



# APPLICATION NOTE

TELULAR SX5 SERIES PHONE CELL & XPERT2/9210B SPEECH MODEM (OR 8210-3014 MODEM)

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## TELULAR SX5 SERIES PHONE CELL & XPERT2/9210B SPEECH MODEM

(OR 8210-3014 MODEM)



### APPLICATION NOTE

**May 2008**

Prepared by:

Integrated Systems Division

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## 1. OVERVIEW

The Telular PhoneCell SX5 series is a tri-mode (CDMA/GSM/PCS/AMPS) cellular modem capable of supporting Voice, FAX and Data operation. Analog Speech Voice operation is supported in all modes. This makes the Telular PhoneCell best suited for applications requiring voice announcements of weather related sensor conditions or alarm voice announcements to a destination phone connection.

The Telular PhoneCell is a fixed wireless terminal (FWT). These FWT devices are based on Telular's proprietary RJ-11 to cellular interface technologies. This allows connection to the Sutron XPert Voice Modem (P/N-8080-0005-1) using a standard RJ-11 cable connection. This same connection idea will work with the 8210-3014 together with the Sutron supplied RJ11 pigtail interface connector for the side terminal strip on the 8210.

Data operations with the Phonecell are dependent on several factors including your local cellular service provider. Because most CDMA/TDMA and PCS networks do not support digital fax and data services, AMPS 800 MHz networks or AMPS 800 MHz channels on TDMA 800 MHz networks are used for fax and data services. Contact your local cellular dealer or service provider to determine the availability of an AMPS analog network. Other cellular products are best suited for data only applications.

The Sutron XPert Voice Modem will allow voice communication with the XPert and XLite 9210 Data Loggers. User's may dial in and obtain real-time readings via voice reports. Voice reports of alarm conditions previously defined by the user can be transmitted to up to three different phone numbers by the XPert or XLite dialing out using the Phonecell FWT.

While the FWT can use either the Sutron XPert, 9210 XLite Data Logger or the 8210-3014 speech modem equipped data logger, the two sections below are based (section 3) on the use of the 9210 XLite or (section 4) the 8210 unit. The following sections present:

The required equipment and options

- ▶ Equipment cable connections and equipment specifications
- ▶ Instructions for setting up cellular service and the FWT
- ▶ Instructions for setting up the XPert Voice Modem
- ▶ Instructions for setting up a 9210 XLite Data Logger to use the XPert Voice Modem.
- ▶ Instructions for programming the 9210 can be found in the XLite 9210 Users Manual. A copy this manual for download at:

[www.sutron.com/DownloadsUpdates/9210 User Manual](http://www.sutron.com/DownloadsUpdates/9210 User Manual)





## 2. EQUIPMENT & OPTIONS

The application requires the following equipment:

	Part Number	Description
1	9210-0000-1A	9210 Datalogger
2	8080-0005-1	XPert Voice Modem
3	SX5X-XX	Phonecell SX5 series FWT with RJ-11, RJ11 cables, AC power cable
4	8210-3014-1A	8210 Data Logger with Speech Modem

*PHONECELL*<sup>®</sup> is a registered trade mark of the Telular Corporation.

The FWT is typically supplied with an eight (8) inch omni antenna. The antenna input connection of the FWT is a TNC female connection. This antenna is suited for use in areas with strong cellular service signal. The following antenna options are available:

- ▶ 8111-1168-1 Antenna, YAGI, 800MHz, 6db w/15ft RF cable
- ▶ 8111-1168-2 Antenna, ONMI, Dual Band 800-1900 MHz, 2db w/15ft RF cable
- ▶ 8111-1168-3 Antenna, YAGI, 1900MHz, 6db w/15ft RF cable

Each includes a coaxial surge protector and 3ft TNC male to type N male jumper cable to interface from the type N female protector to the antenna.

## 3. EQUIPMENT CONNECTIONS

The equipment configuration consists of a 9210 Datalogger, an XPert Voice Modem, and a SX5 series cellular FWT.

The XPert Voice Modem will be connected to Com3 of the 9210. A straight DB-9 modem cable should be used. Com3 is configured to provide +5VDC power to the modem on pin 9. If Com2 is used, power to the modem must be provided externally. The cellular modem transceiver will be connected to the XPert Voice Modem using an RJ-11 connection. The cellular modem has an RJ-11 receptacle on its side, connect a cable from this port to either of the RJ-11 receptacles of the Sutron XPert Voice Modem.

Therefore, XLite 9210 connects to the XPert Voice Modem through a standard DB-9 modem cable. The XPert Voice Modem connects to the SX5 FWT via a standard RJ-11 phone cable.



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Figure 1. Connection example.

Typical connection points including the supplied GPS antenna are shown in Figure 1. Follow the instructions in the SX5T owners manual for further mounting information. On most installations the battery switch will be set to AC input to power the unit normally.

The internal batteries are used to supply power to the FWT in a emergency NON-AC input condition just like a normal land line. This may be important in critical placement installations of the FWT. The batteries should be installed BEFORE mounting in a wall configuration for example. Note that the FWT will NOT charge the internal batteries so pure Alkaline units are recommended by Telular for most installations instead of chargeables.

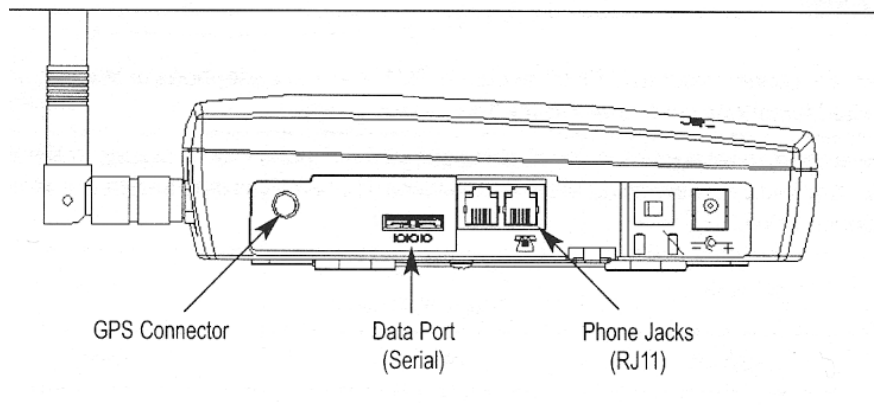


Figure 2. Connections on the side of the SX5 series modem



## 4 EQUIPMENT SPECIFICATIONS

### 4.1 SX5T CELLULAR MODEM FEATURES

- ▶ Exceptional voice quality with echo cancellation and digital voice/data privacy
- ▶ DTMF and pulse-dial capability
- ▶ External low voltage power supply supplied with unit
- ▶ Built-in signal strength indication and self monitoring capabilities for user diagnostics
- ▶ Easily programmed using ordinary RJ11 based analog telephone
- ▶ 4.1.1 SX5T Specifications
- ▶ Air Interface Standard
- ▶ GSM for the SX5e units
- ▶ CDMA for the SX5T units
- ▶ PCS for all
- ▶ 800 MHz AMPS (ANALOG)

#### 4.1.1 SX5T Specifications

##### Air Interface Standard

- ▶ GSM for the SX5e units
- ▶ CDMA for the SX5T units
- ▶ PCS for all
- ▶ 800 MHz AMPS (ANALOG)

**Transmit Power** Maximum 600mW

**Operating Voltage** AC 115/230V to 7.1VDC at 1.7A unit supplied.

**Environment** *Operating temperature range: -10C to +50C*  
*Storage Temperature Range: -25C to +65C*

**Humidity** 5% to 95%

**LED Indicators** Power Status indication for good AC voltage.  
Cellular service Status LED.  
RSSI 3 LED Status Indications in the upper right of the units.  
ON Hook/OFF Hook for stuck cable indicator.

**SX5 series Connectors** RJ-11 interface jack for data/voice (Accepts dual RJ-11 phone line connector.)  
Proprietary serial cable #1L01A042 connection available separately.



## 4.2 XPert Voice Modem Features

- ▶ Wave file circuitry in XPert/XLite allows programming of unit in various languages for transmissions by voice announcements using the FWT in the voice mode.
- ▶ RS 232 interface, bit rate to 115200 communications with XPert/XLite and FWT data mode
- ▶ Voice playback and record
- ▶ DTMF (Dual Tone Multi-Frequency) Decode
- ▶ -40°C to +85°C extended operating temperature
- ▶ V.42,MNP 2-4 and 10E-C error correction
- ▶ V.42bits, and MNP-5 data compression
- ▶ Auto power up on ring with 60 second timer
- ▶ DLG- Digital Line Guard Protection (Modem has built in Digital Line Guard Circuit that automatically detects an over current on the Tip and Ring pins thus protecting the modem in case it is accidentally connected to a Digital telephone Line).

### 4.2.1 XPert Modem Specifications

- ▶ RS232 interface, baud rate up to 115200
- ▶ V.90, 56kpbs data receiving
- ▶ V.34, 33.6 kbps data sending and receiving
- ▶ DTMF decode
- ▶ Power jumper selectable, +5 + 0.25V 0.5A minimum or +12 +3 V 0.5A minimum



## 5 SX5T CDMA CELLULAR MODEM ACTIVATION

Selection of a cellular service provider involves several considerations including: signal strength at the remote site, system type (CDMA\PCS\AMPS), and service plan cost. Most established services started with AMPS and are required to maintain this service. Digital data service may be available and may be at a lower cost. Consult your service providers in the area of the station to determine the best selection. Once a service provider has been selected and service has been initiated, the FWT needs to be programmed for the system.

**NOTE! NEVER EVER** wire the RJ11 connectors of the FWT to a regular land line RJ11 jack. This land line high voltage will seriously damage the input circuits of the FWT.

The FWT is programmed with an ordinary tone-dial (DTMF) telephone, which is sometimes referred to as POTS (Plain Old Telephone Service) phone. The following steps provide a typical programming setup. Consult the Phonocell User Manual for the detailed programming instructions. Except for the Mobile Identification Number (MIN) discussed below, the factory defaults will work in most cases. Be certain to review the programming steps given below with your service provider or have your service provider program the Phonocell.

The exact programming may vary from VERIZON model to ALLTELL model, etc. refer to Telular Phonocell User Manual sent with the unit for final instructions.

Before you begin programming, connect the antenna, plug in the power, and connect a tone-dial (DTMF) telephone.

- 1) **Pick up the POTS telephone handset and listen for a tone** (either a steady dial tone or a beeping no-service tone).
- 2) **Press: # \* 0 \* 1 2 3 4 4 3 2 1 #**

The tone will change to a different, steady "Programming" tone and the bottom LED indicator on the Phonocell will blink alternately RED and GREEN to indicate that you're in programming mode. You now have two minutes to start the programming steps.

- 3) **Press: # \* 1 \* <MIN> #**

This key sequence is used to enter your 10-digit telephone number (Mobile Identification Number, or MIN). If you enter the number incorrectly, you'll hear 3 short tones followed by the programming tone. If correct, you'll hear the programming tone again. If the MIN phone number value is not 10 digits, it is considered invalid and the FWT will not update or store this value; the currently stored value will remain.

*Note – With the instigation of phone number portability, user phone number may be different from the MIN. Make certain the service provider gives you both the user phone number and the MIN.*

- 4) **Press: # \* 5 \* <SID> #**

This key sequence is used to enter the 1- to 5-digit System Identifier, or SID. This information identifies your cellular service company. If you enter the SID incorrectly, you'll hear three short tones followed by the programming tone; if correct, you'll hear the programming tone again. If the SID value is not in the range of 0 to 32,767, it is considered invalid. The factory default is 69.



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**5) Press: # \* 4 \* <paging channel> #**

This key sequence is used to set up your 1- to 4-digit initial paging channel. When you turn on your Phonecell, this channel helps the service provider find you-and viceversa. If the paging channel is not in the range of 1 to 1023, it is considered invalid.

**NOTE:** Channels 800 to 990 are invalid. The factory default channel setting is 333.

**6) Press: # \* 7 \* <band order> #**

This key sequence is used to enter the band order. The band order value is a series of digits between 1 and 2 that must be at least 1 digit and not more than 2 digits long. The following table describes the relationship between the band order digits and EIA/TIA-136 system/band assignment:

Band Order Digits EIA/TIA-136

1 System A (800 MHz)

2 System B (800 MHz)

3 Band A (1900 MHz)

4 Band B (1900 MHz)

5 Band C (1900 MHz)

6 Band D (1900 MHz)

7 Band E (1900 MHz)

8 Band F (1900 MHz)

If the band order values are not in the range of 1 to 8, or there are less than 1 or more than 8 digits, the entry is considered invalid. The factory default is 3 4 1 2 5 6 7 8.

**7) Hang up the phone. The flashing LED indicator will become solid GREEN.**

*Phone Number Setup is complete.*



## 6. XPert VOICE MODEM SETUP

### 6.1 XPert Voice Modem Connections And Jumpers

The XPert Voice Modem can connect to any of the serial ports of the XPert/XLite; however, Sutron recommends using COM3. COM2 is typically used for SATLINK and COM1 is typically used for a direct laptop connection. From the factory, the XPert and XLite will be configured to supply +5V from pin 9 of COM 3 and the XPert Voice Modem will be configured to be powered through the DB-9 @ +5V. This arrangement will make it possible to use one DB-9 RS-232 modem cable to both power the modem and to communicate.

The other communication connection required is the RJ-11 cable. The XPert Voice Modem has two identical RJ-11 receptacles. Connect the RJ-11 cable from the FWT to either RJ-11 receptacle on the XPert Voice Modem.

A complete description of the XPert Voice Modem jumpers and setup are provided in the XPert Voice Modem Operation Manual which can be downloaded from the Sutron website at:

[www.sutron.com/DownloadsUpdates/XPert Modem Manual.doc](http://www.sutron.com/DownloadsUpdates/XPert%20Modem%20Manual.doc)

### 6.2 FWT Voice Configuration with the XPert

After the FWT has the 10 digit number programmed, the FWT will be ready for voice outgoing queries to the XPert for logger sensor readings. The XPert may also place a call to announce alarm indications when so programmed. But if any problems occur you can return the FWT to voice mode by using the connected analog phone and enter: # \* 7 # into the FWT.

## 7. XPert/XLITE DATA LOGGER SETUP

This section presents the steps that enable the XPert or XLite unit to use the XPert Voice Modem. An example setup of one sensor input configured to use the XPert Voice Modem is included.

### 7.1 XPert Voice Modem Configuration on 9210/XPert

The 9210 XLite unit requires the following minimum setup to use the XPert Voice Modem:

- ▶ Installation of voice files on the 9210
- ▶ Enable COM3 for use with the Voice Modem
- ▶ Configure COM3 for the Voice Modem
- ▶ Configure a sensor input to include a Coms Tag processing block

## 7.1.1 Initial Setup – Acquiring the Speech Files

- ▶ The first step is to add the Additional Speech Files available at the Sutron web site at: <http://www.sutron.com/DownloadsUpdates/Downloads.htm>
- ▶ After downloading the files to your PC, place the .vox files in a convenient subfolder.
- ▶ The next step is to load these .vox files into the XLite.
- ▶ Use XTerm software provided with the XLite Utilities CD to access the 9210 as shown in Figure 3 below. (XTerm is also available from the Sutron website.)

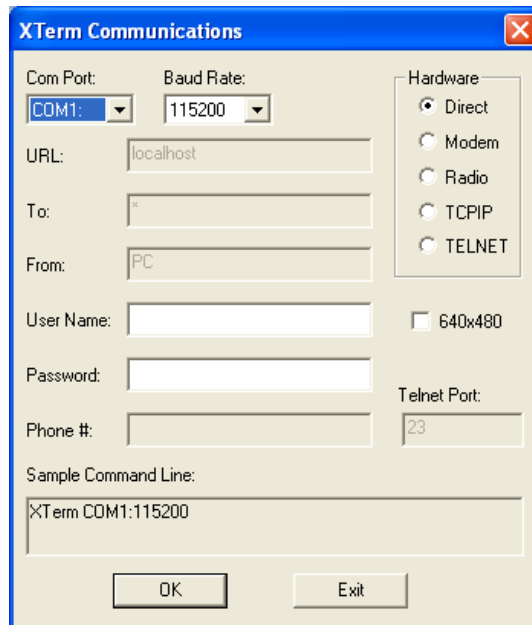


Figure 3. XTerm Start-up Window

- ▶ Connect to the unit via a Direct Connect at 115200 as shown above

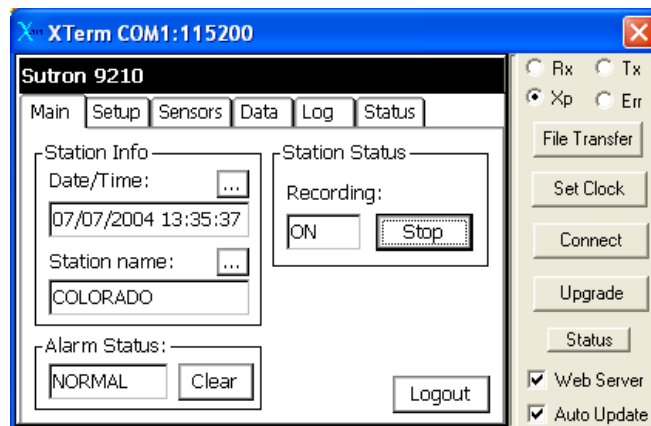


Figure 4. 9210 Main tab

- ▶ The next step is to transfer the speech files using the XTerm file transfer function.
- ▶ Go to File Transfer:
- ▶ Select the \Flash Disk\Speech\English subfolder in the XPert window.
- ▶ Select the .vox speech files in the PC window, left panel.
- ▶ Depress the left window transfer button to send the selected files to the XPert.

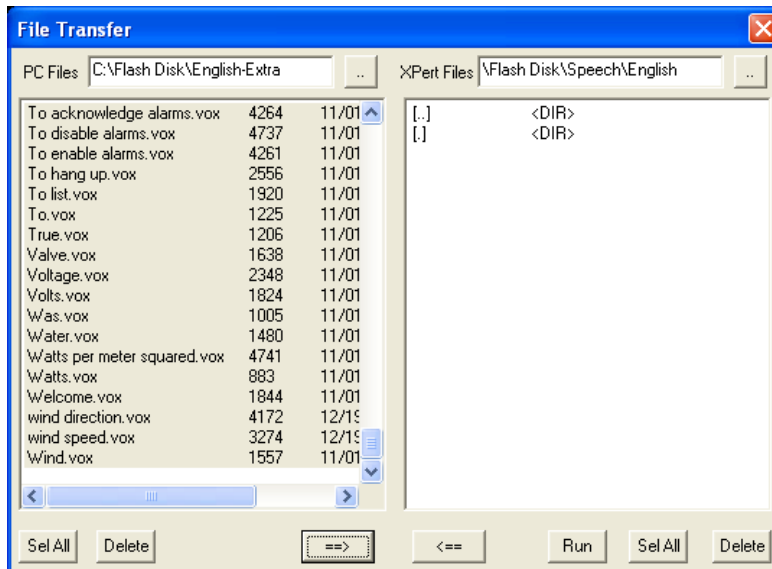


Figure 5. File Transfer window

The File Transfer window will have all the files in both windows at the conclusion of the transfer process as shown in **Error! Reference source not found.**

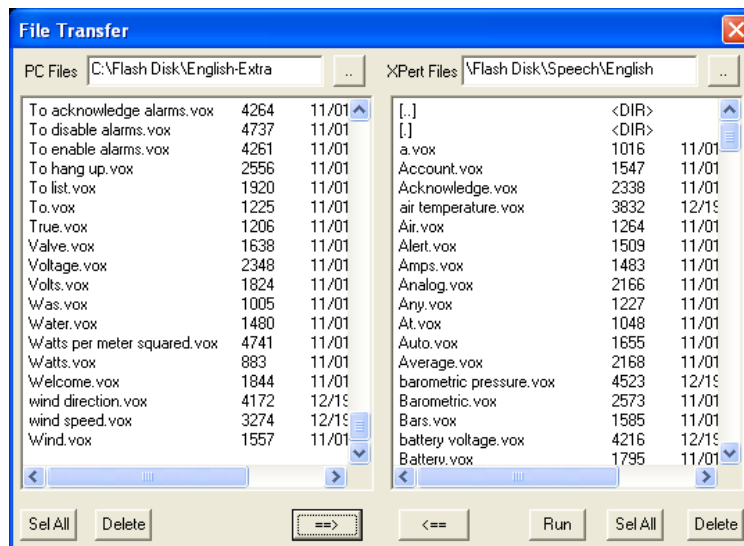


Figure 6. Transfer of speech file

## 7.1.2 Configuring COM3 for the Voice Modem

- ▶ The next step is to configure COM3 to use the Voice Modem
- ▶ Go to Coms in the Setup tab and click Edit as shown in **Error! Reference source not found.**
- ▶ Use the drag down menu and select **Voice** on **Com3**. The baud rate is **115200**.

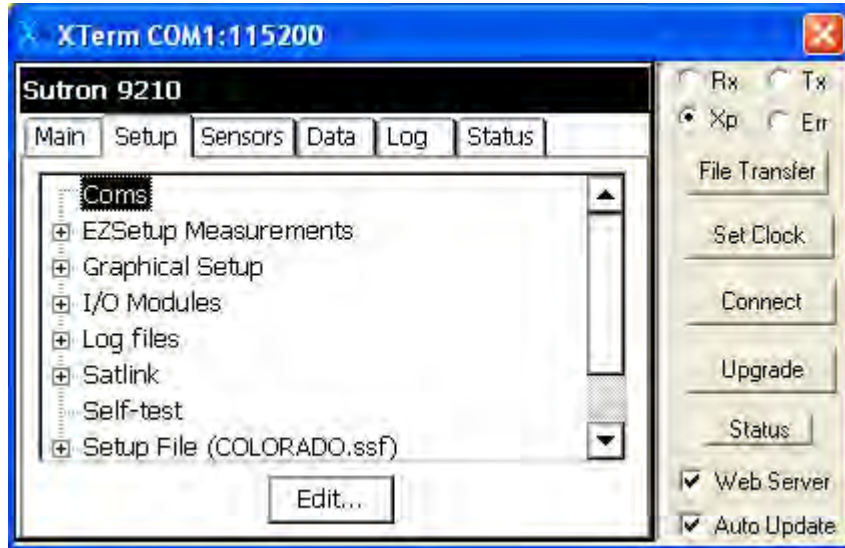


Figure 7. Setup tab with Coms node selected

- ▶ Use the drag down menu and select **Voice** on **Com3**; **set the baud rate to 115200**, and select the check box as shown in Figure 8.

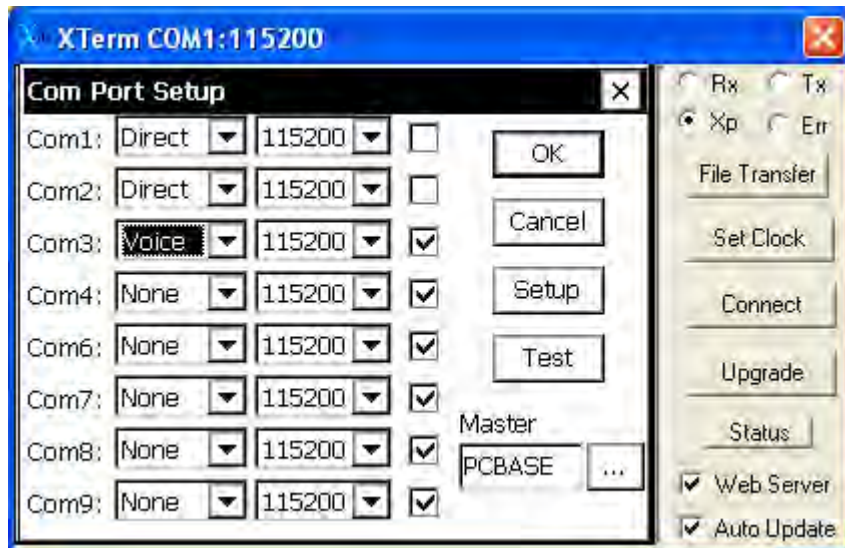


Figure 8. Com Port Setup window

After clicking OK, the Coms Menu will add a **Voice3** option as a subfolder.

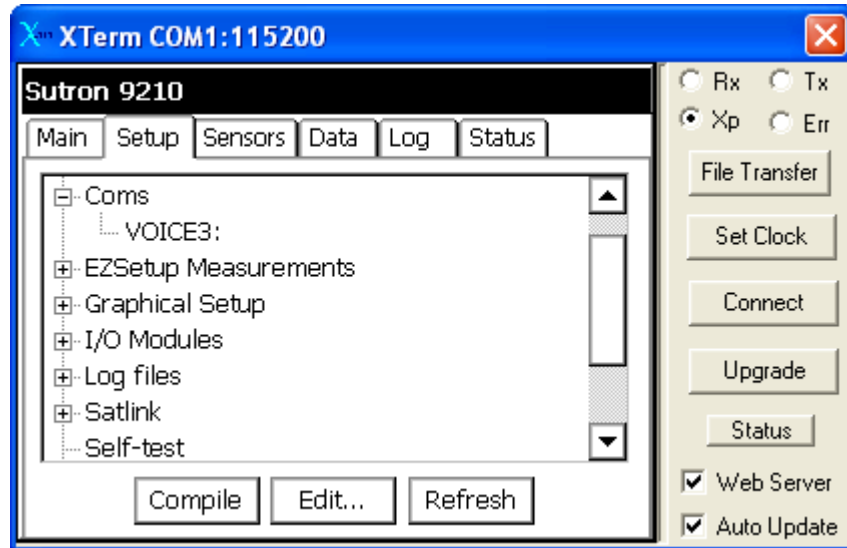


Figure 9. Coms Folder with VOICE3:

### 7.1.3 Editing the Setup of the Voice Modem

Click on **VOICE3**. Depress the Edit button. Set Answer Mode to Voice or Voice & Data and then configure the dial-in properties by depressing the Dial-In button.

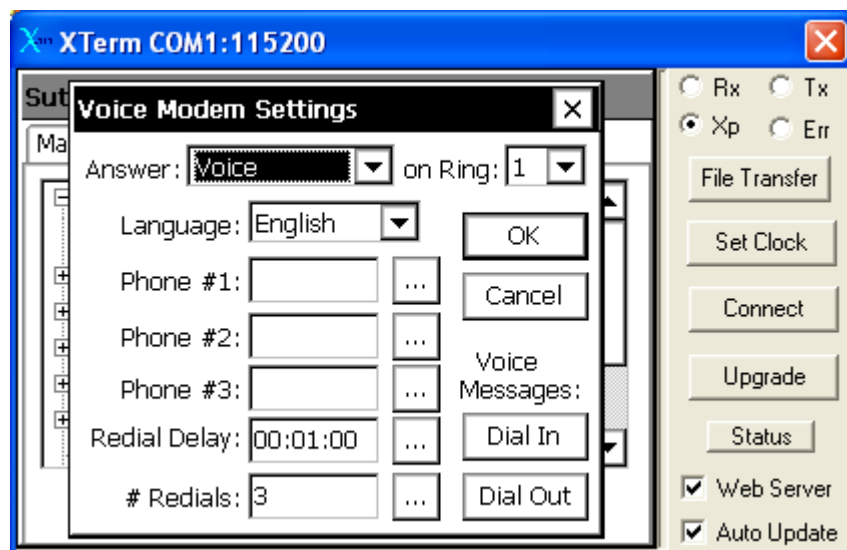


Figure 10. Voice Modem properties

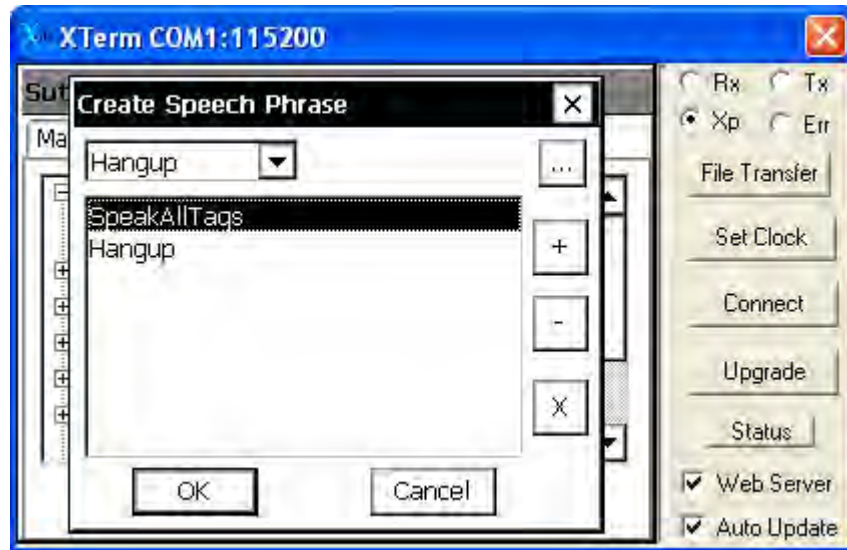


Figure 11. Setup of Speech Phrases

Speech configurations will vary depending on the user configuration. In the example above the modem is configured to pick up and speak all tags. This means that the current value of all the inputs that have been tagged using a ComsTag will be reported to the caller. After the report is complete the modem will hang-up the phone.

Refer to the “Voice Modem Settings” section of the [9210 XLite Operation and Maintenance Manual](#) for a complete description of these speech phrase functions.

## 7.2 Sample Sensor Setup

The last step is to create a Setup. To create a Setup go to the Setup Tab and start a new Graphical Setup.

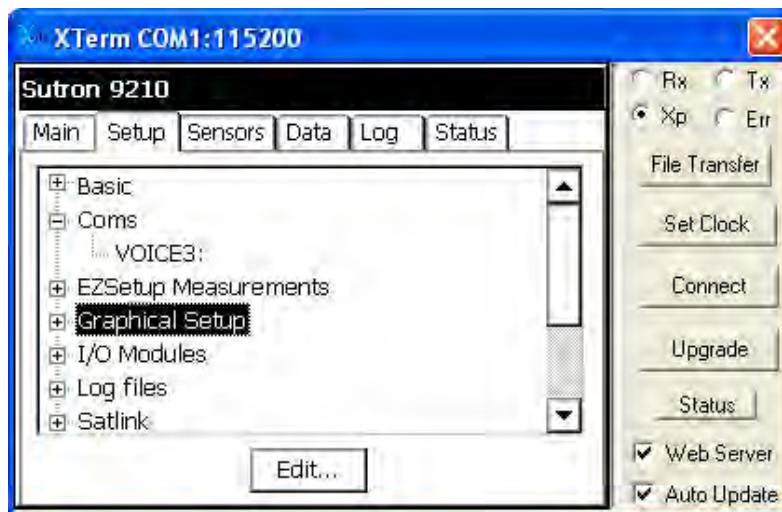


Figure 12. Setup Tab with Graphical Setup node selected

Once in the graphical setup window click on the +Add tab. The following menu will appear:

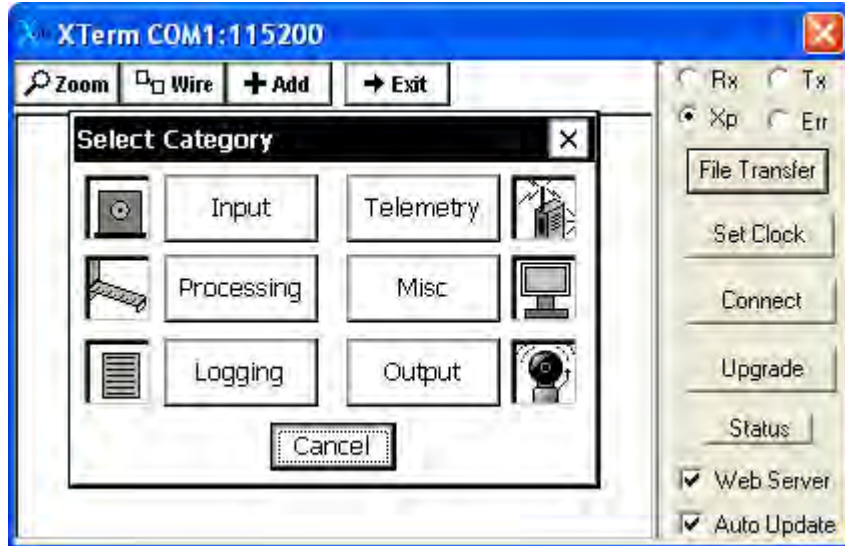


Figure 13. Graphical Setup window

Add an input followed by a Measure block followed by a Log block and finally connect a telemetry block (Coms Tag). Each block can be added one at a time or all at once using the Setup Wizard as shown below. The setup wizard is useful if several sensors with the same processing sequence are being added.

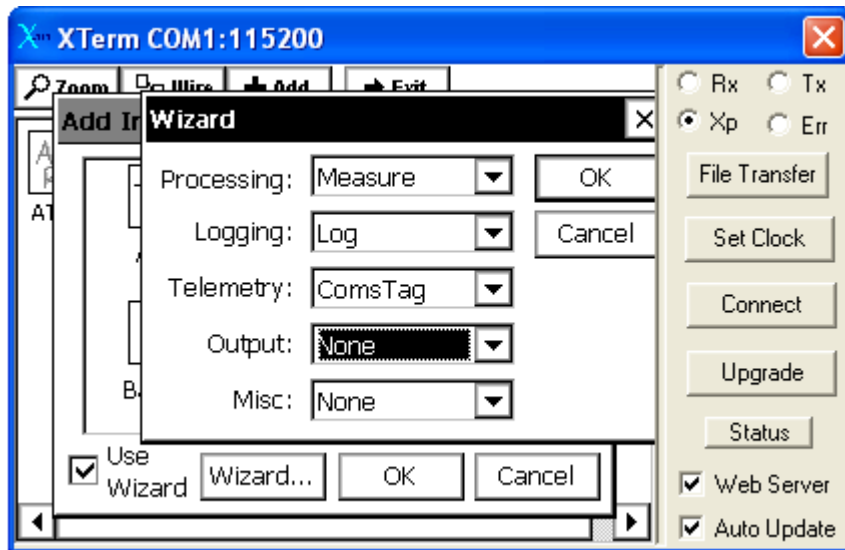


Figure 14. Use of Setup Wizard

The example setup is displayed below showing an AT/RH sensor as the input, connected to a measure block, followed by a log, with a ComsTag as the final block.

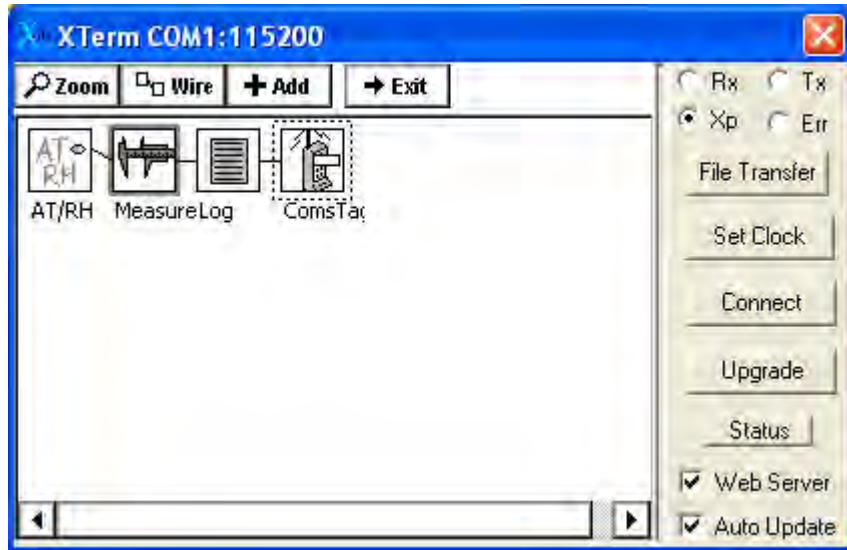


Figure 15. Sample graphical setup

The Coms Tag is used to setup the speech phrases associated with the input sensor. The properties of the Coms Tag block are displayed below. The prefix and suffix are speech files. The pre-fix corresponds to the sensor name, in this case Air Temperature. The suffix corresponds to a voice file for the units, in this case Centigrade or Fahrenheit.

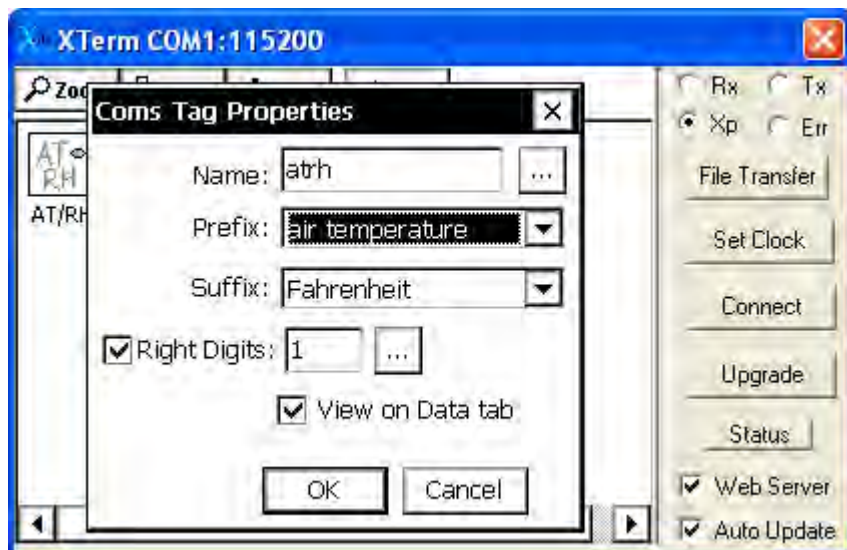


Figure 16. ComsTag properties

### 8. 8210 TO FWT VOICE OPERATION

The 8210-3014 is normally used to announcing voice sounds of the sensor digital recorded values over the standard phone line in this case as the FWT connected unit. Connect the 8210 to the FWT using the Sutron supplied RJ11 adapter 6411-1159-1 and FWT supplied RJ11 cable as shown in Figure 17.



Figure 17. 8210 RJ11 adapter to FWT RJ11 jacks

Be sure the RED wire connects to the RING terminal block connection on the side of the 8210 terminal strip. The 8210 operations manual page 5-2 covers some detail on setup. Also necessary is entries into the 8210 MODEM Setup Menu for 10 digit numbers and voice messages to be spoken by the 8210. See pages 4-40 to 4-53 for information.

Be sure to set the 8210 answer mode to voice. The other modes such as data, Voice and Data and Data and Voice are not supported by the combination of speech board and Telular modem.

Once the FWT is set with the 10 digit number the default settings are voice.

### 9. 8210 TO FWT DATA OPERATION

The 8210 logger along with XPer modem (8080-0005-1) may be used as standard HAYES data modem with the FWT by placing the FWT in the data mode. This configuration utilizes the 8210 external TERM port. A typical setup is shown in Figure 18. A standard serial cable together with a NULL MODEM adapter plug is required for connecting to the speech modem as shown in Figure 18.

#### 9.1 8210 Configuration

- ▶ Set the 8210 as follows:
- ▶ Scroll using the DOWN arrow so the EEROM SETUP is visible.



- ▶ RIGHT arrow once so SERIAL: USER is visible,
- ▶ Press the SET key until EXT MODEM is visible,
- ▶ Press the DOWN arrow once and verify USER RATE: 9600 is visible. If not then press SET until baud rate cycles to 9600.
- ▶ Press the DOWN arrow until ENTER REQD: OFF is visible.
- ▶ Press the SET key once to turn ON this option.
- ▶ Press the ON/OFF key once.

The 8210 is now configured.

## 9.2 9210 Voice Modem configuration

Perform/verify the following to configure the XPert 8080-0005-1 modem.

- ▶ Remove the gray cover and verify the internal jumpers are set as follows:

J5-- 2 to 3

J7—1 to 2

J3—1 to 2

This sets the input power to come from external +12 volts from the small green terminal strip. Note the markings on the terminals. Verify power to the modem is OK with a DVM.

Do the following to program the speech settings on the XPert modem.

- ▶ Using the standard serial cable connect from the PC male COM port to the modem DB9 female connector WITHOUT the NULL MODEM adapter.
- ▶ Use a program like HyperTerminal to establish communication with the modem.
- ▶ Set HyperTerminal to: 8 bits, No parity, 1 stop bit, 9600 bps.
- ▶ Press the ENTER key a couple of times to set the modem to 9600 bps.
- ▶ Type AT&V.

The current active profile will be shown as below.

*ACTIVE PROFILE:*

```
B1 E0 L1 M1 N0 Q1 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S38:020 S46:138 S48:007
S95:000
```

*STORED PROFILE 0:*

```
B1 E0 L1 M1 N0 Q1 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0
```



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S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000  
S36:007 S40:104 S41:195 S46:138 S95:000

*STORED PROFILE 1:*

B1 E1 L1 M1 N0 Q0 T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0  
S00:000 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000  
S36:007 S40:104 S41:195 S46:138 S95:000

*TELEPHONE NUMBERS:*

0=                    1=  
2=                    3=

Type following configuration string into the modem using HyperTerminal.

ATS0=2  
ATE0Q1&D0&W

- ▶ The configured modem will NOT respond to normal AT commands at this point. However, the modem will retain the settings.
- ▶ Disconnect the PC and connect the cable to the 8210 external serial port USING THE NULL MODEM adapter on the modem end.
- ▶ Connect the RJ11 cable from the FWT RJ11 jack to the modems RJ11 jack.
- ▶ From a remote location, call the Telular FWT at the associated 10 digit number with a communication program like HyperTerminal. Set HyperTerminal as follows: 8 bits, No parity, 1 stop bit, Flow control=NONE, Terminal emulation=VT100.
- ▶ When communication with the 8210 is established, press ENTER a couple of times and the opening menu should be displayed.

The 9210 voice modem is now configured for data mode.



Figure 18. 8210 to speech modem to FWT connections

### 9.3 FWT Configuration

Configure the FWT (in this example a SX5T VERIZON modem) for data mode with the following commands. A telephone handset must be connected to the SX5T device on the marked RJ11 jack. For the following commands refer to Page 16 of the SX5T user Manual.

- ▶ Enter # \* 6 # - This will place the SX5T in data always mode. Note, you do not have to be in configuration mode to enter this command.
- ▶ Enter configuration mode for the following commands. The lock code default is the last 4 of the 10 digit assigned telephone number unless it has been changed by the user.
- ▶ Enter # \* 0 \* (Lock Code) # to enter configuration mode. Typically the last 4 digits of the phone number are the Lock Code unless changed by the user.
- ▶ Enter # \* 113 \* 1 \* 0 # to select data port RJ-11.
- ▶ Enter # \* 136 \* 2 # to SX5T for circuit-switched data at 19200 bps.

At this point the data transfers will be done via the serial data modes of the modems.



## 10. TROUBLESHOOTING

PROBLEM	CHECKPOINTS/SOLUTIONS
<i>The modem answers, but the voice is of poor quality(noisy)</i>	Increase the baud rate in the configuration of COM3. This should be set to 115200.  Check cell phone coverage in the area. The cell phone has 3 LEDs, they should all be green
<i>The modem does not pick up. Instead, you get a dead signal.</i>	Check if the cell modem has 12V.
	Check if the XPert Voice Modem is connected to Com3 and thus is receiving 5VDC.
	Check serial cable connections between modem and 9210.
	Check external battery, voltage should be around 12VDC.
<i>You can get voice messages from the modem, but not data.</i>	Contact local cellular provider to see if this feature is available