Data Logging
• Records average time per program and displays it in percentage of total hours and actual hours
• Records number of battery changes and estimates average battery life in hours
• Additional data logged: Average VC setting per program, user environment levels per program, usage log, and total hours used

Digital Random Noise Generator for Tinnitus Therapy
• Digital generation of random noise gives a clean noise sound for masking use
• Can be used in mixed-mode applications: one program for masking and another program for hearing instrument use

Digital Volume Control Compatible
• Two-pin digital VC port
• Start-up VC position is programmable
• Use push-button switches or a digital rotary control
• Analog VC mode also available

Autosave for Program and VC Position
• Active program and current VC position are saved to the Electrically Erasable Programmable Read-Only Memory (EEPROM) after program or VC change

Reflowable PCB Package

Product Features

Fourth-Generation Reliant™ Adaptive Feedback Cancelling
• Fast adapting speed means less squeaking, even when things move around the ear
• New aggressive setting to minimize feedback in the most challenging situations

Wind Noise Suppression
• Detection system quickly recognizes when wind is present
• Automatically suppresses wind noise while preserving speech

Sixteen-channel Wide Dynamic Range Compression with Dynamic Contrast Detection™
• Three-mode adaptive time constants to optimize Wide Dynamic Range Compression (WDRC) performance in critical environments
• Compression ratio and threshold are independently adjustable in each channel
• MPO compression limiting is independently adjustable in each channel

ACOUS-TAP™ Acoustic Push Switch
• IntriCon's patented acoustic switch changes programs when a user taps their ear and not the hearing instrument
• Eliminates the need for physical push button, saving size and cost

Layered Noise Reduction™
• A state-of-the-art solution to environmental noise reduction

Adaptive Directional Microphone Processing
• Automatically switches from Omni to Directional when the environment changes
• Eliminates the need for a dedicated ‘directional’ user program needing manual activation

Voice Indicators
• Voice prompts available for Start-up Program, Active Program, Min/Max Volume Control (VC) Position and Low Battery warning
• Choose from the IntriCon standard prompts or create and load your own custom prompts
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 (50dB), mid (55dB), high (60dB) and highest (65dB).

ACOUS-TAP Acoustic Push Button
The Audion 16 amplifier has the Acous-Tap acoustic push button option for program selection, designed for in the ear applications. In these applications, the hearing instrument wearer taps their ear with their hand to change programs. The tap generates a pressure wave which is detected by the amplifier and changes the programs. The switch functions in the same manner as a physical push button with regards to how it changes programs and the switch tones that are generated.

There are two mode settings for the Acous-Tap:
1) Single Tap — This is the simplest mode, requiring only one tap to activate the switch.
2) Double Tap — This mode requires the user to tap their ear twice to activate the switch. This mode is more resistant to false switches than the single tap.

There is also a sensitivity setting for the acoustic switch that compensates for the low frequency response of the microphone. The normal setting is for flat response mics and the high setting is for mics with low frequency roll-off.

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 telecoil switch (TSW) pad to GND. When the TSW pad is pulled to GND, the amplifier switches to program 6 and stays there until the TSW pad is open. The amplifier then reverts to the user program that was active just before the TSW was grounded. The ‘Auto Telecoil’ mode is enabled through software programming.

Autosave
The Autosave option enables the writing of Current Program and VC position to EEPROM. If the program switch is activated or the VC position changes, a flag is set telling the processor to save the value(s) 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
Sixteen band gain adjusters — equalizers — are available to precisely match fitting targets. Band 1 covers the frequency 250 Hz and below. Bands 2-15 are 500 Hz wide and go from 500 Hz to 7 kHz. Band 16 covers 7250 Hz to 8000 Hz. Each band has adjustable gain in 2 dB steps from 0 dB to -40 dB.

Customized Voice Prompts
Unique voice prompts can be recorded for each of the nine available prompts. These voice prompts can be language specific and can be loaded at the device level, so there is no need to stock a unique device. Load desired prompts before shipping to dispensing professional.

Data Logging
The data logging feature on Audion 16 stores information associated with the device usage: time per program, total usage time, daily usage, and average battery life. It will also track environmental levels and the amount of time spent in each level.

In-situ Tone Generator
The Audion 16 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 frequency 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 100 dB SPL, in 5 dB increments. The duration of the tone being generated is set by providing a count which sets the signal duration as follows: Count = Duration (sec) / .0005 sec. Count is an integer between 1 and 32767.

Example: Count needed to get 500ms beep is: .5s/0.0005s = 1000

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 options are 500 Hz, 1 kHz, 1.5 kHz, and 2 kHz. Seven loudness levels are available (70 to 100 db).

Input Low Cut Filter
The Input Low Cut Filter provides a 12 dB/octave smooth linear roll off below the corner frequency. Programmable corner frequency values are 250 Hz, 500 Hz, 750 Hz, 1 kHz, 1.25 kHz, 1.5 kHz, 2 kHz, 2.5 kHz, 3 kHz.

Input Modes
There are 14 selectable input modes. The first four modes are single input modes: Microphone 1, Microphone 2, Telecoil, 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. All 4 inputs are capacitive coupled, so there is no need for external coupling capacitors.

There are three fixed directional pattern modes and three adaptive directional pattern modes that use the signals from microphones connected to inputs Microphone 1 and Microphone 2.

• Fixed modes are: Fixed Cardioid, Fixed Supercardioid, Fixed Directional-Hypercardioid
• Adaptive modes are: Adaptive Cardioid, Adaptive Supercardioid, Adaptive Hypercardioid.

There is one input mode that enables the Digital Noise Generator source. The Digital Noise Generator may be used for tinnitus treatment.

Three summing input modes are available: (Microphone 1 + DAI), (Microphone 1 + TC), and (Microphone 1 + Noise Generator).

Layered Noise Reduction
Our Layered Noise Reduction (LNR) technology acts to remove noise between speech syllables, as well as lowering general background noise from the environment. The LNR function can be set to the following settings: Off, Low (7 dB), Medium (10 dB), High (13 dB), and Max (17 dB).
**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 1.1V. 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 1.05V, the amplifier will emit six sets of double beeps and shuts down 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 by programming.

**Low-Level Expansion**
Our new Low-Level Expansion feature works in conjunction with our LNR function to further reduce unwanted noise at lower levels. The low-level expansion threshold is fixed at 45 dB SPL.

**Manufacturer’s Data Area (Scratch-Pad Memory)**
Approximately 224 bytes of scratch pad space is available for storing manufacturer specific data. 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 each individual manufacturer’s hearing instruments. Intricon’s Motif engineering software 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 security key provided by Intricon. This prevents undesired changes to hearing instrument parameters.

**Overall Gain**
The overall gain parameter is adjustable in 1 dB steps, from 0 dB to -47 dB. Use this parameter to set the overall gain and then use the band gain adjusters to handle frequency shaping. The user volume control adjustment will reduce the gain downward starting at the setting of matrix gain. It is important to remember that some matrix gain values will be too high for certain applications and the fitting system should ensure that these high values are not available at fitting time.

**Output Filter**
The two output filters provide the flexibility to adjust the overall frequency response for all programs. There are 12 preset filters (6 High Pass filters and 6 Low Pass filters) and the option to create custom filters. The preset High Pass filter cutoff frequencies are 500 Hz, 1 kHz, 2 kHz, 3 kHz, 4 kHz, 5 kHz and 5 kHz. The preset Low Pass filter cutoff frequencies are 1 kHz, 2 kHz, 3 kHz, 4 kHz, 5 kHz and 6 kHz. Custom filter types are: High Pass, Low Pass, Peak, Notch, Low Shelf and High Shelf with adjustable frequency, Q and gain. The Q and gain adjustments are operational based on filter type selected.

**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 the sixteen compression channels, the MPO can be programmed to the settings of: Off, 0 dB, -2 dB, -4 dB, -6 dB, -8 dB, -10 dB, -12 dB, -14 dB, -16 dB, -18 dB, and -20 dB (relative to maximum output). The output limiter threshold will not be affected by the VC setting, since the limiter is placed right before the output stage and after the VC block.

**Preamp Digital Gain**
Each input also has an additional digital preamp gain control parameter that can be used to get more low noise front end gain. This can be used in applications using low sensitivity inputs, such as a passive telecoil (T-Coil) input. The digital gain can be adjusted from 0 dB to 18 dB, in 6 dB increments.

**Power-on Options**
Two parameters are available to control how the amplifier behaves during power-up. The Delay Until Normal Volume sets the length of time before the amplifier reaches full volume after the power is applied. It is programmable to values of None, 5, 10 and 15 seconds. The Initial Volume Level controls how loud the amplifier is after power is applied until the preset volume setting is reached. Parameter values are: Mute (-60 dB), -30 dB, -20 dB, -10 dB.

**Program Switch Indicator**
When the Program Switch Indicator feature is enabled, the amplifier will either emit a voice prompt or beeps every time the switch pad is connected to ground. If programmed for Tones, the number of beeps indicates the program number being switched into, i.e. when moving into Program 2, two beeps will be heard. If programmed for Voice, the voice prompt indicates the program being switched into, i.e. when moving into Program 2, the “Program 2” voice prompt will be heard. The frequency and level of the beep tones or voice prompts are programmed as set forth in the section ‘Indicator Adjustments.’

**Random Noise Generator**
The Audion 16 amplifier has an internal random noise generator that creates a flat spectrum, pseudo-random digital noise sequence. The Noise Generator can be set up as Input referred or Output referred. When set to Input referred, 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 to 65 dB SPL (input referred) in 5 dB increments. When set to output referred, the noise signal is injected at the output of the amplifier and is shaped using the noise filters. The two noise filters provide 12 preset filters (6 High Pass filters and 6 Low Pass filters) and the ability to create custom filters to shape the Noise Generator frequency response independently from the microphone frequency response. The preset High Pass filter cutoff frequencies are 500 Hz, 1 kHz, 2 kHz, 3 kHz, 4 kHz, and 5 kHz. The preset Low Pass filter cutoff frequencies are 1 kHz, 2 kHz, 3 kHz, 4 kHz, 5 kHz and 6 kHz. Custom filter types are: High Pass, Low Pass, Peak, Notch, Low Shelf and High Shelf with adjustable frequency, Q and gain. The Q and gain adjustments are operational based on filter type selected. Using the Input Selector parameter, the Noise Generator can be set up to operate in any of the user programs. For example, Program 1 could be set up with microphone 1 active as a hearing instrument program and Program 2 could be set up to activate the noise generator as a masking program.
Reliant Adaptive Feedback Canceller

Our fourth-generation Reliant Adaptive Feedback Canceller (AFC) takes the technology to a new level. By making the adaptation time faster, this unique adaptive filtering technology cancels feedback before it becomes bothersome, even in the most extreme situations. Advancements in feedback detection have also allowed better resistance to entrainment. Entrainment is the tendency of a feedback canceller to become confused by tonal sounds. This can cause false whistling and squeaks. The AFC is effective for feedback occurring in the frequency range of 750 Hz to 6750 Hz. The AFC can be programmed as enabled or disabled separately in each user program. There is also an additional setting to allow for a more aggressive Feedback management. This setting may add a small amount of distortion, but further reduces squeaks and whistling.

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 using IntriCon’s generic dynamic-linked library. 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.

User Program

Up to six programs are available by setting the value of the configuration parameter “number_of_programs.” Each of the user programs has a unique set of audio parameters. All of these parameters change when the user changes programs. The program change is accomplished by grounding the switch pad of the amplifier. There are three modes for this switch function: static mode, momentary mode and multifunction push button. The static mode only allows changes from Program 1 to Program 2 using a toggle switch. When the switch pad is grounded, Program 1 is active and when the switch pad is open, Program 2 is active. In the momentary mode, every time the switch pad is grounded, the user program is incremented until the top available program is active. The next time the switch pad needs to be grounded is longer, therefore the user push button control input required is a push and hold instead of just a press. The Multifunction Rocker is a shared user control (see section ‘Volume Control Function’ for additional functionality). Program voice prompts or switch tones will sound if enabled (see section ‘Program Switch Indicator’).

Note: Program 6 will adjust the ATC program when the Auto-Telecoil feature is activated.

Volume Control Function

A user VC can be connected to this amplifier and the function can be configured to match the application. The VC can be programmed to one of three digital modes (digital control, multifunction rocker and single push button VC), analog control or disabled.
Audion 16 Standard Hybrid Package
Part Number 93083-0009 — RoHS Compliant

Hybrid Schematic

NB1-2 are not real components, the net ties are devices to keep the nets separate until the proper location to join nets.

2.2uF 0201 replaces 1uF due to aging

Abbreviated Part Number
Date Code:
WW = week number
YY = year
XX = order number

93083-0009 HYBRID
Audion 16 Mini Hybrid Package
Part Number 93084-0009 — RoHS Compliant

Mini Hybrid Schematic

NTx are not real components, the net ties are devices to keep the nets separate until the proper location to join nets.

2.2uf 0201 replaces 1uF due to aging.

93084-0009 HYBRID
Wiring Schematic Showing Digital VC with Program Switch

- M+
- MIC1
- MIC2
- M-
- TC+
- TC-
- DAI

Wiring Schematic Showing Digital Scroller VC

- M+
- MIC1
- MIC2
- M-
- TC+
- TC-
- DAI

Digital VC (Sonion DCU Scroller or equivalent)
Programmer Wiring

Pin numbering of the DIN connector on the front of the Hi-Pro, as seen facing the Hi-Pro box

Programmer Wiring Diagram:
- Hi-Pro pin 1
- Hi-Pro pin 4
- Hi-Pro pin 2
- To VCC
- To SDA
- To GND
- Hi-Pro
- Amplifier

Technical Specifications

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