



FM/HD Radio™ Receiver

Installation & User Guide



January, 2012 - Rev. 1 Firmware



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(See Notice of Limited Certification on Page 2)

Section I

INTRODUCTION

Product Description

The **INO_{mini} 632** is an FM and FM/HD Radio™ receiver for off-air broadcast monitoring. It receives standard analog FM broadcast transmissions, as well as FM/HD Radio digital broadcasts transmitted via the FM station's associated HD1 through HD8 auxiliary, digital broadcasting channels.

Analog FM and HD Radio digital programs are both accompanied by digitized text and 'housekeeping' data. FM RDS (Radio Data System) and HD Radio PAD (Program-Associated Data) are shown on the front-panel LCD display of the 632, along with readouts of signal quality information.

When the 632 is set by the user to receive HD Radio digital broadcasts, it does *not* automatically revert to FM reception if the digital signal is lost. Thus this receiver is not a suitable radio for general consumer use.

Product Features

Features of the Inovonics 632 include:

- Reception of all standard FM and FM/HD Radio broadcasts.
- Easy setup using the LCD screen and jog-wheel navigation of the receiver's menu tree.
- Front-panel display of most-essential FM RDS (Radio Data system) and HD Radio PAD (Program-Associated Data) information.
- 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.

Product Specifications

Tuning Range: 87.7MHz - 107.9MHz in 100kHz steps.

Antenna Input: 75-ohm (F).

Receiver Sensitivity:

≤ 10µV for 50dB monaural FM S/N.

Audio Frequency Response:

FM: 30Hz-15kHz

HD: 20Hz-20kHz

FM De-Emphasis: 75µs

RDS Fields Displayed: PI, PS, PTY, RT, RT+.

HD Radio PAD Data Displayed: NAME, TYPE, L(ong) NAME, ARTIST, TITLE.

Program Audio Output(s): +4dBm balanced Analog Left/Right (XLR); AES Digital (XLR); Front-Panel Headphone Jack (1/8" TRS).

Alarm Tallies: Individual open-collector NPN transistor outputs for Carrier Loss, Digital Loss and Audio Loss.

Power Requirement: 12VDC at 180mA. A 'wall-outlet transformer' (WallWart®) switching-type power supply appropriate to the destination AC mains voltage is provided, along with a short DC power cord to allow this 632 to be 'daisy-chained' with additional 632 receivers or other **INO_{mini}** modules that share a common rack-mount adapter.

Mounting Options: The 632 may easily be fastened to any convenient surface with two small screws. An optional rack adapter may be used to rack-mount up to three **INO_{mini}** 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.

Notice of Limited Certification

The Inovonics 632 receiver is licensed for manufacture by iBiquity Digital Corporation, as noted at the bottom of the inside of the front cover. This is a *limited certification*, however, due to the following variance from iBiquity Digital's minimum certification requirements:

1. The Inovonics 632 displays only four characters of Call Sign (not all 6 characters as defined in the requirements.)
2. The Inovonics 632 displays only 39 characters of Artist (not 64 characters as defined in the certification requirements supporting the ID3v2.3 standard.)
3. The Inovonics 632 displays only 39 characters of Title (not 64 characters as defined in the certification requirements supporting the ID3v2.3 standard.)

Section II

INSTALLATION AND CONNECTION

Unpacking and Inspection

Immediately upon receipt of the equipment, 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 case return for Warranty repair is required. Shipping damage sustained as a result of improper packing for return may invalidate the Warranty!

Warranty Registration

It is important to complete and return the Warranty Registration Card included with this Manual, or to register the Warranty online at www.inovonicsbroadcast.com. 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.

Mounting

The Model 632 receiver is packaged in a compact 'clamshell' chassis that defines the standardized Inovonics' **INO_{mini}** module. The 632 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 632 to be fastened to the inside of an equipment rack cabinet with two #4 screws.

An optional rack-mount kit is available for the 632, which can house up to three **INO_{mini}** modules. The kit comes with blanking panels for unused spaces.

AC Mains Power

All Inovonics **INO_{mini}** 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 180mA at 12 volts DC, a second DC connector on the rear panel of the 632 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.

Radio Frequency Interference (RFI)

Although we have anticipated that the 632 receiver will be used in the immediate proximity of broadcast transmission equipment, please do practice reasonable care in locating the unit away from *abnormally* high RF fields. The LCD screen should *not* light up when the unit is unplugged!

The Front-Panel Display and Jog Wheel

The front-panel MENU jog wheel scrolls the LCD through the various viewing and programming options. Please refer to Section III of this manual for easy menu setup (receiver programming) instructions.

Headphone Jack

The front-panel PHONES jack will accommodate any set of stereo headphones or horrid earbuds of virtually any impedance with an eighth-inch stereo plug. When headphones are plugged in, the LCD menu will automatically go to the HEADPHONE VOL screen, and the jog wheel knob will adjust the listening volume. When the volume has been set at a comfortable level, push the knob to re-enter the menu selection mode.

Rear Panel Connections

- | | |
|---------|--|
| ANTENNA | The rear-panel ‘F’ connector should be connected to a good outdoor FM antenna for best reception. This is particularly important for reception in the HD Radio mode, as the digital signal power level is substantially below that of the main FM carrier. |
| G C D A | These are alarm “tally” outputs for remote indication of reception problems. |

Designations are also noted on the rear panel and stand for Ground, Carrier Loss, Digital Loss and Audio Loss.

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, which must be returned to the G (Ground) terminal.

The plastic connector body may be unplugged from the chassis to make connection easier and for quick disconnect.

The balanced, transformer-isolated AES digital audio output has a fixed sampling rate of 44.1kHz, a rate that is common to most devices associated with HD Radio installations.

The active-balanced analog line outputs provide a program level of +4dBm at 100% FM carrier and 0dBFS HD Radio modulation.

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.

The Model 632 receiver draws 180mA. Check the rating on the label of the power supply to make sure it has enough oomph for the modules it must power.

AES DIGITAL
AUDIO OUTPUT

ANALOG LINE
OUTPUTS L/R

+12VDC
POWER I/O

Section III

OPERATING THE 632 RECEIVER

Menu Navigation Basics

If, like most of us, you've allowed youthful enthusiasm to override methodical procedure, you've either already figured out the 632 receiver menu for yourself, or you are ready to throw this **INO_{mini}** under the wheels of a passing locomotive.

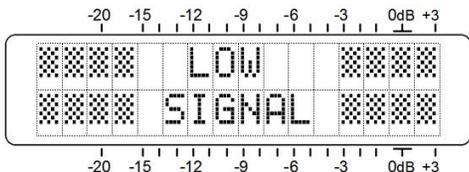
Quite simply, you *turn* the knob to navigate from one menu to the next, *push* the knob to enter any menu associated with receiver setup, *turn* the knob to set a value, and then *push* again to accept the selection and return to menu navigation.

In setup menus, any parameter that can be edited will begin blinking when the knob is pushed-in. This shows that a new value may be selected. *Turn* the knob to select a new value, and then *push* once again to choose the selection and transfer that selection to non-volatile memory.

Each Model 632 menu will be discussed separately, both for the analog FM reception mode and the HD Radio digital-reception mode.

Wait! What's all that flashing???

The 632 has three alarms that indicate reception problems. These are detailed later in the manual, but you may already have noticed a front-panel flashing alarm. 'Flashing' alarms accompany the alarm ID with large lighted block areas, which can be seen across a room, like the **LOW SIGNAL** example shown here. Flashing alarms are not to be confused with 'blinking' menu items that may be selected and edited.



If the 632 has not already been tuned to a signal, the **LOW SIGNAL** and/or **AUDIO LOSS** alarms will begin to flash soon

after the receiver is turned on. If you press or turn the knob, you will get a few seconds respite from the flashing alarm, enough time to navigate to any setup menu. Of course, once a station has been tuned-in properly the alarm condition will be reset.

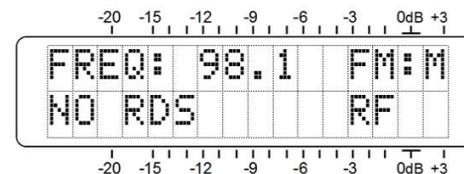
Whenever you are in the 'edit mode'; that is, you have entered a menu to edit (make a change to) a blinking setup item, the front-panel flashing alarm is inhibited while that parameter is being programmed. The edit mode will time out after 30 seconds if no entry is made.

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

Tuning and Mode Selection

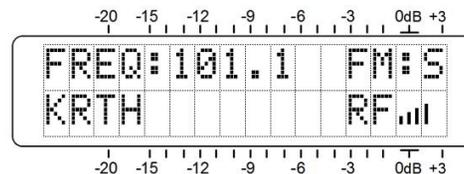
Whenever power is applied to the 632 receiver, a 'splash screen' with the product ID pops up immediately on the LCD. This reverts in a few seconds to Menu Screen 1.

This is an example of Menu Screen 1 as it might appear when the receiver is first powered-up and before it has been programmed.



Push the jog wheel knob and **FREQ** will begin to blink. Now the receiver may be tuned by rotating the knob. When tuned to an FM station, a series of bars to the right of **RF** will give a rudimentary display of incoming carrier strength. **FM:S** (stereo), **FM:B** (blended stereo) or **FM:M** (monaural) transmissions will be verified in the upper, right-hand corner. (See Page 11 for selecting the FM reception mode.)

If the station is broadcasting an RDS (Radio Data System) subcarrier, call letters decoded from the station PI code should appear on the LCD screen below **FREQ**.



In regions where the PI code is not derived from call letters, the actual PI code will be shown.

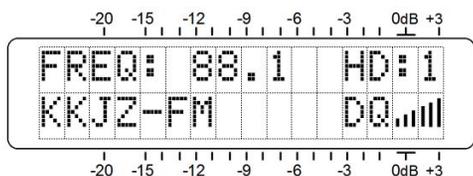
Push the knob again and **FM** will begin to blink. Turn the knob to force the radio into the HD Radio reception mode.

This can be done whether or not the station is transmitting an HD Radio digital signal. Any of the possible digital channels may be selected, HD1 through HD8.

The 632 does *not* automatically cross-fade or switch-over to the FM program when an HD Radio transmission is absent. NO HD1 (or whichever digital channel is selected) will show on the display, and after a few seconds an HD LOSS alarm will be triggered.

PLEASE KEEP IN MIND: The HD Radio system employs complex coding of the stereo audio program into a digital data stream. This coding includes powerful error-correction techniques to ensure solid reception under adverse conditions. The HD Radio receiver must buffer a generous amount of the data stream before the program can be heard, so please be patient. It may take several seconds after tuning an HD Radio broadcast before you are able to hear the audio.

If the station is indeed broadcasting HD Radio programming, the DQ (Digital Quality) bargraph will appear, along with station call letters.



The series of bars to the right of DQ is an elementary indicator of digital signal 'robustness' and is derived from a number of parameters. Generally it's an all-or-nothing indication, and in any case a relative one.

When the receiver is tuned and set to the desired mode, push the jog wheel so that neither FREQ nor FM nor HD is blinking. Your setup will be transferred into non-volatile memory and the jog wheel released to navigate to other menus.

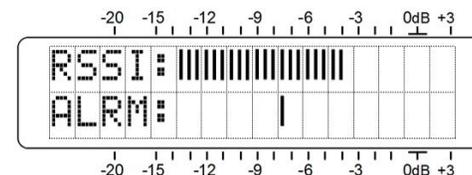
HD Radio Digital-Loss Alarm

If the 632 receiver has been manually set to the HD Radio reception mode, but either the station is not transmitting a digital signal or reception conditions prevent the receiver from locking onto the digital broadcast, after a short delay HD LOSS will begin flashing on the front-panel LCD.

The rear-panel D terminal gives an NPN transistor saturation to ground on a digital-signal-loss alarm. This may be used to actuate a relay or light a remote LED.

Carrier Strength and Alarm

Turn the jog wheel to Menu Screen 2. The upper bargraph gives a representation of RSSI:, which stands for Received Signal Strength Indication. This is a measurement of the *relative* strength of the FM carrier and has no relevance to the dB scale beside the LCD window, which is used only for audio level measurement.



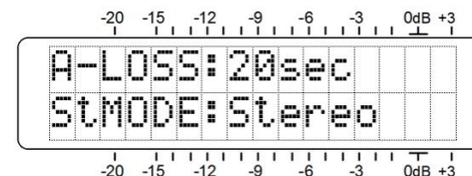
The lower LCD scale is labeled ALARM: and has a single tic mark off to the right. Push the jog wheel and ALARM: will begin to blink. Now turn the knob and note that the single tic mark can be positioned anywhere beneath the RSSI: scale.

During normal receiver operation, anytime the RSSI: bargraph falls 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 an alarm, which may be used to actuate a relay or light a remote LED indicator.

Set the carrier-loss trigger point about a quarter of the way down from the top of the RSSI scale. This will allow for normal signal fading over a typical receive path, but will still alert the user to a valid carrier loss or transmitter power problem. When the point has been set, push the knob again to fix the alarm point in memory and to release the menu.

The Audio Loss Alarm

Navigate to Menu 3 and push the knob. A-LOSS: will begin blinking. Turn the knob to dial-in the desired audio loss alarm delay time. This is the time in seconds between the onset of 'dead air' and an AUDIO LOSS alarm. The delay may be set to OFF, which deactivates the alarm, or programmed in one-second intervals up to 120sec (2 minutes).



The level 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 gives an NPN transistor saturation to ground on an audio-loss alarm. This ground may be used to actuate a relay or light an LED at a remote location.

FM Reception Modes

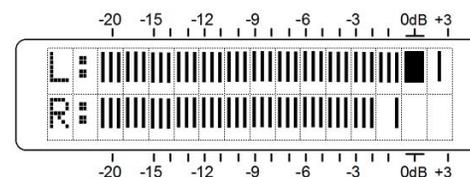
Once **A-LOSS:** has been set, press the knob again. If the receiver is in the FM reception mode **St.MODE:** will begin to blink on the lower line of Menu 3. (This is not an editable option in the HD Radio reception mode.) To set the FM mode, turn the knob to select **Stereo**, generally the normal 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 image to mono as the FM signal deteriorates under fringe-area or other poor reception conditions. This mode is identified with **FM:B** in Menu 1, although the degree of blending or the reception of a monaural broadcast will not be indicated. This option is included in the 632 to duplicate the performance of typical consumer radios, but may be considered "cheating" in a professional environment.

Program Audio Levels

Menu Screen 4 is a bargraph readout of program audio level. 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.

For FM reception, 0dB represents $\pm 75\text{kHz}$ carrier deviation. A low-frequency, monaural sinewave test tone would take the meter to this point. At higher frequencies receiver de-emphasis must also be factored into the reading, and of course with stereo broadcasting the 19kHz pilot consumes the top 1dB of modulation. Aggressively-processed program audio should peak the bargraphs consistently at about -1.5dB.

The HD Radio system, on the other hand, does not suffer the same stereo pilot and de-emphasis limitations. Moreover, HD Radio transmission practices maintain a headroom 'buffer,' which normally is not breached by 'loudness wars' audio processing. When the HD Radio signal is conservatively modulated to 0dB peaks, the automatic cross-fade between FM and HD in consumer receivers will sound seamless, insofar as levels are concerned. Remember, the 632 does *not* cross-fade between modes or default to analog FM when the digital signal is lost.

Headphone Monitoring

A front-panel PHONES jack offers a convenient monitoring point for setup and casual listening. Whenever a pair of headphones is plugged in, the LCD screen automatically goes to Menu 5. **HEADPHONE VOL:** will begin blinking and the panel knob may be adjusted for a comfortable listening level. An arbitrary numerical value and a bargraph representation of the headphone volume are shown on the LCD. Once volume is set, push the knob to save the setting to memory and to return the screen to the previous menu.

Item Number 31 is the station “short name,” which in this illustration is being sent during a commercial cluster. As in Menu 8, if the tag is too long for the LCD, push the jog wheel and turn it to scroll through the entire text. Push the knob again to resume menu navigation.

RDS Reception Notes

The Inovonics 632 receiver utilizes an all-digital RF ‘front end,’ which not only demodulates both the FM and HD Radio carriers, but decodes the FM RDS and HD PADS data as well. One idiosyncrasy of this circuit topology is that RDS data for FM broadcasts may be corrupted by an RF input at an abnormally high level. If the RDS data is erratic or garbled, it may be necessary to insert a pad in the antenna lead.

If an incoming signal is so strong as to cause RDS decoding problems, a 20dB attenuator should resolve the issue without compromising system SNR. Suitable ‘F’-connector attenuators are available at low cost from CATV equipment suppliers. For example, Part No. 33-2780 from MCM Electronics; www.mcmelectronics.com.

HD Radio Menus

- Menu 6 HD NAME identifies the radio station, usually with call letters, such as KHHT-FM.
HD TYPE describes the programming format of the station. The display might show ADULT HIT MUSIC, SPORTS or RELIGIOUS.
- Menu 7 HD ARTIST identifies the performer of the song that is playing at the moment. Press the knob and then turn it to scroll through the name of a group that overruns the LCD display. Press the knob again to exit this menu.
- Menu 8 HD TITLE names the song that is playing. Press the knob to scroll through a title that exceeds the LCD display capability, turn the knob to see the entire text, and then press the knob again to exit this menu.

Section IV TECHNICAL MATTERS

Firmware Version

With the 632 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 632 Firmware screen. This shows the firmware version installed in your unit. This information may prove important when communicating with the factory. Other screens in this menu subset contain version information specific to the HD Radio receiver subassembly.

Next, navigate back to the 632 Firmware screen. Push the knob once again to return to the regular menu tree for normal operation.

‘Under The Hood’

The Model 632 receiver is simple and small, 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 pretty-much precludes servicing the unit in the field. 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, our policy has always been one of ‘full disclosure.’ We feel that, unless we are doing something underhanded, 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 light, returning the 632 receiver for factory servicing or firmware upgrades 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 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, 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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