REN816XB

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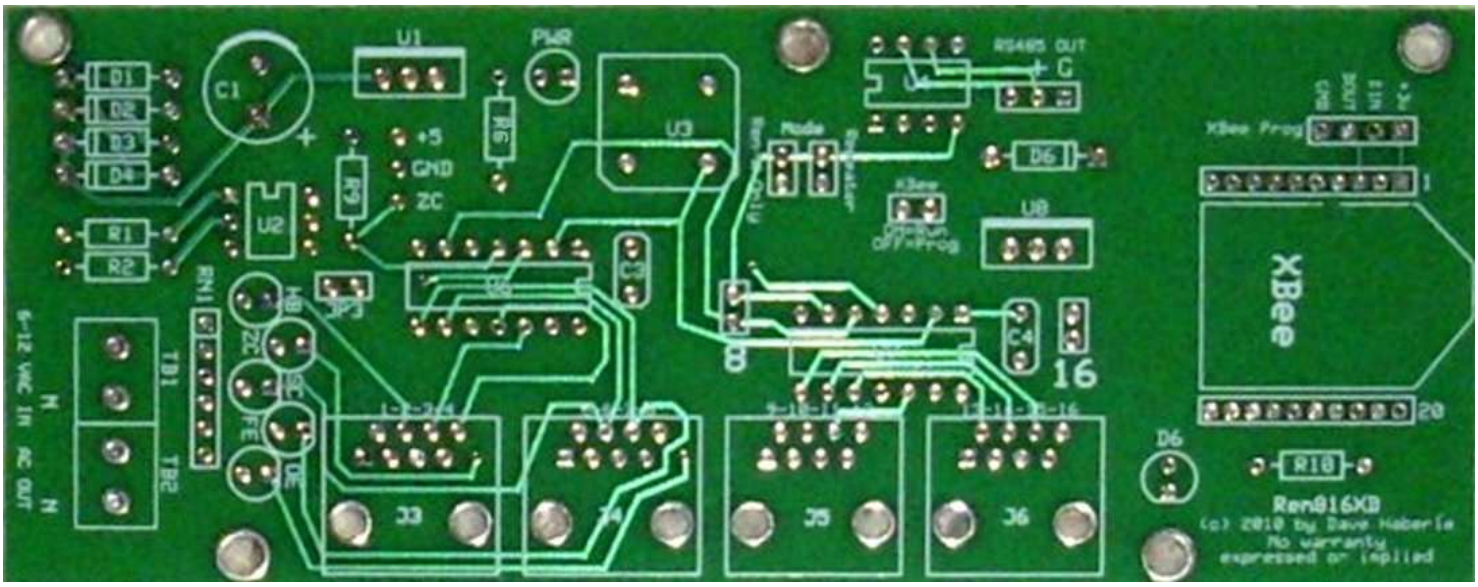


The REN816XB is a wireless 8 or 16 channel wireless data Christmas light controller. It is based on the Renard SS16 design- it's essentially the structure of an SS16, almost as if you'd taken a band saw and cut the optos, triacs and transformer off of an SS16 board (see DIYC www.doityourselfchristmas.com for details). It uses an onboard XBEE Series 1 or compatible wireless module (see http://www.digi.com/xbee/ for details). It is designed for off-board SSR modules to allow for dimming control of lights.

BOM

Use the Ren SS16 documentation as a starting place for the General BOM, component handling and assembly instructions; the parts mostly have the same silkscreen numbers. Differences noted in the following table.

Designation	SS16 / Ren816xb	Ren816xb only	QTY	Part	Notes
U1	X		1	5 VDC low dropout 500ma Voltage Regulator	511-LF50CVDG
-	X		1	Heat Sync for 5V reg	532-577102B00
U2	X		1	H11AA1 Optocoupler, Bi-Directional Input	782-H11AA1
-	X		1	6 pin socket for U2	571-1-390261-1
U3	X		1	Crystal Clock Oscillator, 18.432 MHz	815-ACH-18.432-EK
U4	X (opt)		1?	ST485 Differential Bus Transceiver	511-ST485BN
-	X		1	8 pin socket for U4	571-1-390261-2
U5		X	0	Do not populate on Rev A boards	Not used on the Rev A board, Rev B does not have a spot for this
U6, U7	X		2	PIC16F688 I/P PIC microcontrollers	579-PIC16F688-I/P
-	X		2	Pin socket for U6, U7	571-1-390261-3
U8		X	1	3.3 VDC voltage regulator	595-UA78M33CKCSE3 Note: LDO Regulators have a different pinout and do NOT directly substitute in!
-		X (opt)	1?	Heat Sync for 3.3V reg	532-577102B00
XBee		X	1	Series 1 or equiv XBee module	See notes[1]
-		X	2	2MM x 10 pin Xbee connectors	M22-7131042
D1-D4	X		4	1N5817-E3 Schottky rectifier	511-LF50CVDG
D6 above U8		X	1	3.3V 1W Zener diode	583-1N4728A-B
PWR, HB, ZC, SD	X		4	3mm green LEDs	604-WP710A10GT
FE, OE	X		2	3mm red LEDs	604-WP7104IT
D6 next to J6		X (opt)	1?	3mm blue LED (can be red or grn) Indicates XBee is powered)	604-WP710A10QBC/D
R1, R2	X		2	750Ω 1/4 watt	291-750-RC
R6	X		1	680Ω 1/8 watt[2]	299-680-RC
R10		X (opt)	1?	680Ω 1/8 watt	299-680-RC
R9	X		1	27KΩ 1/8 watt	299-27K-RC
RN1	X		1	Resistor Network, 6 pin, 330ohms 2% Common connection	264-330-RC or you can use 5 individual 330 1/8W resistors (pin 1 is common)
C1	X		1	Radial Electrolytic Capacitor 16V 2200uF 20%	140-REA222M1CBK1320P
C3, C4	X		2	Capacitor, Radial Ceramic 50V 0.1uF	80-C322C104K5R
J3 – J6		X	4	RJ45 top mount jacks	571-5556416-1
JP3, “8”, “16”, MODE x2		X	6	2 pin header blocks	649-69173-402 or 538-22-03-2021
RS485 Out		X (opt)	1?	3 pin header block for option to RS485 output to daisy chain to other Renards.	649-69190-103H
XBee Prog		X (opt)	1?	4 pin header block for XBee serial programming option	649-68002-404HLF
-		X	3	Jumper shunts	151-8000

AC In		X	1	5mm terminal jack (power in/out)	571-7969492
AC Out		X (opt)	1?	5mm terminal jack (power in/out)	571-7969492
6-12AC wall wart		X	1	1 x AC wall transformer	

[1] Series 1 Pro modules recommended as the higher power makes communication more reliable, and series 2 modules are difficult to get working in a mult-cast environment. See the DIYC Wiki for details on configuring the XBee.

[2] 1/4 watt resistors can be used in place of the 1/8 watt if desired.

Jumper options:

JP3 jumpered if you want to see the diagnostic LEDs.

"8" or **"16"** – default is "16" jumpered and "8" not jumpered.

Note: If you use the "8" jumper options, pull the 2nd PIC at U7 off the board.

The idea behind the 816 was that it could be made up as either an 8 or 16 channel board just by moving a jumper. Moving the jumper from 16 to 8 removes power from the U7 PIC and also connects the overflow output from the U6 PIC to be directed to U4 (the outbound ST485BN chip). Don't put jumpers on both 8 and 16. I suggest leaving it on 16 unless you put only one PIC on the board. If you use only one PIC, put it in U6 and then connect the jumper at "8".

XBee Jumper – default is ON=RUN for normal operation. If you remove the jumper (OFF=PROG) it allows you to reprogram the XBee modules via a serial link to via the 4 pin header marked "XBee Prog". I put it there in case the user solders the XBee directly to the board instead of using female header pins, in which case, it'd be the only way you could change the XBee's configuration. The Xbee jumper of ON=RUN should be connected when using the board. If you were reprogramming it via the 4-pin jumper, you'd want to disconnect that jumper to protect the U6 pic. That's what the ON=RUN or OFF=PROG means. If you're not going to use the 4-pin header, then you either need to connect a jumper at the XBee or just solder a wire across the Xbee ON=RUN jumper's solder pads.

MODE – default is neither jumpered.

The two MODE jumpers are curious. Usually neither would be connected. However, it's possible to use the board in a Ren-W mode ONLY by connecting the two left pins marked Ren-W Only. This routes the data from the XBee directly to the U4 ST485BN chip which can go out the RS485 OUT pins to a controller (using a special cat5 cable, of course). I included it in case it might be needed that way. Note that if you use that, you should not put a jumper at either the 8 or 16 spots -- leave them open. The board will still function as an 8-channel controller as well, but the same channel information that goes to U6 will also go out the U4 RS485 chip to the next controller, so it'd be almost like having two identical controllers using the same channels. Strange idea, I know...

The other MODE jumper turns the XBee into a repeater by feeding the extra channels back to the XBee's data input, in which case the Xbee will retransmit channels it doesn't use. This is very dangerous to jumper unless you really know what you're doing -- you could hammer all of your communications on all the wireless units if you're not careful. (A repeater must transmit to a specific radio using XBee's embedded 16-bit addressing mode, which is a completely different animal than start_address firmware in the PIC chips).

Other notes:

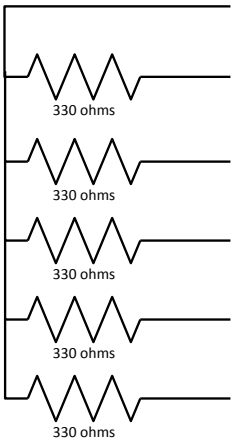
- The ST485BN chip at U4 functions as an RS485 outbound chip to daisy chain to the next board. The signal comes out the 3-pin header marked RS485 OUT. You'd connect an RJ45 cable to those pins. I left an RJ45 jack out as I had no plan to ever do it but wanted the capability just in case. If you have no need to daisy chain to another board, you can leave U4, the 8-pin DIP socket and the 3-pin header out and save yourself $2

- The R10 resistor and D6 LED are really optional. I added them just to give the board its own "blinky." All it does is blink when the power is on to the XBee module, and it just takes an extra 20ma of current or so. Leave it out and save yourself 40 cents.

- Beware substituting LDO voltage regulators as they tend to have a totally different pinout than the “standard” regulators used on this board. The regulator pinout expected by this board is:

Vin, Gnd, Vout whereas some LDO regulators are: Gnd, Vout, Vin. Pick your substitutes carefully.

- The resistor network can be replaced with 5 individual 330Ω 1/8W (or 1/4W) resistors. On the board, pin 1 for RN1 is the common that all the resistors tie to in common. The other side of each resistor goes into pads 2-6.



Firmware

The normal Renard SS firmware will work fine. Keep in mind because of the wireless nature of the board, you may need to consider setting a start address per the details in the DIYC Wiki for the SS series firmware.

Final Assembly Picture

The following is a board built by DIYC user CaptKirk. He left off the optional U4 ST485 and jumper, used individual resistors in place of the resistor network at RN1, re-purposed some TO-220 heat syncs for the regulators, and used crystal clear red, green and blue 3mm LEDs. The jumpers are also not placed yet in this picture. Finally, the empty sockets need the H11AA1, the two PICs programmed with the Renard code and the XBee radio module.