NØXAS ID-O-Matic II

Morse ID Timer / Annunciator

The ID-O-Matic II kit is a microprocessor based, ID timer/annunciator with repeater control functions suitable for Amateur Radio and other applications. Several modes of operation make it suitable for use in the shack or as an automatic Morse code ID for beacons, repeaters and "fox hunt" transmitters. The ID-O-Matic II includes audio mixing, de-emphasis and amplification as well as input signal conditioning and output drivers.

ID-O-Matic II Features
(Firmware version 3.3, PCB Rev. B)

- Supply voltage up to 24V with on-board regulator
- Serial interface for setup from PC or terminal
- Dual color LED for green/yellow/red indicator
- Reminder mode for shack use
- Delays from 1 second to over 9 hours may be set
- All memory and parameter settings retained with power off
- Auto ID mode with repeater inputs
- Morse code speed adjustable from 5 to 40 WPM
- INHIBIT input to delay ID
- COR input to prevent repeater ID on quiet channel
- Repeater beacon timer to announce at regular intervals when desired
- Receiver audio muting when COR is not active

- Separate normal and beacon ID messages can be used, up to 64 characters each
- Special ID message for power failure or other alert condition
- Optional, courtesy beep for repeater mode use can be any Morse character
- Variable delay before courtesy beep
- Independent audio frequencies for Morse ID and courtesy beep
- Adjustable PTT hang time
- PTT time-out timer
- Audio (MCW), CW and PTT outputs
- CW and PTT outputs drive MOSFETs for direct connection to many rigs
- AR, BT, SK prosigns and new @ character supported
- PWM audio signal for smoother ID tome than the original ID-O-Matic
- De-emphasis and level control for receiver audio input

Parts List

Qty.	Part
2	18 pF ceramic capacitor (marked 18J) *See NOTE 1 below
1	.047 µF ceramic capacitor (marked 473)
4	.1 µF ceramic capacitor (marked 104)
3	.33 µF ceramic capacitor (marked 334)
1	100 µF electrolytic capacitor
1	220 µF electrolytic capacitor
2	1N4732 4.7V Zener diode
1	10 Ohm (brown-black-black) OR 100 Ohm (brown-black-brown) resistor
1	470 Ohm resistor (yellow-violet-brown)
3	1K resistor (brown-black-red)
3	2.2K resistor (red-red-red)
1	4.7K resistor (yellow-violet-red)
1	10K resistor (brown-black-orange)
4	100K resistor (brown-black-yellow)
2	10K Ohm trimmer potentiometer
6	2N7000 MOSFET
1	78L05 voltage regulator
1	20 MHz cylindrical crystal
1	8-pin IC socket
1	10-pin IC socket
1	LM386N or NJM386 audio amplifier IC
1	PIC16F648A ID-I-Matic II processor IC

Table 1 - Parts List

*NOTE 1: Due to printing inconsistencies, these may appear to be marked "111J"

Kit Construction

Keep all semiconductor parts in the anti-static packaging until you are ready to use them. Always use good static prevention practices when working with static sensitive parts. This means you should wear a grounding strap when possible, or work on a static-dissipative work surface. Use a grounded tip soldering iron. When soldering small parts it is a good idea to use a small, pencil-type soldering iron of no more than 25 Watts or so, or preferably a temperature controlled soldering station. Use pliers, clamps or alligator clips as heat sinks to prevent heat damage to parts while soldering. If you are not fairly experienced with soldering small parts, you may want to practice on some scrap parts first or get some help.

Work in an area with good lighting. You may want to use a magnifying lens to do some of the small soldering required. Insert each component from the top side of the board (the side with the white silkscreen lettering), in the order shown in the instructions below. As each component is installed, solder the leads and trim off excess leads with a small pair of side cutters.

1. ☐ Install a .1 µF capacitor (marked 104) in the location marked C1.

2. ☐ Install a .1 µF capacitor at C4.

3. ☐ Install a .1 µF capacitor at C6.

4. ☐ Install a .1 µF capacitor at C11.

5. ☐ Install a .33 µF capacitor (marked 334) at C2.

6. ☐ Install a .33 µF capacitor at C3.

7. ☐ Install the .047 µF capacitor (marked 473) at C8.

8. ☐ Install two 18 pF capacitors in locations C9 and C10.

9. ☐ If you want to use the de-emphasis circuit for the secondary (receiver) audio input, install a .33 µF capacitor (marked 334) at C12. If you do not want de-emphasis, omit C12.

10. ☐ Install a 1N4732 Zener diode at D1. Make sure the banded end of the diode is toward the circle marked on the PCB.

11. ☐ Install the other Zener diode at D2, oriented the same way

12. ☐ Install a 100K Ohm resistor (brown-black-yellow) at R1.

13. ☐ Install a 100K Ohm resistor in location R6.

14. ☐ Install a 100K Ohm resistor in location R7.

15. ☐ Install a 100K Ohm resistor in location R8.

16. ☐ Install the 470 Ohm resistor (yellow-violet-brown) at R2.

17. ☐ Install the 1K Ohm (brown-black-red) resistor in location R3.

18. ☐ Install a 1K Ohm resistor in location R12.

19. ☐ Install a 1K Ohm resistor in location R13.

20. ☐ Install a 2.2K Ohm (red-red-red) resistor in location R4.

21. ☐ Install a 2.2K Ohm resistor in location R5.

22. ☐ If you plan to use your ID-O-Matic II with a handheld transceiver, install a 2.2K Ohm resistor at R10. If not, you should omit R10.

23. ☐ Install the 4.7K Ohm (yellow-violet-red) resistor in location R9.

24. ☐ Install a 10 Ohm (brown-black-black) resistor in location R11..

25. ☐ Install the 10K Ohm (brown-black-orange) resistor in location R14.

26. ☐ Install the two square blue trimmer potentiometers in the ID_VOL and IN_VOL locations. Be sure to get them properly oriented, with the 1 & 3 markings are toward the bottom of the board (closer to Q2).

27. ☐ Install the 78L05 voltage regulator in location U1. Check for proper orientation with outline on board. Be sure to check the marking to ensure you have the 78L05, and not one of the 2N7000s.

28. ☐ Install 2N7000 MOSFET transistors in locations Q1 through Q6. Make sure the transistors are oriented with the flat side as shown on the board. Double check to make sure you don't accidentally grab the 78L05 regulator.

29. ☐ Install the 220 µF electrolytic capacitor at C5. Make sure the longer + lead goes into the hole with the **square** solder pad.

30. ☐ Install the 100 µF electrolytic capacitor at C7. Again, make sure the longer lead is in the + marked hole with the **square** solder pad.

31. ☐ Install the 18-pin IC socket in location U2. M make sure the notch in one end of the socket is positioned to match the board outline. **Do not install the chip yet**.

32. ☐ Install the 8-pin IC socket in location U3. Again, make sure the notch is oriented as indicated by the marking on the PCB. **Do not install the chip yet**.

33. ☐ Carefully install the small 20 MHz cylindrical crystal in location X1. *NOTE:* This part is easy to damage with excess heat while soldering. *Be extra careful!*

34. ☐ Install the DB-9 connector in location J1.

35. ☐ Install the 10-position terminal block at J1. Make sure the "open" side where there are openings for wires faces the outside edge of the board.

36. ☐ Install the 6-pin header strip in the indicated location for the INH and COR jumpers.

37. ☐ Mount the Dual-color LED in the position indicated. Pay attention to the markings on the PCB, and match them with the leads on the LED. Note that one lead has a square bend, and the other has an angled bend. You can also mount the LED remotely using any convenient length of wire.

Powering the ID-O-Matic II

Power can be supplied by battery or a DC power source up to 24V. Connect the power input to terminals 1 (GROUND) and 2 (+V) of the terminal strip. **Warning: There is no diode to protect against reversed power leads – double check your connections!!** If you plan to build your ID-O-Matic II into a rig or a repeater controller, you don't need to worry about battery backup to preserve your settings. All memory and parameter settings are retained in non-volatile EEPROM memory and will be automatically recalled when power is applied.

Check the power supply voltage at pins 5 (GROUND) and 14 (POWER) on the 18-pin IC socket at U2. Once you have verified that there is a safe voltage of 5V plus or minus .25V or so, remove power. Install the ID-O-Matic chip in socket U2, and the LM386 amplifier chip in U3. Make sure to orient the two chips properly, with the Pin 1 dot and/or notch toward the notch indicated by the silkscreened outline on the PCB.
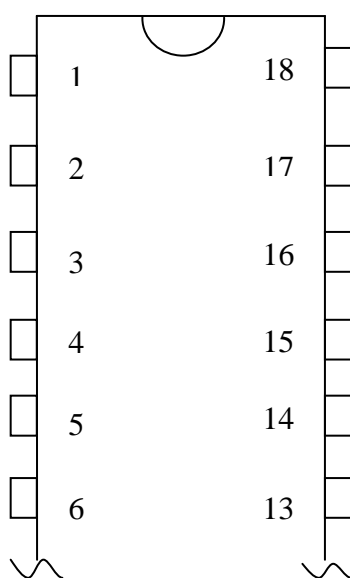
Pin numbering

Off-Board Connections

You may want to install a RESET switch, speaker, etc. All off-board connections normally needed are available at the ten pads (or screw clamp terminals, if installed) marked J1. These connections may be used as follows:

Pad	Function
J1-1	Ground
J1-2	+V DC power input
J1-3	PTT output; open-drain MOSFET, 60 V 200 mA max.
J1-4	CW output; open-drain MOSFET, 60 V 200 mA max.
J1-5	Beacon indicator. This is a TTL level signal that goes high during a beacon ID, and is low the rest of the time. **This output is not buffered**, do not exceed 5V/15 mA.
J1-6	RESET input; ground momentarily to reset the CPU. Do not allow this signal to exceed 5V.
J1-7	COR input. Normally used for a COR or squelch signal from the receiver. This signal was known as START on the original ID-O-Matic.
J1-8	Receiver audio input.
J1-9	INHIBIT input. Can be used to hold off ID if needed.
J1-10	Audio output. For HT use, the PTT signal is supplied through a 2.2K Ohm resistor.

Table 2 - Off-board connections

PTT and CW Outputs
The PTT and CW outputs are open-drain MOSFET outputs, and can be directly connected to inputs that do not exceed 60V or 200 mA at any time. They can be used to drive relays if needed. If you intend to use the ID-O-Matic II with equipment requiring grid-block or cathode keying or any other application that will exceed 60 Volts or 200 mA, you will need to add a grid-block keying adapter such as the Universal Keying Adapter 2 or some other suitable output arrangement.

Note that the CW output is an on/off keyed signal suitable for driving a CW transmitter, indicator or other on/off keyed load. It is not an audio output.

Audio Signals
The ID-O-Matic II uses two audio signal sources. The first is the Morse ID audio, also used for the courtesy beep tone. This signal is generated as a pulse-width modulated (PWM) signal by the microcontroller. After low-pass filtering provided by R9 & C3, it is passed to the LM386 audio amp. Level control is provided by the ID_VOL trim pot.

The other source is the receiver audio input from J1-8. This signal is passed through the IN_VOL level control and the de-emphasis circuit (R14/C12), then on to the LM386 amplifier. The two audio signals are mixed and sent to J1-10 through a DC blocking capacitor. If you wish to bypass the de-emphasis circuit, you can omit C12 at build time.

COR and INHIBIT Signal Inputs

Two control signal inputs, COR and INHIBIT, are used only in repeater mode. These inputs can be either active-high or active-low. Active-high means that, when the signal is inactive, it is held at or near ground potential. When it goes active, it should swing to a positive voltage of 3.5V or more. Conversely, active-low means that the signal normally floats or is driven to some positive voltage, and goes to ground or near ground when active. One example of this would be a grounding PTT switch or a relay input. For either arrangement, the input signal conditioning circuits (R7/R12/D1/Q6 and R6/R13/D2/Q5) will clamp the signals to safe levels of 4.7V or less, and invert them if necessary.

You will need to set the two jumpers according to the polarity of the input signals. For an active-high signal, set the corresponding jumper to the "H" position. For an active-low signal, set the jumper to the "L" position. If either signal will not be used, just leave the jumper on the center pin in case you need it later. In the diagram below, the jumpers are set for an **active-LOW** COR and no (unused) INHIBIT. The COR jumper is connecting the center and L pins, and the INH jumper is left open.
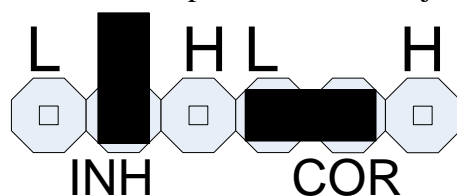

Figure 1 - COR and INH jumpers

ALT MSG and RESET inputs

Note that the ALT MSG and RESET inputs may be left floating (unconnected) if not used, and are not equipped with input signal protection as the COR and INHIBIT inputs are. **Be careful not to exceed 5V on these inputs!** They are active-low logic inputs, meaning they are active when grounded or driven below 0.5V. If you need to use a signal source that may exceed 5V, you must use some method of limiting the input signal to a range of 0V to 5V. You can use a simple Zener diode circuit as shown below to reduce the voltage to a compatible level.
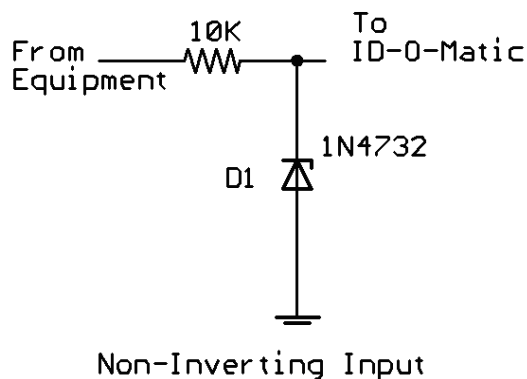

Figure 2 - Limiting input voltage

Additional Solder Pads

You will note there are three additional solder pads to the right of the PIC processor, marked A3, A4 and B0. These are for some additional signals that are not commonly needed, but are available should you have a use for them.

Pad	Function
A3	ID Indicator. This is an unbuffered, 0-5 V output signal that goes HIGH when the ID message is being sent, and LOW at all other times. It is only active while the ID is being transmitted, with no lead or tail time.
A4	Audio mute. This signal can be used to mute the receiver audio input when COR is not active. See "Receiver audio muting" section below.
B0	**TEST/ALT MSG** input. This input is dual purpose. If this input is held LOW when power is applied or the ID-O-Matic II is reset, it will send the version number, **ID Msg**, **Beacon Msg** and **Alternate Msg** (if they are set), separated by slant bars. After initial power up, this input can be used to select the **Alternate Msg** (if it is set) to be sent in place of the **ID Msg**. This can be used to send an alternate ID message when needed to indicate primary power failure or for whatever other purpose you may have in mind.

Table 3 - Additional solder pads

Operation

Simple timer mode

For shack use as a simple ID reminder, simply turn the ID-O-Matic II on. The LED should show green for nine minutes, then turn yellow. At nine minutes thirty seconds, the LED will begin to blink yellow and red. After ten minutes the LED will turn solid red and the ID-O-Matic II will beep at you to remind you to ID, then automatically reset and begin a new timing cycle. The open-drain PTT output can be used to drive an external indicator such as a lamp or LED. Push the RESET button to begin a new cycle any time you ID.

Auto ID mode

Similar to the simple timer mode, this will send a Morse ID at regular intervals. The INHIBIT input can be used to delay the ID if needed. Note that two Morse outputs are provided; there is CW output that is used for on-off keyed devices (CW transmitters, etc) and an audio output. The PTT signal is also active in Auto ID mode. The ID message will be sent every time the ID timer reaches zero, and the timer will automatically reset and begin counting again. This can be useful for "fox" transmitters, beacons, etc.

Repeater mode

In this mode of operation, the COR input is used to indicate that the transmitter has been keyed. It is normally connected to either a receiver COR/COS or squelch output, or to the PTT line that would otherwise be connected to the transmitter. When the COR input first goes active, the PTT output line is immediately activated. The ID timer is loaded with your specified ID interval and begins counting down. At this time the LED will begin flashing green. When the ID timer reaches 60 seconds, the LED goes to solid yellow. At 30 seconds, the LED begins alternating red and yellow until the timer expires. At that point the LED goes solid red and the ID message is sent. The yellow and blink times are configurable using the setup menu.

If the interval since the last ID message has been longer than the ID interval – for instance, if your ID interval is set to 10 minutes and the repeater has been idle for more than 10 minutes since the last ID -- an initial ID will be sent 10 seconds after the first time COR goes active. The ID timer is then reset with the normal ID interval. During this phase, a "polite" ID is used; the ID message will not be sent until COR is released OR the normal ID interval is reached.

The INHIBIT Line can be used to hold off the ID until the repeater is not busy. As long as INHIBIT is held low, the ID message or beacon message will not be sent. As soon as it is released, any pending message will be sent. The only exception to this rule is if you have PTT MAX (time-out timer) set; the ID-O-Matic II will send "TOT" (for Time-Out Timer) and its ID message when the PTT MAX timeout is reached, regardless of the state of INHIBIT.

The PTT output is always active when the ID or beacon message is being sent. It is also active:
- If PTT hang time is set (not zero), the entire time COR is active plus the length of the PTT hang time setting;
- If a courtesy beep is set, the entire time COR is active plus half a second and the length of the courtesy beep;
- If both are set, the entire time COR is active, plus the courtesy beep and hang time delays.

Three separate messages can be entered at setup time. They are used as follows:
- ID Message: This is the "normal" ID message, sent when the timer expires.
- Beacon message: This message is optional. If you wish to have your repeater or link transmit a different ID message after a period of inactivity, you can use this message. The beacon message will be sent only after the repeater has been idle for the length of time indicated by the Beacon Time setting. If this message is not set, the regular ID message will be used for the beacon message.
- Alternate (ALT) Message: This message is used in place of the ID message if the ALT/TEST input is held low when the timer expires. This can be useful to indicate some external condition. For example, a simple circuit consisting of a series resistor and a 4.7V Zener diode can be used to indicate if the main power source has failed and the repeater is running on backup power. The input pin has an internal weak pull-up of approximately 47K Ohms, so a pull-down resistor is also needed. Below is an example circuit; you may need to alter it to fit your particular setup.
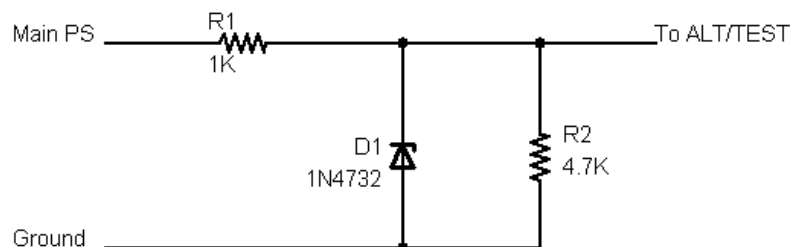

Figure 3 - Example of ALT MSG input

Setting Up the ID-O-Matic II

For beacon, foxhunt or repeater use, connect your ID-O-Matic II to a PC or other serial terminal device using a straight-through 9 pin serial cable. If using a PC you can use the HyperTerminal program provided with some versions of Windows, or just about any other serial communications program such as PuTTY or Minicom. Set your communication parameters for 9600 baud, eight bits, no parity, one or two stop bits and no handshake or flow control. As a quick check to see if your serial port and communication software is set up correctly, you can connect a serial cable to the computer but not to the ID-O-Matic II. Connect pins 2 & 3 together at the end of your serial cable. Anything you type should be echoed back to your computer. If this quick test works, you're set up properly to connect to your ID-O-Matic II and perform the next steps.

Connect the ID-O-Matic II and turn the power on. You should see the firmware version number displayed on your screen. Tap the ENTER key twice to enter the setup menu. You will be prompted for several bits of information. In each case you can hit RETURN to keep the current setting, which will be displayed in parenthesis after the prompt.

- **ID Time:** Enter the delay time, in seconds. This will be the time between ID reminders or Morse announcements. Note that a setting of less than a second or two may make it quite challenging to get into the setup menu.
- **Yellow time:** Enter the number of seconds from zero at which you want the LED to turn solid yellow. Setting this value to zero disables turning the LED yellow.
- **Blink time:** Enter the number of seconds from zero at which you want the LED to begin blinking red/yellow. Setting this value to zero disables red/yellow blinking.
- **ID Msg:** Enter up to 64 characters for your desired Morse code ID. Common punctuation and prosigns are supported:
    - Type a dash (**–**) for BT
    - Type a semicolon (**;**) for AR
    - Type a greater-than (**>**) for SK
    - @ will be sent as the new Morse @ sign character (.--.-.)
    - Comma, period, slash and question mark signs are sent as typed
    - To send a steady tone or CW carrier for a specified length of time (such as for a propagation beacon), type **:*nnn*:** where ***nnn*** is the number of seconds from 1 to 255. For a 5 second key-down, for example, you would use **:5:** or **:005:**.
    - Less-than (<) and other characters will be ignored.
    - Spaces, including trailing spaces, will be sent. **Note that entering a space as the first character of a message will delete the message**.
- **Beacon Msg:** Similar to the ID message, this message will be sent if the beacon time is set. If the beacon time is set and this message is empty, the ID message will be sent at beacon time instead.
- **Alternate Msg:** This message, if present, will be send in place of the **ID msg** if the TEST/ALT MSG input is active (low) when the timer expires.
- **Auto CW ID:** Type Y to use the Morse code ID, or N for a simple beeping ID reminder.
- **CW Speed:** Enter the desired Morse code speed in words per minute. This will also affect the rate of beeping if Auto CW ID is off.
- **ID Audio Tone:** Enter the desired Morse ID audio frequency in Hz between 250 and 2500.
- **Repeater mode?:** Type Y if you intend to use the COR input. Type N if you do NOT plan to use the COR input, even if it will be used in a repeater. In repeater mode, the COR input starts a

timing/ID cycle. In non-repeater mode, the timer runs non-stop and the unit will ID at the end of every cycle.

- **Courtesy beep tone:** This prompt will only appear if you answered "Y" to Repeater mode. This setting can be set to an audio frequency (in Hz) between 250 and 2500.
- **Courtesy beep delay time:** This is the delay, in tenths of a second, between the time the COR input goes inactive (high) and the courtesy beep. The valid range is from 0 (no delay) to 255 (25.5 seconds). For example, the default value of 5 gives you a half-second delay; 20 would be a 2 second delay and so on.
- **Courtesy beep char:** If you have selected Repeater mode, this allows you to specify a Morse character to be sent for the courtesy beep. For a simple short beep, use "E"; for a longer beep use "T". You can use any single character. *Leave this blank to disable the courtesy beep.*
- **Beacon time**: This prompt will only appear if you answered "Y" to Repeater mode. Setting this to other than zero will cause the ID-O-Matic II to send a Morse message at regular intervals if nothing is seen on the COR input while in repeater mode. This can be set to 3600 to announce the repeater every hour, for example, if the repeater is idle. Enter the number of seconds you wish to have between beacons, up to 65535. The beacon message is used if it is set, otherwise the ID message will be used. Set this to zero to disable beaconing.
- **PTT hang time:** This value is specified in seconds. While in repeater mode, the PTT output will be active as soon as the COR in put goes low and will remain active for the specified number of seconds after the COR input goes high and any ID or courtesy beep is finished. With PTT hang time set to 0, PTT drops immediately after the courtesy beep.
- **PTT Max:** This setting will specify the maximum number of seconds the ID-O-Matic II will allow PTT to be active. If the COR input is active for longer then this setting, the ID-O-Matic II will send "TOT" (for "Time-Out Timer"), then send the ID message and disable PTT until the COR input is inactive.

Status LED indications and what they mean	
Green (solid)	Timer is operating; timer is more than 60 seconds from expiring.
Green (blinking)	In repeater mode, COR input has been seen and ID timer is running.
Yellow	Timer is within 60 seconds (or YELLOW time) of expiring.
Yellow/Red Blinking	Timer is within 30 seconds (or BLINK time) of expiring
Red	Timer has expired. In repeater mode, ID is being transmitted (or is pending, being delayed until COR and/or INHIBIT go inactive).

Table 4 - Status LED indications

Receiver Audio Muting

In some cases you may wish to mute the receiver audio while the COR signal is inactive. This is the case, for example, when you are using discriminator audio from the receiver; the audio is not squelched from the receiver, but you don't want to hear the unsquelched audio after COR drops and before the courtesy beep and/or ID.

This can be accomplished by running a wire from the A4 pad to the IN_VOL potentiometer pin closest to the serial I/O connector side of the board, as shown in the illustration below. Use an insulated wire tacked in place. Pin A4 floats when COR is active, allowing receiver audio to pass through. As soon as COR drops, pin A4 is driven near ground to mute the audio input.
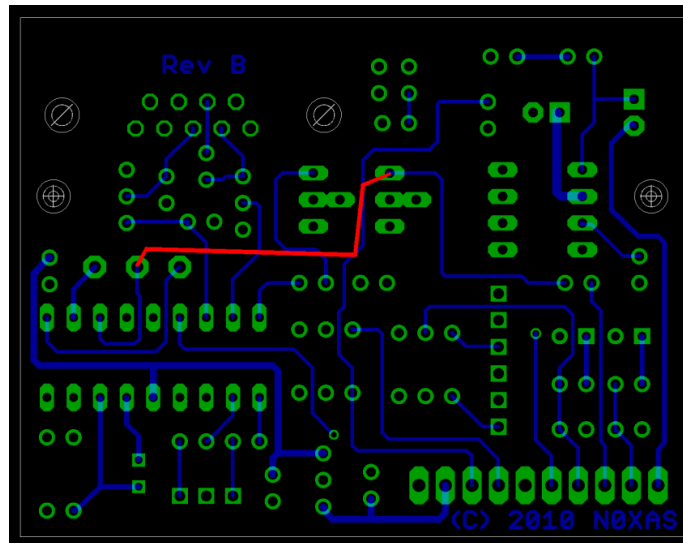

Figure 4 - Receiver audio muting

Reducing the ID Audio Level

The ID-O-Matic II was designed to be used in a very wide range of different applications. In some cases, the audio level of the Morse ID may be too high for your equipment. There are a few steps you can take to reduce the ID audio to a lower level.

- Substitute a .01 µF capacitor for C4
- Add a 1K Ohm resistor between pin 3 and pin 4 of audio amp U3
- Add a 10K Ohm resistor in series with C4 and a 1K Ohm between pins 3 & 4 of U3

Troubleshooting

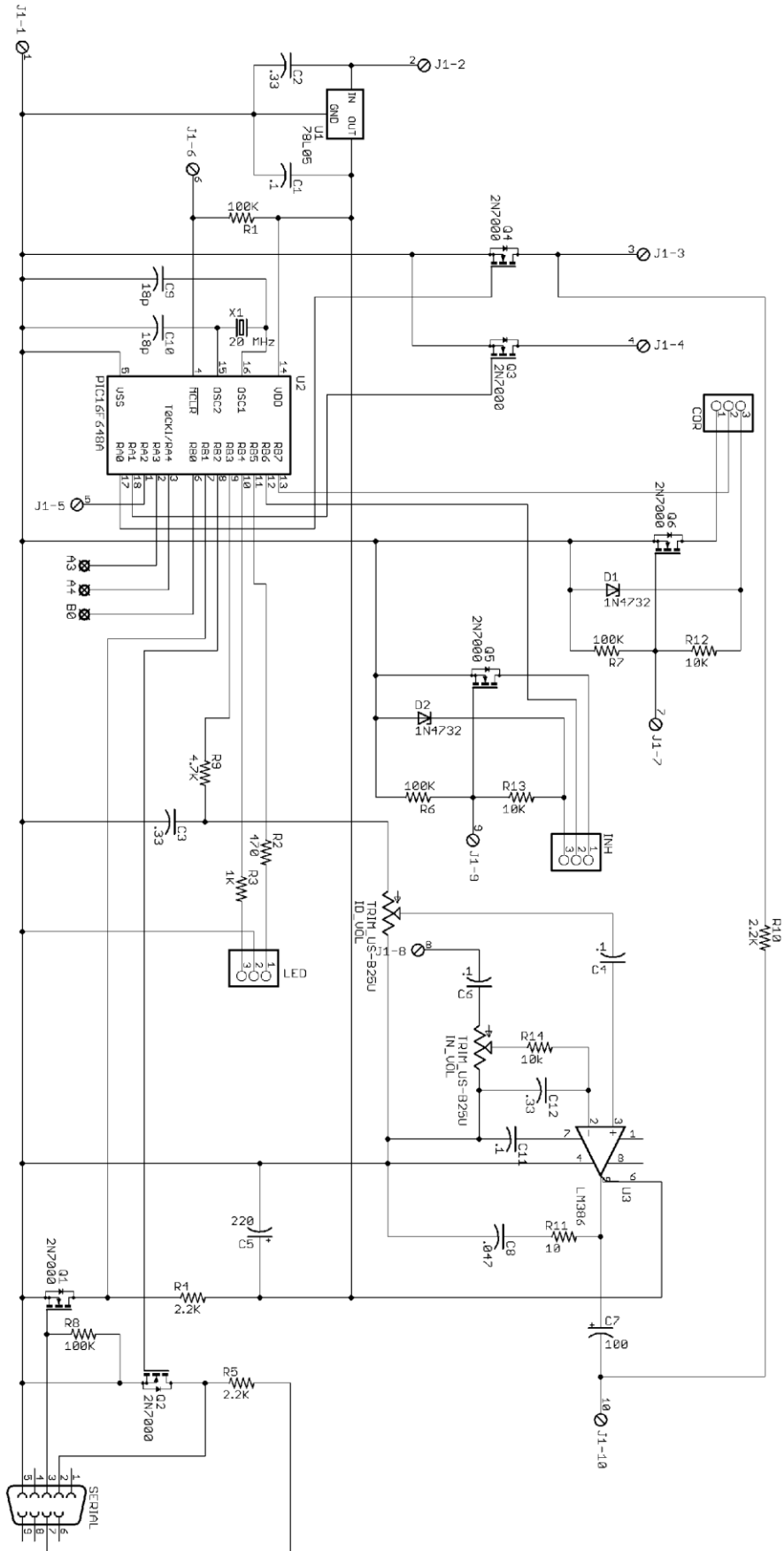| Symptom	Check this:
No green LED with power applied	• 5V DC from IC pin 5 (GND) to pin 14 (+5)? If not: • Remember where position 1 of the terminal block is? Check the parts placement diagram on the last page! • Chip inserted backward? • U1 & one of the 2N7000s exchanged? • Crystal damaged by excessive heat • R1 shorted to ground – check for 5V across RESET pads
No sound from speaker / No audio to transmitter	• Adjust audio levels using trim pots • U3 in backward • R10 shorted to ground
LED blinks and turns RED as soon as power is applied	ID delay time set to zero. Try hitting ENTER repeatedly as you apply power or reset by momentarily grounding J1-6.
No version notice when power is applied	• Possible serial communication issue (see below). • Q2 bad. • R5 open or shorted.
Version notice appears, but the ID-O-Matic II won't respond when you hit ENTER a number of times	• Possible serial communication issue (see below). • Q1 bad. • R8 open or shorted.
No voltage on J1-3 or J1-4	This is normal; these are active low, open-drain MOSFET outputs. See instruction manual. Use a pull-up resistor if needed.
No Morse code ID, unit just beeps 10 times	Set "AUTO CW ID" to YES in the setup menu.

Table 5 - Troubleshooting

Support

Should you need support, have questions, have feature requests or bug/problem reports, please feel free to contact me via email at N0XAS@HamGadgets.com. I will make every effort to respond as quickly as possible. Documentation, frequently asked questions and troubleshooting information can be found at **http://www.HamGadgets.com**.

Warranty

All parts are guaranteed against defects for 90 days from date of purchase. This warranty does not cover damage due to incorrect assembly, improper soldering or wiring, overvoltage, static damage or other misuse or abuse. If you have problems, please contact me via email to arrange for an exchange or replacement part. If you accidentally damage a part, don't panic – just contact me, replacements are not expensive.

Schematic Diagram

Parts Placement