AARON 640
Premium FM Rebroadcast Receiver

Installation & User Guide

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Section I

INTRODUCTION

AARON 640 PRODUCT DESCRIPTION

Inovonics' AARON 640 is a professional-grade receiver for the commercial FM broadcast band, with features and performance equaling those of the best industrial or consumer receivers currently available.

Although the AARON's primary application is in re-broadcast (FM 'translator') service, this receiver finds use in any demanding reception situation.

Features   Leading features of the Inovonics AARON 640:

- All-digital "SDR" (Software-Defined Radio) design.

- Full-bandwidth Composite/MPX output with negligible latency (delay) and adjustable composite processing.

- Balanced, low-latency L/R analog and AES digital audio outputs; built-in test tone generator.

- Advanced and effective Reception Tools that mitigate poor reception situations and respond to changing RF signal conditions.

- Intuitive, menu-driven front-panel setup, plus a built-in Web server for full remote operation over any IP network.

- Supports SNMP remote monitoring.

- Built-in FM BandScanner™ gives a plot of the entire FM band or the spectrum around a specific frequency of interest.

- Local and remote graphic readout of program levels, plus a graph of program density (loudness) over time.

- Local, remote and self-logging alarms for audio loss, RF loss, and RDS loss or 'hijacking'. Alarms include e-mail or text-message notification.

- The AARON 640 boots or resets *in less than one second* and draws only 5 watts from the AC mains.

AARON 640 TECHNICAL SPECIFICATIONS

Certain technical specs of the AARON 640 (and receivers in general) are either difficult to quantify in tabular form, or they do not adequately reflect receiver operation in a real-world environment. Manual text further explains features and performance aspects in appropriate sections of the text.

GENERAL PERFORMANCE

Tuning Range: 65.0MHz–108.0MHz

Sensitivity/Noise Performance:

> **Unweighted monaural SNR for AES Digital and L/R Analog line outputs referenced to ±75kHz carrier deviation at specified RF input levels:**
> > ≥82dB Digital, ≥80dB Analog at 60dBµv
> > ≥78dB Digital, ≥76dB Analog at 40dBµv
> > ≥60dB Digital/Analog at 20dBµv
> > ≥50dB Digital/Analog at 10dBµv
> > ≥43dB Digital/Analog at 0dBµv

Selectivity:

> **Selectable IF bandwidths**:
> > 311kHz, 287kHz, 254kHz, 236kHz, 217kHz, 200kHz, 184kHz, 168kHz, 151kHz, 133kHz, 114kHz, 97kHz, 84kHz, 72kHz, 64kHz and 56kHz

Frequency Response:

> **Composite/MPX Output (pass-through):**
> > ±0.5dB, 20Hz–100kHz

> **AES Digital & L/R Analog Line Outputs:**
> > ±0.2dB, 20Hz–15kHz

Stereo Separation (at 1kHz):

> **Composite/MPX Output:** >45dB

> **AES Digital & L/R Analog Line Outputs:** >50dB

Program Signal Latency (Delay):

> **Composite/MPX Output:** ≤250µs

> **AES Digital & L/R Analog Line Outputs:** ≤2.0ms

Regional Settings:

> **Tuning Steps:**
> > 200kHz, 100kHz or 10kHz

> **De-Emphasis (Line Outputs):**
> > 75µs or 50µs

> **Radio Data System:**
> > RBDS or RDS

REAR-PANEL APPOINTMENTS

Antenna Input:
> 50-ohm (N)

Digital Line Output:
> The AES3 (XLR) stereo output is a 24-bit, 48kHz output that may be adjusted between –30dBFS and 0dBFS, corresponding to ±75kHz carrier deviation, with or without de-emphasis.

Analog Line Outputs:
> Active balanced (XLR) L/R outputs are adjustable between –20dBu and +18dBu (+15.5dBm), corresponding to ±75kHz carrier deviation, with or without de-emphasis. Source impedance is 200 ohms.

Composite/MPX Outputs:
> The unbalanced (BNC) output may be adjusted between 1V p-p and 6V p-p, corresponding to ±75kHz carrier deviation. Source impedance is 75 ohms.

Composite Audio Processing:
> Up to 3dB of composite clipping may be applied to the composite/MPX output to better define the FM deviation limit. The 19kHz stereo pilot and the 57kHz RDS subcarrier are stripped, filtered and reinserted after the clipper. This clipping feature does not affect the demodulated L/R program outputs.

Network Port:
> An RJ45 jack accepts TCP/IP network connections for remote setup and operation of the AARON 640.

Headphone Jack (Front Panel):
> A quarter-inch (TRS) headphone jack monitors the off-air program signal. Headphone volume is a menu item.

THE USER INTERFACE

Front-Panel:
> A front-panel graphic display and jog wheel allow easy, menu-guided *in-situ* setup and operation of the AARON 640. LED "VU" meters display L/R program audio levels.

Software Control:
> The IP network port enables complete remote setup and operation of the AARON 640 over a local network or the Internet using any Desktop, tablet or mobile browser.

SNMP:
> SNMP remote monitoring is supported.

MISCELLANEOUS

Test Tone Generator:
  20Hz – 20kHz; 60dB attenuator.

AC Mains Requirements:
  90–130VAC or 200–255VAC, 50/60Hz; 5W.

Size:
  H: 1¾in/44mm, W: 19in/483mm,
  D: 9½in/240mm (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:

$\mathsf{C}\,\mathsf{E}$ EN50081-1
       EN50082-1
       93/68/EEC

√RoHS   2002/95/EC

BLOCK DIAGRAM

The AARON 640 is essentially a Software-Defined Radio (SDR) and is almost entirely DSP-based. Virtually all its functionality is provided through firmware coding. The Block Diagram presented below illustrates receiver basics and has deliberately been organized as if the AARON 640 were a more conventional *analog* design. This should give the reader a more familiar and understandable functional representation of the product, although the actual signal path may deviate appreciably from what's shown.
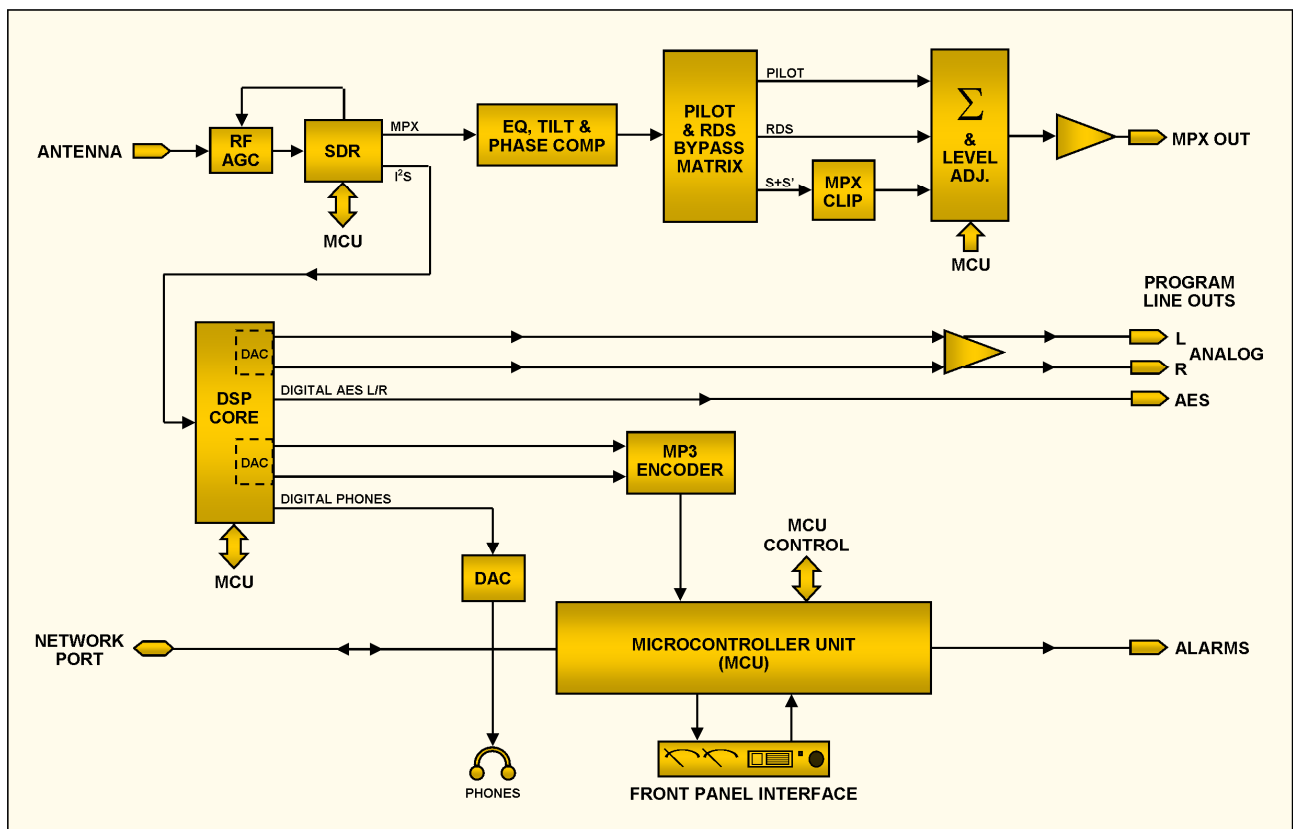
Block Diagram – AARON 640 Rebroadcast Receiver

Section II

INSTALLATION

GENERAL

This section of the manual addresses the physical installation of the AARON 640 in its operating location, the 'nuts and bolts' of connecting the unit. This section also references pages where pertinent setup adjustments are discussed.

Menu Navigation

Throughout the manual initial references to AARON 640 setup and adjustment assume the use of the front-panel graphic display, jog wheel and Back button. A menu 'tree' is presented on Pages 17 and 18.

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 Over a Network

Anything that can be done from the front panel may also be accomplished over a network from a remote location using the Web server built into the AARON 640. Refer to Section VI for details.

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 AARON 640. 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.

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 AARON 640 setup and use. Do please refer back to this sec-

tion, however, to confirm proper physical installation and interconnection with other station equipment.

AARON 640 Rear View

MOUNTING

Rack Requirement

The AARON 640 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 roughly the same amount of energy as the charger for an electric razor, the AARON 640 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 equipment may 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 AARON 640 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 operate the slide switch adjacent to the AC mains connector on the rear panel. 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: 1/4A for 115V mains, 1/8A 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 AARON 640 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 AARON 640 will be co-located with FM transmission equipment, do practice care and common sense in locating the unit away from *abnormally* high RF fields.

Ground Loops   Because the unbalanced composite/MPX output of the AARON 640 is referenced to chassis ground, 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 alleviate this 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.

ANTENNA INPUT

The rear-panel ANTENNA 'N' connector is the 50-ohm RF input to the receiver.

PROGRAM LINE OUTPUTS

AARON 640 analog and digital line outputs are available simultaneously with independent settings.

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 *not* transformer-isolated.

Under the Setup / Analog Audio Output menu, left and right line outputs may be adjusted to any level between –20dBu and +18dBu. The dB levels shown below the slider control represent the *unloaded* output level at ±75kHz carrier deviation. The outputs have a resistive source impedance of 200 ohms, with 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.

Just as with the Digital Line Output discussed above, De-emph (de-emphasis) may be turned On or Off here.

Unbalanced Operation   To connect the analog line outputs of the AARON 640 to the low-level, unbalanced inputs of consumer-grade equipment, 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).

When driving unbalanced lines the actual output level will be *6dB lower* than the Analog Level shown in the Analog Audio Output menu, as only one side of the bridge-configuration output amplifier is driving the line.

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 fixed sampling rate of 48kHz.

This menu sets the digital output level and frequency characteristic. The dB notation below the slider control relates to digital full-scale (dBFS) and corresponds to the level of program peaks at 100% modulation (±75kHz carrier deviation). The output may be adjusted between 0dBFS (digital full-scale) and –30dBFS.

De-emph (de-emphasis) may be set either On to follow the regional standard (Page 21), or Off for an output that will retain the transmitted FM pre-emphasis curve. Your selection will depend on whether an exciter fed by the AARON 640 has internal pre-emphasis or depends on a pre-emphasized feed.

COMPOSITE/MPX OUTPUT

The MPX OUT BNC connector on the rear panel of the AARON 640 is an unbalanced FM baseband output with a resistive source impedance of 75 ohms. The level of this signal is adjusted under the Setup / MPX Output menu and is indicated in open-circuit (unloaded) peak-to-peak volts. It may be adjusted between 1V p-p and 6V p-p, corresponding to ±75kHz deviation of the incoming carrier.

Optional processing of the composite/MPX is discussed on Page 26, and will be loosely referred-to as 'audio processing.' This will differentiate it from the several RF signal processing options available under Reception Tools that may be called into play to improve reception under adverse conditions.

NETWORK PORT

A standard RJ-45 network jack is used to connect the AARON 640 to a Local Area Network (LAN) or to the Internet. Full remote control and off-air audio monitoring is afforded via the internal Webpage interface. Networking setup and Web-based operation is explained in Sections IV and V.

ALARM TALLIES

Four reception-error alarms are available on this terminal block, which may be unplugged from the chassis for ease in wiring and maintenance. These alarms are:

- Loss of program audio
- Interruption (loss or reduction) of the RF carrier
- Loss or 'hijacking' of the RDS/RBDS data subcarrier
- Loss of stereo pilot

Either an active-high or an active-low output may be programmed under the Setup / Alarm Closure Polarity menu. +5VDC and Ground are provided here also. The programming of these alarm functions is detailed on Page 29.

Section III

SETUP AND OPERATION

Instructions in this section cover AARON 640 setup using the front-panel graphic display screen and jog wheel. Anything that can be done from the front panel can also be accomplished using the Web interface, which closely follows the front-panel menus and readouts. Networking the AARON 640 is covered in Section IV, and remote operation in Section V. 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 for initiating network connectivity in the first place.

"QUICK START" TECHNOLOGY"

'Instant Boot'   'Boot' (startup) time of AARON 640 is less than one second. When AC power is first applied, or after any momentary power interruption, the unit is back in full operation in very short order. Setup and reception parameters in use previous to the power interruption are reloaded instantly from non-volatile memory to the receiver's processing core.

Brownout Detection   Although the AARON 640 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 and operating adjustments of the AARON 640 are under firmware control. There are no jumpers, switches or mechanical potentiometers, only the front-panel jog wheel A and Back button B identified in the illustration here.

Graphic Display   The graphic display screen C 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 knob to cycle among highlighted menu items, and then *push* the knob 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 Menu screen.

In all setup instructions given in this manual, the menus will be shown as a string of commands. As an example, starting at the Main Screen: Setup / Analog Audio Output would direct you to do the following:

1) *turn* the jog wheel knob so that Setup is highlighted;
2) *push* the knob to enter the Setup menu;
3) *turn* the knob to highlight Analog Audio Output;
4) *push* the knob to enter the Analog Audio Output sub-menu;
5) *push* the knob again to enable the control 'slider';
6) *turn* the knob to set the output to the desired level;
7) *push* the knob (or Back button) to commit the adjustment to non-volatile memory.

If you make a mistake (for example, you might *push* the knob off-center, which might 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 Menu screen, or simply leave any current screen showing. After 30 seconds, the current screen will 'deselect,' meaning that the jog wheel knob won't accept an adjustment command without that command once again being selected.

After a programmed interval 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

THE AARON 640 MENU TREE

The several levels of setup and operating menus are laid out in an intuitive and easy-to-manage fashion. The complete Menu Tree is shown and explained on the following couple of pages.

Each menu level shown will indicates whether that level is simply a (display) or (listing) of some parameter, or whether it accepts some form of user entry. (set) generally signifies an on/off or enable/disable function, (select) denotes user control

over a much wider range of choices, perhaps selecting between a number of options or adjusting some value in very small increments. (data entry) calls for alphanumeric character entry into data fields.

Menu Titles are shown in a font that approximates that of the front-panel display. Main Menu items are against the left margin, submenu levels are indented appropriately. A contrasting font defines the descriptive callout in parentheses following menu items.

Now Playing (station information display)
Tuner
    Frequency Select (main tuning set))
Preset Stations
    Save Preset
        Name Your Preset (data entry)
    Individual Presets / (Empty) (display/select)
    Delete Preset (select)
Reception Tools
    IF Bandwidth
        Auto (set)
        Fixed (select 16 bandwidths)
    Stereo Blend
        Auto (set)
        RSSI (select)
        USN (select)
        Mpath (select)
    High Blend
        Auto (set)
        RSSI (select)
        USN (select)
        Mpath (select)
    Highcut
        Auto (set)
        RSSI (select)
        USN (select)
        Mpath (select)
    Stereo/Mono
        Stereo (Auto) / Forced Mono (set)
    Enhancers
        Multipath Suppression (set)
        Channel Equalizer (set)
Graphs & Metering
    BandScanner (FM spectrum display)
        Center Freq. (select)
        Step Size (select)
        RSSI Range (select)
        Scan (set)
    Processing (Reception Tools display)
    L+R/L-R (stereo sum & difference display)
    LR Plot (loudness display)

RDS Info
    Decoded RDS (multi-parameter display)
    Radio Text Plus (display)
    Alternative Frequencies
        No. of AFs (display)
        Frequencies List (listing)
    RDS Groups
        Block Error Rate (display)
        List of Active Groups (listing)
    Open Data Applications
        No. of ODAs (display)
        ODAs by RDS Group (listing)
Alarms & Notifications
    Audio Loss
        Alarm (set)
        Threshold On (select)
        Time On (select)
        Threshold Off (select)
        Time Off (select)
    Low Signal
        Alarm (set)
        Mute (set)
        Threshold On (select)
        Time On (select)
        Threshold Off (select)
        Time Off (select)
    RDS Error
        Alarm (set)
        PI Error (set)
        Time On (select)
        Time Off (select)
        PI Code (data entry)
        PI Code (display)
    Pilot Loss
        Alarm (set)
        Time On (select)
        Time Off (select)
    Email Notifications (set and select)
    Alarm Log (display)

Setup
    Analog Audio Output
        Analog Level (**select**)
        De-emph (**set**)
    Digital Audio Output
        Digital Level (**select**)
        De-emph (**set**)
    MPX Output
        Level (**select**)
        Clipping (**select**)
    Network
        IP Settings
            Port: (**data entry**)
            DHCP / Static IP (**set**)
            Parameters (**display**)
        Hostname
            Hostname: (**data entry**)
        Dynamic DNS
            Mode: (**select**)
            Host: (**data entry**)
            User: (**data entry**)
            Pass: (**data entry**)
        Time
            Time Zone & DST
                DST / Auto / Off (**set**)
                Time Zone (**select**)
            Time Server (**data entry**)
        SNMP
            Mode & Communities
                Mode (**select**)
                Communities
                    Read (**data entry**)
                    Write (**data entry**)
            SNMP Ports
                General **Port** (**data entry**)
                Trap **Port** (**data entry**)
            Trap Destinations (**data entry**)
        Status (**network status display**)

Setup (**continued**)
    Email Preferences
        SMTP Server
            SMTP Server (**data entry**)
            Use SSL (**set**)
            Port: (**data entry**)
        Sender
            Username: (**data entry**)
            Password: (**data entry**)
        Recipients
            Select: (**select from list**)
            Address: (**data entry**)
    Send Test Email (**test utility**)
    Alarm Log Settings
        Status: (**display**)
        Email When: (**select**)
        Clear Log (**set**)
    Alarm Closure Polarity
        Audio (**set**)
        RSSI (**set**)
        RDS (**set**)
        Pilot (**set**)
    Region
        Tuning Steps (**select**)
        De-emph (**select**)
        RDS/RBDS (**select**)
    Test Oscillator
        Off / L only / R only / L+R (**select**)
        Frequency (**set**)
        Level (**set**)
Admin
    Security
        Current Password: (**data entry**)
        Enable (**set**)
    Display
        Brightness (**select**)
        Timeout (**select**)
    Firmware Update (**utility**)
    About (**display**)
    Headphone Volume
        Volume (**select**)

AARON 640 READOUTS AND METERING

The AARON 640 offers an array of meters and data readouts that can be used to advantage in setting-up the unit and monitoring incoming and outgoing signal quality. The front-panel OLED display offers exceptional resolution for a 1U presentation, and the Web interface echoes the same information on any PC, tablet or mobile phone with network access.

The most useful 'global' displays will be described here at the outset, as they may have frequent reference. The more specific displays will be discussed along with their applications.

The Now-Playing Screen   Now Playing is at the top of the Main Menu. Highlight this item and *push* the knob to bring up a readout of station information.

Top row: **1)** The frequency that the AARON 640 is tuned to; **2)** The RDS PI code; **3)** Station call letters (RBDS mode only, these are derived from the PI code in the US and Canada).

Second row: **1)** The RDS PS field; **2)** The RDS Radio Text field (scrolling).

Bottom row: **1)** Incoming carrier signal strength in dBuV; **2)** The current IF bandwidth; **3)** Multipath distortion relative to carrier modulation;   **4)** Ultrasonic noise relative to carrier modulation.

Graphs and Metering   The Graphs & Metering sub-menu is a bit farther down the Main Menu.   Navigate there and *push* the knob to bring up this screen.

FM BandScanner   The first Graphs & Metering item, the BandScanner, gives an RF spectrum display of the incoming signals at carrier frequencies. Here you can set the Center Freq of the display, the Step Size, or resolution bandwidth, and the RSSI Range where the vertical range of the 10dB/div display may be scaled to meet signal strength criteria. Bracket and select Scan to initiate the spectrum plot.

This shot is a wide-range analysis centered at 98.1 MHz with a step size of 100kHz. Here you see the entire FM band with the individual carriers of stations in the local market.
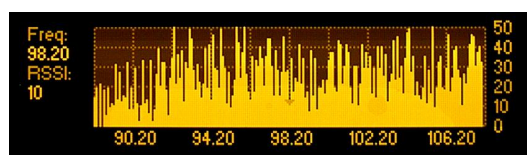
Zooming-in on the station at 94.7MHz, and narrowing to 10kHz steps, clearly shows the main carrier, the narrow HD Radio® digital carrier pair, and the significant adjacent channels.
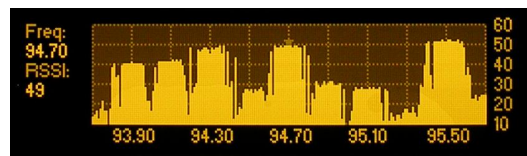
The BandScanner is a handy utility for checking possible sources of adjacent-channel interference. It is normally used only for receiver installation and setup.

NOTE: When the BandScanner is in use, the program signal going through the AARON 640 will be temporarily compromised. You will experience a 'burbling' in the MPX and program outputs during the scan.

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Reception Tools Processing

The next Graphs & Metering menu item, Processing, displays the real-time action of the three Reception Tools that can improve performance when the incoming signal is less than optimal. Keep in mind that these tools are associated with the AARON 640's built-in stereo decoder, so *they affect only the analog and digital line outputs.* These reception tools have no effect on the composite/MPX output.

The criteria for these Reception Tools are explained under Reception Tools beginning on Page 23. The readouts in this menu are actually redundant to similar displays associated with each of the Reception Tools, but on this menu screen they incorporate a peak-hold feature, have a higher readout resolution, and allow viewing all three readouts at once. Page numbers noted here refer to the corresponding Reception Tools setup notes.

Highcut shows the amount of high-end audio rolloff imposed on the demodulated and decoded L/R stereo program signal when poor reception conditions would otherwise contribute an annoying hiss to the program. The percentage figure at the end of the scale is somewhat arbitrary, but does depict the working range of this audio control. (Page 25)

Stereo Blend indicates the amount of broadband (full audio spectrum) blending put in effect to mitigate noise from a low level of incoming carrier or from multipath effects. (Page 24)

High Blend is similar to the broadband blending discussed above, except that the blending action is restricted to the upper audio frequencies only. (Page 25)

The actual result of blending action can be observed in the L+R / L–R menu screen discussed next.

'Stereophony' Display

The L+R / L–R menu screen shows the stereo sum and difference levels on separate peak-reading bargraphs. The relative level of the L–R stereo-difference signal is a good measure of how 'wide' the stereo image is.

An off-scale (dead) L–R bar is a clear indication of a strictly-monaural program signal. Conversely, an L–R level that is *consistently higher* than the L+R component suggests stereo program audio that is out-of-phase.

Loudness Plot

The LR Plot is a history of the left and right channel peak values over a 10-second 'rolling' time period. This gives a first-order measure of program loudness, as the amount of time that program peaks spend at or near the 0dB abscissa is a persuasive measure of program audio density. Remember: over-processed audio leads to early listener fatigue and lower TSL.

RDS Information Display

The AARON 640 provides a comprehensive display of RadioData (RDS/RBDS) parameters. From the Main Menu, navigate to RDS Info.

The five submenu screens only display data; there are no adjustments or provision for data entry.

The RDS Info utility has marginal bearing on the use of the AARON 640 as a translator receiver even though it is still a powerful RDS diagnostics tool. It has been included for the interest and convenience of 'power users' of the Radio Data System and the many features that RDS offers above scrolling song titles. Those users will already be familiar with what appears on these screens, so most details will be omitted in this manual.

The second of these screens, Radio Text +, will be of interest to those stations that practice RDS 'tagging.' RDS Groups will indicate the total data percentage used within each of the groups. RDS Groups also has a BLER (BLock Error Rate) readout, which quantifies RDS data corruption due to poor reception conditions.

QUICK RECEIVER SETUP

The AARON 640 may be placed in operation in very short order. In situations with a healthy incoming signal, you can probably accept factory-default setup options and values. Of course the receiver must be tuned to the incoming carrier, but for straightforward operation in a typical FM translator application, just set the MPX or line output level to match the input sensitivity of the FM exciter and assure proper carrier re-modulation using your mod-monitor.

REGIONAL SETTINGS

From the Main Menu, navigate to: Setup / Region. This accesses three settings that, once set, can generally be forgotten. Here you can set the main Tuning Steps to 200kHz, 100kHz or 10kHz intervals; the program De-emph (de-emphasis) to either the 75μs or 50μs (microsecond) rolloff characteristic for the L/R line outputs; and the proper RadioData registers for the European RDS or North American RBDS standards.

TUNING AND PRESETS

Tuning the AARON 640

From the Main Menu navigate to Tuner. (Menu navigation is explained on Page 10.) *Turn* the knob to bracket the receive frequency, *push* the knob to enter the edit mode, and then *turn* the knob to dial-in the desired frequency. *Push* the knob again to set this frequency in memory and return you to command of the Tuner screen.

Station Presets   The AARON 640 has ten station presets. This memory function keeps track of the receive frequency, Reception Tool settings and signal alarm setup options for each individual preset.

From the Main Menu jump down to Preset Stations and *push* the knob. Highlight Save Preset at the top of the list and *push* the knob again. This will open the data-entry field shown here, where you can name the preset with station call letters or other identifier of your choice. Just *turn* and *push* the knob to enter characters one at a time. Highlight and *push* Backspace to correct any errors, and when the field is complete, highlight and push Save.

This returns you to the Preset Stations menu where your entry will assume the top position in the station list. The arrow beside the entry shows that this is the station now being received. To tune between multiple presets, highlight the one you want to receive and *push* the knob to select the new frequency and its other associated settings.

REBROADCAST MODES

Direct Composite/MPX   Most rebroadcast receivers will have both a composite/MPX 'baseband' output and left/right program line outputs. The composite/MPX output is commonly connected to the baseband input of the FM exciter to rebroadcast the entire demodulated FM baseband spectrum. This includes the FM-multiplex program signal along with RDS and other subcarriers that the station might carry. With a clean, noise-free incoming carrier, this rebroadcast method is generally preferred.

Re-Encoding Advantages   However, there are advantages to re-encoding the composite baseband signal. Re-encoding refers to first demodulating the incoming carrier down to left and right program audio and then re-creating the FM baseband, either with a standalone stereo-gen or with one built into the exciter.

Leading the re-encoding advantages is a 'clean-up' of the incoming signal. Baseband noise, including 'ultrasonic' noise (USN) outside the multiplexed program components, can compromise modulation efficiency. Re-encoding removes these sources of noise.

The AARON 640 has a variety of Reception Tools that are active only in the analog and digital L/R stereo line outputs. These are very effective in reducing audible noise and in preserving the quality of the program as it is rebroadcast. The obvious

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drawback, however, is that RDS and any other subcarriers will be lost, or will have to be re-inserted by the rebroadcast exciter.

Monaural Operation Although the AARON 640 incorporates certain 'reception tools'that are effective in improving performance under noisy-signal conditions, when those conditions become really severe you may choose to rebroadcast stereo programming as a monaural signal. (See the discussion regarding Reception Tools and 'stereo disadvantage' under the next heading.) To do this you must use the re-encoding option and set your exciter to omit the 19kHz stereo pilot and the 38kHz suppressed-carrier DSB stereo difference subcarrier.

Additionally, you will need to force the AARON 640 into monaural reception. Under the Reception Tools menu, select Stereo/Mono. Here you can change the default setting: ⊙ Stereo (Auto) to: ⊙ Forced Mono.

RECEPTION TOOLS

The SDR (Software-Defined Radio) front-end of the AARON 640 incorporates various means of improving reception under adverse conditions. A complete technical explanation of these utilities is not within the scope of this manual, but each will be addressed as to its basic function and how it may be adjusted to help cope with reception problems.

We refer to these built-in utilities as Reception Tools and offer a range of adjustments over parameters that affect their operation.

NOTE: Most of these tools are available only when the program is delivered via the analog and/or digital L/R line outputs. Exceptions will be noted.

From the Main Menu, highlight Reception Tools and _push_ the knob. This presents the menu shown here, listing the various utilities.

IF Bandwidth The first of the Reception Tools is one of the few which is active for both the composite/MPX baseband output and the analog and digital L/R line outputs.

Highlight IF Bandwidth and push the knob. You will be presented with a pair of 'radio buttons' and a slider adjustment. In the factory-default ⊙ Auto mode, the Fixed Bandwidth slider is grayed-out and inoperable. Receiver bandwidth is controlled in this case by a composite of signal parameters, which will always strive to maintain maximum bandwidth consistent with signal quality. The actual bandwidth selected may be con-

firmed on the Now Playing menu screen at the top of the Main Menu.

To set the IF bandwidth manually, bracket ⊙ Fixed and push the knob. Then bracket and select the Fixed Bandwidth slider to set IF bandwidth incrementally between 56kHz and 311kHz. For an incoming carrier with RDS, you would want to use a minimum setting of 151kHz to assure good stereo and solid data recovery. Any additional subcarriers above the 57kHz RDS subcarrier may require an even wider setting.

FM Advantage vs. Stereo Disadvantage

In terms of immunity from sources of noise and interference, frequency modulation (FM) enjoys a certain advantage over amplitude modulation (AM). This is known as "The FM Advantage." But with the advent of stereophonic FM transmission in 1961, a significant amount of inherent noise immunity was lost forever.

It is a matter of the physics of the Zenith/GE FM multiplex system that monaural FM "goes farther" than stereo. Actually, the signal-to-noise ratio (SNR) of a stereo broadcast is always about 20dB worse than mono, but in the fringe reception areas the effect is pronounced.

Most high-quality FM receivers have a "blend" function that incrementally changes the reception mode from stereo to mono as the incoming signal deteriorates. This helps the perceived noise performance of these radios, but at the expense of stereo separation as the sound field 'collapses' under poor signal conditions. Another option is to roll-off the higher audio frequencies as the incoming signal deteriorates.

The AARON 640 analyzes three independent properties of the incoming carrier to control the amount of L/R broadband blending, high frequency blending, and top-end program audio rolloff. The effect these properties have on stereo blending or HF rolloff can either be 'automatic,' or placed entirely under user control.

NOTE: These particular Reception Tools are useful *only* when using the demodulated analog or digital line outputs of the AARON 640.

Stereo Blend

From the Reception Tools menu, enter the setup menu for the Stereo Blend function.

The factory-default setting is ⊠Auto. The bargraph and numerical readout above this selection shows the amount of stereo blending in effect,

whether the function is automatic or under user control. Note that the three other setup options are grayed-out. Push the knob again to uncheck the ☐ Auto box and to gain user control over these adjustments.

Blending (ultimately to mono) may be based on ☐ RSSI (incoming signal strength), on ☐ USN (ultrasonic noise) or ☐ Mpath (multipath effects). Bargraphs and numerical readouts give a realtime measurement of these criteria.

Turn the knob to scroll through the setup options. You can bracket signal property callouts and *push* the knob to activate any or all. You may also bracket the bargraph above each property to set the threshold where that property will begin to effect noise and stereo separation.

☒ RSSI is a 'good' quality, so blending begins as the indicated signal strength dips *below* the threshold value. ☒ USN and ☒ Mpath are 'bad' qualities, and blending will begin as these parameters climb *above* their thresholds. Blending will be proportional to the property's value relative to the threshold you dial-in.

You will need to experiment with these settings as there are no hard-and-fast rules for their adjustment. Every signal reception scenario is a bit different, so *listen* for the effects of these Reception Tools. You may use the headphone jack in this case, but remember: these tools are effective only for the analog and digital line outputs of the AARON 640. They have no effect over the composite/MPX output.

High Blend   The High Blend setup menu is identical to the Stereo Blend menu just discussed, and the very same setup criteria and notes apply. The difference here is that only the higher audio frequencies are progressively blended toward mono, the idea being, "why blend everything to mono when most of the noise is high-end hiss?" Whether you use Stereo Blend, High Blend or a combination of the two will, again, depend entirely on reception conditions, the character of the noise you are trying to get rid of, and other factors best decided after critical listening in each situation.

Highcut   The Highcut setup menu looks identical to the two blending menus, the difference being that instead of sacrificing stereo separation for a lower noise floor, the high audio frequencies are progressively rolled-off as the RF signal deteriorates. Highcut may prove of some use in translator applications, but the downside is that the program will lose its 'sparkle,' and even sound 'dead' when enough top-end rolloff is dialed-in to make an audible improvement in noise.

Again, use your ears to evaluate the value of Highcut, and remember: it works only for the analog and digital line outputs. Setup guidelines are the same for this function as outlined for blending, above.

Stereo/Mono   As already discussed, the Stereo/Mono setup menu simply allows the AARON 640 to be placed in ⊙ Forced Mono for the analog and digital line outputs; the composite/MPX output is not affected. Normal operation is ⊙ Stereo (Auto).

Enhancers The SDR front end offers two Reception Tools of an advanced nature. These operate in the RF/IF signal path and thus are active for both the analog and digital line outputs and for the composite/MPX baseband output.

There are no adjustments for these two tools, and use of them is dictated solely on their sonic merits when receiving a signal of marginal quality. The factory default for both of these is 'on' (both boxes checked): ☒ Multipath Suppression and ☒ Channel Equalizer.

SETTING OUTPUT LEVELS

From the Main Menu, navigate to any output level adjustment utility of interest: Setup / Analog Audio Output, Setup / Digital Audio Output or MPX Output. The characteristics of each of these outputs, their options and adjustment ranges are explained on Pages 12 and 13. Just bracket, *push* and *turn* to set levels.

COMPOSITE/MPX SIGNAL PROCESSING

The AARON 640 includes a 'composite clipper' in the composite/MPX output path to better define and control the peak-to-peak amplitude of the output signal. This processing block affects only the composite/MPX output and has no effect on the analog and digital line ouputs.

The composite waveform is first stripped of the 19kHz stereo pilot and 57kHz RDS subcarrier, which are re-introduced after the clipper. (See Block Diagram, Page 9.) This exercise prevents pilot modulation and RDS perturbations at any clipping depth.

From the Main Menu, navigate to: Setup / MPX output. This data-entry screen is where you set the final peak-to-peak amplitude of the MPX output. The Clipping slider adjustment allows anywhere from –2dB to +3dB of composite clipping, which requires a bit of further explanation.

The composite/MPX signal level at this point in the circuit is at a specific peak-to-peak level that assumes ±75kHz of stereo-encoded carrier deviation. The *stereo* audio program components (stripped of the pilot and RDS in this case) will be right at the clipper threshold when Clipping is set to 0dB. If peak deviations of the incoming carrier are strictly held to "100% modulation," the clipper will never touch the program waveform.

The program peak level of a monaural broadcast will be about 1dB higher than a stereo transmission, simply from the lack of 19kHz stereo pilot modulation. The Clipping control in this case

would need to be set to –1dB to avoid any clipping, assuming ±75kHz deviation of the (mono) carrier.

In the real world, however, this assumption may be naïve. For example, FCC regulations in the US permit a bit of over-deviation when data and audio subcarriers are present. Moreover, enthusiastic broadcasters in competitive markets occasionally 'speed' a bit, subcarriers notwithstanding. This is why the Clipping adjustment has a plus-and-minus range (plus for more clipping, minus for less).

The obvious downside to composite clipping is the introduction of 'harmonics' (harmonic and IM distortion products, actually) within the audible spectrum and beyond. We suggest judicious use of the Clipping control.

ALARMS

The AARON 640 includes alarms to apprise the user of these signal reception problems: **1)** Loss of audio, **2)** Loss of Carrier (or a drop in level) **3)** RDS Error (subcarrier loss or 'hijacking'), and **4)** Loss of Pilot (stereo loss). These alarms are indicated on the front panel of the AARON 640 and are available as alarm 'tallies' (contact closures) on the rear panel. In addition, alarms may be set up independently to send e-mail or text messages to selected station personnel.

From the Main Menu, navigate to Alarms & Notifications. This menu screen gives access to individual alarm set-ups, and to the Email Notifications and Alarm Log settings. These will be described in menu order, but as there are setup redundancies among the alarms, do please read them all.

Audio Loss *Push* the knob to enter the Audio Loss setup menu and *turn* it to bracket the five setup options. Individual options are accessed by *pushing* the knob, then *turning* it to change parameters.

When ⊠ Alarm shows a checkmark in the box, the alarm is activated. An empty □ Alarm box means that the alarm is turned off.

The Threshold On slider sets the threshold that will trigger an alarm when program audio falls *below* the user-programmed point. The slider actually gives a display of program audio in real time, and also has a flag that shows the set point in dB with reference to full modulation.

When the program level falls below the Threshold On value, the alarm does not pop on immediately. Instead, the program must *remain* below the threshold for the time period programmed into the Time On box. Bracket this box and push the knob, then turn the knob to adjust the time. The figure you select will be dictated to some degree on the station's format, and on your intended use for this particular alarm.

Once the program returns, the alarm does not immediately reset either. First of all, the program must reach the Threshold Off level. This may be set to the same level as Threshold On, or to a higher level to afford some hysteresis for this alarm function. Moreover, the program must remain above the Threshold Off figure for the time period programmed into the Time Off box. Only then will the alarm be reset.

The Threshold On and Threshold Off sliders are interactive; you cannot set the 'off' level lower than the 'on' level.

Low Signal The Low Signal alarm is so very similar to the Audio Loss alarm discussed above that its explanation will be abbreviated here. Refer back up for clarification.

On the Low Signal setup menu, Threshold On, Time On, Threshold Off and Time Off are adjusted to give an alarm when the incoming carrier falls and stays below a programmed threshold value. Units of measure in this case are dBuV, rather than the dB associated with the audio program level threshold.

Audio Muting The Low Signal alarm has one additional feature. When the ☒ Mute box is checked, program audio will be interrupted (turned off!) during the alarm condition. The ☐ Alarm box must of course be checked as well. This holds true for both the composite/MPX and program line (audio) outputs.

RDS Error Enter the RDS Error setup menu to access these options.
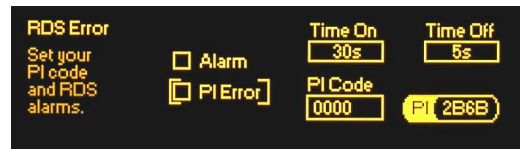
When the ☒ Alarm is set (box checked), loss of the 57kHz RDS subcarrier will initiate an alarm following the interval entered in the Time On box. Once the RDS subcarrier returns, and remains for the period entered in the Time Off box, the alarm will reset.

The RDS Error alarm may also be used to guard against 'hijacking,' which refers to receiving a distant station when the main signal is lost, or some nefarious pirate taking over the legitimate broadcaster's translator. The RDS Error utility may be programmed to give an alarm when the incoming PI code does not match the code programmed into the AARON 640.

The PI code of the incoming carrier shows up in the PI box at the lower-right of the menu screen. Make note of this code and then highlight the PI Code box and push the knob.

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Using Backspace, remove the four factory-default zeros and enter the PI code of the incoming carrier. Execute a Save to return to the RDS Error menu screen. Now check the ⊠ PI Error box to engage the anti-hijacking feature. The ⊠ Alarm box must also be checked for the feature to function.
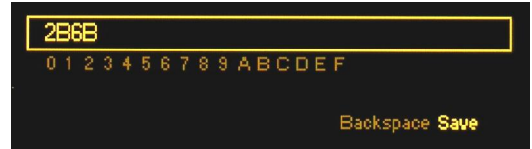
Pilot Loss An incoming signal that contains the 19kHz stereo pilot tone in the FM baseband will light the front-panel STEREO PILOT indicator whether the Pilot Loss alarm is armed or not. This LED is an instantaneous indicator of stereo pilot presence and is independent of the Pilot Loss alarm.

Open the Pilot Loss alarm setup menu. You may turn the ⊠ Alarm on here by checking the box. The figure you enter in the Time On box will fix the interval between loss of pilot and the alarm. Time Off determines how fast the alarm resets after the pilot returns.

ALARM TALLIES

The four alarms discussed above are available as rear-panel 'tallies' as well. Normally these would just be closures to ground, but we have made these tallies more versatile by enabling the logic states.

From the Main Menu, navigate to: Setup / Alarm Closure Polarity. This matrix allows the user to decide whether he gets a ground or an open for each of the four alarms. Simply us e to knob to bracket and select a ⊙ Ground or an ⊙ Open condition when each of the alarms activates.

E-MAIL NOTIFICATIONS

NOTE: The time-stamp feature for e-mail notifications and the Alarm Log depend on Internet time, and with the proper time offset entered. This is done under: Setup / Network / Time as detailed on Page 31.

Any or all alarms can send e-mail or text notifications to one or more recipients, and which alarms go to whom may be programmed as well. This feature naturally requires an Internet connection (Page 35).

E-mail recipients must first be entered in another area, however. From the Main Menu, navigate to: Setup / Email Preferences / Recipients.

Highlight the Address box and *push* the knob. This brings up an entry screen for an e-mail address. *Turn* and *push* the knob to enter each character sequentially. Once the address is entered, as shown in the example above, execute a Save.

Back on the Recipients screen, the address you just entered will show up in the Select box headed by a number. Up to ten e-mail addresses may be entered in this same fashion; just bring up a 'blank' number and enter the address the same way. Addresses are edited or deleted by bringing up the particular Address and using Backspace to erase it.

Now BACK out to the Main Menu and navigate to: Alarms & Notifications / Email Notifications. Highlight the upper box and turn the knob to bring up any of the e-mail addresses you have entered under Recipients.

With a recipient showing, check boxes to select the alarm(s) for that person's notification. In addition to the four signal property alarms, you may also send that person a complete log of all alarms on a ⊠ D (daily), ⊠ W (weekly), or ⊠ M (monthly) schedule, or any combination of these intervals.

THE ALARM LOG

From the Main Menu, navigate to: Alarms & Notifications / Alarm Log. This shows a listing of all alarms received since the last reset of the log. Alarm (type of alarm), Station (frequency) and Time & Date of the alarm are maintained.

NOTE: A Time & Date time-stamp for the Alarm Log uses Internet time, meaning an internet connection and the proper time offset entered. This is done under: Setup / Network / Time as detailed under the next heading.

Alarm Log Settings From the Main Menu, navigate to: Setup / Alarm Log Settings. At the top of the screen is a notation of how full the log is at the moment. Although the log is capable of containing a couple of thousand events, it might be important to know when you have accumulated a certain number of entries, as this could be an indication of some recurring reception problem. Highlight the Email When: box, *push* the knob, and *turn* it to set a desired figure. A setting of 10% equates to about 200 log entries.

Clear Log is at the bottom of the screen. Highlight the box, *push* the knob and, when prompted, *push* it again to delete all alarm history. The AARON 640 Web interface provides means of downloading the alarm log if desired.

TIME AND TIME ZONE

Navigate to Setup / Network / Time, and enter the Time Zone & DST menu. Here you set the AARON 640 to your particular worldwide time zone as an offset from UTC. You also may specify whether you wish to let the Internet time utility determine DST (Daylight Saving Time) for you: ☒ Auto DST, or specify this manually: ☒ DST. Leave both boxes unchecked if your region does not recognize Daylight Saving Time.

Once the AARON 640 synchronizes with Internet time, the correct local time should be displayed at the bottom of the menu screen as shown here.

The associated Time Server menu will display the factory-default selection for an Internet time server: time.nist.gov for the Western Hemisphere. You may enter this menu to change time server URLs for other regions.

SNMP OPERATION

SNMP Overview SNMP, or Simple Network Management Protocol, allows other TCP/UDP/IP equipment on the same Local Area Network (LAN) to communicate directly with the AARON 640, and for the receiver, itself, to initiate an alarm on the network.

The AARON 640 will interface directly with a network controller, which technically is known as the SNMP 'Manager.' The AARON 640 incorporates an embedded ASCII text file called a Management Information Base, or MIB. In setting up for SNMP operation, the MIB file will have to be downloaded from the AARON 640 and uploaded to the SNMP Manager. Downloading the MIB file employs the AARON 640 Web interface and is detailed on Page 40.

SNMP Mode From the front panel, navigate to Setup / Network / SNMP, and then select Mode & Communities. The default setting for Mode: is Disabled, which inhibits communication between the AARON 640 and the SNMP Manager.

Changing Mode: to Read Only allows the AARON 640 to be interrogated by the SNMP Manager so that stream metadata, alarms, etc. can be integrated with other equipment on the network.

Setting the Mode: to Read & Write allows the SNMP Manager to send commands to the AARON 640. At present the only command that the receiver can execute are to tune the current frequency, change the antenna selection, or select a Preset Station.

SNMP Security SNMP 'Communities' serve as passwords for this function. Go into the Read: and Write: boxes to enter text that is specified for the read/write strings on the SNMP Manager monitoring device. As with similar text-entry screens, execute a Save after entering.

SNMP Traps When the AARON 640 *initiates* an alarm, rather than being *queried* or *polled* for one, the alarm is known as a 'trap.' Navigate to Setup / Network / SNMP / Trap Destinations. Here three local network IP addresses may be entered, each corresponding to other devices on the LAN that want to be apprised of alarms.

SNMP Ports The default SNMP Ports, General Port 161 and Trap Port 162, are customary for a majority of SNMP operations. These may be changed in the usual manner if required.

NOTE: The foregoing discussion of SNMP operation is purposely abbreviated. SNMP is a complex utility, managed exclusively by whatever SNMP Manager (the monitoring equipment) is employed. Refer to all instructions for the SNMP Manager in setting-up the AARON 640. From the active AARON 640 browser screen, you can download the MIB file to help unravel mysteries in this regard as well (see Page 40).

MISCELLANEOUS SETTINGS

From the Main Menu, navigate to: Admin. These Administrative Settings enable the setup of the functions listed, which are explained below.

Security AARON 640 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 AARON 640.

Highlight Security on the Administrative Settings menu and push the knob. With the Current Password field highlighted, *push* the knob.

Push and *turn* the knob to enter an initial password, using the uppercase and lowercase alphabet, numbers and any punctuation marks shown, up to 31 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 AARON 640 will lock any time the screen times-out (goes dark) after the unit is untouched for the programmed timeout period. It may also be locked immediately by holding down the Back button for a few seconds.

Once the AARON 640 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 Web.

When working on a password-protected unit, uncheck ☐ Enable 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 AARON 640 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 AARON 640 to all-factory-default values. *All user settings will be lost!*

Display Settings The Display menu offers an OLED display Brightness choice. You may change the brightness of the graphic display from the 60% default value to a higher or lower setting. We don't recommend a much higher setting because this 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.

Timeout programs the interval between last using the jog-wheel knob and the screen going into its 'screen-saver' (dark) mode. This may be set in 5-minute increments between 5 min and 60 min. You may put the unit into the screen-saver mode manually by holding-down the Back button.

Firmware Update Updates to AARON 640 firmware are covered separately in Section VI.

About The About screen shows the current Firmware Rev., the appropriate Webpage Rev. for that unit, Ethernet: port status, the Serial # of the particular unit, and Uptime:, or how long the AARON 640 has been running since power was last applied.

Headphone Volume When you plug a pair of 'phones into the front-panel jack, the Headphone Volume menu will pop-up automatically. Just *turn* the knob to adjust volume, and then *push* the knob to return to the menu you were on previously.

To change the volume when the 'phones are already plugged in, navigate from the Main Menu to Headphone Volume, *push* the knob to enable the slider, then *turn* the knob to adjust volume.

Section IV

CONNECTING TO THE INTERNET

NOTE: The AARON 640 should always have a wired connection to the Internet router or server. Never attempt a Wi-Fi connection using a Wi-Fi 'bridge.'

FRONT PANEL VS. WEB INTERFACE

The 'responsive' design of the AARON 640 Web interface provides an optimal viewing experience across a wide range of devices. From desktop computer monitors to tablets to mobile phones, the user needs to do a minimum of resizing, panning or scrolling. Data entry using a real keyboard will almost always prove easier than knob-and-button menu navigation, and use of the receiver's Web interface is thoroughly covered in Section V.

Initial configuration (setup) of the AARON 640 has been presented using front-panel 'knob and button' data entry, as this is necessary to get the unit online in the first place. However, other setup programming of the unit is easier and faster with a conventional keyboard, once the unit's Webpages can be brought up in a computer browser (see Section V).

DHCP IP Assignment
With the LAN jack on the back of the AARON 640 connected to your network, navigate from the Main Menu to Setup / Network / IP Settings. Here you may select: ⊙ DHCP to have your router automatically assign an IP address to the receiver. Once DHCP connection is established, the fields on the right-hand side of the screen will populate automatically.

Manual IP Setup
For any of several reasons you may need to set the IP address of the AARON 640 manually. Select the ⊙ Static IP radio button and use the knob to bracket the various network parameter options. *Push* the knob to bring up each data-entry field, and then *turn* and *push* to enter the proper decimal-delineated numbers. Use Backspace to erase an entry or to make corrections, and when you're finished be sure to Save the new entry.

It is not within the scope of this discussion to detail the complete static-IP setup procedure, but a competent IT professional should be familiar with the intricacies of this operation.

Assigning a Host Name   Hostname is the second item on the Network menu. It allows the user to assign a unique name to a particular Internet Radio Monitor, and will identify the AARON 640 when accessing it via the network. The factory-default name is AARON640. You may change this to personalize the equipment name, or to differentiate one receiver from another on a common network.

Push and *turn* the knob to assign a new name and Save the name when finished. Host Names are entered in all-capital letters and the Hostname assignment cannot include spaces. It is not necessary to use all-caps when addressing the monitor, however. Under Windows operating systems you may access the AARON 640 through a Web browser on the same network simply by typing its name and a forward-slash into the browser address bar as shown here.
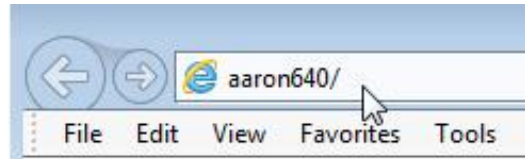

Non-Windows browsers may require you to enter the complete IP address of the unit, which you may find by front-panel navigating to: Setup / Network / IP Settings.

ACCESSING THE AARON 640 REMOTELY

On a common local network (LAN), access the receiver's Web interface by entering its IP address or, under Windows, its Host Name into your browser's address bar as shown above.

To address the AARON 640 from outside your LAN (from the Internet), the unit must have a static IP address. If your router makes DHCP assignments for other equipment on the network, simply assign the receiver a static IP that is outside the router's DHCP range. This is an easy matter with the aid of the router's Help utility.

It is also necessary to open a specific port for the AARON 640 on the network router. Within the router's Port Forwarding utility you will be able to enter your static IP address for the unit (Internal IP), followed by a colon and a port number. The port number may be any number in the router's range. If your Internet Service Provider (ISP) assigns you a static IP address, then it is a simple matter to address the receiver from anywhere. Just type the IP address and port number into your browser as shown in this example.
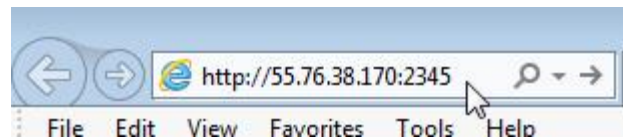
But if your ISP issues you a *dynamic* IP, which is most often the case, this mandates 'Dynamic DNS' operation, using the services of an IP-forwarding provider.

Dynamic DNS   It would not be possible to address equipment behind a dynamic IP address if it were not for IP-forwarding providers available on the Internet. Their services, which are either free or at a very modest charge, will allow the AARON 640 to keep the provider apprised of its reassigned IP address each time that address is updated by the ISP. The IP-forwarding provider intercepts data attempting to connect with the receiver and converts the IP address to the updated one.

There are three popular forwarding service providers available on the Internet. Their basic service (all you really need) may be free of charge, but advanced features may command a nominal annual fee. All services require registration on the appropriate Website.

From the Main Menu, navigate to Setup / Network / Dynamic DNS. Disabled is the default selection in the Mode: field, but here you may choose among the three popular providers. Write down these provider names and enter each in your Web browser to learn more about their services and to register with whichever provider seems best to meet your needs.

When you register, the provider will issue you a Hostname, Username and Password. Use the front-panel knob to enter these into each of the three fields. When finished, the screen should look something like the example above.

Network Status   Highlight Status at the bottom of the Network menu and push the knob. This brings up a screen that gives full particulars of the network connection. This screen is useful for troubleshooting and for verifying connection parameters.

Section V

THE AARON 640 WEB PAGE

Up to this point we've used the front-panel display and 'jog wheel' knob to get the AARON 640 receiver up and running. Nearly any function may be accessed in this manner, but entering and editing text is much easier using the Web interface screen and a real-live keyboard.

Because the functionality of the Web interface is identical to what can be accomplished from the front panel, this discussion will not detail each Web screen. Each function has already been covered where operation is presented from a front-panel perspective. The front-panel and Web interface menus are arranged in much the same order, but you will find some functions organized a bit differently between various presentations: front-panel display, desktop PC, tablet and mobile device. All menus may be accessed remotely, however, so if one seems to be missing, just look around… it's there.

CONNECTING WITH THE AARON 640

Once you are connected to the same network as the AARON 640, from a Windows-environment browser type in the Host Name followed by a / (forward slash). Otherwise enter the full IP address of the receiver (shown under Setup / Network / IP Settings). This will take you to the receiver's main Now Playing Webpage, as illustrated using Microsoft's Internet Explorer browser at the top of the next page.

THE WEB INTERFACE PAGES

Each of the individual AARON 640 Webpages will display a Menu list that follows the form of the front-panel Main Menu. For higher-resolution computer or tablet browser screens we are able to consolidate menu functions, so Web interface Menu choices may be greater (or fewer!) for different Web-enabled devices. Everything will be there somewhere, however, so scan the various screens to learn the correlation between front-panel menu choices and what is displayed on your device.
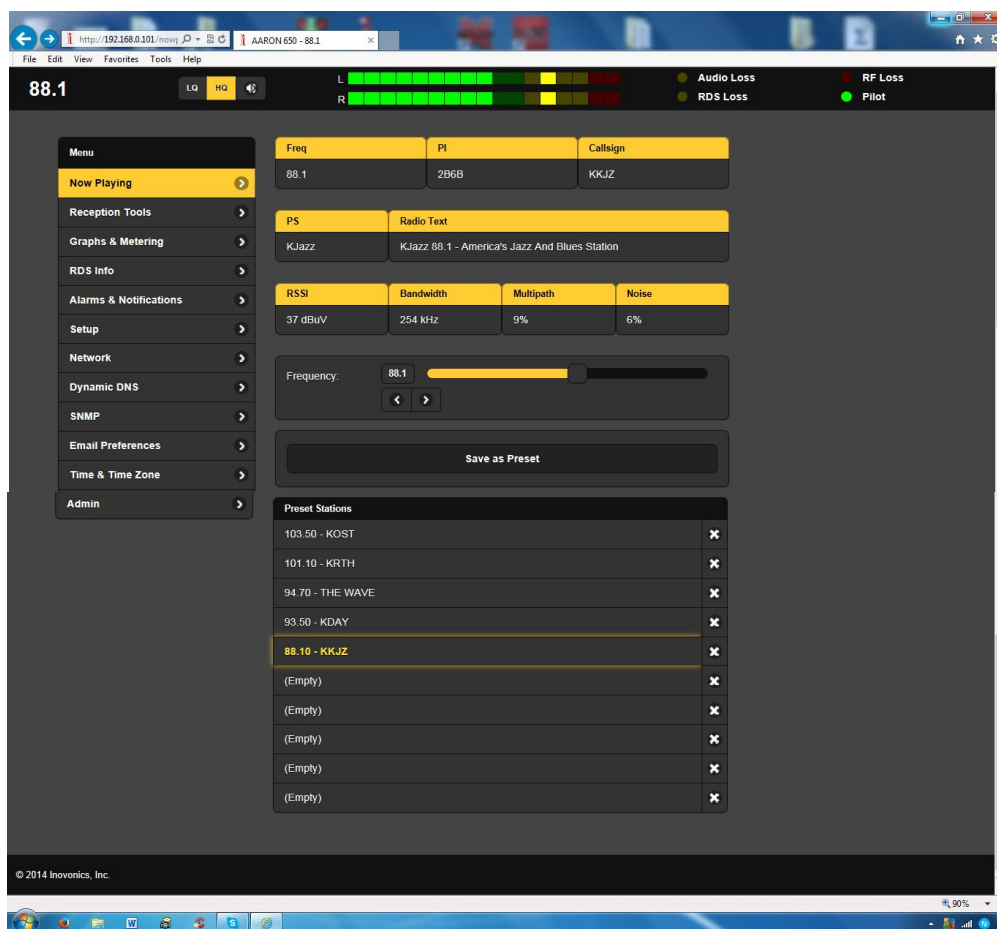
The main Now Playing screen pictured above enables remote listening via the Internet and displays alarms, RDS data, and reception parameters concerning the station currently playing. The Left/Right 'VU' Meters may be found here along with the station presets utility. Metering, listening options and alarm information will "tag along" and appear at the top of all AARON 640 Web pages.

Tuning the AARON 640 The receiver may be tuned by any of several means. You can: 1) grab the tuning bar and slide it back and forth; 2) click the ◀ and ▶ (down/up) buttons to step the frequency; 3) overwrite the numbers in the digital Frequency: display box; or 4) click any of the Preset Stations underneath.

Station Presets When you have tuned a station that you wish to keep as a preset, click on one of the (Empty) slots down below. This will bring up a Save Station data-entry box where you may type in call letters or other identifier and Save the selection. Your preset will be added at the top of the list.

To reorganize the list, you must re-enter presets, as required, in reverse order that you want them to appear (enter the top preset last). Duplicates may be deleted afterward by clicking the ✖ to the right of the name.

Remote Listening A loudspeaker icon appears at the top of the Now Playing screen. Click this to listen to the station from a remote location.

There are two audio quality options available. LQ has an MP3 data rate of 64kbps, and HQ is 128kbps. With marginal connections, LQ may prove the better choice.

The encodings/decoding and buffering time (latency) of the audio will depend to some degree on the connection path and network quality, but is a minimum of 8 to 10 seconds, even on a Local Area Network. This listening utility has been included to confirm the presence of audio, not for performing a critical assessment of off-air audio quality. Keep in mind that the audio will lag the metering by several seconds.

THE MENU LIST

The other remote, on-screen menus are arranged as much as possible in the same order as the front-panel menus. Differences will be discussed in the remainder of this section.

Graphs and Metering This Web menu item gives access to the BandScanner utility and to the stereo sum-and-difference meter. The Peak History "loudness" history plot is not available for remote viewing.

Alarms and Notifications The Alarms and Notifications screen contains all relevant submenus on the one Webpage. After first entering e-mail recipients on the Email Preferences menu, set the 'who gets what' notification preferences for each recipient under Alarms and Notifications by selecting the name from the pull-down menu and then checking appropriate boxes.

The Web interface further enables the Alarm Log download to your computer as a 640alarmlog.csv (comma-separated values) file in typical Windows fashion. The log file may be read using a text editor like Windows Notepad, or may be brought into a spreadsheet program such as Microsoft Excel for further use in analyzing failure modes.

Networking Issues Between the Network and the Dynamic DNS screens, connection parameters may be set up and confirmed just as they are from the front panel of the unit.

Downloading the MIB File The SNMP screen similarly allows setup of this function, and also enables downloading the MIB file. An outline of SNMP operation begins on Page 31 of this manual. The MIB file is a small text (.txt) file that is required by the SNMP Manager. Click: Download MIB to initiate the process; the file is saved in the usual Windows manner. The MIB file is in plain text and may be read with Windows Notepad.

E-Mail or Text Message Notifications   The e-mail or text-message addresses for recipients of alarm notifications are entered on the Email Preferences menu page. Notification preferences (who gets which alarm messages) are set on the Alarms and Notifications menu page described earlier.

Timekeeping   The Time & Time Zone menu screen sets the internal timekeeping function of the AARON 640 to Internet time, including allowance for Daylight Saving Time as appropriate. Timekeeping is vital in tagging tag alarm notifications and for the Alarm Log.

The Admin menu screen is any easy means of setting up a password for the AARON 640, but also has another bonus feature, the Hardware Profile.

SAVING THE HARDWARE PROFILE

The entire AARON 640 setup, which includes the Preset Stations list, receiver setup choices, hardware options, alarm notification preferences and SNMP options, may be saved to your computer as a small text file. The Hardware Profile is useful for restoring a previous receiver setup or for 'cloning' a second unit for backup service.

The Hardware Profile utility is found under the Web interface Admin screen.

Click: Download Hardware Profile to save the profile to your system.

With the version of Windows Internet Explorer used in this example, the file is saved to a Downloads folder. Other browsers may ask you to specify a 'save to' location. The file has a default name of 640settings.ini.
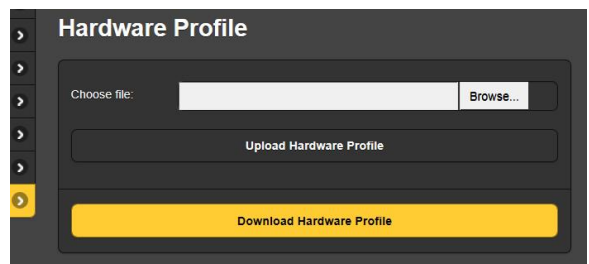
To upload a saved setting to your AARON 640, first click: Browse… to locate the saved profile, and then click: Upload Hardware Profile. This will replace all setup parameters that are currently loaded and running in your receiver.
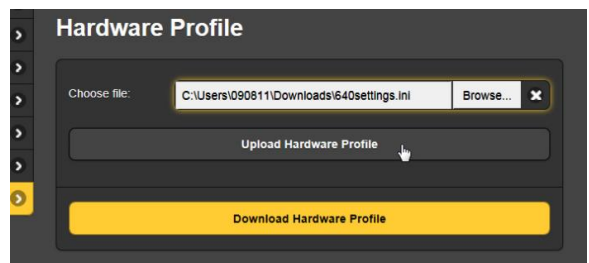
Section VI

UPDATING AARON 640 FIRMWARE

THE FIRMWARE UPDATER

The AARON 640 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 AARON 640 includes a 'bootloader' utility that allows firmware to be updated whenever Inovonics issues changes to add features to improve performance or otherwise expand the usefulness of the product. Inovonics supplies firmware updates free of any additional charge.
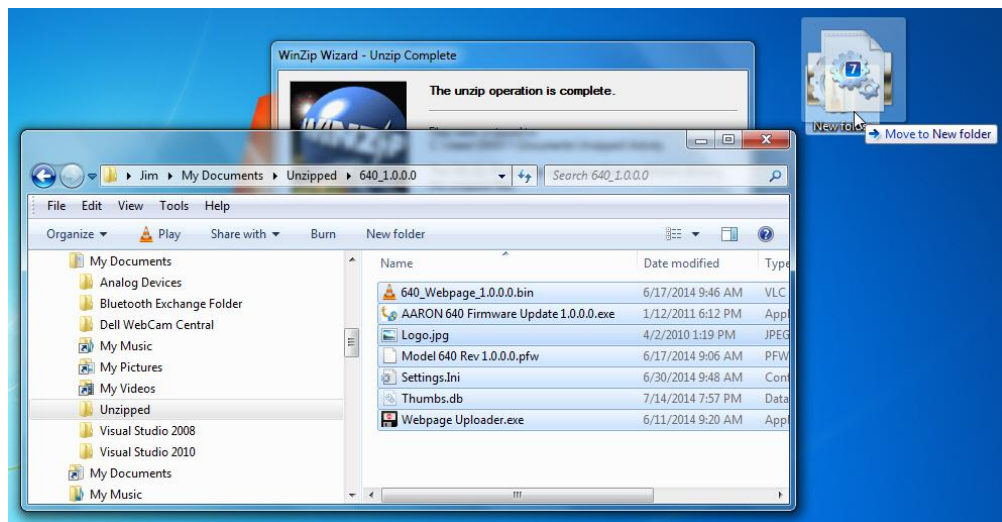
A bootloader is a simple software routine that runs on any PC that is on the same network as the AARON 640. Refer to Section IV for specifics on assuring a connection between the AARON 640 and your computer. This *must* be a wired, LAN connection for both the PC and for the AARON 640. Attempting to use a Wi-Fi link will almost guarantee failure.

Warning A firmware update will restore the AARON 640 to factory defaults. *All settings and presets will be overwritten!* Always perform a Hardware Profile Save (Page 41) before proceeding with an update. This will save all user setup parameters.
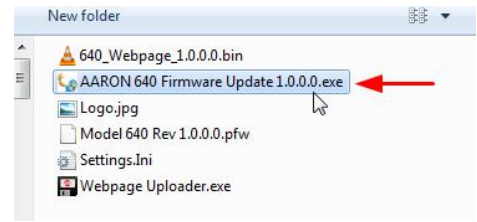
Firmware Update Files A firmware update will be supplied as a 'zipped' folder containing a number of files. This may be distributed as a download from the Inovonics Website or supplied on a CD-ROM or USB flash drive. Regardless of how the update is received, make a temporary New Folder on your PC Desktop and unzip these files to it as shown below.

One of the supplied files is the third-party bootloader utility, an 'executable' (.exe) file. Because executables are notorious for propagating viruses, many antivirus programs will not allow .exe files to be downloaded and will urge you not to install them. But you must trust us and throw caution to the wind.
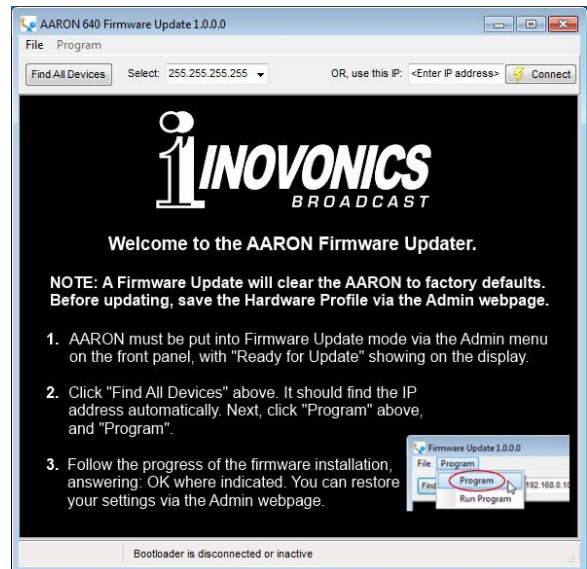
Running the Firmware Updater

Navigate to your temporary Desktop folder (New folder) and double-click the bootloader .exe file. This is the file marked with the arrow in the snapshot on the right.

That will bring up this Information message, advising that the Firmware Updater does not yet find the AARON 640. Click: OK. This will start the firmware updating utility and display its main screen.
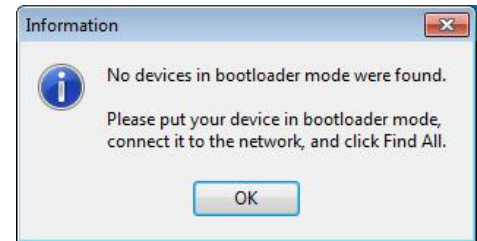
The bootloader window outlines the firmware update process in three easy steps.

The first step advises that the AARON 640 must, itself, be in the Firmware Update mode.

Using the front-panel jog wheel, navigate to: Admin / Firmware Update. This will bring up the first of two front-panel screens, each with a stern warning about proceeding. If you have backed up your Hardware Profile and are reasonably certain that the AARON 640 and your computer are ready to connect properly, select: ☒ Yes in both cases, paying close heed to the warnings in each.

When the AARON 640 is ready to accept the firmware update it will display the message on the right.

Next, click: Find All Devices at the top of the bootloader window. The IP address of your AARON 640 should appear in the Select: field, confirming that you are properly connected. If you do *not* see the IP address of your AARON 640, abort the update (described below) and troubleshoot connection issues. You may always bring up the AARON 640 Webpage to test the interconnection. If you can bring up the main Webpage, the Firmware

Updater should connect.

In step 2 first click: Program at the top of the bootloader screen to display the drop-down menu shown here. Then click: Program (*not* Run Program!) to start the firmware update process.
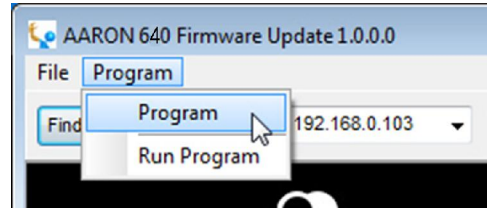
The PC screen will display various progress bars as firmware is uploaded to the AARON 640.

In Step 3 click: OK as directed at the end of the upload. The AARON 640 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 AARON 640 it is *almost* too late to turn back. If for some reason the Firmware Updater cannot connect to the AARON 640, 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 AARON 640 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!
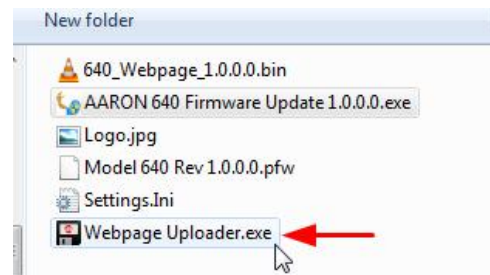
If for some reason the firmware update does not 'take,' do not power-cycle the AARON 640. Continue to re-run the bootloader until all hope is gone, then call us.

Updating the AARON 640 Webpages

The various Webpages (menu pages) for IP remote communication of the AARON 640 are updated separately from the general firmware files.

If a new version of firmware calls for a Webpage update, there will be one extra file in the bootloader folder. This image shows such a file with an arrow to mark the Webpage Uploader.exe file.

Immediately after the firmware update is bootloaded, and while the AARON 640 is still in communication with your computer, return to the un-zipped bootloader folder and double-click the Webpage Uploader.exe entry. You also will need to enter the IP ad-

dress of your AARON 640. The existing Webpages will be summarily replaced with the new ones.

ℹ️ 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, 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.