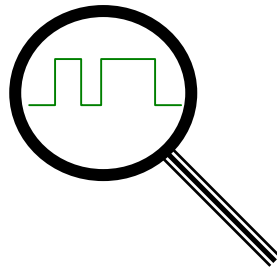


SirPic BitStream

1-bit Digital Storage Scope

User Guide
v1.1



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1 Introduction

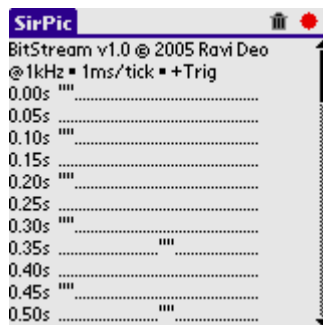
BitStream is an embedded PIC application for constructing a low cost, low bandwidth, 1-bit digital storage scope. The PIC microchip performs the data acquisition (data stored locally) and then transmits the captured waveform serially (via Infra-red or wired RS232) for display.



BitStream offers the following features:

- ❑ Sampling rates of 1/10/100/500 kHz.
- ❑ Real-time compression of data, providing a sample buffer of between 160 and 40,000 bit samples (varies according to signal entropy).
- ❑ Trigger edge selection (positive or negative).
- ❑ Supports wired and wireless infra red connection to Palm PDA running SirPic.
- ❑ Supports wired serial connections to other PDAs, laptop or PCs running SirPic or third party terminal emulation or data logging software.
- ❑ Captured waveform is output in text graphic format with timestamps for quick and easy analysis.
- ❑ Uses the popular Microchip PIC16F628 micro controller with a 4 MHz crystal.

A sample Palm PDA screenshot is shown below for a captured sample signal (4ms pulse at 10Hz, increasing to 13Hz after 0.30secs).



1.1 Purpose Of Document

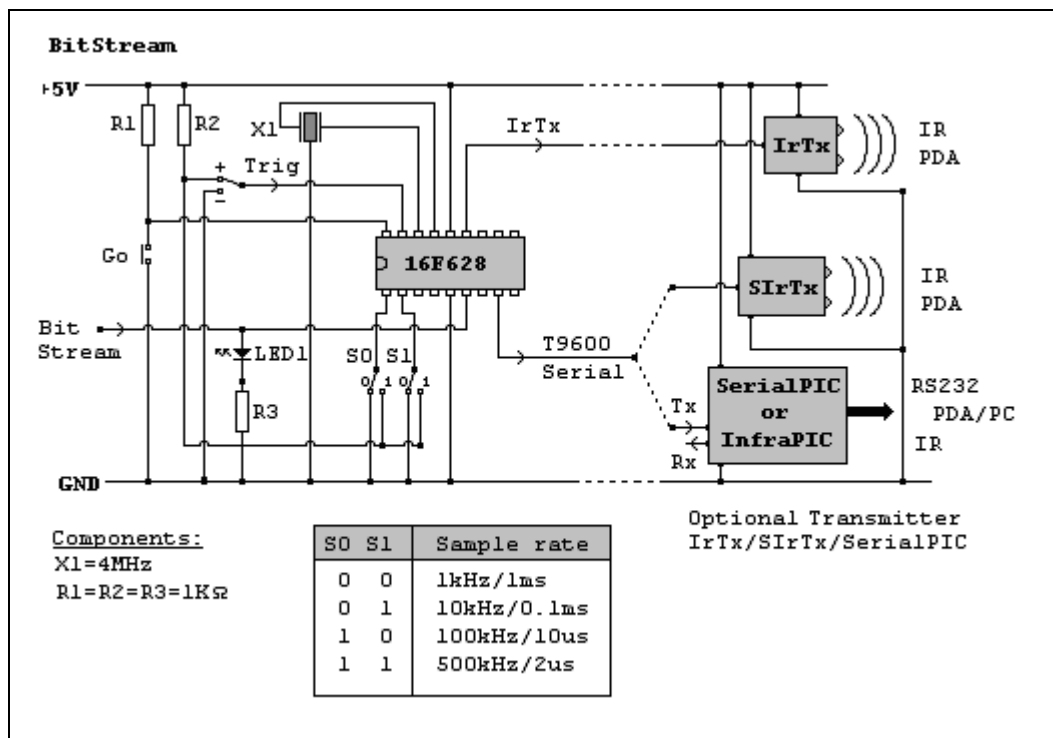
This document describes how BitStream can be constructed, configured and used to capture and display bit stream waveforms.

1.2 Related Documents

Users who wish to use SirPic for Palm as their output display device should also read the following documents (available from <http://www.sirpic.com>):

- SirPic User Guide
- SirPic Interface Guide

2 Schematic

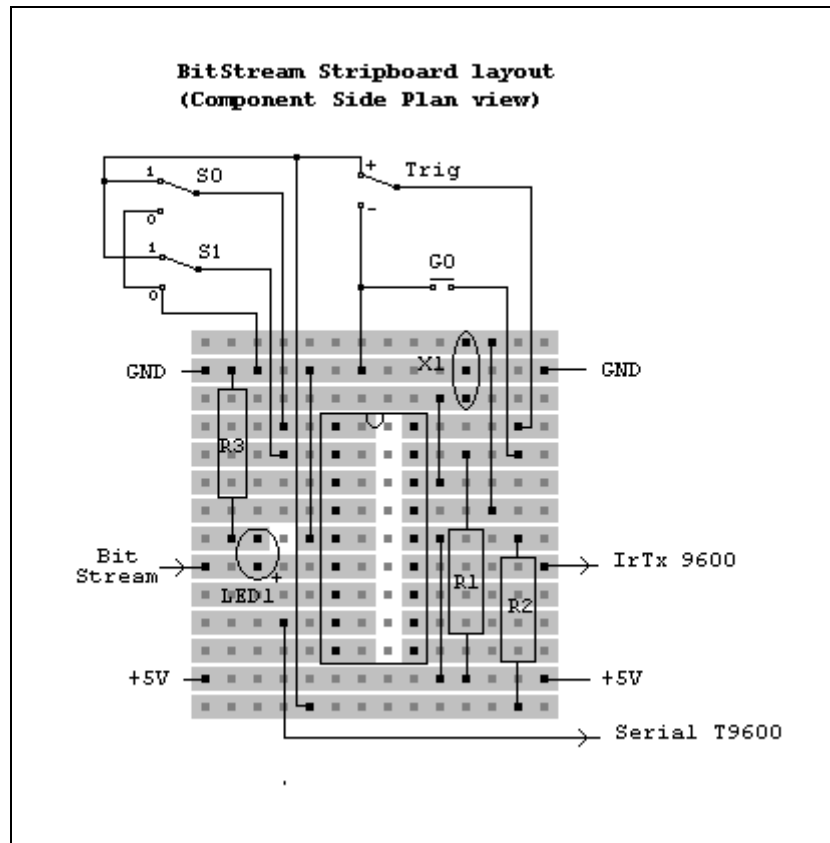


The BitStream circuit comprises of the PIC16F628, which is clocked by an external 4MHz clock resonator. The PIC16F628 device can be programmed using the BitStream hex file. Alternatively a pre-programmed 16F628 device can be ordered (both available from the SirPic website).

The user has several options for the final transmitter stage. This choice will depend upon whether the user wishes to use a wired or wireless (infra-red) transmitter, or both. BitStream supports the IrTx, SIrTx, SerialPIC and InfraPIC interfaces, as described in the SirPic Interface guide.

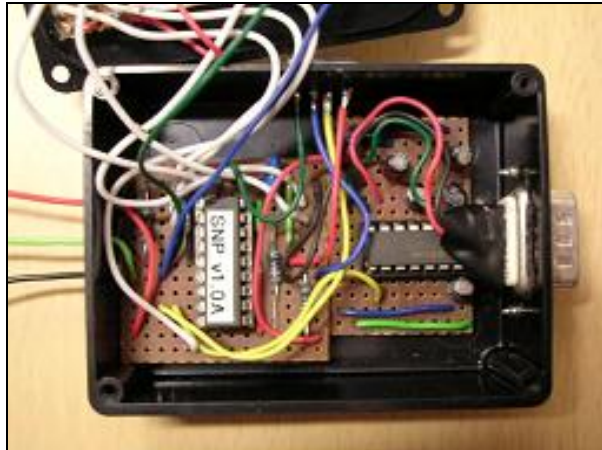
3 Construction

The BitStream sample rate and trigger edge inputs are activated via SPDT switches. The Go input is activated via a push-to-make switch. For convenience of construction, the above schematic has been laid out onto a stripboard (14 tracks x 14 holes), with 10 breaks in the tracks. Depending upon which transmitter is being used, both IrTx and Serial T9600 outputs are provided for driving the selected transmitter interface.



The constructed unit below, shows the configuration switches boxed with an enclosed RS232 SerialPIC interface, as the final transmitter stage.





The picture above shows the BitStream (left) and SerialPIC (right) circuit boards contained within the enclosure.

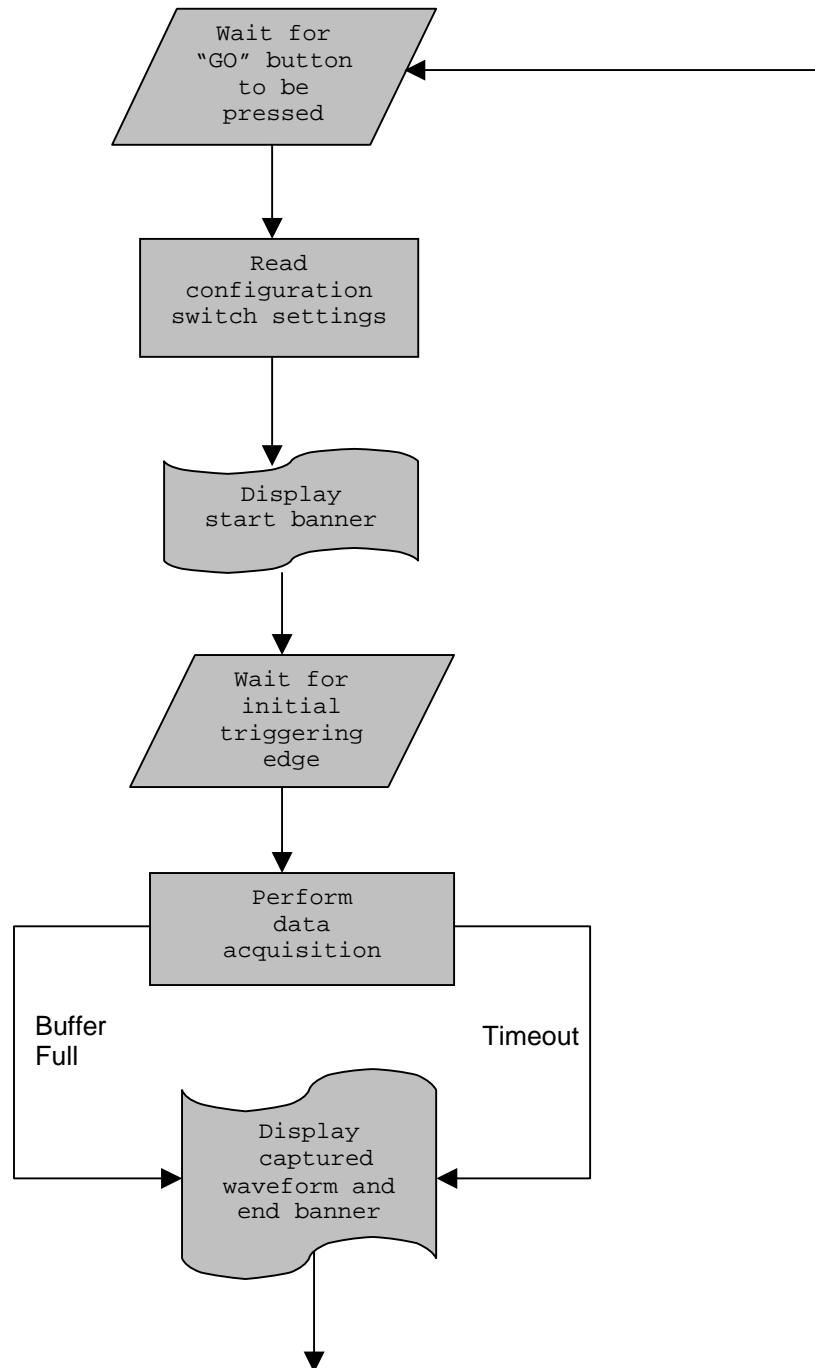


In addition, a 4 pin connector is provided, to enable connection of the optional wireless infrared transmitter modules. The optional IrTx transmitter is shown connected below.



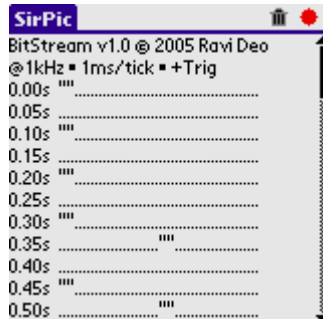
4 BitStream Functionality

4.1 Functional Flowchart



4.2 Display Output

The following display screenshots is taken from SirPic on a Palm PDA. Display output from Terminal Emulator software should be identical.



4.2.1 Start Banner

On pressing the 'Go' button, the start banner is displayed. The start banner is formatted as the first two lines of display, containing the following fields of information:

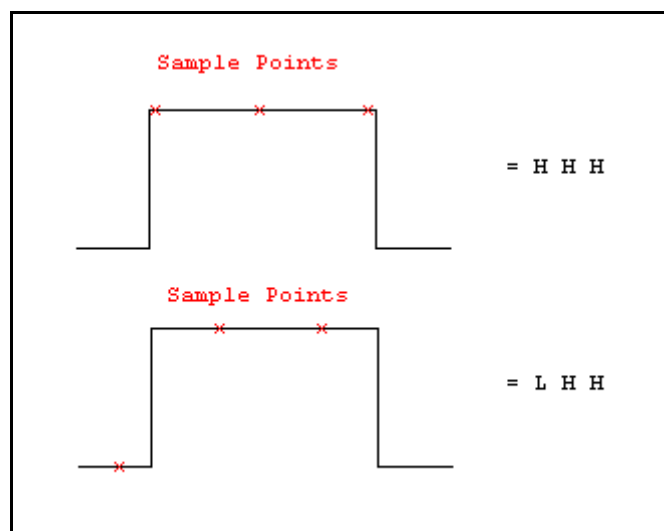
- ❑ BitStream firmware version
- ❑ Copyright information
- ❑ Current sampling frequency rate
- ❑ Current sampling tick period (1/sampling frequency)
- ❑ Current triggering edge

4.2.2 Captured Waveform

After data acquisition, the captured waveform is displayed. The captured waveform is displayed a series of high and low ticks. A 'High' sample tick is displayed as the single quote character ('). A 'Low' sample tick is displayed as the decimal point character (.). The high and low ticks correspond to TTL voltage level ranges.

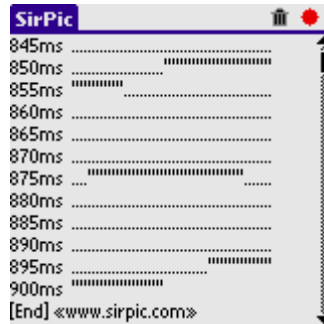
A maximum of 50 sample ticks is displayed per data capture output line. A timestamp is also displayed at the start of each line.

Note that each sample 'tick' represents the status of the signal at that point in time. For example the following pulse signal with a duration of 23us sampled at 100kHz (10us per tick), could be displayed as 2 or 3 high ticks, depending on where the sampling points occurred.



4.2.3 End Banner

The final display line contains a short message displaying the termination status (in square brackets), followed by the SirPic website address.



4.3 Sampling Rate Selection

BitStream offers the following Sampling Rate modes (selected via S0 and S1 inputs):

Sample Mode		Sampling Rate (Frequency)
S0	S1	
0	0	1kHz
0	1	10kHz
1	0	100kHz
1	1	500kHz

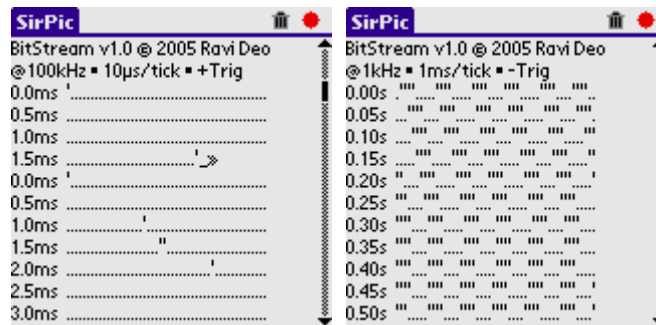
Sampling Rate (Frequency)	Sample Interval (Period)	Data Compression	Sample Buffer Size		Total Sample Duration	
			Min	Max	Min	Max
1kHz	1ms	YES	160	40,000	160 msec	40secs
10kHz	0.1ms	YES	160	40,000	16 msec	4secs
100kHz	10us	YES	160	40,000	1.6 msec	0.4secs
500kHz	2us	NO	641	641	1.282 msec	1.282msec

BitStream uses data compression for sampling rates of 100kHz and below. The compressed buffer data size varies according to signal entropy (change of signal), hence the buffer size is variable. At 500 kHz, no data compression is used, and the sample buffer size is fixed.

4.4 Trigger Selection

BitStream offers both positive (low to high) and negative (high to low) edge triggering. If the signal being captured is normally high during data inactivity, negative edge triggering should be selected. Similarly, if the data is normally low during data inactivity, positive edge triggering should be selected.

The following PDA screenshots display capture for a positive and negative edge triggered signals.



4.5 Compression Overflow

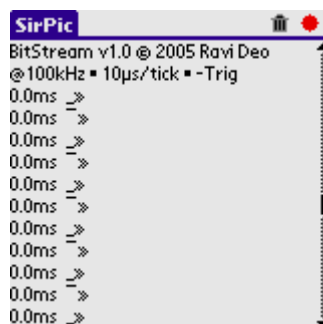
For compressed sampling modes, if the data remains static for more than 255 samples, an overflow condition occurs. The data capture is then automatically truncated to preserve buffer memory, until the signal changes again. This is particularly useful for ignoring inactive periods between bursts of data activity. If this feature is not required, a slower sampling rate should be selected.

When a compression overflow condition is encountered, this is displayed as an underscore character (for low) or overscore character (for high), followed by the double greater than symbol (indicating overflow).

- Low Compression Overflow: `_>>`
- High Compression Overflow: `^->>`

As timing counts are lost during a Compression Overflow, the following data activity will always begin on a new line beginning with a zero timestamp.

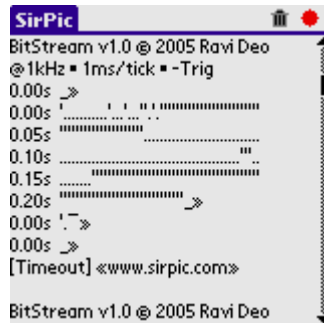
The following PDA screenshot displays both low and high compression overflows for a 1Hz signal.



4.6 Inactive Timeout

For compressed sampling modes, during data capture it is possible to hit a compression overflow condition, and the signal could remain static thereafter. This could typically happen after capturing a one-shot signal. To prevent the data acquisition engine from sitting in an endless loop waiting for more data activity, an inactivity timeout of 5 seconds is provided. After this timeout the data capture is stopped, and the captured waveform displayed, with the suffix message "[Timeout]". Inactive timeouts do not apply whilst waiting for the initial triggering edge.

The following PDA screenshot displays a captured signal, which has terminated with an inactive timeout.



5 Operational Use

To use BitStream:

1. Connect BitStream power connections to GND and +5V.
2. Connect the BitStream monitor signal wire to the digital signal source (TTL 0V/5V)
3. Configure the display terminal for receiving data from BitStream
4. Configure the BitStream Sample rate and trigger edge
5. Press the 'Go' button
6. The BitStream banner is displayed confirming configured settings
7. Data acquisition begins, waiting for the initial trigger edge
8. Data acquisition ends
9. The captured waveform is transmitted for display output.
10. Go to step 4/5 (for next capture)

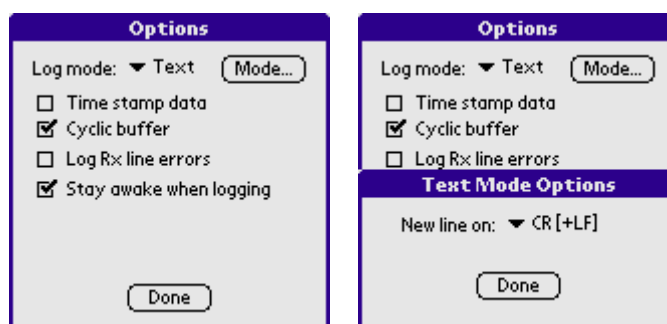
5.1 Configuring Display Terminal

BitStream can be used with the following software applications:

- ❑ SirPic for Palm v1.20 onwards (supports both Wireless infra-red and wired RS232 interfaces)
- ❑ Third Party terminal emulation software or data logging application (usually only supporting wired RS232 connection) eg HyperTerm, CRT etc

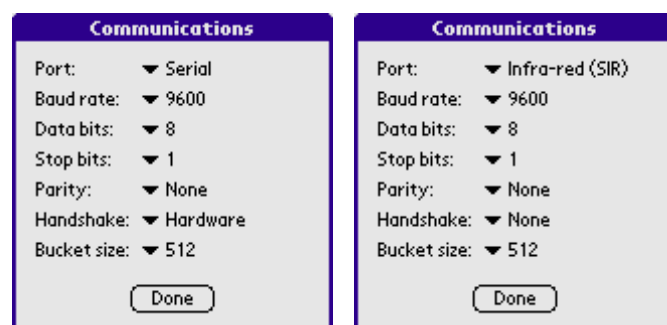
5.1.1 Configuring SirPic (Palm PDA)

The following "Options" settings are recommended:



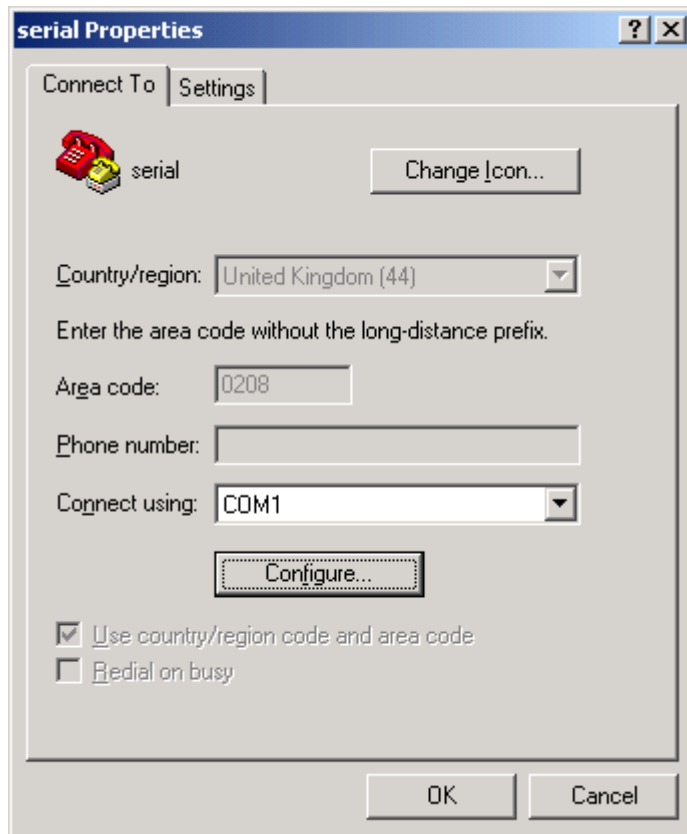
The "time stamp data" option should be unticked (to avoid confusion) and the text "Mode..." option for "New line" must also be set to "CR[+LF]". The remaining settings are optional.

For wired serial RS232 and wireless infra red data logging, the following corresponding communication settings should be used:

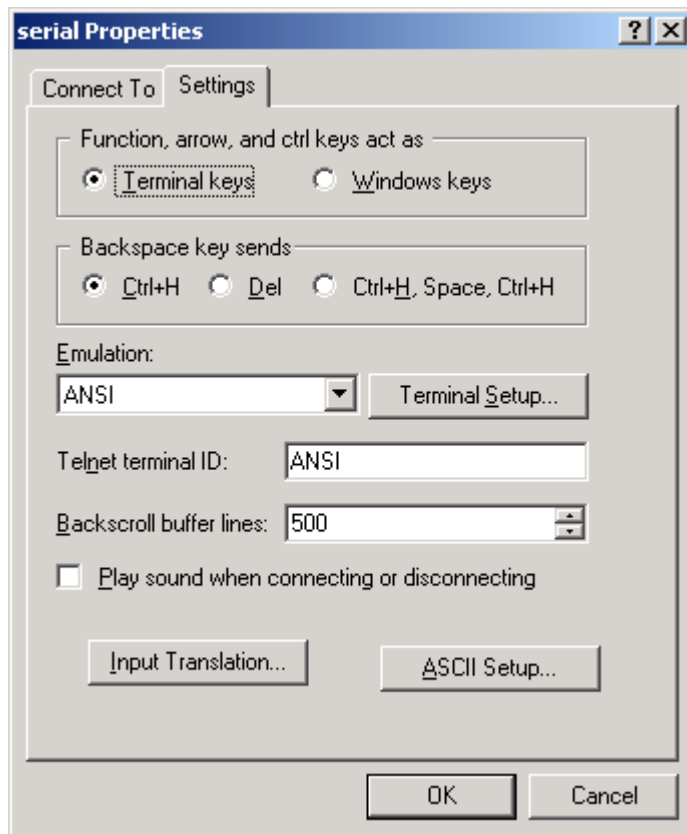


5.1.2 Configuring Terminal Emulator (PC)

The following screen shots have been taken for the HyperTerminal application, which is often distributed with the Microsoft Windows Operating Systems. HyperTerminal can usually be found under *Start->Programs->Accessories->Communication->HyperTerm*. Similar settings will apply for other terminal emulation packages.



Select the serial COM port to which BitStream is connected, via the RS232 SerialPIC interface.



The ANSI terminal ensures that the same character set is used as the Palm OS (ISO-8859 standard international 8 bit character set, as used by Palm PDA). On some terminal emulation packages, using the Courier New font for a VT100 terminal, has the same effect.

