

# DAVID IV

## FM Audio Broadcast Processor

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### Installation & User Guide





**PRODUCT REGISTRATION RECORD**

Model 719 – Serial No. \_\_\_\_\_

Purchase Date \_\_\_\_\_

Warranty Registered? Mail Web

Reg. Date \_\_\_\_\_ By: \_\_\_\_\_

# Installation & Operation User Guide

## **DAVID IV**

Model 719

## FM Audio Broadcast Processor

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Software Rev. 3

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# Section I

## INTRODUCTION

### DAVID IV PRODUCT DESCRIPTION

The 719 is fourth in Inovonics' series of "DAVID" FM Broadcast Processor/Stereo Generators. DAVID, referring to David vs. Goliath, is an apt name for this series of airchain audio processors that consistently deliver giant-killing performance that belies the modest cost of ownership and simplicity of operation.

DAVIDs I through III made exclusive use of analog circuitry, but the DAVID IV moved into the digital realm as a DSP-based product. As such it more approximates an audio processing *engine* that is easily upgraded in the field as new processing algorithms are suggested, developed and released.

Rev. 3 brings new features and performance enhancements to the DAVID IV, with many firmware and software updates. Rev. 3 firmware and software are distributed without charge by Inovonics to upgrade existing units.

#### **Features**

Leading features of the Inovonics DAVID IV:

- A dual-slope "windowed" AGC automatically corrects wandering levels from the console or playout system, maintaining long-term consistency between diverse program sources without altering the intended tonal balance.
- 5 bands of dynamic range compression and equalization help create a 'sonic signature' tailored to the station's format and personality. A low-bass augmentation provision gives independent control over both the transient and the sustained program bass elements.
- Stereo-enhancement options address both the apparent width of the stereo image as well as solo (center channel) fullness.
- 'Look-ahead' final limiting includes Inovonics' proprietary PIPP™ limiter technology to assure optimum modulation efficiency.
- Flexible control over the r.m.s. power of the composite, multiplex output, conforming to the European ITU-R BS.412.9 Standard.
- Analog and digital inputs accept virtually any program audio feed.
- Dual composite/MPX outputs can feed main and backup transmitters; simultaneous analog and digital line out-

puts may be configured for FM, or for full-range digital broadcast requirements or Internet streaming.

- Optional “Diversity Delay” of the composite multiplex and FM-mode line outputs synchronize the analog FM signal with the digital program broadcast in the HD Radio™ System.
- Internal RDS subcarrier combining includes built-in metering to obviate the need for specialized monitoring equipment.
- Intuitive front-panel setup and full remote operation are afforded over any IP network. Provided software runs under Windows XP or later with easy PC backup of all DAVID IV settings.
- A built-in test-tone generator simplifies setup.
- Low latency allows off-air monitoring.
- The DAVID IV boots or resets *in less than one second* and draws only 8 watts from the AC mains.

## DAVID IV TECHNICAL SPECIFICATIONS

Some specifications of the DAVID IV are difficult to quantify in tabular form. Page numbers in parentheses here and elsewhere in the manual point to more-in-depth discussions.

### GENERAL PERFORMANCE

#### PLEASE NOTE:

- 1) The gain structure of an audio processing system is determined in large part by how the user sees fit to set numerous ‘subjective’ adjustments. In addition, various processing functions intentionally upset the tonal balance (static and dynamic frequency response) and the waveshape (‘native distortion’ inherent in all program material). Thus it has become customary to establish and publish performance specifications with audio processing features disabled or bypassed. Unless otherwise expressed or implied herein, this is the case with figures shown here, as indeed seems also the practice of our worthy competitors.
- 2) Measurements taken from the Composite/MPX outputs, or analog/digital line outputs in the FM mode, presume use of an appropriate de-emphasis network.

#### **Frequency Response:**

##### **Composite/MPX Output:**

±0.25dB, 20Hz-15kHz

##### **L/R Analog Line Outputs:**

±0.25dB, 20Hz-15kHz, FM mode;  
±0.25dB, 20Hz-20kHz, Flat mode.

##### **AES Digital Output (Digital Input):**

±0.25dB, 20Hz-15kHz, FM mode;  
±0.1dB, 20Hz-20kHz, Flat mode.

##### **Noise (unweighted r.m.s.):**

##### **Composite/MPX Output:**

SNR >85dB referred to full carrier modulation.

##### **L/R Analog Line Outputs:**

Residual noise better than 100dB below the output clipping point.

##### **AES Digital Output (Digital Input):**

Residual noise better than 130dB below 0dBFS.

##### **Distortion:**

##### **Composite/MPX Output:**

<0.01% THD

##### **Line Outputs (Digital or Analog):**

<0.006% THD

##### **Stereo Separation:**

##### **Composite/MPX Output:**

>65dB, 20Hz-15kHz assuming the use of a lab-quality FM-multiplex decoder.  
>78dB Linear Crosstalk (main/sub or sub/main).

##### **L/R Analog Line Outputs:**

>100dB at 1dB below the output clipping level.

**AES Digital Output (Digital Input):**

>130dB at 0dBFS

**Program Signal Latency**

≤3.6 milliseconds for composite/MPX;  
≤4.2 milliseconds from any input to  
any output in any operating mode.

**19kHz Stereo Pilot Protection:**

>65dB referred to 9% pilot injection.

**38kHz Suppression:**

>80dB referred to full carrier modulation.

**57kHz RDS Subcarrier Protection:**

>65dB referred to 5% RDS subcarrier injection.

**REAR-PANEL APPOINTMENTS****Digital Line Input:**

The AES3 stereo input (XLR) accepts 16- or 24-bit program sources at sampling rates of 32kHz, 44.1kHz, 48kHz and 96kHz. Input gain is adjustable for average program levels between -5dBFS and -35dBFS. (Page 12)

**Analog Line Inputs:**

L/R active balanced/bridging (XLR) inputs accept average program line levels between -15dBu and +15dBu. +26dBu peak input level. (Pages 12, 19)

**Digital Line Output:**

The AES3 (XLR) 24-bit stereo output may be adjusted between -20dBFS and 0dBFS, corresponding to full carrier modulation. The output sampling rate may be set to follow the Digital Line Input or forced to 32kHz, 44.1kHz, 48kHz or 96kHz. (Pages 13, 37)

**Analog Line Outputs:**

Active balanced (XLR) outputs are adjustable between -10dBu and +24dBu (+21.5dBm), corresponding to full carrier modulation; source impedance is 200 ohms. (Pages 13, 37)

**Line Output Characteristics:**

The Digital and Analog Line Outputs may each be configured independently for 20kHz flat response, or for 15kHz 'FM' characteristics, either with pre-emphasis or normalized to flat. (Pages 13, 38)

**Composite/MPX Output:**

Two unbalanced (BNC) outputs are independently adjustable between 0.8V p-p and 9V p-p (+12dBu), corresponding to 100% carrier modulation; source impedance is 75 ohms. Pre-emphasis may be set to 75µs, 50µs or OFF. (Pages 13, 40)

**RDS Input:**

Unbalanced/bridging (BNC) input accepts a 57kHz RDS subcarrier at any level between 0.5V p-p and 5.0V p-p for a typical injection level of 5% of total carrier modulation. (Pages 14, 41)

**19kHz RDS Sync:**

When RDS is enabled, the Sync Output (BNC) delivers a 5V p-p TTL-compatible square wave at the 19kHz pilot frequency; 75-ohm source. (Page 14)

**Network Port:**

An RJ45 jack accepts TCP/IP network connections for remote setup and operation of the DAVID IV. (Page 47)

**Headphone Jack (Front Panel):**

A quarter-inch (TRS) headphone jack allows the user to monitor the processed program audio. A volume control next to the jack adjusts the listening level.

**AUDIO PROCESSING FEATURES****Program High-Pass:**

A user-programmable high-pass filter attenuates sub-audible noise that could compromise modulation efficiency. The filter is adjustable between 20Hz and 65Hz. (Page 21)

**AGC:**

Unobtrusive, 'windowed' AGC is both peak- and average-responding with a capture/correction range of ±18dB. Positive AGC gain may be truncated to any value between +18dB and 0dB. The AGC window and correction rate are user-programmable. (Page 22)

**Stereo Enhancement:**

This dual-action utility effectively broadens the soundstage for the stereo program and the center-channel 'solo' component independently. (Page 23)

**5-Band 'Multipressor':**

Program audio is split into five frequency bands. Each user-adjustable band imparts parameter-programmable dynamic compression and adjustable static gain to afford both static and dynamic equalization 'signature' control over the program audio. (Page 24)

**Bass Augmentation:**

Sub-bass program frequencies undergo independent dynamic compression, expansion, selective clipping and filtering for control over both static 'Rumble' and dynamic 'Punch' of bottom-end components. (Page 29)

### **PIPP™ Peak Limiter:**

Inovonics' exclusive Polarity-Independent Peak Processor assures optimum modulation of the FM carrier or other transmission system. (Page 30)

### **ITU Multiplex Power Control:**

The Peak Limiter section may optionally be configured to control the r.m.s. power of the composite multiplex signal to meet European Standard ITU-R BS.412.9. (Page 33)

### **Adaptive Pre-Emphasis:**

User-defined HF limiting and/or distortion-cancelled clipping provide independent amplitude management of program frequencies subjected to the FM pre-emphasis curve. This helps preserve program brightness and clarity despite power bandwidth constraints native to FM broadcasting. (Page 34)

### **Composite Clipping:**

At the user's discretion, up to 3dB of clipping may be applied to the composite/baseband signal. Clipping is performed before the injection of the stereo pilot and RDS subcarrier. (Page 35)

### **HD Radio Delay (Optional):**

An optional plug-in circuit board allows the composite/MPX output of the DAVID IV to be delayed between 1ms and 9.999 seconds in 1ms increments, relative to the analog and digital program line outputs when they are set to the 20kHz (Flat) output mode. When set to the FM mode(s), the line outputs are subjected to the programmed delay as well. (Page 36)

## THE USER INTERFACE

### **Front-Panel:**

A front-panel graphic display and jog wheel allow easy, menu-guided *in-situ* setup and operation of the DAVID IV. LED-bar displays indicate in/out levels and audio processing action. (Page 16)

### **Software Control:**

The IP network port and supplied software allow remote setup and operation of the DAVID IV over a local network or the Internet using any Windows® PC (XP or later). (Page 54)

## MISCELLANEOUS

### **Test Tone Generator:**

20Hz - 20kHz, pre- or post-processing; 60dB attenuator. (Page 18)

### **AC Mains Requirements:**

105-130VAC or 210-255VAC, 50/60Hz; 8 watts.

### **Size:**

H: 1¾in/44mm, W: 19in/483mm, D: 13in/330mm (1U).

### **Weight:**

9lb/4kg (net), 12lbs/5.4kg (shipping).

### **Environmental:**

Continuous operation guaranteed at ambient temperatures between 32°F/0°C and 122°F/50°C; 0-95% relative humidity, non-condensing; altitudes to 10,000ft/3048m.

### **Conformances:**



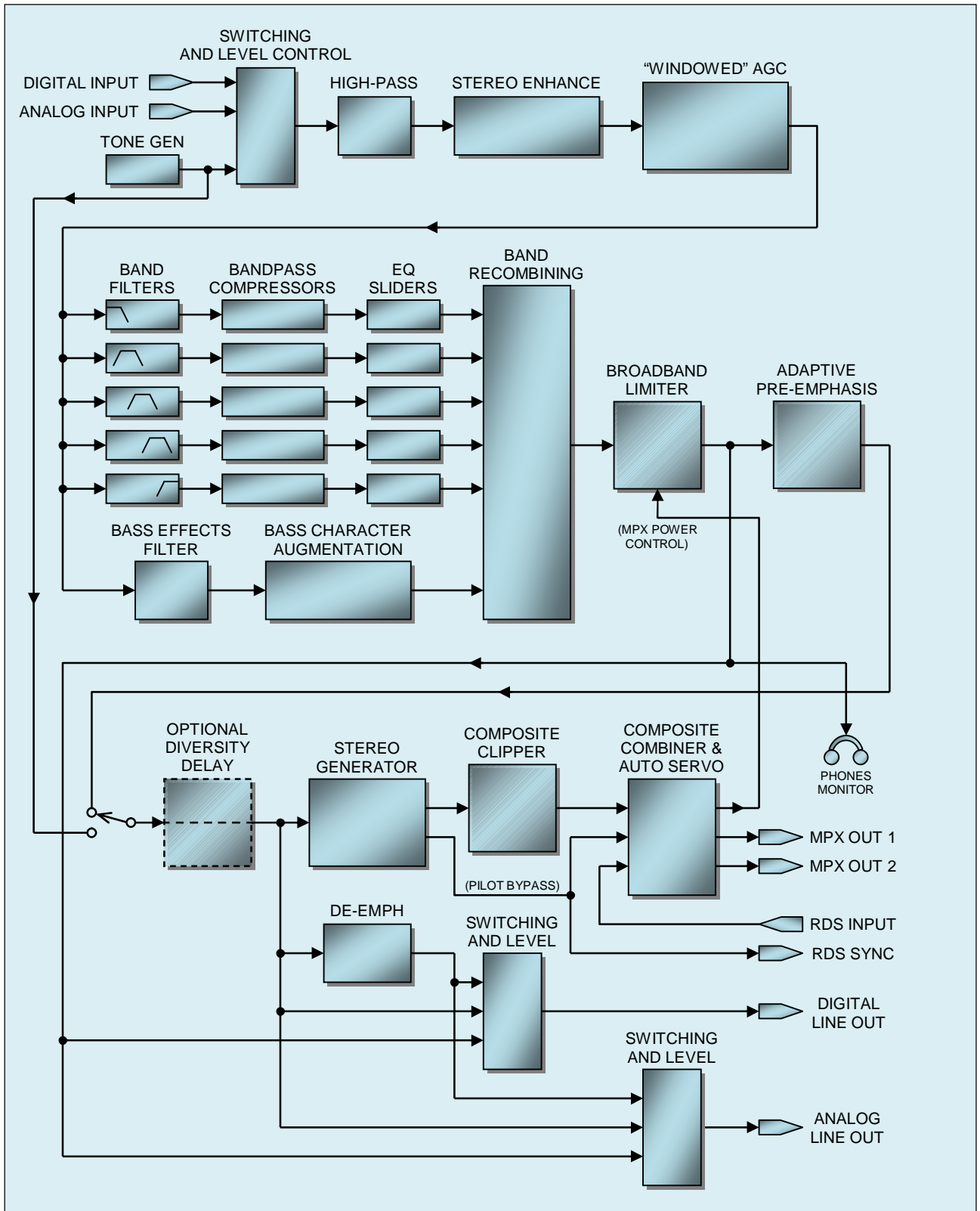
EN50081-1  
EN50082-1  
93/68/EEC



2002/95/EC

## BLOCK DIAGRAM

The DAVID IV is entirely DSP-based with virtually all its functionality provided through firmware coding. This Block Diagram, on the other hand, has been deliberately organized as if the DAVID IV were an *analog* processor. It is our expectation that this benign obfuscation will give the reader a more familiar and understandable functional representation of the product. This means of clarification does imply a good deal of 'literary license,' however, so do be advised that the illustration is not an accurate representation of the actual signal path. *"Sit emptor confundi!"*



DAVID IV Block Diagram

## Section II

# INSTALLATION

### GENERAL

This section of the manual addresses the physical installation of the DAVID IV in its operating location, the ‘nuts and bolts’ of connecting the unit, but it also references pages where pertinent adjustments are discussed.

#### **Menu Navigation**

Throughout the manual there are references to DAVID IV setup and adjustment using the front-panel graphic display, jog wheel and Back button. This is illustrated and described in further detail on Page 16. Basically, you *turn* the jog wheel to cycle among highlighted menu items, and then *push* the jog wheel to select the highlighted item for adjustment. The Back button returns you to the previous menu.

#### **Setup Using the Software**

Anything that can be done from the front panel may also be accomplished over a network from a remote location using a Windows® computer and the supplied software. Refer to Section IV (Page 47) for instructions on networking the DAVID IV.

### UNPACKING AND INSPECTION

As soon as the equipment is received, inspect carefully for any shipping damage. If damage is found or suspected, notify the carrier at once, and then contact Inovonics.

We recommend retaining the original shipping carton and packing materials for return or transshipment. If returned for Warranty repair, shipping damage sustained as a result of improper packing for return may invalidate the Warranty!

**IT IS IMPORTANT** to register the Warranty of your DAVID IV. This assures coverage of the equipment under terms of the Warranty, provides a means of tracing lost or stolen gear, and adds the user to a database to receive specific service instructions or software/firmware updates when issued. Register online at: [www.inovonicsbroadcast.com](http://www.inovonicsbroadcast.com).

*PLEASE NOTE:* Many users choose first to familiarize themselves with equipment on the bench or at their desk, in which case they may immediately turn to Section III that describes DAVID IV setup and use. Do please refer back to this section, however, to confirm proper physical installation and interconnection with other equipment.

## MOUNTING

- Rack Requirement** The DAVID IV mounts in a standard 19-inch equipment rack and requires only 1¾ inches (1U) of vertical rack space. We recommend using plastic or fiber washers to protect the painted finish around the mounting holes.
- Heat Dissipation** Consuming less power when it's running than many consumer products do when they are turned off, the DAVID IV itself generates negligible heat and thus has no noisy internal fan and associated filter to change. The unit is specified for operation within an ambient temperature range extending from freezing to 120°F/50°C. But because adjacent, un-green and less efficient equipments may themselves radiate substantial heat, be sure that the equipment rack is adequately ventilated to keep internal temperature below the specified maximum ambient.

## AC (MAINS) POWER

- Mains Voltage Selector** Unless specifically ordered for export shipment, the DAVID IV is set at the factory for operation from 115V, 50/60Hz AC mains.
- To change the mains voltage, first *disconnect the mains cord* and then remove the top cover of the unit. A clearly marked slide switch is directly behind the AC mains connector on the circuit board. Use a small screwdriver to set the switch for 115V or 230V operation.
- Mains Fuse** It is important to install the appropriate fuse as noted on the rear panel next to the fuseholder: ½A for 115V mains, ¼A for 230V operation. Fuses are the GMA/S500 type (5mm X 20mm size, 'fast blow').
- Power Cord** The detachable IEC-type power cord supplied with the DAVID IV is fitted with a North-American-standard male plug. If you need to replace the mains plug with another, you will find that the individual cord conductors are color-coded in one of two ways. US standards specify black for AC 'hot,' white for AC neutral and green for earth ground. European CEE standards specify brown for AC 'hot,' blue for AC neutral and green with a yellow stripe for earth ground. Please keep these straight.

## RADIO FREQUENCY INTERFERENCE (RFI)

- Location** Although it is expected that the DAVID IV may be co-located with FM transmitters, please practice care and common sense in locating the unit away from *abnormally* high RF fields.
- Ground Loops** Because the unbalanced RDS input and composite/MPX outputs of the DAVID IV are chassis-ground-referenced, a mains frequency or RF ground loop could be formed between cable

shield grounds and the AC power cord ground. A 'ground-lifting' AC adapter may well remedy such a situation, although the chassis must somehow be returned to earth ground for safety. Generally, being screwed-down in the equipment rack will satisfy the safety requirement.

## PROGRAM LINE INPUTS

**AES Digital Input** The female XLR connector labeled AES DIGITAL INPUT is a balanced, transformer-coupled digital stereo program input conforming to the AES3 (AES/EBU) specification. This input accepts digital audio signals up to 24 bits in word length, and at sampling rates of 32kHz, 44.1kHz, 48kHz and 96kHz. The on-board sampling rate converter (SRC) locks onto the input signal automatically and gives a display of the data rate in the Setup / Sample Rate Converter menu (Page 39).

The digital input will accept average program levels between -5dBFS and -35dBFS, presupposing a nominal, "zero-VU" average level close to -20dBFS. Gain is programmed under the Setup / Audio Input / Digital Gain menu (Page 19).

**Analog Line Inputs** The DAVID IV has electronically-balanced (transformerless) left- and right-channel ANALOG INPUTS with female XLR connectors. These are bridging, high-impedance inputs. They do not provide termination for the console or other equipment that feeds the DAVID IV. Here's why.

With few exceptions, audio line impedance matching is ridiculed by today's hip broadcasters (you) and erudite equipment manufacturers (us). The concept of 600-ohm "line matching" dates from the age of transformer-coupled telephone transmission lines and the necessity of optimizing telephony 'return loss' performance.

The analog line inputs accept "zero-VU" program levels between -15dBu and +15dBu. The input gain is adjusted under the Setup / Audio Input / Analog Gain menu (Page 19).

**Unbalanced Operation** It's not uncommon for "Part 15" as well as blatant pirate broadcasters to include consumer audio products in their installations. Also, there may be a legitimate reason to feed the DAVID IV directly from a CD or MP3 player or a computer sound card in a 'professional emergency'. Sufficient gain has been included to interface with single-ended inputs in the -10dBv, consumer-level range.

For unbalanced inputs, the single center conductor of the shielded lead should be connected to Pin 2 of the XLR plug, and the shield braid split and connected both to Pin 1 and to Pin 3.



## PROGRAM LINE OUTPUTS

DAVID IV digital and analog line outputs are available simultaneously and may independently be adjusted in level and assigned the characteristic selected in the Setup / Audio Output menu (Page 37).

Line outputs may individually be set for a 20kHz flat characteristic for digital radio, streaming, or other flat-power-bandwidth applications. Alternatively, an FM mode is included for feeding an FM exciter that has a built-in stereo generator, in which case the outputs may assume a pre-emphasized or a normalized (flat) frequency characteristic. Both FM options have full benefit of independent HF limiting to protect the pre-emphasis curve.

### **AES Digital Line Output**

The male XLR connector labeled AES DIGITAL OUTPUT is a balanced, transformer-coupled digital stereo program output conforming to the AES3 (AES/EBU) specification. This is a 24-bit output at a sampling rate that may be set to 32kHz, 44.1kHz, 48kHz or 96kHz. Sampling rate selection is made under the Setup / Sample Rate Converter menu (Page 35). The output sampling rate may also be locked to the input sampling rate when the DAVID IV is fed from a digital program source.

The digital output level shown below the slider control corresponds to program peaks that have been limited to 100% modulation. The output level may be adjusted between 0dBFS (digital full-scale) and -20dBFS.

### **Analog Line Outputs**

Male XLR left- and right-channel ANALOG OUTPUTS on the rear panel are electronically-balanced. This means that they are ground-referenced and are *not* transformer-coupled.

Analog line outputs may be adjusted to any level between -10dBu and +24dBu. The dBu levels shown below the slider control represent the *unloaded* output level for 100%-modulation peaks. The outputs have a resistive source impedance of 200 ohms; that is, there is a 100-ohm 'buildout' resistor in each leg. When feeding a 600-ohm load, the actual dBm level will be 2.5dB below the Analog Level shown under the slider.

### **Unbalanced Operation**

Should you have need to connect the analog line outputs of the DAVID IV to consumer-grade, unbalanced inputs, connect the center conductor of the shielded output lead to Pin 2 of the XLR connector, and the shield to Pin 1. Leave Pin 3 floating (unconnected). Be aware that the actual line level will be 6dB lower than the Analog Level shown in the Setup / Audio Output menu as only one side of the bridge-configuration output amplifier is driving the line.

## COMPOSITE / MPX OUTPUTS

There are two independent composite/MPX outputs on the rear panel of the DAVID IV. These are unbalanced BNC connectors, not surprisingly labeled MPX OUT 1 and MPX OUT 2. Their source impedance is a resistive 75 ohms.

The level of the multiplex signal at each output is independently adjusted under the Setup / Stereo Generator / Multiplex Output menu (Page 37). The level in open-circuit peak-to-peak volts is indicated in the menu, and can be adjusted between 0.8V p-p and 9V p-p (+12dBu), corresponding to program peak modulation.

## RDS COMBINING PROVISION

- |                          |   |
|--------------------------|---|
| <b>19kHz Sync Output</b> | The 19kHz SYNC BNC connector gives a TTL-compatible square-wave output at the 19kHz stereo pilot frequency when RDS combining is enabled. This is a 5V p-p square wave with a 50% duty cycle, in-phase with the stereo pilot component of the FM multiplex signal. This waveform may be used to synchronize an RDS (Radio Data System) encoder with the stereo pilot.   |
| <b>RDS Input</b>         | The RDS INPUT BNC connector accepts the 57kHz RDS subcarrier for combining with the FM multiplex program signal. The p-p level of the subcarrier can range from 0.5V to 5V, corresponding to a typical injection level that's approximately 5% of total carrier deviation.  |
| <b>Internal Metering</b> | The DAVID IV has an accurate and helpful internal metering utility for adjusting the RDS subcarrier injection. The actual injection level is shown directly as a percentage of total carrier modulation under the Setup / Stereo Generator / RDS Input menu (Page 41). This is very useful during installation of the RDS encoder, especially when a modulation monitor that displays actual RDS subcarrier injection is not available. |

## Section III

# SETUP AND OPERATION

This section of the manual takes the user through the steps of getting the DAVID IV into operation and discusses certain implications of the many audio processing adjustments. Please refer back to the previous section for information on the physical interconnection of the unit with other station equipment.

This section addresses the various subsections of the DAVID IV in the general signal-path order indicated by the Block Diagram, on Page 9. As stated on Page 8, the Block Diagram does not necessarily reflect the actual signal path or even the order of audio processing stages. Rather, it's an *analog* representation of audio processing stages operating in an all-digital domain.

Instructions in this section cover DAVID IV setup using the front-panel graphic display screen and jog wheel. This may as easily be accomplished over a network connection using a Windows® PC and the supplied software, which duplicates the front-panel menus and readouts. Networking the DAVID IV is covered in Section IV (Page 47), and software operation in Section V (Page 54). We recommend starting with front-panel setup, however, as this method not only gives the immediate gratification of a hands-on experience, but is necessary in any event for initiating network connectivity.

### USER ADJUSTMENT GROUPINGS

User adjustments for DAVID IV operation are divided into two primary groups:

**Setup  
Adjustments**

*Setup* adjustments are those performed when the unit is placed into service and then largely ignored afterward. These include input and output gains and levels, networking and security settings. These adjustments are relevant to the specific installation and should be considered the dominion of the engineering staff.

**Processing  
Adjustments**

*Processing* adjustments, on the other hand, determine how the station sounds, as opposed to the technical considerations of modulation, subcarrier injection, etc. Responsibility over this area probably has to be shared with the Program Director or station management, persons of unassailable wisdom and character who might defer to their 'artistic license' in making adjustment decisions.

There is, of course, some interaction between the two general groupings of DAVID IV adjustments. The processing sections depend on proper levels at the input, and output levels will be ambiguous unless the processing has been set up properly. Keep this in mind through the following guide, as it is arranged more-or-less in signal-path order.

**Backing-up Settings**

All setup adjustments, as well as factory and user processing presets in DAVID IV memory at the time, may be backed up as *Profiles* using the provided software (Page 60).

Also, just the user processing *Presets* may be individually saved as small files, handy for sharing between stations in a group that want to sound the same while maintaining each station's unique setup adjustments (Page 61).

**“QUICK START TECHNOLOGY”**

**‘Instant Boot’**

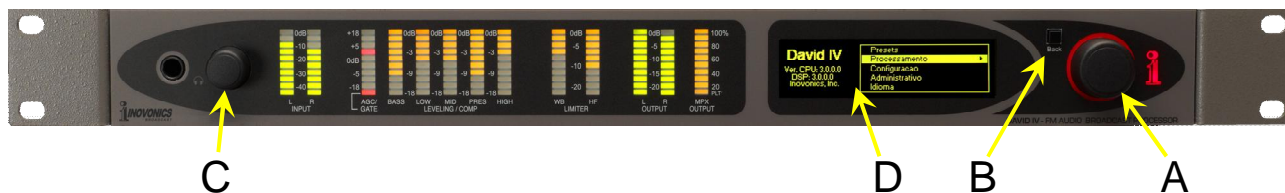
‘Boot’ (startup) time of DAVID IV is less than one second. When AC power is first applied, or after any momentary power interruption, the unit is back in full operation almost immediately. Setup and processing parameters in use previous to the power interruption are reloaded instantly from non-volatile memory to the processing core.

**Brownout Detection**

Although the DAVID IV power supply and digital logic circuits will operate at AC mains voltages down to about 50% of nominal, the graphic display and LED readouts would fail to give consistent indications at very low mains voltages. A ‘brownout’ detector reboots the unit at a mains voltage somewhat below the “low line” value given in the product specification.

**NAVIGATING THE MENUS**

Setup values and processing adjustments of the DAVID IV are firmware-controlled. There are no jumpers, switches or mechanical potentiometers, only the front-panel jog wheel A, Back button B, and headphone volume control C identified in the illustration here.



**Graphic Display**

The graphic display screen D presents the intuitive setup menu tree in an easy-to-read format. The display uses a screen saver, so when the screen goes completely dark, simply push the jog wheel or Back button once to bring it back to life. No selection or change is made with this ‘wake-up call.’

### Jog Wheel and Back Button

Turn the jog wheel to cycle among highlighted menu items, and then *push* the jog wheel to select or adjust the highlighted item. The Back button returns you to the previous menu. Push the Back button repeatedly to return to the Main Screen.

In all setup instructions given here, the menus will be shown as a string of commands. As an example, starting at the Main Screen: Setup / Stereo Generator / RDS Input / RDS Injection would direct you to do the following:

- 1) *turn* the jog wheel so that Setup is highlighted;
- 2) *push* the jog wheel to enter the setup menu;
- 3) *turn* the jog wheel to highlight Stereo Generator;
- 4) *push* the jog wheel to enter the stereo-gen sub-menu;
- 5) *turn* the jog wheel to select RDS Input;
- 6) *push* again to access to the RDS sub-menu;
- 7) *turn* the jog wheel to position the brackets over the RDS Input Level adjustment 'slider';
- 8) *push* the jog wheel to enable the slider;
- 9) *turn* the jog wheel to dial-in the desired injection.

If you make a mistake (for example, you might *push* the jog wheel off-center, which could also rotate it and bring up the wrong menu), simply push the Back button to return to the previous menu and try again.

### Menu Timeout and Screensaver

Once an adjustment is made, you may press the Back button to eventually return to the Main Screen, or simply leave any current screen showing. After 30 seconds, the current screen will 'deselect,' meaning that the jog wheel won't accept an adjustment command without that command once again being selected.

After another couple of minutes the screen will go dark. This screen-saving feature prolongs the life of the OLED graphic display. At any time, however you can press the jog wheel or Back button to bring the dark screen to life and display the last menu accessed.

## LANGUAGES

The front-panel menu screens and the computer software screens both may be shown in English, Spanish or Portuguese. From the default English-language Main Screen select Language. Turn the jog wheel to position the brackets and *push* to check the box appropriate to your language selection.



## INTERNAL TONE GENERATOR

A built-in test tone generator (audio oscillator) may prove helpful in setting up the DAVID IV, or in verifying overall system performance. Navigate to: Setup / Oscillator.



### Pre and Post Modes

Off is the default selection for normal operation of the DAVID IV. For testing, tones may be applied ahead of the processing stages:  Pre, or following all processing:  Post. *Turn* the jog wheel to position the brackets, and then *press* the jog wheel to make the selection.

The test tone is a monaural source applied to both the left and right channels. Frequency may be varied between 20Hz and 20kHz in 10Hz steps, and the Level of the test tone may be set in 1dB steps between -60dBFS and 0dBFS.

Program Frequency and Level by *turning* the jog wheel to set the brackets around the Frequency or Level slider, then *push* the jog wheel to enable that slider so that you can then *turn* the jog wheel to dial-in the desired frequency or level. Frequency programming has 'ballistic acceleration,' meaning that the faster you turn the jog wheel the more steps you get per revolution.

### A Brief Note on DAVID IV Gain Structure

A -20dB, 400Hz test tone applied at the *input* to the processing stages:  Pre will bring the AGC to 0dB (unity) gain. -20dB is the nominal internal "zero-VU" reference level at this point and refers to the program's *average* level.

Gain associated with normal processing action is expected to drive the processor to full 0dB or 100%-modulation output. Thus when this same -20dB tone is applied *after* processing:  Post, it drives the composite/MPX output only to the 10% point on the MPX OUTPUT meter, and to -20dB on the L and R OUTPUT meters. Readjust Level to reach a desired output condition.

## SELECTING THE INPUT

The DAVID IV has both an AES (stereo) digital input and individual left/right analog inputs. Either set can serve as the program input to the unit. Characteristics of these inputs are discussed in the Specifications (Page 7) and in Section II (Page 12).

Navigate to: Setup / Audio Input:



Turn the jog wheel to position the brackets around either the  Digital or the  Analog audio input, and then *press* the jog wheel to confirm and save the selection.

## SETTING INPUT GAIN

### Importance of AGC Action

The DAVID IV has an intelligent dual-slope ‘windowed’ AGC (Automatic Gain Control) to gain-ride the program input signal. AGC has a capture range of  $\pm 18\text{dB}$ , meaning that the input signal can wander aimlessly over this  $36\text{dB}$  range and be automatically corrected to the proper level. AGC gain is shown by a front-panel LED bargraph.

AGC has been designed for symmetrical correction around a resting-point of  $0\text{dB}$  or unity gain. It will bring up lower levels and pull down higher ones at the selected correction rate. AGC action is ‘gated’ to freeze the gain when the program pauses, returning it to the  $0\text{dB}$  resting point during extended periods of silence. The front-panel GATE indicator glows when the gate is ‘open’; that is, when the AGC is active.

AGC is considered a processing parameter of the DAVID IV, but one that, by design, does not make an audible contribution to the station’s “signature sound.” The sole purpose of the AGC is to normalize levels ahead of the other processing stages without adding coloration. This is possible only with a wideband AGC, which should always be the first stage in any comprehensive audio processing system. “Multiband AGC” is a misnomer. Long-term *leveling* in individual frequency ranges may have utility in some instances, but this amounts to spectrum-shaping. Using multiband AGC to normalize levels from diverse sources or to correct for sloppy operators is analogous to turning the listening volume in your living room up and down using the individual sliders of a graphic equalizer.

The DAVID IV AGC delivers a uniform program signal to subsequent processing stages. AGC gain is based on both the peak and average energy values of the program content. Regardless of changes you might want to make in AGC operation for a specific need (this will be addressed later), check that the AGC is set to factory defaults during setup of input levels. Navigate to: Processing / AGC to confirm that the AGC is  Active with a Cor-

rection Rate of 1.75 (dB/sec), (Max) Gain of +18.0 (dB), and a Window setting of 6dB ( $\pm 3$ dB) as shown here:



### Using Test Tones... or Not

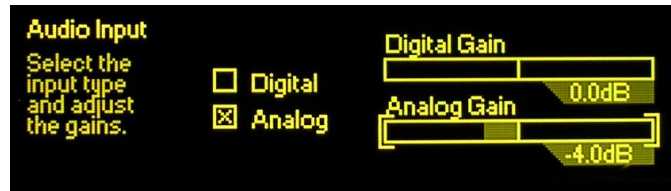
Although a “zero-VU” test tone may certainly be used during DAVID IV setup, input gain is most accurately set with actual program material. Here’s why.

Audio levels are typically measured and monitored in any of several different manners. The traditional US mechanical “VU” meter and the European “PPM” (Peak Programme Meter) each adhere to audio industry measurement standards based on exhaustive studies. But there are many knock-offs and alternative level-indicating gizmos as well, few of which have traceability to any recognized standard. Substandard meters may have floppy mechanical movements or take the form of flashy LED and other bargraph readouts, or they can be fancy and colorful computer screen displays.

But compliant or not, all these devices have their own response to, and provide their own representation of, program peak and average levels. What’s more, board operators lend their individual interpretations to what they see, assuming that they are even paying attention to meters in the first place.

### Adjusting Input Gain

Return to the Setup / Audio Input menu:



Next, *turn* the jog wheel to position the brackets around the Digital Gain or Analog Gain slider, whichever is appropriate to the input you have selected. *Push* the jog wheel to enable that slider so that you can then *turn* the jog wheel to dial-in the required gain.

With program material playing, adjust Digital Gain or Analog Gain so that the front-panel AGC gain indicator (the AGC/GATE LED bargraph) hovers around 0dB most of the time. This will show that AGC action is more or less centered and working in its ‘sweet spot.’

The DAVID IV AGC is a gain-riding function with a dual correction rate. Don’t rush this step as there will be some delay before the AGC meter settles-down each time the slider is adjusted.



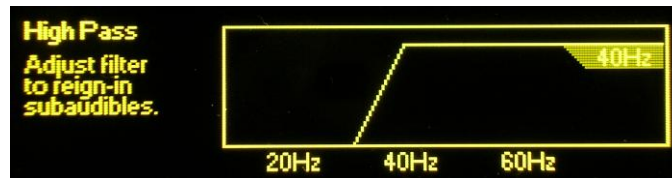
There will, of course, be a range over which the AGC wanders; it is not realistic to expect the indicator to hover right at the 0dB mark all the time. But the indicator should spend about as much time above 0dB as it does below.

The dB gain numbers shown below each input gain slider are somewhat arbitrary, but have been scaled so that 0dB equates to the program *average* level at nominal studio line level figures. This might be +4dBu for analog inputs or -20dBFS for digital feeds. For example, a well-tempered +4dBm program line would suggest an Analog Gain setting of -4.0dB, and digital program levels with a typical headroom allowance of 20dB (relative to 0dBFS) would need a Digital Gain figure of 0dB. Again, the scaling holds true more for actual program material than for steady-state tones.

## THE HIGH-PASS FILTER

The DAVID IV is equipped with a steep high-pass filter to lessen the modulation-robbing effects of unwanted subaudible program audio components. The term ‘unwanted’ is the keyword here, as “mega-bass” seems a mandatory part of any car audio installation, and a “big bottom-end” characterizes the sonic signature or nearly all contemporary music stations.

Navigate to: Processing / High Pass Filter:



Once you have arrived at this menu *push* the jog wheel to enter the adjustment mode. Then as you *turn* the jog wheel the screen animation will illustrate filter action.

This filter is a 4<sup>th</sup> order (24dB/octave) high-pass, which may be set for a turnover frequency (-0.15dB point in this case) between 20Hz and 65Hz. The factory default is 20Hz, which is probably a valid setting for any music format, unless you have severe turntable rumble (say, what?), noisy studio air conditioning, do a lot of outdoor sports remotes in windy stadiums or have creditors pounding on the front door.

This high-pass function has been included in the DAVID IV design to define a low-frequency limit to the station airchain. But the use of this high-pass filter should generally be considered a Band-Aid<sup>®</sup> fix for problems that are best addressed at their source.

## OPTIMIZING “WINDOWED” AGC ACTION

Access the AGC screen and its adjustments with: Processing / AGC:



Before setting the DAVID IV input gain under the previous sub-heading, the AGC was confirmed at the factory default setting; that is, AGC enabled over its entire  $\pm 18\text{dB}$  correction range with mid-values for correction rate and ‘windowing.’ Actually, these settings should work pretty well for nearly any broadcast format, but there may be instances where they might want to be changed.

### Defeating the AGC

Turning the AGC off:  Bypass is never a good idea in everyday operation. The AGC presents downstream processing stages with an input signal that is optimized for further processing. AGC has been carefully engineered for intelligent response to program material, taking into account both the peak and average values of the audio signal. The only justification for turning AGC off is for test purposes, or if the user is 100% confident that the board operator is diligent in riding the gain manually (fat chance!). Even in the latter instance, trust the AGC to know best what the downstream processing stages want to see.

### AGC Maximum Gain

Classical music and jazz are two genres that often have wide level variations that beg to be preserved. *Pianissimo* classical passages and a standup-bass solo are two examples. In these instances, a normal configuration of the AGC stage would slowly bring up these passages to the 100%-modulation point, which would not sound right at all.

The Gain slider is generally kept at +18.0 (dB) for full AGC action. If you want to limit the amount of *positive* gain that the AGC can impart to the program input, this slider can be adjusted anywhere between +18.0 and 0.0. This does not change the static, ‘resting’ gain of the AGC section, nor does it limit the amount of negative gain that the AGC can introduce for inputs that are too loud. Gain only limits how far the AGC can bring up low-level material. Experiment with Gain settings for formats that call for a wider dynamic range.

### ‘Windowing’ and the AGC Correction Rate

The DAVID IV has a ‘windowed’ AGC with one correction rate when AGC gain is close to the target value and a faster, ‘makeup’ rate when the incoming program level shifts abruptly.

The AGC Window may be set to any dB figure between 0 (no window) and 12, which in actuality is  $\pm 6\text{dB}$ . This means, for example, with the window set for 8, if the input signal wanders only  $\pm 4\text{dB}$  or less from where it is right now, correction is a

very unobtrusive 0.5dB/second. However, if the input signal suddenly blasts or takes a big dive, the correction rate then increases to whatever figure has been set by the Rate slider... say 2dB/second, which is four times faster. If the Window slider is set to 0, the windowing function is essentially defeated, and all AGC action will be at the speed set by the Rate slider. Rate is adjustable between 0.50 (dB/second), which is quite slow, to 3.00 (dB/second), which is pretty darn quick.

With Gain fixed at 0, a Window setting of 0 and a Rate setting of 0.50 might prove a proper choice for a classical music format where extended *pianissimo* passages want to remain below *mezzo-piano* ones, *forte* passages then calling for a modicum of compression.

Alternatively, AGC could be turned completely off in such a case:  Bypass, assuming that the classical Boss-Jock knows the music like the back of his hand and can make judicious artistic manual corrections on the fly, watching his meters with nary a blink.

A fast rate with a mid-value window might be just the ticket in an aggressive pop-music format. Even with this setting, AGC in the DAVID IV shouldn't alter the perceived dynamics of the program, although it will definitely erase long-term level variations in a hurry.

Some settings might allow AGC action to be audible in speech, during a talk-show segment for example, but not during musical programming. You might want to experiment with various AGC rates using program material representative of your format. The default settings have proven to work quite well in most situations.

## STEREO ENHANCEMENT

The DAVID IV has a twin-action stereo enhancer. Navigate to the Processing / Stereo Enhance menu:



The Stereo Enhance menu has check boxes to turn the enhancement effects on and off, plus two sliders that graphically depict the expected action of this feature.

### Stereo Width

The Stereo Width slider increases the perceived width of the soundstage, the area between the listener's left and right loudspeakers. Increasing Stereo Width makes the stereo 'wider,' exaggerating the stereo effect even to the point of its appearing to extend outside the confines of the normal soundstage; that

is, to the left of the left speaker and to the right of the right one.

As the control is advanced, the graphic display will highlight an area outside the normal soundstage as shown here. The shaded area, as well as the number shown below it, is somewhat arbitrary, serving only to illustrate what's intended and to give a number for set-up reference.



Stereo Width is active only on stereophonic program material, it does not imply any sort of stereo synthesis from a monaural source.

**Solo Width** The Solo Width slider, on the other hand, acts only on center-channel (monaural) material.

Nearly all contemporary music is recorded in very sterile multi-track sessions. Generally, each instrument has its own microphone (or several!) and is recorded as an individual monaural track. The recording engineer, under the expert guidance of the session's Producer, uses a 'pan pot' to place each track somewhere between full-left and full-right, essentially creating a pseudo-stereophonic soundstage, or sound field. Vocal solos are almost always panned dead-center, just like the talent mic in the radio studio.

As Solo Width processing is introduced and increased, the centered vocalist (and on-air talent) will appear to 'spread' across the soundstage. This is illustrated on the graphic display as shown here. Just like the Stereo Width control, the shaded area and number are arbitrary and relative.



Use this enhancement technique with some caution. A hawker of memory-foam mattresses who seems to fill the listener's automobile may be a bit intimidating to driver and passengers alike!

Stereo enhancement effects are frequently subtle, depending in large part on characteristics of the program source. In making these adjustments, alternate between  Active and  Bypass to judge the action more clearly than simply moving the sliders back and forth.

## THE FIVE-BAND 'MULTIPRESSOR'

The heart of DAVID IV's dynamics processing is the 5-band Multipressor (Multiband Compressor). This processing block divides the program audio into five discrete frequency bands, with nominal crossovers and filter slopes optimized for each range of frequencies. Each band undergoes dynamic range

compression, with the threshold, waveform response and transfer function engineered for the most effective action within each band.

Optimum Multipressor parameter settings were derived from exhaustive tests by a core of listeners comprising both technical and non-technical types, including those with extensive musical training. Many of these parameters are fixed, as providing user control over the thousands of parameter permutations would make setup a veritable nightmare... not the objective of this product. Some parameters, those that most readily define 'sonic signature,' have been made available for user adjustment over a reasonable range.

### Compressor Drive

Navigate to: Processing / Compression / Drive:



There are two adjustments in this menu. Master Drive varies the total signal level going into the DAVID IV compression section. The setting of this control determines how hard the compressor will work, overall, and to a large extent how 'busy' or dense the program will sound.

Master Drive has been given a very wide range. At the minimum setting of 0.0dB, even program material with very wide dynamics will not even 'tickle' the compressors, with no indication of gain reduction, or G/R, in any band as shown on the LEVELING/COMP bargraph readouts. Advanced all the way to 30.0dB, all five bands will probably be dancing down close to the bottom of the bargraph displays.

A proper setting for this control will probably be somewhere close to the center of this control range. The factory *default* is +17.0dB, although individual factory *presets* will have varying values for specific formats. Generally, a lower setting is called for with classical, jazz and 'easy-listening' formats, and a more aggressive setting for pop, rock and heavy-metal.

### Spectral Loading

The greatest audible effect of multiband processing is realized when each band operates independently of the others. Of course there is some duplicity at the band crossover frequencies, but fully independent operation of each band will increase 'spectral density.' This means that it will tend to maximize the energy at all frequencies, even if the incoming program material has a 'peaky' (varied) spectral profile. We have named this effect *Spectral Loading*.

A good way to picture this is to imagine the input program profile as seen on a real-time audio analyzer, or RTA, which shows the audio energy at specific frequency intervals across the au-

dible spectrum. Solo voices and instruments will have high energy levels at their fundamental frequencies, whereas a band or orchestra will have a broader spectral profile with energy spread over a wide range of frequencies.

Spectral Loading brings down the energy where it is the highest, and increases low energy at other frequencies. As displayed on the RTA, the shape of the audio spectrum will be flatter and the sound of the program will appear 'busier.' Spectral Loading will also impart 'brightness' to the sound, as the level of high frequencies, which generally contain lower total energy, will be brought up.

### Band Coupling

One element of control over the sonic signature of a station is to establish the degree to which multiband processing is used. Fully independent operation of the bands will create an artificially busy and bright sound that may not reflect the desired signature goal.

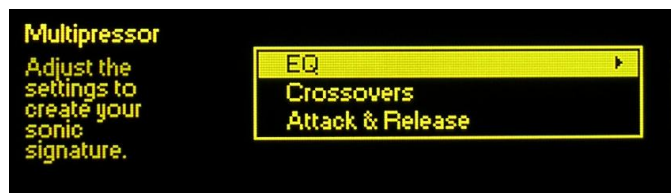
The DAVID IV allows the user to proportionally 'link' the five bands, allowing the unit to serve as a compressor that's effectively variable between five bands and one band.

Full linking does not actually turn the DAVID IV into a single-band unit, however, as each band is still able to respond independently to program *peak* energy within that band's range. Rather, the amount of *average* compression in bands 2, 3 and 4 is integrated over time and used as a 'platform' release value for all five bands. Band 1 is excluded in the integration, as there is generally a lot of bass energy in modern music, which should not be allowed to reduce the gain of other bands.

The ◀Linked Indep.▶ slider on the Compressor Drive menu gives eleven levels of band coupling, from 0 (fully linked) to 10 (fully independent). The factory-default value is 5, midway between the extremes, although factory-defined processing *presets* will have varied settings. Use your ears with this slider to determine how 'busy' you want the audio to sound.

## PROGRAM EQUALIZATION

Not surprisingly, the 5-band Multipressor is the basis for a 5-band graphic equalizer. This gives static equalization control over the program's spectral shape. Open the Processing / Compression / Multipressor menu, which will display this sub-menu.



Highlight and select EQ. This gives access to five EQ sliders:



### The 5 Bands Defined

The five DAVID IV bands are labeled: Bass, Low, Mid, Pres and High. Although we have afforded some user adjustment over crossover frequencies (described later), bands have these nominal boundaries:

- Bass The really deep bass frequencies that are generally lost without a good subwoofer.
- Low This range would be perceived as ‘bass’ on radios with puny speakers. It covers a range that includes male voices. Excessive energy in this band tends to make the program sound ‘tubby’ or ‘muddy.’
- Mid This is the ‘articulation’ region, pretty much smack-dab in the center of the audible range. Female vocals and the ‘melody’ in music reside here.
- Pres ‘Presence’ frequencies are responsible for brightness, aliveness, immediacy and closeness, the effect that the program source is live and up-front.
- High Frequencies above the presence range contribute to the quality of ‘sparkle,’ ‘tinkle’ and ‘air’ in the program audio.

Not surprisingly these are the same bands used for multiband compression. The EQ sliders are simply level controls in the outputs of the five bands where the spectrum is recombined. Use these EQ sliders to craft the general shape of the station’s sonic signature. You’ve got to use your ears for adjusting EQ and for making decisions regarding Multipressor drive and band coupling. The factory default for EQ sliders is a flat setting of 0dB in all bands. Factory-defined *presets*, on the other hand, will show these controls in positions that complement the selected format.

### Multipressor Crossovers

The crossover frequencies for the 5-band Multipressor have been made variable over the range of an octave or so. From the Processing / Compression / Multipressor sub-menu, select Crossovers to display this screen:



Note the ‘artist’s conception’ depiction of the five bands. Crossover frequencies are in data boxes above the crossover points, which may be bracketed, selected and changed.

Each of the four crossovers is variable over about an octave, which is a 2:1 frequency ratio. Factory-default values are smack-dab in the middle of the range. These factory defaults divide the audio spectrum into equal octave-based bands. You may alter these adjustments, perhaps to split the bands to better complement your particular format.

For your reference, the default factory values are: 125Hz, 450Hz, 1450Hz and 5000Hz. We recommend that you return to these values if things start sounding ‘not right.’

**Compressor  
Attack and  
Release**

Attack and release time constants for each of the Multipressor stages are variable over the very wide range of 1 millisecond to 2 seconds. Clearly there is great danger of creating objectionable distortion and processing artifacts if these settings are not selected with great care. Thus we urge most users to leave these settings at, or near, the values for the factory processing presets. Remember, if you mess with these and get into trouble, just go back and choose a factory processing preset to reset these time constants to safe figures.

From the Processing / Compression / Multipressor sub-menu, select Attack & Release to bring up the formidable panel shown here:



Note that each band has A (Attack) and R (Release) data-entry boxes that may be bracketed, selected and changed. Release times can never be shorter than attack times or, put another way, attack times cannot be longer than release times. Keep this in mind, for the system automatically locks-out time constants that are not compatible. If you find that you cannot set an attack time to a higher (slower) value that you’d like to try, check the associated release time. You will have to set the release to a larger (slower) number before you will be allowed to increase the attack to the higher number you want to try.

Although the Multipressor sections are r.m.s. responding, a short attack time will cause the compressors to act more like peak limiters. A shorter release time will increase the energy in that band, but may also cause audible distortion because of sidechain self-modulation.

We don’t offer any hard-and-fast rules for choosing time constants, nor do we even proffer educated suggestions. These adjustments are very subjective and can easily open the door to really, really bad-sounding results. You are on your own here,



our only word of advice is to return to our thoughtful and conservative factory values if you start hearing something you don't like. Bottom line: don't mess with these if you have reservations about what you're doing!

## BASS CHARACTER ENHANCEMENT

The DAVID IV offers two separate and distinct options for augmenting deep-bass content in the program material. Navigate to: Processing / Compression / Bass Character. There are two sliders in this menu:



### Punch and Rumble

*Punch* is that 'thump' that tries to rip the cone out of the speaker... the tight bass line that hits you in the chest. *Rumble*, on the other hand, refers to a pervading deep-bass line that seems to just sit there under the music providing a sort of melodic 'drone.'

DAVID IV bass enhancement algorithms utilize compression, expansion, soft and hard clipping, intermodulation and sidechain re-modulation techniques. This processing is purposely conducted in the monaural (L+R) domain to maximize the effect and to prevent creation of stereo-difference energy at these low frequencies.

The two controls, Punch and Rumble, allow for individual adjustment of these bass effects. Each control may be set between 0 (off) and 10 (maximum). In setting these, let your ears and your conscience be your guide. Despite the desire for that solid and pervasive 'bottom-end,' resist the temptation to run both these controls to the max. And when setting them, make sure you are listening over a system that can reproduce the effects you are dialing-in.

There is one caveat with respect to the bass enhancement section, one that is hinted on the Block Diagram (Page 9). Bass effects are added back into the multiband mix at the input to the peak limiting section, bypassing the Multipressor. 'Enhanced' bass energy will not be subject to compression before it hits the peak limiter, and huge amounts of bass may cause some degree of broadband 'ducking' as a result. Listen for this and trim your adjustments accordingly.

## PROGRAM PEAK CONTROL

Control of program peaks by the DAVID IV is accomplished in two sections: 1) a broadband final limiter, and for FM broadcasting: 2) 'adaptive pre-emphasis,' which is essentially independent limiting for high frequencies that are subject to pre-emphasis.

The broadband peak limiter acts on program audio that is delivered to any of the unit's outputs, whether it's a flat, 20kHz signal for digital broadcasting or other full-power-bandwidth application, or for FM transmission. But FM transmission requires additional processing to restrict energy in the pre-emphasized portion of the spectrum. This is provided independently by the adaptive pre-emphasis stage that follows the broadband limiter, and is active only for FM transmission.

Broadband limiting and adaptive pre-emphasis will be discussed separately.

## BROADBAND LIMITING

**PIPP\* Limiting** PIPP\* is an acronym for *Polarity-Independent Peak Processing*, an Inovonics-proprietary (patented) technique used in the more recent analog and digital processing products from our firm. This is a function that can be turned on or off by the user, and when disabled the DAVID IV peak controller behaves much like any contemporary "lookahead" limiter.

In the PIPP\* mode, the program audio waveform is split into positive-going and negative-going components. Each half of the waveform is then independently limited to a peak value that corresponds to 100% carrier modulation in the respective directions, and the components then recombined. The purpose of this somewhat roundabout exercise is to optimize carrier modulation regardless of waveform asymmetry.

The initial response to this elementary explanation is generally one of astonishment that such a degree of "distortion" would deliberately be introduced, much less tolerated. Please allow us to debunk this knee-jerk reaction.

The only truly undistorted audio waveform is a pure tone; that is, a sine wave. A sine wave is inherently a symmetrical waveform and the positive and negative halves are mirror-images of one another. The PIPP\* limiter would divide, limit and recombine these halves to create a spitting image of the original: an amplitude-limited symmetrical sine wave with no added distortion components.

An asymmetrical program waveform, notably speech, vocals or a solo musical instrument, will demonstrate a 'peaky' nature in either the positive or negative direction. This is due to the addition of natural overtones (harmonics) that assign the source

its distinctive ‘sound’ or timbre. The PIPP\* limiter will hold the peaky side to the 100%-modulation point, and will ‘expand,’ or increase the amplitude of the companion polarity until it also reaches the 100%-modulation limit.

This implies that the waveform, which by definition is already “distorted” with natural harmonic content, will be further distorted by the PIPP\* limiter. Technically accurate, a solo saxophone will sound more saxophone-like and speech or solo vocals will exhibit a slight ‘edge’ or character. But pop music and other program material that contains a plurality of instruments and vocals will have less asymmetry and will be less affected by PIPP\* limiting. Anyway, there’s an option to turn this novel feature off if you are a purist or otherwise don’t buy any of this.

### Lookahead Limiting

The DAVID IV broadband limiter is a *lookahead* limiter, acting to reduce program peaks essentially before they reach it. No, this limiter is not a member of the Psychic Friends Network™, it simply introduces a short delay in the signal path so the limiter can sense a peak and reduce gain before the peak actually comes along. The delay is only a couple of milliseconds, but this practice prevents flat-top-clipping of the program waveform during the limiter’s initial gain-reduction ‘attack’ phase.

Avoiding flat-top-clipping through the use of lookahead limiting eliminates short-term (transient) intermodulation distortion (TIM) of the program audio. Clipping, whether hard or soft, is generally to be avoided in flat-power-bandwidth transmission, but can be used with good success in pre-emphasized systems such as FM broadcasting. More about this later.

Navigate to Processing / Peak Limiting:



### PIPP\*, Normal or ITU?

This menu first allows the selection of either the proprietary  PIPP\* limiter, or a more conventional  Normal limiting function that does not include our controversial ‘waveshape-symmetry management.’ The third choice,  ITU, is a special-purpose limiting mode that ensures compliance with a broadcasting standard practiced in certain European countries. This is discussed in detail under the next subheading.

Action of the PIPP\* limiter was described earlier, and use of this function will be predicated on how particular program material sounds, which of course also depends on the setup of other processing parameters. You may wish to proceed with DAVID IV setup using the  Normal limiter selection, and then assess any advantage (or not) by switching back and forth between  Normal and  PIPP\*.

**Limiter Drive** The Limiter Drive slider sets the input level to the broadband peak controller section to determine how hard the limiter will be working. Much like the Drive control in the Multipressor section, this slider has been given a range far greater than required, so that the effect of essentially no limiting vs. a very great amount of limiting can be sampled and judged.

Actual limiter gain reduction (G/R) is shown by the front-panel WB LIMITER LED bargraph display. Limiter G/R will also be influenced to a lesser degree by Multipressor settings, so Limiter Drive should be adjusted after the Multipressor has been roughed-in for the desired spectral composition of the station's signature sound.

Carrier modulation will top-out at the 100% point whenever G/R is indicated by the WB LIMITER display. So, generally, the more G/R that is shown, the more consistently program *peaks* will hover near the 100% mark. Obviously, a high-energy rock format would justify a higher level of Limiter Drive, perhaps on the order of 8dB or more (the figure shown below the slider), and classical or jazz music should use a lower setting, maybe 5dB or less.

**Limiter Density** While Limiter Drive forces program *peaks* toward the 100%-modulation point, Limiter Density serves a similar function for the *average* level, or loudness, of the program.

The attack time of the DAVID IV peak controller roughly matches the delay of the limiter 'lookahead' feature. Limiter release, on the other hand, has a dual-slope, 'platform' function, with a quick release to the platform value, and then a much slower release of the platform itself. The limiter platform is based on program average energy content, the working value of which is adjusted with the Limiter Density slider.

With the Limiter Density slider 'wide open,' +3dB on the scale, limiter release is fast over the entire release range, imparting greatest density (loudness) to the program audio, but not without some audible side effects. As the slider value is scaled back, program *peaks* will continue to reach 100% modulation, but the *average* level of the program signal will be reduced. This allows the program audio to retain more of its inherent dynamic range.

A proper setting of the Limiter Density control is determined entirely by subjective evaluation of the on-air sound. Density is one very important quality of the station's signature sound, and no other control has a greater effect over perceived loudness. The factory default value is a setting of 0dB, the center of the control range. There is no setting considered a wrong one, but the range extremes will probably be relegated to special situations. Use your ears and consider the long-term *listener fatigue* effects of very dense programming.

## MULTIPLEX POWER CONTROL (BS.412-9)

### The ITU 'Recommendation'

In 1998, the International Telecommunication Union (ITU), a key European standards organization, published their *Recommendation ITU-R BS.412-9*, the culmination of several years' work to study and mitigate interference between broadcast stations on the crowded European VHF-FM band.

Channel spacing, transmitter power and other assigned considerations were major factors in this study, but insofar as audio processing is concerned, the short version is that the ITU found direct correlation between FM carrier modulation and audible interference between stations on adjacent frequencies. What's more, it further found that *modulation density* was in large part responsible for this interference. In other words, not necessarily the absolute *peak* deviation of the carrier but the *r.m.s. power* of the modulating program signal integrated over a specified period of time.

The ITU *Recommendation* specifies the r.m.s. power of the composite-multiplex signal (including the stereo pilot and any audio (SCA) or data subcarriers), as measured and integrated in a 'floating' 1-minute measurement window. It states that this value should not exceed the r.m.s. power of a single-tone sine wave modulated with a peak deviation of  $\pm 19\text{kHz}$ .

Now,  $\pm 19\text{kHz}$  is just about 12dB below the  $\pm 75\text{kHz}$  peak deviation limit. This implies an average-to-peak ratio of the program signal that, by contemporary broadcasting standards, gives a rather pathetic showing... certainly not the in-your-face, highly-compressed dynamics that Program Directors have come to know and love(!) since the mid-1960s!

The ITU *Recommendation* has been mandatory in Germany, Austria and Switzerland since 2004, but with some latitude. Germany adheres to the letter of the *Recommendation*, "0dBr" they call it. But Austria and Switzerland are able to exceed that point by 3dB. In other words, their r.m.s. modulation is permitted to go to "+3dBr."

The DAVID IV provides compliance to the ITU standard by re-defining the peak-limiting processing function when the  ITU option is selected.



First, the PIPP\* limiter is defeated in favor of more conservative symmetrical peak control. Secondly, the Limiter Drive and Limiter Density sliders are re-scaled for less-aggressive overall processing. The Limiter Density slider is, in fact, renamed in the  ITU mode, becoming the dBr BS.412-9 slider shown above.

This slider, calibrated to the multiplex r.m.s. “0dBr” value cited in the ITU *Recommendation*, may be set at any value between -1dBr and +5dBr, accommodating any ‘fudge factor’ that might be permitted by the regulating authority in that location.

In operation, the DAVID IV continues to utilize the native algorithm of the Limiter Density slider to anticipate a certain amount of average-level modulation control based on audio program dynamics. This approximation is supplemented with feedback of the r.m.s. value of the multiplex signal to arrive at a final and accurate correction factor.

**Other ITU  
Processing  
Implications**

The  ITU mode will hold r.m.s carrier modulation to the prescribed limit, but processing ahead of the peak limiter section will have a second-order effect on how effective this utility will be in complying with both the letter and the intent of the *Recommendation*.

One *caveat* of the ITU *Recommendation* is that audio processing used to satisfy the requirement must not create audible side-effects (i.e.: ‘breathing,’ ‘pumping’ and obvious level shifts). The user must thus exercise conservative judgment and avoid overuse of Multipressor and other ‘sound-enhancement’ features.

## ADAPTIVE PRE-EMPHASIS

FM broadcasting makes use of audio pre-emphasis in transmission and complementary de-emphasis in the receiver. This practice requires special consideration with respect to program peak control.

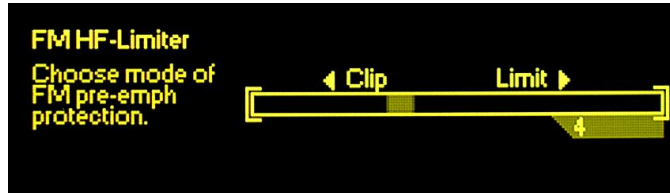
FM pre- and de-emphasis characteristics were established in the 1940s. These were far simpler times in radio programming, long before the term ‘competitive loudness’ was on the lips of Program Directors. Broadcast practices and recording techniques from that era did not anticipate today’s sizzling, high-energy, closely-mic’d and heavily-EQ’d music trends.

Today’s program material severely taxes the ability of the FM transmission channel to pass content in a ‘transparent’ manner. High frequency energy must be controlled independently of the broadband levels, a necessity that can make music sound as ‘dull’ by today’s standards as, in fact, any recorded music might have sounded to many of us if we were transported back to those halcyon days.

The DAVID IV utilizes ‘adaptive pre-emphasis,’ a term we coined to describe an independent high-frequency limiter that follows the broadband peak controller. Because this HF limiting is performed only in the pre-emphasized domain, a judicious amount of HF clipping may also be employed without causing painful audible artifacts. The clipper algorithm includes proprietary distortion-cancellation techniques that sig-

nificantly reduce audible intermodulation artifacts, particularly those associated with vocal sibilants.

Navigate to: Processing / FM HF-Limiter:



The slider actually controls the attack time of the independent high frequency limiter. A near-instantaneous attack (10) will ensure that negligible high frequency clipping will occur. This will sound somewhat dull, especially with pop-music sources, but may keep artifacts to a minimum with more conservative fare. As the slider is moved to the left and attack time increased, more high-frequency peaks will slide through and be clipped, rather than limited. This will sound brighter, although clipping artifacts may be noticeable with Attack settings of 3 or less. The factory default setting of 5 is a good compromise for most broadcast formats.

As seen on the Block Diagram (Page 9), adaptive pre-emphasis is used only for FM program transmission. It is a fulltime function for the composite/MPX outputs, but is applied to the analog and digital line outputs only in their FM modes for feeding an FM exciter with a built-in stereocoder.

The characteristics of adaptive pre-emphasis are set when the pre-emphasis selection is made: 75 microseconds for the Western Hemisphere, 50 microseconds for Europe and most other export areas. Pre-emphasis verification is covered on Page 40.

## COMPOSITE CLIPPING

Navigate to: Processing / Composite Clipper:



At the user's discretion, up to 3dB of composite clipping may be introduced. This is brute-force, flat-topped clipping of the baseband signal, but before the 19kHz stereo pilot and RDS subcarrier (if used) are added. Baseband clipping invariably introduces harmonic components that can clutter the spectrum above the program signal to a greater or lesser extent. Composite clipping does provide some degree of loudness advantage with somewhat less harshness than program signal clipping in the L/R audio domain. Nonetheless, exercise this advantage

with care. A conservative figure of 1.0dB, the factory default, is generally benign.

Composite Clipping has no effect on either the analog or digital line outputs, even when they are set to their FM modes.

## HD RADIO™ DELAY

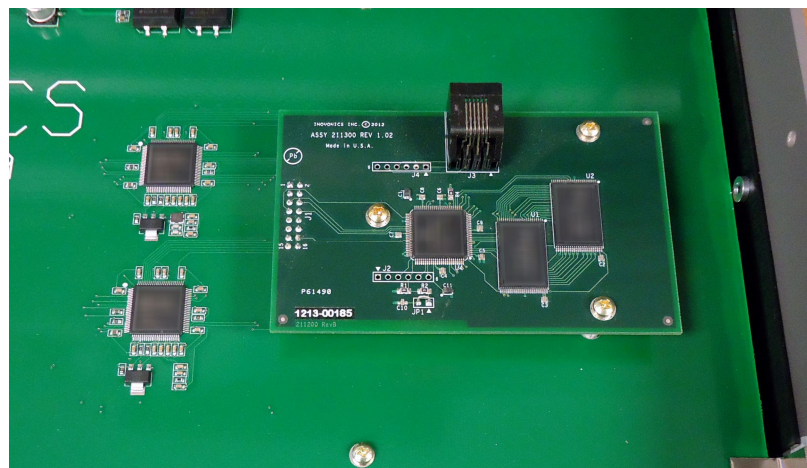
The HD Radio digital broadcasting system, employed principally in the U.S., is a ‘hybrid’ broadcasting system. This means that the all-digital signal carrier is transmitted ‘on-channel,’ simultaneously with the traditional analog FM (or AM) carrier. Legacy radios are thus able to receive the program in the usual manner, and new HD Radio receivers can recover both the analog and the digital versions of the program.

Because there is an obligatory delay of some 8 seconds(!) in the digital program encoding and decoding process, the analog signal must be delayed by this same amount to arrive in sync with the digital signal. The HD Radio receiver first tunes and plays analog audio to the listener, but then it cross-fades to digital reception once the digital signal is acquired. If this were not the practice, then using pushbutton presets would be an agonizing process, much as digital-TV channel-surfing can sometimes be frustrating, though to a lesser extent because of shorter delay in TV signal decoding.

This time-aligning “diversity delay,” as it is called, is enabled in the DAVID IV with an optional accessory circuit board that is simply plugged into a header strip on the main board.

### Installing the Delay Subassembly

If you are adding the HD Radio delay option in the field, first disconnect power from the unit. Then remove the top cover and install the accessory board as shown here. Mounting standoffs are already in place, just plug the accessory board squarely onto the header strip so that the screw holes line up. Fasten the board down with the screws that came with it. The DAVID IV will recognize the board when it boots, and you can then access and set up the delay menu.

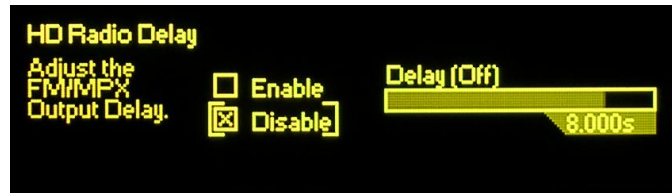




NOTE: The HD Radio Delay menu appears only if the accessory board is installed correctly.

### Adjusting the Delay

Use the front-panel jog wheel to navigate to: Setup / HD Radio Delay:



HD Radio delay may be set in 1ms increments, anywhere between 1ms and 9.999 seconds. This is a much wider range than required, but expresses hope for improvements in the encoding/decoding process of the HD Radio system.

To enable the delay, highlight and select:  Enable. Next, Highlight the Delay slider and then *push* the knob.



Now *turn* the knob to set the time and *push* it to activate the setting.

NOTE: To obviate frustration and blisters, the DAVID IV will race through the 1ms increments at an accelerated rate when the jog wheel is turned fast and furiously. Turn the jog wheel slowly for precise 1ms steps. Keep in mind that the setting will not become active until the knob is pushed, committing the setting to memory.

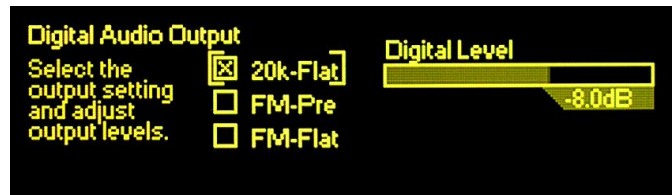
The delay is most easily set using an HD Radio receiver that can be put into the “split” mode, where the analog program is heard in one stereo channel and the digital program in the other. *Turn* and *push* the jog wheel to hone-in the timing so that there is no discernible echo heard.

An HD Radio receiver in its normal operating mode will fade from analog to digital within a few seconds after the station is tuned. Tune away from your station and then tune back again. The transition should be ‘seamless,’ with no echo, gaps, stuttering or level shift as the radio cross-fades from analog to digital.

## PROGRAM LINE OUTPUTS

The digital and analog line outputs of the DAVID IV are available simultaneously, and are independently programmable as to their output characteristic and output peak level. Depending

on which output you intend to use, navigate either to: Setup / Digital Audio Output:



Or to: Setup / Analog Audio Output:



Note that the screens are very similar and the following explanation applies to either one.

**Line Output Characteristic**

**20kHz Flat**

The checkboxes on the left select the characteristic of the program line outputs. These are the choices:

20k-Flat is a full-range (20kHz) output that comes directly from the output of the broadband peak limiter. This output is suitable for any form of full-power-bandwidth digital radio broadcasting, for audio production and recording, or for high quality streaming. The  20k-Flat output does *not* include the independent HF limiting afforded by adaptive pre-emphasis, 15kHz low-pass filtering, nor will it incorporate the HD Radio delay when it is implemented for the multiplex output.

**Pre-Emphasized FM Output**

When the  FM-Pre output characteristic is selected, the output is configured to feed an FM exciter that has a built-in stereo-coder (stereo-gen). The line output will include adaptive pre-emphasis and the 15kHz low-pass filtering required for stereo pilot protection, and is pre-emphasized in this mode. This means that any pre-emphasis option in the exciter should be switched OFF. If HD Radio delay is enabled, the line output will be delayed just as it is for the multiplex output.

**Normalized (Flat) FM Output**

The  FM-Flat output characteristic is similar to  FM-Pre, except that the signal has been 'normalized' with a de-emphasis network to restore a flat frequency characteristic. This output would be the proper feed to an FM exciter that does its own pre-emphasis. Although the audio response from this output is flat, it still includes the 15kHz low-pass filter and independent HF limiting to protect the spectrum and the stereo pilot, plus it will also have the HD Radio delay if it is enabled.

**Output Level Controls**

The Digital Level and Analog Level output sliders vary the limited program output over a broad range. Both outputs are available simultaneously and may be programmed independently as appropriate.

The Digital Level is variable between 0dBFS and -20dBFS. FS refers to digital-full-scale, or as high as the digital signal can go. This means that audio peaks in the program signal, which have been limited to 100% modulation, can assume any level between digital-full-scale and a value 20dB below this. In digital signal distribution it is customary to maintain the *average* level of the program audio (“zero” on a VU meter) a comfortable value below digital full scale to allow for program peaks. This ‘headroom offset’ is historically on the order of 20dB for raw, unprocessed audio, but since the output of the DAVID IV is tightly peak-limited there is no headroom issue even when this is set wide-open at 0dB. Nevertheless, running program peaks to 0dBFS is not a good idea because of what’s called “zero dBFS plus,” a phenomenon leading to overshoots, clipping and distortion in the eventual D-to-A converter somewhere downstream. Try an Internet search for: *dBFS+* to learn more about this.

The Analog Level may be varied between +24dBu and -10dBu for program peak values. The dBu numbers below the slider are based on traditional dBm voltage values, the ‘u’ referring to unloaded, open-circuit volts (0dBu = 0.775V r.m.s), rather than one milliwatt in a 600-ohm circuit (0dBm).

NOTE: The output level in dBm (feeding a 600-ohm termination) may be set by adding 2.5dB to the numbers shown below the slider. (e.g.: +6.5dBu = +4dBm when the output is loaded.)

The range of the Analog Level control covers traditional studio line levels (e.g.: “Plus Four”) and the lower levels common to semi-pro audio gear. This lower output range is useful when, for example, the DAVID IV feeds the input of a conventional computer sound card. As covered on Page 13, when a single-ended unbalanced output is taken from the DAVID IV, only one side of the line-drive stage is used, and the actual dBu output level is 6dB lower than what is shown beneath the slider.

### Sample Rate Converter

Navigate to the Setup / Sample Rate Converter menu:



Here the Input Rate (digital sampling rate) of the AES program input is automatically displayed in the upper box if a digital input is connected to the DAVID IV. The sampling rate of the AES digital output is selected in the lower box. *Press* the jog wheel to enable the Output Rate selector, and *turn* the knob to pick a fixed output rate. The Output Rate may also be set to follow the incoming digital signal if the digital input is selected under Setup / Audio Input.

## FRONT-PANEL HEADPHONE JACK

The headphone jack on the front panel monitors the broadband-limited output of the peak limiter. This is a 'flat' monitor point that does *not* reflect action of the 15kHz low-pass filter and adaptive pre-emphasis for FM transmission, nor the effects of composite clipping. The volume control next to the jack adjusts only the headphone volume.

## COMPOSITE MULTIPLEX OUTPUT

The DAVID IV has two independent outputs for the composite/MPX (multiplex) signal. These outputs include the S (L+R), S' (L-R), 19kHz Stereo Pilot and optional RDS subcarrier components that comprise the FM baseband signal.

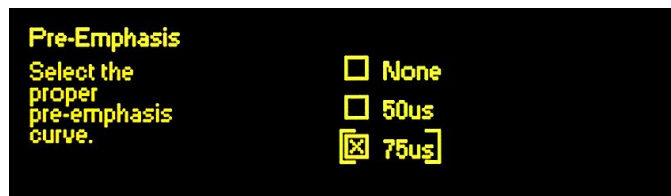
Navigate to: Setup / Stereo Generator:



### Confirming Pre-Emphasis

FM broadcasting imparts high-frequency pre-emphasis to the program audio signal in transmission, and the FM receiver provides the complementary de-emphasis. The time constant of the pre- and de-emphasis networks is determined by geographic location. The Americas (Western Hemisphere) have standardized on a 75-microsecond curve, and Europe has chosen 50-microseconds. Other parts of the world have opted for one or the other of these, so make sure you know what setting is the proper one for you location before proceeding.

From the previous menu select: Pre-Emphasis to bring up the selection screen shown here:



Turn the jog wheel to position the brackets around the desired characteristic:  50us or  75us, and then *push* the knob to set it and fix this selection in the DAVID IV non-volatile memory. The  None option is included for test purposes only.

### Mono Mode and Pilot Injection

Press the Back button to return to the Stereo Generator menu. Turn the jog wheel to select Pilot and *push* the knob to bring up the Pilot menu, shown at the top of the next page.



Here the DAVID IV can be placed in the  Mono (monaural transmission) mode for testing or for special circumstances, though  Stereo will be the usual choice for normal operation. Selecting  Mono removes both the 19kHz stereo pilot tone and the S' (L-R 'stereo difference') subcarrier.

The 19kHz RDS sync output remains active, however, assuring that RDS messaging remains an available option in mono.

The factory-default setting of 9.0% stereo pilot injection is normal for FM transmissions worldwide, although the value may be set anywhere between 6% and 12%. To reset the level to a nonstandard figure, *turn* the jog wheel to place the brackets around the Pilot Level slider, *push* the knob, and then *turn* it to adjust the injection level.

### Adjusting the Multiplex Outputs

Press the Back button to return to the Stereo Generator menu. *Turn* the jog wheel to select Multiplex Out and *push* the knob to bring up the Multiplex Output menu:



The levels of the two independent composite/MPX outputs are individually adjustable. The open-circuit peak-to-peak voltage at the rear-panel BNC connectors is displayed below the slider window. This voltage level, which represents 100% program-peak carrier modulation, is adjustable between 0.8V p-p and 9V p-p (+12dBu.) *Turn* the jog wheel to bracket the appropriate slider (MPX Level 1 or MPX Level 2), *push* the knob to select it, and then *turn* the knob to dial-in the desired output level.

The exact setting of this control will depend on the input sensitivity of your FM exciter or STL (microwave link) transmitter and the desired peak carrier modulation you wish to achieve. Use your mod-monitor to check the off-air signal when making this adjustment, and be sure that audio processing setup has been completed to your satisfaction before fine-tuning the output level.

### Multiplex Output Servo

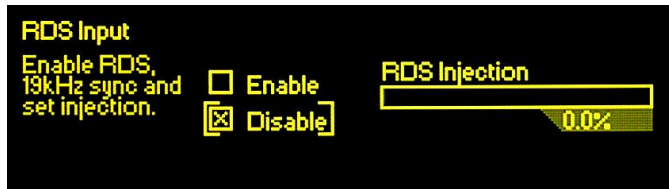
The DAVID IV employs an open-loop servo system to maintain the multiplex output at the precise level set by the user. As either the 19kHz stereo pilot level or the RDS injection level is adjusted (or even turned off), the composite/MPX output remains constant so that no back-and-forth tweaking is required.

## RDS SETUP

The Radio Data System, or RDS (called the Radio *Broadcast* Data System, or RBDS in the US), enables the FM broadcaster to transmit certain digital ‘metadata’ along with his program audio. The transmitted information includes certain mandatory housekeeping functions that identify the station format, keep track of rebroadcast translators, send time information, etc., and it can also display advertising or music artist and title info on the faceplate of RDS radios.

An external encoder is required to generate the RDS subcarrier. When RDS is enabled, the DAVID IV supplies a synchronizing signal to lock the encoder to the stereo pilot. The DAVID IV has a self-metering combining network to add the RDS subcarrier to the composite/MPX output signal. Additional details may be found in Section II (Page 14).

Navigate to: Setup / Stereo Generator / RDS Input:



Before connecting your RDS encoder, be sure first to back the RDS Injection slider all the way down. *Turn* the jog wheel to bracket the slider, *push* the knob to select it, and then *turn* the knob counterclockwise until the lighted portion of the slider is off the bottom of the scale. Note that the numbers below the slider do not change during this operation.

Next, connect your encoder. If it is programmed and ready to go, *turn* the jog wheel to bracket:  Enable, and *push* the knob to set this function.

Next *turn* the jog wheel to again bracket the slider and *push* the knob to select it. Watching the numbers beneath the slider, carefully advance RDS Injection by turning the knob clockwise. The lighted portion of the slider will creep up from the bottom of the box, and at some point you should begin to see the injection percentage appear below the slider. Because the DAVID IV is actually measuring the RDS peak level, the relationship between the numbers and the position of the slider will depend on the output level of the encoder. The DAVID IV accepts a wide range of input levels, but an input between 0.5V p-p and 5V p-p is the recommended range.



When RDS Injection is set for a typical working figure of 5%, the slider should be neither at the very top nor at the very bottom of the adjustment range. This would indicate either an unusually low or absurdly high level from the encoder, respectively. As RDS Injection is adjusted, total carrier modulation will not change. The multiplex output servo described earlier eliminates the need to reset the composite/MPX output level as the RDS subcarrier is adjusted.

## PROCESSING PRESETS

From the main menu, navigate to Presets:



Turn the knob to scroll through a list of 25 factory (F) presets and 20 more shown as <Empty>.

### Factory Presets

The 25 factory (F) presets are named for genres of music or other programming formats that are common in radio broadcasting today. The processing presets were painstakingly crafted by our team of qualified consultants, ranging from classically-trained musicians to teenage hooligans hanging-out at the local mall. These presets may be used as-is, or may serve as a starting point for your own thoughtfully-tweaked processing setups.

Factory (F) presets cannot be changed, but any one may be modified, renamed and saved as one of your own.

### Creating Custom Presets

You may start with the (F) Flat setting or with any factory preset that sounds about right for your use. Just use your ears and the jog wheel with the processing menus to create a “sonic signature” that ultimately sounds right to you.

Once the DAVID IV is sounding like what you have in mind, navigate again to the Presets menu and highlight Save New Preset at the very top of the list. *Push* the knob to bring up the name-entry area, as shown here.



*Turn* the knob to highlight numbers and letters in the character set. *Turn-and-push* to enter a name for the preset you have created; that is, the one playing on-air right now. Space puts a blank between words and Backspace lets you correct errors.

When you have a name entered, highlight Save and *push* the knob. That will bring you back to the list where you will find your new preset just below the factory ones.



**What am I listening to?**

The currently-selected preset is identified by an arrow ▶ pointing to the name. If you don't see an arrow when you enter the Presets menu, simply scroll down until the active preset is displayed. Use the Back button to escape from the Presets menu without making changes.



**Deleting Presets**

Factory (F) presets cannot be deleted, only the user-defined ones can. To delete a user preset, navigate to the Presets menu and scroll to the bottom of the list. Highlight Delete and *push* the knob, X Delete will begin flashing. Turn the jog wheel to highlight any user preset. (Note that the list will not even show the factory (F) presets.) Your selected preset will flash, and when you *push* the knob it will be deleted.

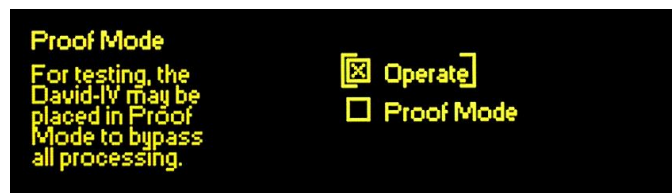
If you happen to delete a user preset that is currently on-air, the preset name will revert to <Empty>. But the processing setup will remain loaded in the DAVID IV, even through a power cycle. So if you delete a working preset by mistake, you can simply rename and re-save the on-air setup as described above. Whatever is currently on-air (even a factory preset) can always be renamed and saved as a custom preset.

**Exporting and Importing Presets**

User presets are saved in the DAVID IV's non-volatile memory, but will be lost if the user needs to do a 'hard reset' (Page 46), and when performing a firmware update (Page 63). Custom (user-defined) processing presets may be individually exported and imported, and the entire DAVID IV 'profile' (levels, presets and all) may be saved as small files using the supplied software. These procedures are described in Section V on Pages 60 and 61, respectively.

**"PROOF" MODE**

Navigate to Setup / Proof Mode:





In 'Proof,' the input and output level controls remain functional, but all dynamics-processing utilities are fixed at unity gain with a flat-frequency characteristic.

In the science and magic of audio processing, it has become customary to make noise, distortion and similar measurements with processing stages 'normalized' (defeated), as explained ahead of the DAVID IV Specifications on Page 6. Keep in mind that today's sophisticated DSP algorithms do much to mask the audible artifacts of aggressive audio processing; so much so, in fact, that laboratory measurements are a very poor reflection of how audible these artifacts may be to listeners.

## ADMINISTRATIVE SETTINGS

From the main menu, navigate to Administrative:



### Passwords

DAVID IV settings may be protected by a password, which must then be entered before any subsequent changes can be made. The password will lock both front-panel (jog wheel) and software control of the DAVID IV.

Highlight Security on the Administrative Settings menu and push the jog wheel.  Disable must be checked to set a password. Highlight the Current Password field and *push* the knob.

*Push* and *turn* the jog wheel to enter a password, using the uppercase and lowercase alphabet, numbers and any punctuation marks shown, up to 29 characters.



Once the password is entered, highlight Save and *push* the knob. This will return you to the Security menu. Next highlight  Enable and *push* the knob to set the password.

The DAVID IV will lock any time the screen times-out (goes dark), about two minutes after the unit is left untouched. It may also be locked immediately by holding down the Back button for a few seconds.

Once the DAVID IV is password-protected you will be prompted to enter the password before any menu can be accessed and any adjustments made. After entering the password, highlight: Done and *push* the knob. This will be necessary each time the

unit is awakened from a dark screen. Similarly, the password must be entered on the controlling computer whenever connection is made via the remote-control (software) interface.

When working on a password-protected unit, check  Disable to keep from having to enter the password each time the screen times-out. Remember to  Enable the password when finished.

**Lost Password  
(Hard Reset)**

To recover control of the DAVID IV if the password is lost, you must do a “hard reset” of the unit. This is accomplished by holding down the Back button as you power-cycle the unit (disconnect and then reconnect AC-mains power).

**WARNING:** A hard reset deletes not only the password, but will also return the DAVID IV to all-factory-default values. ***Custom presets, the current on-air processing setup and in/out level settings will all be lost!*** Page 60 gives instructions for backing-up a DAVID IV ‘profile’ (all settings) to your computer.

**Display  
Brightness**

The Administrative Settings menu also has a Brightness choice. The user may change the brightness of the graphic display from an approximate 50% default value to a higher or lower setting. We do not recommend a higher setting because there is little visible difference between 50% and 100%, and a high setting may shorten the life of the OLED graphic display. A lower setting may actually appear a bit sharper and kinder on the eyes in subdued lighting.

## Section IV

# NETWORKING THE DAVID IV

## CONNECTING THE DAVID IV TO YOUR NETWORK

IP (Internet Protocol) networking is a somewhat complex discipline that can present the broadcast engineer with formidable challenges. We've tried our best to make this easy, so please bear with us here.

Navigate to: Setup / Network / IP Settings:



### DHCP Assignment

DHCP stands for Dynamic Host Configuration Protocol. This is an automatic configuration utility that greatly simplifies network setup. With  DHCP selected, your server/router should assign a 'dynamic' IP address to each computer or other network-enabled device connected to your LAN (Local Area Network). In fact, if you simply connect the DAVID IV to a router/server port on your network, all settings on the IP Settings screen should populate at once, as they did in the image above.

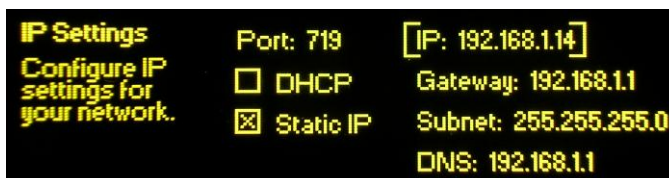
Dynamic IP addressing is common with DHCP-mode routers and servers, allowing multiple networked devices to share a limited range of IP addresses. When one device disconnects from the network, its address may be reassigned to another.

Whether connecting to a LAN, or to the Internet through a router, let DHCP do the work for you if at all possible. Simply select:  DHCP on the IP Settings menu.

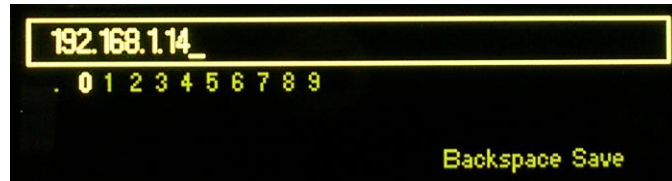
### Manual IP Setup

There are instances, however, when the IP address and its associated items must be set manually. With:  Static IP selected you will be able to position brackets over each IP parameter to set it by hand.

From the IP Settings menu, *turn* the jog wheel to position the brackets around the IP address. (In our illustration this was previously set by DHCP.)



Next, *Push* the knob to go to the data entry screen shown here:



*Turn* the knob so that the word Backspace at the bottom of the screen is highlighted. Now, each time you *push* the knob one character will be deleted from the existing IP address entry. *Push* the knob repeatedly to erase the entire IP address field, or as much as is required.

Once the field is empty, *turn* the knob to select digits (and the delineating decimal point) to input the desired IP address. The addresses in these fields always consist of four groups of three-or-fewer digits with the groups separated by decimal points. Once the IP address has been entered manually, *turn* the knob so that the word Save is highlighted, then *push* the knob to commit the address to memory. If the word Save is not visible, this means that the entry has incorrect syntax and must be re-entered. If a valid address is not entered and saved, the menu will time out in a couple of minutes and revert to a previous valid IP address or to: 0.0.0.0.

Manual data-entry must then be repeated for the other IP Settings fields: Gateway, Subnet and DNS. Entries in these fields will be dictated by existing network protocols, depending on how the server or router is configured. Your Network Administrator should know all about this; it is not within the scope of this manual to provide a tutorial on network setup. Sufficient to say that DHCP operation is the preferred mode.

## COMMUNICATING FROM OUTSIDE THE LOCAL NETWORK

To address your DAVID IV from outside your Local Area Network (LAN), you must open a port on the network router. This is required, for example, when your unit is being addressed and controlled over the Internet.

To make it easy to remember, we picked a default port number of 719, the formal model number of the DAVID IV. This may be changed from the IP Settings menu, however. Your router must be configured for 'port forwarding,' using Port 719 to forward both TCP and UDP traffic to the IP address specific to the DAVID IV.

Should you need to address two or more DAVID IV units from outside the local network, each must be associated with its own router port. Use the IP Settings menu to change default Port 719 to alternate port numbers for multiple DAVID IVs.

**What is  
Dynamic DNS?**

Most DSL and TV-cable connections to the Internet are subject to 'dynamic' IP assignments. As described earlier, a router or server working in the DHCP mode makes efficient use of a limited IP address list by reassigning addresses as devices disconnect from the network. An Internet Service Provider (ISP) uses this same technique on their clients' primary external-IP (Web) addresses. Thus the incoming routing path to your DAVID IV may well change from time to time, perhaps daily.

It would not be possible to address equipment behind a dynamic IP address if it were not for IP-forwarding providers available via the Internet. This service is either free or comes at a very modest charge, and will allow the DAVID IV to keep the provider apprised of its reassigned IP address whenever that IP address changes. The IP-forwarding provider will intercept data attempting to connect with the DAVID IV and convert the earlier and obsolete IP address to the current one.

**Dynamic DNS  
Providers**

There are three popular forwarding service providers available on the Internet. Basic forwarding service may be free of charge, but advanced features can command a nominal annual fee. These services require registration on the appropriate Website.

Navigate to: Setup / Network / Dynamic DNS:



Bracket the Mode: field and *push* the knob. Next, turn the knob to reveal the three Dynamic DNS forwarding services. These are: dyndns.org, no-ip.com and dnsomatic.com. Put the traditional www. ahead of these links in your computer browser to find out more about each provider and to register with one of them for using the dynamic DNS feature built into the DAVID IV.

The three fields: Hostname, Username and Password must be filled-in with the information you receive when you register on the provider's Website. This information is entered into the three fields using the jog wheel.

Let's say, for example, that you have signed-up with www.no-ip.com and have chosen a Hostname of 'radiocenter,' a Username of 'kangaroo,' and a Password of 'LA234red.' From the Dynamic DNS menu, turn the jog wheel to bracket Mode:, *push* the jog wheel to enter this field, and then *turn* the knob to select no-ip.com. *Push* the knob again to save this selection.

Next *turn* the jog wheel to bracket Hostname: and *push* the knob. This brings up the data entry screen shown at the top of the next page.



If the entry field is not blank, *turn* the jog wheel until Backspace is highlighted, then *push* the knob repeatedly to erase any entry in this field. Then *turn* the knob to scroll through the field of symbols (numbers, letters, etc.), pausing and *pushing* the knob to enter the assigned Hostname. Use Backspace whenever you need to make corrections. When finished, select: Save and *push* the knob one last time to enter the Hostname into memory. Repeat this process for the Username: and Password: fields. At the end of this process your screen will look something like this:



### Dynamic DNS System Abuse

The DAVID IV will normally communicate with the provider only when the IP address changes, but it also must check in following a power interruption and whenever the Dynamic DNS mode is altered in any way.

Some small part of the forwarding provider's processing resources is used each time an IP address is renewed. These providers, especially the for-free ones, don't appreciate repeated and unnecessary IP address renewals. If a particular account makes a nuisance of itself, the provider may justifiably cut the user off. In that case the entire Dynamic DNS registration and setup process will have to be repeated.

## THE NETWORK STATUS SCREEN

Navigate to: Setup / Network / Status:



This screen lists the DAVID IV network settings as explained below.

Internal IP: Your DHCP router or server will assign an IP address to your DAVID IV, or in some cases this is done manually (Page 47). This is known as the *internal IP* address.

External IP: When you are connected to the Internet, your local network (LAN) also has an IP address so that

anyone on the Web can find you. This is your *external* IP address and is assigned by your Internet Service Provider (ISP). The more common *dynamic* IP is subject to routine update (change), either on a schedule or as required. A *static* IP may be provided as an option by some ISPs and will remain constant.

MAC: MAC is the Media Access Control address of your individual DAVID IV unit. Each DAVID IV is registered at the factory with a unique, permanent MAC address. This is an essential element in providing reliable network connectivity of any hardware connected to your local network (LAN) or to the Internet. The MAC address of your DAVID IV cannot be changed.

Dyn DNS: This field shows the current status of the Dynamic DNS feature (Page 49).

Port: The port number assigned to your DAVID IV, as well as the associated router port for forwarding TCP and UDP traffic.

Remote: This field shows the IP address of any computer that is currently communicating with the DAVID IV over a network connection.

## DIRECT COMPUTER CONNECTION TO THE DAVID IV

If your station does not have a local network, perhaps the easiest way to have computer control over the DAVID IV is by using an inexpensive 4-port router to create a “Tabletop LAN.” All you need to do is plug the DAVID IV into one router port and the computer’s LAN cable into another. No WAN (Internet) connection is necessary. Set the DAVID IV to:  DHCP and your router will make the necessary IP assignments.

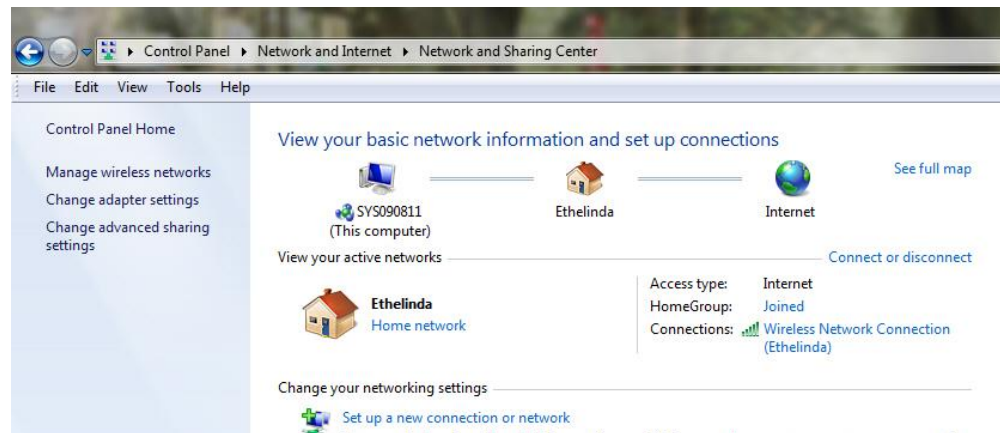
But even without a LAN of any kind you may still use the rear-panel NETWORK PORT connector to connect your DAVID IV directly to a PC, both for using the supplied setup and operating software for controlling the DAVID IV, and for performing firmware updates as they become available (Page 63).

With earlier versions of Windows, a true direct-connection option required changes to the network connection settings of your computer to actually set up an ‘imaginary’ network. This procedure temporarily compromised your ability to connect to the Internet with this same computer until the settings had been restored to their previous values.

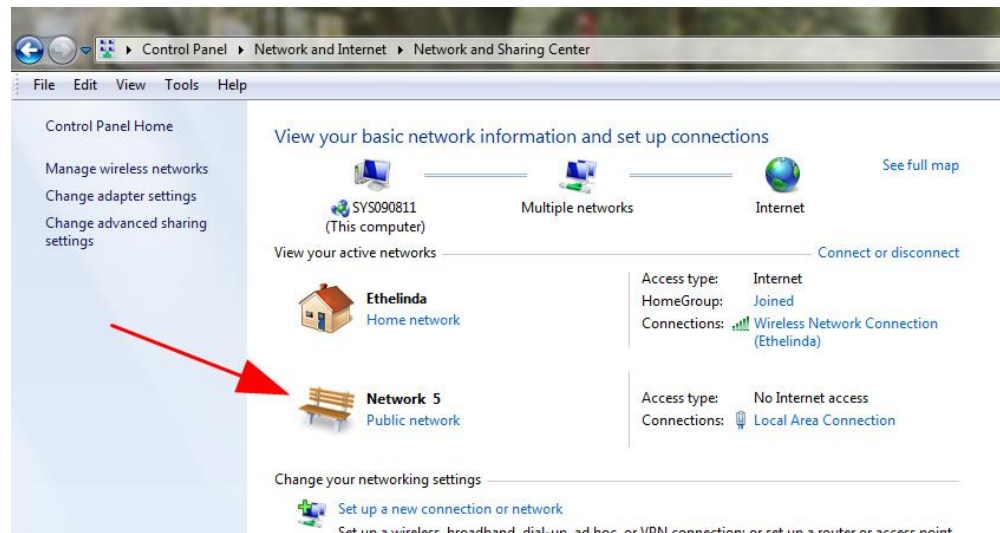
## Setting-up an 'Imaginary' Network

Beginning with Windows 7, however, this operation became a more simple matter. This illustration will use a Windows 7 machine; other computers may require alternate methods.

The main networking page is found under the Control Panel on most versions of Windows. In the case of this Windows 7 machine it's under Control Panel / Network and Internet / Network and Sharing Center. This screen shows that this particular computer has just a 'Wi-Fi' connection with Internet availability.



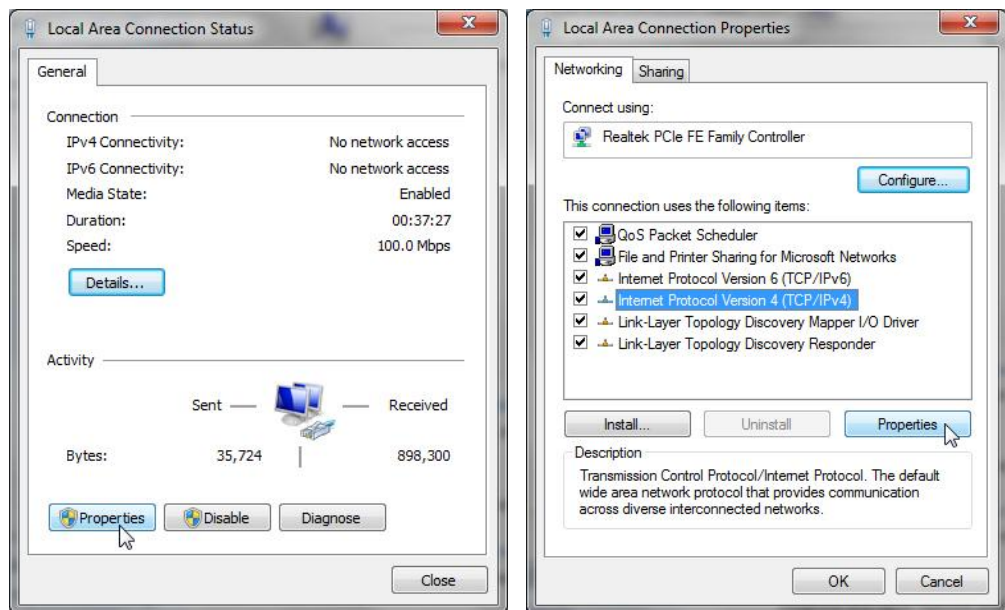
Next, simply use a straight-through LAN cable to connect the DAVID IV to the LAN port of your computer. After a half-minute or so, the computer will recognize that something is connected and show it like this:



Don't be concerned over what Windows calls this network as it will depend on what old, abandoned connections may still be resident in the Registry.

This new network needs a bit of setup, so click on Local Area Connection in the right-hand pane. A Connection Status window will appear, as shown on the left at the top of the next page. Click the Properties button at the bottom, which will open the image on the right.



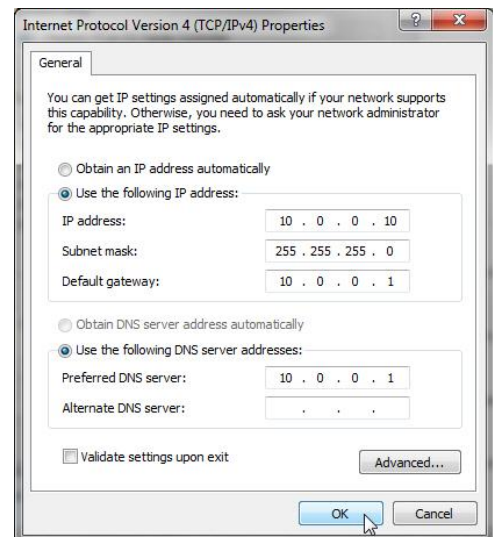


Highlight: Internet Protocol Version 4 (TCP/IPv4) and click the Properties button

Next, select: Use the following IP address: and proceed to enter the IP information exactly as shown in the screenshot on the right. That is:

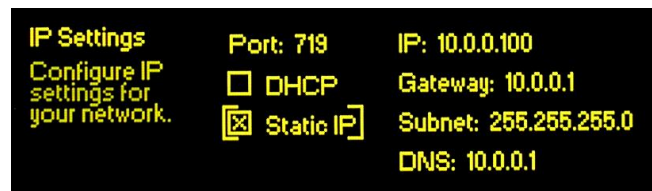
IP address: 10.0.0.10  
 Subnet mask: 255.255.255.0  
 Default Gateway: 10.0.0.1  
 Preferred DNS server: 10.0.0.1

When these entries are complete, click: OK and close all panes.



**DAVID IV Settings**

Now we need to assign a static IP address to the DAVID IV. Using the jog wheel in the manner described under **Manual IP Setup** (Page 47), enter IP settings for the DAVID IV as follows:



Static IP  
 IP: 10.0.0.100  
 Gateway: 10.0.0.1  
 Subnet: 255.255.255.0  
 DNS: 10.0.0.1

This gives the DAVID IV a compatible 'bogus' IP setup, which we will use only for this direct connection. At this point you may start, configure and run the provided software (Page 55) to control the DAVID IV from the PC, to back up profiles or presets (Page 60), or use the "bootloader" utility to update the firmware (Page 63).

## Section V

# DAVID IV REMOTE-CONTROL SOFTWARE

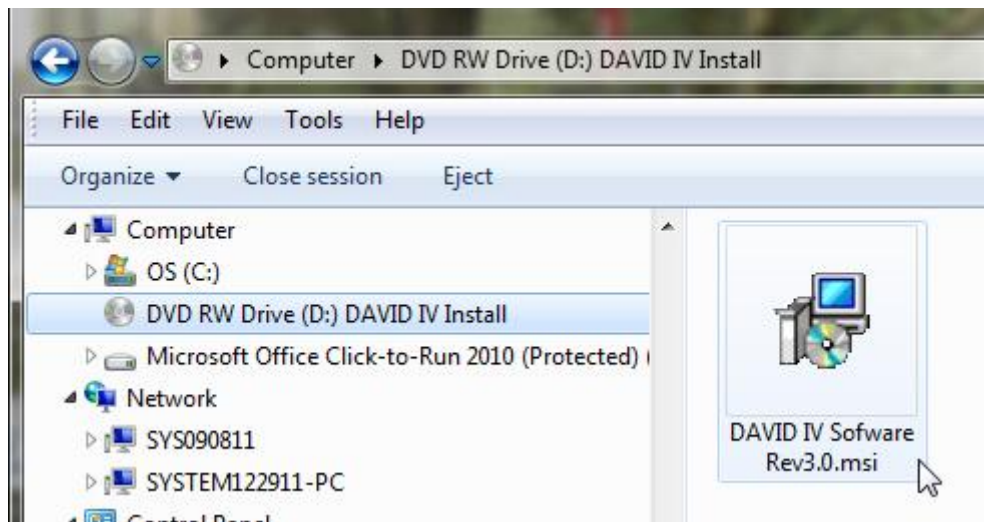
### GENERAL

DAVID IV remote-control software consists of a lightweight installation utility that runs under Microsoft Windows® (XP and later). It is provided on the CD-ROM that accompanies each DAVID IV, or may be downloaded from the Inovonics Website: [www.inovonicsbroadcast.com/downloads](http://www.inovonicsbroadcast.com/downloads).

Changes made via the software screen are immediately sent to the unit's firmware. This is then echoed back to the software for display on the computer screen. If communication is lost, the DAVID IV continues working indefinitely with the parameters set at the time the link was broken, even through local power interruptions. These settings will again be reflected on the computer screen immediately upon reconnection.

### INSTALLING THE SOFTWARE

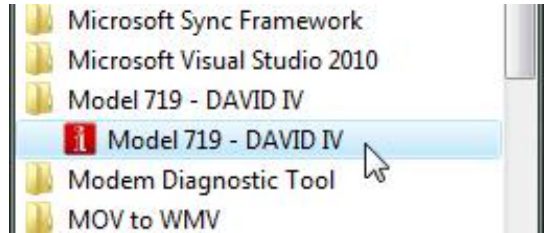
DAVID IV software is supplied as a Microsoft Windows Installer Package file with a .msi extension. The supplied CD-ROM does not include an autostart utility. Open the CD drive location and double-click the file shown here:



If the software file has been downloaded from the Inovonics Website, it will be 'zipped.' Unzip the file, transfer it to the Desktop and double-click.

The software installation routine will run automatically. Simply click: Next when prompted, and: Finish at the end of the installation.

The installation will add the DAVID IV program to your computer's list of programs. This list may be found by pushing the Start button on Windows XP, or the 'meatball' on Vista and newer operating systems. The program will be under All Programs / Model 719 – DAVID IV.



The installation routine will also have placed a shortcut icon on your Desktop. After confirming a network connection you may double-click this to launch the DAVID IV software.



### Confirming a Network Connection

Before starting the software utility, check to see that your computer and the DAVID IV are both connected to your local network.

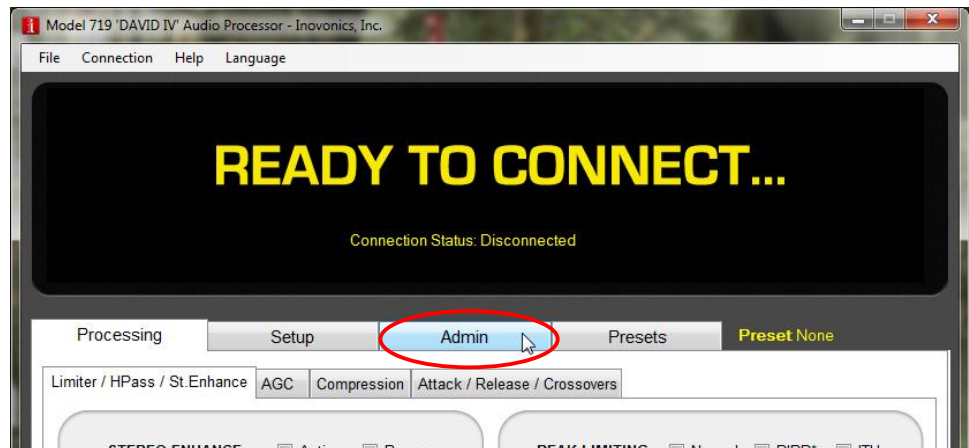
Using the front-panel jog wheel, navigate to: Setup / Network / Status. If the DAVID IV has a network connection (in this case the "Tabletop LAN" described on Page 51), the menu screen should look something like this:



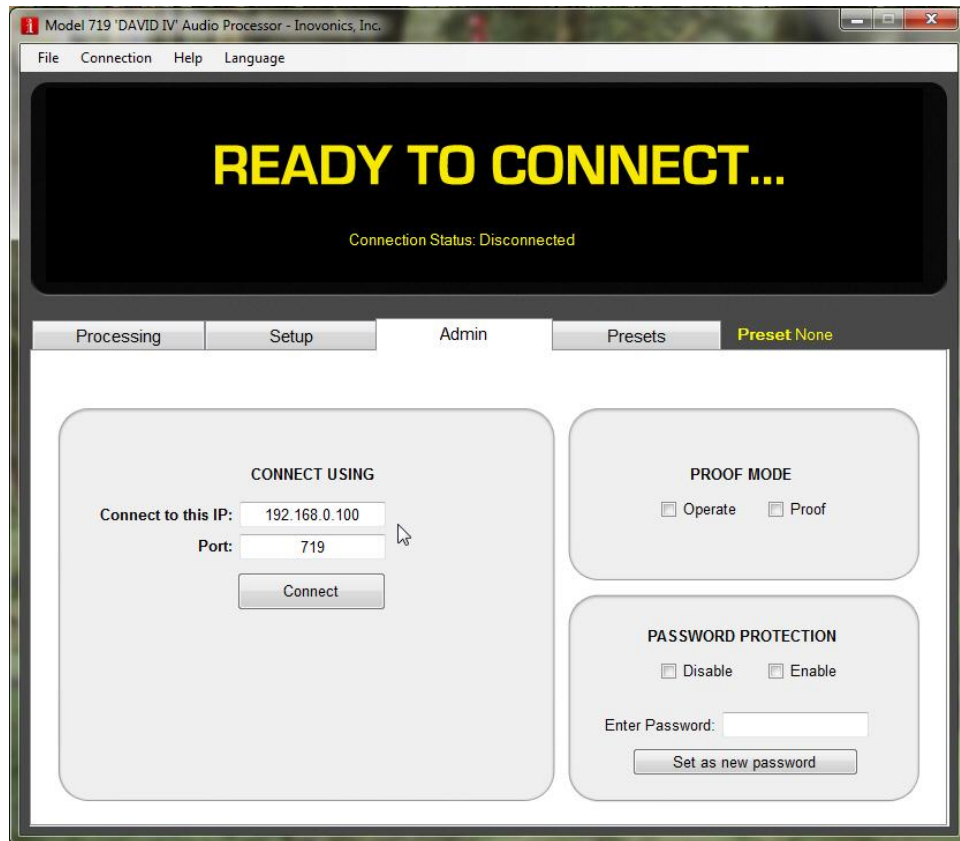
### Running the Software

The screen tells us that the unit does indeed have a local network (LAN) connection (but no Internet access), and that the unit's Internal IP: address is 192.168.0.100. Jot this number down.

Now, double-click the icon on your computer Desktop to start the software. The screen that comes up will indicate that you are READY TO CONNECT to the DAVID IV.

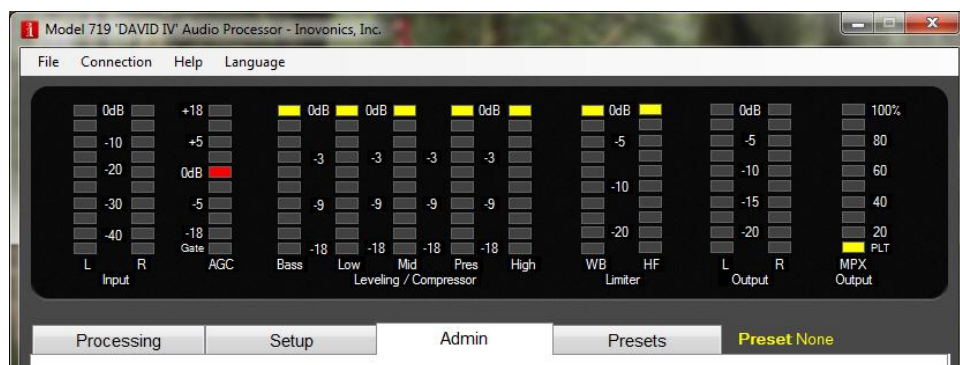


Click on the Admin tab, circled above. This brings you to the Administration screen:



In the Connect to this IP: box, enter the IP address of the DAVID IV shown on its front-panel display. In this use of our 'tabletop LAN,' the IP is: 192.168.0.100. Also enter the default number 719 in the Port: field, unless you must address two DAVID-IV units behind a common external IP address (Page 48). If you have already protected the DAVID IV with a password (Page 45), then you must type that into the Enter Password: box on the right.

Now click the Connect button to invite the software to communicate with the DAVID IV. Interactivity will be indicated by appearance of the bargraph readouts at the top of the screen as shown below.



If the computer has any problem connecting with the DAVID IV, you will see a comment just below the bold wording, **READY TO CONNECT**.

Click: Connection at the top of the software screen to display the drop-down menu shown here. Clicking: Connect here is the same as clicking the Connect button down below. Clicking: Disconnect in this box will terminate the connection. Checking the box beside: Connect On Startup will make software connection automatic; that is, you will connect automatically whenever the software is launched.



At this point, you may again access the Setup / Network / Status menu and note that the IP address of the controlling computer is listed as the Remote: 192.168.0.101 as shown here:

```
Internal IP: 192.168.0.100      DynDNS: Disabled
External IP: Unknown          Port: 719
MAC: 00:04:A3:18:38:AA        Remote: 192.168.0.101
```

## REMOTE CONTROL OF THE DAVID IV

Once connected, any operation that can be performed with the menu-guided front-panel jog wheel can be duplicated at a remote location using the DAVID IV software routine. This includes setting all input and output levels, adjusting all processing parameters, and using and saving processing presets.

Because software control simply mirrors the adjustment routines already discussed in Section III, the various adjustments will not be detailed here again, except where differences exist.

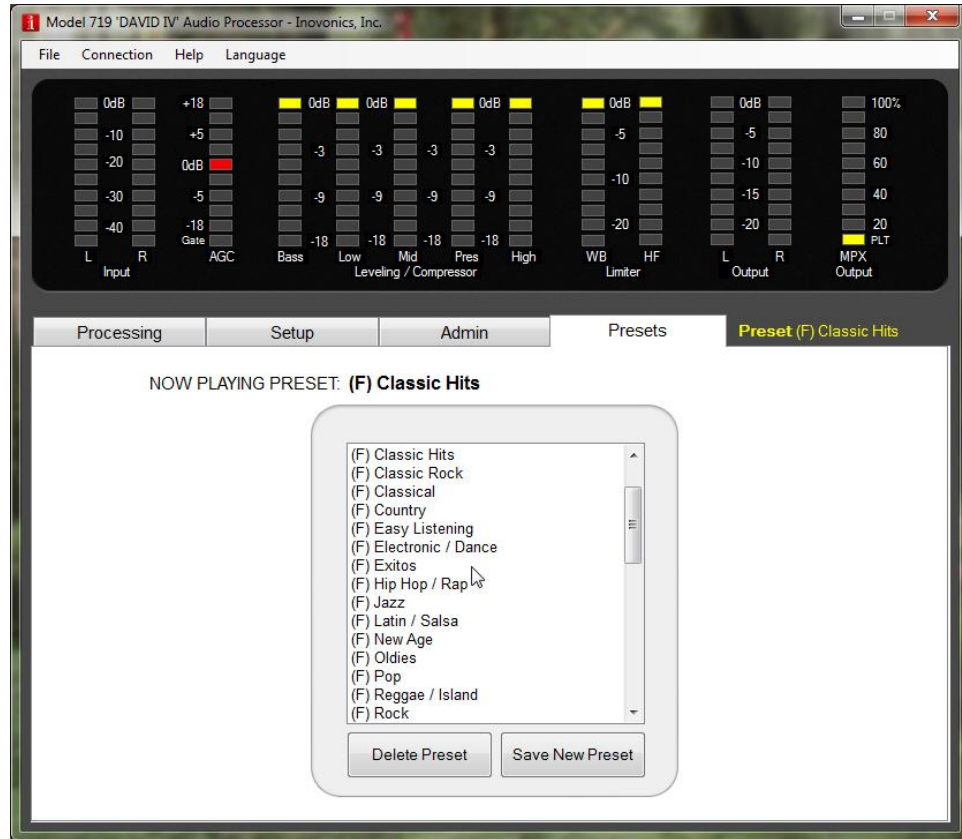
The software screen always displays the action of the front-panel LED bargraph indicators, which respond in real time. Below this field, the four tabs reflect four of the jog wheel selections on the DAVID IV main menu screen. Language, however, is a separate item at the top of the software screen.

### Presets

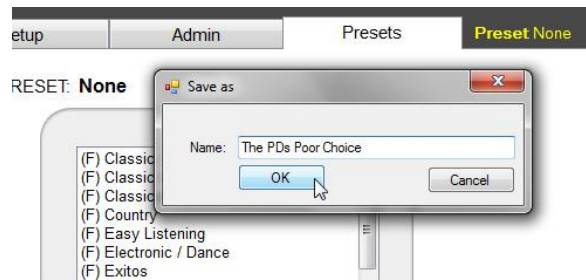
The Presets tab shown at the top of the next page duplicates the DAVID IV front-panel Presets menu information, with the exception that the preset that is 'on air' at the moment is named both above the list and to the right of the tabs, rather than indicated with an arrow within the list as it is on DAVID IV front-panel display.

You select any preset from the list by *double*-clicking it.

As you change or fine-tweak any processing parameter, the NOW PLAYING PRESET: name will change immediately to None. What this means is that the preset that *was* on air has been modified and needs to be saved with a new name. This remains true even if you change a setting and then put it back the way it was. All changes are registered.



Click: Save New Preset and a pop-up box will appear. Name your new preset and click: OK. Your preset will become resident in DAVID IV firmware and be added to the list. This is the preset on-air right now, and it will remain so until another preset is selected.



To delete a user preset via software control, highlight (*single*-click) the preset to be exorcised. Then click the Delete Preset button. Factory (F) presets cannot be deleted.

## Processing

The Processing tab has two sub-tabs. The Compression tab is illustrated here:



Other tabs give access to adjustments that are found in front-panel menu items by the same names.

## Setup

The Setup tab has four sub-tabs with adjustments for in/out levels, stereo-gen settings, networking setup and the built-in tone generator. A fifth tab for the HD Radio delay adjustment appears only if the optional delay board has been installed (Page 36). All sliders and 'radio buttons' on these tabs reflect the DAVID IV menu-driven jog wheel adjustments, which have been explained in Section III.

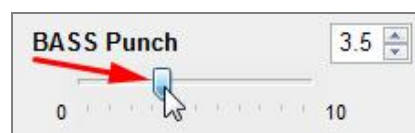
## Admin

This tab gives access to the Administrative settings: the security (password) utility, a place to enter the IP address of the DAVID IV to enable communications, and selection of the Proof mode. Adjusting the brightness of the graphic display from a distance seemed a ridiculous idea and was not included.

## Software 'Sliders'

The software slider controls may be adjusted four different ways:

1. Grab and drag the slider knob with the mouse pointer.



2. Click the up/down buttons next to the value window.



3. Type a value directly into the window and then press Enter (or click anywhere on the screen) to set that value.



4. Or you may click any slider and use the mouse scroll wheel as a 'virtual knob' to increment or decrement the value.

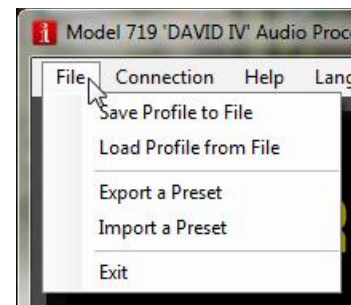
## PROFILE AND PRESET FILE MANAGEMENT

Although the DAVID IV has a non-volatile memory that saves all setup parameters and user presets, the software interface includes a utility for saving this information on your computer as small files. There are a couple of good reasons for backing-up these settings as a matter of routine course:

1. Emergency backup to restore your settings in a loaner or replacement unit in the event that yours requires replacement due to environmental damage or theft by misguided copper recyclers.
2. To duplicate settings for a backup DAVID IV or for associated sites that want to sound the same.

### **Saving a Profile**

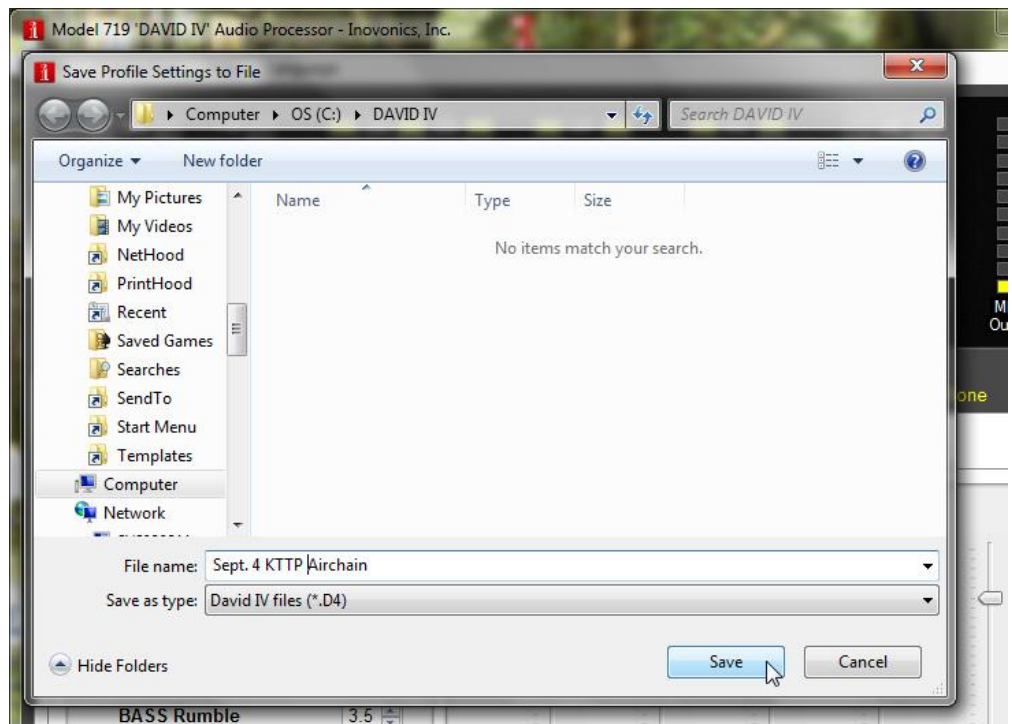
Click: File at the top of the software screen. The first two options: Save Profile to File and Load Profile from File refer to all settings and custom presets currently resident in the DAVID IV firmware. This includes processing preferences, input and output level settings, RDS injection... in short, everything that has been adjusted either by the front-panel jog wheel or through software control of the unit.



To save all this, the entire contents of the DAVID IV memory, click: Save Profile to File. This action will then prompt you to name the profile and find a convenient place to park it.

For example, and with reference to the snapshot on the next page, we first create a 'new' folder directly under the (C:) drive and named it DAVID IV. Then after clicking: Save Profile to File, we navigated to that folder, selected the folder and typed-in a name for our profile... in this case: Sept. 4 KTTP Airchain. When we then click: Save, the program will attach a .D4 extension to the file and it will become resident in that folder.





Recovering and reloading a profile back into your DAVID IV, or another unit, is simply the reverse of this process. Click: File / Load Profile from File, navigate to the proper folder, highlight the file you have saved and click: Open. The profile will be uploaded to the software screen and into DAVID IV firmware.

***WARNING:*** A profile upload will overwrite the current (*on air!*) settings resident in the DAVID IV!

### **Saving a Preset**

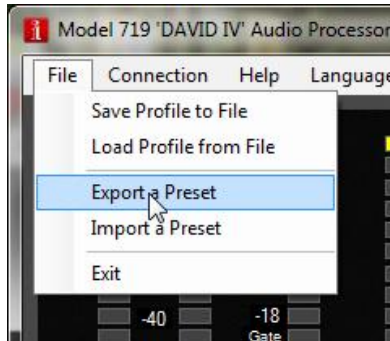
User presets are ‘saved’ (actually *exported* and *imported*) in much the same manner as profiles. Only the custom, user-created presets may be saved, not the factory presets that are common to every DAVID IV. User presets are saved *individually* as single files.

A preset file will *not* include setup parameters (levels, RDS injection, etc.), but only the processing adjustments for that particular, single preset. This means that a preset file can be used among multiple installations that all want to *sound* the same, but the imported preset will leave in/out levels and other *setup* parameters properly adjusted for each installation.

Presets are saved one-at-a-time as individual files. These files, which are actually resident in the DAVID IV firmware, are accessed via the software screen, and may be exported to a location on the computer hard drive. Files may be ‘passed around,’ copied to a flash drive or attached to an e-mail, so that any preset may be imported into another DAVID IV that wants to have the same sonic ‘signature.’

First, highlight (*single-click*) the preset you wish to save. (Remember: if you double-click, you will put that preset on air!) It may be the preset currently on-air or could be any other user-created preset. In the example illustrated to the right, we have selected a preset crafted especially for the afternoon drive.

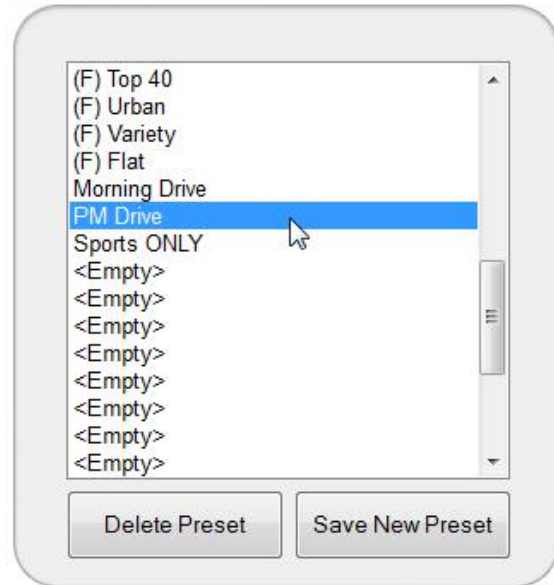
Next, click: File / Export a Preset at the top of your screen as illustrated below:



### Importing a Preset

Importing a preset is just the reverse process. Click: Import a Preset, navigate to the folder on the computer where presets are held. Highlight the preset and click: Open. The saved preset will be added to the list, both on the software screen and on the DAVID IV display, but it will not immediately be selected as the on-air setting. Double-click the entry on the software screen or select it with the jog wheel to make the imported preset (or any preset) your current on-air choice.

ESET: (F) Classic Hits



This will prompt you to specify a file location, which can be the same folder used to save your profiles, or another folder created the same fashion as described under the **Saving a Profile** heading (Page 60). The file with that preset will be saved with its listed name and a .D4p extension.

## Section VI

# UPDATING DAVID IV FIRMWARE

## THE FIRMWARE UPDATER

The all-digital DAVID IV is a firmware-based product. The term ‘firmware’ refers to the code loaded into the microcontroller and DSP chips, the ‘smarts’ that make the product work.

The design of the DAVID IV includes a utility that allows firmware to be updated whenever Inovonics changes or adds features to improve performance or to expand the usefulness of the product. Firmware updates are supplied free of charge.

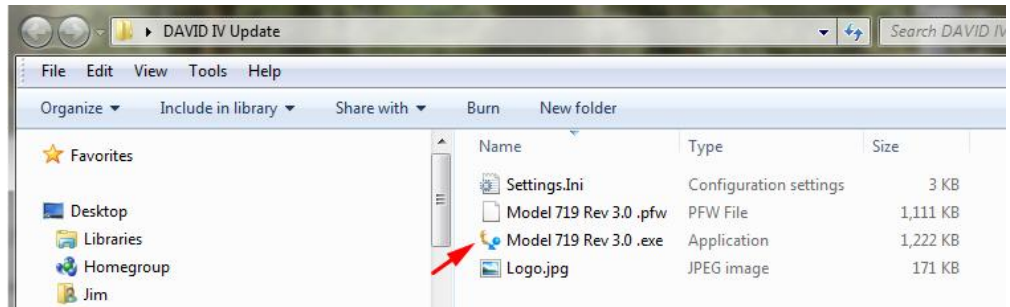
### Warning

A firmware update will restore the DAVID IV to factory defaults. *All level, processing settings and custom/user presets will be overwritten!* Always perform a Profile Save (Page 60) before proceeding with an update. This will save your level and other setup parameters, plus factory and user processing presets.

Firmware updates are *bootloaded* into the DAVID IV. A bootloader is a simple software routine that runs on a PC connected to the DAVID IV. Refer to Section IV for specifics on interconnecting the DAVID IV to your computer, either over a LAN (network) connection (Page 47), or directly with a CAT5 cable (Page 51).

### Firmware Update Files

A firmware update will be supplied as a ‘zipped’ folder containing four files. This may be distributed as a download from the Inovonics Website or supplied on a CD-ROM or USB flash drive. Regardless of how the update is received, make a temporary New Folder on your PC Desktop and unzip these files to it as shown below.



One of the supplied files is the third-party bootloader utility, which is an ‘executable’ (.exe) file. This is marked with an arrow in the snapshot. Because executables are notorious for propagating viruses, many antivirus programs will not allow .exe files to be downloaded, and additionally may urge you not

to install them. To circumvent this inconvenience, and also depending on how the Firmware Updater utility was delivered, we *may* have renamed the one file with a `.ex_` extension. So the actual file extension may be either `.ex_` or `.exe`. If it was amended for delivery, the proper `.exe` extension must be restored for the Firmware Updater to work. If necessary, right-click this file and rename the `.ex_` extension `.exe`.

## Running the Firmware Updater

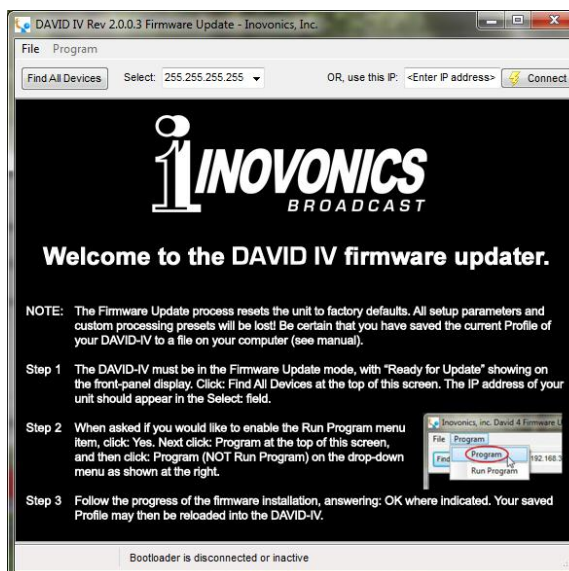
Navigate to your temporary Desktop folder and double-click the `.exe` file. (arrow, above). That will bring up this Information message advising that the Firmware Updater does not yet find the DAVID IV. Click: OK. This will start the Firmware Updater and display the main screen.



This screen outlines the firmware update process in three easy steps.

**Step 1** advises that the DAVID IV must, itself, be in the Firmware Update mode.

Using the front-panel jog wheel, navigate to: Administrative / Firmware Update. This will bring up the first of two screens, each with a stern warning about proceeding. If you have backed up your Profile, and are reasonably certain that the DAVID IV and your computer are ready to connect properly, select:  Yes in the next two menus, paying close heed to the warnings in each.

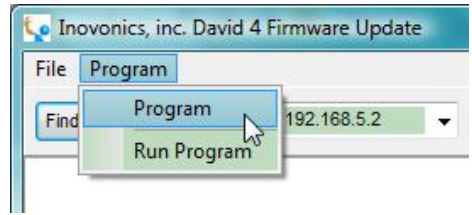


When the DAVID IV is ready to accept the firmware update it will display this message.

**FIRMWARE UPDATE:  
Ready for Upload**

Next, click: Find All Devices at the top of the computer screen. The IP address of your DAVID IV should appear in the Select: field, confirming that you are properly connected. If you do *not* see the IP address of your DAVID IV, abort the update (described below) and troubleshoot connection issues. You may always use the DAVID IV PC software to test the interconnection. If the PC (remote control) software connects, the Firmware Updater should also connect.

**Step 2:** click: Program to display the drop-down menu, and then click: Program (*not* Run Program) to start the firmware update process.



The PC screen will display various progress bars as firmware is uploaded to the DAVID IV.

**Step 3:** click: OK as directed at the end of the upload. The DAVID IV will revert to the main menu where you can confirm the version number of the uploaded firmware.

### Aborting a Firmware Update

Before you have committed to a firmware update, pushing the Back button will return you to previous screens, effectively aborting the update process.

But once you see this message on your DAVID IV it is *almost* too late to turn back; you have committed to uploading the new firmware.

**FIRMWARE UPDATE:  
Ready for Upload**

If for some reason the Firmware Updater cannot connect to the DAVID IV, and you have not yet initiated Step 2 to begin the update routine, even at this point, and with this message showing, you may power-cycle the DAVID IV as a last-ditch means of aborting the process and returning to the existing version of the firmware. *Do not* hold down the Back button while doing this abort; that is, *do not* perform a hard reset!

HOWEVER, once the updater process is underway, if it does not complete successfully there is a chance you could lose the existing firmware version. In that case you will have to return your DAVID IV to Inovonics for a factory firmware reinstallation.

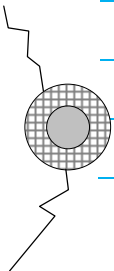
# NOTES AND DOODLES



A set of ten horizontal blue lines for writing, with a vertical red margin line on the left side.



A set of ten horizontal blue lines for writing, with a vertical red margin line on the left side.



A set of two horizontal blue lines for writing, with a vertical red margin line on the left side.



# INOVONICS WARRANTY

- I TERMS OF SALE:** Inovonics products are sold with an understanding of “full satisfaction”; that is, full credit or refund will be issued for products sold as new if returned to the point of purchase within 30 days following their receipt, provided that they are returned complete and in an “as received” condition.
- II CONDITIONS OF WARRANTY:** The following terms apply unless amended *in writing* by Inovonics, Inc.
- A. The Warranty Registration Card supplied with this product *must* be registered online at [www.inovonicsbroadcast.com](http://www.inovonicsbroadcast.com), within 10 days of delivery.
  - B. This Warranty applies only to products sold “as new.” It is extended only to the original end-user and may not be transferred or assigned without prior written approval by Inovonics.
  - C. This Warranty does not apply to damage caused by misuse, abuse, accident or neglect. This Warranty is voided by unauthorized attempts at repair or modification, or if the serial identification label has been removed or altered.
- III TERMS OF WARRANTY:** Inovonics, Inc. products are warranted to be free from defects in materials and workmanship.
- A. Any discrepancies noted within THREE YEARS of the date of delivery will be repaired free of charge, or will be replaced with a new or remanufactured product at Inovonics’ option.
  - B. Parts and labor for factory repair required after the three-year Warranty period will be billed at prevailing prices and rates.
- IV RETURNING GOODS FOR FACTORY REPAIR:**
- A. Equipment will not be accepted for Warranty or other repair without a Return Authorization (RA) number issued by Inovonics prior to its return. An RA number may be obtained by calling the factory. The number should be prominently marked on the outside of the shipping carton.
  - B. Equipment must be shipped prepaid to Inovonics. Shipping charges will be reimbursed for valid Warranty claims. Damage sustained as a result of improper packing for return to the factory is not covered under terms of the Warranty and may occasion additional charges.