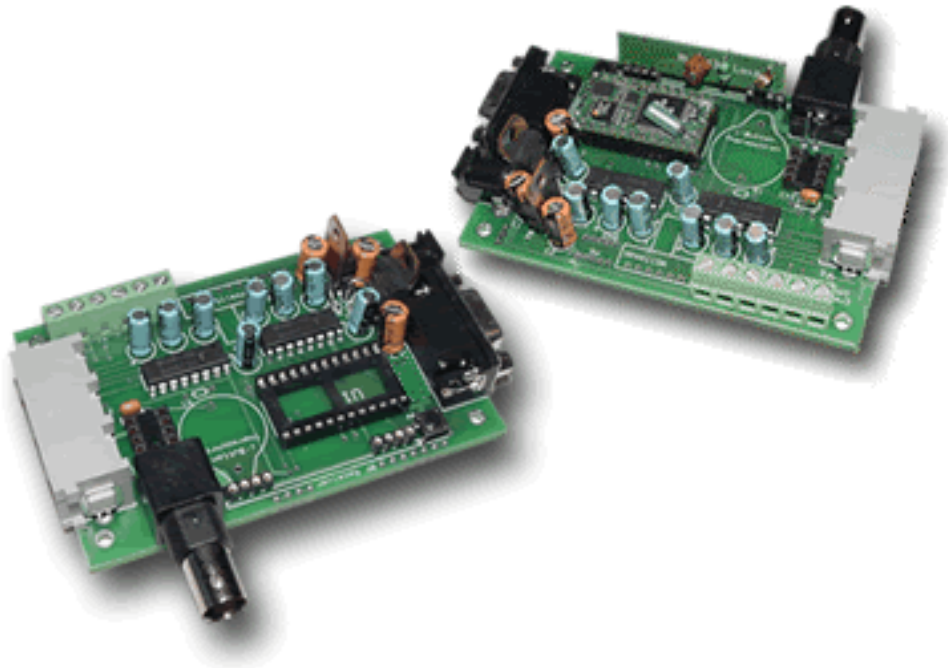# Building
the
BX24-AHT

Tips & Tricks

Use a 25W or smaller soldering iron with a pencil tip. RadioShack has a 15W iron (CAT. NO. 64-2051B) that is excellent.

While sockets are not required for the ICs, their use is advised as they allow for easy replacement and there is no need to apply soldering heat directly to the ICs.

Square solder pads are used for Pin 1 of all connectors and ICs. For other, polarized components, square pads denote the positive terminal. For polarized capacitors, the longer lead denotes positive. For diodes, the band denotes the negative (cathode) side. The end opposite the band is the positive (anode) side. See the illustrations on the following page. To align the power connector (P1), toothpicks can be inserted in one or two mounting holes, alongside the terminal, to wedge it in place until one unwedged terminal is soldered.

The voltage ratings for the electrolytic capacitors is a minimum rating. Capacitors with larger ratings are OK - those with lower ratings are not. There are "standard" values that usually cost less. The physical size of the capacitor may get too big if the voltage rating is too high. We designed for approximately 0.250 inch diameter capacitors with 0.100 inch lead spacings.

The BX24-AHT can be powered by any +12VDC, 2.1mm, center positive wall transformer with an adequate current rating. Be sure to include possible options when sizing the transformer. 100mA is adequate for the BX-24 (20mA), EDV-frq-R (4.5mA MAX), the MAX232 and SN75176B ICs. The unused pins of the BX-24 can be connected as inputs or outputs. Each can source 10mA or sink 15mA with a maximum total for all output pins of 70mA. See the NetMedia BX-24 documentation for detailed specifications. See below for the various options.

If used, the Fire-Stick II IR transmitter needs 60mA MAX. It can be powered from the +9V regulated supply for the BX-24. There are solder pads for +9V, GND, & Data to connect to the Fire-Stick II. There are also pads for +5V regulated for other devices. Use care that you do not exceed the ratings of the 7805T.

The unregulated 12VDC supply is also routed to T1 (T1-3 & T1-4) and can be used to power future RS-485 network modules. NOTE: There is no fuse in this circuit - shorts in the RS-485 modules or wiring may damage the BX24-AHT printed circuit board. We advise using an inline fuse (in the lead to T1-4) for protection. If preferred, the BX24-AHT can be powered from T1-3 & T1-4 instead of by P1.

OPTIONS:

Pin 12 of the BX-24 can be used for an IR Receiver (e.g. PNA4602M) or for a second RF Receiver, or for the DS1921 Thermochron iButton, or for Digital I/O. Pin 12 is only connected to a short trace that leads to a solder pad that can be used to connect it to any of the above devices.

If Serial Port 3 is not used, pins 9 & 10 of the BX-24 can be used for for digital I/O. Do not install the RS232 driver IC or socket and connect to the solder pads (at the driver location) that go to pins 9 & 10 of the BX-24.

If Serial Port 2 is not used, pins 7 & 8 of the BX-24 can be used for for digital I/O. Cut the traces at the RS232 driver IC or socket and connect to the extra solder pads that are on pins 9 & 10 of the BX-24.

If Serial Port 1 is not used, pins 5 & 6 of the BX-24 can be used for for digital I/O. Do not install the RS232 driver IC or socket and connect to the solder pads (at the driver location) that go to pins 5 & 6 of the BX-24.

If the RS485 network is not used, pins 15, 16 & 17 of the BX-24 can be used for Digital I/O or for 10-bit, 0-5V ADC inputs. Do not install the RS485 driver IC or socket and connect to the pads (at the driver location) that go to pins 15, 16 & 17 of the BX-24.

Pin 18 has nothing connected to it except a short trace to a solder pad. It can be used for the optional DS1921 Thermochron iButton or for for Digital I/O or for a 10-bit, 0-5V ADC input.

If the optional HIH3605 is not used, pin 19 is available for Digital I/O or for 10-bit, 0-5V ADC inputs. Connect to the center pad for the HIH3605. **WARNING: DO NOT CONNECT ANYTHING OTHER THAN THE HIH3605 TO PIN 21 (Vcc).**

The HIH3605 is affected by direct light so it is mounted beneath the BX-24. The HIH3605 must be installed before installing the socket for the BX-24. The center plastic crosspiece must be removed from the BX-24 socket to provide clearance for the HIH3605.
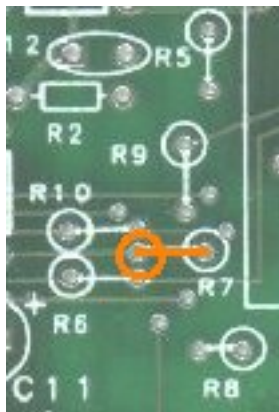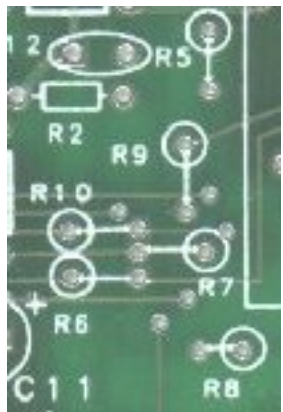
The optional DS1921 Themochron data terminal is not connected to any of the BX-24 pins. There is a short trace to a solder pad. You can connect it either to pin 12 or pin 18, depending on whether pin 12 is being used for an IR Receiver, a second RF Receiver, DIO or is unused.

The solder pads for connecting to pins 12, 18, 19 & the DS1921 are circled in red on the picture of the printed circuit board on the following page.

Diodes D1, D2 & D3 are mounted vertically. The cathode (band) side should go to the silkscreened circles on the board with the long lead going to the square solder pad.
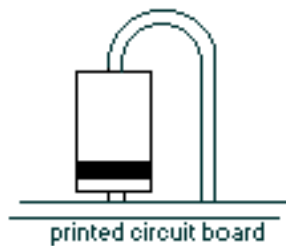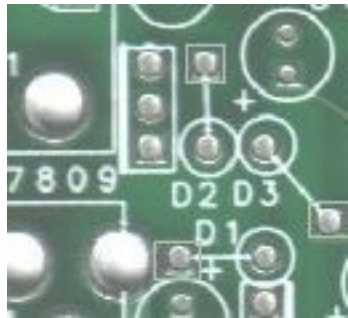
Resistors R5, R6, R7, R8, R9 & R10 also mount vertically. We suggest that the position of R7 be reversed as shown in red on the right below. This will insure that none of the leads can touch those of other resistors.

Identifying & Locating Components

Cathode −   Anode +

1N4004 DIODE

☐ Positive +
◎ Negative −
ELECTROLYTIC CAPACITOR

BX-24

Pin 1
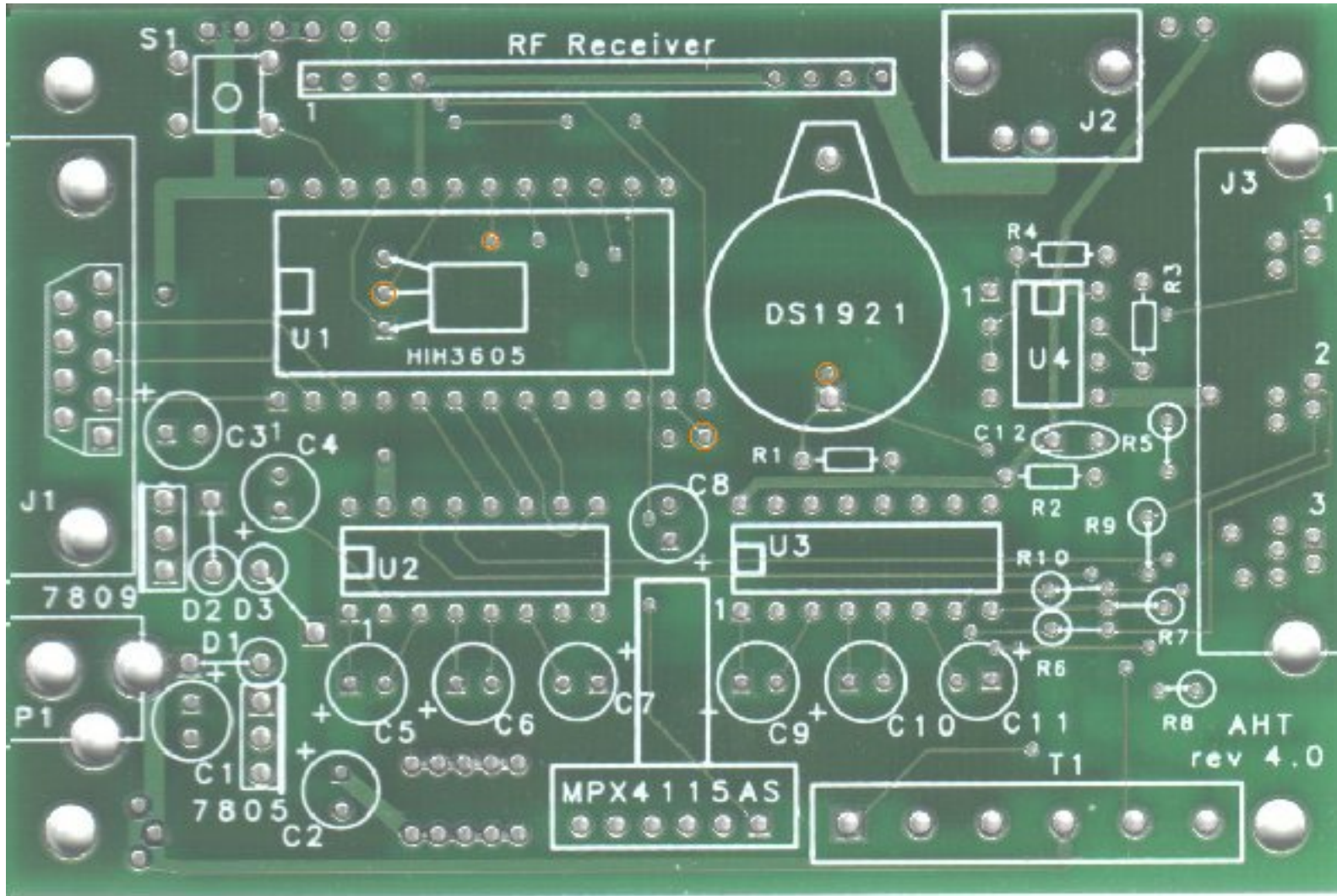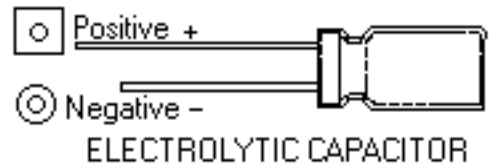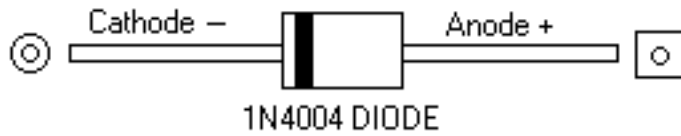
PIN 1   RF Receiver

BX24-AHT Recommended Construction Sequence

	HIH3605	humidity sensor (OPTIONAL)
	S1	reset switch
	SIP1, SIP2	RF receiver socket (See Note 1)
	U2, U3	ICL232CPE TTL/RS232 Level Converter IC (or 16-pin DIP socket)
	U4 socket	8-pin DIP for SN75176B RS485 Driver IC
	C12	0.1µF Monolithic capacitor
	U1 socket	24-pin DIP for BX-24 board
	J1	DB-9
	P1	2.1mm power connector
	D1	1N4004
	C1	47µF/50V electrolytic capacitor
	7809	+9VDC 1.5A voltage regulator (heatsink towards J1)
	D2	1N4004
	C3	47µF/50V electrolytic capacitor

Connect +12V DC wall transformer to P1. Check for +9V on Pin 24 of the BX-24 pads (nearest S1). Disconnect wall transformer

	7805	+5VDC 1.5A voltage regulator (heatsink towards C2)
	D3	1N4004
	C2	47µF/50V electrolytic capacitor

Connect +12V DC wall transformer to P1. Check for +5V at the five auxillary 5V pads near C2. Disconnect wall transformer.

	C4,C5,C6,C7, C8,C9,C10,C11	1µF/25V electrolytic capacitors
	R5,R6,R7	10K resistors
	R8,R9,R10	470 ohm resistors
	J2	BNC connector (See Note 2)
	J3	3x6P4C modular jack
	T1	6-position terminal strip

Insert the BX-24 and other ICs into their sockets.

BX24-AHT Components List

ITEM	Source	Part Number
Printed Circuit Board	Electric Dog	BX24-AHT-PCB
RF Receiver (US/Canada)	Electric Dog	RLP434-315
RF Receiver (UK)	Electric Dog	RLP434-418
RF Receiver (UK/Europe)	Electric Dog	RLP434-433.92
RS-485 Driver IC	Electric Dog	SN75176B
6' 6P4C-4P4C modular cable	Electric Dog	6P4C-4P4C-MOD-6
6' DB9 M/F cable	Electric Dog	DB9-M/F-6
S1	Mouser Electronics	101-0161
J1	Mouser Electronics	152-3409
J2	Mouser Electronics	523-31-5538-10-RFX
J3	Mouser Electronics	154-6413
T1	Mouser Electronics	651-1729160
P1	Mouser Electronics	163-5004
7805	Mouser Electronics	511-L7805ACV
7809	Mouser Electronics	511-L7809CV
D1-D3	Mouser Electronics	625-1N4004
C1-C3	Mouser Electronics	75-515D50V47
C4-C11	Mouser Electronics	140-XRL25V1.0
C12	Mouser Electronics	75-1C10X7R104K050B
R5-R7	Mouser Electronics	299-10K
R8-R10	Mouser Electronics	299-470
SIP socket *	Mouser Electronics	575-193108
8-pin DIP socket	Mouser Electronics	571-26404634
(2) 16-pin DIP socket	Mouser Electronics	571-26403584
24-pin DIP socket	Mouser Electronics	571-3902621
(2) RS-232 Driver IC	Mouser Electronics	570-ICL232CPE
BasicX-24 MCU board	Peter Anderson	BX-24
* *Cut into two 4-pin SIPs*		

The BX-24 is also available from NetMedia.

URLs

Electric Dog: http://www.myelectricdog.com
Mouser Electronics: http://www.mouser.com
Peter Anderson: http://www.phanderson.com
NetMedia: http://www.basicx.com

No License Required: The RF receiver subassembly modules do not require licensing when used in accordance with low power devices used for remote control applications per Part 15 Title 47 of FCC rules & regulations. For further information in the USA, please contact the FCC at: http://www.fcc.gov

FOR USE OUTSIDE OF THE U.S.A. It is the responsibility of the end-user to be aware of the regulations, and requirements in their area of operation and application.

Options

Battery-backed RTC & Temperature Sensor		
Item	**Source**	**Part Number**
R1 iButton Clip Thermochron iButton	Mouser Electronics Dallas Semiconductor Dallas Semiconductor	299-4.7K DS9094F DS1921L-F52
Barometer		
Item	**Source**	**Part Number**
Barometric Pressure Sensor	Peter Anderson	MPX4115A
Infrared Transmitter		
Item	**Source**	**Part Number**
IR Transmitter	Reynolds Electronics	Fire-Stick II

URLs

Dallas Semiconductor: http://www.ibutton.com/ibuttons/index.html
Peter Anderson: http://www.phanderson.com
Reynolds Electronics: http://www.rentron.com

Tuning the RF Receiver

Once you have constructed the BX24-AHT, connected the antenna, have it under power, and have downloaded the firmware, it is time to tune the RF receiver. The EDV-310-R, EDV-418-R & EDV-434-R receivers come from the factory pretuned and should need only a slight tweaking.

The green LED on the BX-24 will go out whenever the BX24-AHT is processing an RF code. You can use this feature to do coarse tuning. Clamp a button down on a palmpad or other RF remote and tunable coil until you see the LED light flicker off as it receives and processes RF codes. Keep the transmitter 5 to 6 feet from the receiver.

Use a non-metallic screwdriver for the adjustments. If all you have is a metallic screwdriver, make small adjustments and remove the screwdriver (and your hands) from the area of the receiver to test after each adjustment.

After the coarse tuning, you can fine tune the receiver by using the RF signal strength reported to the output window. Tune to maximize the number in the [brackets]. Repeat with the transmitter 20 feet or more away. Make small adjustments and move away from the receiver and out of the line of sight for the readings. If you are close to the receiver your body can affect reception.

Since this procedure will tune the RF receiver to the specific transmitter used, you should use the transmitter that will normally get the most use or that will be furthest from the antenna.

The initial tuning can be done using a 9 inch length of hookup wire as the antenna. Just insert it in the center of the BNC connector and leave it horizontal.

Once you have connected a permanent antenna, tweak the tuning again for maximum signal strength with a transmitter located 20 feet or more from the antenna and receiver.