HD Radio

INOmini 639

FM / HD Radio Receiver

Installation & User Guide

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INOVONICS
BROADCAST
www.inovonicsbroadcast.com

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Section I

INTRODUCTION

Product Description

The INOmini 639 is an FM and FM/HD Radio™ receiver for professional off-air broadcast monitoring. It receives standard analog-FM broadcast transmissions as well as FM/HD Radio digital broadcasts transmitted 'in-band, on-channel' via the FM station's associated HD1 through HD8 auxiliary digital broadcasting channels.

Analog and digital FM programs are each accompanied by digitized text and housekeeping data. Analog-FM RDS (Radio Data System) and digital-HD Radio PAD (Program-Associated Data) are shown on the INOmini 639 front-panel LCD display, along with incoming signal quality and other information. Additionally, RDS and PAD data may be accessed through the front-panel USB connector for computer analysis and logging.

A leading feature of the INOmini 639 is that it does *not* automatically revert to FM reception if the digital signal is lost. This is of critical importance to the broadcaster, but makes this product somewhat unsuited to general consumer use.

Product Features

Features of the Receiver include:

- Reception of all standard FM and FM-band HD Radio broadcasts.
- Easy setup using the LCD screen and jog-wheel navigation of the receiver's menu tree.
- Direct display of RT+ 'tagging' data.
- Analog L/R and AES-digital program line outputs.
- Front-panel alarms with rear-panel 'tallies' for Carrier Loss, Digital Program Loss and Audio Loss.
- Accurate front-panel program audio level display.
- Front-panel headphone jack.

Product Specifications

Tuning Range: 87.5MHz–107.9MHz in 100kHz steps

HD Radio Channels: Selectable HD1 through HD8

Antenna Input: 75-ohm (F)

Receiver Sensitivity: ≤10µV for 50dB monaural FM SNR

Audio Response:
  Analog FM Mode: ±1dB, 30Hz–15kHz; de-emphasis is 75µs or 50µs, menu-selectable
  HD Radio Mode: ±0.25dB, 20Hz–20kHz

Analog Line Output: L/R balanced (XLR); level adjustable between –15dBu and +15dBu from the front panel.

Digital Line Output: AES3 (XLR); 44.1kHz sampling rate; level adjustable between –30dBFS and 0dBFS from the front panel.

Headphone Jack: front-panel (TRS) 3.5mm; volume is adjustable from the front panel.

Alarms: Carrier Loss, Digital Loss, Audio Loss; NPN transistor saturations to ground with menu-programmable logic polarity.

Power Requirement: 12VDC at 230mA (2.1mm x 5.5mm coaxial); a universal inline switchmode power supply is provided.

Mounting Options: An optional rack adapter accepts up to three INOmini modules in a 1U, 19-inch rack space. The Receiver may also be fastened to any convenient surface with two small screws.

Size and Weight: 1.6"H x 5.5"W x 5.5"D; 4 lbs. shipping weight.

Section II

INSTALLATION AND CONNECTION

Unpacking and Inspection

Inspect for shipping damage immediately upon receipt of the equipment. If damage is found or suspected, notify the carrier at once, and then contact Inovonics.

We recommend that you set aside the original shipping materials should return for Warranty repair become necessary. Shipping damage sustained as a result of improper packing for return may invalidate the Warranty!

Warranty Registration

Please complete the Warranty Registration process. Not only does this assure coverage of the equipment under terms of the Warranty (printed inside the back cover of this manual), but the user will receive any specific service and modification instructions, including firmware/software updates. Register online at:

www.inovonicsbroadcast.com/product-registration

Mounting

The INOmini 639 is packaged in a compact 'clamshell' chassis that defines the standardized module in this series of Inovonics products. The INOmini 639 may simply be set on top of an existing piece of rack-mounted equipment, as long as at least 1U of panel space is left open above the rack-mounted 'host' to access the unit. Alternatively, a pair of mounting holes on the chassis base allows the INOmini 639 to be fastened to any flat surface with two #4 screws.

An optional rack-mount kit is available for the INOmini 639. The rack kit can hold up to three INOmini modules and comes with blanking panels for unused spaces, and with two 'daisy-chain' power cables so that two or three INOmini modules may share a single power supply.

AC Mains Power

All Inovonics INOmini modules are supplied with a 'brick' switching-type power supply compatible with international mains voltages. The actual power consumed by the Receiver is 230mA at 12 volts DC. A second DC connector on the rear panel allows 'daisy-chaining' INOmini modules. This means that two or more units may be fed from the same AC supply, but with the obvious caution that the total input power specification of a given assortment of INOmini modules must not exceed the current rating noted on the power supply label.

Radio Frequency Interference (RFI)

Although we have anticipated use of the INOmini 639 in the vicinity of broadcast transmitters, please do practice reasonable care in locating the unit away from *abnormally* high RF fields.

The Front-Panel Display and Menu Knob

The front-panel MENU knob scrolls the LCD through the various viewing and programming options. Section III of this manual explains the easy setup and various operating options of the INOmini 639.

Headphone Jack

The front-panel PHONES jack will accommodate stereo headphones of virtually any impedance and with a 3.5mm stereo plug. When headphones are plugged in, the LCD menu will automatically go to the `Headphone Vol` screen so that you can adjust the listening level with the knob. When the volume has been set to a comfortable level, push the knob to return to the previous menu.

Rear Panel Connections

ANTENNA   The antenna input is a US-standard 75-ohm F connector. Inexpensive, ready-made cables of various lengths are common in this format, and adapters for other RF connector types are readily available.

|	
L/R ANALOG LINE OUTPUTS	The active-balanced analog line outputs are menu-adjustable in level between –15dBu and +15dBu, corresponding to 100% peak modulation of the FM carrier, or 0dB (–3dBFS) HD Radio modulation.
AES DIGITAL AUDIO OUTPUT	The balanced, transformer-isolated AES digital audio output has a fixed sampling rate of 44.1kHz, a rate common to most devices associated with HD Radio installations. The audio level is menu-adjustable between –30dBFS and 0dBFS, corresponding to 100% peak modulation of the FM carrier or 0dB (–3dBFS) HD Radio modulation.
+12VDC POWER I/O	These two connecters are in parallel to allow 'daisy-chaining' INOmini modules. This allows one DC supply to power up to three modules mounted in a single rack adapter, provided that the rating of the supply is observed. Two short 'pigtail' cables are provided with each rack adapter.
	The INOmini 639 draws 230mA. Check the rating on the label of the power supply to make sure that it's rating accommodates all the modules it is called upon to support.
	These power connectors are not a locking type, and the mating plugs do pull out rather easily. A Ty-Wrap® will secure the cables to the plastic anchor above the jacks if this is a problem.

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Section III

OPERATING THE INOmini 639

Hey, why is the screen flashing?

Local visual and remote alarm tallies respond to reception problems or errors. These are individually detailed later in this section, but you may encounter one or more of these as soon as you power-up the receiver. These alarms identify a problem and flash lighted blocks on the LCD display, making the alarm quite visible, even across the room.

If the 639 has not yet been tuned to a station, the `LOW SIGNAL` and/or `AUDIO LOSS` alarms will begin to flash soon after the receiver is turned on.
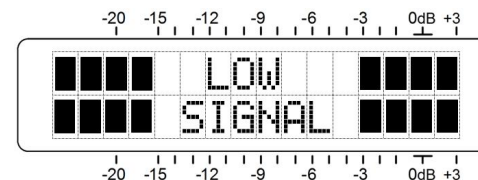
If you push or turn the knob you will get ten seconds' respite from the flashing, enough time to navigate to any of the setup menus. Of course, once a station has been tuned-in the alarm condition will be reset.

Whenever you are in the 'edit mode'; that is, you have entered a menu to edit (make a change to) a setup item, the front-panel flashing alarm is inhibited while that parameter is being programmed. The edit mode times out after 30 seconds if no entry is made.

NOTE: Flashing alarms are not to be confused with 'blinking' menu callouts. Blinking callouts indicate options for editing and will be discussed shortly.

The rear-panel tally outputs will always be active for the duration of an alarm, even when front-panel flashing is temporarily inhibited by knob action.

Menu Navigation Basics

You may already have figured-out the menu tree for yourself. Quite simply: 1) *turn* the knob to navigate from one menu to the next, 2) *push* the knob to enter any menu associated with setup, 3) *turn* the knob to choose an option or to

— 8 —

set a value, and then 4) *push* the knob again to accept the selection and commit it to memory, and return you to normal menu navigation.

Menu items that can be edited will 'blink' at a rapid rate when you push the knob. Don't confuse 'blinking' menu callouts, such as the one illustrated here, with the 'flashing' alarm discussed above.

```
      -20  -15   -12   -9    -6    -3   0dB +3
RF  47:||||||||||||
▓▓ 32:       |  |
      -20  -15   -12   -9    -6    -3   0dB +3
```
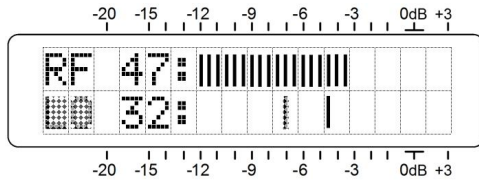
To recap: in setup menus, any parameter that can be edited will begin blinking as soon as the knob is pushed. Blinking indicates that a different option or value may be selected. Turn the knob to make your choice, and then push it once again to accept the selection.

FM and HD Radio Menu Screens Explained

Some INOmini 639 menu screens are common to both the FM and HD Radio modes; others are specific to one mode or another. The menu screens that are common to both modes will be discussed first. FM-specific menus and HD Radio-specific menus are interspersed.

The last menu in the series is discussed first, however, as it could constitute a show-stopper.
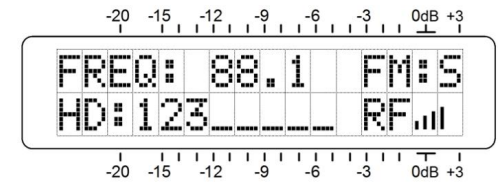
Locked Menus (Menu Screen 16)

To guard against inadvertent menu editing or casual tampering, the very last menu in the sequence allows the user to lock the knob out of the editing mode. If you find that when you push the knob you can't enter a setup menu to change a parameter, scroll all the way to the very last menu screen. Push the knob and the word Menus will start to blink. Turn the knob to select Menus: Unlocked. Push the

knob again to set this selection. Then navigate back to whichever screen you were trying to edit. You can re-lock the menu when you've finished making changes.

```
      -20  -15   -12   -9    -6    -3   0dB +3
Menus:  Locked
      -20  -15   -12   -9    -6    -3   0dB +3
```
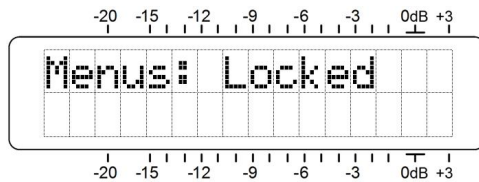
Setting the Frequency and Mode (Menu Screen 1)

When power is applied to the INOmini 639, a 'splash screen' with the product ID pops up immediately on the LCD. Within a few seconds this will revert to Menu Screen 1 shown here.

```
      -20  -15   -12   -9    -6    -3   0dB +3
FREQ:  88.1    FM:S
HD:123_____    RF.ıll
      -20  -15   -12   -9    -6    -3   0dB +3
```

The top line of Menu Screen 1 displays the frequency of the station and whether it is broadcasting in FM:S (FM/stereo), FM:B (a 'blended,' noise-reducing mode for FM, FM:M (FM/monaural), or HD Radio channels HD:1 through HD:8.

The second line in this menu always shows which HD Radio channels, if any, are being broadcast by the selected station. HD:Sync... is displayed as the receiver acquires lock. Once locked, all HD Radio channels being received will be listed as shown in the example above. If there is no HD Radio activity, HD:None will be indicated.

When receiving FM, the RF bargraph is a rough measurement of incoming signal level. In the HD Radio reception mode RF is replaced by DQ (Digital Quality), an indication of digital reception integrity.

Push the knob once and FREQ will blink. Turn the knob to tune-in the desired receive frequency. Push the knob a second time and FM will begin blinking. At this point you can turn the knob to switch to HD Radio reception (if available), selecting HD:1 through HD:8. The INOmini 639 receiver does not blend between reception modes, nor does it default to FM when the digital HD Radio signal cannot be acquired or simply is not there. What you select is what you get.

Carrier Strength and Alarm (Menu Screen 2)

The upper line of this screen displays signal strength of the FM carrier. The RF numerical value is the level at the antenna input in dBuV,

```
      -20  -15   -12   -9    -6    -3   0dB +3
RF  42:|||||||||||
LOSIG:      |  |
      -20  -15   -12   -9    -6    -3   0dB +3
```

and defines a range between 0dBuV (1 microvolt) and 75dBuV (about 5 millivolts). The bargraph readout gives an
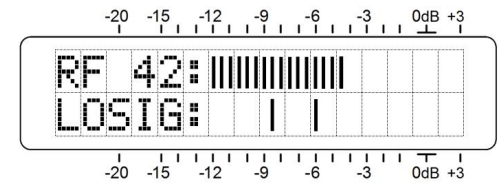
analog display of levels between 10dBuV and 75dBuV. The signal strength display does not refer to the dB scaling above the display, which is used only for audio level measurements in Menu Screen 7 for HD Radio reception or 8 for FM.

The lower LCD scale is labeled LOSIG: and has a pair of tic marks off to the right. Push the knob and LO, will begin to blink, along with the left-hand tic mark. Turn the knob to position the left tic mark anywhere beneath the RF bargraph. The tic mark level in dBuV is also displayed.

When the RF bargraph falls below this tic mark during normal receiver operation, it initiates a carrier-loss alarm and causes LOW SIGNAL to flash on the LCD screen.

As a starting point, you might set the carrier-loss trigger point about half the way down from the top of the RF bargraph, as shown in the illustration. This should allow for typical signal fading over the receive path, but will still alert the user to a valid carrier loss or transmitter power problem.

Push the knob again. HI and the right-hand tic mark will blink. Turn the knob to set that tic mark (and its numerical value) to a point that the carrier level must come back up to for the alarm to reset, maybe a few segments above the left tic mark. Push the knob again to set these points in memory and to release the menu.

The rear-panel C terminal gives an NPN transistor saturation to ground for a carrier-loss alarm; the polarity (logic state) of the alarm is set on one of the hidden menu screens, which are explained beginning on Page 20. This ground may be used to actuate a relay, light an LED at a remote location or tie-in with a remote control system.

Audio Muting (Menu Screen 3)

Mute on Low Sig: is a function that mutes the audio outputs during a low-signal alarm condition. This is most useful when the INOmini 639 is used as a rebroadcast 'translator' receiver in its FM reception mode, preventing the rebroadcasting of the loud hissing sound characteristic of an FM receiver when no signal is present. To enable muting, Push the knob and select either On or Off for this option.

With this option set to Off, a carrier loss will generally not initiate an audio loss alarm.

RF and HD Radio Signal Readouts (Menu Screen 4)

RF: is redundant to the similar measurement on Menu Screen 2, a 0 to 75 numerical readout of the RF level in dBµV at the antenna terminals. The bargraph represents this entire range here.

HD: indicates the relative power in the HD Radio carrier portion of the FM channel spectrum. The numerical value and bargraph cover a scale of 0 to 99. There is no hard-and-fast rule governing the relationship of these side-by-side measurements, though HD: will reflect the "dBc" injection level of the HD Radio carrier pair as well as reception conditions.

Signal-to-Noise and Multipath (Menu Screen 5)

These are two additional signal-quality indicators. Numerical values are assigned to each of these readouts as well, but these numbers are relative and arbitrary, and do not relate to any fixed measurement parameter.

SN is a first-order approximation of the signal-to-noise ratio of the received FM signal. This measurement takes several signal quality factors into account, but is strictly a relative indication. The number does not signify anything concrete, but certainly "more is better."
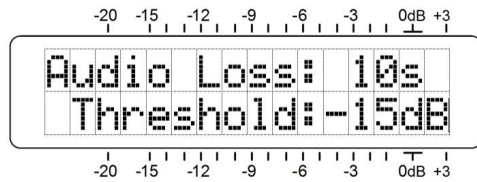
Likewise, MP gives a relative indication of multipath (signal reflection) effects that the transmission encounters on its trip to the receiver. Multipath effects introduce noise and distortion into FM programs and cause errors in digital signals that translate into dropouts and echoes. The object here is to keep MP as low as possible. 00 is ideal and should be attainable when receiving a solid signal.

RF, SN and MP numerical values are handy metrics when installing a rooftop antenna. In locating and aiming the antenna, do everything you can to maximize RF and SN, and to minimize MP.

The Audio Loss Alarm (Menu Screen 6)

Navigate to this screen and push the knob. Audio Loss will begin blinking. Turn the knob to dial-in the desired au-

dio loss alarm delay time, which is the number of seconds between the onset of 'dead air' and a flashing LCD and rear-panel alarm. The

`-20  -15   -12   -9    -6    -3    0dB +3`

```
Audio Loss: 10s
Threshold:-15dB
```

`-20  -15   -12   -9    -6    -3    0dB +3`

delay may be programmed in one-second increments up to 2 minutes. To deactivate the alarm altogether, turn the knob completely counterclockwise to `Audio Loss: OFF`.

Once the delay is set, push the knob again and `Threshold` will begin to blink. This is the programmable audio level trip point at which the alarm function will recognize 'dead air.' The trip point may be set for program peak levels between –30dB and 0dB. Do consider the dynamics of the broadcast format when setting this delay. Even peaks in Classical music will regularly exceed –20dB, and a setting of 60 seconds would probably accommodate most all *pianissimo* passages. A pop-music P.D. might ask for a setting of 1 second and 0dB, but use your own good judgment.

The rear-panel A terminal gives an NPN transistor saturation to ground for an audio-loss alarm. The polarity (logic state) of the alarm is set on one of the hidden menu screens that are explained beginning on Page 20. This ground may be used to actuate a relay, light an LED at a remote location or tie-in with a remote control system.

FM Stereo Modes (FM Menu Screen 7)

Enter this menu screen to set the FM reception mode. The default state is `StMode: Stereo`. With this setting, the receiver will attempt to decode any FM stereo transmission regardless of signal quality. In the `Stereo` mode, the noise-reducing stereo-to-mono 'blend' feature, common to most modern FM receivers, is *not* engaged. The FM mode display in Menu Screen 1 will show `FM:S` for stereo broadcasts and `FM:M` if the station is transmitting a monaural signal.

`-20  -15   -12   -9    -6    -3    0dB +3`

```
StMode: Stereo
||||||||||||||||██||||||||||||||||
```

`-20  -15   -12   -9    -6    -3    0dB +3`
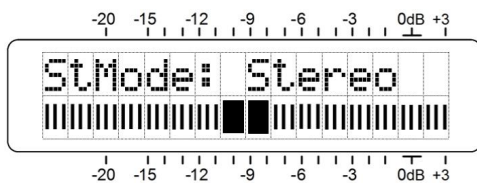
The graphic on the second line of FM Menu Screen 7 represents the 'wide' soundstage that characterizes a normal ste-

reo transmission. When the stereo pilot is lost, the display will collapse to the center.

Stereo-FM suffers a theoretical noise disadvantage of about 20dB when compared with monaural broadcasts. Push the knob and turn it to select `Blend-St`.

This mode will mitigate the noise situation substantially by progressively 'blending' the stereo image to mono as the FM signal deteriorates under

`-20  -15   -12   -9    -6    -3    0dB +3`

```
StMode:  Blend-St
|||||||||██||||||||
```

`-20  -15   -12   -9    -6    -3    0dB +3`

low-signal, multipath or other reception handicaps. This mode is identified with `FM:B` in Menu Screen 1. The degree of blending is not indicated on Menu Screen 1, nor will the screen indicate `FM:M` if the transmission reverts to full monaural when `Blend-St` is selected.
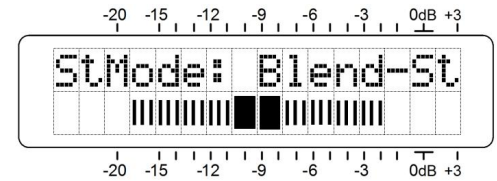
The bargraph on the second line in this menu does, in fact, depict a 'dynamic soundstage.' As the circuit blends between full stereo and full mono, the actual blending action will be indicated by a proportional narrowing of the bargraph.

`F-Mono` (Forced-Mono), will force the INOmini 639 into a fulltime monaural reception mode. This might be desirable when monitoring or re-

`-20  -15   -12   -9    -6    -3    0dB +3`

```
StMode:  F-Mono
██
```

`-20  -15   -12   -9    -6    -3    0dB +3`

laying a station that never broadcasts in stereo.
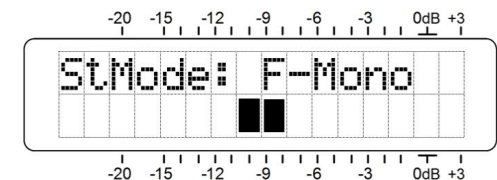
Feel free to switch among the three options here. You can evaluate the audible differences, either a noise tradeoff between `Blend-St` and `Stereo`, or a separation tradeoff between `Blend-St` and `F-Mono`. This blending option is included in the INOmini 639 to at least offer a feature common to consumer radios, although it well may be considered 'cheating' in the professional workplace.

Program Audio Levels (HD Radio Menu Screen 7; FM Menu 8)

This is a very accurate, peak-responding display of program audio levels and includes a floating peak-hold function.

"Full" modulation is denoted by the large block opposite the 0dB marking on the panel. The meter resolves +1, +2 and +3dB above 0dB, and from 0dB down it is calibrated in 0.5dB steps to –15dB, and then in 1dB steps to –21dB.
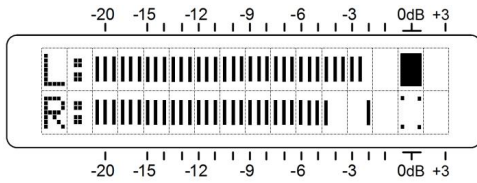
For FM reception, the 0dB panel marking represents ±75kHz carrier deviation. A 400Hz monaural test tone would take the meter to exactly 0dB. Receiver de-emphasis must necessarily be factored into the reading at higher frequencies, and of course the 19kHz stereo pilot consumes the top 1dB of stereo broadcast modulation. Aggressively-processed program audio should consistently peak the bars to about –1dB.

When HD Radio broadcasts are being received, 0dB corresponds to the iBiquity specification of –3dBFS for an absolute limit of program peak excursions.

Headphone Volume (HD Radio Menu Screen 8; FM Menu 9)

A front-panel PHONES jack offers a convenient monitoring point for Receiver setup and casual listening. As a pair of headphones is plugged into the front-panel jack, the LCD screen automatically goes to this Menu Screen. Headphone Vol will begin blinking and the panel knob may be adjusted for a comfortable listening level.

The LCD shows an arbitrary numerical value and a bargraph representation of the headphone volume. Once volume is set, push the knob to save the setting to memory.

Line Output Levels (HD Radio Menu Screen 9; FM Menu 10)

You may set analog and digital audio levels leaving the INOmini 639 on this Menu Screen. The numbers shown refer to the peak levels of either FM or HD Radio program signals at 100% modulation.
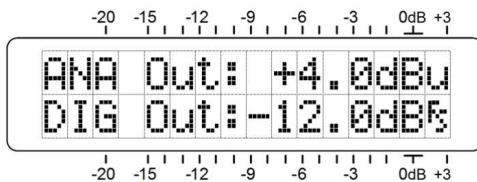
Push the knob and ANA Out will start to blink. Turn the knob to set the levels of the balanced left and right analog

outputs to any value between –15dBu and +15dBu in 0.2dB increments.

Push the knob again to set DIG Out:, the AES digital line output level. Numbers reference 'dBFS,' or dB with reference to digital full-scale. The adjustment range is –30dBFS to 0dBFS in 0.2dB increments.

PI / CL / Time (FM Menu Screen 11)

PI: is the station's four-character, hexadecimal identifier, the station's "digital address."

In North America the PI code is numerically derived from station call letters. 'Reverse-decoded' call letters for the PI code shown adhere to the RBDS standard and will display in the CL: field.

In some instances, North American PI codes derived from call letters will conflict with use of the RDS TMC (Traffic Message Channel) function. In those cases stations may adopt a 'bogus' PI code that will back-calculate to incorrect call letters. If the incorrect call letters happen to be the same as another station's legitimate assignment, the two stations must necessarily be in widely-separated coverage areas to avoid RDS housekeeping conflicts.
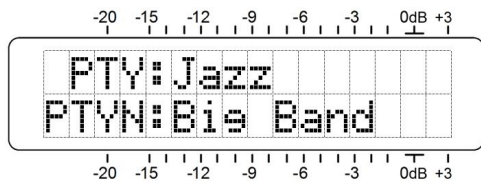
Another RDS utility sets the listener's radio clock to the current local time. This is a double-edge sword, however, as a change in time zones within the broadcaster's primary coverage area could cause trouble and alienate listeners. For this and other reasons, many broadcasters feel a responsibility *not* to implement this RDS timekeeping utility.

The lower line of FM Menu Screen 11 will scroll the RDS Clock/Time field. This will include the date, the current time in 24-hour notation, and the offset from UTC (Universal Coordinated Time).
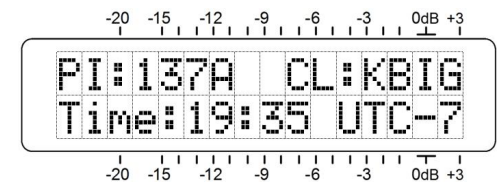
PTY / PTYN (FM Menu Screen 12)

The RDS PTY (Program TYpe) function identifies 'programming type' (or 'format' in the US) from a list of about thirty fixed categories. Some consumer radios can be programmed to search automatically for available programming based on the PTY sets of identifiers. The upper line on this screen identifies the decoded PTY by name from the appropriate list.

```
 -20  -15  -12   -9   -6   -3   0dB +3
┌─────────────────────────────────────┐
│ PTY:Jazz                            │
│ PTYN:Big Band                       │
└─────────────────────────────────────┘
 -20  -15  -12   -9   -6   -3   0dB +3
```

The PTY field is one important difference between the US RBDS and European RDS standards. The proper PTY list is selected automatically when the INOmini 639 Region: is set in one of the 'hidden' menus with explanations beginning on Page 20.

PTYN is an optional 8-character identifier used to further define the programming type or format. It is not used by the receiver to search for specific programming, but once the receiver is tuned to the station PTYN can further detail the program content and present it on the radio faceplate.

The lower line of FM Menu Screen 12 displays the optional PTYN if this information is being sent. In the example above, a jazz station might send Big Band during a daypart period that focuses on popular music of the 1940s.

PS and Radio Text (FM Menu Screen 13)

The upper line of this menu shows the station's 8-character PS:, or Program Service Name. This can be a *static*-PS message, like the station's call letters: WREN-FM, or a familiar 'street name' such as LIVE-95.
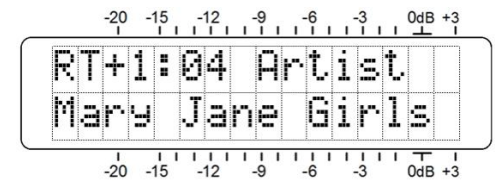
Most stations now practice *dynamic*-PS messaging, actually transmitting a different 8-character block at quick intervals to create a scrolling display on the radio faceplate. This can convey song title and artist information, program promotions or even advertising.

RT:, Radio Text, is a 64-character message that is displayed on consumer receivers that have a TEXT or INFO button. The INOmini 639 automatically scrolls the RT: message to display all 64 characters.

RT: may be used to present the same artist and title data that is commonly scrolled in the PS: field, but is often reserved for static information such as the station's telephone number, web address or program promotion.

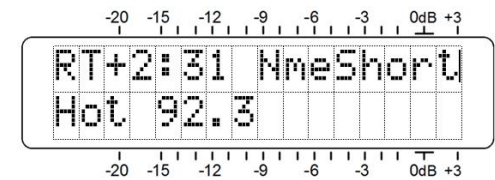**Radio Text Plus (Tagging)** (FM Menu Screens 14 and 15)

'Tagging' is the process of identifying certain data, such as song title and artist, within the Radio Text field. The tagged info must appear as plain text within the 64-character message and is 'tagged' with a numerical code that defines its location within the 64-character block. This code is then transmitted in the two fields identified as RT+1: and RT+2: on these menu screens. In addition to artist and title, 'tags' may also be used for advertiser tie-ins or product promotion.

```
 -20  -15  -12   -9   -6   -3   0dB +3
┌─────────────────────────────────────┐
│ RT+1:04 Artist                      │
│ Mary Jane Girls                     │
└─────────────────────────────────────┘
 -20  -15  -12   -9   -6   -3   0dB +3
```

The 04 in this Menu Screen 14 example refers to the RT+ Item Number, which in this case is Artist. The second line names the performer. If the group name overruns the LCD display, it will scroll automatically.

Here, Menu Screen 15 gives a similar display for the RT+2 tag. In this case it's RT+ Item 31, the "short name" of the station. Hot 92.3 is being sent to receivers during a commercial cluster. Again, tags too long for the LCD will scroll.

```
 -20  -15  -12   -9   -6   -3   0dB +3
┌─────────────────────────────────────┐
│ RT+2:31 NmeShortI                   │
│ Hot 92.3                            │
└─────────────────────────────────────┘
 -20  -15  -12   -9   -6   -3   0dB +3
```

As shown in the RT+2 example, tagging is not restricted to song information. Telephone numbers, e-mail addresses, station IDs and many other RT+ 'items' may be tagged. With tagging, a listener simply pushes a button on an equipped radio to automate the purchase of a song download or to retain a phone number or Web address in his portable device memory. Later, when docked with an Internet connection, his radio can assist in downloading music, purchasing merchandise, or allow the user to place a call or find a Website of interest with minimum effort.
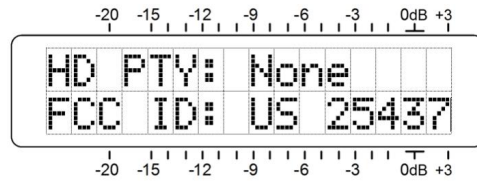
HD Name (HD Radio Menu Screen 10)

This Menu Screen identifies the radio station by its assigned primary FM call letters, as shown on the upper line here. The lower line displays a chosen station slogan.

```
    -20  -15  -12  -9   -6   -3   0dB +3
HD Name: KKJZ-FM
KJazz 88.1
    -20  -15  -12  -9   -6   -3   0dB +3
```
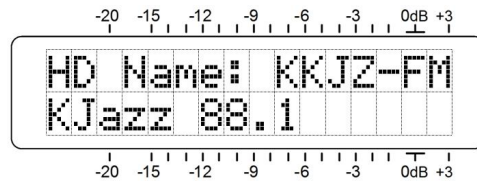
HD PTY and FCC ID (HD Radio Menu Screen 11)

The HD PTY: field is quite similar to the RDS PTY program identifier. If the broadcaster elects use HD Genre (see below) instead, None will display on the top line.

```
    -20  -15  -12  -9   -6   -3   0dB +3
HD PTY:  None
FCC ID:  US 25437
    -20  -15  -12  -9   -6   -3   0dB +3
```

FCC ID: is a numerical identification of the station transmitting HD Radio programming. This is analogous to the RDS PI identifier.

HD Artist (HD Radio Menu Screen 12)

HD Artist: identifies the performer of the song that is playing at the moment. Text will automatically scroll to reveal the full name of a group if it overruns the LCD display.

HD Title (HD Radio Menu Screen 13)

HD Title: names the song that is being played. Again, text will automatically scroll to reveal a full title that overruns the LCD display.

HD Album (HD Radio Menu Screen 14)

HD Album: simply names the album that the selection currently playing is taken from if the broadcaster provides this information. Text will automatically scroll to reveal the full album name if it's too long for the LCD display.

HD Genre (HD Radio Menu Screen 15)

HD Genre: is similar to the HD PTY: field, except that the station transmits its own description for the type of programming in this field, rather than accepting one from a

predefined list. This is similar to the RDS PTYN field. For example, an HD PTY: Jazz might not convey the subtleties of a station's programming, in which case the station might elect instead to send: Smooth Jazz and Rhythmic Hits, which would scroll on the HD Genre: menu screen.

"Hidden" Menus

Additional diagnostic data and infrequently-used setup options are available on a series of 'hidden' menus, explained in order here. To enter this mysterious realm, simply hold down the knob for about 5 seconds, until the 639 Firmware menu screen appears.

The 639 Firmware screen will apprise you of what firmware version is installed in your unit.

TX Gain: and TX BCTL: are active displays only in the HD Radio reception mode. When tuned to a station that is not transmitting HD Radio programming, both will show N/A.

With HD Radio transmissions, TX Gain: will normally show +0dB. The HD Radio system can use a housekeeping command to 'rescale' the system's nominal 100%-audio-modulation point. This adjusts receiver audio gain to complement a transmitter audio level offset.

TX BCTL: describes the 'blend mode' for HD Radio broadcasts; that is, whether the analog FM signal will blend to the digital program once the HD Radio signal is acquired and buffered. This field will display Normal in most instances. An obvious exception would be during a baseball game, when the 8+ second 'diversity delay' would present a problem listening to the play-by-play in the stands. In this case the diversity delay is removed from the analog-FM channel to eliminate latency. Ballgame is the identifier that would pop-up (pun intended) in this event, but other, somewhat obscure options provided in the HD Radio Specification are No Blend and Invalid.

Codec Mode: defines the composition of the HD Radio digital stream. As of this writing, with analog FM and HD Radio digital program channels broadcast concurrently and, hopefully, in sync, the first description in the following list will scroll in this field. Other options are, at this point, for future use and included here for reference:

```
0:  FM hybrid single-stream on P1 channel
1:  FM all digital dual-stream with mono core
```

```
2:   AM hybrid/all digital dual-stream
3:   FM all digital dual-stream with stereo core
10:  FM dual-stream on SPS
13:  FM hybrid/all digital single-stream
```

Split Mode: allows the user to make a rough audible check of timing synchronism between the analog FM and digital HD1 program channels. This is normally set Off, but can be turned On to route a monaural version of the HD1 program to the left audio channel, and monaural FM programming to the right channel. FM and HD Radio audio levels may be compared with the LCD level meter as well in this mode. After using this utility, be sure to turn it back Off to ensure proper operation of the INOmini 639.

De-Emph: displays the current setting for FM program audio de-emphasis. 75us (75 microseconds) is used in the Western Hemisphere, and 50us for the rest of the world. Push and turn the knob to change this selection.

Highlight and enter Region to load the proper list of pre-defined RDS PTY classifications. Set this to NA RBDS for North America, or EU RDS for Europe and most of the rest of the world. If you operating outside of the US, Canada or the European Union, consult the appropriate Radio Authority to verify a proper choice.

The three rear-panel alarm tallies are NPN transistors that normally saturate to ground for the C (Carrier loss) D (HD Radio Digital loss) and A (Audio loss) rear-panel alarm tallies. This is the default setting: a ground on the rear-panel connector when the alarms are active. Alarm Polarity: may be reversed, however, so that the terminal will normally sit at ground and go open for an alarm. Push the knob to cycle through the three alarms and set the polarity accordingly. For example: A:G gives a ground when audio is lost; A:O an open-circuit for dead air.

The Load Defaults? Menu screen will reboot the INOmini 639 and reset all setup choices to factory-default values. Push and turn the knob to bring up Yes on the second line, and push the knob again to complete the task.

If you are in a hidden menu that can be edited, you must navigate back to the first, 639 Firmware screen and push the knob to exit the hidden menu area.

Section IV

USING THE ANALYSIS SOFTWARE

Installing the Software

The analysis and logging software should be installed before connecting the INOmini 639 to your computer.

Installation is a simple Windows Installer (.msi) routine distributed on the CD-ROM packaged with the INOmini 639. This small file may also be downloaded from the Inovonics Website.

You may install directly from the CD-ROM, or download the .msi file to the Windows Desktop where it will regenerate the icon shown here. Double-click the icon to start the installation.
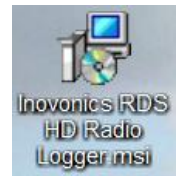
The initial installation screen is a Welcome to the RDS HD Radio Logger Setup Wizard. Click: Next to bring up this second screen. Here the installer suggests a Program File location. Unless you have a specific issue, either with this or with the privileges selection, simply accept the defaults and continue to click: Next.
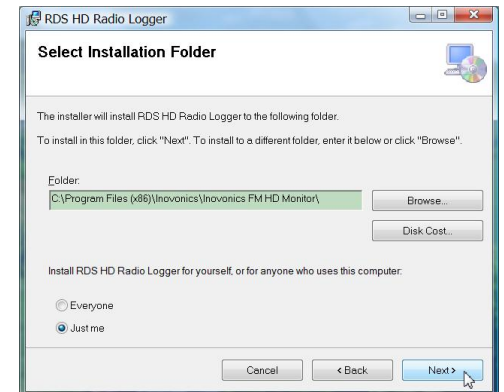
The installation should proceed and complete flawlessly, placing this program shortcut icon on your Windows Desktop.

At this point, connect the INOmini 639 to a USB port of your computer, using the cable provided. Then double-click the icon to launch the INOmini 639 analysis and logging utility.

Software Settings

Once the application is running, you'll find a Settings tab at the top of the screen. Click this tab to activate the drop-down menu illustrated here. Click the first setting: Select Device to bring up a Device List where connected hardware will be noted as recognized by the computer. Highlight the INOmini 639 listing and then click: OK.

Next click: Connect at the bottom of the software screen. The software will begin to populate both the analog-FM Decoded RDS and the HD Radio HD Info panes. You may switch between these panes regardless of the listening mode actually selected on the front panel.
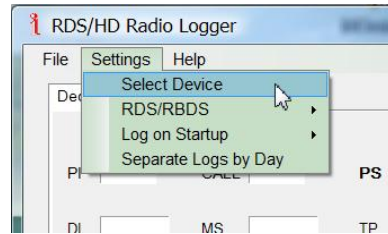
The Decoded RDS Pane
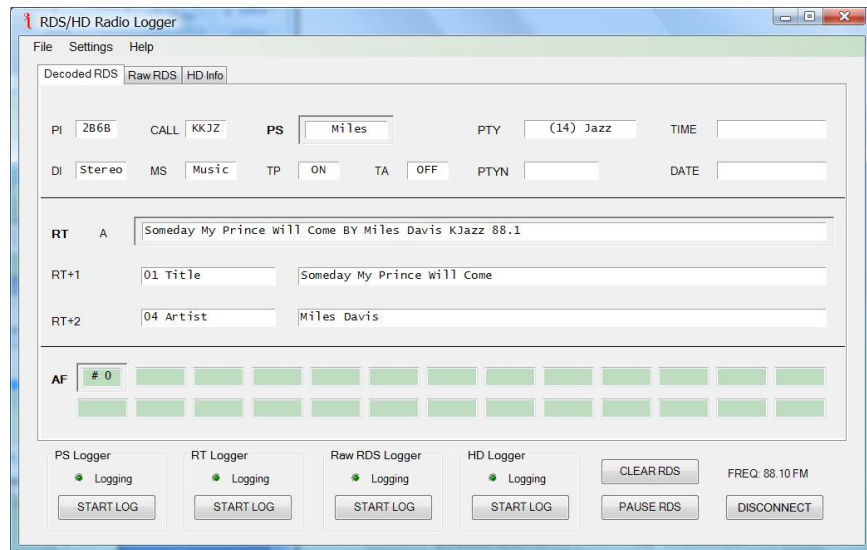
This pane displays static and dynamic RDS data, including the RT+ 1 and 2 'tags.' It is not within the scope of this manual to detail all the RDS functions. A good source for this information is the manual for our Model 730 RDS Encoder, which may be downloaded from the Inovonics Website. The 730 manual gives a good overview of the RDS system in general, and goes into fairly extensive detail regarding the various utilities, including RT+ 'tagging' technology and proper use of the Alternative Frequencies (AF) list.

As detailed on Page 16, the call letters displayed in this pane are back-calculated from the station's PI code. In the screenshot, the PI code is accurately derived from call letters and the station is scrolling the PS field with the same artist and title information shown in the Radio Text field. This station does include traffic announcements in their programming, but they do not update time and date or utilize any alternative frequencies (FM translators).

What's shown on in this pane amounts to a 'profile' of the station's RDS transmission at any given moment. This profile may be saved on your computer. Click: File at the top of the screen, and then click: Save RDS Profile. You'll be prompted to pick a name and folder location for the file, which will be saved with a .txt extension that may be opened with Windows Notepad.
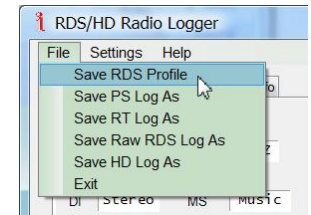
The Raw RDS Pane

Clicking the Raw RDS tab at the top of the software screen will take the user to the view shown at the top of the following page.

The left-hand Groups window displays the contribution percentage that each of the fifteen RDS groups makes to the total data throughput. Group 0 is the most active as it carries the bulk of RDS housekeeping. Percentages are continually calculated and updated on the fly, but the figure to the right of the percentages is a running total of occurrences of each group from the start of the monitoring period.
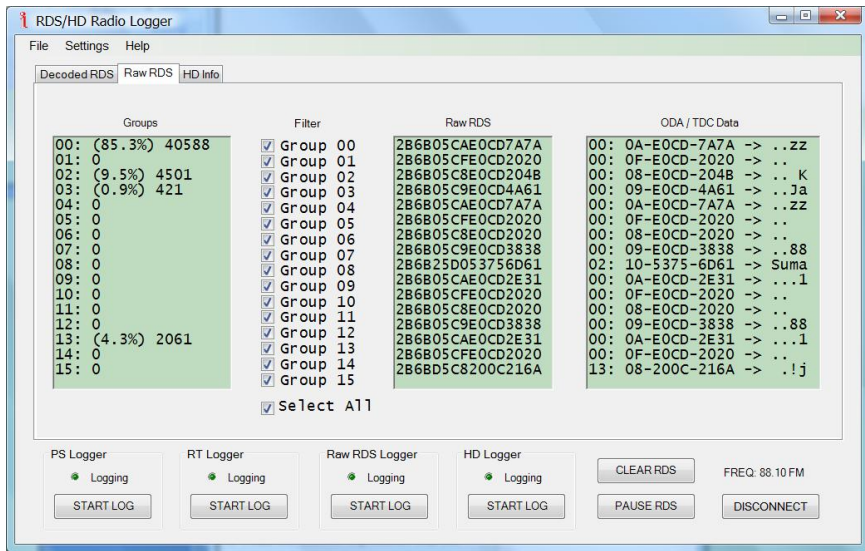
The Raw RDS window is a running display of the hexadecimal RDS data received. Again, this manual does not address the composition of the data groups, and needless to say it's not a simple coding scheme. However, in the far-right ODA/TDC Data column these data are broken down by individual groups and decoded to plain text… sort-of.

RDS data are sent in interspersed packets, and the packets are assembled into messages by the receiver. By using the Filter checkboxes, the user can single-out specific RDS functions. For example, by clearing all boxes except for group 2, the Radio Text messaging becomes readable, as displayed here.
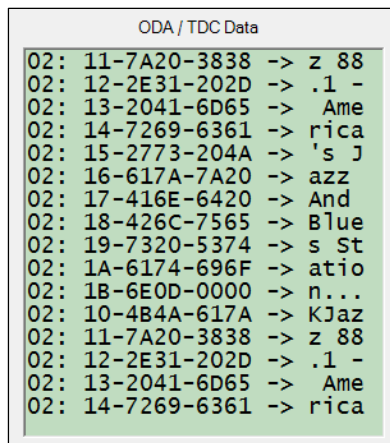
Group filter check boxes may be individually checked and cleared. The Select All box either checks or clears the lot.

The PAUSE RDS and CLEAR RDS buttons at the bottom of the screen will indeed perform the indicated functions, allowing the screens to re-populate and re-accumulation the data.

The HD Info Pane
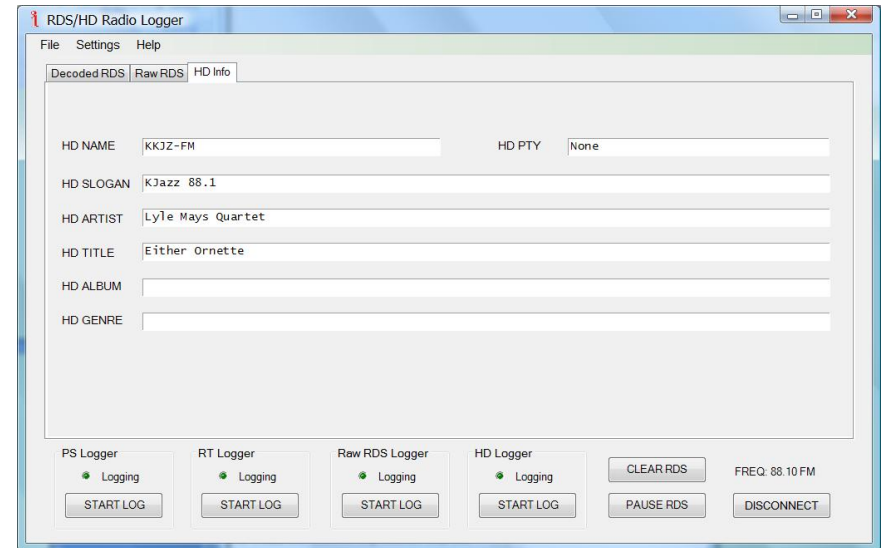
HD Radio 'PAD' metadata is displayed here in much the same manner as is the decoded RDS data for the analog FM channel. These fields were covered in a previous discussion (see Page 19).

Data Logging

Various buttons at the bottom of the screen allow the user to generate logs, independently and simultaneously, for various RDS and HD Radio data fields.


Simply clicking any of the the START LOG buttons will automatically open similarly-named .txt files on the Windows Desktop and begin logging the information there. The green Logging indicators blink to confirm operation. The START LOG button changes to STOP LOG with logging underway, and files will continue to accumulate data until you click the STOP LOG button.

These 'default' Desktop logs will continue to accumulate PS and RT data each time the program is opened and the

START LOG button is clicked. Unless they are manually deleted, these logs will grow indefinitely.

A better way to manage the logs is to pre-name the log files. At the top of the software screen, click File and Save (XX) Log As. You'll be prompted to pick a folder location and a name for your log. Then when you click the START LOG button, data will be saved to the named file and not to default Desktop files. If you click STOP LOG and later click START LOG without first closing the program, the new data will be appended to that same file(s). Specify a new name before clicking START LOG if you want to begin a new log file.
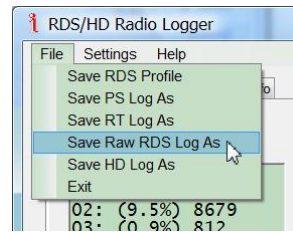
Entries to these logs are made only when data changes. Data will be shown alongside the date/time stamp for each log entry. The two examples shown here were from a few minutes' logging of the station displayed on the previous pages.
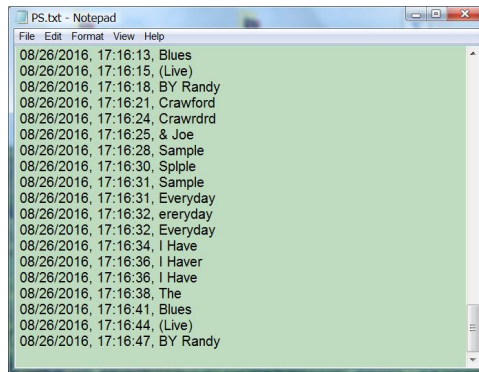
Note that the upper PS.txt log shows frequent updates. This is because the PS message is *dynamic*, or scrolling. Scrolling-PS essentially creates a new 8-character display every few seconds. The HD.txt log, on the other hand, shows only three entries for the identical logging period.
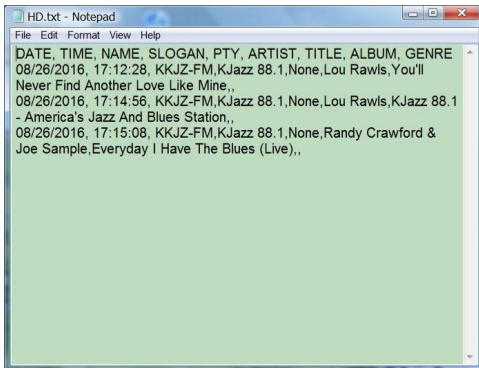
These files are comma-delineated and can be read in Windows Notepad, or imported into a spreadsheet program for additional analysis or to search for specific terms (song ti-

tle, program promo, advertisement, specific date and time of day).

Once again, if you do not name new log files when pausing or changing stations, the files will continue to accumulate data and thus may contain mixed entries that can be identified only by context or by the time stamp.

UPDATING THE FIRMWARE

Firmware updates for the INOmini 639 will be distributed without charge whenever new features or performance enhancements become available. Updates may be downloaded from the Inovonics Website, or we can mail them to you on CD-ROM or flash drive at minimal cost if your ISP or IT security procedures expressly forbid a .exe file download.

Bootloader Files

The new firmware is 'bootloaded' into the 639 through the front-panel USB connector. Use the USB cable provided with the INOmini 639: 'male A' to 'mini-B' as shown in the snapshot here.

Copy the update file to your computer Desktop. It will resemble the example on the left, except that the Rev (version) number should always supersede the version currently resident in your unit. You can check your current version by holding-down the knob for 5 seconds or more.

Saving Settings

A firmware update may or may not restore your unit to factory-default settings. This depends on whether the update is a 'minor' or a 'major one.

Minor updates are issued to correct firmware bugs. A minor update might take a version from 1.0.0.5 to 1.0.0.6, a change in the *last* digit of the version number.

Major updates have more to do with features and their adjustment limits. In that case the version number might bump from 1.0.0.8 up to 1.0.1.0, a change in this case of the last two digits.

A change of this magnitude would most likely purge all user setup information from the INOmini 639. The update would have an accompanying 'Changelog,' which will describe the update and urge you to jot down your settings

before installing it. In any case it's always a good idea to go through your setup menus, one by one, and make note of each setting.
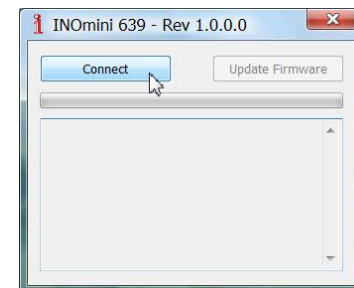
The Update Procedure

1. Unplug the DC power connector from the rear-panel jack.

2. Press and hold-down the front-panel knob as you reconnect the DC power. This action will bring up the firmware update screen illustrated here.

   NOTE: At this point you still have a chance to escape from the update process. Just perform a normal power cycle; that is, unplug and replug DC power without holding-down the knob.

3. With your computer cabled to the INOmini 639, double-click the bootloader BL.exe file on your Desktop. Relying fully on your undying trust in Inovonics, click Run when directed. The information box shown at the right will appear on your screen.

4. Next click: Connect, and then when the utility has found the INOmini 639 in its bootloader mode as shown here, click: Update Firmware. The box will display the update process and advise you when the update has completed.
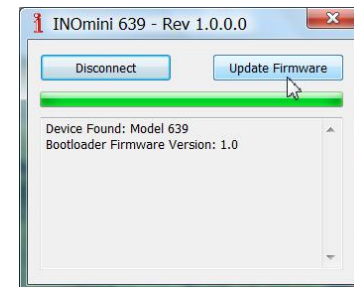
Section VI

TECHNICAL MATTERS

Firmware Version

With the INOmini 639 powered-up, hold the knob down for 5 seconds or so. The menu screen you have been viewing will be replaced by the `639 Firmware` screen. This shows the firmware version installed in your unit. This is information that may prove useful when communicating with the factory. Push the knob again to return to the normal menu sequence.

'Under the Hood'

The INOmini 639 is compact and sophisticated, utilizing mostly surface-mounted (SMD) components. Many of these are application-specific and/or pre-programmed at the factory, but all of them are impossibly tiny. This makes servicing the unit in the field a difficult proposition at best. For these reasons, and also because of the small format of this manual, we have elected to dispense with schematic diagrams, servicing instructions and a listing of component parts.

Notwithstanding this decision, our policy has always been one of 'full disclosure.' We feel that, unless we are doing something nefarious (or acting in the interest of national security!), there should never be a reason to hide information from the user. With a clear conscience, and upon request, we will cheerfully provide additional documentation and divulge all but the very darkest secrets concerning any Inovonics product.

Because it is so small and lightweight, returning the Receiver for factory servicing is an option that we encourage. Inovonics has never considered factory repair charges a significant source of revenue, and we are confident that you will be truly astonished at our reasonable shop rates!

ⅰ INOVONICS WARRANTY

I **TERMS OF SALE:** Inovonics products are sold with an under-standing of "full satisfaction"; that is, full credit or refund will be is-sued for products sold as new if returned to the point of purchase within 30 days following their receipt, provided that they are re-turned complete, and in "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 the product *must* be completed and returned to Inovonics, or the Warranty regis-tered online at www.inovonicsbroadcast.com, within 10 days of delivery.

B. The Warranty applies only to products sold "as new." It is ex-tended only to the original end-user and may not be transferred or assigned without prior written approval by Inovonics.

C. The Warranty does not apply to damage caused by misuse, abuse, accident or neglect. This Warranty is voided by unau-thorized attempts at repair or modification, or if the serial identi-fication tag 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 the equipment 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 **RETURN OF 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 fac-tory is not covered under terms of the Warranty and may occa-sion additional charges.

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