ESSENTIAL® 150

Product Features

Suitable for a Wide Range of Applications

- Cost-sensitive digital programmable hearing instruments
- Trimmer-controlled hearing instruments — Analog replacement
- Product line consolidation

Dynamic Contrast Detection™ 2-channel Compression

- Three-mode adaptive time constants to optimize AGC performance in critical environments
- 12-Band Gain Adjustment
- Excellent target matching capability

Trimmer Control Capability

- Factory-programmable setup for controlling TK, Low-cut, High-cut, and MPO
- Use 100 kohm linear-taper trimmers for any function
- Use 1-3 trimmer as needed

Programmable Volume Control Range

- Customize volume control performance at design, manufacturing or fitting time

Program Switch Tones

- Adjustable frequency and loudness

MIC + Telecoil Input Summing Mode

Low Battery Warning

- Adjustable frequency and loudness

Low-level Expansion

Automatic Telecoil & MTO Switch Compatible

Automatic Telecoil and MTO Switching

A dedicated switching pad is available for applications of automatic telecoil switching or MTO 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. The 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, and 7250 Hz. Each band has adjustable gain in 2 dB increments from 0 dB to -30 dB.

Feedback Notch Filter

This filter emulates notch filter with a bandwidth of 500 Hz and a filter depth of 10 dB. The center frequencies of the notch filter are 4500 Hz, 4000 Hz, 3500 Hz, 3000 Hz, 2500 Hz, and 2000 Hz. The center frequency of the Feedback Notch Filter can also be trimmer controlled.

High Cut Filter

This filter emulates a 2nd-order butterworth-tuned low-pass filter. This gives a 12 dB/octave roll-off above the corner frequency. Programmable corner frequencies values are 8000 Hz, 4000 Hz, 3150 Hz, 2500 Hz, 2000 Hz, 1600 Hz, and 1250 Hz. The corner frequency can also be trimmer controlled.

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 TC+ and DAI are DC coupled and usually require an external AC coupling capacitor. There are two summing modes available. Mode MT1 allows the inputs MIC1 and TC+ to be active simultaneously and their signals are summed after pre-amplification. Mode MT2 allows the inputs MIC2 and DAI to be active simultaneously and their signals are summed after pre-amplification.

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 Cut Filter

This filter in placed in the front end of the amplifier before the bands are split. It is implemented with a 2nd-order butterworth-tuned infiniteimpulse-response (IIR) high-pass filter. This gives a 12 dB/octave smooth linear roll-off below the corner frequency. Programmable corner frequencies values are 200 Hz, 500 Hz, 750 Hz, 1000 Hz, 1500 Hz, 2000 Hz, and 3000 Hz. The corner frequency can also be trimmer controlled.

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 ms attack time and about 300 ms release time.

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.

Output Mode

There are two output modes available on this amplifier. The switching output mode uses the pads OA and OB for so-called 'Class D' output, to be used with zero-bias receivers. The auxiliary output mode sends an analog signal out of the AUXOUT pad when a separate output stage is used.

Overall Gain

The parameter for overall gain of the amplifier is also called Matrix Gain. It is adjustable in 1 dB steps from 0 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.

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 0, -4 dB, -8 dB, -12 dB, -16 dB, -20 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.

Pre-amplifiers

There are two adjustable preamplifiers to handle the four input pads. Preamplifier 1 handles inputs MIC1 and DAI. Preamplifier 2 handles MIC2 and TC+. Each preamplifier is programmable to the settings 0 dB, 12 dB, 15 dB, 18 dB, 21 dB, 24 dB, 27 dB, and 30 dB gain.

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, i.e. 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 are programmed as set forth in the section 'Tone Adjustments.'

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.

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 essential.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 front-end tone generator. Thus the tones are input referred, and will be affected by the settings of band gain, overall gain, filters, and compression, etc. Available frequency settings are 500 Hz, 1000 Hz, 1500 Hz, and 2000 Hz. Available loudness settings are 60 dB SPL, 66 dB SPL, 72 dB SPL, and 78 dB SPL referred to the input pads.

Trimmer Control

The amplifier offers trimmer control capability of several of the programmable parameters. Up to 3 trimmers can be configured. To create a trimmer control, a 100 kohm linear-taper trimmer (such as IntriCon models 17, 37, and 75) is wired with the center terminal to the T1, T2, or T3 pad, and the ends of the trimmer are wired to M+ and GND respectively. The one of the trimmer-controllable parameters is assigned to that trimmer by setting the 'mapping' parameter by programming. The parameters that can be trimmer controlled are Low-cut, High-cut, TK, and MPO. For example, to assign trimmer 1 to the Low-cut parameter, set the LC_MAP parameter to 1. Each trimmer can adjust each parameter to one of 7 settings linearly spaced over the rotation of the trimmer.

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 switch is open, the user Program 1 is active. When the switch 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. 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. To create a 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. By programming, the VC can be enabled or disabled. The range of the VC is programmable to the settings 50 dB, 40 dB, 30 dB, 20 dB, 10 dB.
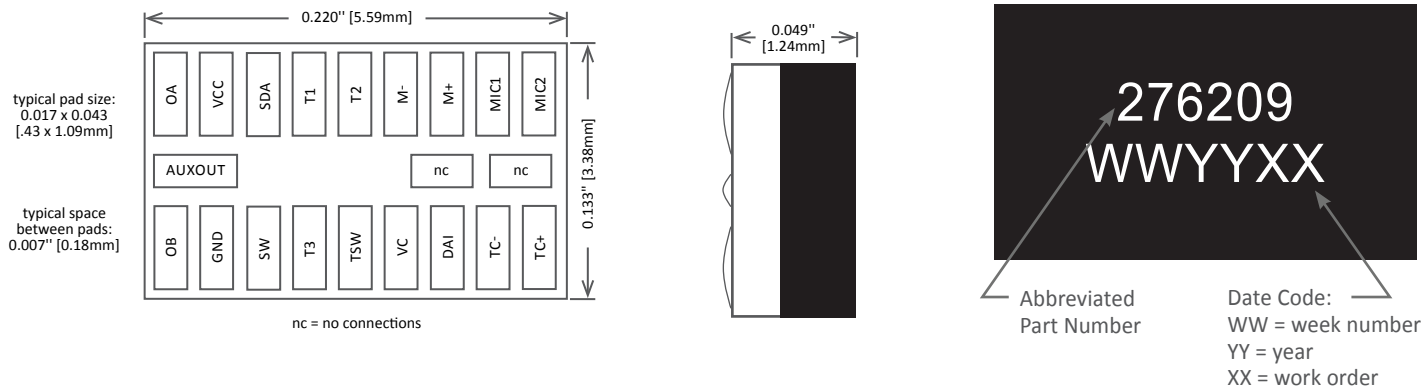
Wide-Dynamic-Range Compression (WDRC) with Dynamic Contrast Detection™

The amplifier uses unique IntriCon technology called Dynamic Contrast Detection in the 2-channel Wide Dynamic Range Compression (WDRC) compression system. 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 dB SPL, 45 dB SPL, 50 dB SPL, 55 dB SPL, 60 dB SPL, 65 dB SPL, and 70 dB SPL input-referred. Compression ratios settings of each channel are 1:1, 1.14:1, 1.33:1, 1.6:1, 2.0:1, 2.65:1, 4.0:1. Time constants settings are described in the technology white paper mentioned above. Compression thresholds can also be trimmer controlled.
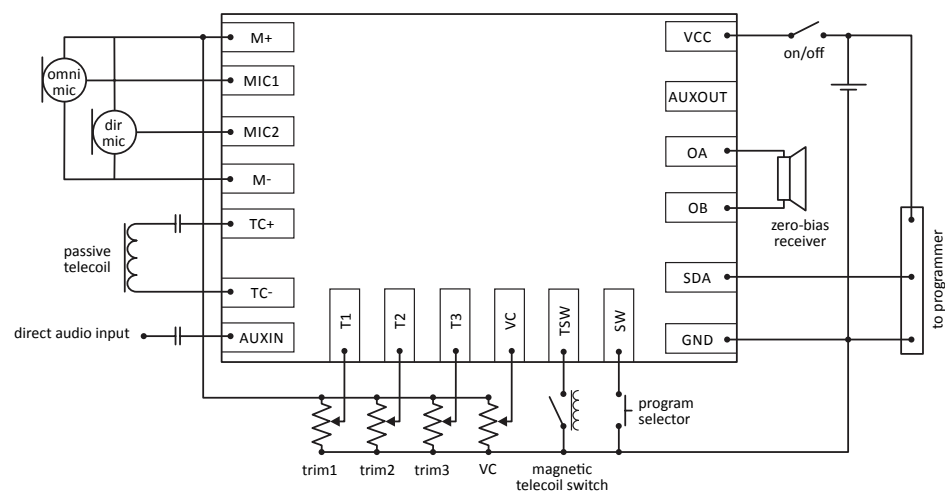
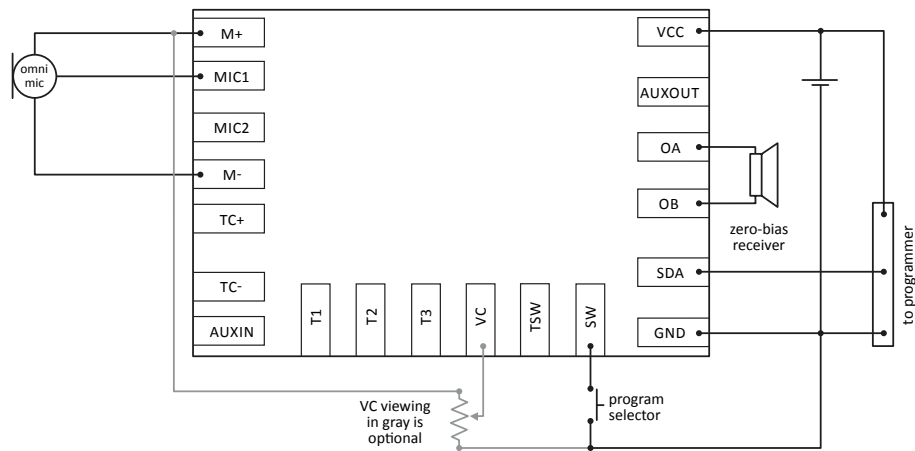## Essential® 150 Amplifier Hybrid
Part Number 92762-0009

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

0.220'' [5.59mm]

0.133'' [3.38mm]

| OA | VCC | SDA | T1 | T2 | M- | M+ | MIC1 | MIC2 |

| AUXOUT | | | | | nc | | nc | |

| OB | GND | SW | T3 | TSW | VC | DAI | TC- | TC+ |

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

nc = no connections

0.049''
[1.24mm]

276209
WWYYXX

Abbreviated
Part Number

Date Code:
WW = week number
YY = year
XX = work order

Wiring Schematic Showing Full Features

omni
mic

dir
mic

| M+ |
| MIC1 |
| MIC2 |
| M- |
| TC+ |
| TC- |
| AUXIN |

passive
telecoil

direct audio input

VCC	on/off
AUXOUT	
OA	
OB	
SDA	
GND	

zero-bias
receiver

to programmer

| T1 | T2 | T3 | VC | TSW | SW |

program
selector

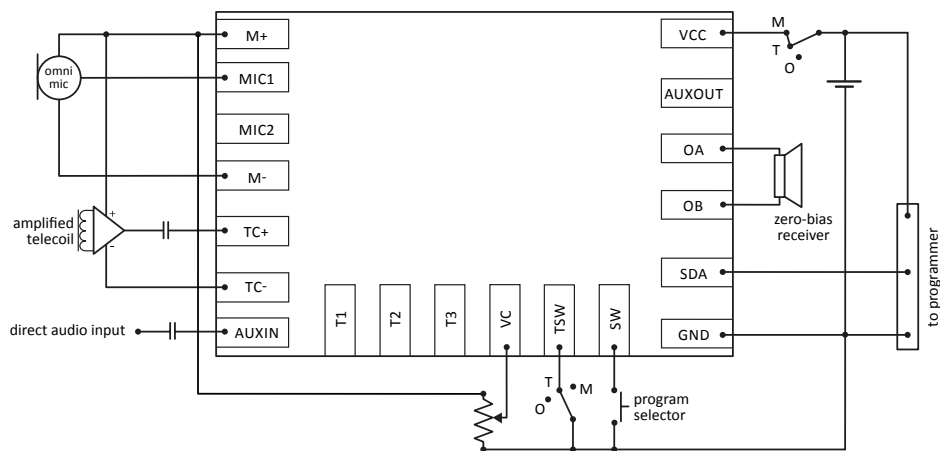trim1   trim2   trim3   VC   magnetic
telecoil switch
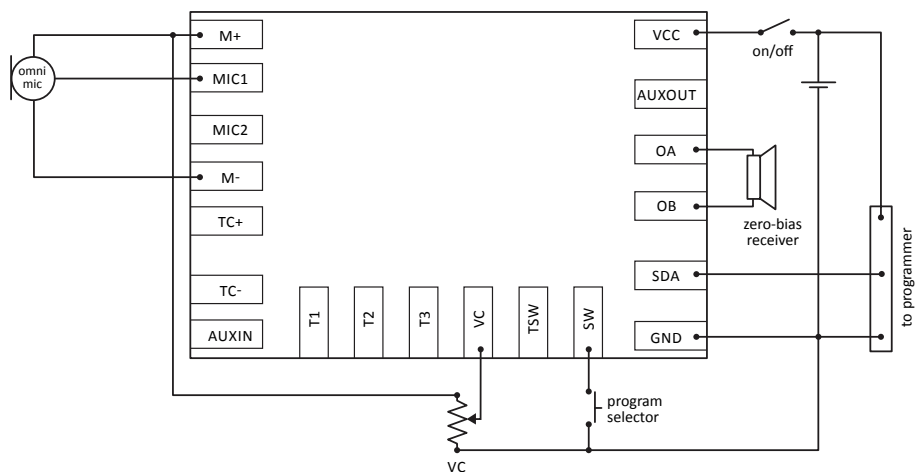
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APPLICATIONS

Wiring Schematic for Simple Programmable Application

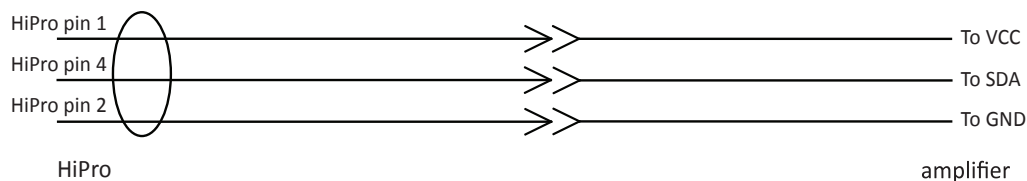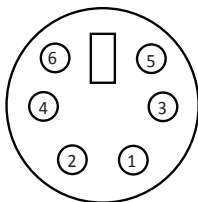## Wiring Schematic with Active Tcoil, VC, DAI, and MTO Switch

Wiring Schematic Showing VC with Switch

APPLICATIONS

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	1.05	--	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)
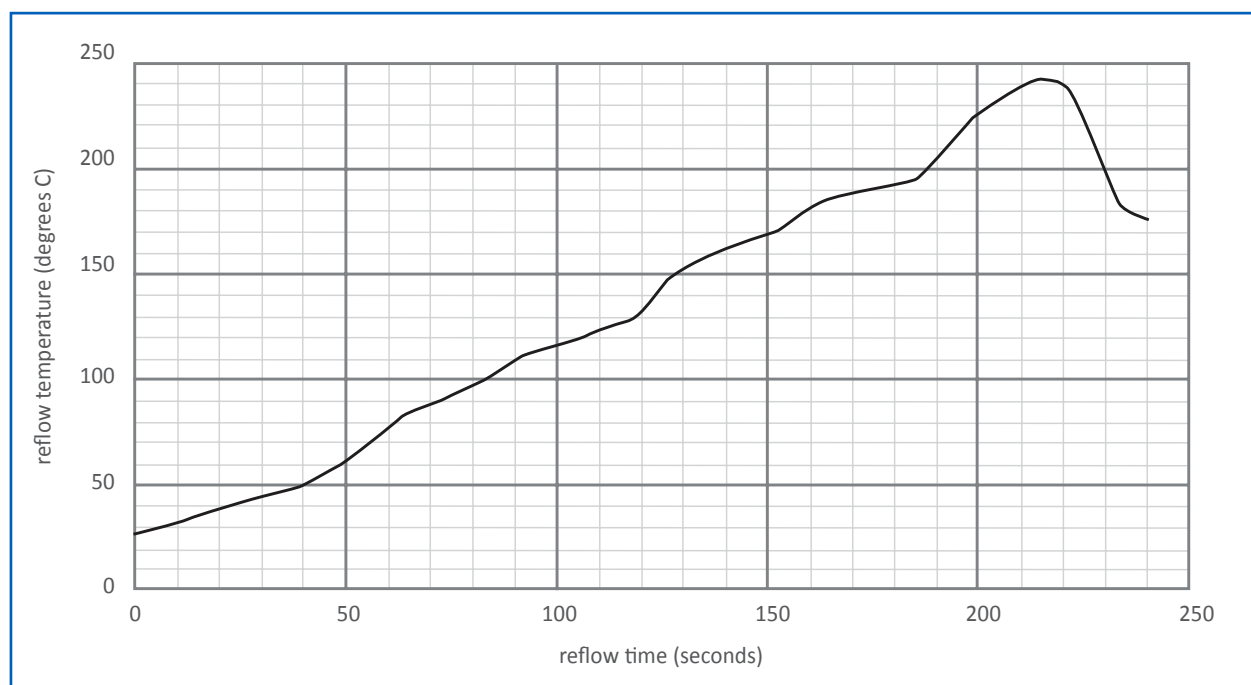
For more information on IntriCon products, visit www.intricon.com
or email hearinghealthsales@intricon.com

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