MiniRen Controllers – Universal Construction/Operation Manual

Wireless Renard Controllers from DIGWDF

Overview

MiniRen controllers are small channel-count wireless Renard controllers that use an XBee module for communication to the main transmitting base station. Because of their small size, they are ideal for granular control of lighting displays and inexpensive enough to install directly into display pieces. As they are wireless, they also eliminate a lot of control cabling that has traditionally been used for lighting displays.

How to use this manual

Read this manual through from cover to cover before turning on your soldering iron. Become familiar with the electronic parts and parts identification, where they go on the circuit boards and the order in which they are installed. This is for your benefit. Defective parts are quite rare and a properly assembled MiniRen controller will work first time, every time if it is properly assembled. The typical assembly time for a MiniRen controller by a moderately experienced electronics builder is about an hour, but relax and take your time.

BOM – Bill of Materials – Common Parts for All MiniRen Controllers

All MiniRen controllers share the same power and logic components with few exceptions; the list of common parts is printed below. Additional BOMs are listed later that highlight specific additions/exceptions for each MiniRen controller. Pictures of the MiniRen circuit boards are at the end of this document for verification of parts locations.

Qty	Mouser Part#	Item Description
2	291-750-RC	Resistors, 750 ohm, ¼ watt
1	291-27K-RC	Resistor, 27K ohm, ¼ watt
1	291-680-RC	Resistors, 680 ohm, ¼ watt
2	80-C322C104K5R	.1uf 50v non-polarized capacitors
1	871-B41827A5228M000	2200uf 25v (16v minimum) electrolytic capacitor
1	647-UVR1C470MDD	47uf 10v (minimum) electrolytic capacitor
1	511-LF50CV	5v voltage regulator
1	595-UA78M33CKCSE3	3.3v voltage regulator
1	604-WP710A10IT	Common LED – Red (any color is ok)
1	625-DF01M-E3	Bridge Rectifier 1A, 100v
1	782-H11AA1	H11AA1 optoisolator
1	579-PIC16F688-I/P	PIC16F688 microprocessor
1	520-TCH1843-X	18.432mhz half-size crystal oscillator
1	571-1-390261-3	14-pin DIP socket (for PIC16F688)
2	855-M22-7131042	XBee female header sockets
1	532-577102B00	Heat sink (for LF50CV voltage regulator)
1	273-1385B (Radio Shack)	120v primary, 12.6v secondary 300ma transformer
1	888-XBP24-AWI-001	XBee Series-1 module (multiple choices available)
1	538-42375-1863	10-pin breakaway single row header
2	504-1A5018-07	Fuse terminals
1	BK/S500-5-R	5x20mm 5A fuse
1	3527C	5x20mm fuse cover

Note: eBay can be an excellent source for inexpensive electronic components in bulk, such as 5mm terminal blocks, breakaway header pins, DIP sockets, resistors and capacitors, fuses, voltage regulators, triacs and LEDs. Buying common parts in bulk (even from Mouser) can require a slightly greater investment up-front, but you'll save tens and even hundreds of dollars later in terms of convenience and eliminating expensive shipping fees for small orders. At the end of this document is a listing of parts common to a lot of DIY electronic gear and links to several good sources for electronic parts.

MiniRen8/4XB Additions/Exceptions

2	538-42375-1863	10-pin breakaway single row header
4	291-680-RC	Resistors, 680 ohm, ¼ watt
4	291-180-RC	Resistors, 180 ohm, ¼ watt
4	859-MOC3023	Optocoupler/triac
4	571-1-390261-1	6-pin DIP sockets (for MOC3023)
4	BTA06-600CW	Triac
5	571-2828372	5mm terminal blocks
8	538-16-02-0102	Female header/wire housing sockets (optional)
1	(EXCEPTION)	External in-line fuse instead of the 5x20mm fuse. (Suggest using a plug cut from a string of lights)

MiniRen8/8XB Additions/Exceptions – board version 20130302

1	538-42375-1863	10-pin breakaway single row header
8	291-680-RC	Resistors, 680 ohm, ¼ watt
8	291-180-RC	Resistors, 180 ohm, ¼ watt
8	859-MOC3023	Optocoupler/triac
8	571-1-390261-1	6-pin DIP sockets (for MOC3023)
8	BTA06-600CW	Triac
9	571-2828372	5mm terminal blocks
1	838-3FS-312	Tamura 3FS-312 12.6v/6.3v transformer may be used instead of the Radio Shack 273-1385

MiniRen8/8VOXB Additions/Exceptions

1	538-42375-1863	10-pin breakaway single row header
8	291-680-RC	Resistors, 680 ohm, ¼ watt
8	782-VO2223	VO2223 Optocoupler/triac (VO2223A is ok)
8	571-1-390261-2	8-pin DIP sockets (for VO2223A)
9	571-2828372	5mm terminal blocks

MiniRen8XBLSD Additions/Exceptions

1	538-42375-1863	10-pin breakaway single row header
8	299-470-RC	Resistors, 470 ohm, 1/8 watt
8	863-P2N2222AG	2N2222A transistor (or equivalent)
2	538-95503-2881	RJ45 jacks, vertical PCB mount
3	571-2828372	5mm terminal blocks
1	(EXCEPTION)	External in-line fuse instead of the 5x20mm fuse (Suggest using a plug cut from a string of lights)

MiniRenServoXB Additions/Exceptions

4	538-42375-1863	10-pin breakaway single row header
2	571-2828372	5mm terminal blocks

Step-by-Step Construction

General concepts: It is usually advisable to assemble a circuit board by the height of the parts themselves, starting with the smallest/thinnest parts that are mounted so they lie low right on the board and graduating to the taller and finally the tallest parts such as large capacitors and transformers. In this fashion, you can usually insert several common-height parts into their respective mounting holes, flip the board over and solder them as a group which is more convenient because the parts stay in the holes instead of falling out. In these general construction tips, some items may not be applicable if the board does not require those parts; just skip to the next item on the list. The word "install" implies both mounting and soldering the part to the board and clipping off any extra leads after soldering. Note that many parts are polarized and require that they be installed in a specific orientation on the board. Also, most electrical parts are pretty robust and can withstand some heat, but in general, over-soldering by using too much solder and/or too much heat can create problems and damage either the part or the board itself.

1. As you perform each installation step, take a pencil and check it off. This will ensure you haven't missed anything.
2. Install resistors first. Resistors do not have a polarity, but it's the best technique to install them all the same way, reading the colored stripe values from left-to-right.
3. Install the XBee female headers. They have a very low profile. Don't use too much solder as it may flow into the header holes too far and prevent plugging the XBee securely into the headers.
4. Install the bridge rectifier (BR). Take heed of the chip's polarity, with an AC side (marked with ~) and the DC side (marked with +/-). Slightly heat-sensitive; don't over solder.
5. Install all DIP sockets. Take care to orient the notches on the sockets with the markings on the board. Note: DIP sockets are optional; some users solder the chips directly to the board, which is fine. If you do, solder them in place of the DIP sockets and understand that they are usually quite heat-sensitive.
6. Install the .1uf decoupling capacitors. These are non-polarized.
7. Install the 18.432mhz crystal oscillator. Note that this part has one sharp corner marking pin #1. Be sure it is installed to match the marking on the board. Slightly heat-sensitive; don't over solder.
8. Install the PWR Led. Be sure to orient the flat side/cathode properly. The cathode is the shorter lead and goes into the square hole. Heat sensitive; don't over solder.
9. Install the fuse mounts, if applicable. These fit quite tightly and you may have to wiggle them into the mounting holes. However, don't use force. It is sometimes easier to install fuse mounts when they're mounted on the fuse first but be careful, as the fuse is made of glass. After installation, slip the fuse cover over the fuse for safety.
10. Install terminal blocks, if applicable. Terminal blocks normally interlock with one another, and it's a good idea to lock them into a row first and then solder the entire row together. Be sure to install them with the exit holes facing outward so that you can insert connection cables to lights later on.
11. Install the 47uf electrolytic capacitor. This is a polarized part -- note the orientation. The + side goes to the square pad but the cap is marked on the NEGATIVE side with a – stripe.
12. Install header pins as appropriate. The breakaway header pins are handy to use (and less expensive overall) because you can cut off the number you need. Different MiniRen boards use different numbers of header pins but they are generally in similar locations.
13. Install the 7805 and UA78M33 voltage regulators, observing the proper orientation on the board. The metal tab coincides with the extra line marking on the board. Some users find it more convenient to mount the heat sink on the 7805 using a tiny dab of heat sink compound and a screw before installing the regulator on the board.
14. Install the BTA06 triacs (if applicable), observing the proper position of the metal tab. Triacs are pretty robust but can be damaged by too much heat.
15. Install the transformer (if applicable). Be sure the 120 and 12vac sides are in the proper holes! You may find that butting/breaking-off the mounting tabs on either side of the transformer is required so that the transformer will

fit. Bend the leads over on the bottom of the board for a more secure fit before soldering. NOTE: MiniRen boards starting with version 20130302 may use the Tamura 3FS-312 transformer in place of the Radio Shack unit. This transformer eliminates the need for a heat sink on the L7805 5v regulator.

16. Check both the top and bottom of the board for any bits of wire or solder which may be leftover from construction, and check the bottom of the board to ensure that no solder points have been missed, which is a rather common assembly mistake.

17. Double-check that parts and chips have the proper orientation on the board. Many parts are not polarized so it doesn't matter, but many other parts ARE polarized and they will work only one way. Installing them backwards can and often does damage the part (or the board) when power is applied.

18. **Initial voltage testing:** You will need a voltmeter for this testing.

    CAUTION: When plugged in, parts of the MiniRen carry dangerous and potentially lethal 120vac electrical current. Do not pick up the board or touch it with anything but the voltmeter's leads while the MiniRen is plugged in!

    a. Plug the board into 120vac power. The power LED should light. If it does not light, unplug the board immediately and determine what the problem is before continuing.

    b. Set the voltmeter to measure A/C voltage. Voltage on the two pins on the left side of the bridge rectifier (marked with ~) should read approximately 12.6vac.

    c. Set the voltmeter to measure D/C voltage. Voltage on the right side of the bridge rectifier (marked with + and -) should read approximately

    d. At the JP2 header, test at the G and +5v pins should read 5vdc. A measurement between 4.9 and 5.1vdc is acceptable.

    e. At the right side of the board, the voltage between the metal tab on the 3.3 regulator and the BOTTOM solder point of the .1uf capacitor adjacent to it should be 3.3vdc (or very close to it).

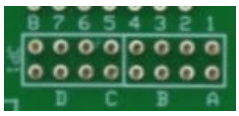
    f. If the above voltages check out, it should be safe to continue.

    g. **Unplug the MiniRen from 120vac power before continuing.**

19. At this point and for the purpose of these instructions, it is assumed that the PIC16F688 processor chip has been properly flashed with the appropriate Renard firmware and the XBee module has been properly configured as well. These are separate topics that are quite adequately addressed elsewhere. If either the PIC16F688 or the XBee are not configured properly, further testing is not possible.

20. Insert the PIC16F688, H11AA1, XBee module and any other IC chips into their respective sockets. Be sure to orient the chips properly with the notches on the sockets, which should also match the notches marked on the board. Some chips may not have a notch but use a dot or other mark adjacent to what is "pin #1" on the chip. You may have to gently bend the legs on the chips so they fit easily into the sockets. When done, double-check each socket to make sure there are no bent pins and that the chips are securely mounted.

21. **MiniRen8/4XB only:** This controller requires assigning four of the eight available channels to the four output MOC3023/Triacs that power the lights. This is done by connecting the top row of channel pins marked 87865431 to the lower row of output pins marked DCBA.



    a. **Connect only 4 of the numbered pins to the the lettered pins. Do not use jumper shunts to connect the numbered pins directly across to the lettered pins.**

    b. Make four short connection wires using spare cat5 or other thin wire and the female header/wire housing sockets (Mouser # 538-16-02-0102). Cover each end with a short section of shrink tube or tape to prevent accidental shorts.

c. Connect the desired numbered channel pins to the desired lettered output pins. Connect them in any order you wish, depending on what controller channels are to be assigned to the light outputs.

22. Connect appropriate lights to the respective controller outputs.
23. Reconnect the MiniRen to 120vac power, again being careful not to touch the controller while it is plugged in.
24. Live, wireless testing can now be performed using a sequence that has appropriate channel setups for the channels assigned to the controller. It is assumed that the sequencing software is properly configured to send its output to the transmitting XBee module and that the XBee is properly configured, too. Those issues are outside the scope of this manual and are adequately addressed elsewhere.
25. The compact design of the MiniRen controllers makes it easy to move them around for distance testing or other experimentation. However, always place the board in an electrically protected enclosure before transferring it from place to place to protect from possible electrical shock.

Individual Controller Features/Idiosyncrasies

Two of the controller boards have additional terminal blocks and/or jumper settings that provide special functionality. These differences are explained here. You may wish to review the pictures of the controller boards, later in this document.

MiniRenServoXB

- There are TWO terminal blocks for power; one is the main 120vac power; the other is named "Servo DC-IN." The transformer on the board may be able to provide enough current for a single, small servo, but for more than one servo, external DC power is required; connect it at the Servo DC-IN terminal block observing the marked polarities. Also, when using the onboard transformer to power the servo, connect a shunt jumper across the 2-pin header marked "Internal 5vdc." When using external 5vdc power, disconnect this shunt jumper.
- This board also has dual markings for the channel order of the output pins. Above the block of 24 pins "Regular Firmware" indicates which channels each control pin has if using normal (non-servo) Renard firmware. Below the block of 24 pins "Servo Firmware" highlights the normal servo order of the output pins as H1, H2, etc. It's important to know that only the top row of pins is the control pin, and it's marked CTL. The other two rows are merely +5v power and GND. A servo cable normally has 3 wires: red is +5v, black is GND, and a white (or other color) wire is typically the control line. Connect them accordingly to the 24-pin header block.

MiniRen8XBLSD

- Like the ServoXB board above, the XBLSD has a terminal block for 120vac power, another block marked EXTERNAL, and header pins marked INTERNAL POWER, with choices either 5vdc or 12vdc. All of these are related to the source and amount of current that flows out to the lights via the J1 and J2 RJ45 jacks.
    - A shunt-jumper across the INTERNAL POWER 5v pins provides 5vdc power to the RJ45 jacks from the internal transformer/power section of the board. This may be adequate for a few LEDs, but remember that the transformer only provides up to 300ma total and the output current per channel is not very high. It is certainly adequate for testing purposes.
    - A shunt-jumper across the INTERNAL POWER 12v pins provides 12vdc power to the RJ45 jacks from the internal transformer/power section of the board. Again, this may be adequate for a few LEDs or circuits running at 12v but probably not very many. Again, it is adequate for testing purposes.
    - Do not shunt jumpers across both the 5v and 12v pins simultaneously; use one or the other, but not both if you use the internal power supply to power the RJ45 outputs.
    - If you plan to connect external DC power (either 5 or 12vdc) to the EXTERNAL terminal block, DO NOT CONNECT the shunt jumpers at either the 5v or 12v internal power pins.
    - The XBLSD uses standard LSD firmware settings and *not the regular Renard firmware*. These are:
        - **`#define PWM_build 1`** (change from: `#define PWM build 0`)
        - **`#define DC_build 1`** (change from: `#define DC_build 0`)
        - **`#define CTR_LOCKOUT 1`** (change from: `#define CTR_LOCKOUT 15`)
        - **`;;#define OUTPUT_NEGATIVE_TRUE`** (add `;;` in front of the line to comment the line out)

Troubleshooting

As the MiniRen uses the same firmware as any normal Renard controller, the same diagnostics apply. However, the following voltage information may be helpful to the newer user:

- **CAUTION:** the controller carries live 120VAC current. DO NOT pick up the board while it is powered on; it is far too easy to touch the live AC terminals on the bottom of the board. It may be helpful to paint a coating of Liquid Tape on the bottom of the MiniRen board once it has proven to be fully operational. Liquid tape is an excellent moisture preventer and insulator and can help prevent electrical issues caused by climate changes later on.
- Every MiniRen controller has header pin locations for the following values. Some of the MiniRen controllers have most of these in the JP2 header; others may have these located individually on different places on the board. These can be tested using appropriate test equipment, such as a voltmeter or oscilloscope:
    - +5vdc
    - Ground
    - ZC - zero cross signal from the H11AA1 chip. Connects to pin 4 of the 16F688 chip
    - DO - data OUT. This is data overflow from pin 6 of the 16F688 chip.
    - CK or CLK – the clock timing signal from the 18.432mhz crystal oscillator, connects to pin 2 of the 16F688.
    - RX – data IN, connects to pin 5 of the 16F688.
    - DIN – data IN (pin 3) to the XBee module. See XBee section below.
    - DOH or DOX – data OUT (pin 2) from the XBee. This pin feeds data to pin 5 of the 16F688 chip.

- **CAUTION:** 120vac can be measured at the top screw terminals of the 120vac power terminal block.
- **CAUTION:** with the board not receiving any data from the computer, the voltage output that normally goes to lights should be at or near zero.

Testing the PIC16F688 Channel outputs

- The eight JP1 header pins are marked from left-to-right, 87654321 to correspond with the channel number outputs from the 16F688 chip. (The only exception is the MiniRenServoXB, which has two sets of numbers (one for “regular” Renard firmware and the other for RenServo firmware.)
- With normal firmware installed, the outputs at each of these pins should be +5vdc.
- When a channel is at 100% intensity, the value at its pin should be near or at zero.
- You may fashion an LED tester with a 680 to 1K ohm resistor in series with one of the legs of the LED, and connecting the LED to both the ground pin of JP2 and one of the channel pins; the brightness of the LED should correspond to the intensity level of that channel and you can view the ramping up/down in live-time.
- If the measurement of ALL of the PIC’s pins remains at +5vdc and never changes, there either is a short somewhere on the PIC or the XBee module is not receiving data (or is not plugged in).

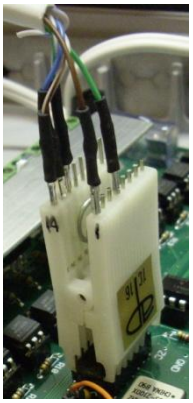
XBee Module

- Some XBee pin values worth checking. Pin 1 is clearly marked on the module itself:
    - Pin 1: +3.3vdc
    - Pin 10: GND
    - Pin 15: status (can blink an LED approx once per second – use a 330 ohm resistor to drop LED current)
- The MiniRen’s DIN header pin is linked to pin 3 of the XBee. This is disconnected on all MiniRen controllers because when data is seen by the XBee module on pin 3, it automatically transmits it out, which would create havoc on the same channel frequency and PANID that the main transmitter is using. However, if the controller’s XBee is programmed to transmit to another *specifically addressed* XBee module, the MiniRen can become a “forwarding” controller, essentially “daisy-chaining” to the next controller. To do this, the following should work:
    - Note that this is a highly advanced use of the controller and generally not recommended unless the user has an excellent understanding of XBee addressing methods.

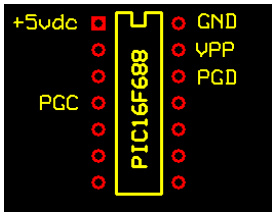
- Connect the DO pin from the MiniRen to the DIN pin by the XBee module.
- Connect a 3.3v Zener diode across the DO pin and GROUND. The Zener diode is necessary to limit input voltage to the XBee; without it the XBee module will likely lock-up and become unresponsive or worse, become damaged.

ICSP Programming of the PIC16F688 chip

- While a dedicated ICSP header hasn't been provided, the functionality of it can be created by connecting the PIC Programmer to various header pins on the MiniRen controller:
  - PGD connection: channel 2 pin of the PIC (same as PIC pin #12)
  - VPP connection: channel 3 pin of the PIC (same as PIC pin #13)
  - PGC connection: ZC pin (same as PIC pin #4)
  - GND: G pin (same as PIC pin #14)
  - VCC connection: +5v pin (same as PIC pin #1)

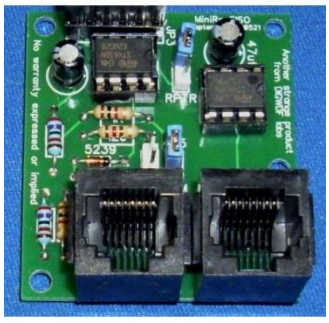


- An easier and faster method can be by using a clamp-on test clip that is appropriately connected to your PIC programmer's ICSP port, and simply clamping it directly onto the pins of the 16F688 chip itself. The active programming pins on the 16F688 chip are:
  - 16F688 pin 1: +5vdc
  - 16F688 pin 4: PGC
  - 16F688 pin 12: PGD
  - 16F688 pin 13: VPP
  - 16F688 pin 14: GND



Adapters - Compatibility/Connectivity with other Renard controllers

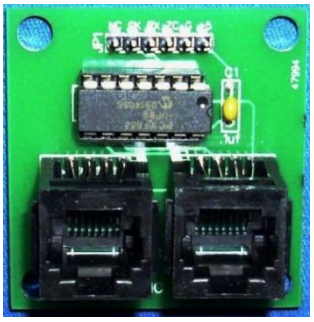
MiniRen's original design concept is that of a wireless end-point device that uses Renard start_address firmware. However, the MiniRen has optional adapters that can be plugged into various header pins that expand the controller's capabilities and make it fully compatible with traditional, wired Renard controllers.



MinirenSISO adapter, full wired input/output capability
RS-232/RS-485 in, RS-485 out

MiniRenSI adapter:
serial input only
RS-232 or RS-485

MiniRenSO adapter:
serial output only
RS-485 only



MiniRen PIC Adapter:
Adds another 8 channels
for external SSR use

Additional Hacks/Ideas

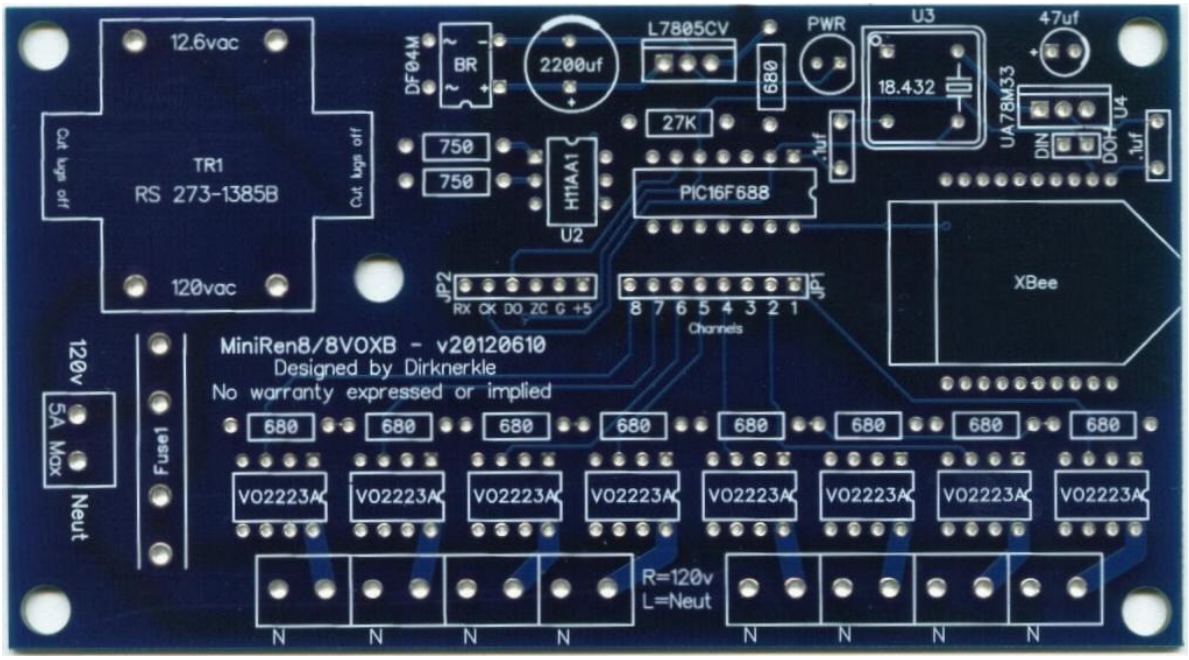
- Since all MiniRen controllers include eight channel output header pins, it is possible to use any MiniRen as an 8-channel controller for external SSRs by simply devising two cat5 cables that plug into the 8-pin channel header and also connecting to the +5v header pin. Note that the MiniRen's transformer does not output enough current to drive LED strings directly through a channel pin output but it can certainly drive indicator or diagnostic LEDs for each channel.
- It is possible to daisy chain one MiniRen into the next either wirelessly (using the repeater functions) or directly by removing the XBee on the second MiniRen and connecting the DO output of the first unit to the DOH or DOX pin of the second unit and connecting the grounds of each units together as well.
- Roving Networks' RN-XV module is a drop-in replacement for Digi's XBee module, having the same I/O and power supply pins. However, the RN-XV is a Wi-Fi enabled module that provides wireless Ethernet capability, enabling controlling the MiniRen controllers via your wireless router/laptop. This has already been tested and proven to work although the specifics are outside the scope of the MiniRen manual.
- Be careful about connecting anything to pin 3 of the XBee module, or any signal to any of the XBee's pins especially if the voltage exceeds 3.3vdc. While the XBee is quite tolerant and usually won't be damaged, as a safety, use a 3.3v zener diode to ground to protect the XBee anytime you're connecting a signal to it. An over-voltage situation usually causes the XBee to 'lock-up' and a power off restart is required before the XBee becomes responsive again.

Questions/Answers

- **Will the MiniRen support DMX?** Yes and no. The MiniRen's XBee radio cannot process the data as fast as is required for DMX communication, so a wireless MiniRen is not a good choice for DMX-based systems. However, if the MiniRenSI or MiniRenSISO adapters are used in a wired setting, the MiniRen operates as an ordinary Renard controller and fully supports DMX for Renard. Further, the Roving Networks' RN-XV module can be configured to operate at higher speeds than the XBee and as a drop-in replacement, could conceivably enable the MiniRen with wireless DMX capability, too. While the RN-XV has been proven to work with the MiniRen, wireless DMX has not been tested.
- **Will a wired version of the MiniRen be developed?** Three plug-in adapters are already available for those who wish to put a MiniRen controller in a wired setting. A specific "wired" version is not on the planning board insofar as there are many other outstanding wired Renard controllers available.
- **How much does it cost to build a MiniRen?** Cost ranges from $45-$65, depending on which MiniRen controller and XBee radio is chosen. A MiniRen is not a cheap unit to build, but then again, MiniRen can work in ways that no other DIY controller can, and it can provide a flexibility that is unmatched by any other DIY gear available today.
- **How do I program the XBee radio?** MiniRen borrows from some of the earlier development of the Ren-W wireless converter for Renard controllers, and the XBee configuration concepts that apply to the Ren-W apply to the MiniRen as well. Read the Ren-W documentation in the WIKI at either www.diychristmas.org or www.doityourselchristmas.com .
- **Do all of the XBee modules work with the MiniRen?** MiniRen supports all versions of the Series-1 XBee radios, both regular and pro versions, and all current antenna configurations. It is electrically compatible with the Series-II XBee radios, but they utilize different communication methods and are not compatible with Series-1 radios; use Series-II at your own risk.
- **Which XBee radio should I order?** Consult the Ren-W documentation section called "Antennas" for transmission patterns, antenna types and capabilities.
- **I want to etch my own MiniRen board, is the ground plane necessary?** Yes. Many components are connected to the ground connection which permeates the entire ground plane itself. The ground plane also helps reduce electrical noise which can hamper wireless communications.
- **I want to make my own MiniRen board but I've never etched a board before. This looks like a good place to start.** No, we don't believe that this is a very good board for a first-time etch attempt. It is a bit complex and has some very small traces and close soldering tolerances. It is not really designed with the neophyte home-etcher in mind and requires rather excellent home etching skills, followed by extremely careful soldering skills.
- **Can I purchase a pre-made board somewhere?** Yes. Contact dirknerkle for availability and pricing or visit the DIGWDF store at www.diychristmas.org .
- **Where can I find out more information about the MiniRen?** You're reading all the information there is for it. MiniRen borrows from the collective wisdom of all those who use Renard controllers and those who use Ren-W wireless adapters. Since it uses most of the same component parts as many of the other Renard controllers, there shouldn't be any surprises there. It is highly suggested that the user have a strong understanding of how Renard controllers operate before jumping into the world of wireless controllers, and most especially in the kind of hybrid, specialized controller that the MiniRen was designed to be.
- **If I run into trouble building/troubleshooting my MiniRen, where can I get help?** If you're even a moderately-experienced builder you shouldn't have any trouble at all. However, implementing a MiniRen requires an understanding of not only electronic circuit board assembly, but a good understanding of how Renard controllers work, how Renard start address firmware works and how to flash PIC chips, plus how XBee communication works. Therefore, if you have little or no experience in any of these areas, a MiniRen controller is probably not a good choice for you. MiniRen is not a beginner's DIY project. DIY means, of course "do it yourself," not "you build it and fix it for me." However, if you do get into a jam, contact **Dirknerkle** directly via either the DIGWDF store at diychristmas.org or via PM at doityourselfchristmas.com.

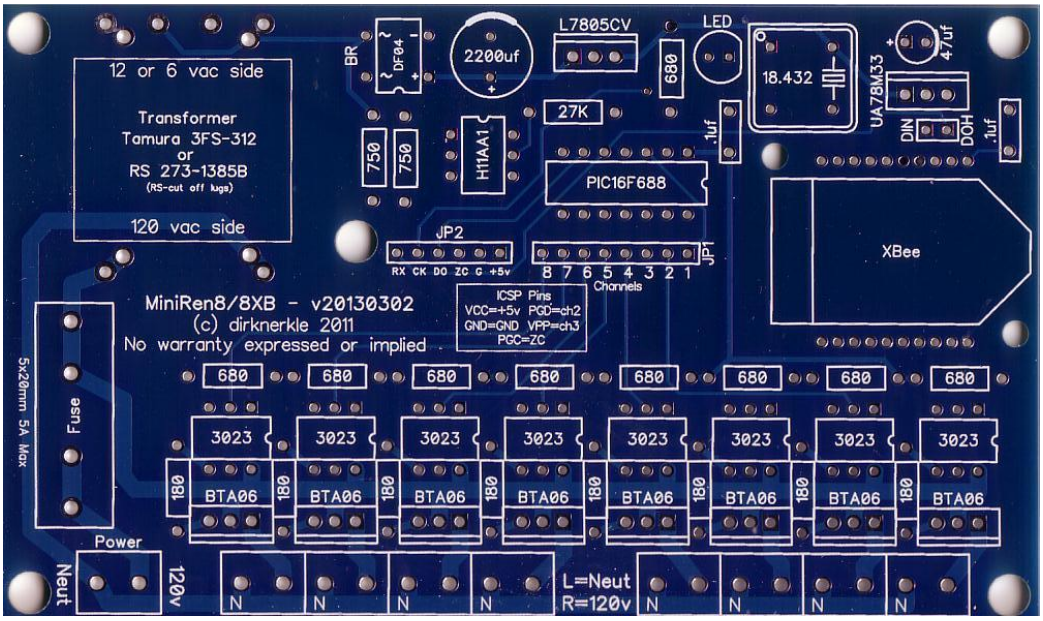
MiniRen Circuit Boards/Parts Locations

Because MiniRen controllers share many common parts, discerning what parts go where is easy and consistent. In some cases, the parts values have been printed on the board while other circuit boards have part references instead. Over time as the circuit boards are revised, all MiniRen boards will display parts values only.



MiniRen8/8XB

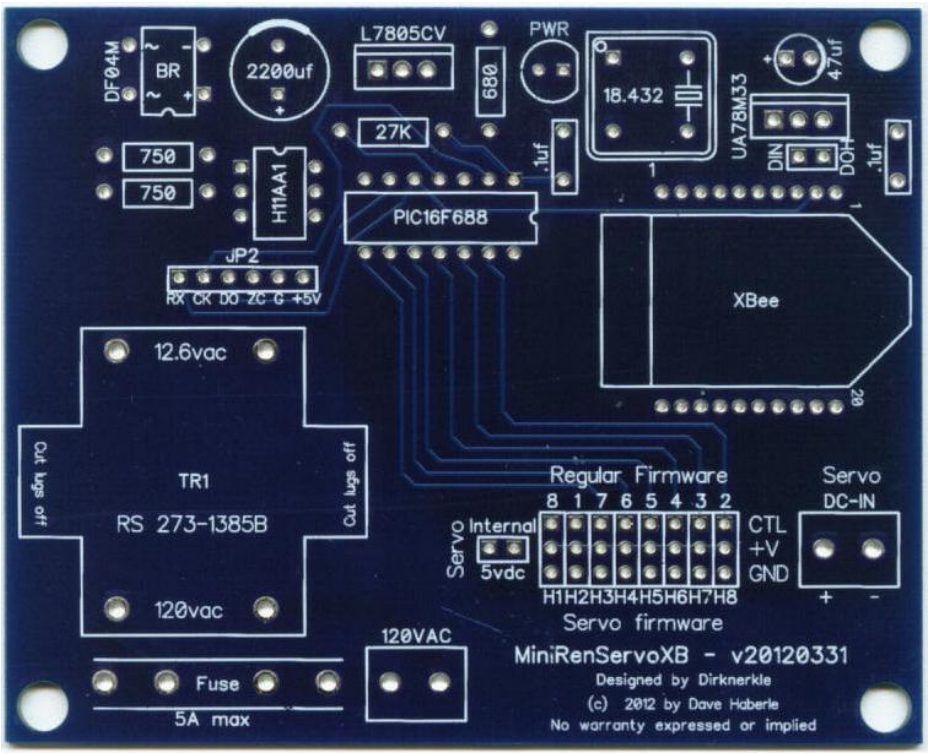
BR = Bridge Rectifier
C1 = 2200 uf capacitor
C2 = 47uf capacitor
C3, C4 = .1uf capacitor
U1 = L7805CV
PWR = Led
R1, R2 = 750 ohms
R9 = 27K ohms
R6, R10-R17 = 680 ohms
R18-R25 = 180 ohms
U3 = 18.432mhz oscillator
U4 = UA78M33
M1-M8 = MOC3023
T1 – T8 = BTA06 Triac
TR1 = transformer
JP1 = 8-pin header
JP2 = 4-pin header
DIN/DOH = 2 pin header
"N" boxes = terminal blocks
Power = terminal block



MiniRenServoXB

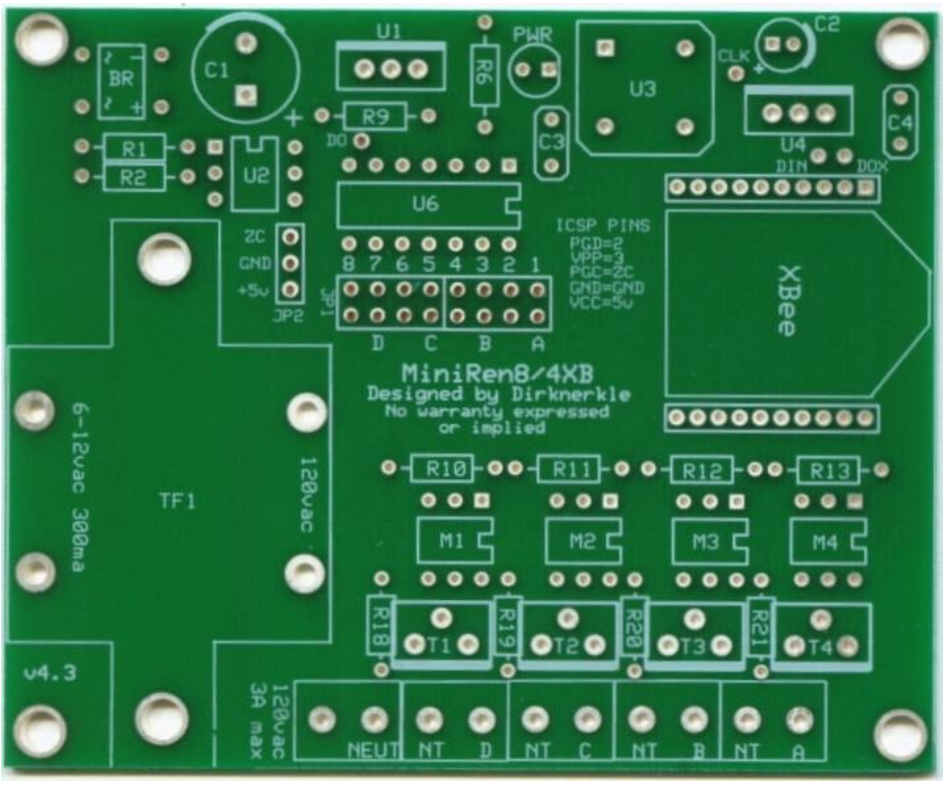
Use the breakaway header pins to populate the JP2, DIN/DOH, CTL, +V, and Servo header pin locations.

5mm terminal blocks at the 120vac and DC-IN locations.



MiniRen8/4XB

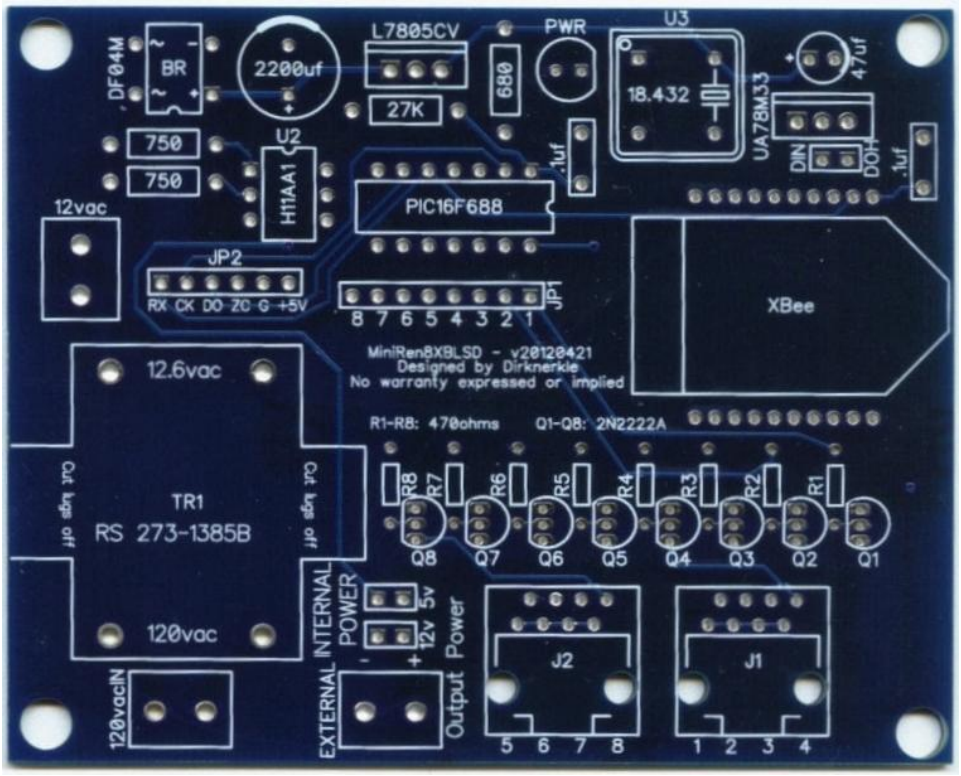
BR = Bridge Rectifier
C1 = 2200 uf capacitor
C2 = 47uf capacitor
C3, C4 = .1uf capacitor
U1 = L7805CV
U2 = H11AA1
PWR = Led
R1, R2 = 750 ohms
R9 = 27K ohms
R6, R10-R13 = 680 ohms
R18-R21 = 180 ohms
U3 = 18.432mhz oscillator
U4 = UA78M33
U6 = PIC16F688
M1-M4 = MOC3023
T1 – T4 = BTA06 Triac
TF1 = transformer
"NT" boxes = terminal blocks
NEUT box = terminal blocks
JP1 = 2 rows of 8 header pins
JP2 = 3-pin header
DIN/DOH = 2 pin header
CLK = 1 pin header
DO = 1 pin header



MiniRen8XBLSD
Use the breakaway header pins to populate the JP2, DIN/DOH and INTERNAL POWER locations.

5mm terminal blocks at the 120vac, 12VAC and EXTERNAL OUTPUT locations.

Note the board marking for resistors R1-R8 = 470 ohms, and for transistors Q1-Q8, 2N2222A type.



Common Electronic Parts for many DIY Electronic Projects

- Resistors (1/4 watt): 120, 180, 680, 750, 1K, 27K ohm
- Resistors (1/8 watt): 120, 330, 470 ohm
- Resistors (1/2 watt): 8, 9, 10, 15k ohm
- Diodes: 1N4001, 1N4004
- Diodes – Zener type: 3.3 volt, 4.3volt, 9.1 volt (1/2 or 1 watt rating)
- LEDs – red or green, 3mm type, for power/diagnostics use not displays
- Voltage Regulators: 3.3v, 5v, 12v, look for 1amp or greater
- Bridge Rectifier: DF01M, DF04M
- Non-polarized capacitors (ceramic or disc): .1uf, 1uf (50volt rating is usually ok)
- Polarized capacitors (electrolytic): 10uf, 47uf, 100uf, 2200 uf, 4700uf (25volt rating is usually ok)
- DIP sockets: 6-pin, 8-pin, 14-pin
- Header pins (breakaway type, often available in rows of 40 or 80 pins)
- Female XBee header mounts
- Fuses, fuse holders: 5x20mm, 4amp, 5amp, 7amp
- RJ45 jacks (vertical and horizontal PCB mount type)
- 18.432mhz crystal oscillators
- IC Chips: H11AA1, PIC16F688, MOC3023, ST485BN
- Jumper shunts (Mouser # 151-8000-E)
- Heat sinks (for TO220 style voltage regulators – Mouser # 532-577102B00)
- Female header/wire housing sockets (make your own jumper wires – Mouser# 538-16-02-0102)

A few good sources of electronic parts for DIY projects (some suggestions are included):

- www.mouser.com (most comprehensive supply of all products)
- www.digikey.com (broad product line, good prices on resistors in bulk rolls)
- www.alliedelec.com (broad product line)
- www.futureelectronics.com (more electronic components, good prices)
- www.futurlec.com (preassembled adapter boards, some parts)
- www.taydaelectronics.com (factory extras/overstocks, terminal blocks, fuses)
- www.newark.com (more electronic components, good prices)
- www.ebay.com (breakaway header pins, DIP sockets, terminal blocks, LEDs, bulk capacitors)
- www.radioshack.com (excellent solder, transformers, some tools, DVM's, wire)
- www.sparkfun.com (source for XBee programming tools, lots of adapters, multi-wire connection cables)
- www.seeedstudio.com (multi-wire connection cables, other adapters, retail adapters, cables)
- www.monoprice.com (cable adapters, bulk cat5 cable, connectors)
- www.sureelectronics.com (power supplies, adapters)