

**INO** *mini*  
**633**

## FM/RDS Monitor Receiver

### Installation & User Guide



July, 2013 - Rev. 2.0 Firmware & Software  
(RDS-Loss / PI Mismatch Alarm)

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## Section I

# INTRODUCTION

### Product Description

The INomini 633 is an FM-only receiver for off-air broadcast monitoring and re-broadcast (translator) service. It receives standard analog FM broadcast transmissions and also decodes the digitized text and 'housekeeping' data that are transmitted to the North American RBDS (Radio Broadcast Data System) and European RDS (Radio Data System) standards. These both will be referred to simply as 'RDS' in this manual, but differences are defined in a later section.

The front-panel, back-lighted LCD display is host to numerous menu screens, which enable easy setup of the 633, and display both signal quality and RDS RadioData information.

### Product Features

Features of the Inovonics 633 include:

- Sensitive and selective DSP-based receiver.
- Receives worldwide-standard FM radio broadcasts and optional associated RDS data.
- Offers 'Extended-Band' coverage down to 76MHz.
- Easy setup using the LCD screen and jog-wheel navigation of the receiver's menu tree.
- Front-panel display of most-essential FM RDS information including RT+ 'tagging' data; USB port sends RDS data to any PC for analysis by the included software.
- Analog L/R and AES-digital program line outputs.
- Front-panel alarms with rear-panel 'tallies' for Carrier Loss, Audio Program Loss, and RDS Loss or PI Code Mismatch.

### Product Specifications

**Tuning Range:** 76.0MHz - 108.1MHz in 100kHz steps

**Antenna Input:** 50/75-ohm (F) (See Page 7)

**Receiver Sensitivity:**  $\leq 10\mu\text{V}$  for 50dB monaural FM S/N

**Audio Frequency Response:** 30Hz-15kHz

**FM De-Emphasis:** 75 $\mu\text{s}$ /50 $\mu\text{s}$  selectable

**RDS Fields Displayed:** AF, CT, DI, M/S, PI, PS, PTY, PTYN  
RT, RT+, TA, TP; Groups Received

**Program Audio Output(s):** +4dBu balanced Analog Left/Right (XLR), 200-ohm source impedance; AES Digital (XLR), 44.1kHz sampling rate; Front-Panel Headphone Jack (3.5mm TRS)

**USB Port:** Raw RDS data for external analysis (software provided)

**Alarm Tallies:** Individual open-collector NPN transistor outputs for Carrier Loss and Audio Loss

**Power Requirement:** 12VDC at 140mA. A universal-inline switching-type power supply is provided and accommodates AC mains voltages between 100V and 240V.

**Mounting Options:** The 633 may easily be fastened to any convenient surface with two small screws, or an optional rack adapter will accept up to three INomini modules in a 1U, 19-inch rack space.

**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**

Immediately upon receipt of the 633 receiver, inspect for any possible shipping damage. If damage is found or suspected, notify the carrier at once, and then contact Inovonics.

We recommend that you set aside the original shipping carton in the event that return for Warranty repair is required. 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 registration assure coverage of the equipment under terms of the Warranty (printed inside the back cover of this manual), but the user automatically receives any specific service and modification instructions, including software/firmware updates. Register online at:

[www.inovonicsbroadcast.com/product-registration](http://www.inovonicsbroadcast.com/product-registration)

### **Mounting**

The Model 633 receiver is packaged in a compact ‘clamshell’ chassis that defines the standardized Inovonics’ INOmini module. The 633 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 receiver. Alternatively, a pair of mounting holes on the chassis base allows the 633 to be fastened to the inside of an equipment rack cabinet with two #4 screws.

An optional rack-mount kit is available for the 633, which can house up to three INOmini modules. The kit 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 supply.

### **AC Mains Power**

All Inovonics INOmini modules are supplied with an out-board switching-type power supply suited to the destination mains voltage. As the actual power consumed by the receiver is 140mA at 12 volts DC, a second DC connector on the rear panel of the 633 allows the user to ‘daisy-chain’ INOmini modules. This means that two or more units may be fed from the same AC supply, but with the 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.

### **Battery Operation**

The 633 receiver may optionally be powered by either a wet or a sealed (gel) 12-volt lead/acid battery. The nominal input voltage should never exceed 15V, and protection should be afforded against voltage surges from charging circuits.

### **Radio Frequency Interference (RFI)**

Although we have anticipated that the 633 receiver will be used in the immediate proximity 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. Please refer to Section III of this manual for easy setup and receiver programming instructions.

### **Headphone Jack**

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

### **RDS Data Port**

The front-panel mini-USB connector delivers raw RDS data to any Windows® PC running the supplied analysis software.

A connecting cable is included. See Section IV for particulars concerning this feature.

### **Rear Panel Connections**

ANTENNA	The rear-panel 'F' connector should be connected to a good outdoor FM antenna for best reception. Although the antenna input is nominally 75 ohms, experience has shown that 75-ohm and 50-ohm antennas performs equally well without additional impedance-matching efforts.
G C R A	<p>These are alarm "tally" outputs for remote indication of reception problems or RDS errors. Designations are also noted on the rear panel; these stand for <u>G</u>round, <u>C</u>arrier Loss, <u>R</u>D<sup>S</sup> Alarm and <u>A</u>udio Loss.</p> <p>The three alarm outputs are the collectors of NPN transistors that saturate to ground for an alarm condition. Up to 100mA may be 'sunk' by each of these outputs to operate relays or LED indicators using an external voltage source up to 24VDC, which must be returned to the G (Ground) terminal.</p> <p>The plastic connector body may be unplugged from the chassis to make connection easier and for quick disconnect.</p>
AES DIGITAL AUDIO OUTPUT	The balanced, transformer-isolated AES digital audio output has a fixed sampling rate of 44.1kHz.
ANALOG LINE OUTPUTS L/R	The active-balanced analog line outputs provide a program level of +4dBu at 100% modulation ( $\pm 75$ kHz deviation of the FM carrier by a monaural, 400Hz tone). These outputs have a 200-ohm source impedance.

+12VDC  
POWER I/O

These two parallel connectors 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 not exceeded. Two short 'pig-tail' cables are provided with each rack adapter.

The Model 633 receiver draws 140mA. Check the rating on the label of the power supply to make sure it has enough oomph for all the modules it must support.

These power connectors are not a locking type, and the mating plugs pull out rather easily. A Ty-Wrap® will secure the cables to the plastic anchor above the jacks if this is considered a potential problem.

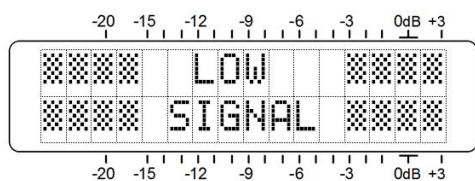
## Section III

### OPERATING THE 633 RECEIVER

#### Hey, why is the screen flashing?

The 633 features three alarms that indicate 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 LDC display, making the alarm quite visible even across the room.

If the 633 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 a few seconds respite from the flashing, enough time to navigate to any of the setup menus. Of course, once a station has been tuned-in properly 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.

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

**NOTE:** Flashing alarms are not to be confused with 'blinking' menu callouts that indicate options for editing.

#### Menu Navigation Basics

By the time you've read this, you've probably already figured out the 633 receiver menu for yourself; it's really quite intuitive. Quite simply: 1) *turn* the knob to navigate from one menu to the next, 2) *push* the knob to enter any menu associated with receiver setup, 3) *turn* the knob to set a val-

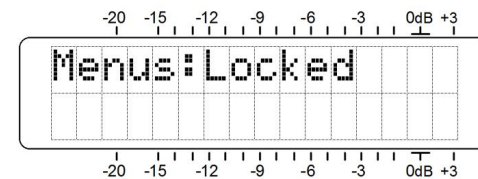
ue, and then 4) *push* again to accept the selection, send it to non-volatile memory, and return to menu navigation.

In setup menus, any parameter that can be edited will begin blinking when 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 once again to transfer that selection to memory.

Each Model 633 menu screen will be discussed separately and in order, except that the last menu is discussed first, as it could be a show-stopper!

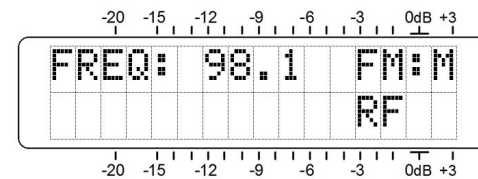
#### Locked Menu (Menu Screen 23)

To guard against inadvertent menu editing or casual tampering, the very last menu in the sequence lets the user lock-out the knob from the editing mode. If you find that when you push the knob you are unable to enter the menu to change a receiver setup parameter, go all the way to the last Menu Screen, 23, shown here. Push the knob and the word `Menus` will begin blinking. You can then turn the knob to select `Menus:Unlocked` and push the knob again to set this selection. From there you may navigate back to whichever screen you were trying to edit.



#### Tuning the Receiver (Menu Screen 1)

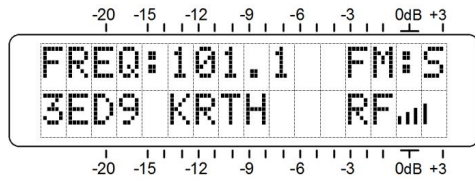
When power is applied to the 633 receiver, a 'splash screen' with the product ID pops up immediately on the LCD. Within a few seconds this will revert to Menu Screen 1, shown here as it might appear when the receiver is first powered-up, but before it has been programmed.



Push the knob and `FREQ` will begin to blink. Now the receiver may be tuned by turning the knob. When tuned to an FM station, `FM:S` (stereo), `FM:B` (blended stereo, see Page 13) or `FM:M` (monaural) transmissions will be verified in the upper,

right-hand corner. A series of bars to the right of RF will give a rudimentary display of incoming carrier strength.

If the station is transmitting an RDS (Radio Data System) subcarrier, the station PI (Program Identification) hexadecimal code will appear on the LCD screen below FREQ.



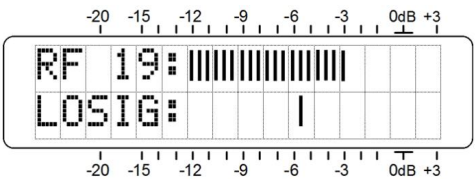
In North America, where the PI code is numerically derived from station call letters, those call letters will be decoded and displayed to the right of the PI hex value.

**NOTE:** In some cases, North American PI codes derived from call letters will conflict with use of the RDS TMC (Traffic Message Channel) function. These stations will have a reassigned PI code that will back-calculate to incorrect call letters. If the bogus call is the same as another station's legitimate call letter assignment, the two stations must necessarily be in widely-separated coverage areas.

Once the receiver is tuned, push the jog wheel. FREQ will stop blinking and the tuned frequency will be transferred into non-volatile memory. This releases the jog wheel to navigate to other menus.

### Carrier Strength and Alarm (Menu Screen 2)

The RF bargraph at the top of this menu screen shows incoming signal level. There is an RF numerical value given as well. This number simply represents the number of visible bargraph segments but may be used as a comparative reference. This display is strictly a *relative* indication of the FM carrier strength and has no association with the dB scale beside the LCD window. The dB scales are used only for audio level measurements in Menu Screen 5.



The lower LCD scale is labeled LOSIG: and has a single tick mark off to the right. Push the jog wheel and LOSIG will begin to blink. As you turn the knob, note that the single tick mark can be positioned anywhere beneath the RF bargraph.

During normal receiver operation, should the RF: bargraph fall below the tic mark, LOW SIGNAL will flash on the LCD screen and a carrier-loss alarm will be sent to the rear-panel connector. The rear-panel C terminal gives an NPN transistor saturation to ground on this alarm, which may be used to actuate a relay, light a remote LED indicator or tie into a remote control system.

As a starting point, you might set the carrier-loss trigger point about a quarter of 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. Your actual setting may need to take additional factors into account, but when the proper trigger point has been determined and set, push the knob again to fix the alarm point in memory and to release the menu.

### Signal-to-Noise and Multipath (Menu Screen 3)

This screen displays two additional signal-quality measurements. Numerical values are assigned to each of these readouts as well, but again signify only the number of visible bargraph segments.

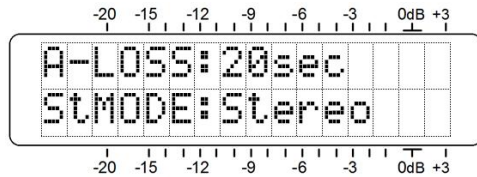
SN is a first-order approximation of the signal-to-noise quality of the tuned signal. This measurement takes several signal quality factors into account, but is strictly a relative indication. No hard-and-fast rule can be derived from this display, except that "more is better."

Similarly, MF gives a relative indication of multipath (signal reflection) effects that the transmission encounters in its trip to the receiver. Multipath effects are an important consideration in the quality of the recovered audio program, affecting noise and other audible artifacts. The object here is to keep MF as low as possible. Zero would be nice and should be attainable when a good signal is received.

The SN and MF numerical values are handy to keep track of when installing a rooftop or tower-mounted antenna. In locating, orientating and aiming the antenna, do everything you can to maximize SN and minimize MF.

### The Audio Loss Alarm (Menu Screen 4A)

Navigate to this Screen and push the knob. A-LOSS: will begin to blink. Turn the knob to dial-in the desired audio loss alarm delay time,



which is the time in seconds between the onset of 'dead air' and a flashing LCD and rear-panel alarm. The delay may be programmed in one-second increments up to 2 minutes. Turn the knob completely counterclockwise to OFF to deactivate the alarm altogether.

The trip point of the audio loss alarm is fixed at a program peak level about 15dB below 100% modulation. Even classical music will have peaks that exceed this level regularly. Do consider the dynamics of the broadcast format when setting this delay. For classical music a setting of 60 seconds would probably still exceed most legitimate *pianissimo* passage; Ravel's *Bolero*, unprocessed, a possible exception.

The rear-panel A terminal is an NPN transistor saturation to ground for an audio-loss alarm. This ground may be used to actuate a relay, light an LED at a remote location or tie-in to a remote control system.

### FM Reception Modes (Menu Screen 4B)

Once A-LOSS: has been set, push the knob again. StMODE will begin to blink on the lower line of Menu Screen 4. To set the FM mode, turn the knob to select Stereo, generally the normal receiver operating mode, or to select Blend-St. (blended stereo) or F-Mono to force monaural FM reception.

With Stereo selected, 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 mode display in Menu 1 will show FM:S for stereo broadcasts and FM:M if the station is transmitting a monaural signal.

Stereo-FM suffers a theoretical noise disadvantage of about 20dB when compared with monaural transmission. Selecting the Blend-St reception mode will mitigate this condition substantially by progressively 'blending' the stereo im-

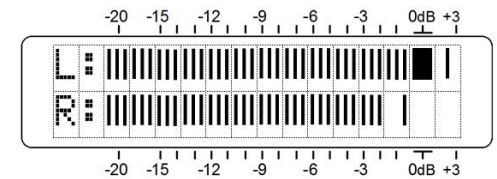
age to mono as the FM signal deteriorates under a low-signal, multipath or other poor reception condition. This mode is identified with FM:B in Menu Screen 1.

The degree of blending is not indicated, nor will the screen indicate FM:M if the station reverts to a monaural transmission. In the FM:B (blended) mode, you may switch among the three options to evaluate the audible differences: either a noise tradeoff between Blend-St. and Stereo, or the separation tradeoff between Blend-St. and F-Mono. The blending option is included in the 633 to at least offer a feature common to consumer radios, but it well may be considered "cheating" in a professional environment.

F-Mono, or Forced-Mono, will place the 633 receiver in a monaural-only reception mode. This would be an obvious choice when monitoring or relaying a station that never broadcasts in stereo.

### Program Audio Levels (Menu Screen 5)

Menu Screen 5 gives a bargraph presentation of program audio levels. This is a peak-responding meter with a floating peak-hold function.



100% modulation is denoted by the large block opposite the 0dB marking on the panel. The meter resolves +1, +2 and +3dB above 0dB. Below 0dB the scale is linear in 0.5dB steps down to -15dB, and then in 1dB steps to -21dB.

0dB represents  $\pm 75$ kHz carrier deviation. A 400Hz monaural test tone would take the meter to the 0dB point. At higher frequencies receiver de-emphasis must necessarily be factored into the reading, and of course with stereo broadcasts the 19kHz pilot consumes the top 1dB of modulation. Aggressively-processed program audio should peak the bargraphs consistently at about -1dB.

### Headphone Monitoring (Menu Screen 6)

A front-panel PHONES jack offers a convenient monitoring point for 633 setup and casual listening. Whenever a pair of headphones is plugged into the front-panel jack, the LCD screen automatically goes to Menu Screen 6. 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 and to return the screen to the last menu on display.

### **PS and PTY** (Menu Screen 7)

The upper line of Menu Screen 7 shows the station's 8-character **PS**:, or Program Service Name message. This can be a *static*-PS message, perhaps simply the station's call letters: WREN-FM or a 'street name' like LIVE-95.

Many stations scroll a PS message in 8-character blocks, this is *dynamic*-PS messaging, which can include song title and artist information, program promos or even advertising.

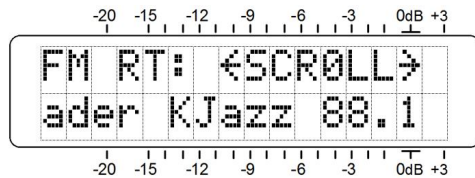
The lower line identifies the decoded **PTY**: (Program Type), which is the station's programming format defined by one of about thirty choices within each of the RDS or RBDS Standards.

These are display fields only, nothing can be edited here.

### **Radio Text** (Menu Screen 8)

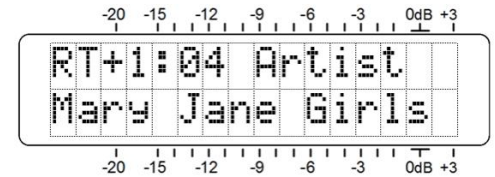
Menu Screen 8 displays Radio Text, a 64-character message that is displayed on consumer receivers that have a **TEXT** or **INFO** button. The Radio Text message is separate from, and in addition to, the PS field, which is used by many stations to scroll artist and song titles so that they will be visible on all RDS-equipped receivers. The Radio Text field may also present artist and title data, but is often used for static information such as the station's telephone number, web address or program promo messages.

Radio Text automatically scrolls in Menu Screen 8, but by pushing the knob the user can manually scroll back and forth through the 64 characters, rather than having them scroll by themselves.



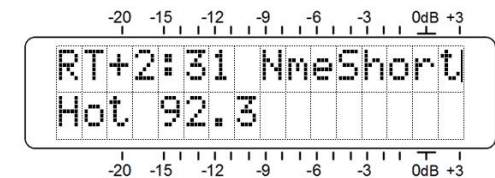
### **RT+ "Tagging"** (Menu Screens 9 and 10)

"Tagging" is the process of identifying certain data within the Radio Text field, such as song title and artist. 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 RT+1 and RT+2 fields. These fields are decoded by the 633 and shown in plain text in Menu Screens 9 and 10. The example here is a typical Menu Screen 9 display.



The 04 in this 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 be scrolled here automatically. Alternatively, push and turn the knob to scroll through the full text manually; push again to navigate the menus.

Here, Menu Screen 10 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, if the tag is too long for the LCD it will scroll, or push and turn the knob to scroll through the entire text manually, then push again to resume menu navigation.



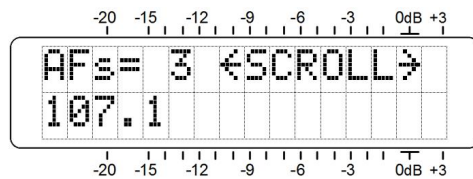
As shown in this RT+2 example, tagging is not restricted to song information. Telephone numbers, e-mail addresses, station IDs and many other RT+ 'items' may be tagged. With tagging, a listener simply pushes a button on his radio to automate the purchase of a song download or to retain a phone number or Web address in the memory of his portable device. 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.

### The AF List (Menu Screen 11)

A feature of the Radio Data System is its ability to retune the listener's radio to a different frequency where the identical program is available under better reception conditions. This is probably more useful in Europe, where nationwide networks utilize a number of low-power transmitters to cover the entire country. In the US, "translators" are sometimes used to rebroadcast a station's program on another frequency to fill dead spots in the primary coverage area.

This useful feature is managed by the Alternative Frequency List. The main channel and all other appearances of the same program use RDS to send out a listing of all frequencies where the program can be received. The RDS radio constantly monitors these 'alternative' frequencies, and then decides which one might give better reception. The radio then seamlessly switches to the better signal.

Menu Screen 11 shows how many Alternative Frequencies carry the identical programming, in sync, of course, with the one being received.

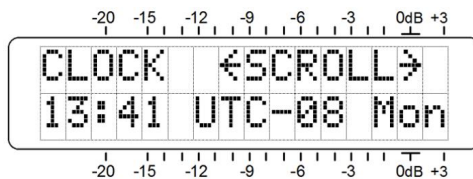


The user may scroll through this list to confirm that the proper frequencies have been entered into the RDS encoder.

### The Clock-Time Function (Menu Screen 12)

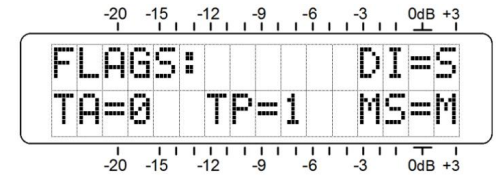
Another utility of RDS is to set the listener's radio clock to the current local time. This is a double-edge sword, however, as a change in time zones within the broadcaster's primary coverage area could cause trouble and alienate listeners. For this and other reasons, many broadcasters feel a responsibility *not* to implement this RDS utility.

Nonetheless, the 633 gives the user the option of monitoring the CLOCK (CT) function. Push the knob to activate scrolling and view the current time, the offset from Universal Coordinated Time, and the day of the week, day, month and year.



### RDS 'Flags' (Menu Screen 13)

The Radio Data System performs certain housekeeping functions to convey simple status information to the receiver. These RDS 'flags' may be observed on this screen. A typical example is shown here and is explained as follows.



DI=S signifies this is a typical stereo transmission. There are several, somewhat obscure alternatives, but this is what you'll see in any common instance.

TA=0 means that no Traffic Announcement is currently being broadcast by the station. A Traffic Announcement is a short-duration verbal alert for road hazards, etc. Raising the TA=1 flag automatically tunes all TA-enabled RDS radios to the station broadcasting the alert.

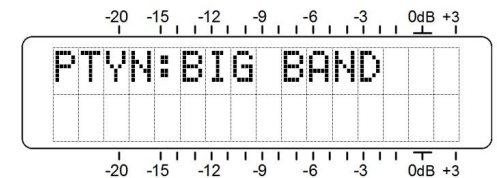
TP=1 indicates that this is a station that carries traffic information as a normal element of its broadcast programming. If the station sends a TP=0 flag, it disregards traffic and thus cannot participate in the TA flag program.

MS=M shows the condition the 'music/speech' switch. This differentiates between broadcasts with mixed music and speech, and all-speech programming. An all-news station might send: MS=S, but this would be very rare.

### PTY Name (Menu Screen 14)

The basic RDS PTY (Program Type) function identifies 'programming type,' known as 'format' in the US, from a list of thirty or so fixed categories. The station's PTY is shown on Menu Screen 7. Consumer radios can be programmed to search automatically for available programming based on the PTY sets of identifiers.

PTYN is an 8-character optional identifier used to further define the Program Type (PTY). It is not used by the receiver to search for a specific format, but once the receiver is tuned to the station, PTYN can further detail the type of programming and display it on the radio faceplate.

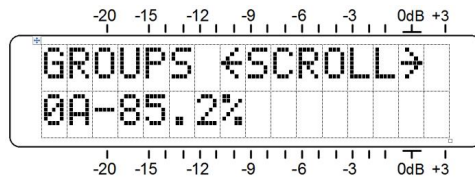


Menu Screen 14 displays the optional PTYN if this information is being sent. In the example above, a jazz station might send **BIG BAND** during a daypart period that focuses on music of the 1940s.

### RDS Groups Received (Menu Screen 15)

This screen will show a listing of the RDS data groups that the station is transmitting. Groups are numbered zero to 15, with an A and a B version in each group. Only the groups being transmitted will show on the list.

Push and turn the knob to scroll through the groups. Active groups will show what percentage of RDS overhead they are using. The bulk of RDS functionality is handled by just a few groups; others may be employed on a sporadic basis. RDS groups that the station transmits will appear on the list, but some may indicate 0.00% activity at the moment.

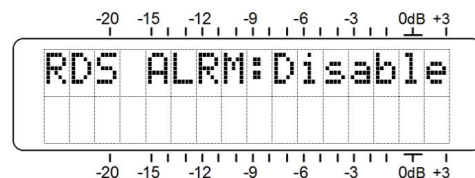


With this screen open, holding down the knob will clear groups from the list. Calculation will start over when the knob is released.

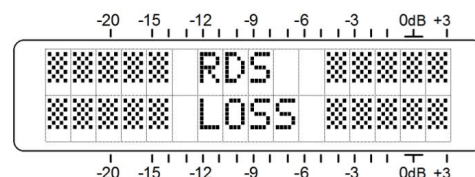
### RDS Alarm (Menu Screen 16)

Effective with Rev. 2 units, the 633 incorporates an alarm function associated with the Radio Data System (RDS or RBDS). This flashing display and rear-panel closure warns the user of either of two conditions: 1) a missing 57kHz RDS subcarrier, or: 2) an incoming PI code that differs from the code that the user enters manually.

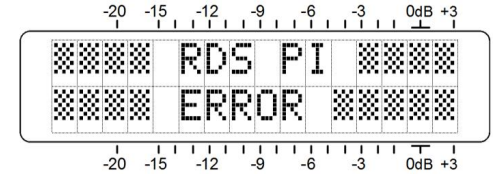
Navigate to Menu Screen 16. The default setting is **Disable**. Push and turn the knob and two alarm options may be selected: **RDSLoss** and **PI Err.**



With **RDSLoss** selected, a 57kHz subcarrier loss will flash this warning after a 10-second delay, and apply ground to the rear-panel R terminal.



With **PI Err.** selected, the 633 gives an alarm for a PI code mismatch between the received PI and the PI code entered into the 633 by the user. (Instructions for entering the PI code are covered in the next topic.) After a 10-second delay, a PI mismatch will flash this warning and apply ground the R terminal.

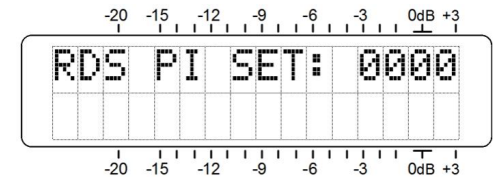


The rear-panel R terminal is an NPN transistor saturation to ground for the selected RDS alarm. This ground may be used to actuate a relay, light an LED at a remote location or tie-in to a remote control system.

The RDS alarm function is turned off by selecting **Disable** on Menu Screen 16.

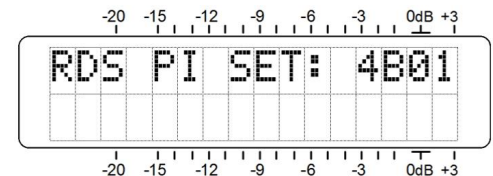
### RDS PI Set (Menu Screen 17)

The PI Error alarm is enabled by selecting **PI Err.** in Menu Screen 16, and by entering the matching PI code here in Menu Screen 17.



PI codes are hexadecimal values that use digits zero through 9 and letters A through F. The hexadecimal value of the PI code being received by the 633 is shown on Menu Screen 1. Although these 'hex' values are derived from call letters in North America, you cannot simply enter call letters here.

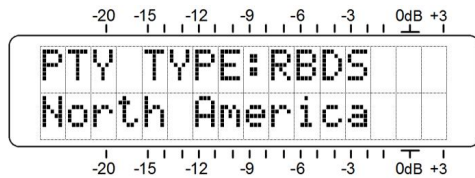
To enter a valid PI code, push the knob once; the first digit will begin blinking. Turn the knob until the first hex character is dialed in, and then push the knob again. The first character will be entered and the second space will blink. Continue entering the complete 4-character code. The final push on the knob will set the value in memory and release the menu.



### PTY Type (Menu Screen 18)

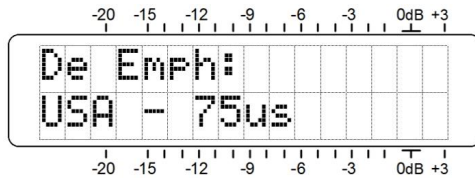
The PTY (Program Type) function of the RDS system lets a listener put the search for preferred programming entirely into the hands of his radio. Two PTY lists define 'Station Format' (N. America) or 'Program Type' (Europe). The regional/cultural basis for separate lists remains the primary difference between the North American RBDS and the European RDS Standards. An RDS radio will display items from a different list of programming choices depending on what market it has been manufactured for.

The 633 receiver is able to decode PTY from either list and display the proper description of programming in Menu Screen 7. Push the knob on this screen and PTY TYPE will begin to blink. Turn the knob to specify North America or Europe, and then push the knob again to transfer the choice to memory.



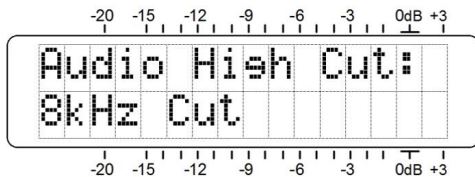
### Program Audio De-Emphasis (Menu Screen 19)

De-emphasis for the program audio is selected here. 75 $\mu$ s (75-microsecond) de-emphasis is standard for the Western Hemisphere, and 50 $\mu$ s for Europe and most of the rest of the world. Push and turn the knob to select, push again to set in memory.



### Audio High-Cut Filter (Menu Screen 20)

The 633 receiver incorporates a user-selectable, rather gentle low-pass filter that may be inserted into both the L/R analog and AES digital line outputs. This filter allows the user to roll off the higher audio frequencies at his discretion to reduce the audibility of hiss-type noise under poor reception conditions.



The default setting for this filter is Disabled. As may be considered necessary, however, it can be set for an HF cut-

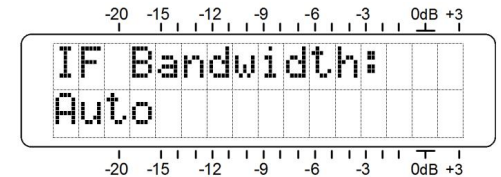
off of 15kHz, 10kHz, 8kHz, 6kHz, 5kHz and 4kHz. Before implementing this fixed HF rolloff to reduce noise, you might first try the automatic stereo-to-mono 'blending' option afforded in Menu Screen 4, StMode:Blend-St. This is a program-controlled function that proportionally reduces stereo separation (and noise) as reception conditions deteriorate.

The cutoff frequency shown in this menu is approximately the -3dB point of the filter. The filter slope is not a straight-line function, but becomes steeper as the frequency increases.

### IF Bandwidth Control (Menu Screen 21)

This menu is a bit of a misnomer as this DSP-based receiver really doesn't have an intermediate frequency (IF) as such. But the utility of this menu equates to the same function in a traditional analog receiver.

The maximum reception bandwidth of the 633 is  $\pm 110$ kHz. The default setting, however, is Auto (automatic). In this mode receive bandwidth



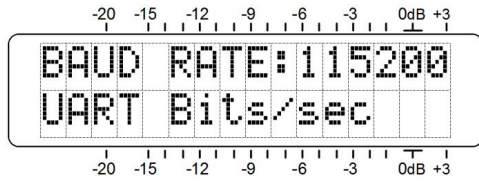
is subject to restriction based on signal reception conditions. The receiver pulls in the band edges as either the high-frequency noise component of the baseband signal increases, or as interference from an adjacent-channel station encroaches.

Fixed bandwidth values may be manually selected as well. Push and turn the knob to select: 110kHz, 84kHz, 60kHz or 40kHz. Unlike AM radio, you won't hear the high frequencies roll off as receive bandwidth is reduced. Instead, stereo separation and harmonic distortion performance will be compromised to a greater or lesser extent. If the Auto setting is not effective in lessening 'splatter' from an adjacent channel, try the lower cutoff frequencies to reduce audible interference. When a setting is selected, push the knob again to fix it in memory.

### USB Baud Rate (Menu Screen 22)

This screen is used to set the UART baud rate for USB communication between the 633 receiver and a PC connected

with the provided cable. The default baud rate for this connection is 115200. With nearly all PCs sporting USB 2.0 ports, and with the relatively short USB cable provided, there should rarely be a reason to run at one of the lower rates. Nevertheless, should communication at 115200 prove dodgy, or if the connected PC cannot run the provided analysis software reliably using that data rate, the baud rate can be reduced to 57600, 38400, 19200 or 9600. Push and turn the knob to change the rate, push again to set in memory. Be advised that the baud rate set for the 633 by the front panel must match the baud rate setting in the software. This is mentioned again in the next section.



## Section IV USING THE ANALYSIS SOFTWARE

The mini-USB connector on the front panel of the 633 delivers raw RDS data to a connected computer. Provided software running under the Windows OS provides organization and analysis of the RDS data stream.

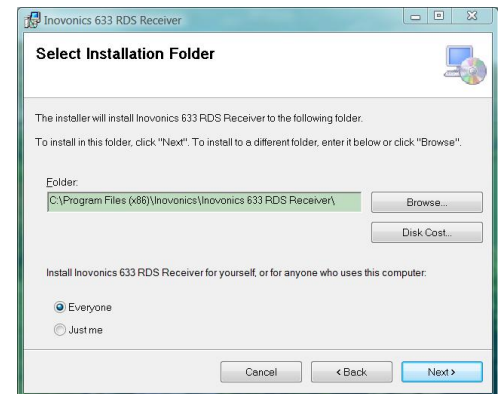
### Install the Software First

Analysis software installation is a simple Windows Installer (.msi) routine distributed on the CD-ROM packaged with the 633. This small file may also be downloaded from the Inovonics Website. Because 'hacked' installer files may carry computer viruses, do make sure that the file is legitimate. You should be able to run a virus scan on the .msi file.

You may install directly from the CD-ROM, or copy 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 first installation screen is a Welcome to the Inovonics 633 RDS Receiver Setup Wizard. Click: Next on the Welcome Screen to bring up the second screen shown here. Here the installer suggests a Program File location, and unless you have a specific issue, either with this or with the privileges selection, simply accept the defaults and click: Next.



The installation should complete flawlessly and place this program shortcut icon on your Windows Desktop. Please resist the temptation to click on it just yet, we still have one other installation step to perform.

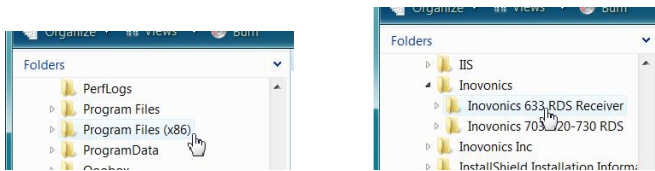
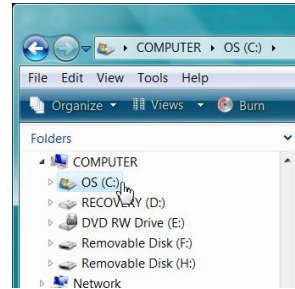


## Install the USB Driver

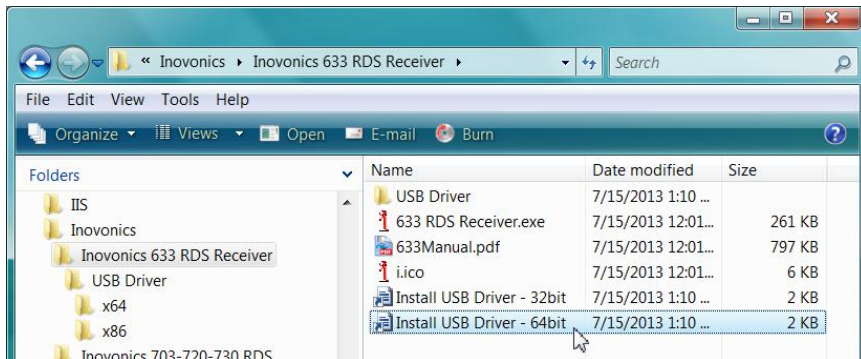
USB communications between the 633 and your computer utilizes a 'virtual COM port,' a special driver that must be installed with a separate simple routine.

Using Windows Explorer, navigate to your main (C) drive, and scroll down to Program Files (x86).

Under the Program Files (x86) folder, locate the newly-installed Program File for the 633 Receiver, shown on the right:



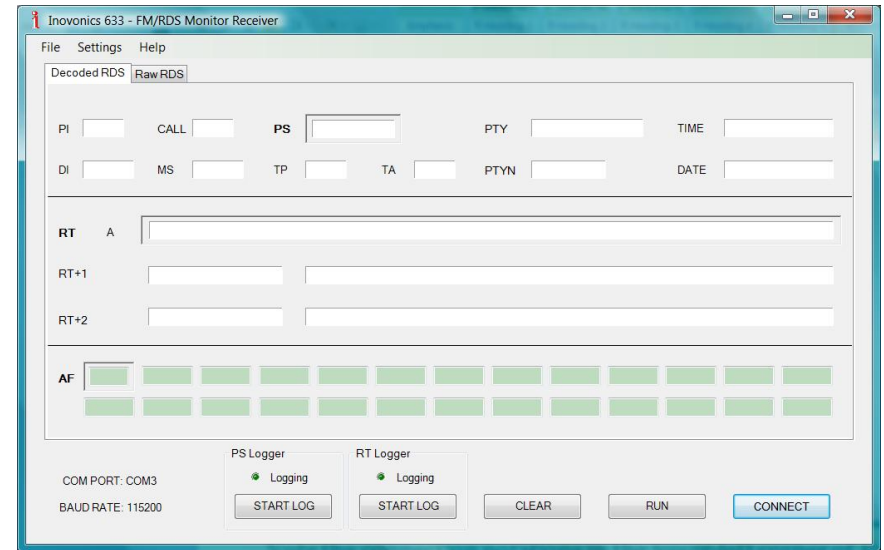
Do not expand the Inovonics 633 RDS Receiver folder, but double-click to open it. This will display the individual files within the folder.



The driver files are at the bottom of the list. There is one driver for 32-bit systems and one for 64-bit systems. Double-click the installation file appropriate to your computer. The driver will 'self-install' in a few seconds. The little 'busy' icon should be visible during installation, and when it disappears you may close Windows Explorer and go back to your Windows Desktop.

## Connecting and Running the Software Program

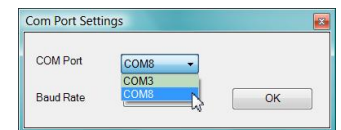
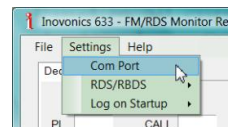
Double-click the Desktop icon for the 633 RDS Receiver to open the program.



Note the connection notations in the lower-left corner of the screen. The USB 'virtual COM port' defaults to the values shown here; that is, COM PORT: COM 3 and BAUD RATE: 115200.

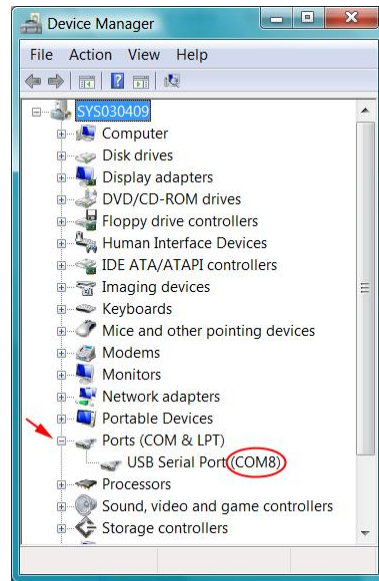
Now, with the mini-USB cable provided, connect the 633 to your computer.

At the top of the software screen, under Settings / Com Port, use the pull-down menu to confirm or to reset the port. Default COM3 will show here, and this may actually be the proper COM port if no others show. But if another COM is listed, as COM8 is in this example, the chances are that this one, rather than default COM3, is the virtual COM port that should be selected.



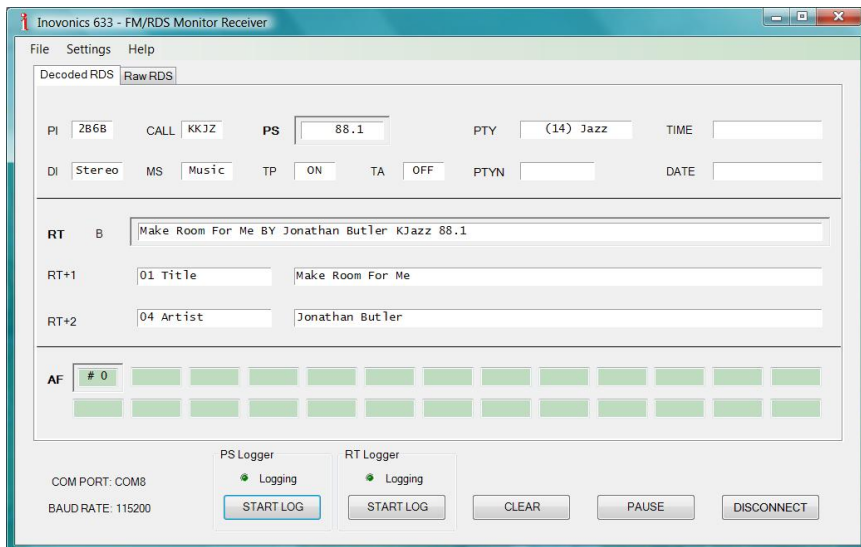
The virtual COM port may always be verified by checking the Windows Device Manager, which is found under the Control Panel in all current and recent versions of the Windows OS. Make sure that the 633 is connected to the computer during this verification.

The Device Manager list will include Ports (COM and LPT). Expand this category to display the number of the virtual COM port, COM8 in this case.



With modern computers, the default baud rate of 115200 should not be a problem. But when using a long USB extension cable or otherwise experiencing intermittent data, this can be changed to a lower figure. You must also change the baud rate on Menu Screen 22 of the 633 to match the baud rate setting on the software screen.

Next, click: CONNECT at the bottom of the software screen. RDS data should begin populating the screen immediately as shown here:



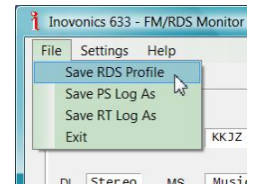
### The Decoded RDS Pane

Decoded RDS is the primary software pane, the one that comes up when the program is launched. It 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 an overview of the RDS system and goes into fairly extensive detail of the various utilities, including RT+ 'tagging' technology and proper use of the Alternative Frequencies (AF) list.

In the previous 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 not include traffic announcements in their programming, nor do they update time and date or maintain alternative frequencies (FM translators).

What's shown on this screen amounts to a 'profile' of the station's RDS transmission at any given moment. This profile may be saved on the 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.



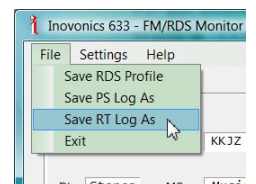
### Data Logging

Two buttons at the bottom of the screen allow the user to generate logs of the PS and RT data fields. These logs may be managed in either of two ways.

Simply clicking the START LOG button will open a PS.txt and/or a RT.txt file on the Windows Desktop and begin logging the information there. The green Logging indicators blink to confirm operation. The START LOG button toggles to STOP LOG with logging underway, and files will continue to accumulate data until you click the STOP LOG button.

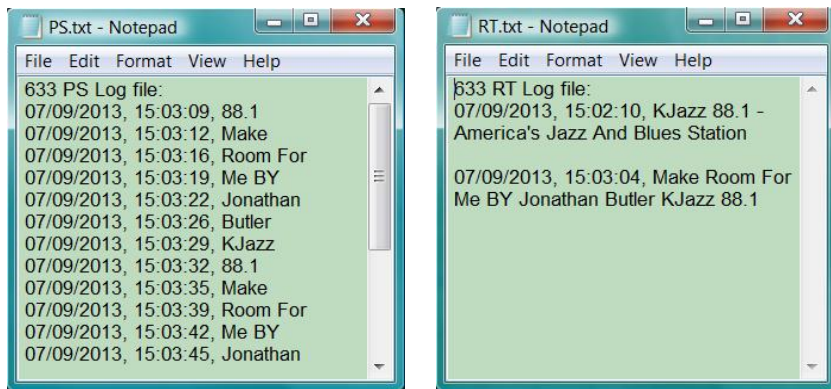
**NOTE:** These 'default' Desktop logs will continue to accumulate PS and RT data each time the program is opened and the START LOG button is clicked. Unless they are manually deleted, these logs will grow indefinitely.

A better way to manage the logs is to pre-name the log files. At the top of the screen, click File and Save PS(RT) 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, not to the 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. The PS and RT messages 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 page.



Note that the PS 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 Radio Text field, on the other hand, shows only a single update during the example logging period, a station promo replaced by title and artist once the song started.

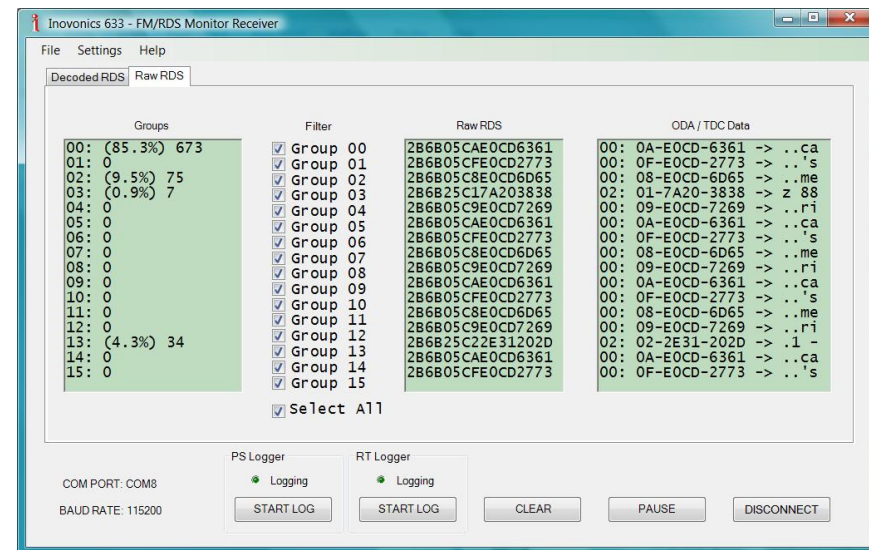
These files are comma-delineated and can be read in Windows Notepad (like the RDS Profile), or imported into a spreadsheet program for additional analysis or to search for specific terms (song title, program promo, advertisement, specific date and time of day).

The CLEAR and PAUSE buttons are self-explanatory. The software screen automatically clears when the RDS subcarrier is lost, but the log files remain intact. When the signal returns the screen will come to life and logging will resume.

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 time stamp.

## The Raw RDS Pane

Clicking the Raw RDS tab at the top of the software screen will take the user to this view:



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 displays the hexadecimal RDS data received by the 633. 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, which are assembled into messages by the receiver.

By using the Filter checkboxes, the user is able to single-out specific RDS functions. For example, by clearing all boxes except for group 2, the Radio Text messaging becomes readable, as shown on the following page.



Group filter check boxes may be individually checked and cleared. The Select All box either checks or clears the lot.

There is no provision for saving raw RDS data. The primary use for this window is in troubleshooting RDS problems. Sixteen lines of data are shown in these scrolling displays, and the display may be paused and resumed to catch possible coding errors.

ODA / TDC Data		
02:	11-7A20-3838	-> z 88
02:	12-2E31-202D	-> .1 -
02:	13-2041-6D65	-> Ame
02:	14-7269-6361	-> rica
02:	15-2773-204A	-> 's J
02:	16-617A-7A20	-> azz
02:	17-416E-6420	-> And
02:	18-426C-7565	-> Blue
02:	19-7320-5374	-> s St
02:	1A-6174-696F	-> atio
02:	1B-6E0D-0000	-> n...
02:	10-4B4A-617A	-> KJaz
02:	11-7A20-3838	-> z 88
02:	12-2E31-202D	-> .1 -
02:	13-2041-6D65	-> Ame
02:	14-7269-6361	-> rica

## Section V

### TECHNICAL MATTERS

#### Firmware Version

With the 633 powered-up and operational, hold down the jog wheel knob for 5 to 10 seconds. The menu screen you have been viewing will be replaced by the **633 Firmware** screen. This shows the firmware version installed in your unit, information that may prove important when communicating with the factory. Turning the knob will reveal the version of the DSP radio chip. Push the knob again to return to the Menu Screens.

#### 'Under the Hood'

The Model 633 receiver is small and compact, utilizing mostly surface-mounted (SMD) components. Some of these parts 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 dispensed with schematic diagrams, servicing instructions and a listing of component parts.

Having said that, Inovonics policy has always been one of 'full disclosure.' We feel that, unless we are doing something underhanded, there should never be a reason to deny the user any reasonable philosophical or design information. 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 compact and lightweight, we encourage customer return of the 633 receiver for factory servicing or firmware upgrades. Inovonics has never considered factory repair charges a significant source of revenue, and we are confident that you will be astonished at how reasonable our rates actually are!

# 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 “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 registered online at [www.inovonicsbroadcast.com](http://www.inovonicsbroadcast.com), within 10 days of delivery.

B. The 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. The 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 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 factory is not covered under terms of the Warranty and may occasion additional charges.

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