



APPLICATION NOTE

TELEDESIGN TS4000 TO 9210 XLITE DATA LOGGER

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TELEDESIGN TS4000



Interfacing Sutron Loggers to Analog Radios

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1. Overview

Sutron's standard loggers can be interfaced to analog radios, which are ideal for telephone line replacement. The radio discussed in this particular note is the Teledesign TS 4000.

2. Specifications

2.1 TS 4000 FEATURES

- ▶ High speed channel rates in excess of 19,200 bits per second
- ▶ Selectable operating modes for transparent and packet data operation
- ▶ Addressed communications for devices not directly addressable
- ▶ Store-and-forward data repeating for wide area coverage
- ▶ Two individually configurable data ports
- ▶ Supports data activation (three wire) and RTS/CTS handshake protocols
- ▶ Powerful network diagnostics for non-intrusive monitoring of all radio and data network functions
- ▶ Built-in bit error rate (BER) monitoring
- ▶ Configurable RF output power levels
- ▶ Programmable receive sensitivity level (squelch) for use on noisy channels
- ▶ Watertight case option for field work and marine installations
- ▶ Clear Channel Scan - The TS4000 can be configured to automatically select the best channel for communication.
- ▶ Automatic CW Station ID - The TS4000 can be configured to periodically transmit a Morse code station ID

2.2 TS 4000 SPECIFICATIONS

2.2.1 General

Supply Voltage	9 to 28 VDC
Power	1.5 watts receive (typical) 7 to 25 watts transmit (depends on RF output power)
Power Connector	2 pin Molex or through Data Ports
Data Buffer	32 kByte SRAM



Program Storage	512 kByte Flash ROM (supports in field firmware upgrades)
LED Indicators	Transmit, Receive, Power
Operating Temperature	-22 to +140 °F (-30 to +60 °C)
Dimensions	4.3" x 3.1" x 1.8" (109 mm x 79 mm x 46 mm)
Weight	12 ounces (340 grams)
Enclosure Options	Standard and Watertight

2.2.2 Data Interfaces

Data Rates	300, 1200, 2400, 4800, 9600, 19200, 38400 baud
Data Format	Asynchronous, 8 or 9 bit words
Signal Levels	RS-232 or TTL (Data Port 1), RS-232 (Data Port 2) RS-485 (with adapter)
Handshake Protocols	Data Activation (3 wire): Requires only TD, RD and ground (SG) Full Handshake: Supports RTS, CTS, DCD, DSR, DTR
Data Only Time	Out 1 to 500 character periods
CTS Control Line	Buffer, Channel, or RTS Driven
DCD Control Line	Data and/or Channel Driven
DSR Control Line	Active when Operational, Transmitting, or Receiving
DTR Control Line	Enabled or Disabled (receive data flow control)
RTS to CTS delay	Programmable: 0 to 999 milliseconds
Data Connectors	9 pin D, female, DCE (standard case), LEMO connector (watertight case)

2.2.3 Radio *(general specifications, depends on model)*

Frequency Ranges	132-174, 380-512, 928-960 MHz
Number of Channels	99 receive/transmit pairs, stored in non-volatile memory
Channel Spacing	5, 6.25, 7.5, 10, 12.5, 15, 25 and 30 kHz (depends on model)
Channel Rate	2,000 to 19,200 bps - GMSK
RF Output Power	0.1 watts to 5 watts, external amplifiers available for up to 100 watts Receive



Data Sensitivity	-103 dBm for less than 1 x 10E-6 BER (Bit Error Rate) (typical)
Carrier Detect Threshold	-110 to -60 dBm, programmable
RF Connector	BNC (standard case), TNC (watertight case), N (optional)

2.2.4 Channel Options

Data Protocol	Transparent or Packet (AirNet)
Data Security	254 Selectable Scrambling Codes
FEC (Error Correction Coding)	None or 12,8 Hamming code with 16 bit Interleaving

2.2.5 Optional AirNet Packet Protocol

Channel Access	Master-Slave or Carrier Sense Multiple Access (CSMA) with Programmable Attempt Rate
<i>Protocol</i>	Automatic Repeat reQuest (ARQ)
<i>Packet Size</i>	1 to 5000 characters
<i>Retries</i>	0 to 50 per packet
<i>Address Space</i>	999 Individual Addresses per Group, up to 60 Groups Transfers Individual with Acknowledgment (to any address) Individual without Acknowledgment (to any address) Group Broadcast (to all addresses in a single group) Network Broadcast (to all addresses in all groups) Multicast Reception (from up to 20 other groups)
<i>Relay Operation</i>	Store and Forward Data Repeating with Address Filtering

2.2.6 Diagnostics

Internally Monitored Values

Supply Voltages, Temperature, Receive Carrier Signal Level (RSSI), Phase Lock Loop status - all models
Forward and Reflected Transmit Power - 5 watt models



2.2.7 PC Configurable

- ▶ Windows based configuration software provides quick setup and testing of TS4000 radio modems and networks.
- ▶ Flash memory program storage allows easy in-field firmware upgrades.
- ▶ AirTest is included with the TS4000 configuration program. AirTest is a general purpose wireless modem test program that can be used to verify operation and to gather performance statistics (BER) about the link between modems.
- ▶ The TS4000 configuration program comes with AirScan that enables the TS4000 to be used as a frequency scanner

2.3 9210/XLITE SPECIFICATIONS

Sutron's robust XLite datalogger is the heart of the remote monitoring network. The 9210 is highly modular in design and scalable to handle simple to complex requirements.

- ▶ Intuitive graphical block-oriented setup
- ▶ Unlimited I/O expansion
- ▶ Software extensibility with DLL libraries
- ▶ 2x20 Backlit LCD Display
- ▶ Menu and Data keys
- ▶ 8 Channel Digital I/O, RS485, SDI-12
- ▶ 10 Channel Analog Input, DC Power Connection
- ▶ 3 RS-232 Ports, I2C Bus to I/O Modules, Optional PCMCIA
- ▶ Windows CE Operating System with a 486 Processor & C++ Programming!
- ▶ Low power consumption – sleep modes with low quiescent power (<2mA), low operating power.
- ▶ Battery operated – each module operates off of 10 to 15 VDC.
- ▶ Wide temperature operation – -40 to +60C.
- ▶ High reliability and robust – no fuses, fault tolerant, lightning protection.
- ▶ Flash memory expansion cards are available.
- ▶ Multiple telemetry – Telephone, LOS Radio, METEOSAT telemetry (up to 3).
- ▶ Plug-n-play ease of setup – the system is setup with ease. Install a new module, and the system automatically detects it and allows it to be configured for operation.



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- ▶ Flexible measuring and recording – The setup allows separate measuring schedules for data as well as individual recording intervals.
- ▶ Open design – the system will operate with sensors and modules manufactured by others
- ▶ Takes measurements from low cost sensors.
- ▶ High-speed data transfers – data downloads to PC at 115k baud



3. Programming the Radio

Download the programming software from the following link.

<http://www.teledesignsystems.com/download.html#TS4000%20Downloads>

Proceed with the following steps to program the radio

- a. Connect the power connector on the front of the Radio. Also, connect the 5W load resistor and rubber duck antenna to the RF port of the Radio.
- b. Connect the red & black wire of the power connector to the +12 Volt & GND of power supply, respectively.
- c. Connect the DB9 cable from computer's COM port to Data Port ONE (1) of the Radio.
- d. Start the TS4000 Program on your PC.
- e. After agree to the licensing agreement. The following screen will appear.

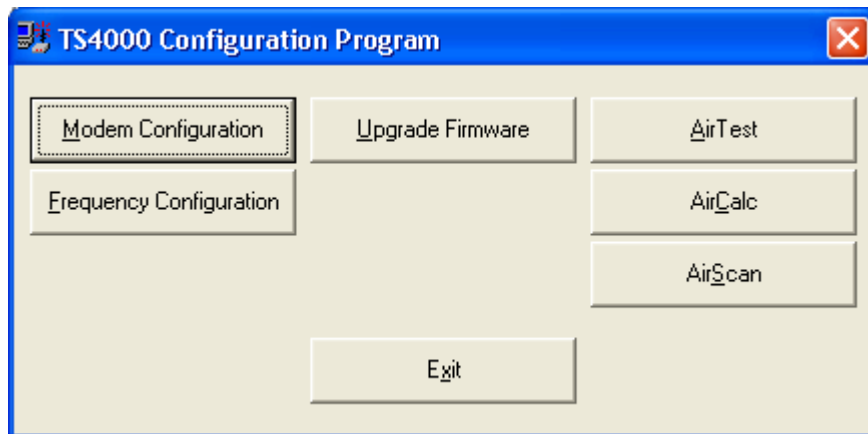


Figure 1: TS4000 Main Menu

- f. Click on the Modem Configuration button

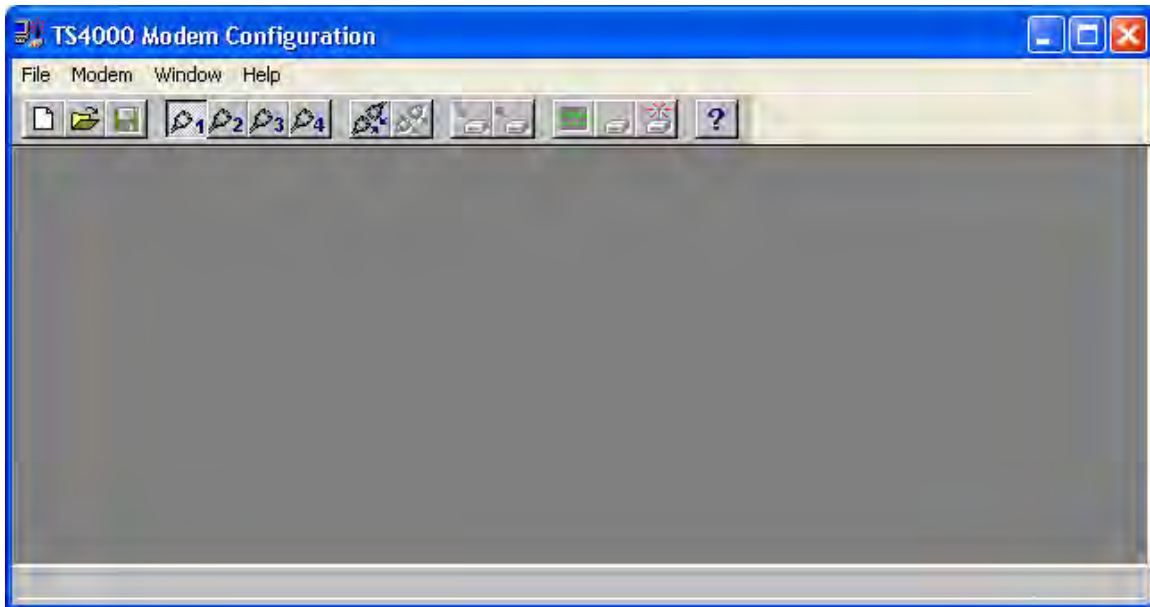


Figure 2: TS4000 Modem Configuration Window

- g. Under the modem tab click choose the COM port on your computer to which the radio is connected, then click “connect to modem”. The set-up will attempt to connect to the radio by scanning through the different baud rate of the radio. Once connected you will see the following acknowledgement.

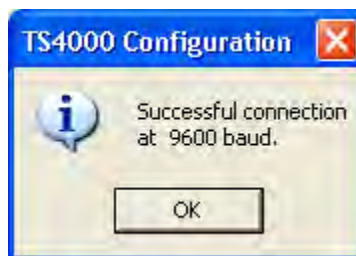


Figure 3: Connection Acknowledgement

- h. To retrieve the modem setting go to the modem tag and in the drop down menu choose retrieve configuration.

- i. Under the Serial Port tab we need only to configure the COM port.

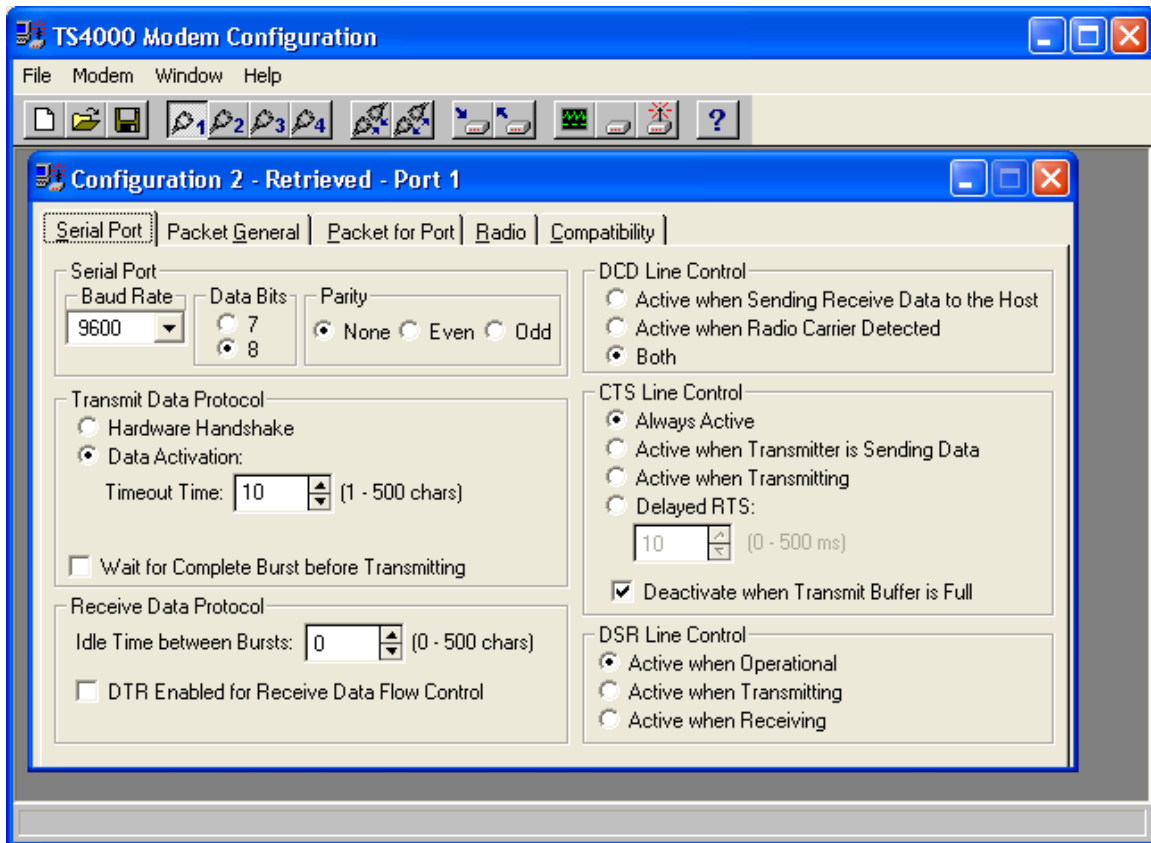


Figure 4: Configuring COM port

- j. Under the Packet General we would only using the Master Slave option if we did not want two modems to transmit at the same time. If this is not an issue then it should be left in the default position.

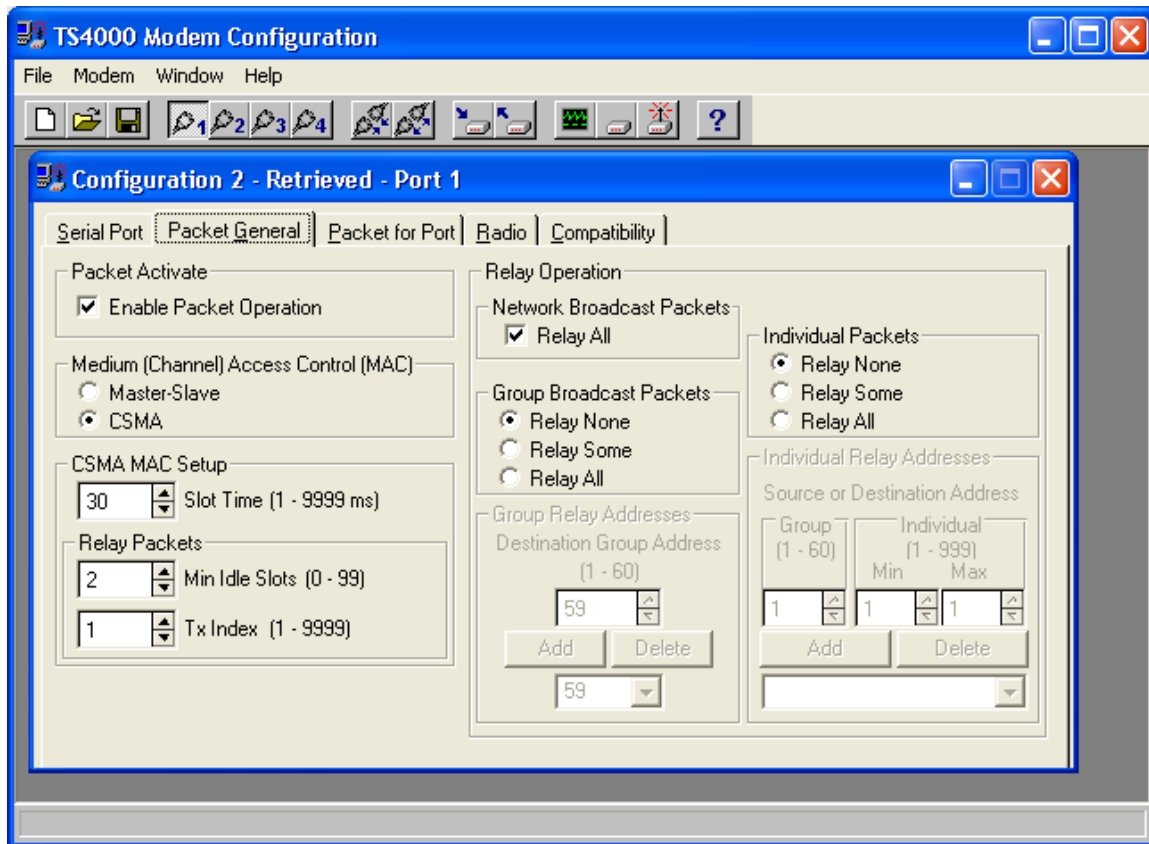


Figure 5: Packet General

- k. The modem address section allows us to assign an address to the radio modem, and also to be able to create groups that will be allowed to talk to each or not allow to talk with other modems.

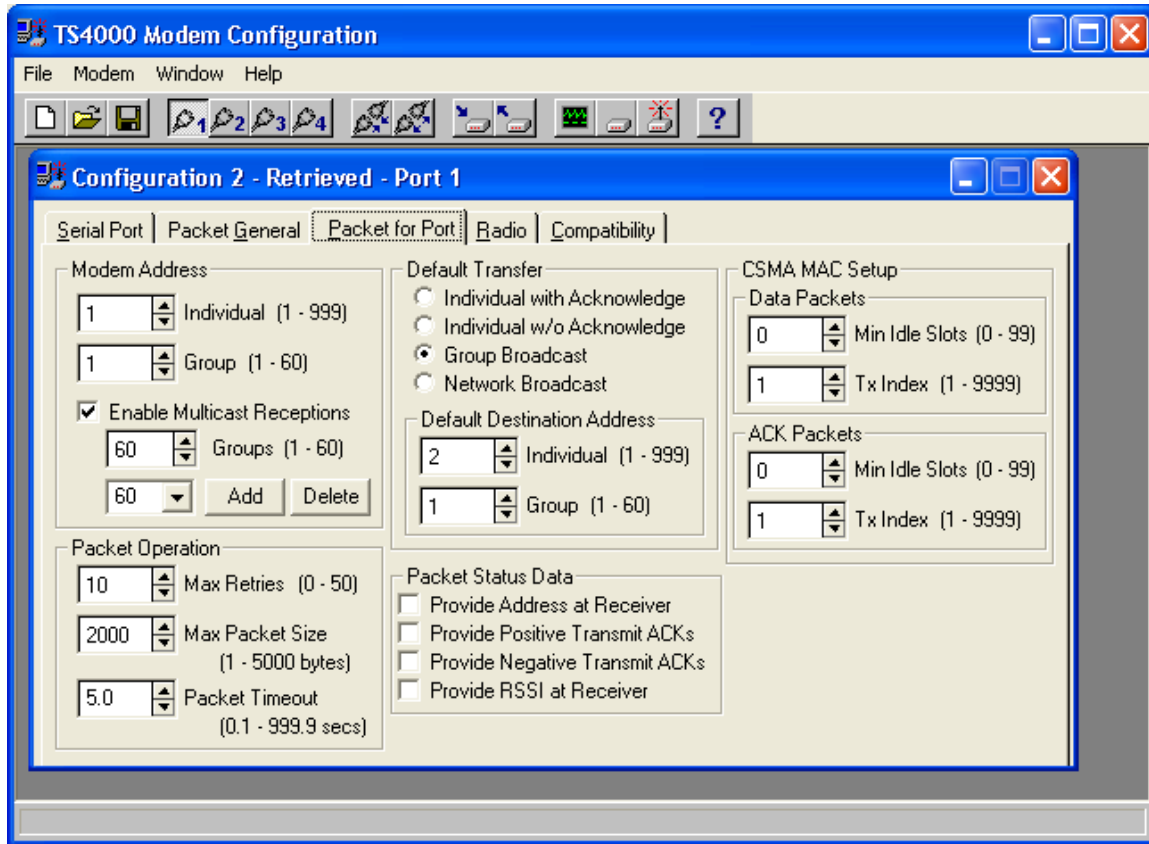


Figure 6: Packet for Port

- Under the radio tab we choose the channel on which we wish to transmit and receive on. The channel can be set up under the frequency configuration. If there is noise we can adjust the sensitivity of the receiver by changing the value of the Receive Carrier Detection Level.

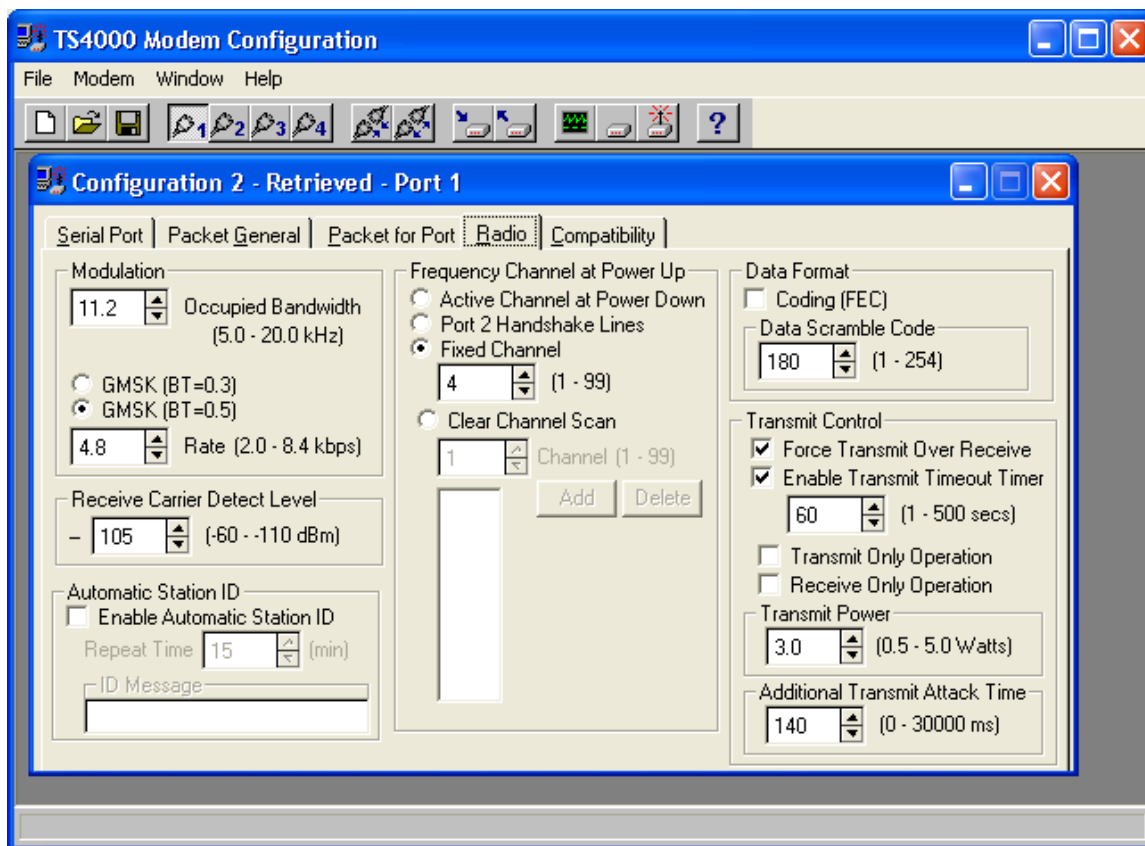


Figure 7: Radio

- m. The compatibility tab we use for setting up repeaters. We check the repeater choose and set up the modems' transmit and receive frequencies under the frequency configuration.

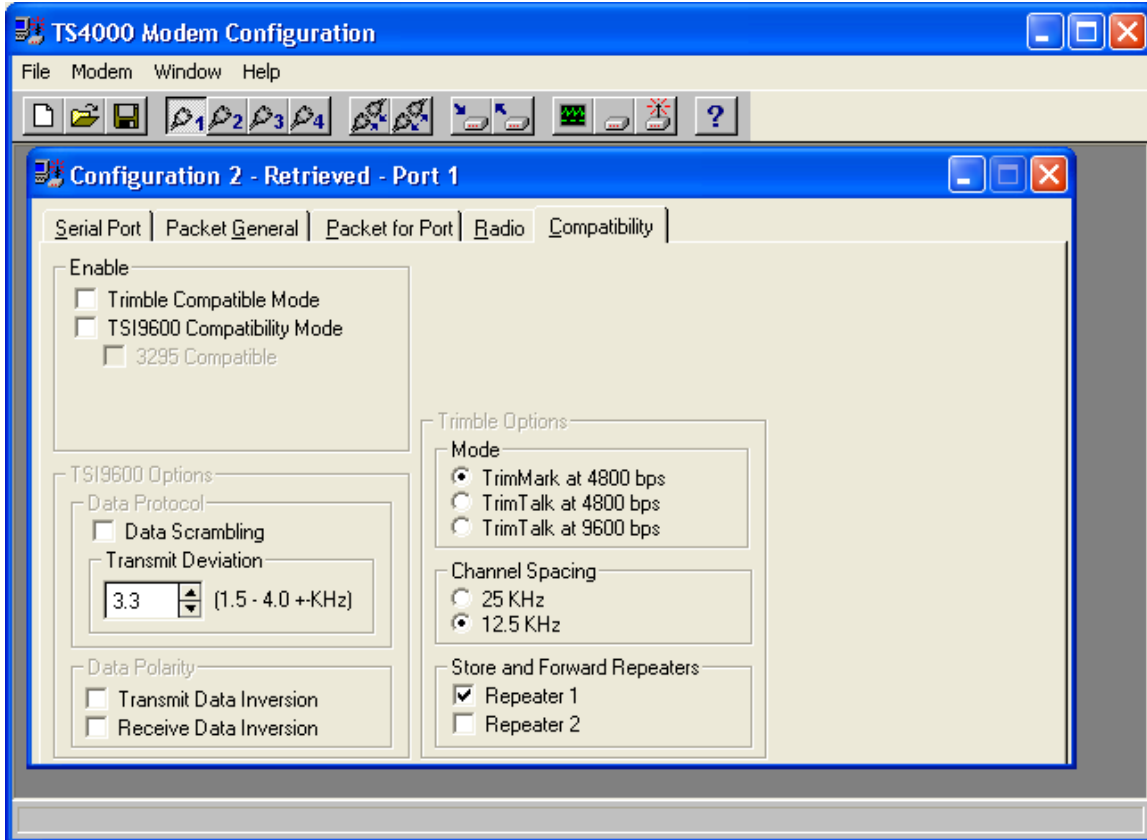


Figure 8: Compatibility

- n. After making changes to the Modem setting, write the new setting to the modem by clicking the Program configuration choose under the modem tab

- o. If we completely close out the modem configuration we are back at the configuration program.

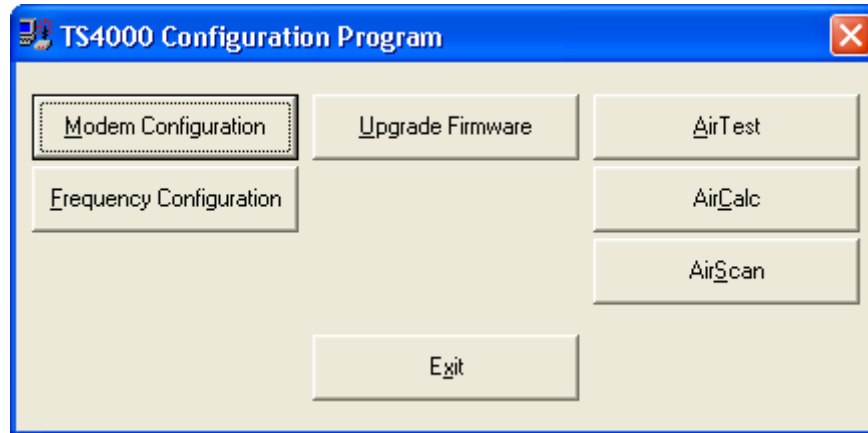


Figure 9: TS4000 Configuration Program

- p. After agree to the licensing agreement, under the modem tab click choose the COM port on your computer to which the radio is connected, then click “connect to modem”. The set-up will attempt to connect to the radio by scanning through the different baud rate of the radio. Once connected you will see the following acknowledgement.
- q.



Figure 10: Connection Acknowledgement

r. We then click OK and following window appears.

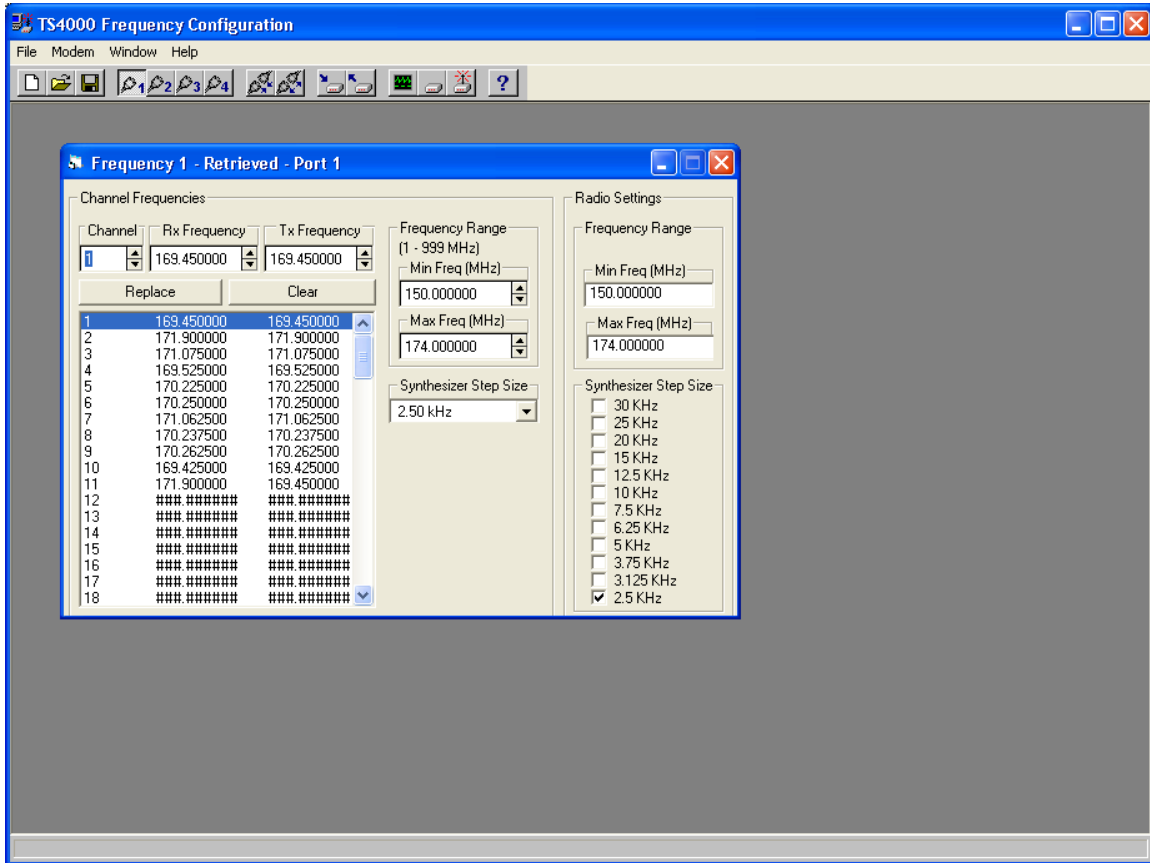


Figure 11: Frequency Configuration

s. We choose our transmission, reception frequencies and the channel to which there are assigned, or we can make our own combination of frequency.



4. 9210 to Radio Interface

4.1 9210 COM PORTS PIN OUT

9210	Com 2 &3	
	DTE Male	
DTE	Signal Name	Direction
1	CD	IN
2	RD	IN
3	TX	OUT
4	DTR	OUT
5	GND	
6	DSR	In
7	RTS	IN
8	CTS	OUT
9	Set by jumpers to RI, +5V Or +12V	IN

4.2 TS4000 TO 9210 COM PORT CABLE

DB-9 Male	DB-9 Female
2 RD	2 RD
3 TX	3 TX
7 RTS	7 RTS
8 CTS	8 CTS
6 DSR	6 DSR
5 GND	5 GND
1 CD	1 CD
9	9

5. Operation details

The 9210-Xlite will serve as the controller for the application. The Sutron XLite/9210 Data Recorder is the functional foundation of the Station. A unique feature of the XLite design is its block-oriented setup. Blocks of various types are connected together to graphically represent data flow from all sensors, with data flowing from left to right. The diagram gives a good overall picture of what the XLite is measuring and how it is processing the data from each of the sensors. More detail is revealed by using the Zoom button or by viewing the property window for a specific block.

When connected to Xlite via **Xterm** the user can modify the setup, thus add or remove sensors in a very simple way. A block represents every sensor or category. Blocks are interconnected to perform an operation. When the user enters the setup bracket of Xterm a blank window will pop open; here the user can add blocks from the following categories: input, processing, logging, telemetry, miscellaneous, and outputs. PLEASE REFER TO 9210 PRODUCT MANUAL FOR DETAILS ON HOW TO PROGRAM IT.

To set up the Xlite/9210 for the TS4000 connect to the Xlite/9210 using Xterm.

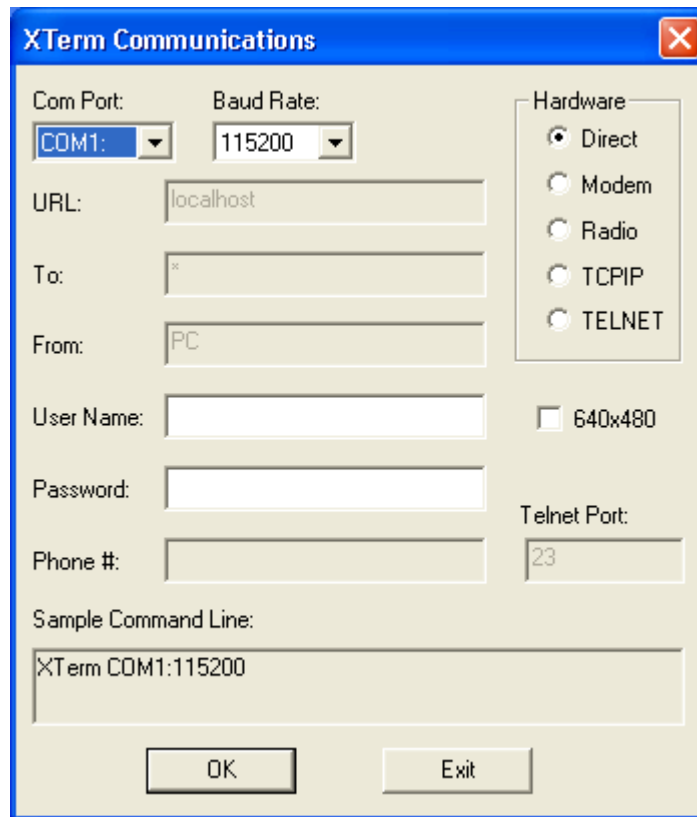
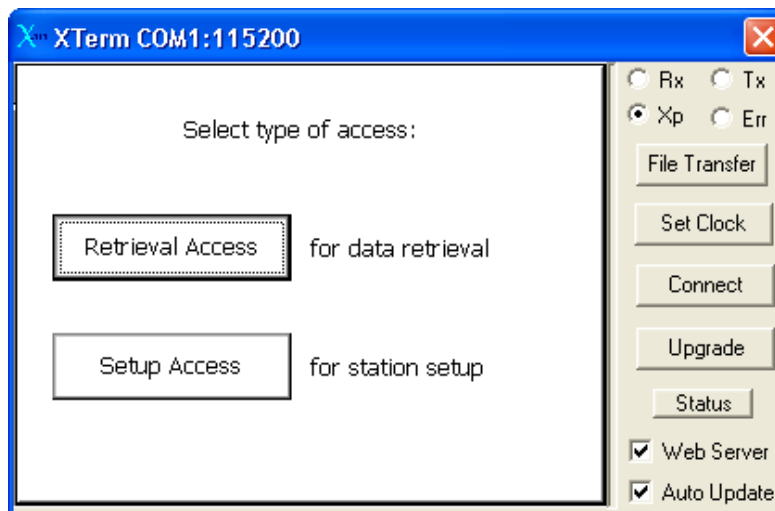


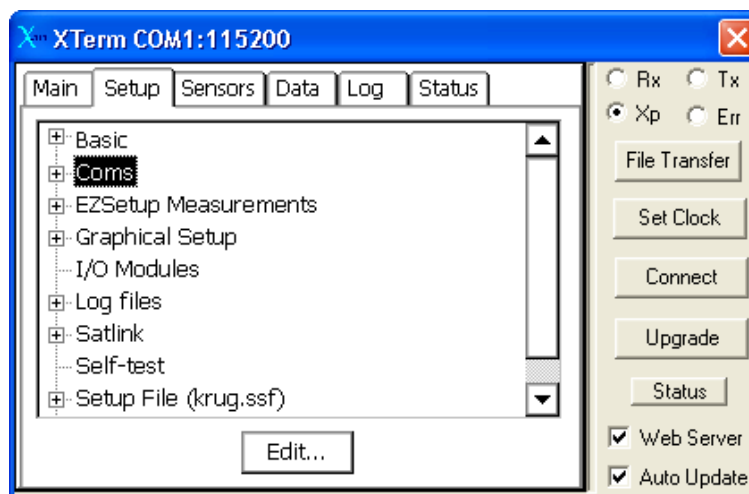
Figure 12: Xterm Connection settings



Then hit OK to connect to the Xlite /9210 and select setup access.



Next select the SETUP tab and highlight the COM branch, and hit edit.





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Set COM 2 as shown below. COM 2 is usually used for radios and Com three for modem. Then hit OK to allow the Xlite/9210 to save the new setting, and then exit the program.

