

A Complete Send and Receive Fax & Data Modem

Description

Xecom's XE9624F and XE9624FS include a 2400bps data modem, a Group III Send and Receive fax modem and the telephone interface in one compact component. Both models include user transferable FCC Part 68 registration.

Xecom puts the XE9624F in our dual inline package. The XE9624F is pin compatible with other Xecom modems including the XE2401, XE2496, and XE9624E.

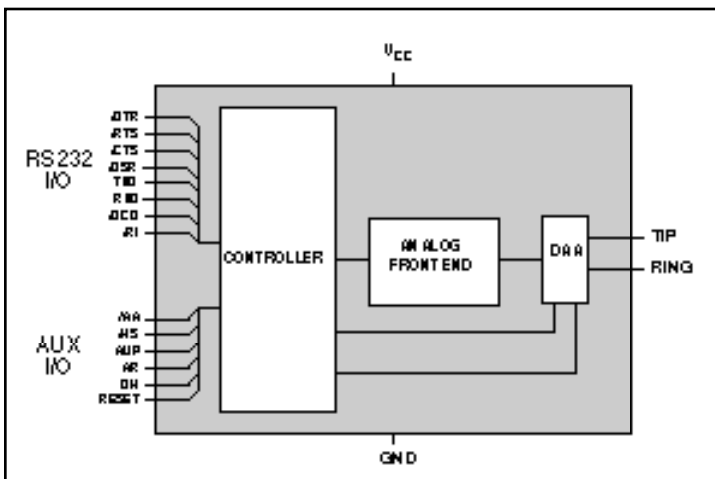
The XE9624FS comes in a Single Inline Package. The XE9624FS can be ordered for either vertical (XE9624FS1) or horizontal (XE9624FS2) mounting to optimize space utilization.

Xecom designed the XE9624F and XE9624FS specifically to provide computer, notebook, and industrial systems manufacturers with a complete, highly integrated, compact solution for adding data and fax communications.

Features

- Data Rates: 2400, 1200 and 300 bps
- Send fax to 9600 bps
- Receive fax to 4800 bps
- Enhanced "AT" commands for modem control and configuration.
- Class 1 commands for facsimile control.
- Single +5V supply
- Low power CMOS:
Operating: 200 mW (Typ.)
Sleep mode: 50 mW (Typ.)
- Dimensions;
XE9624F: 2.28" by 1.08" by 0.42"
XE9624FS: 1.53" by 0.46" by 0.92"

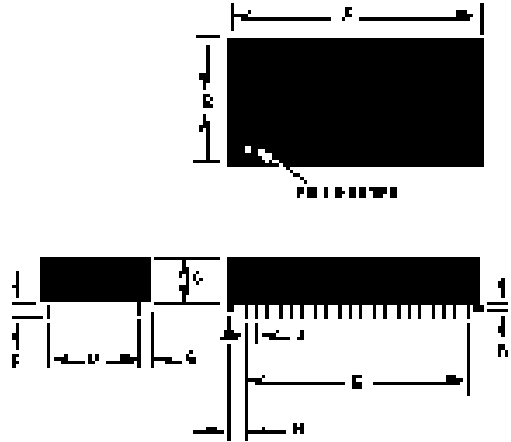
Block Diagram



XE9624F Mechanical Specifications

PIN	INCHES		METRIC(MM)	
	MIN	MAX	MIN	MAX
A	2.270	2.290	57.66	58.17
B	1.070	1.090	27.18	27.69
C	0.420	0.430	10.67	10.92
D	0.890	0.910	22.61	23.11
E	1.890	1.910	48.01	48.51
F	0.125	0.200	3.18	5.08
G	0.080	0.100	2.03	2.54
H	0.180	0.200	4.57	5.08
J	0.090	0.110	2.29	2.79
K	0.020	0.025	0.51	0.64

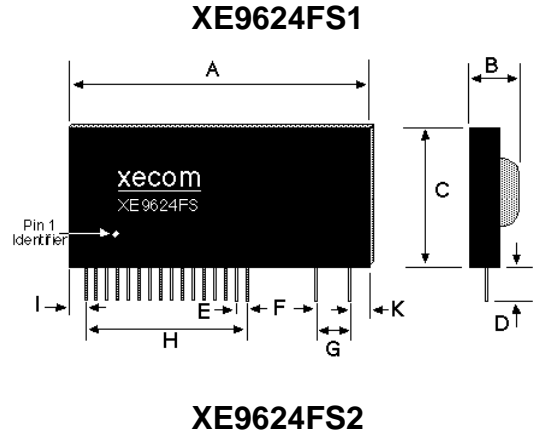
Pins = 0.025 inch square pin
All pins tin-plated



XE9624FS Mechanical Specifications

PIN	INCHES		METRIC(MM)	
	MIN	MAX	MIN	MAX
A	1.500	1.560	38.10	39.62
B	0.430	0.490	10.92	12.45
C	0.890	0.950	22.61	24.13
D	0.090	0.140	2.23	3.56
E	0.045	0.055	1.14	1.40
F	0.340	0.360	8.64	9.14
G	0.140	0.160	3.56	4.06
H	0.790	0.810	20.07	20.57
I	0.050	0.110	1.27	2.79
K	0.200	0.260	5.08	6.60
L	0.420	0.480	10.67	12.19

Pins = 0.018 inch diameter pin
All pins tin-plated



Pin Descriptions

NAME	I/O	DESCRIPTION
RESET	I	Hardware reset pin, Schmitt input, active HI, TTL. Use of an external reset is not required
AR	O	Auxiliary Data/Voice Relay output, active HI, TTL/CMOS. When high, AR drives an external auxiliary telephone set relay closed to allow the same telephone line to be used for voice communications.
RXD	O	Serial data output to the DTE (i.e. external UART). A logic "high" represents a "mark" and a logic "low" represents a "space", TTL.
\DTR	I	Data Terminal Ready, input, active LO, TTL. The function of this pin is set by the &D command and the value in register S21. Normally the modem ignores DTR.
\AA	O	Auto Answer enable indicator, output, active LO, TTL/CMOS. A low indicates the modem is set to automatically answer an incoming call.
\CTS	O	Clear to Send, output, active LO, TTL/CMOS.
OH	O	DAA hookswitch relay is closed in the "off-hook" position connecting the DAA to the telephone line.
TXD	I	Serial data input from the DTE (i.e. external UART). A logic "high" represents a "mark" and a low represents a "space", TTL.
\RTS	I	Request to Send, input, active LO, TTL. Not used.
\HS	O	High Speed indicator, output, active LO, TTL/CMOS. Low when operating at 2400bps rate, high otherwise.
\RI	O	Ring Indicator, output, active LO, TTL. When low indicates the modem is receiving a ring signal.
TIP	—	Tip connection to the phone line(RJ11 pin3) from the internal DAA.
RING	—	Ring connection to the phone line(RJ11 pin4) from the internal DAA. Caution: Observe design rules for Tip & Ring trace layout

NAME	I/O	DESCRIPTION
GND	—	Ground (0 volts).
AMP	O	Audio output to speaker. Function is determined by L & M commands and the value in register S22. This output can drive a 50Kohm load.
\DCD	O	Data Carrier Detect, output, active LO, TTL/CMOS. Function is set by the &C command and the value in register S21.
\DSR	O	Data Set Ready, output, active LO, TTL/CMOS. Function is set by the &S command and the value in register S21.
Vcc	—	+5 Volts

Pin Configurations

XE9624F			
Pin Configuration			
RESET	1	40	+5V
AR	2	39	/DSR
RXD	3	38	/DCD
	4	37	
	5	36	
	6	35	
	7	34	
	8	33	
/DTR	9	32	
/AA	10	31	
/CTS	11	30	
OH	12	29	
TXD	13	28	
/RTS	14	27	
/HS	15	26	
/RI	16	25	
	17	24	
TIP	18	23	
	19	22	AMP
RING	20	21	GND

XE9624FS	
Pin Configuration	
VCC	1
Reset	2
TXD	3
RXD	4
VAA	5
\RTS	6
\DTR	7
\RI	8
\HS	9
\DCD	10
\CTS	11
\DSR	12
OH	13
AR	14
AMP	15
Gnd	16
Tip	17
Ring	18

AT Commands

The XE9624F and XE9624FS use the Hayes "AT" commands for configuration and control. Extensions to the AT commands support fax operation. The following section describes how to use the AT command format and lists the AT commands, Registers and Result codes used to control modem operation.

Modes of Operation

The "AT" commands have three operational modes; Command, Fax and Data Modes.

Data Mode: The XE9624F/FS enters data mode after it makes a connection with a remote modem and issues an appropriate "CONNECT" result code. In the Data Mode the modem sends all data on the Transmit Data line to the remote modem and puts data from the remote modem onto the Received Data line for the host equipment. When the modem exits data mode, it issues a "NO CARRIER" result code.

Command Mode: The XE9624F/FS enters command mode on power-up, reset, a lost connection, or receipt of an escape code. When in command mode, the modem accepts command line instructions from the host on transmit data. More than one instruction may be placed on each command line. Appropriate result codes are returned to the host on received data. The AT commands allow the host to configure the modem for a specific application.

Fax Mode: The XE9624F/FS enters fax mode after it receives the AT+FCLASS=1 command. In fax mode commands and responses are issued at 19,200 bits per second; the character format is 8 bits no parity. The modem accepts Class 1 fax commands only while in the fax mode. The A/, ATO, AT&T and escape commands are not valid in fax mode.

Command Line Format

Command lines issued to the modem follow a strict format. Each command begins with the prefix AT. The command line is stored in the command buffer and executed upon receipt of a carriage return. Until executed, the command line can be edited with the backspace key.

Command Prefix - Each command, except for the A/ command, begins with the AT prefix. The "A" and "T" may be either both caps or both lower case but cannot be of different cases. The prefix identifies the speed and parity of the commands sent to the modem by the host. Speed is determined by measuring the width of the incoming bits. Parity is determined by comparing the parity bit of the "A" and the "T." Result codes are sent at the speed and parity determined by the prefix.

Command Line - Commands may be joined in a single command line up to 40 characters long. Commands are executed in the sequence they appear. Spaces may be inserted into the command line to improve readability. Spaces do not fill space in the command buffer. A carriage return terminates the command line and causes the commands to be executed. Register S3 allows the user to select a character other than a carriage return to terminate the command line.

Command Buffer - No more than 40 characters, including the AT prefix, may be loaded into the command buffer. If the command buffer overflows, the modem issues an "ERROR" result code and commands are not executed.

Command Line Editing - The backspace can be used to edit the command line before it is executed. Hitting the backspace key, or Control and H simultaneously on some systems, erases the previous character in the command line. All of the characters in the command line can be erased except for the "A" and "T." Register S5 allows the user to select another character other than a backspace to edit the command line.

Re-Execute Last Command - The A/ command causes the modem to reexecute the last command line. This is the only command which does not require the "AT" prefix.

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

Escape Characters - A 3 character escape sequence maybe entered while in data mode to switch the modem into command mode while on line. The escape character, set by Register S2, must be entered 3 times in succession within a 1 second guard time to execute the escape. The default escape sequence is "+++."

Result Codes - The modem issues a result code after each action. Result codes may be provided as full words, numeric codes or may be disabled all together. Each result code ends with a carriage return when numeric resul codes are chosen. When full word result codes are chosen, a Line feed and Carriage Return preceed abd follow each result code.

AT Command List

A - Answer Command -

Bn - Select Communications Standard

- n=0 Selects CCITT standards
- n=1 Selects Bell standards

D - Dial Command -

- P = Pulse dial
- T = Tone dial
- R = Connect as an answering modem
- W = Wait for dial tone
- , = Pause for the duration ofr S8
- @ = Wait for silence
- ! = Switch hook flash
- ; = Return to the command state

En - Command Echo

- n=0 Do not echo commands
- n=1 Enable command echo*

Hn - Switch Hook Control -

- n=0 Switch hook relay closes
- n=1 The switch hook relay opens

In - Modem Identification

Ln - Speaker Volume1 -

- n=0 Low speaker volume
- n=1 Low speaker volume
- n=2 Moderate speaker volume*
- n=3 High speaker volume

Mn - Speaker Activity -

- n=0 Speaker off
- n=1 Speaker on until carrier received*
- n=2 Speaker remains on
- n=3 Speaker on after dialing until carrier is detected.

On - On Line

- n=0 Return On Line with no retrain
- n=1 Initiate retrain while returning On line.

Qn - Responses

- n=0 Send responses*
- n=1 No Responses
- n=2 Send responses only in Originate

Sr? - Interrogate Register -

Sr=n - Set Register Value -

Vn - Result Codes -

- n=0 Numeric Result Codes
- n=1 English Word Result Codes*

Xn - Result Code Set -

Z - Reset -

&Cn - DCD Operation

- n=0 DCD is forced active.*
- n=1 DCD indicates a valid carrier signal

&Dn - DTR

- n=0 DTR is ignored by the modem.*
- n=2 Modem disconnects if the host rescinds DTR.
- n=3 The modem performs a soft reset when DTR is rescinded.

&Fn - Defaults

- n=0 Modem configuration to the default settings stored with AT&W0.*
- n=1 Modem configuration to the default settings stored with AT&W1.

AT Command List (continued)

&Ln - Line Type

- n=0 Modem operates on dial-up lines.*
- n=1 Modem operates on leased lines

&Qn - Communications Format

- n=0 Sets the modem for normal, unbuffered operation.

&Sn - DSR Operation

- n=0 DSR always active.*
- n=1 DSR in accordance with V.25.

&Tn - Test Modes

- n=0 Exit test mode
- n=1 Local analog loopback
- n=3 Initiate local digital loopback

- n=4 Respond to remote loop request*
- n=5 Deny remote loop request
- n=6 Initiate a Remote Digital loopback
- n=7 Remote digital loopback w self-test
- n=8 Local analog loopback w self-test

&V - View Active Profile -

&Wn - Store Profile -

- n=0 Stores the current configuration in memory location 0.*
- n=1 Stores the current configuration in memory location 1.

&Yn - Recall Profile

- n=0 Use memory location 0.*
- n=1 Use memory location 1.

* Command Default values

Result Code Summary

DIGIT	CODE	WORD CODE MEANING
0	OK	Successfully executed command line
1	CONNECT	300 bps connection established
2	RING	Ring signal detected
3	NO CARRIER	Carrier not detected within Register S7 detect time
4	ERROR	Error found in command line; returns to command line
5	CONNECT 1200	1200 bps connection established
6	NO DIAL TONE	No dial tone detected within 5 Sec. after going off-hook
7	BUSY	Busy signal detected after automatically dialing a call
8	NO ANSWER	Five seconds of silence was not detected when using the @ command in the Dial command line
10	CONNECT 2400	Connection established at 2400 bps
13	DATA	Connected in data mode after automatically answering the call.
15	FAX	Connected in fax mode after automatically answering the call.
+F4	+FCERROR	Fax carrier error detected.

Class 1 Fax Command List

+FCLASS? - Service Class Indication

- 0 = Configured as a data modem
- 1 = Configured for Service Class 1.
- 2 = Reserved for Service Class 2.
- 3 = Reserved for Service Class 3.

+FCLASS=? - Service Class Capability

- 0 = Configured as a data modem
- 1 = Configured for Service Class 1.
- 2 = Reserved for Service Class 2.
- 3 = Reserved for Service Class 3.

+FCLASS=n - Set Service Class

- 0 = Configured as a data modem
- 1 = Configured for Service Class 1.
- 2 = Reserved for Service Class 2.
- 3 = Reserved for Service Class 3.

+FTS<time> - Transmit Silence

+FRS<time> - Receive Silence

+FTM<mod> - Transmit Fax

- 3 V.21 Channel 2, 300 bps
- 24 V.27ter, 2400 bps
- 48 V.27ter, 4800 bps
- 72 V.29, 7200 bps
- 96 V.29, 9600 bps

+FRM<mod> - Receive Fax

- 3 V.21 Channel 2, 300 bps
- 24 V.27ter, 2400 bps
- 48 V.27ter, 4800 bps

+FTH<mod> - Transmit HDLC Data

- 3 V.21 Channel 2, 300 bps
- 24 V.27ter, 2400 bps
- 48 V.27ter, 4800 bps
- 72 V.29, 7200 bps
- 96 V.29, 9600 bps

+FRH<mod> - Receive HDLC Data

- 3 V.21 Channel 2, 300 bps
- 24 V.27ter, 2400 bps
- 48 V.27ter, 4800 bps

+FAA=n - Data/Fax Auto Answer

- 0 = Answer as a fax modem only
- 1 = Either a fax or data modem

+FF - Enhanced Flow Control

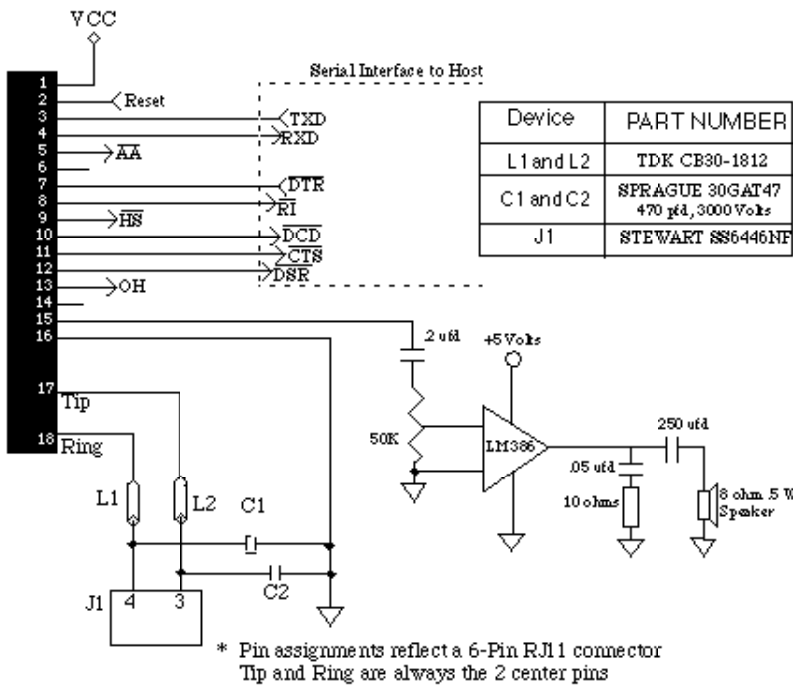
+FRTn - Receive Test Data

+FTTn=m - Transmit Test Data

S-Register Summary

REG.	RANGE/UNITS	DESCRIPTION	DEFAULT
S0	0-255/rings	Number of rings to answer on	000
S1	0-255/rings	Count number of incoming rings	000
S2	0-127/ASCII	Escape character	043
S3	0-127/ASCII	Carriage return character	013
S4	0-127/ASCII	Line feed character	010
S5	0-32,127/ASCII	Backspace character	008
S6	2-255/sec	Dial tone wait time	002
S7	1-60/sec	Wait time for remote carrier	030
S8	0-255/sec	Comma pause time	002
S9	1-255/0.1 sec	Carrier detect response time	006
S10	1-255/0.1 sec	Delay from loss of carrier to hang up	014
S11	50-255/msec	DTMF dialing speed	095
S12	0-255/0.02 sec	Escape guard time	050
S13	—	Reserved	
S14	Bit Mapped	E,Q,V,T,P,D,A,R accept/ignore	171
S15	—	Reserved	
S16	Bit Mapped	Modem loopback tests	000
S17	—	Reserved	
S18	0-255/sec	Modem test timer	000
S19	—	Reserved	
S20	—	Reserved	
S21	Bit Mapped	J, &R, &D, &C, &S, Y	000
S22	Bit Mapped	L, M, X, &P, &T4, &T5, DTE speed and parity	118
S23	Bit Mapped	&T4,&T5, DTE speed, parity	103
S24	—	Reserved	
S27	Bit Mapped	&Q, &L, &X, B commands	073
S28	Bit mapped	&Pn	000

Modem Applications Schematic



Power Supply Characteristics (TA = 0 - 70°C, Vcc = 5v ±5%)

Symbol	Parameter	Min	Typ	Max	Units	Comments
Vcc	Supply Voltage	4.75	5.0	5.25	V	
Icc	Vcc Supply Current		40		mA	All outputs Disconnected
Iccpd	Sleep Mode Current		10		mA	

Power Management: The XE9624F and XE9624FS have an integrated power management capability. If RXD, DTR, and RI lines remain inactive for 5 seconds, the modem automatically enters sleep mode. In the sleep mode power consumption drops to less than 50 milliwatts.

Electrical Specifications

ABSOLUTE MAXIMUM RATINGS*

SUPPLY VOLTAGE - Vcc	+6.5 Volts
DC INPUT VOLTAGE	-0.6 Volts to +6.5 Volts
STORAGE TEMPERATURE RANGE	-25° C TO +100° C
LEAD TEMPERATURE (Soldering, 2 sec per wave)	260° C
OPERATING TEMPERATURE RANGE	0 TO 70° C

*Exceeding these values may result in permanent damage to the device.

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
DTMF Level		-2.2	0	dBm	
DTMF Twist (Balance)			3	dB	
Pulse Dialing Make/Break		39/61		%	USA
		33/67		%	CCITT
Pulse Interdigit Interval		785		ms	
Billing Delay Interval	2.0			sec.	
Tone Detection Bandpass Frequency	290		665	Hz	3 dB point
Tone Detection OFF to ON Threshold	-33			dBm	into 600 ohms
Tone Detection ON to OFF Threshold	-35			dBm	into 600 ohms
Dial Tone Detect Duration		3.0			sec.
Ringback Tone Detect Duration	0.75			sec.	
Ringback Tone Detect Cadence	1.5			sec.	OFF/ON Ratio
Busy Tone Detect Duration	0.2			sec.	
Busy Tone Detect Cadence	0.67		1.5	sec.	OFF/ON Ratio

I/O Characteristics

Signals	Description		
DIGITAL INPUTS	Input High	Input Low	
/DTR, TXD, RESET	min. 2.0 V	max. 0.8 V	
DIGITAL OUTPUTS	Output High	Output Low	Current Drive
AR, /RI	min. 2.4 V	max. 0.8 V	15 ma
/CTS, /DSR, /DCD, RXD	min. 2.4 V	max. 0.4 V	1.6 ma

Telephone Line Interface Specifications

PARAMETER	MIN	TYP	MAX	UNIT
Telephone Line Impedance Match		600		ohms
Ring Detect Sensitivity (on hook, Type B ringer)	38			Vrms
Telephone Line Holding Current	20		100	mA

Sample Fax Reception

Host	Fax Modem	Comments	Host	Fax Modem	Comments
AT+FCLASS=1	Set for Fax "OK" "Ring"	waits for ring		Pass DCS "OK"	
ATA	Answers CALL "CONNECT"		AT+FTH=3	Sends flags "CONNECT"	
	Sends Flags "CONNECT"		CFR data	Frame and Send "OK", drop carrier	
NSF Data	Frame and send "CONNECT"		AT+FRM=96	Set to 9600 bps Pass Page Data "NO CARRIER"	Remote fax sends page
CSI Data	Frame and send "CONNECT"		AT+FRH=3	Buffers Frames "CONNECT" Pass EOP data "OK"	Remote fax sends EOP
DIS Data	Frame and send "OK", drop carrier		AT+FTH=3	Sends flags "CONNECT"	
AT+FRH=3	Buffers Frames "CONNECT" Pass TSI "OK"	Remote sends TSI	MCF data	Frame and Send "OK", drop carrier	
AT+FRH=3	Buffers Frames "CONNECT"	Remote fax sends DCS	AT+FRH=3	Buffers Frames "CONNECT" Pass DCS Frame "OK"	Remote fax sends DCS Remote fax Disconnects
AT+FRM=96	Set to 9600 bps "CONNECT" Pass TCF "NO CARRIER"	Remote fax sends TCF	ATH0	hangs up "OK"	

Sample Fax Transmission

Host	Fax Modem	Comments	Host	Fax Modem	Comments
AT+FCLASS=1	Set for Fax Operation "OK"		AT+FRH3	Buffers Frames "CONNECT"	Remote sends CFR Pass CFR
ATDT5846161	Modem Dials CONNECT	Remote Fax Answers and sends Flags NSF, CSI, & DIS sent by remote		"OK", drop carrier "NO CARRIER"	Tx squelch after DCS
	Buffers Frames Pass NSF "OK"		AT+FTM96	Set to 9600bps "CONNECT"	
AT+FRH3	Buffers Frames Pass CSI "OK"		Page Data	Sends Page Data "OK"	
AT+FRH3	Buffers Frames Pass DIS "OK"		AT+FTH3	Sends flags "CONNECT"	
AT+FTH3	Sends flags "CONNECT"		EOP	Frame and send "OK", Drop Carrier	Tx squelch after DCS
TSI data	Frame and send "CONNECT"		AT+FRH3	Buffers frames "CONNECT" Pass MCF data "OK" "NO CARRIER"	Remote sends MCF
DCS Data	Frame and send "OK", drop carrier	Tx squelch after DCS	AT+FTH3	Sends Flags "CONNECT"	
AT+FTS8	Wait 80 msec "OK"		DCN	Frane & Send "OK", Drop Carrier	Tx Squelch after DCS
AT+FRM96	Set Tx to 9600bps "CONNECT"		ATH0	Hangs up "OK"	Remote Disconnect
Send TCF (training)	Transmit TCF "OK"				

FCC Instructions

This product complies with Part 68 of the FCC Rules and Regulations. Each device shipped includes a label which contains the FCC Registration Number and Ringer Equivalence (REN). If requested, this FCC information must be provided to the telephone company. A registration label must be affixed to the cabinet's exterior for each device mounted within a closed assembly.

Ringer Equivalence (REN) is used to calculate the number of devices you may connect to one telephone line and still have all of the devices respond to an incoming call. Typically, the sum of the RENs of all devices connected to one line should not exceed five (5.0). Contact your local telephone company to determine the maximum REN for your area.

Mount this device in the final assembly so as to prevent exposure to any hazardous voltages in the system and to preserve the high voltage protection between Tip/Ring and the rest of the system. Installation must provide adequate separation and restraint of cables and cords. Xecom recommends maintaining a minimum of .100 inches between the Tip and Ring traces and all other circuits. No circuitry may be added between Tip/Ring and the telephone line connection unless specifically allowed by the rules.

This device requires use of an RSOC RJ-11C jack for the telephone line connection. The jack selected must be certified to meet FCC Part 68 subpart F requirements.

If you experience trouble with this device, contact XECOM at (408)945-6640 to obtain service. There are no repairs the customer may make to this device. If your system causes harm to the telephone network, the telephone company may discontinue service temporarily until the problem has been corrected or it is demonstrated that the device is not malfunctioning. If possible, you will be notified in advance that service is being discontinued. If advance notice is not practical, you will be notified as soon as possible.

Your telephone company may make changes to their facilities, equipment, or operation that affect proper functioning of your equipment. You will be notified in advance of such changes to give you the opportunity to maintain uninterrupted telephone service.

This device cannot be used on coin operated telephone lines provided by the telephone company. Connection of this equipment to party lines is subject to state tariffs.

Any one using this device for fax transfer must include sender identification information as required in the Telephone Consumer Protection Act of 1991. The Telephone Consumer Protection Act of 1991 makes it unlawful to send a fax without clearly identifying the fax sender (business or individual) and the number of the transmitting fax machine. This information may be provided either on the first page of the fax or in the top or bottom margin of each page. The number listed may not be a 900 number or other number for which charges exceed local or long distance transmission.

The final assembler must provide these FCC instructions to the end user of the equipment.

FCC Registration Number: DWEUSA-20716-MM-E
Ringer Equivalence: 0.8B

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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