■ **LEVEL RATING SYSTEM**

To find out the level of difficulty for each of these projects, turn to our ratings for the answers.

● ○ ○ ○ . . . . Beginner Level

● ● ○ ○ . . . . Intermediate Level

● ● ● ○ . . . . Advanced Level

● ● ● ● . . . . Professional Level

I had planned on showing you how to add an LCD receiver satellite in this series, but before I do, I need to show you how to utilize the new Maxstream Series 2 XBee modules.

Maxstream no longer supports mesh networking utilizing the original XBee modules.

CONTROL YOUR WORLD

Build a Wireless Weather System: Final Fixes and Options

Mesh Network Options

This project series has been one of my most popular so I wanted to make sure you know your options in completing the different projects.

• *OPTION 1:* If you have not yet purchased your XBee modules, purchase the XBee Series 2 modules. There are only a few differences in the setup, of which I will be going into shortly.
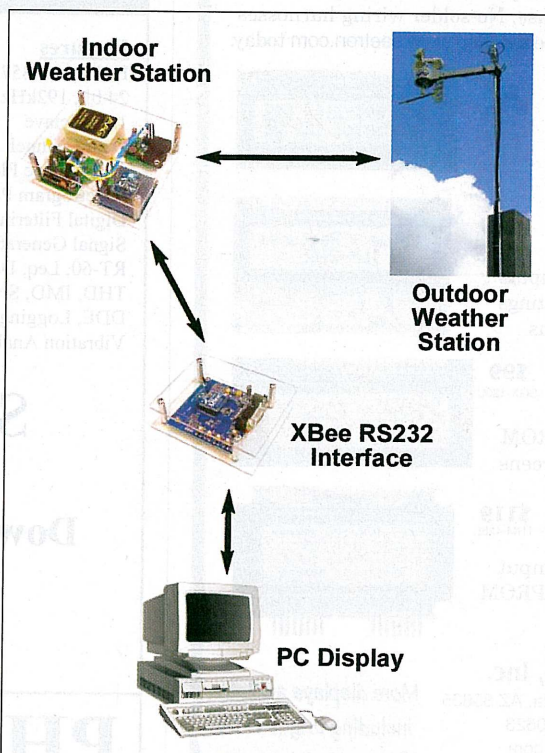
• *OPTION 2:* If you have already purchased Series 1 modules, you need to check to see if they are Rev A or Rev B. You can tell which type by looking at the sticker on the underside of the module. All Rev B modules have a REV-B on the sticker as shown in Figure 2.

If you have REV-B, you need to return the module. These modules cannot be used to create a mesh network. Contact your point of purchase first to see if you can return the modules. If they will not take the modules back, contact customer support at **www.Maxstream.net**.

If you have REV-A, you can contact customer support at **www.Max stream.net** and they will send you the firmware files I utilized in the first part of this series.

• *OPTION 3:* The new series 2 modules are compatible with the series 1 development boards. If you purchased one of these boards or starter kits, you have the option of simply purchasing the individual Series 2 modules.

Maxstream has indicated to me that the Series 2 modules are mesh

■ FIGURE 1. System diagram showing the major players and the movement of data between them.

Labels in figure:
- Indoor Weather Station
- Outdoor Weather Station
- XBee RS232 Interface
- PC Display

■ FIGURE 2

■ FIGURE 3

network only and do not support the 802.15.4 Point-to-Point protocol of the original modules. On the flip side, the original modules are 802.15.4 only and no longer support mesh networking.

I will be doing various point-to-point articles in the future so that you *will* be able to utilize the Series 1 modules.

I also wanted to let you know that at the time of this writing, the XBee Pro Series 2 module was not available. However, it should be available by the time this article goes to press. Once I get my hands on one, I will let you know how it works.

Series 2 Development Kit

All right, you know your options. I wanted to go into some detail on how to set up the new series 2 modules. Maxstream sells a development kit that's a perfect match for our weather station. Shown in Figure 3, the kit comes with five development boards. You get two USB and three RS-232 boards. The USB boards are actually RS-232 boards with USB-to-serial converters built in so that when the drivers are installed, they create new COM ports for our software to use.

The kit also comes with five XBee modules.
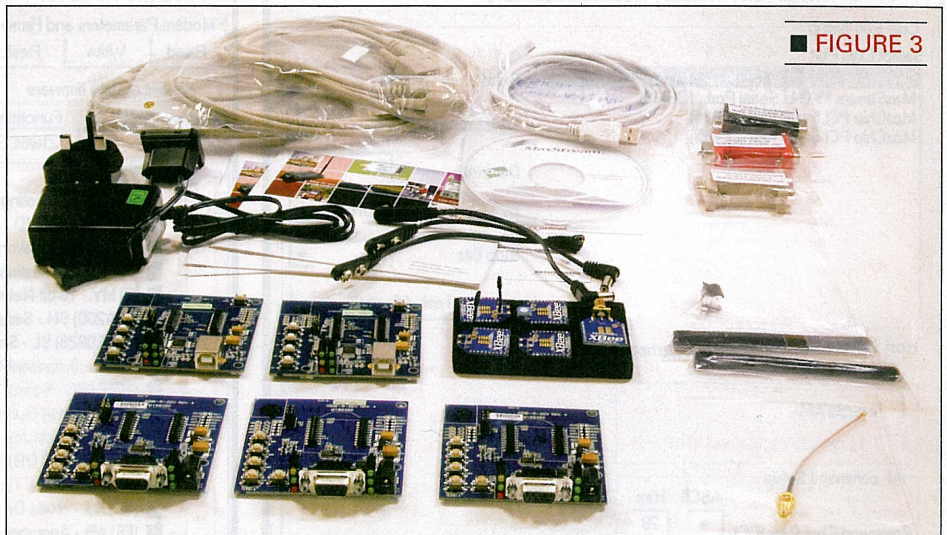
- One XB24-BCIT-004 – chip antenna
- Two XB24-BWIT-004 – wire antennas
- One XB24-BUIT-004 – UFL connector
- One XB24-BSIT-004 – SMA connector

The UFL connector is perfect for routing an antenna outside an enclosure. The development kit comes with a small UFL-to-SMA adapter cable that will connect this module to one of the included SMA antennas. The SMA connector based module can be connected directly to one of the included antennas. We will use both of these configurations for our weather station.

Configuration

To get you started, I am going to create a coordinator and a router/end device so that we can get our weather network up and running. I will be using the development kit
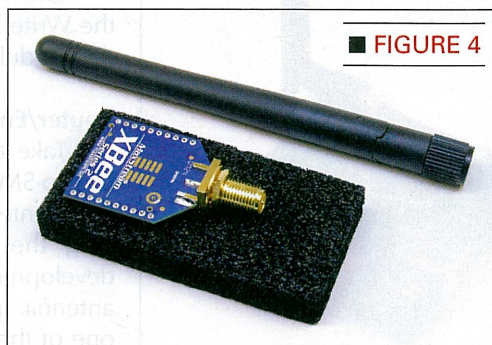
for my examples. You can use any module or development board.

Coordinator Setup

Start by selecting the SMA based module and an SMA antenna as shown in Figure 4. Plug the module into one of the development boards and attach the antenna. I'm going to use one of the RS-232 development boards. I also recommend attaching the board to a plastic base in order to keep from shorting out if you happen to place it on top of something. I often also add a top base, as well for further protection as shown in Figure 5.

I am going to set this module up as a coordinator. Later, we will use the

■ FIGURE 4

■ FIGURE 5

■ FIGURE 6

■ FIGURE 7
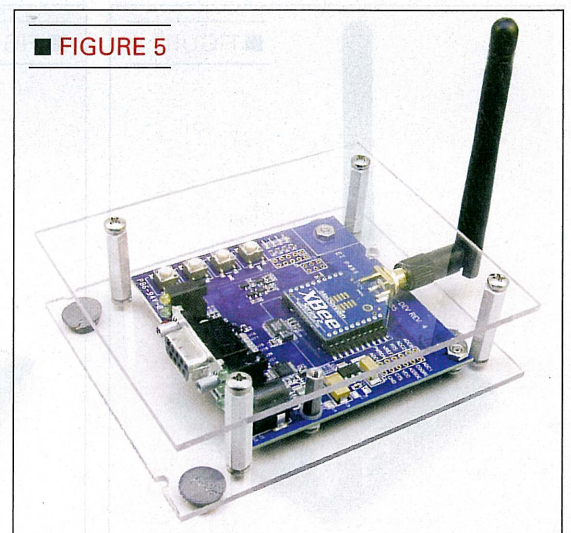
■ FIGURE 8
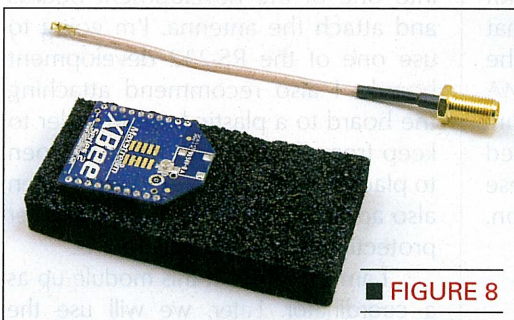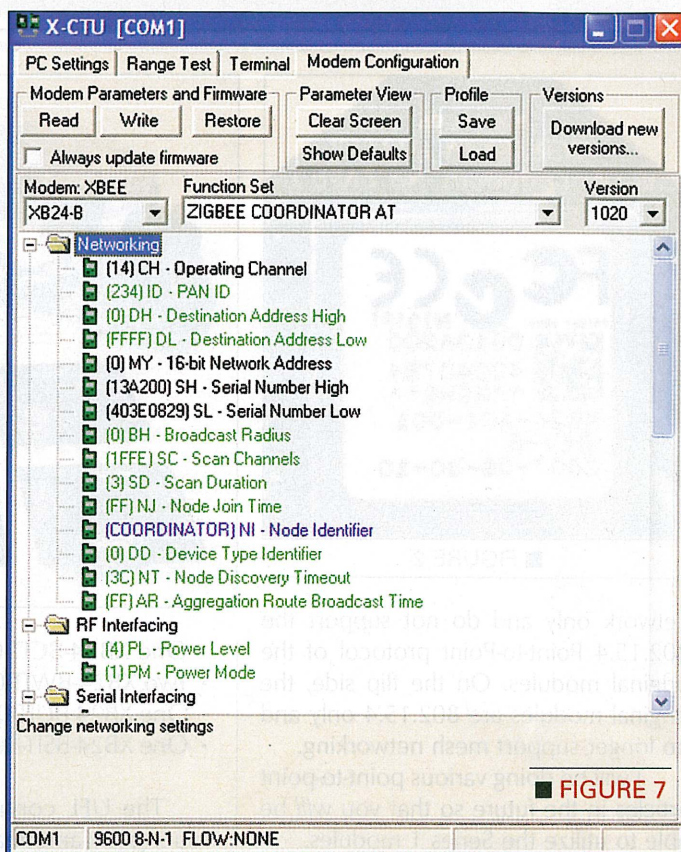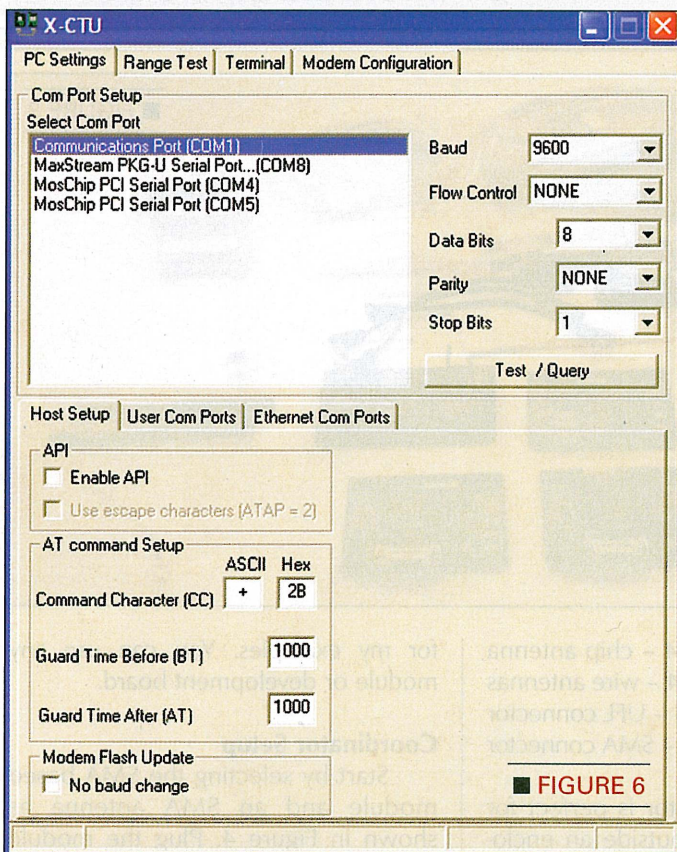
■ FIGURE 9

■ FIGURE 10

module in our coordinator satellite. Load up the X-CTU software and select the com port that is associated with the RS-232 development board as shown in Figure 6.

Apply power to the RS-232 development board (included in the kit). Select the Modem Configuration tab and hit the read button. Once the read is complete, select the ZIGBEE COOR DINATOR AT function set as shown in Figure 7 and hit the Write button.

Once the write is complete, hit the Read button. You need to set a few of the parameters. You can do this manually or use the XB2coord.pro file included in the downloads.

The fields that are changed include the following:

- PAN ID = 234
- Destination Address Low = FFFF
- Node Identifier = COORDINATOR
- Packetization Timeout = 25

Once the values are changed, hit the Write button. Make sure you label the module so you can keep track.

Router/End Device Setup

Take the UFL based module, the UFL-to-SMA adapter cable, and an SMA antenna as shown in Figure 8. Plug the module into one of the development boards and attach the antenna. In this case, I'm going to use one of the USB development boards.
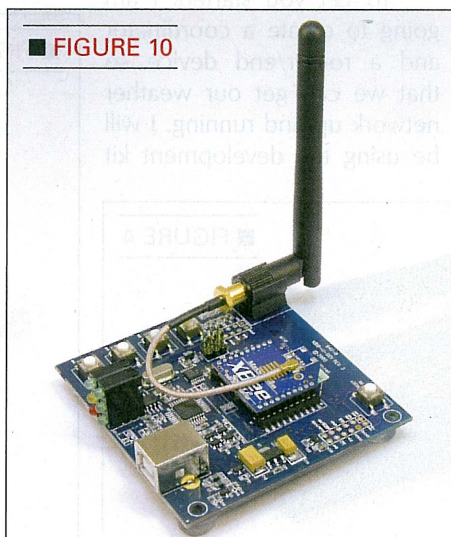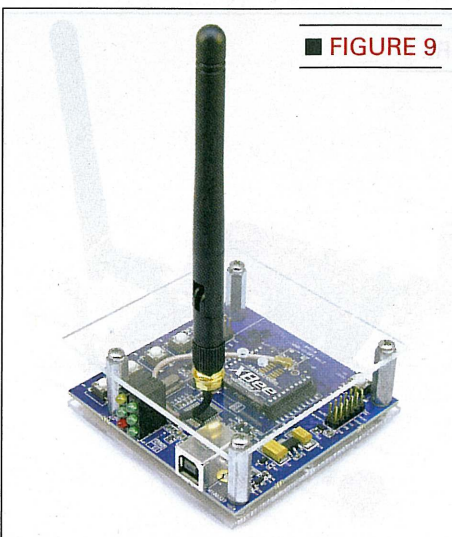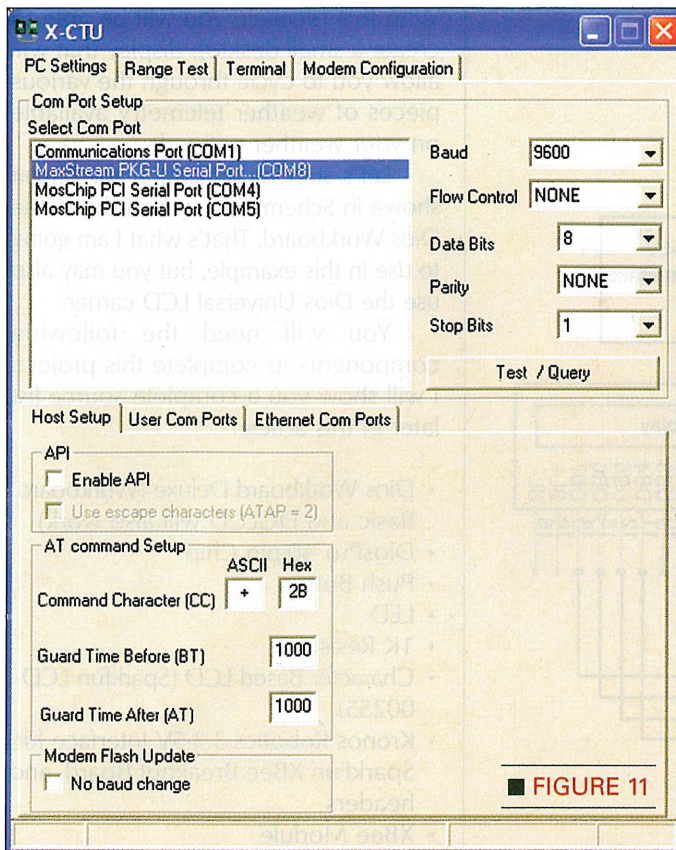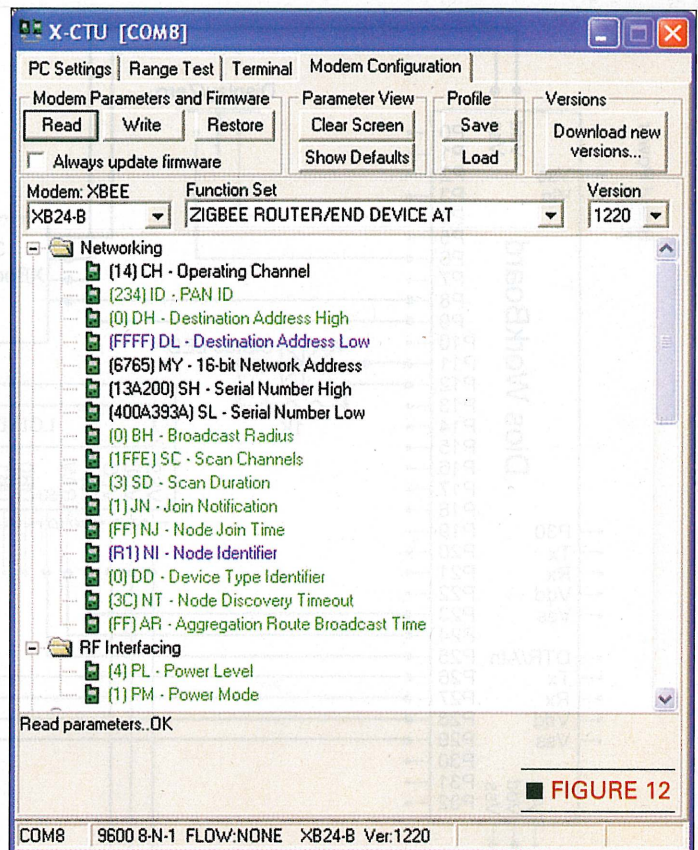
■ FIGURE 11

■ FIGURE 12

In order to use the SMA antenna with this module, you have two choices. First, you can mount the development board between two pieces of plastic and drill a hole to install the SMA side of the adapter cable as shown in Figure 9. You can also attach the small antenna clip (included with the kit) and route the adapter as shown in Figure 10. I also added some small rubber feet to this board in lieu of the plastic base. This particular module and development board will be used as my PC Weather Satellite.

Load up another copy of the X-CTU software and select the COM port that is associated with the USB development board as shown in Figure 11. The USB boards will have the name "MaxStream PKG-U Serial Port."

You won't need to apply power to this board. It gets its power from the USB port. Select the Modem Configuration tab and hit the Read button. Once the read is complete, select the ZIGBEE ROUTER/END DEVICE AT function set as shown in Figure 12 and hit the Write button.

Once the write is complete, hit the Read button. You need to set a few of the parameters. You can do this manually or use the XB2rout.pro file included in the downloads.

The fields that are changed include the following:

• PAN ID = 234
• Destination Address Low = FFFF
• Node Identifier = R1
• Packetization Timeout = 25

Once the values are changed, hit the Write button. Make sure you label the module so you can keep track.

Note that each router will need to have a different Node Identifier. I used R1-Rn in my network. It does not really matter what you use as long as they are different.

You may want to repeat the ROUTER/END DEVICE procedure just mentioned for all the remaining modules you are going to use in your network. You can utilize any of the

development boards for this.

Quick Test

At this point, you should be able to open the Terminal tab on each of the X-CTU software instances and type messages back and forth.

Indoor Weather Satellite Revisit

Once the new series 2 modules are configured, they are plug compatible in the weather satellites that I have described in the previous articles in this series. However, you may want to make
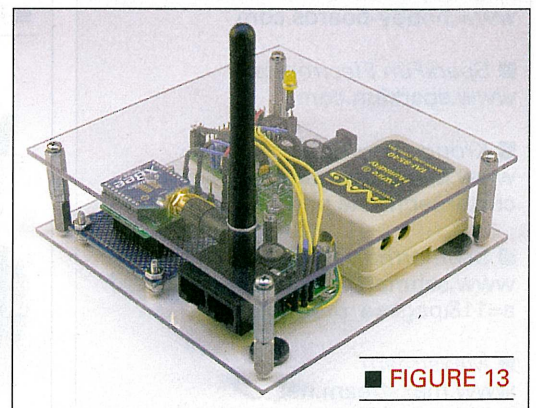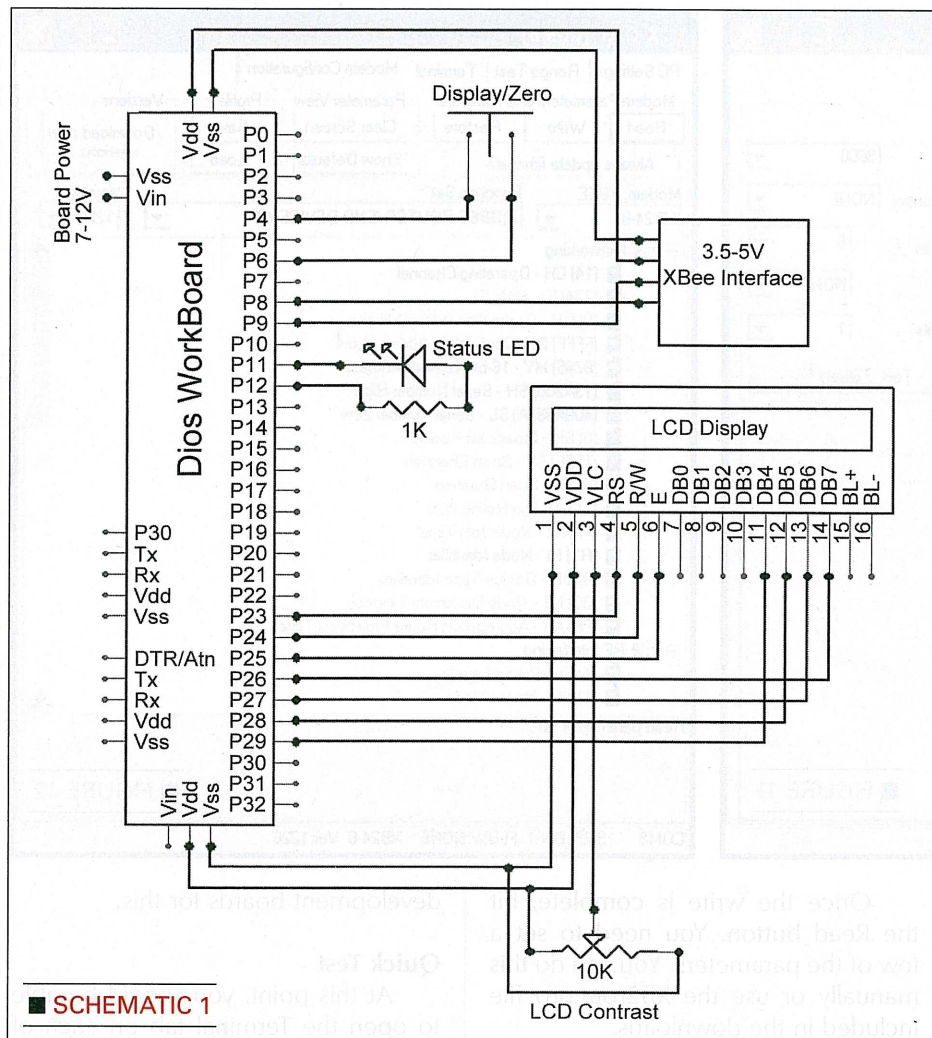

■ FIGURE 13

■ SCHEMATIC 1

With this receiver, you will be able to create a small desktop display that will allow you to cycle through the various pieces of weather telemetry available on your weather network.

Let's start by looking at the circuit shown in Schematic 1, which shows the Dios Workboard. That's what I am going to use in this example, but you may also use the Dios Universal LCD carrier.

You will need the following components to complete this project. I will show you a complete source list later in this article.

- Dios Workboard Deluxe (Workboard Basic and DGLCD will also work)
- DiosPro 40-pin Chip
- Push Button
- LED
- 1K Resistor
- Character Based LCD (Sparkfun LCD-00255)
- Kronos Robotics 3.3-5V Interface Kit, SparkFun XBee Breakout Board, and headers
- XBee Module
- Free DiosPro Compiler

• _STEP 1:_ Build the Kronos Robotics 3.3-5V interface kit and XBee breakout board. If you are going to use this with a breadboard as I have done in Figure 14, make sure you install the five-pin header on the bottom of the board. If you will be mounting it in a more permanent enclosure, placing the header on top and using jumpers is a better choice.

Wire the interface according to Schematic 1. You don't need to attach the LCD at this time. Take the button and attach it to ports 4 and 6. As an option, attach an LED and resistor combination to ports 11 and 12.

• _STEP 2:_ Included in the downloads for this article is a program called WeatherReceiver.txt. Start the DiosPro compiler and load, then program the WeatherReceiver.txt file into the chip. Whenever the XBee module receives any kind of signal, the green LED on the interface will light. When a valid weather packet start indicator is received, the optional LED on ports 11 and 12 will light. As weather packets

a few changes to accommodate the SMA antenna. Figure 13 shows how all that is needed is a small hole drilled in the upper base. Other than that, the electrical connections are the same.

LINKS

■ _Hobby Boards_
www.hobby-boards.com

■ _SparkFun Electronics_
www.sparkfun.com

■ _Kronos Robotics_
www.kronosrobotics.com/xcart/
customer/home.php

■ _SchmartBoard_
www.schmartboard.com/index.asp?
a=11&page=a_products

■ _Maxstream_
www.maxstream.net

Build the LCD Weather Receiver

Last time, I showed you how to use the protocol to create your own customizable satellites. Let's use that knowledge to create an LCD receiver.

■ FIGURE 14

are received, the readings will be displayed in the debug window as shown in Figure 15.

• *STEP 3:* Attach the LCD as shown in Figure 16 and load the program called LCDreceiver1.txt. The data will now appear on the LCD display. Use the button to cycle through the different displays. I have included another program called LCDreceiver2.txt. In this file, rain and lightning data is displayed.

By holding the button down until the status LED changes, you can zero out the rain or lightning totals. If you want to add these features to your weather station, you will have to add them to your outdoor satellite, as well. Some of the code from previous articles has this included; it's just a matter of adding the correct ROM for your 1Wire boards or chips.

You may also use the Dios Universal LCD carrier as shown in Figure 17. This has a much smaller footprint so you will need to mount the

■ FIGURE 15
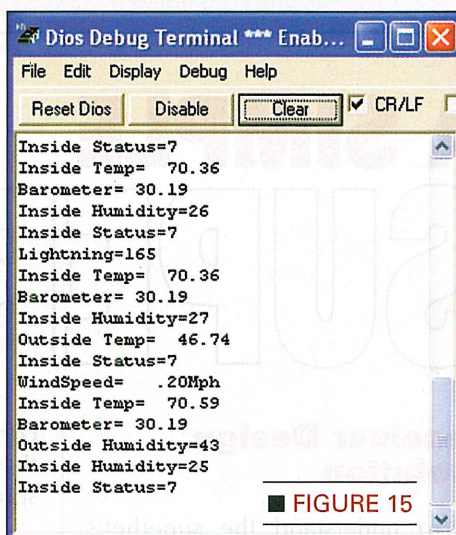
XBee interface on the bottom.

Final Thoughts

There is a ton of room for expanding the wireless weather station. It is even possible to utilize the system for controlling various aspects of your home. Some time in the future, I plan on writing a article where I have created an integrated thermostat that

■ FIGURE 16

■ FIGURE 17
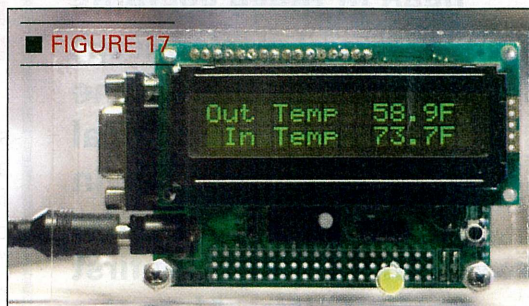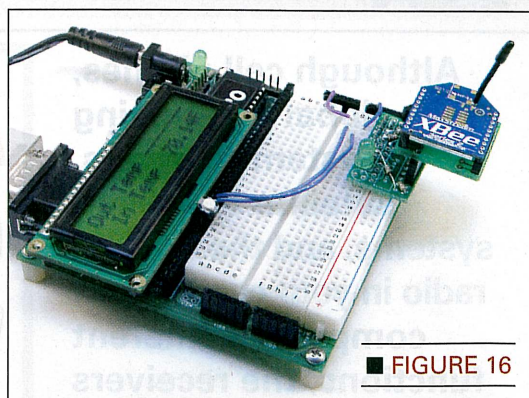
controls my home heating system.

Be sure to check for downloads and updates at **www.kronosrobot ics.com/Projects/wirelessweather. shtml**. **NV**

PARTS LIST

The following is a breakdown of the sources for all the components needed for this part of the project.

MAXSTREAM
❑ Series 2 Development Kit #XB24-BPDK
www.maxstream.net/products/xbee-series-2/dev-kit-zigbee.php

HOBBY BOARDS
❑ Lightning Detector
www.hobbyboards.com/catalog/produ ct_info.php?cPath=22&products_id=65

SPARK FUN ELECTRONICS
❑ XBee Breakout Board (Used to build various interface boards)
www.sparkfun.com/commerce/prod uct_info.php?products_id=8276

❑ 2 mm Connectors (You need two for each breakout board)
www.sparkfun.com/commerce/prod uct_info.php?products_id=8272

❑ 2x16 Character LCD Black on Green
www.sparkfun.com/commerce/prod

uct_info.php?products_id=255

❑ 2x16 Character LCD White on Black
www.sparkfun.com/commerce/prod uct_info.php?products_id=709

KRONOS ROBOTICS
❑ DiosPro 40 chip
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16428

❑ Dios Workboard Deluxe
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16452

❑ Dios Workboard Basic
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16453

❑ Dios Universal LCD Carrier
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16410

❑ 3.3V to 5V Interface Kit
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16537

❑ 1K Resistors

www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16178

❑ Red LED
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16234

❑ Push Button
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16244

❑ 40 Pin Male Header
www.kronosrobotics.com/xcart/cus tomer/product.php?produtid=16290

❑ Free Dios Compiler (Includes 1Wire libraries)
www.kronosrobotics.com/down loads/DiosSetup.exe

SCHMARTBOARD
❑ Jumpers 5" Yellow
www.schmartboard.com/index.asp? a=11&id=42

❑ Jumpers 3" Red
www.schmartboard.com/index.asp? a=11&id=41