



DAB/DAB+ Monitor Receiver

Installation & User Guide



August, 2017 - Rev. 1.0.0.1 Firmware

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Section I

INTRODUCTION

Product Description

The INOmini 660 is a professional-quality, off-air confidence monitor receiver for DAB and DAB+ digital radio transmissions. The bright, easy-to-read panel display presents metadata that accompanies the broadcast, as well as pertinent signal quality parameters and audio levels.

The receiver has balanced analog left/right and AES-digital program line outputs. Front-panel alarms give visual alerts for RF carrier loss, DAB channel loss and program audio loss, and rear-panel ‘tally’ connections can trigger remote fault indicators or interface with remote-control and site-monitoring equipment.

The compact 1/3-rack form factor allows up to three units to be mounted in a single 1U rack-mount adapter.

Product Features

Features of the INOmini 660 include:

- Receives EBU-specified Band III DAB and DAB+ broadcasts
- Front-panel LCD display shows essential signal quality information, demodulated audio levels, alarm conditions and program-related metadata
- Analog L/R and AES-digital program line outputs with menu-accessed level controls
- Programmable alarms with tallies for low signal, DAB loss and audio loss
- Front-panel headphone jack with adjustable volume

Product Specifications

Tuning Range: DAB Band III, Mode I (174.928MHz-239.200MHz / Blocks 5-12, A-D) plus Block 13 A-F

Receiver Sensitivity: $\geq 10\mu\text{V}$ for error-free reception

Antenna Input: 75-ohm (BNC)

Audio Codecs: MPEG-1, Audio Layer 2 (MP2); HE-AAC (AAC+)

Audio Response: 20Hz-20kHz, $\pm 0.25\text{dB}$

Signal Parameters Displayed: Frequency, FQ (FIC Quality), RF (RSSI), SNR, CNR

Metadata Displayed: Ensemble Label, Component List & ID, Service List & ID, Dynamic Label, PTY, Sample Rate, Bit Rate, Gain, Mode, Service Mode, Protection Info, Current CU & Address, Country, Language, Time & Date

Analog Line Outputs: L/R balanced (XLR); adjustable between -15dBu and $+15\text{dBu}$ from the front panel

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

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

Alarms/Tallies: Individual open-collector NPN transistor outputs for Low Signal, DAB Loss, Audio Loss; menu-programmable alarm thresholds, delays and logic polarity

Power Requirement: 12VDC at 220mA (2.1mm x 5.5mm coaxial); a universal 100VAC-240VAC 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

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

Environmental: 32°F/0°C-122°F/50°C; 0%-95% non-condensing relative humidity; 10,000ft/3048m

Certifications:



Section II

INSTALLATION AND CONNECTION

Unpacking and Inspection

Immediately upon receipt of the INOmini 660, inspect for 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 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 and software updates. Register online at:

www.inovonicsbroadcast.com/product-registration

Mounting

The INOmini 660 is packaged in a compact ‘clamshell’ chassis that defines the standardized module in this series of Inovonics products. The INOmini 660 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 660 to be fastened to any flat surface with two #4 screws.

An optional rack-mount kit is available for the INOmini 660. 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 ‘universal’ outboard ‘brick’ type switching power supply that accepts mains voltages between 100VAC and 240VAC. The actual power consumed is 220mA at 12 volts DC. A second DC connector on the rear panel of the unit allows the user to ‘daisy-chain’ two or more units to share a common mains supply, thus cutting down on cord clutter. Do make sure that the total power consumption does not exceed the DC current rating noted on the power supply label.

Radio Frequency Interference (RFI)

Although we anticipate the INOmini 660 finding a home in radio broadcasting environments, 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 660.

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 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 75-ohm BNC connector. Inexpensive, ready-made cables of various lengths are common in this format, and adapters for other RF connector types are readily available.

ALARM ‘TALLY’ TERMINALS

The three rear-panel alarm tallies present the collectors of NPN transistors that normally saturate to ground for

the C (Carrier loss) D (DAB loss) and A (Audio loss) alarms. Alarm tally polarity may be changed as described on Page 16.

L/R ANALOG
LINE OUTPUTS

The active-balanced analog line outputs are menu-adjustable in level between -15dBu and +15dBu, corresponding to full modulation of the DAB carrier.

AES DIGITAL
AUDIO OUTPUT

The balanced, transformer-isolated AES digital audio output has a fixed sampling rate of 44.1kHz. The audio level is menu-adjustable between -30dBFS and 0dBFS, corresponding to full modulation.

+12VDC
POWER I/O

These two connectors 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 660 draws 220mA. Check the rating on the label of the power supply to make sure that its 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.

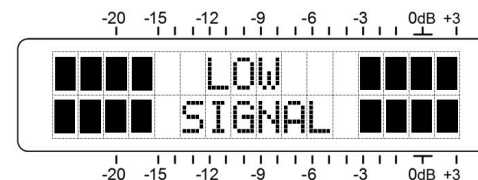
Section III

OPERATING THE INOmini 660

Hey, why is the screen flashing?

Local visual alarms and their tallies respond to reception 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 INOmini 660 has not yet been tuned to a station, one or more of the LOW SIGNAL, DAB LOSS and AUDIO LOSS alarms may begin to flash sequentially shortly after the receiver is powered-up. Push or turn the knob for a ten second 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 reset.



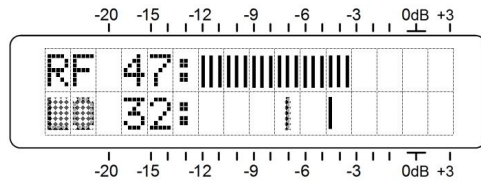
NOTE: Flashing alarms are not to be confused with faster 'blinking' menu callouts. Blinking callouts indicate options for editing and will be discussed shortly.

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

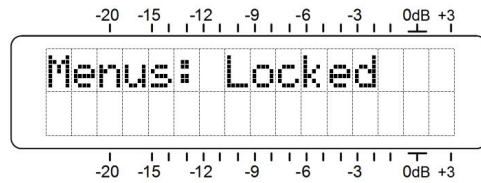
Menu items that can be edited will 'blink' at a rapid rate when you enter that menu and push the knob. Don't confuse 'blinking' menu callouts, such as the one illustrated here, with a 'flashing' alarm condition.



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.

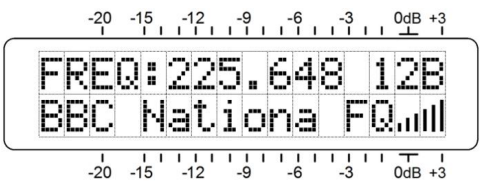
Locked Menus (Menu Screen 21)

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.



Tuning the Receiver (Menu Screen 1)

When power is applied to the INOmini 660, 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.

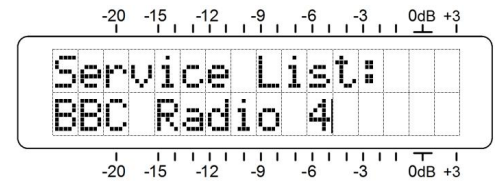


The top line of Menu Screen 1 displays the frequency of the broadcast and the corresponding DAB block designation. Push the knob `FREQ` will blink. Turn the knob to tune-in the desired frequency/group.

The second line shows the Ensemble Label, a service name common to all broadcasts sharing this transmission channel. If the Ensemble Label overruns this 11-character display area it will scroll to reveal the complete text. The `FQ` bargraph gives a rough indication of `FIC` (Fast Information Channel) `Quality`, a representative measure of overall reception integrity.

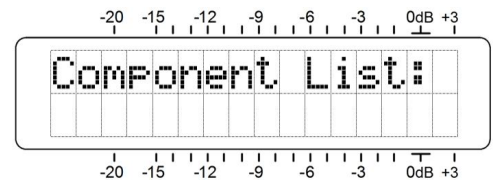
The Service List (Menu Screen 2)

From the Screen 2 Service List menu, push the knob to scroll among the *services* (broadcasters) that share the *ensemble* you are tuned to. The *label* (name) of the service will show up on the second line. For a particular service you select, the INOmini 660 automatically picks the first, or primary *component* (broadcast) to supply the audio you will hear. The next menu selects other components of that service, if available.



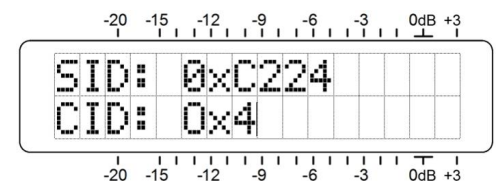
The Component List (Menu Screen 3)

Multiple components of a specific service can carry additional programming by the same broadcaster. This can take the form of another audio program, data or even pictures. The INOmini 660 supports only audio programs, however. On Menu Screen 3, push and turn the knob to scroll among any additional components of the service. If a component is not an audio program, its name will still appear on the second line of this screen, but no audio will be delivered.



Identifiers (Menu Screen 4)

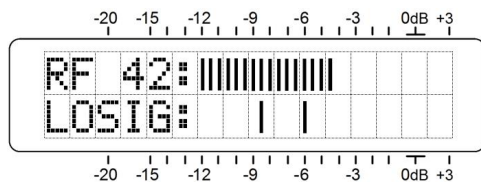
Ensemble services, along with the individual components within those services, each carry a digital identifier. Menu screen 4 displays `SID`:



(Service ID) and CID: (Component ID) 32- or 16-bit hexadecimal codes.

Carrier Strength and Alarm (Menu Screen 5)

The upper line of this screen displays signal strength of the RF carrier. The RF numerical value is the level at the antenna input in dBuV, and defines a range between 0dBuV (1 microvolt) and 75dBuV (about 5 millivolts). The bargraph readout gives an analog display of levels in the range of 10dBuV to 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 8.



The lower line of the screen is labeled LOSIG: and has a pair of tic marks off to the right. Push the knob and LQ, 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 left, 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 major transmitter power problem.

Push the knob again. HI and the right-hand tic mark will blink. Turn the knob to set that tic mark 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 L (Low Signal) 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 15.

This ground may be used to actuate a relay, light an LED at a remote location or tie-in with a remote control system.

Signal Quality Readouts (Menu Screen 6)

SN: is a first-order approximation of the signal-to-noise quality of the demodulated program with respect to total channel noise. This measurement takes into account factors that involve multiple channels and other interference factors. The metered range is 0dB to 20dB.

CN: is the OFDM carrier-to-noise ratio. This defines the dynamics of the OFDM subcarrier group signal level between its on and off (null) states. The metered range extends from 0dB to 54dB.

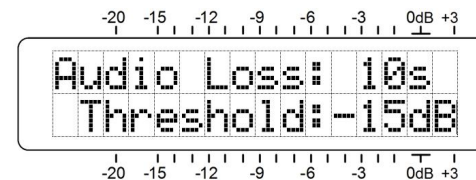
The RF, SN and CN numerical values are handy metrics when installing a rooftop antenna. In locating and aiming the antenna, do everything you can to maximize the numbers.

The DAB Loss Alarm

This alarm has no settings, as loss of the DAB signal is very much a go/no-go situation. When the OFDM digital signal goes missing, there is an instantaneous front-panel flashing alarm and activation of the rear-panel D terminal. This terminal gives an NPN transistor saturation to ground, the polarity (logic state) of the alarm is set on one of the hidden menu screens that are explained beginning on Page 15.

The Audio Loss Alarm (Menu Screen 7)

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



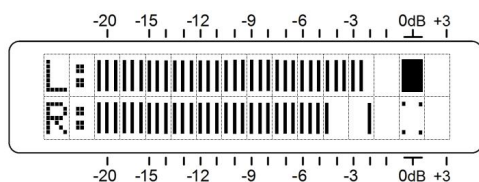
Once the delay is set, push the knob again and Threshold will begin to blink. This is the programmable audio level trip point at which the alarm function will recognize 'dead

air.’ The trip point may be set for program peak levels between 0dB and -30dB. 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 any *pianissimo* passage.

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 15. This ground may be used to actuate a relay, light an LED at a remote location or tie-in with a remote control system.

Program Audio Levels (Menu Screen 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.

The 0dB level of a DAB broadcast corresponds to 0dBFS of the incoming digital audio feed.

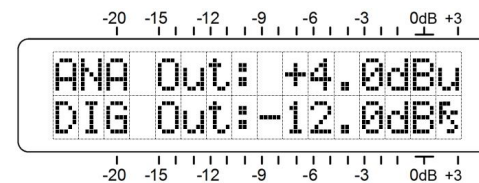
Headphone Volume (Menu Screen 9)

A front-panel PHONES jack offers a convenient monitoring point for INOmini 660 setup and casual listening. A pair of headphones plugged into the front-panel jack automatically brings up this screen, where you can adjust HeadPhone Vol for a comfortable listening level. Once volume has been set, push the knob to save the setting to memory and to return to whatever menu you might have been looking at before.

Line Output Levels (Menu Screen 10)

You may set analog and digital audio output levels on this Menu Screen. The numbers shown refer to the peak levels of program signals at 100% modulation.

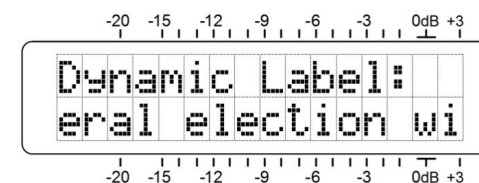
Push the knob and ANA Out will start to blink. Turn the knob to set the levels of the balanced left and right analog outputs to any value between -15dBu and +15dBu in 0.2dB increments.



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

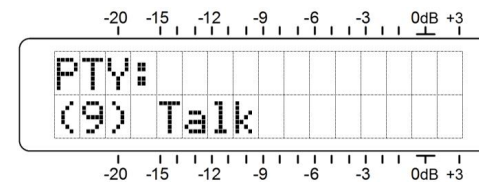
Dynamic Label (Menu Screen 11)

This is a text message associated with the current program content. The message is limited to 128 characters, which may scroll to describe the programming in detail or simply identify the source or genre.



PTY (Menu Screen 12)

PTY: identifies the Program Type from a list of some 30 predefined categories. Placement on the list is shown numerically, and the programming format/genre is listed in brief.



Sample Rate (Menu Screen 13)

The Sample Rate: screen shows the encoding rate for the audio program being monitored.

Bit Rate and Gain (Menu Screen 14)

Bit Rate: of the DAB audio program is shown in kbps on the top line of this screen. The Gain: readout relates to a Dynamic Range Control (DRC) function of DAB radio. Using this feature, the receiver may be user-programmed to re-

duce program dynamic range to favor a noisy listening environment.

Audio Mode (Menu Screen 15)

Mode: describes the disposition of the two DAB audio channels, whether programming is monaural, stereo, bit-rate-reduced 'joint' stereo, or split-channel 'dual' programming for two languages or separate programs.

Service Mode (Menu Screen 16)

This screen defines the type of service being received, whether it is an audio stream, data, data packet, etc.

Protection Info (Menu Screen 17)

This **Protect. Info:** screen identifies the error protection mechanism used in the subchannel coding process. (Very esoteric!)

Capacity Units (Menu Screen 18)

The top line of this screen displays **CU:** or the number of capacity units assigned to the service component being received. Below that is the starting **Address:** of the subchannel in the Common Interleaved Frame (CIF).

Country and Language (Menu Screen 19)

Country: identifies the Ensemble origin by a hexadecimal code, **Language:** specifies the language of the selected component. Refer to the appropriate DAB Standard if you need to verify the codes against the lists in each case.

Time and Date (Menu Screen 20)

This screen presents the time and date that is embedded in the transmission, plus the offset from Universal Coordinated Time (UTC) at the transmission location. The INOmini 660 does not correct the display to show local time if the reception location is in a different time zone.

"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 secret place, simply hold down

the knob for about 5 seconds, until the **660 Firmware** menu screen appears.

The opening screen will apprise you of what firmware version is installed in your unit. Turn the knob a notch to the right to bring up the next hidden menu.

Alarm tallies are NPN transistors that normally saturate to ground for the C (**C**arrier loss) D (**D**AB loss) and A (**A**udio 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 audio loss.

The **Load Defaults?** Menu screen will reboot the INOmini 660 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, **660 Firmware** screen and push the knob to exit the hidden menu area.

Section IV

UPDATING THE FIRMWARE

Firmware updates for the INOmini 660 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 INOmini 660 through the front-panel USB connector. Use a USB cable with '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.

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 660. 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.

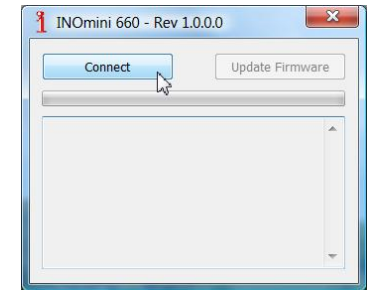
The Update Procedure

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.

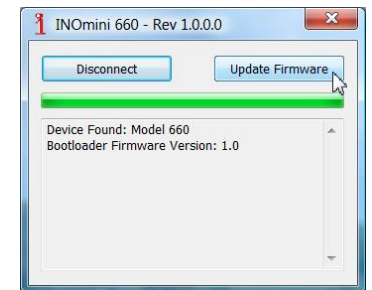


NOTE: At this point you still have a chance to escape from the update process. Just perform a normal power cycle; that is, unplug and replug DC power without holding-down the knob.

3. Connect your computer to the INOmini 660. The first time, Windows may inform you that it's loading the appropriate drivers, but will let you know when you can proceed. Double-click the .exe file on your Desktop and 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 660 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 V

TECHNICAL MATTERS

Firmware Version

With the INOmini 660 powered-up, hold the knob down for 5 seconds to bring up the ~~660~~ **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 660 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 frustrating proposition. 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 withhold information from the user. If you ask nicely, 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!

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. Register the Warranty 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 will be replaced with a new or remanufactured product at Inovonics’ option.
 - B. Parts and labor for factory repair required after the three-year Warranty period will be billed at prevailing prices and rates.
- IV **RETURNING GOODS FOR FACTORY REPAIR:**
- A. Equipment will not be accepted for Warranty or other repair without a Return Authorization (RA) number issued by Inovonics prior to its return. An RA number may be obtained by calling the factory. The number should be prominently marked on the outside of the shipping carton.
 - B. Equipment must be shipped prepaid to Inovonics. Shipping charges will be reimbursed for valid Warranty claims. Damage sustained as a result of improper packing for return to the factory is not covered under terms of the Warranty and may occasion additional charges.

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