

XE900S-500 Smart Spread Spectrum Transceiver

Description

The XE900S-500 combines a spread spectrum transceiver and micro-controller in a single, easy-to-use, FCC Part 15 Registered module. The embedded communications controller manages the Frequency Hopping Spread Spectrum (FHSS) link and the host system interface.

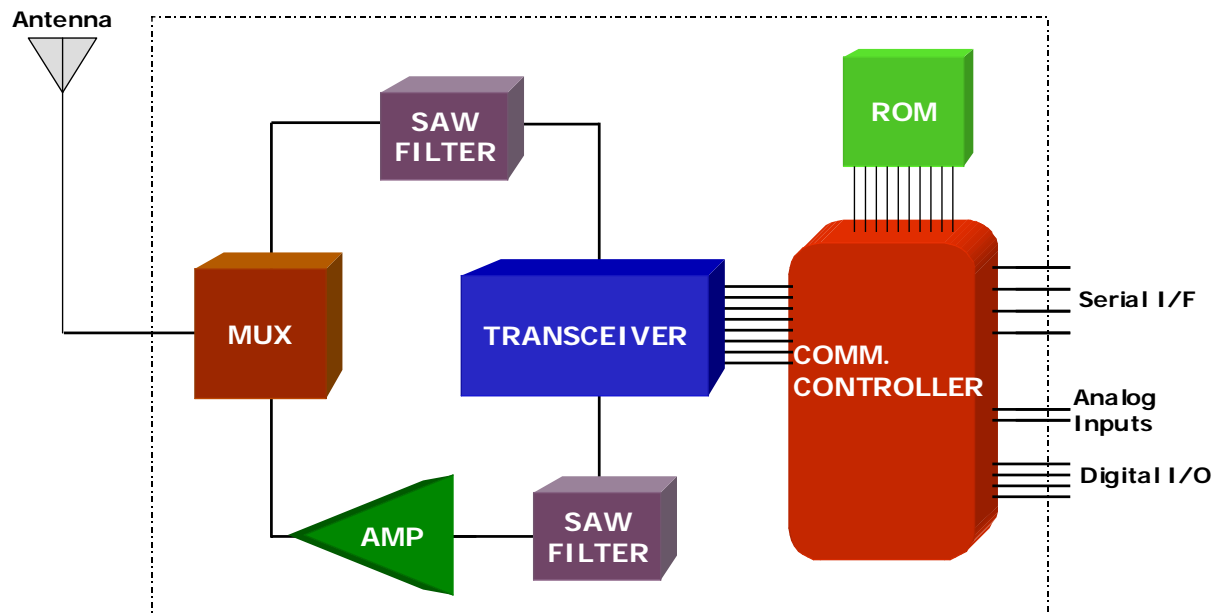
The XE900S-500 supports two unique features to simplify wireless networking. Count-Off™ allows the network master to quickly retrieve the status of 125 remote nodes with a single broadcast command. SensorOnAir™ eliminates the need for an application controller by utilizing the communications controller to directly manage analog inputs and digital control lines.

Xecom also offers a low power spread spectrum model, the XE900SL10, for applications that require less range. The XE900SL10 has an obstructed range of 300 feet but is smaller, costs less and uses significantly less power.

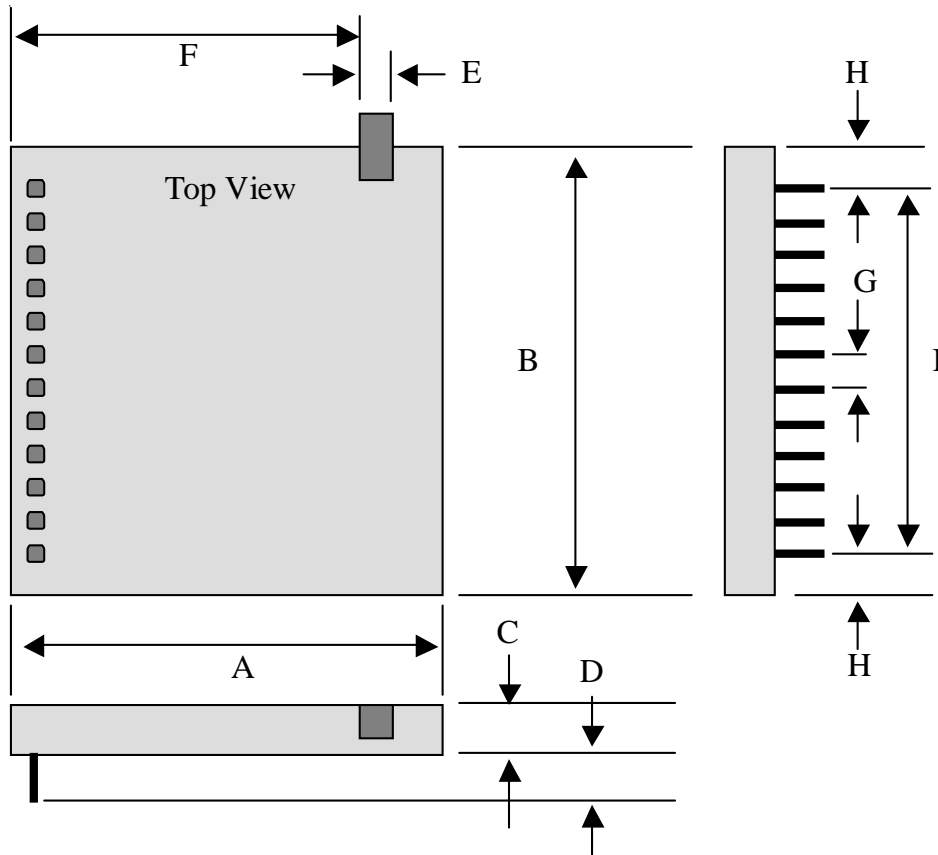
Features

- * Small Size: 1.295" by 1.410" by 0.255"
- * Serial Control and Configuration of the Wireless Link.
- * Supports a 254 node point-to-multipoint network
- * Programmable Transmit Power Output 100 to 500 mW.
- * Typical Receiver Sensitivity -100 dBm
- * Obstructed signal range to 1000 feet;
- * Wireless Data Rate 76.8K bps, half-duplex
- * Low power Consumption
XE900S-500: 1000 mA @ 3.3 Volts; when transmitting at 500 mW output power; less than 1 mA of current flows in Sleep Mode or Power-Down modes
- * SensorOnAir™ (patent pending) allows direct connection of sensors to the Smart Transceiver
- * Count-Off™ (patent pending) allows the host node to download the status of all nodes in under 10 seconds.
- * Operating Temperature Range of -40 to +85 C
- * FCC Part 15 Registered

XE900S-500 Block Diagram



XE900S-500 MECHANICAL SPECIFICATIONS



Dimension	Description	Inches	MM
A	Module Width	1.295	32.89
B	Module Length	1.410	35.81
C	Module Thickness	0.255	6.48
D	Minimum Lead Length	0.125	3.18
E	Antenna Width	0.134	3.40
F	Edge to Antenna	0.995	25.27
G	Pin to Pin Spacing	0.100	2.54
H	Edge to End of Pin Row	0.155	3.94
I	Pin Row Length	1.100	27.94

Layout PCB for XE900S-500 and XE900SL10

Despite the fact that the XE900S-500 is substantially larger module than the XE900SL10, a common PCB layout can be used to support both products. This makes it easy to accommodate applications which include nodes with both long range and short range requirements.

The XE900S-500 and XE900SL10 can share board layout because of common pin assignments. Pins 1 through 8 of the XE900SL10 are equivalent to Pins 3 through 10 on the XE900S-500; they have the same functions and are placed in the same sequence. Pin 9 on the XE900SL10 is an unused pin and therefore does not conflict with the ADC1 signal assigned to Pin 11 of the XE900S-500.

The XE900SL10 requires a separate pin row for Pins 10 through 14. These pins will be hidden under the XE900S-500 module when the larger module is installed. The XE900SL10 also includes one unique signal, Reset. Reset is an active high signal that can be left unconnected if no external reset is desired.

The figure below shows the overlapping layout that supports both modules. The XE900S-500 outline and pins are shown in green. XE900SL10 pins and outline are shown in red.

XE900S-500/XE900SL10 Overlay

Gnd	● 1	XE900S-500	
Vcc	● 2		
/TXD	● 3/1	XE900SL10	
/RXD	● 4/2		
/CTS	● 5/3		
/RTS	● 6/4		
DIO3	● 7/5		14 ● Reset
DIO2	● 8/6		13 ● ADC0
DIO1	● 9/7		12 ● ADC1
DIO0	● 10/8		11 ● Vcc
ADC1/NC	● 11/9		10 ● Gnd
ADC0	● 12		

Using the XE900S-500 Power Saving Modes

The XE900S-500 includes three low power operating modes (Sleep, Power-Down and RF Monitor) to allow the host application to make maximum use of the available power. The #P command determines how the transceiver will operate when not being asked to transmit or receive an RF signal. Below are descriptions of all of the XE900S-500 operating modes.

IDLE: In Idle Mode all circuits within the XE900S-500 are powered and available for immediate action. This includes the RF receiver which actively monitors the air for an incoming communications request. Current draw in Idle Mode is typically 23 milliamps.

SLEEP: In Sleep Mode all circuits within the XE900S-500 are powered-down to reduce consumption. The XE900S-500 will not accept commands or respond to incoming RF communications requests. Any input on the TXD line will wake the transceiver and return it either the Idle or Power-Down Mode which ever mode it was last in before being put into Sleep Mode. Current draw in Sleep Mode is less than 100 microamps.

Power-Down: In Power-Down Mode all RF circuitry is shut down but the communications controller remains active to accept AT commands. In this mode the XE900S-500 cannot respond to incoming RF communications requests. If a transmit RF or Receive RF command is received, the XE900S-500 can activate the RF section in under 200 microseconds. Current draw in Power-Down Mode is less than 800 microamps.

RF Monitor Mode: The XE900S-500 includes 4 RF monitor modes. In each of these RF Monitor modes the transceiver sits in power down mode for a prescribed period of time. The transceiver then wakes up, turns on its receiver and checks for incoming messages. If no messages are received the transceiver returns to power down mode after about 200 milliseconds. If a carrier is detected, the transceiver completes the transaction before returning to power down mode. Intervals of 2 seconds (#P3, 4 seconds (#P4), 8 seconds (#P5) and 16 seconds (#P6) can be selected.

RF Receive Mode: In RF Receive Mode the XE900S-500 is actively receiving an incoming 900 MHz data signal. Current draw in RF Receive Mode is typically 35 milliamps.

RF Transmit Mode: In RF Transmit Mode the XE900S-500 is actively transmitting a 900 MHz data signal. Current draw in Transmit mode is no more than 1000 milliamps with the transmit output power set to maximum, 500 milliwatts.

AT Command Control

The power saving modes are controlled by the AT#Pn command, see below.

AT#P0 - Sets the transceiver to Idle mode.

AT#P1 - Sets the transceiver to Sleep Mode.

AT#P2 - Sets the transceiver for Power-Down Mode.

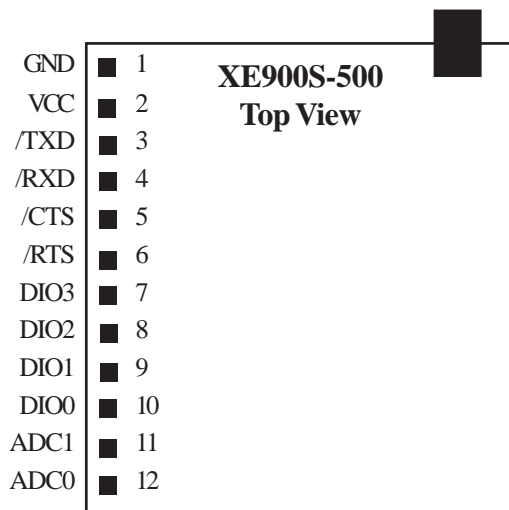
AT#P3 - RF Monitor Mode (2 second interval)

AT#P4 - RF Monitor Mode (4 second interval)

AT#P5 - RF Monitor Mode (8 second interval)

AT#P6 - RF Monitor Mode (16 second interval)

XE900S-500 PIN CONFIGURATION



SIGNAL	PINS	DESCRIPTION
Ground	1	Common voltage reference for the XE900S-500.
VCC	2	3.3 Volt power for the XE900S-500.
/TXD	3	Transmit Data is the data input to the XE900S-500
/RXD	4	Received Data is the data output from the XE900S-500.
/CTS	5	Clear to Send provides hardware flow control from the XE900S-500. The XE900S-500 drives /CTS high to signal the host to temporarily stop the flow of data on the /TXD.
/RTS	6	Request to Send provides hardware flow control from the host system. The host system drives /RTS high to signal the XE900S-500 to temporarily stop the flow of data on /RXD.
DIO3	7	DIO3 may be programmed as either a digital input or digital output. It connects directly to the communications controller in the XE900S-500.
DIO2	8	DIO2 may be programmed as either a digital input or digital output. It connects directly to the communications controller in the XE900S-500.
DIO1	9	DIO1 may be programmed as either a digital input or digital output. It connects directly to the communications controller in the XE900S-500.
DIO0	10	DIO0 may be programmed as either a digital input or digital output. It connects directly to the communications controller in the XE900S-500.
ADC1	11	Analog Input 1 to the XE900S-500 communications controller. ADC1 connects to an internal 12-bit Analog to Digital Convertor. ADC0 may also be configured as a digital input if no analog inputs are required.
ADC0	12	Analog Input 0 to the XE900S-500 communications controller. ADC0 connects to an internal 12-bit Analog to Digital Convertor. ADC0 may also be configured as a digital input if no analog inputs are required.

ABSOLUTE MAXIMUM RATINGS

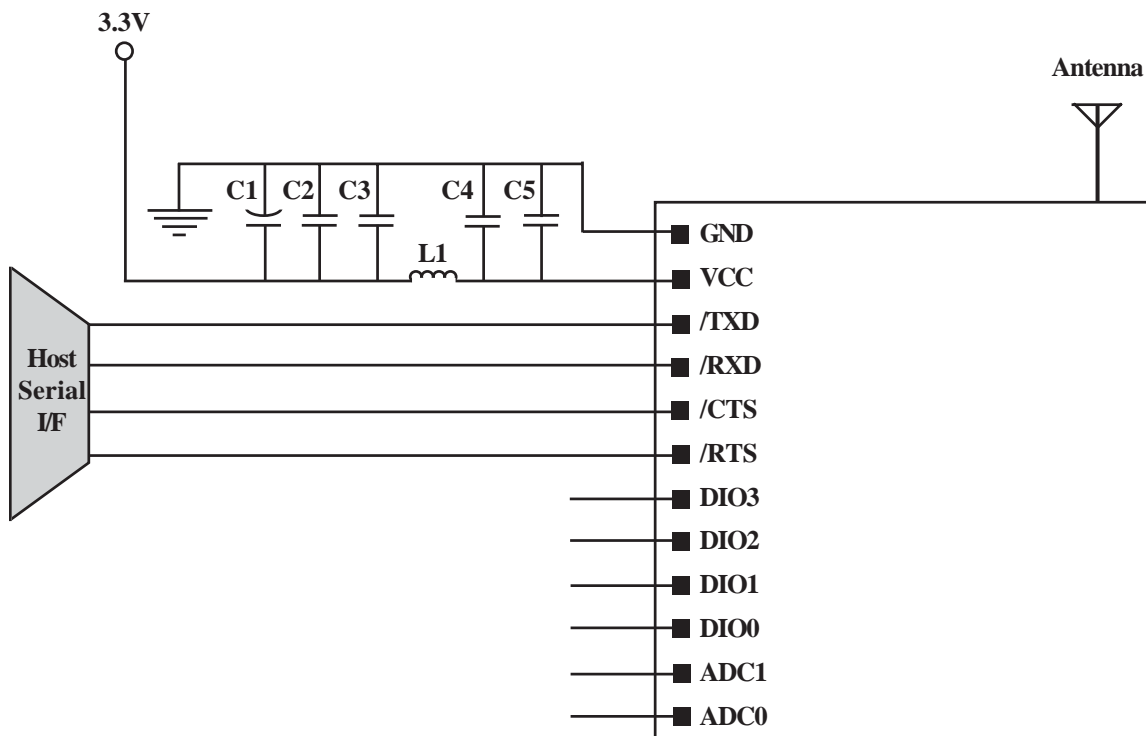
VCC	3.9 Volts
Storage Temperature	-55° C to +125° C
Operating Temperature Range	-40° C to +85° C

WARNING: Exceeding any of these ratings will void the warranty and may damage the device

XE900S-500 ELECTRICAL SPECIFICATIONS

Parameter	Min	Typ	Max	Units	Comments
VCC	2.7	3.3	3.6	Volts	Transceiver power
ICC			1000	mA	Transmit (500 mW output)
		35		mA	Receive Mode
		23		mA	Idle Mode
		2.2		mA	Avg; 2-sec RF Monitor interval
		1.1		mA	Avg; 4-sec RF Monitor interval
		0.6		mA	Avg; 8-sec RF Monitor interval
		0.3		mA	Avg; 16-sec RF Monitor interval
				0.8	mA
			0.10	mA	Sleep Mode
Output Power:	100		500	mW	50 Ohm Load
Wireless Receive Sensitivity		-100		dBm	
Range thru Physical Obstructions		1000		feet	500 mW output
Frequency Hopping Channels		50			
Frequency Band	902		928	MHz	
Antenna Output Impedance		50		Ohms	
Voh	2.25			Volts	VCC =3.3 Volts
Vol			0.75	Volts	VCC =3.3 Volts
Vih	2.25			Volts	VCC =3.3 Volts
Vil			0.75	Volts	VCC =3.3 Volts

XE900S-500 TYPICAL CONNECTION DIAGRAM



Parts List for XE900S-500 Typical Connection Diagram

Reference Designation	Qty	Description
C1	1	Capacitor, Electrolytic, 100 ufd, 10 Volts
C2, C4	2	Capacitor 0.1 ufd, 10 Volts
C3, C5	2	Capacitor 47 pfd, 10 Volts
L1	1	Coilcraft 0603HC-7N5XJB
Antenna *	1	50 Ohm, 1/4 Wave;

* The Antenna connector on XE900S-500 models is a Male MMCX connector. An female MMCX to Female SMA adapter is needed for the antenna connection

XE900S-500 COMMUNICATIONS CONTROLLER

The XE900S-500 uses an internal micro-controller to control communications. This micro-controller manages the interface to the host system, determines when the communications link is available, and formats data for the RF communications.

HOST INTERFACE

The XE900S-500 has two primary interfaces to the system host; the serial interface and the direct sensor interface supported by the SensorOnAir™ feature. Management of both interfaces is the responsibility of the communications controller.

RS232 Interface

The XE900S-500 supports a 4-signal serial interface. For most applications the XE900S-500 will act as a DCE. Control and configuration of the XE900S-500 takes place through the serial interface using modem-like AT commands. The serial data rate is configurable from 1200 bits per second to 115.2K bits per second. The supported serial interface signals are listed below.

- /TXD - Transmit Data; the input to the XE900S-500 for AT commands and Data to be transmitted on the wireless network.
- /RXD - Received Data; the output from the XE900S-500 for received RF data and responses to AT commands.
- /RTS - Request to Send, provides the hardware flow control input to the XE900S-500. The DTE removes RTS to stop the XE900S-500 from sending more data on the RXD line.
- /CTS - Clear to Send, is the hardware flow control output from the XE900S-500. The XE900S-500 deactivates Clear to Send to advise then host to stop inputting data on the TXD lead.

XE900S-500 AT Command Format

AT commands issued to the XE900S-500 follow a strict format. Each command begins with the prefix AT and ends with a carriage return. The XE900S-500 communications controller accepts commands at data rates from 1200 to 115,200 bps. The default serial data rate is 9600 bps and can be changed using register S23. The communications controller uses the AT command prefix to automatically determine the parity of the incoming characters.

Command Prefix - Each command, except the A/ command, begins with the AT prefix. The "A" and "T" may be either both upper case or both lower case but cannot be of different cases. The prefix identifies parity of the commands sent to the XE900S-500 by comparing the parity bits of the "A" and the "T" characters.

Command Line - Commands may be strung together in a single command line of up to 30 characters. Commands in the command string are executed in the sequence they appear.

Omitted Parameters - Most commands include a parameter which determines the function setting. When the command parameter is omitted from the command string, it is assumed to be a 0.

Result Codes - A result code is normally issued after each action. Result codes may be provided as full words, one or two digit numeric codes, or may be disabled all together. Each result code ends with a carriage return when numeric result codes are chosen. When full word result codes are chosen, a Line Feed and Carriage Return precede and follow each result code.

Disconnect Sequence - A three character sequence initiates a disconnect of the wireless link. The sequence “~~~” is assigned to disconnect the link.

DIRECT CONNECTION OF SENSORS:

SensorOnAir™

Sensors can be connected directly to the XE900S-500 without requiring an applications controller. In this SensorOnAir™ configuration the XE900S-500 communications controller controls the operation of the sensors.

Sensor I/O Lines

SensorOnAir controls the operation of 6 I/O lines to the XE900S-500. This includes 2 analog inputs, ADC0 and ADC1, and 4 digital I/O lines, DIO0, DIO1, DIO2, and DIO3. ADC0 and ADC1 are connected to a 12-bit analog to digital converter and use a 2.5 volt reference derived from VCC as their reference voltage. The digital I/O lines can be programmed to act as either inputs or outputs.

XE900S-500 COMMUNICATIONS CONTROLLER

Configuring the XE900S-500 for Sensor Operation

All SensorOnAir control functions for the analog inputs and digital I/O's are performed by the communications controller within the XE900S-500. Modem-like AT commands loaded through the serial interface, program the functions of the analog and digital I/O lines. The AT commands used to program the SensorOnAir functions are then stored in the XE900S-500 Flash memory. This allows the XE900S-500 to be first programmed and then installed in the application. The communications controller uses the information stored in Flash memory to control the analog and digital I/O lines.

SensorOnAir Commands™

Below is a list of the AT commands used to program the direct control of sensors using the communications controller in the XE900S-500.

S107 - Defines the function of the programmable I/O lines. The two analog input lines, ADC0 and ADC1, can also be defined as digital I/O lines if needed. The four programmable digital I/O lines, DIO0, DIO1, DIO2, and DIO3; can be set as either inputs or outputs. The value of this command is stored in flash memory within the XE900S-500.

AT&IAn? - This command allows a local host to read the value of Analog Input "n."

AT&IDn? - This command allows a local host to read the status of Digital I/O "n."

AT&IDn=z - This command allows a local host equipment to set the condition of the local digital output "n." When z=0 the output is set to a logic low; when z=1 the output is set to a logic high.

AT#IxxxAn? - This command allows the value of Analog Input "n" on node address "xxx" to be read remotely.

AT#IxxxDn? - This command allows the status of Digital I/O "n" on node address "xxx" to be read remotely

AT#IxxxDn=z - This command allows the condition of the local digital output "n" on node address "xxx" to be set remotely. When z=0 the output is set to a logic low; when z=1 the output is set to a logic high.

WIRELESS COMMUNICATIONS

The communications controller manages the RF Link. This includes the frequency hopping algorithm for spread spectrum operation; collision avoidance, node addressing, and packetizing data. The communications controller allows support for point-to-point, point-to-multipoint or multipoint networks.

Carrier Sense Multiple Access (CSMA)

To prevent collisions between network nodes the XE900S-500 uses a Carrier Sense Multiple Access protocol for each network transceiver. In normal communications all nodes, including the Master node in a point-to-Multipoint network, listen for communications activity before initiating a session. If a wireless link already exists, the transceiver waits until that session is complete before initiating a wireless link.

Data Packets

All data presented by the system host is placed into packets by the XE900S-500 communications controller for transmission across the wireless link. These packets provide addressing and error correction for the wireless communications. The communications controllers place the data in packets only for the wireless link. The data is extracted from the packets before being sent out the serial interface.

File Transfer Mode

Xecom's XE900S-500 incorporates a File Transfer mode that uses a simplified networking protocol so that the maximum data transfer rate is achieved. In this mode the XE900S-500 does not automatically retransmit blocks containing errors. A CRC 16 checksum is calculated, transferred at the end of the file, and checked by the receiving unit. An "ERROR" message is displayed if the checksum calculated at the receive end does not match the checksum transmitted with the data.

The File Transfer Mode is controlled by the AT#T command. The format of the command is AT#Txx; where xx is the destination address of the file. Following is a sample file transfer.

XE900S-500 COMMUNICATIONS CONTROLLER

Sample File Transfer

Transmitter		Receiver		Description
TXD	RXD	TXD	RXD	
AT#T01<cr>				Initiate File Transfer
	:<cr>		FILE<cr>	Link Established
abc...z			abc...z	File Data
3 sec pause in data			A718<cr>	Checksum at End of File Transfer
			OK<cr>	File Transfer Successful
			<i>or</i> ERROR<cr>	Error Detected in File Transfer

Notes: The above example shows that the file transfer is assumed to be completed if three seconds pass with no data being presented to the TXD input on the serial port.

File Transfer Mode cannot be used to send binary data.

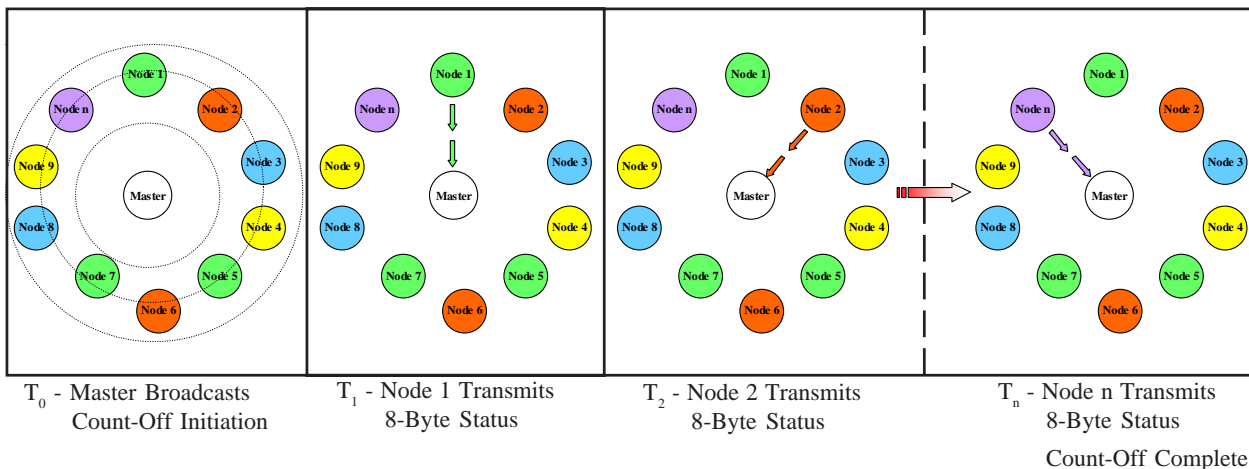
Multipoint Network

System designers using the XE900S-500 can create a point-to-multipoint network with up to 125 remote nodes. The master node is assigned address 1. The remote nodes are assigned address from 2 to 126. Xecom created Count-Off to insure efficient network operation. Count-Off allows the master node to poll the entire network in less than 10 seconds. The Count-Off creates a temporary time division multiplexing scheme which permits each node to report its status without the handshaking sequence normally required for a wireless data exchange.

The Count-Off sequence is initiated by the AT#C command from the host system. The Master node broadcasts the Count-Off command to all network nodes. Upon receipt of the Count-Off broadcast each remote node initializes an internal timer. Then in sequence by address each node sends an 8-byte status message to the Master. The status message is programmed with the AT#E: or AT#E= command. Due to difficulties in synchronizing the spread spectrum signals, a node may sometimes miss the Count-Off command. The network administrator should poll any node that does not respond to the Count-Off request to insure the network integrity.

Using Count-Off network reporting will be completed in less than 10 seconds. Based on the status information the host can then elect to service any of the remote nodes.

COUNT-OFF™ SEQUENCE



AT COMMANDS

An asterisk indicates the factory default

- A Answer Command** - forces the smart transceiver respond to a summons from another wireless device.
- Dn Initiate a Wireless Link** - attempts to establish a connection with the transceiver at address n.
- En Echo Characters** - determines if the XE900S-500 will echo the characters received on its serial interface during command mode.
n=0 Characters not Echoed
n=1 Characters Echoed *
- In Identification** - displays product identification code.
n=0 Display Product Code
n=1 Display Product Name
n=2 Display Model Number
n=3 Display Copyright
n=4 Display Firmware Revision
- Qn Result Code Display** - determines if result codes will be displayed.
n=0 Display Result Codes *
n=1 Do not Display Result Codes
- Sn= Set Value of Register Sn**
- Sn? Read Value of Register Sn**
- Vn Response Type** - selects Full Word or Numeric responses
n=0 Numeric Responses
n=1 Full Word Responses *
- Zn Reset** - executes a soft Reset
n=0 Reset to Values Stored in User Profile 0 *.
n=1 Reset to Values Stored in User Profile 1
- &F Restore Factory Settings** - returns all configuration commands and registers to their factory default values.
- &IAn? Read Local Analog Input “n”** - This command allows the host equipment to read the values of the local analog inputs.
n=0 Read input ADC0
n=1 Read input ADC1

&IDn? Read Local Digital Input “n” - This command allows the host equipment to read the status of the local digital inputs.

- n=0 Read input DIO0
n=1 Read input DIO1
n=2 Read input DIO2
n=3 Read input DIO3
n=4 Read input DIO4 (pin shared with ADC0)
n=5 Read input DIO5 (pin shared with ADC1)

&IDn=z Set Local Digital Output “n” - This command allows the host equipment to set the condition of the local digital outputs. When z=0 the output is set to a logic low; when z=1 the output is set to a logic high.

- n=0 Set output DIO0
n=1 Set output DIO1
n=2 Set output DIO2
n=3 Set output DIO3

&Kn Flow Control - selects the type of flow control to be used between the system host and the XE900S-500

- n=0 Flow Control Disabled
n=3 RTS/CTS, hardware Flow Control
n=4 XON/XOFF, in-band Flow Control

&V View Active Configuration - sends the active configuration data to the system host.

&Wn Store Current Configuration - loads the current XE900S-500 configuration into either User Profile 0 or User Profile 1.

- n=0 load configuration into User Profile 0
n=1 load configuration into User Profile 1

#B Wireless Broadcast Mode - initiates wireless broadcast mode for diagnostic purposes.

#C Count-Off Request (ASCII) - Initiates a “count-off” sequence in the network with node status to be reported in ASCII format.

#E: Count-Off Response (ASCII) - Programs the nodes 8 byte response to a “count-off” request from the network hub in ASCII format.

#E= Count-Off Response (Hex) - Programs the nodes 8 byte response to a “count-off” request from the network hub in hexadecimal format.

AT COMMANDS

#IxxxAn? Read Analog Input “n” at Node Address xxx -

This command allows analog input values at any node to be read remotely.

n=0 Read input ADC0

n=1 Read input ADC1

#IxxxDn? Read Digital Input “n” at Node Address xxx -

This command allows the status of the digital inputs at any node to be read remotely.

n=0 Read input DIO0

n=1 Read input DIO1

n=2 Read input DIO2

n=3 Read input DIO3

n=4 Read input DIO4 (pin shared with ADC0)

n=5 Read input DIO5 (pin shared with ADC1)

#IxxxDn=z Set Digital Output “n” at Node Address xxx

- This command allows the condition of the digital outputs to be modified remotely. When z=0 the output is set to a logic low; when z=1 the output is set to a logic high.

n=0 Set output DIO0

n=1 Set output DIO1

n=2 Set output DIO2

n=3 Set output DIO3

#Pn Low Power Operation - Allows the XE900S-500 to operate in reduced power modes.

n=0 Selects Normal Power Mode

n=1 Places Transceiver in Sleep Mode;

n=2 Places Transceiver in Power-Down Mode

#R Receive Broadcast - Allows XE900S-500 to receive a broadcasted message and present it on the serial interface.

#Txx File Transfer - initiates a file transfer to the destination address xx.

XE900S-500 Responses

<u>Numeric</u>	<u>Full Word</u>	<u>Description</u>
0	OK	Successfully executed command line
1	CONNECT RF	Wireless Connection Established
2	RING	Wireless Link Request Detected
3	DISCONNECT	Lost Wireless Link
4	ERROR	Error in command line, or file transfer
6	NO CONNECTION	Failed to Establish Wireless Link
7	BUSY	Link Request Time Out has occurred
8	SORRY	No Response to Count-Off Request
9	WAIT	Wireless Link is not available
	FILE	File Transfer Mode

XE900S-500 Configuration Registers

- S0 Answer Wireless Link Request:** S0 determines if the XE900S-500 will automatically respond to a wireless link request.
- S0=0 No Automatic response to link requests
- S0=1 Automatically respond to link requests
- S0=128 Enter Broadcast mode on power-up. The command must be stored in nonvolatile memory using the AT&W command.
- S2 Wireless Disconnect Character** - S2 sets the ASCII character to be used in the link disconnect sequence. The default character is the tilde “~”.
- Range: 0-255
- Default: 126
- S7 Link Set-up Timer** - S7 sets the length of time in seconds that the transceiver will attempt to create a link with the destination node.
- Range: 0-60
- Default: 10
- S10 Link Recovery Timer** - S10 sets the length of time in seconds that the transceiver tries to recover a broken link.
- Range: 0-60
- Default: 10
- S12 Disconnect Guard Timer** - S12 sets the guard timer in milliseconds before and after the disconnect sequence. If any characters other than the disconnect sequence are received within the window defined by S12 the disconnect request will be ignored..
- Range: 0-255
- Default: 20
- Units: Milliseconds
- S14 Bit-mapped Register** - S14 stores the values of the ATE, ATQ and ATV commands.
- S23 Serial Interface Data Rate** - S23 stores the serial interface data rate.
- Range 1-10
- 1 = Set serial data rate to 1200 BPS
- 2 = Set serial data rate to 2400 BPS
- 3 = Set serial data rate to 4800 BPS
- 4 = Set serial data rate to 9600 BPS*
- 5 = Set serial data rate to 14400 BPS
- 6 = Set serial data rate to 19200 BPS
- 7 = Set serial data rate to 28800 BPS
- 8 = Set serial data rate to 38400 BPS
- 9 = Set serial data rate to 57600 BPS
- 10 = Set serial data rate to 115200 BPS
- Default: 4
- S39 Bit-mapped Register** - S39 stores the value of the AT&K command.
- S104 Group ID Number** - S104 sets the Group ID number for the XE900S-500. Up to “n” groups may be active in the same area. Only transceivers with the same Group ID number can communicate.
- Range: 0-255
- Default: 0
- S105 XE900S-500 ID Number** - S105 sets the ID number for the XE900S-500. Each unit on the Base Access Network is required to have a unique ID number.
- Range: 1-254

XE900S-500 Configuration Registers

S107 I/O Configuration - S107 is a bit-mapped register which defines the local programmable I/O lines.

Bit 0 = 0 - ADC0 and ADC1 used as Programmable I/O
= 1 - ADC0 and ADC1 defined for Analog use

Bit 1 = reserved

Bit 2 = 0 - DIO0 used as an output
= 1 - DIO0 used as an input

Bit 3 = 0 - DIO1 used as an output
= 1 - DIO1 used as an input

Bit 4 = 0 - DIO2 used as an output
= 1 - DIO2 used as an input

Bit 5 = 0 - DIO3 used as an output
= 1 - DIO3 used as an input

Bit 6 = 0 - DIO4 used as an output (Bit 0 = 0)
= 1 - DIO4 used as an input

Bit 7 = 0 - DIO5 used as an output (Bit 0 = 0)
= 1 - DIO5 used as an input

Default: 193

S108 Transmit Level Control - S108 sets the transmit level

Range: 0-3

0 20 dBm

1 23 dBm

2 26 dBm

3 27 dBm

Default: 3

FCC PART 15 REGULATIONS

Mounting the XE900S-500 in Your Assembly

The XE900S-500 must be mounted horizontally on your printed circuit board to maintain proper orientation of the transceiver. Standoffs should also be used on the side opposite the pin row to maintain clearance between the XE900S-500 and your printed circuit board. The XE900S-500 may not be co-located with any other antenna or transmitter.

XE900S-500 Antenna

The XE900S-500 is certified for compliance to FCC Part 15 rules only using the Xecom XE900A500, 1/4 wave monopole antenna. Use of any other antenna violates FCC Part 15 rules.

FCC Part 15 Certification

The XE900S-500 has been certified per FCC Part 15 rules for integration into OEM products without further testing or certification. This certification is your assurance that the XE900S-500 will not cause harmful interference.

Labeling Requirements

FCC rules require the Original Equipment Manufacturer using the XE900S-500 to place an appropriate label on the outside of the finished equipment. The label must be clearly visible and include the information shown below.

Contains Transmitter Module

FCC ID: DWE-XE900S-500

WARNING:

This device complies with Part 15 of the FCC Rules. Its operation is subject to the following conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any received interference including interference that may cause undesired operation.

Limitations

The XE900S-500 is registered under FCC Part 15 Rules. To utilize this registration on your OEM System you must follow the applications circuit provided in this data sheet and use one of the listed antennas. Any changes or modifications to the recommended circuit must be approved by Xecom. Failure to seek Xecom's approval for modifications could void certification of the end product.

Warning: RF Exposure

The XE900S-500 is approved for mobile, base station and mobile applications. A minimum separation of 20 centimeters should be maintained between the antenna and the equipment operator. For mobile applications check the minimum separation distances defined below. To ensure compliance, operation at distances closer than those defined is not recommended.

The Warning message below must be included in the user Manual for the end product.

To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 20 cm separation distance between the antenna and all persons.

FCC Notifications

The XE900S-500 generates radio frequency energy. It must be installed according to the manufacturer's guidelines stated in the data sheet or it has the potential to cause interference with other radio devices. Testing has been performed to assure that it conforms with the FCC Part 15 rules for intentional and unintentional radiators.

No further EMI compliance testing of the *transmitter* is required as long as the 20 cm separation and co-location requirements are observed. Each new use of the module will, however, need to be scanned for unintentional radiation from digital clocks, etc.

All necessary calibration has been performed at the time of manufacture. Any modification of the device after it leaves the factory is a violation of FCC rules.

Terms of Sale

Devices sold by XECOM are covered by the warranty provisions appearing in its Terms of Sale only. XECOM makes no warranty, express, statutory, implied, or by description regarding the information set forth herein, or regarding the freedom of the described devices from patent infringement. XECOM makes no warranty of merchantability or fitness for any purposes.

XECOM reserves the right to discontinue production and change specifications and prices at any time and without notice. This product is intended for use in normal commercial applications. Applications requiring extended temperature range, unusual environmental requirements, or high reliability applications, such as military, medical life-support or life-sustaining equipment, are specifically not recommended without additional processing and authorization by XECOM for such application.

Xecom assumes no responsibility for the use of any circuitry other than circuitry embodied in a Xecom product. No other circuits, patents, or licenses are implied.

Life Support Policy

Xecom's products are not authorized for use as Critical Components in Life Support Devices or Systems.

Life Support Devices or Systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions provided in the labeling, can be reasonably expected to result in significant injury to the user.

A **Critical Component** is any component of a life support device or system whose failure to perform can be reasonably expected to cause failure of the life support device or system, or to affect its safety or effectiveness.

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