INO mini 514

FM Multiplex Decoder

Installation & User Guide

March, 2013 - Rev. 1 Firmware

INOVONICS BROADCAST
www.inovonicsbroadcast.com

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Section I

INTRODUCTION

Product Description

In the FM-stereo broadcasting system, left and right audio program channels undergo a multiplexing process that creates a composite, baseband signal. This baseband signal is composed of a *main channel*, a *subcarrier* and a reference *pilot tone*, and is broadcast over a station's FM carrier wave.

The INOmini 514 is a stereo-baseband decoder for professional applications. It accepts the multiplexed FM baseband signal and decodes discrete left- and right-channel audio.

Product Features

Features of the Inovonics 514 include:

- Conforms to the worldwide FM 'pilot-tone' system; selectable 75µs/50µs de-emphasis.
- Decodes the composite/MPX signal into L/R audio.
- Analog L/R and AES-digital program line outputs.
- Accurate front-panel metering.
- Front-panel alarms with rear-panel 'tallies' for program audio loss (silence sense) and stereo pilot loss (stereo/mono status).

Product Specifications

Multiplex (MPX) Input: Unbalanced/bridging (BNC); 10k input impedance; requires 0.5V p-p minimum signal.

L/R Analog Line Outputs: Active-balanced (XLR), 200-ohm source impedance; +4dBu output at '0dB' on front-panel meter.

AES Digital Output: Transformer-balanced (XLR), 44.1kHz sampling rate; –6dBFS output at '0dB' on front-panel meter.

Headphone Jack: 3.5mm (TRS) for low-Z or high-Z phones; fixed listening level.

Program Audio De-Emphasis: 75µs/50µs, selected with push-on jumpers under the top cover.

Forced-Mono Operation: Enabled with a push-on jumper under the top cover.

Audio Frequency Response: Follows selected de-emphasis characteristic ±0.5dB, 20Hz to 15kHz.

Noise (Unweighted SNR re: ±75kHz deviation)**:**
MONO: ≥72dB; analog/digital
STEREO: ≥70dB; analog/digital

Distortion: ≤0.05% THD, 20Hz to 15kHz (analog/digital)

Stereo Separation: >50dB 20Hz to 15kHz (analog/digital)

Alarm Tallies: Individual open-collector NPN transistor outputs for Program Audio Loss (either/both channels) and Pilot Loss (stereo/mono indicator)

Power Requirement: 12VDC at 230mA. A 'wall-outlet transformer' (WallWart®) switching-type power supply appropriate to the destination AC mains voltage is provided.

Mounting Options: An optional rack adapter accepts up to three INOmini modules in a 1U, 19-inch rack space. Alternatively the 514 may easily be fastened to any convenient surface with two small screws.

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

Section II

INSTALLATION AND CONNECTION

Unpacking and Inspection

Immediately upon receipt of the 514 decoder, 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 or firmware updates. Register online at:

www.inovonicsbroadcast.com/product-registration

Mounting

The Model 514 decoder is packaged in a compact 'clamshell' chassis that defines the standardized Inovonics' INOmini module. The 514 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 decoder. Alternatively, a pair of mounting holes on the chassis base allows the 514 to be fastened to any convenient surface with two #4 screws.

An optional rack-mount kit is available for the 514, 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 outboard switching-type power supply suited to the destination mains voltage. As the actual power consumed by the 514 decoder is 230mA at 12 volts DC, a second DC connector on the rear panel of the 514 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 514 decoder 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 514 decoder will be used in a radio broadcasting environment, please do practice reasonable care in locating the unit away from *abnormally* high RF fields.

Headphone Jack

The front-panel PHONES jack will accommodate stereo headphones of virtually any impedance with a 3.5mm stereo plug. The listening level is not adjustable.

Rear Panel Connections

COMPOSITE/ MPX INPUT	This unbalanced-bridging rear-panel BNC connector accepts a composite/ multiplex input signal with a minimum peak-to-peak (p-p) value of 0.5V.
G +9 A P	These are alarm "tally" outputs for remote indication of fault conditions. Designations are also noted on the rear panel and stand for Ground, +9 DC volts, Audio Loss and Pilot Loss. The two 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. The +9VDC supplied on the +9 terminal is current-limited with a 300-ohm series resistor and suitable only for optical couplers, LED indicators or small reed relays.

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

ANALOG LINE OUTPUTS L/R

The active-balanced analog line outputs provide a program level of +4dBu for a front-panel meter indication of 0dB. These outputs have a 200-ohm source impedance.

AES DIGITAL AUDIO OUTPUT

The balanced, transformer-isolated AES digital audio output has a fixed sampling rate of 44.1kHz. The level is –6dBFS for a front-panel meter indication of 0dB

+12VDC POWER I/O

These two parallel connecters allow 'daisy-chaining' INOmini modules. A single DC supply may power up to three modules mounted in a single rack adapter, provided that the rating of the supply is not exceeded. Two short 'pigtail' cables are provided with each rack adapter.

The Model 514 decoder draws 230mA. Check the rating on the label of the power supply to make sure of the capacity for 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 might be an issue.

Section III

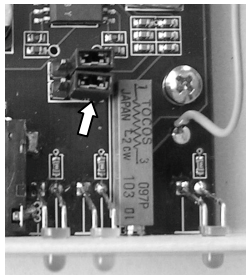
OPERATING THE 514 DECODER

Program Audio De-Emphasis

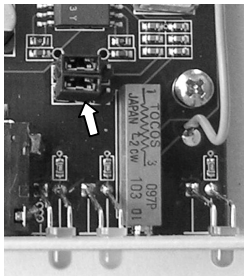
FM-stereo broadcasting utilizes complementary pre-emphasis (transmission) and de-emphasis (reception) to improve the perceived signal-to-noise ratio. The Western Hemisphere employs a 75-microsecond (75µs) characteristic, and the rest of the world a 50µs one.

The INOmini 514 accommodates either de-emphasis standard, and is shipped from the factory with the destination-applicable characteristic enabled. This is easily changed (or confirmed) in the field, however, by removing the top cover of the unit. Simply unscrew the one flathead screw on top and pull the cover off.

A pair of push-on jumpers will be found just beside the MPX INPUT LEVEL SET control, as shown in the two snapshots below. The illustrations show the proper setting of these jumpers for 75µs and 50µs de-emphasis settings.



75µs
(Jumpers to the Right)



50µs
(Jumpers to the Left)

The Front-Panel Meters

The two LED meters indicate the *peak* level of the decoded left and right program audio channels. These meters will, of course, follow the selected de-emphasis characteristic. This means that the meters will indicate a progressive roll-off of the higher audio frequencies. Thus for level-setting

and monitoring purposes, these meters give an expected visual response only for frequencies below about 400Hz.

Setting the Input Level With a Tone

The most accurate method of adjusting the MPX INPUT LEVEL SET control requires applying a 400Hz sinewave tone to the rear-panel COMPOSITE/MPX INPUT jack. This tone must have a peak-to-peak (p-p) amplitude identical to the p-p level of the multiplex broadcast signal required for full, ±75kHz FM-carrier modulation. A p-p (oscilloscope) measurement is essential here because the FM modulation specification is based on a peak, rather than an r.m.s. or averaged value, of the composite-MPX waveform.

With a 400Hz tone applied as specified above, adjust the MPX INPUT LEVEL SET control so that the LEFT and RIGHT 0dB LEDs are on steadily.

NOTE: The MPX INPUT LEVEL SET control is a "multi-turn pot." It requires about 15 full screwdriver rotations to traverse from one end to another.

Once the 400Hz tone has been set and the actual composite/MPX signal connected, program audio levels should peak at about the –1dB point. The stereo pilot and any audio or data subcarriers (such as RDS/RBDS) will not influence the meters. As these 'silent partners' can account for about 10% of total carrier modulation, actual program audio will peak about one dB below 100% modulation.

Setting the Input Level With Program Audio

A reasonably-accurate means of setting the input level is simply to adjust the MPX INPUT LEVEL SET control so that speech and music peaks reach the –1dB point on a fairly regular basis. This setting will depend in large part to how heavily the program audio has been processed, but for all but classical music formats this adjustment method should prove satisfactory.

Status Indicators and Alarms

The series of three LEDs below the INOmini logo indicate status and fault modes.

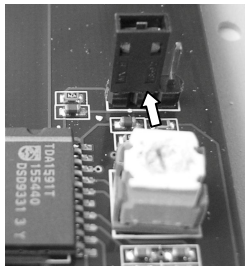
MONO and STEREO will toggle to indicate whether the transmission includes the 19kHz stereo 'pilot tone.' Normally the green STEREO LED will be lighted. But if programming is actually being broadcast in monaural, or if the transmitter defaults from stereo transmission for some reason, or if the input signal is just lost, the yellow MONO LED will come on instead. At this same time, the rear-panel P (Pilot-Loss) terminal gives an NPN transistor saturation to ground. This may be used to actuate a relay, light a remote LED indicator or tie into a remote control system.

The red SILENCE indicator will light when either or both of the program audio channels goes dead. The technical conditions for this are that: 1) the peak level of the audio in either channel has to drop approximately 20dB (off the meter scale), and: 2) must remain below this threshold for about 30 seconds. When these conditions are met, the front-panel SILENCE indicator will light and the rear-panel A (Audio-Loss) terminal will give an NPN transistor saturation to ground. This may be used to actuate a relay, light a remote LED indicator or tie into a remote control system.

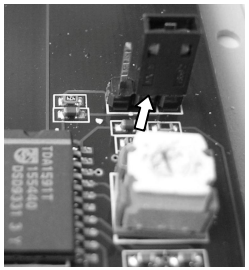
Forced-Monaural Operation

A jumper under the top cover of the 514 decoder may be set by the user to inhibit stereo program decoding. In this case the analog and digital program audio outputs will deliver monaural audio, and the front-panel MONO indicator will remain on, whether a stereo pilot is present in the input signal or not.

The jumper is located on the circuit board somewhat behind the cluster of three status/alarm indicators. These two snapshots illustrate the jumper position for the normal and forced-monaural modes.



Normal (Stereo)
(Jumper to the Left)



Forced-Mono
(Jumper to the Right)

Section IV

TECHNICAL MATTERS

‘Under the Hood’

The Model 514 decoder 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 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, 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 514 decoder 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!

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(A necessary waste of paper!)

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.

Revised Sept. 2011

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