hypercardioid

In-situ Tone Generator

The Audion 8 amplifier comes with a programmable tone generator that can be used for in-situ validation of the hearing instrument fitting. The programmable parameters are frequency, level and duration of the generated tone signal. The eight frequencies options available are: 250 Hz, 500 Hz, 1 kHz, 1.5 kHz, 2 kHz, 3 kHz, 4 kHz, 6 kHz. The input referred level of the generated tone can be adjusted between 20 db SPL and 65 dB SPL in 5 dB increments. The duration of the tone being generated can be set to .5, 1.0, 2.0, 3.0, 4.0, 5.0 and 10 seconds.

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 1.1 volt. At this time, the amplifier will emit either a voiced warning or three sets of double beeps every ten minutes. When the average battery voltage falls lower than 1 volt, the amplifier will issue six sets of double beeps, and then shuts down the audio output of the hearing instrument. The frequency and loudness of the beep tones as well as the level of the voice prompt are programmed as set forth in the section 'Indicator Adjustments.' Low battery warning can be disabled via software.

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 amplifers 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.

Manufacturer's Data Area (Scratch-Pad Memory)

Ten 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.

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. In each of 8 compression channels, 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, -24 dB, -26 dB, and -28 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.

Preamplifiers

There are two adjustable preamplifiers to handle the four input pads. Preamplifier 0 handles the inputs MIC1, MIC2, DAI and TC+. Preamp 1 is used when combined input features, such as directional, are selected. 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 Indicator

When this feature is enabled, the amplifier will either emit a voice prompt or beeps every time the SW pad is connected to ground. If programmed as such, the number of beeps indicates the program number being switched into. For example, when moving into Program 2, two beeps will be heard. When moving into Program 4, four beeps will be heard. The frequency and loudness of the beep tones or the level of the voice prompts are programmed as set forth in the section 'Indicator Adjustments.'

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 Min (~3 seconds), 5 seconds, 10 seconds and 15 seconds. The Power-on Level controls how loud the amplifier is after power on. Parameter values are: Mute (-60 dB), -30 dB, -20 dB, -10 dB.

Random Noise Generator

The Audion 8 amplifier has an internal random noise generator that creates a flat spectrum psuedo-random digital noise sequence. The noise signal is injected at the front end of the amplifier before any of the signal processing. The amplitude of the noise is programmable to values of 30 dB SPL - 65 dB SPL (input referred) in 5 dB increments. Using the Input Selector parameter, one can set up the noise generator to operate optionally in any of the user programs. For example, Program 1 could be set up with MIC1 active as a hearing instrument program. Program 2 could be set to activate the noise generator as a tinnitus masking program.

Reliant™ Adaptive Feedback Canceller (AFC)

Our third-generation adaptive feedback canceller in this amplifier uses unique 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.

SDA Programming Port

Communication to and from the amplifier is by means of the 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 Audion8.dll provided by IntriCon. This driver supports the HiPro interface unit, as well as MicroCard, MicroConnect, and eMiniTec.

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

FEATURE DESCRIPTIONS

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. 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 open, the user Program 1 is active. When the SW pad is grounded, 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. Voice prompts or Program switch tones will sound if this feature is enabled (see section 'Program Switch Indicator').

Voice Prompts

Voice prompts are available for: Start up Program, Active Program, Minimum and Maximum Volume Control Position, and Low Battery Warnings.

Volume Control (VC) Function

A user volume control 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. 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.
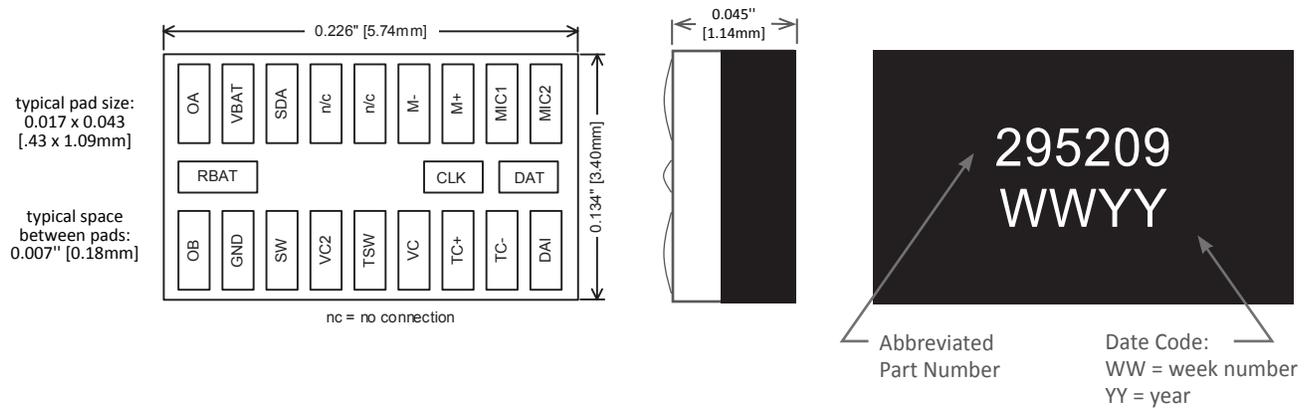
Wide-Dynamic-Range Compression (WDRC) with Dynamic Contrast Detection™

The Audion 8 uses unique IntriCon technology called Dynamic Contrast Detection in an 8-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 both channels together are 40, 45, 50, 55, 60, 65, 70 dB SPL input- referred. Compression ratios 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 250, 750, 1250, 1750, 2750, 3750 and 5500 Hz.
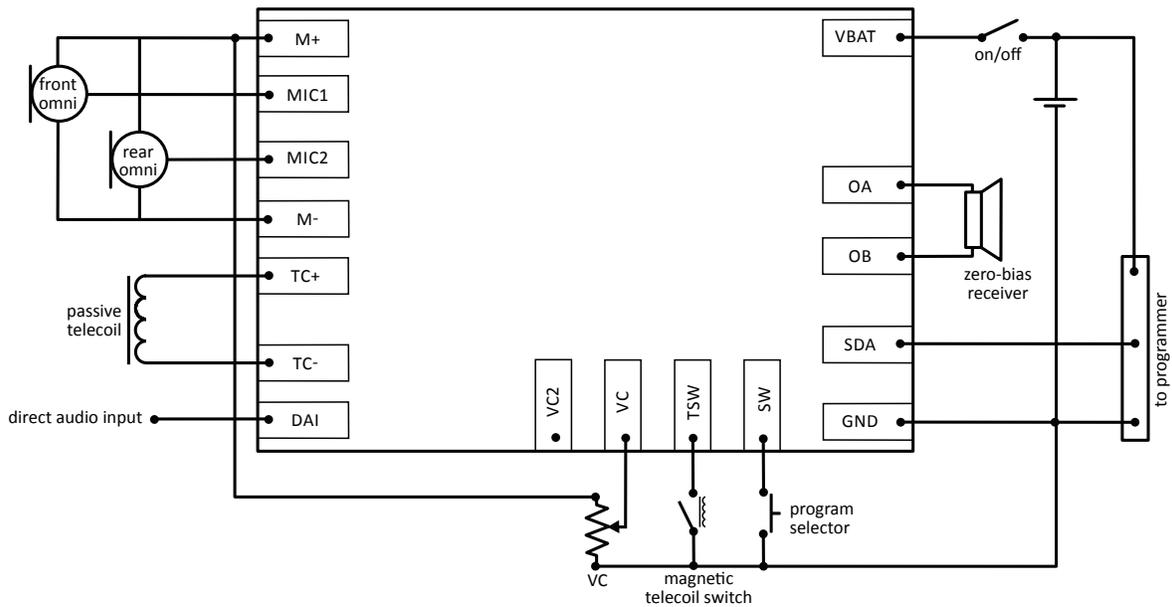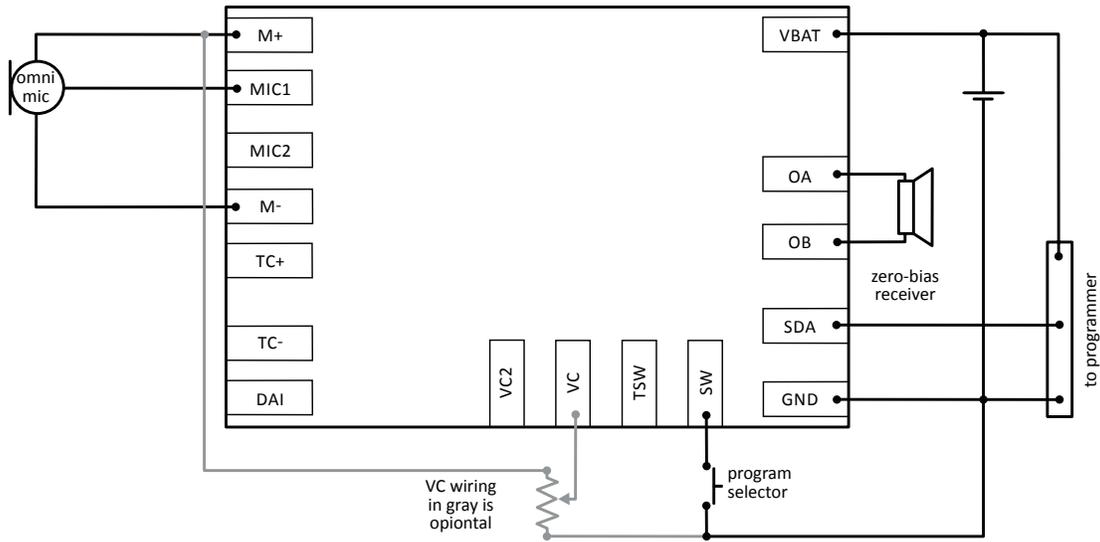
Audion™ 8 PCB Hybrid Package Information
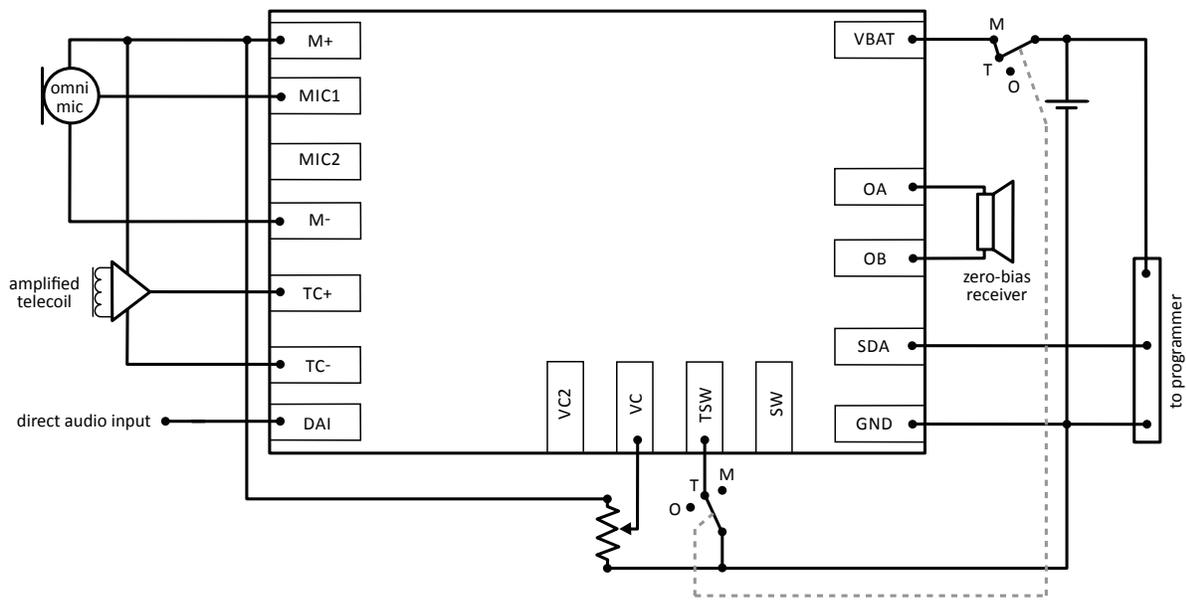
Part Number 92952-0009 — RoHS Compliant

0.226" [5.74mm]

0.045'' [1.14mm]

typical pad size: 0.017 x 0.043 [.43 x 1.09mm]

| OA | VBAT | SDA | n/c | n/c | M- | M+ | MIC1 | MIC2 |

| RBAT | | | | | CLK | DAT |

typical space between pads: 0.007'' [0.18mm]

0.134" [3.40mm]

| OB | GND | SW | VC2 | TSW | VC | TC+ | TC- | DAI |

nc = no connection

295209 WWYY

Abbreviated Part Number

Date Code: WW = week number YY = year

Wiring Schematic Showing Full Features

M+

MIC1

MIC2

M-

TC+

TC-

DAI

front omni

rear omni

passive telecoil

direct audio input

VC2

VC

TSW

SW

VC

magnetic telecoil switch

program selector

VBAT

on/off

OA

OB

zero-bias receiver

SDA

GND

to programmer

APPLICATIONS

Wiring Schematic Simple Programmable Application

M+		VBAT
MIC1		
MIC2		OA
M-		OB
TC+		zero-bias receiver
TC-		SDA
DAI	VC2 VC TSW SW	GND

omni mic

to programmer

VC wiring in gray is opiontal

program selector

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

M+		VBAT
MIC1		
MIC2		OA
M-		OB
TC+		zero-bias receiver
TC-		SDA
DAI	VC2 VC TSW SW	GND

omni mic

amplified telecoil

direct audio input

to programmer

M T O
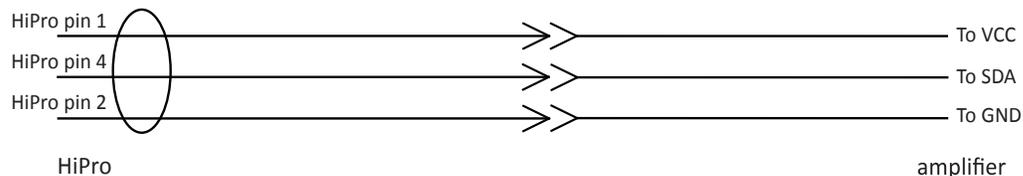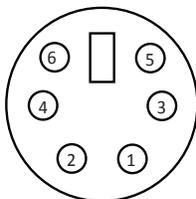
22949_A

Wiring Schematic Showing Digital VC with Program Switch
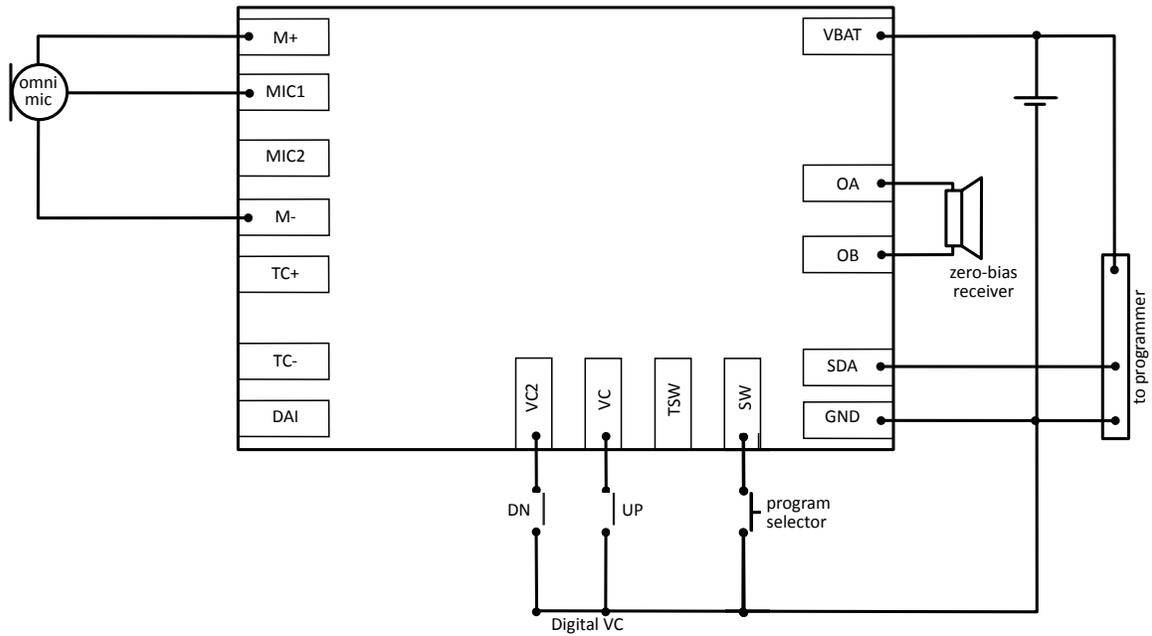
Wiring Schematic Showing Digital Scroller VC
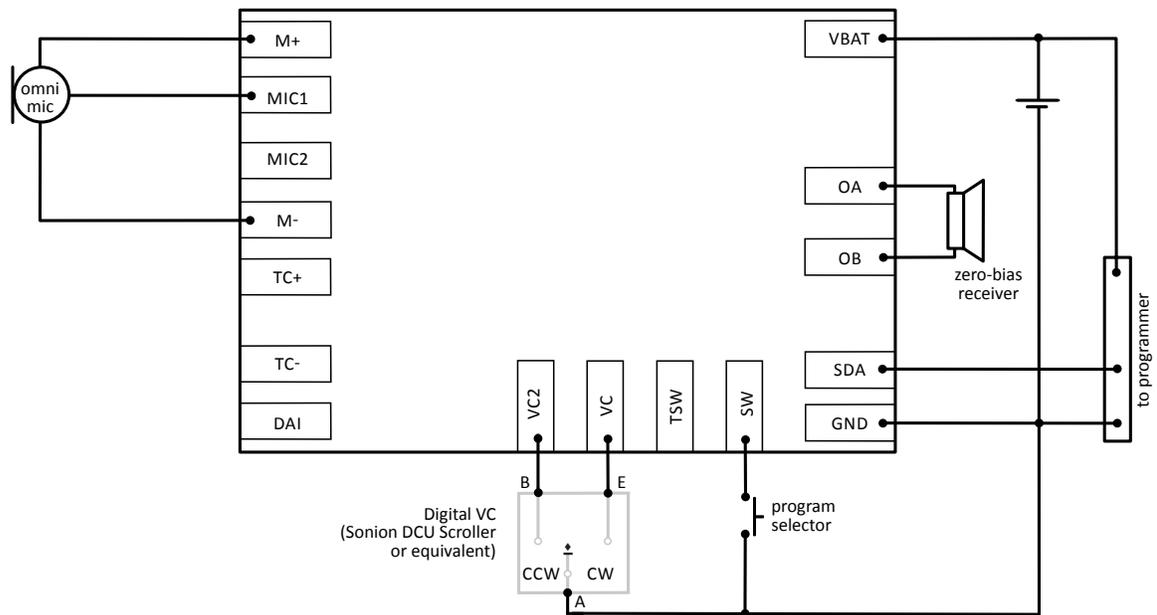
Programmer Wiring

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

HiPro pin 1 — To VCC
HiPro pin 4 — To SDA
HiPro pin 2 — To GND

HiPro   amplifier

Technical Specifications

Parameter	Minimum	Typical	Maximum	Units	Condition
Minimum Operating Supply Voltage	1.0	1.25	2.0	V	
Supply Current	--	1.0	--	mA	AFC enabled at idle
Clock Frequency	--	3.84	--	MHz	
Sampling Frequency	--	16	--	kHz	
Bandwidth	--	8	--	kHz	
Input Noise	--	5.4	7.4	uVrms	bandwidth 200-8000 Hz
Dynamic Range	90	--	--	dB	max input signal with THD < 2%
Output Impedance, Standard Mode	--	5	--	ohms	
Output Impedance, High Power Mode	--	2.5	--	ohms	

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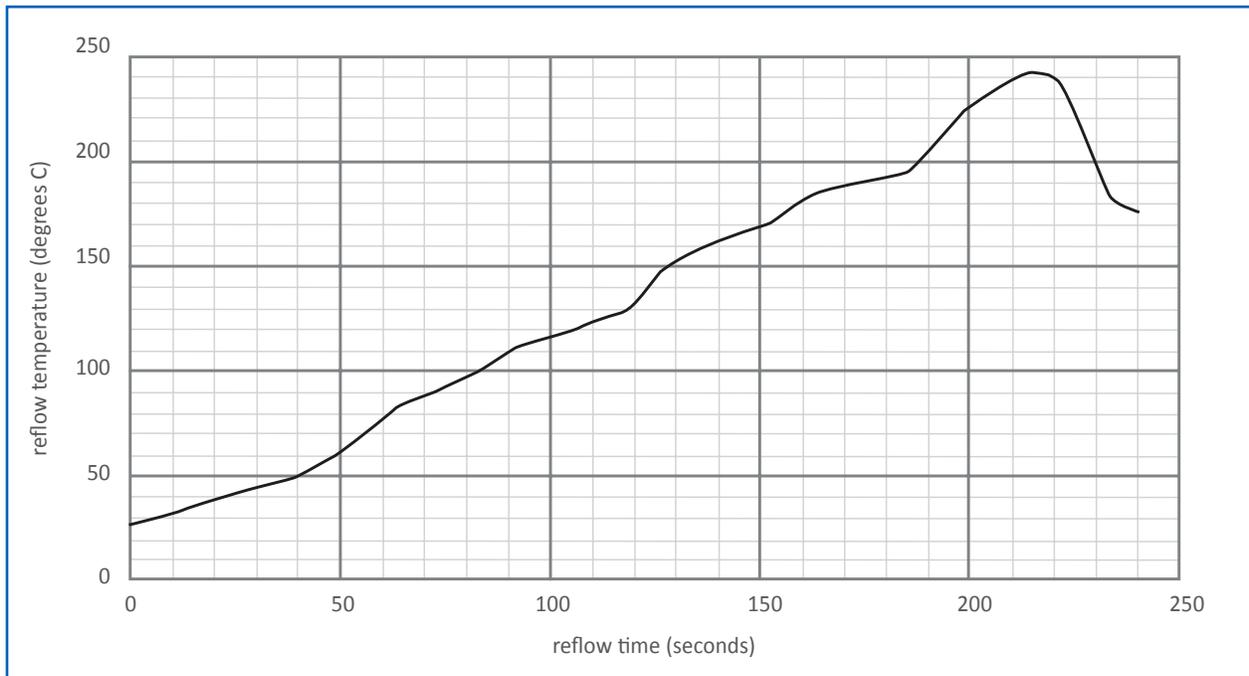
For more information on IntriCon products, visit www.intricon.com
or email hearinghealthsales@intricon.com

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