

# Safety and Operating Use Instructions / Owner Manual

## FEATURES

Updated 03/24/20

- meduci Advanced Wide Voltage I.F and C-QuAM High Quality AM Stereo Decoder Converter.
- Signal Quality Detector that analyzes signal strength, signal-to-noise ratio, and stereo pilot tone prior to switching to the stereo mode.
- Precision AM Stereo Pilot Tone Detector.
- I.F Amplifier with I.F AGC Circuit.
- VCO Shutdown Mode at weak I.F signal input.
- Typical I.F Input Impedance: 2 k-ohms
- Class-A biased discrete transistor audio output buffered amplifier stages -- Audio purity without crossover distortion.
- Decodes Motorola C-QuAM analog AM Stereo broadcasts, where available, with automatic stereo detection.

**WARNING:** All host tuner and receivers must NOT be energized or connected to power source when installing this AM stereo decoder product. There are lethal dangerous voltages present within all consumer electronics devices. You can be killed when in contact with these high voltages. Refer AM stereo decoder installation and modification to be performed by qualified experienced service personnel only.

# meduci AM STEREO DECODER CONVERTER PC BOARD MODULE

Mounting Hole

+8V

+12V

MEDUCI  
AM-ST  
032420  
USA

REV. A

C12

0R  
500  
500

+12  
V.D.C  
(red)

LEFT  
RIGHT  
AUDIO

GROUND  
(black)

I.F INPUT  
(yellow)

FORCED  
MONO  
(green)  
STEREO  
LED (blue)

This meduci high quality AM STEREO outboard Decoder Converter PC Board is assembled and tested; based upon the popular solid state Motorola MC13028AD third-generation decoder IC chip. Please consult the Motorola 'MC13028A.pdf' data sheet for further details concerning all features and operation of this decoder. There are six connections that need to be made to the host AM tuner or AM receiver from this PC board. Composite-level intermediate frequency (I.F) signals, taken from the mono receiver, are detected and decoded into line-level left and right audio outputs back into the host receiver. There is also a convenient AM stereo indication to drive LED. In the absence of a good, strong, and solid AM stereo signal, an un-degraded mono output will be provided from both audio channels.

This add-on decoder functions with the Motorola C-QuAM stereo system, and provides full separation stereo reception from local AM stations transmitting the C-QuAM encoded format, where available.

It is best to install this decoder into digitally-tuned PLL quartz-synthesized host AM tuner or receiver for best results. Manually-tuned radios usually do not have the low-phase noise stable local oscillators that this MC13028AD decoder board requires to provide reliable C-QuAM stereo reception.

There are not any adjustments or modifications necessary to the decoder board circuitry. New 3.6MHz ceramic resonator offers wider stereo lock-in range to the incoming I.F input. New CFU450B ceramic filter on-board. Attractive green printed circuit board adds to the appearance.



Power for this decoder board is derived from any convenient +10 to +12 volt D.C rail within the customer's host tuner. Incoming power is regulated to +8 volts D.C using one (MC78L08 equivalent) three-terminal IC chip mounted directly on the decoder board. Note that the tuner supply rail must be able to deliver up to continuous 20 milli-Amperes (mA) - (10mA typical for stereo decoder, and 10mA maximum for driving the user's stereo LED indicator).

### Selecting a suitable host AM tuner or receiver

Not every FM stereo tuner can be converted to receive AM stereo broadcasts. However, if you are careful when you examine the tuner's capabilities, the conversion should proceed, and successful results should be achieved.

1. Vacuum-tube radios are unacceptable. You will undoubtedly experience issues due to the high voltages and extreme operating temperatures involved.

2. Cheap pocket radios, clock radios, small table radios, portable radios, and the like should not be used. They typically have narrow I.F bandwidths, poor station sensitivity, and self-generated phase and frequency modulations that can seriously degrade channel separation and increase distortion and noise (C-QuAM system uses phase-related information, so your AM stereo decoder is extremely sensitive to phase variations and phase modulation).

3. Manually-tuned tuners, whether variable capacitor or variable inductor types, may cause audible microphonics when in stereo mode. Receivers with self-contained speakers may also be subject to microphonics, due to the speaker cone vibrations. Those vibrations may generate phase modulation

and the associated problems of poor stereo separation, distortion, and noise.

4. Host receiver's local oscillator must be stable and produce a reasonably clean sine-wave signal. An unstable local oscillator or a severely distorted waveform may cause audio distortion, lack of stereo reception, intermittent stereo reception, and other issues. You can usually hear the local oscillator (L.O) signal with a second AM receiver tuned to the host receiver's I.F plus AM station frequency. Example: Host receiver with 450kHz I.F is tuned to 800kHz and second receiver is tuned to 1250kHz. If the L.O signal on the second receiver is clean-sounding carrier, without hum, warble, rumble sounds, and other noise and audio distortion, then the host receiver may be a suitable candidate for AM stereo conversion.

5. Electronically-tuned Radios (ETR) with PLL quartz crystal synthesized 'front ends' are best adapted to AM stereo reception, due to their precise, automatic tuning, and better immunity to tuning disturbances. However, those types of receivers are not guaranteed to be trouble-free. Phase modulation can originate from the PLL comparison frequency, and may appear as an audible tone in the recovered audio from the AM stereo decoder board. In this case, the tuning control voltage may require extra filtering. Consult the tuner's service manual provided by manufacturer for further evaluation.

6. The AGC system of the tuner should be effective, to provide a constant I.F input to the decoder board, from all received AM stations (both local and distant ones). In some digital tuners which use an I.C for the AM tuner section, it is not usually possible to gain access to the low-level I.F signals.

7. A tuner with front end tuned RF amplifier is a major advantage. Increased sensitivity and selectivity aid in stability and stereo reception.

All circuitry, with the exception of the stereo LED indicator, is accommodated on the printed circuit board (coded AM\_ST), and fitted within 1.675 by 1.5 inch layout. Parts layout and the six required connections on this printed circuit board are shown on the second page of these instructions.

### Installation

For quiet, clean, stereo reception, the I.F input signal to the decoder input must be between 90 milli-volts and 120 milli-volts peak-to-peak. If the host tuner has a higher I.F output, a resistor voltage divider must be added to drop the I.F to the required level for the AM stereo decoder board.

I.F input is derived from the mixer output or I.F stage preceding the detector diode or detection circuitry inside the host receiver or tuner. AGC voltages are generally obtained from the detector, so the existing detector circuit should be retained. To avoid conflict with the two audio channels coming from the stereo decoder, the tuner's existing mono audio outputs first must be disconnected (usually at or near the band-switch).

Decoder board may be mounted in any convenient place inside your host tuner, however keep it away from all metal and heat sources, such as power transformer, output transistors, heat sinks, et cetera. Use very short shielded cable for the I.F input and audio connections, and connect the cable shields to tuner's ground point at one end only. Common ground connection to the decoder and the tuner is via the tuner's power supply. Failure to observe this precaution could result in ground loops. Ensure that the power is applied only to the decoder when the host tuner is selected to "AM" band and tuned to receive AM stations.

Left and right audio outputs have nominal one-volt "line" level and are directly connected to the tuner's internal audio band-switch. Remember to first disconnect the mono audio output from the host receiver. Stereo indicator output is ready for connection to user-supplied LED indicator. Alternately, the wire can be connected to the FM stereo decoder's indicator pin, if applicable. Please consult meduci for technical guidance, if needed.

Ensure that at least +10 volts D.C is applied to power input of decoder board (observe correct power polarity). Red wire is for the positive voltage from tuner's power supply, and the black wire is for the tuner's negative ground connection. Measure the I.F input signal (it should be in the range from 90- to 120-mV p-p as double-sideband AM C-QuAM signal, as measured with your oscilloscope probe).

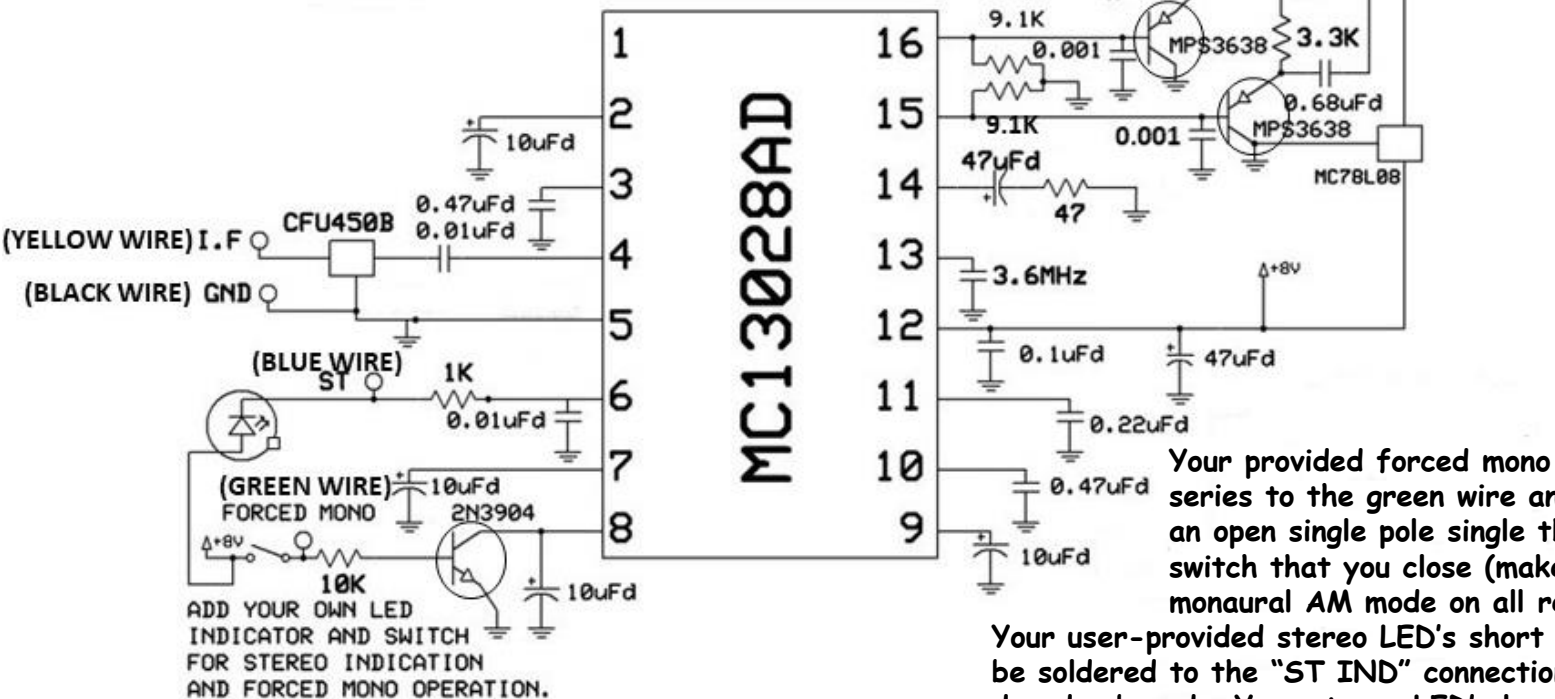
During final installation, ensure that all connections are securely connected, and correctly connected to host tuner. Once the installation has been completed, it is necessary to carry out the set-up procedure.

You are now ready to check for AM stereo reception. Tune local AM station that is known and confirmed to be broadcasting the C-QuAM format. Ensure that the stereo LED glows after a few seconds of receiving desired AM stereo station. Note that accurate tuning and a very strong signal is necessary to obtain good stereo reception.

### Proven conversions

Carver TX-2 was successfully modified. Decoder was mounted inside tuner using stand-offs. Existing power source was verified to be switched "on" only when AM band was selected. I.F was tapped from tuner chip. Mono AM audio was disconnected inside tuner. Left/Right wires were spliced over FM audio. 7

# SCHEMATIC DIAGRAM



Your provided forced mono switch is wired in series to the green wire and +8V pad. This is an open single pole single throw (SPST) toggle switch that you close (make contact) to force monaural AM mode on all received stations.

Your user-provided stereo LED's short lead (cathode) should be soldered to the "ST IND" connection on your AM\_ST decoder board. Your stereo LED's long lead (anode) should be soldered directly to the +8-volt hole on your AM\_ST decoder board (this is in the upper left corner).

# PARTS LIST

(updated 03/24/20)

- 2 - 9.1k-ohm Resistors, 1/8-watt
- 2 - 3.3k-ohm Resistors, 1/8-watt
- 1 - 47-ohm Resistor, 1/8-watt
- 1 - 1k-ohm Resistor, 1/8-watt
- 1 - 10k-ohm Resistor, 1/8-watt
- 1 - 3.6MHz Ceramic Resonator
- 2 - MPS3638 Small-Signal Transistors
- 1 - 2N3904 Small-Signal Transistor
- 1 - MC78L08 Linear Voltage Regulator

- 2 - 0.47uFd Capacitors
- 1 - 0.22uFd Capacitor
- 1 - 0.1uFd Capacitor
- 2 - 0.01uFd Capacitors
- 2 - 0.001uFd Capacitors
- 2 - 0.68uFd Capacitors
- 4 - 10uFd Electrolytic Aluminum Capacitors
- 2 - 47uFd Capacitors
- 1 - MC13028AD AM Stereo IC Chip
- 1 - CFU450B Ceramic Filter
- 1 - Custom Printed Circuit Board, Double-Sided