Features

- Very Small Size - 2.28" x 1.0" x 0.5"
- Full Bell 212A/103 Modem Compatibility
- FCC Part 68 Registered DAA
- Call Progress Monitoring
- Tone or Pulse Dialing
- DTMF Sensing and Decoding
- Voice Sensing
- Software Controlled Audio Interface
- Voice Synthesis Option
- Parallel Host Interface
- ± 5 Volt Operation
- Telephone Line Diagnostics
- Asynchronous Operation
- Line Frequency Monitoring
- Parity Generation/Checking
- UL Recognized Component

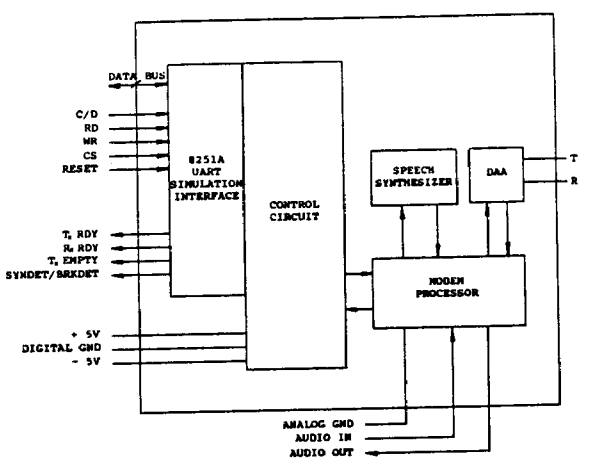
The XE1201 is the basic component; the XE1203 has the voice synthesis option installed. XE1203S, available 4Q89, has a Signetics voice synthesizer.

Description

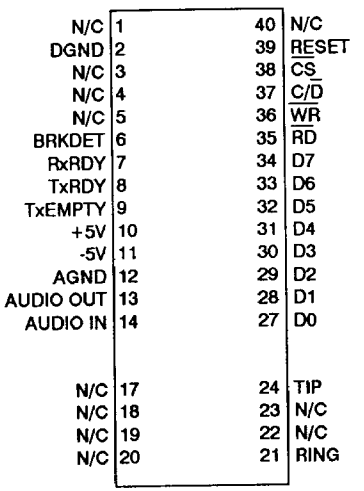
The XECOM XE1201/1203 MOSARTs are high level communication subsystems manufactured in a component sized form factor to enable maximum communications capability in a minimum amount of space.

The primary function of the MOSART is to provide a complete component-sized Bell 212A modem (1200/300 bps) which includes an FCC registered Data Access Arrangement (DAA) in the same package and provides a parallel host interface.

The MOSART has an advanced line monitoring capability which allows it to sense the presence of voice or DTMF (touch tone) signals on the line in additon to its normal call progress monitoring. The MOSART may then be switched into an Audio mode for voice communications, or into a DTMF decoding mode which makes it possible to receive information from a remote telephone and decode it for the host processor. The XE1203 includes a voice synthesizer for voice prompting in the return path or for the user.



Block Diagram



Pin Configuration

Audio input and output lines are provided with a selection of various functions under host software control. These functions include the use of actual voice communication on the phone line, synthesized voice communication on the audio output and/or over the phone line, and modem transmission in the acoustic coupler mode.

The host interface emulates the industry standard 8251A USART with increased bus driving capability. In addition to the 8251A's DATA and COMMAND mode, the XE1201/1203 has a FUNCTION mode. While in the FUNCTION mode, higher level functions such as dialing, answering, line diagnostics and call progress modes may be enabled. This provides the internal capability required for an intelligent modem interface while retaining DATA and COMMAND mode compatibility with the simple 8251A standard.

In addition to the basic Bell 212A communication functions and diagnostic modes, the MOSARTs provide both tone and pulse dialing and a comprehensive call progress monitoring capability. A unique telephone line diagnostic capability may be used to report phone line quality to the host, and XECOM's proprietary Statistical Equalization Algorithm ™ (SEA) automatically uses this diagnostic information to compensate for common line deficiencies.

Host Interface

This tri-state, bi-directional 8 bit Data Bus is the interface between the XE12xx and the host. Data is transmitted or received upon execution of instructions from the host CPU. COMMAND, FUNCTION, Sync words and Status information are also transferred through the Data Bus. The Command, Status, Data-In, and Data-Out registers are separate 8 bit registers communicating with the system bus through the Data Bus.

D0..D7: DPort. These eight pins provide the data bus for control and data values to and from the component. DO is the low order bit.

$\overline{WR}$: Write. A "low" (0) on this input pin informs the XE12xx that the host CPU is writing to the data or control address of the XE12xx.

$\overline{RD}$: Read. A "low" (0) on this input pin informs the XE12xx that the host CPU is reading data or status information from the XE12xx.

C/$\overline{D}$: Control/Data. This input pin selects either the command/status [C/$\overline{D}$ "high" (1)] or the data mode [C/$\overline{D}$ "low" (0)].

$\overline{CS}$: Chip Select. A "low" (0) on this input pin selects the XE12xx. When $\overline{CS}$ is "high" (1), the Data Bus is in the float state and $\overline{RD}$, C/$\overline{D}$ and $\overline{WR}$ have no effect on the component.

Register Addressing

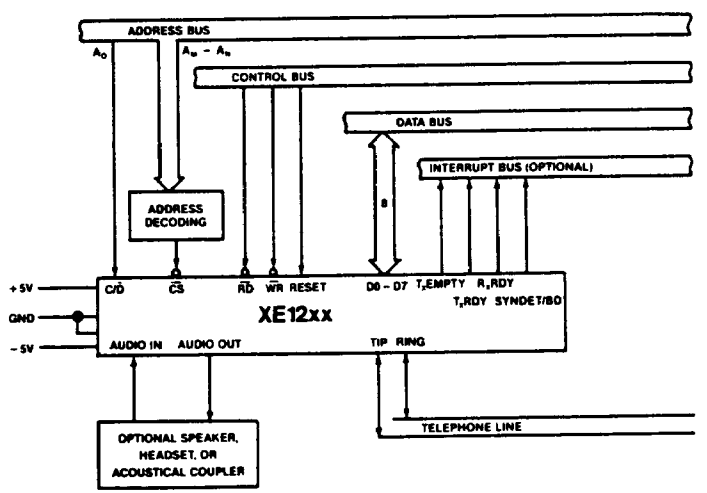
	$\overline{RD}$	$\overline{WR}$	$\overline{CS}$	C/$\overline{D}$
HOST COMMAND WRITE	1	0	0	1
HOST STATUS READ	0	1	0	1
HOST DATA WRITE	1	0	0	0
HOST DATA READ	0	1	0	0
TRI-STATE	X	X	1	X

T_XRDY: Transmitter Ready. A "high" (1) on this output pin signals the host that the modem transmitter is ready to accept a data character. The TxRDY output pin can be used as an interrupt to the system, since it is masked by TxEnable; or, for polled operation, the host CPU can check TxRDY using a Status Read operation. TxRDY is automatically reset by the leading edge of $\overline{WR}$ when a data character is loaded from the host CPU. Note that when using the polled operation, the TxRDY status is not masked by TxEnable, but will only indicate the status of the transmit data buffer.

T_XEMPTY: Transmitter Empty. When the XE12xx has no characters to send, the TxEMPTY output pin will go "high" (1). It resets upon receiving a data character from the host CPU. TxEMPTY remains "high" (1) when the transmitter is disabled. TxEMPTY can be used to indicate the completion of transmission. In the synchronous mode, a "high" (1) on this output indicates that a character has not been loaded and that Sync characters are being transmitted automatically as fillers. TxEMPTY does not go low when the Sync characters are being transmitted.

R_XRDY: Receiver Ready. This output pin indicates the XE12xx contains a character that is ready to be output to the host. RxRDY can be connected to the interrupt structure of the host or, for polled operation, the host can check the condition of RxRDY using a Status Read.

BRKDET: Break Detect. This output pin signals detection at a break signal during a modem connection and an incoming ring signal when the modem is on-hook. In the case of the break signal reception, this line is held "high" (1) for the duration of the break signal. In the case of ring detection, it will be "high" (1) during the ringing portion of the signal and "low" (0) between rings (typically 2 sec on and 4 sec off).



Bus Interfacing

RESET: Reset. A "high" (1) on this input pin forces the XE12xx to "idle". The device will remain at "idle" until a new mode is set. Refer to the Mode Byte description on page 7. Minimum reset time is 30 micro seconds.

DGND: Digital ground, normally connected to the power source ground.

TIP,RING: Input/output pins are provided for direct connection to a wire telephone line. Although the pins are named "TIP" and "RING", they are interchangeable. These lines are insulated from the rest of the XE12xx system and this isolation must be maintained for safe operation.

AUDIO IN: Input to an audio amplifier, which can be switched by modem control inputs to perform one of the following functions:
1. Input audio signals from a headset microphone for voice input over the telphone line.
2. Input data signals from an acoustic coupler for connection to the modem demodulator.

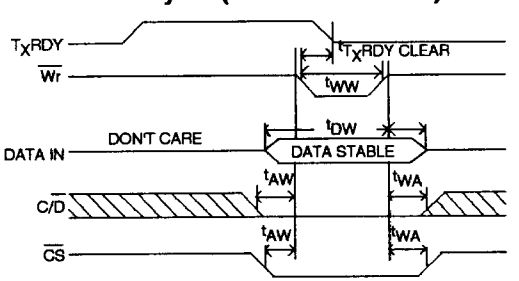
AUDIO OUT: Output from a second audio amplifier which can be switched by modem control inputs to perform one of the following functions:
1. Output audio signals to a headset earphone for voice communication over a telephone line.
2. Output data signals from the modem modulator to an acoustic coupler.
3. Output signals from the voice synthesizer to an external speaker, etc.

AGND: Ground for the analog signals, normally connected with DIGITAL GROUND to the power source ground.

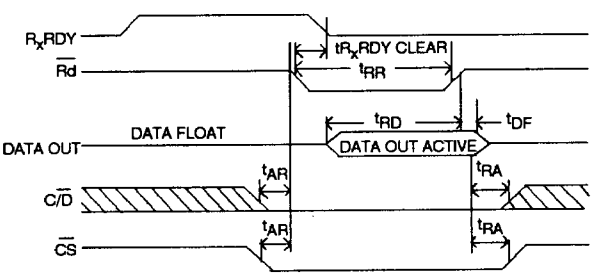
Data Bus Timing

NAME	UNITS	MIN	MAX
t_{AR}, t_{RA}, t_{AW}, t_{WA}	ns	0	-
t_{RR}	ns	250	-
t_{RD}	ns	-	200
t_{WW}	ns	250	-
t_{WD}	ns	20	-
t_{DW}	ns	150	-
t_{DF}	ns	10	100
T_xRDY/R_xRDY Clear	ns	-	400

Write Cycle (CPU→MOSART)



Read Cycle (CPU←MOSART)



Electrical Specifications

(V_{DD}=5.0V ±5%,Vss=5.0V±5%,Ta=0℃ to +50 ℃)

	SYMBOL	UNIT	MIN	NOM	MAX
Power Supply Current	I_{DD}	mA		200	250
	I_{SS}	mA		-15	-25
Storage Temperature	T_S	°C	-25		+85
Minimum High Level Input Voltage	V_{IH}	Volts	2.2		
Maximum Low Level Input Voltage	V_{IL}	Volts			0.8
Minimum High Level Output Voltage	V_{OH}	Volts	2.4	@IOL = -1 mA	
Maximum Low Level Output Voltage	V_{OL}	Volts	@IOL = 5 mA		0.45
Data Bus Drive Current	I_{IB}	mA	10.0	15.0	
Input Leakage Current	I_{IL}	uA		0.1	1.0
Output Leakage Current (Tri-State)	I_{OL}	uA		1.0	10.0

Phone Line Interface

A.C. Impedance	Z	Ohms		600	
Protection	Conforms to FCC Part 68 Rules and Regulations				
Transmit Level	V_T	dBm	-12	-10	-9
Carrier Detect Sensitivity	V_{CD}	dBm(on/off)	-43/48	-45/50	-48/53
Audio Receiver Gain (Line to Audio Output)	G_{AR}	dB		16	
Maximum Audio Output Voltage (Load≥300 Ohms)	V_{AO}	V Peak		2.5	
Audio Output Impedance	X	Ohms			100
Audio Transmit Gain (Audio Input to Line)	G_{AT}	dB		22	
Audio Input Impedance	Z_{AI}	K Ohms		20	
Coupler Mode Receive Sensitivity(A in)on/off	V_{AR}	dBm/dBm		-59/-63	
Coupler Mode Transmit Level(A out) (Load >300 Ohms)	V_{AT}	dBm		-2.5	
Voice Synthesizer Level Audio Out Line	V_{AS} V_{LS}	V Peak V Peak		1.7 0.7	
DTMF Transmit Level	V_{DT}	dBm	-4.5	-3	-2
DTMF Receive Level (decode)	V_{DTR}	dBm			-15
DTMF Transmit Frequency Accuracy	ΔF_{DT}	%		±0.5	
DTMF Transmit Duty Cycle	ΔT_{DT}	ms (on/off)		75/75	
DTMF Receive Duty Cycle	ΔR_{DT}	ms (on/off)		50/50	
Rotary Dialing Speed	ΔS_{RD}	pps		10	
Rotary Dialing Duty Cycle	ΔT_{RD}	% (on/off)		60/40	
Rotary Dialing Inter Digit Time	T_{RI}	ms		500	
DAA Loop Current	I_{LC}	mA	20		

Interface Description

Status

The current status byte is obtained by reading DPort; D0..D7 pins with: $\overline{RD}$ = 0, $\overline{WR}$ = 1, $\overline{CS}$ = 0 and C/$\overline{D}$ = 1.

D7	D6	D5	D4	D3	D2	D1	D0
DSR	BRKDET	FE	OE	PE	TxEMPTY	RxRDY	TxRDY

DSR: Data Set Ready. This bit is "high" (1) when a connection is present and data is being received. DSR is cleared when RxRDY is set if the component is presenting progress information.

BRKDET: Break Detect. This bit signals detection of a break signal during a modem connection and an incoming ring signal when the modem is on-hook. In the case of the break signal reception this bit is held "high" (1) for the duration of the break signal. In the case of ring detection, it will be "high" (1) during the ringing portion of the signal and "low" (0) between rings (typically 2 sec on and 4 sec off).

FE: Framing Error. This bit is set when no stop bit is found where expected in the bit stream. Another framing error will not be indicated until the line has returned to the mark state for at least one bit time.

OE: Over-Run. This bit is set if the controlling processor does not fetch the received Data-Byte before the next incoming byte is assembled.

PE: Parity Error. This bit is set when parity check has been enabled and the received parity bit does not match the calculated parity.

TxEMPTY: Transmitter Empty. This bit is set when the last of the transmit data has been completely clocked out of the component.

RxRDY : Receiver Ready. This bit is set when the XE12xx has assembled an incoming Data-Byte or when a new Information-Byte is ready. The bit is reset when the host fetches the data register.

TxRDY: Transmitter Ready. This bit is set when the component is prepared to accept another command or Data-Byte. This bit reflects the same information as TxRDY line.

Commands

The command byte is set by writing to the DPort with: $\overline{RD}$ = 1, $\overline{WR}$ = 0, $\overline{CS}$ = 0 and C/$\overline{D}$ = 1 after the Mode Byte is loaded. The individual bits of the control port are:

D7	D6	D5	D4	D3	D2	D1	D0
EH	IR	RTS	ER	SBRK	RxE	DTR	TxEN

IR: Internal Reset. Starts the 8251A compatible initialization sequence. This is an alternative to using the RESET line, except on the initial power-up initialization sequence.

RTS: Request To Send. This bit is used to distinguish transmit data bytes (RTS=0). Changing this bit in the absence of TxRDY may cause a previous Data-Byte to be treated as a command or an incomplete command to be aborted.

ER: Error Reset. Writing a one to this bit clears the FE, OE and PE status bits.

SBRK: Send Break. Setting this bit "high" (1) during asynchronous communication will produce a break on the line. The length of a valid break depends on the characteristics of the receiving unit. A minimum break time is equal to two character times. The break will not start until the transmitter is empty (TxEmpty = 1).

RxE: Receiver Enable. Allows the component to start assembling bytes from the incoming bit stream.

DTR: Data Terminal Ready. DTR "high" (1) indicates the host is ready for a connection. If this bit is turned off, the physical connection is terminated.

TxEN: Transmitter Enable. This bit is set to allow the sending of data.

Mode Byte

The mode of operation is established by sending a Mode Byte(s) to the Control Port following a Reset. Reset may be triggered either by the RESET line or by the IR Control Bit in the Control Register.

D7	D6	D5	D4	D3	D2	D1	D0
S1	S0	EP	PEN	L1	L0	B1	B0

S1,S0 These two bits select the number of stop bits to be sent . The receive side never requires more than one stop bit.

Stop bits:	2	1.5	1	Reserved
S1:	1	1	0	0
S0:	1	0	1	0

EP Even parity is generated/checked if this bit and PEN are set (1). If off (0), odd parity is used.

PEN Parity generation/checking is enabled. Valid parity bits are replaced with a zero in the incoming data. On transmission, the generated parity bit replaces any bit the host may have put in that position.

L1,L0 The communication character length is set by these bits. This length does not include the parity bit. If PEN is set the total length is one bit more than indicated.

Bits per character:	8	7	Reserved	
L1:	1	1	0	0
L0:	1	0	1	0

B1,B0 These bits set the default speed. (The default speed may be altered later with the speed selector function).

	B1	B0
Reserved	0	0
1200 bps	0	1
300 bps	1	0
110 bps	1	1

Initialization

The initialization sequence begins with a hardware reset pulse to pin 39 of the device during the initial power-on sequence. This reset pulse may be as long as convenient, however, it must be of at least 30 usec in duration followed by a pause of 100 usec or greater, before proceeding.

Subsequent to the hardware reset, it is recommended to write 3 bytes of 00's to the DPort followed by software reset (40 Hex). Following the software reset, it is necessary to provide a 100 usec or greater delay before proceeding with the Mode Byte.

Next, the Mode Byte should be written to the DPort to set the mode of operation (see MODE BYTE instructions).

Finally, the Command Byte must be written to complete the sequence (see COMMAND instructions). In most cases, this byte should be a 07 Hex, which selects R_xE, DTR and T_xEN and readies the MOSART for transition into the FUNCTION mode.

After a delay of 100 usec, the status register should read 05 Hex (T_xEmpty and T_xRDY) which signifies successful completion of the initialization sequence.

Now, by setting $C/\overline{D}=0$, the MOSART will enter the FUNCTION mode and be ready to accept and execute FUNCTIONS written to the DPort. Upon completion of each FUNCTION written, the status register should contain either a 05 Hex or 07 Hex (see FUNCTIONAL DESCRIPTION).

After originating a modem connection through the execution of a series of FUNCTIONS, it will be necessary to switch to the DATA mode before data may be transmitted. This is achieved by writing a 27 Hex (RTS, R_xE, DTR and T_xEN) to the DPort with $C/\overline{D}$ = 1, then changing to $C/\overline{D}=0$.

It is important to note that the MOSART makes extensive use of CMOS circuitry internally, and care must be taken to ensure that the power supply voltages come up prior to any voltage being applied to the inputs. If voltage is applied to the inputs prior to the supply voltage, the MOSART may be driven into a "Latch-up" mode, which, although usually not catastrophic, may weaken the device and most certainly precludes proper operation.

Special attention should also be taken to ensure that the hardware reset line is free of noise spikes. Noise on the reset line can have the effect of random resets of all or part of the MOSART circuitry, with subsequent lock-up of the system.

TYPICAL INITIAL INSTRUCTION SEQUENCE

RESET	$\overline{RD}$	$\overline{WR}$	$\overline{CS}$	C/$\overline{D}$	DO..D7	COMMENTS
1	-	-	-	-	-	Hardware reset (30 used minimum.)
0	1	0	0	1	00	
0	1	0	0	1	00	
0	1	0	0	1	00	
0	1	0	0	1	40	Software reset (1)
					-	(100 usec delay)
0	1	0	0	1	99	Write Mode Byte
0	1	0	0	1	07	Write Command Byte (Function Mode)
0	0	1	0	1	05	Read Status Register (1,2)
0	1	0	0	0	XX	Write Function
0	0	1	0	1	05 or 07	Read Status Register (1,2)
			———		ETC.	———
0	1	0	0	1	27	Write Command Byte (Data Mode)
0	0	1	0	1	05	Read Status Register (1,2)
0	1	0	0	0	XX	Write Data
0	0	1	0	1	05	Read Status Register (2)
			———		ETC.	———

NOTES:

1. Observe specifications for Read and Write cycle timings. Additionally, it is recommended that a 100 usec delay be inserted following the issuance of a software reset command. When reading the status register following the issuance of a command or function byte, a minimum 100 usec delay should be implemented with a minimum polling loop cycle time of 100 usec.

2. In the typical asynchronous mode, a 05 response indicates successful completion of the function. A 07 response indicates the function was unable to complete and an information byte is waiting to be read from the data register.

Functional Description

Data I/O is performed in the normal manner by supplying or taking data from the DPort as dictated by the interrupt lines or their corresponding bits in the status register. Failure to take an incoming data byte before the next data byte is available will turn on the OE status bit.

The MOSART has a FUNCTION mode in addition to the normal COMMAND and DATA modes of the 8251A USART. COMMAND mode is selected by C/$\overline{D}$ = 1, whereas C/$\overline{D}$ = 0 selects either FUNCTION or DATA modes. These modes are selected from the COMMAND mode by writing a FUNCTION COMMAND INSTRUCTION (such as 07) or a DATA COMMAND INSTRUCTION (such as 27) following the MODE INSTRUCTION. Upon setting C/$\overline{D}$ = 0, the MOSART will shift to the FUNCTION or DATA mode as selected.

Function bytes and their information bytes are exchanged in the same manner as data. A function byte is distinguished by clearing the RTS command bit before the DPort is written. The function signals completion by raising the TxRDY bit. If RTS is set before a function signals completion, the function is aborted. Information bytes are indicated when the DSR status bit is zero and the RxRDY status bit is one.

The functions report successful completion by raising TxRDY to indicate that the MOSART is ready to accept another function. If an error should occur, RxRDY will be set and DSR cleared at the same time indicating that an information byte is waiting to be read. If incoming data is present, DSR clearing and the corresponding information byte will be delayed until the input is taken. In this case the TxRDY bit will not be set until the information byte is presented.

In practice, this means that after a function is written to the DPort, the status register will normally show either a 05 (TxEMPTY, TxRDY) or a 07 (TxEMPTY, RxRDY, TxRDY) upon completion of the function. A 05 indicates that the function has completed properly and the MOSART is ready for the next function command. A 07 indicates that the function did not complete properly, and that there is an information byte in the data register waiting to be read which will provide information as to why the function did not complete properly.

When a modem connection is originated, completion of the origination function will cause the status register to return either a 05 or 07, (with a 07 indicating that an information byte is waiting to be read). DSR will not be set until the first data byte is received, to indicate that any bytes in the data register are indeed data, and not information bytes. Loss of carrier will be indicated by DSR being cleared and BRKDET being set.

Errors do not cause a change in the status of the phone line. For example, if the answer function A is written while a modem connection is already established, it will respond with an I (inappropriate) information byte, but the connection is not disturbed.

The primary method to cause the MOSART to "hang up", (go on-hook), is to zero the DTR command bit. Zeroing DTR will always cause the line to go "on hook", terminating the connection. The host may choose to abort a function by setting RTS before the function has completed without changing the state of the line. This procedure gives the host complete control of the current on/off-hook status. Of course, the MOSART will also go on hook during an initialization sequence (RESET, followed by MODE and COMMAND INSTRUCTIONS).

Nominal switch-station timings are enforced by delaying certain functions. For example, a dialing-digit function does not complete until its assertion and pause requirements have been met.

Many functions cause the line to go off-hook. With each of these functions, a two second "billing-delay" is forced when the function takes the MOSART off-hook. When the MOSART goes on-hook from an off-hook state, a two second pause is enforced to assure that the call is cleared. A reset will cause the MOSART to go on-hook from an unknown state. A pause is forced at reset time to clear a possible previous call.

Incoming calls will cause the BRKDET bit or interrupt line to go high during the ring. This is the ring indication which should be used, for example, to indicate an answer routine from host software.

When writing a COMMAND or FUNCTION byte, a delay of 100 usec or greater should be implemented before reading the status register. When continuously polling the status register (for example while waiting for a FUNCTION to complete) the status register should not be read with a cycle time faster than 100 usec.

The functions' values were designed to be mneumonic aids when interpreted as ASCII characters. Response information referred to here is in the same form and is tabulated below. Invalid function requests will respond with a ? (3F hex) Information-Byte. Reserved codes and functions requesting unimplemented options return a ! (21 hex) Information-Byte. To simplify host programming, the high bit of all function codes is ignored. To ease modification of application programs, function codes NUL and DEL (00, 80, 7F, and FF hex) execute as no-op's, and code ? (3F hex) always returns a ? (invalid) Information-Byte. A caret (^) is used to indicate an ASCII control character, i.e. ^A symbolizes a hex value of 01 (or 81)

Modem Connection Functions

Modem Connection functions attempt to establish a connection with another modem. A successful connection is indicated if no information is returned. If carrier is lost during a modem connection, the XE12xx responds by indicating BRKDET and resetting DSR, but does not go "on-hook". The host may terminate the connection by dropping DTR or reinitializing the MOSART.

A Answer Incoming Call. This function causes the component to begin the answer side of a modem handshake. Possible responses are: F (failed); T (timeout); and I (inappropriate, a connection is in progress).

^A Controlled Answer. This answer function performs like the A function but adds extra monitoring information. The answer sequence may be aborted by the caller in two ways. If the caller presses the DTMF "1", a "1" Information-Byte is returned. If the caller speaks, a "v" (76 hex) information byte is returned. In either case, the answer tone is terminated.

M Monitor. Monitor the line and return the status, or originate a handshake if a modem answer tone is heard. Line monitoring can detect the following: R (ring-back); D (dial-tone); B (busy signal);V (voice) a voice answered; T (timeout) the timeout alarm has gone off; F (failed) an answer tone was heard but the originate handshake failed; I (inappropriate) there already is a connection. The monitor function should be reissued if the host wishes to continue the attempt, (i.e. for the first few rings).

L Line Analysis. This function acts the same as the Monitor function but returns 3 data bytes, if the modem connection is successful. (See Test Functions).

O Originate. This function causes the XE12xx to attempt the origin side of a modem handshake. This is useful when the physical connection is already established. Line Analysis (L) or Monitor (M) would normally be used following dialing. Responses: F (failed); T (timeout) ; I (inappropriate).

Configuration Functions

These functions change the XE12xx mode of operation without requiring a reset. The Mode-Byte settings can be over-ridden, and default audio setting can be changed.

R Rotary dial the subsequent digits.

T Use tones for subsequent digits. Default mode on reset.

^O Set "preferred speed" to 110 bps. A response of I (Inappropriate) indicates that a 1200 bps connection is in progress.

^T Set "preferred speed" to 300 bps. A response of I (inappropriate) indicates that a 1200 bps connection is in progress.

^H Set "preferred speed" to 1200 bps. A response of I (Inappropriate) if a 110/300 connection already exists.

The "preferred speed" will be used when the component originates a connection. When answering, the component is forced to follow the convention of the originator. This may cause a temporary shift to or from 1200 bps. When shifting out of 1200 bps mode, the component presumes the low speed to be 300 bps.

^V Enable Voice to Phone Line Connection. The synthesizer and Audio Input/Output are connected to the phone line. This function will return I (Inappropriate) if a modem connection exists. Subsequent transmit data is routed to the synthesizer until the vx (Disable Voice) function combination or a reset is executed.

V Enable Voice Locally. The synthesizer and audio input are connected to the audio output. Subsequent transmit data is routed to the synthesizer until a Disable Voice (v) function or Reset is executed.

v Disable Voice. Used in combination with the (x) function (vx) to disable the Audio Input/Output. Subsequent transmit data is not routed to the synthesizer.

X,x Enable (X) or Disable (x) the audio output connection to the phone line. The (X) function enables the Audio Output only upon subsequent function and allows the user to listen to the line. When the XE12xx is generating DTMF tones or sending a modem carrier, this connection is blocked. The (x) function is used in the combination (vx) to disable the Audio Output.

Z,z Coupler ON (Z) or Coupler OFF (z). When the coupler is on, the modulator is connected to the audio-out and the demodulator listens to audio-in. (Acoustic couplers are not recommended for 1200 bps operation).

= No parity will be generated/checked.
> Even parity will be generated/checked.
< Odd parity will be generated/checked.
^S Seven bit character length.
^E Eight bit character length.

Telephone Control Functions

These functions are used to control the telephone connection and monitor the dialing process.

D — DTMF Receive Mode. When placed in this mode, the XE12xx will recognize incoming DTMF codes as data input. The code values 0-9, a-d, * and # are presented on the data port as their ASCII values when they are signalled by the other end. Note: DTMF may be transmitted by issuing the normal dialing digits. This mode is cancelled by an H, M, O or A function.

F — Flash. This function causes the telephone line to go "on hook" momentarily for signaling purposes.

H — Hold. The Hold (H) function performs a logical disconnect of the modems but leaves the line in hold status. This function is used to quiet the line for voice or other use during a telephone connection.

W — Wait For Dial Tone. This function will complete normally if a dial tone is sensed. Otherwise, an information byte is returned indicating: B (Busy), I (Inappropriate), M (Modem answer tone), R (Ringing), T (Time-out), V (Voice).

0-9 — Digits 0-9. The corresponding number to be rotary or tone dialed, depending on the current mode.

a-d — Letters a-d. These letters represent the four tones for the fourth column of a touch tone key pad. They are Inappropriate (I) in rotary dial mode.

*,# — Tone Keys. They will respond with an Inappropriate (I) if the current mode is rotary dial.

Test Functions

These functions provide for testing of the XE12xx hardware and the phone line connection.

I,i — Identify. The identify (I) function returns a version letter to identify the firmware used in the XE12xx. Version codes will be assigned consecutively starting with "A" (41 hex) and will signify significant firmware upgrades. The process also performs an integrity check and sets the high bit of the version letter if the check fails. The (i) function returns a revision code. The version and revision codes are returned as data bytes, not information bytes.

m Detailed Monitor. This function monitors the phone line and reports the frequency heard every 0.05 seconds. The frequency is reported as a data-byte ranging in value from 0 to 255. These values may be interpreted as:

Value	Meaning
0	Quiet
1-254	Frequency in 10's of Hz
255	Frequency exceeding 2540 Hz

THIS FUNCTION NEVER TERMINATES. The host may cancel this function by setting RTS or hanging up the phone (Dropping DTR or doing a reset). Using this function with a host program to analyze the data, a user may build specific progress monitor routines. With the newer phone systems, both internal and external signals for busy, ring back, and out of order etc. are becoming highly diversified. Many new systems provide more information through specific tone sequences. A host program, which is aware of the destination system conventions, can make more intelligent decisions about call progress.

L Line Analysis. This function acts the same as the Monitor function but returns three data bytes if the connection is successful.

These bytes represent:

BYTE	CONTENTS
1	Carrier Frequency Error
2	Signal to Noise Ratio
3	Received Carrier Level

I The lower case I function may be used during a 1200 bps connection to check the phase demodulation statistics. I (Inappropriate) is returned when there is no 1200 bps connection.

These bytes represent:

BYTE	CONTENTS
1	Average Phase Error
2	# of phase hits since last request

^X Analog Loop Originate. This function initiates a local loop-back in the originate band. The filters for transmit and receive are set for the originate frequencies and are looped to each other. Transmitted data is routed through the full analog-digital path before being received back at the receiver port. Possible responses are: none (loop initiated), T (Timeout), F (Failed), or I (Inappropriate) if a connection exists.

^Y Analog Loop Answer. This function performs the same as ^X but uses the Answer band. Note: Both ^X and ^Y may be used in either low (110 or 300 bps) or high (1200 bps) modes to test all modes of modulation and demodulation.

Function Summary

Hex	Char	Notes	Name	Information-Byte	Timeout
01	^A	1,2	Controlled Answer	1FITv	17sec.
05	^E		Eight Bit Characters		
08	^H		1200 bps	I	
0F	^O		110 bps	I	
13	^S		Seven Bit Characters		
14	^T		300 bps	I	
16	^V	1,3	Voice to Line	!I	
18	^X		Analog Loop Originate Band	FIT	17 sec.
19	^Y		Analog Loop Answer Band	FIT	17 sec.
21	!		Unimplemented	!	
23	#	1,3	Dual Tone # Key	I	
2A	*	1,3	Dual Tone * Key	I	
30-39	0-9	1,3	Dial Digits 0-9		
3C	<		Set Odd Parity		
3D	=		Set No Parity		
3E	>		Set Even Parity		
3F	?		Invaild Function	?	
41	A	1,2	Answer	FIT	17 sec.
44	D	1,3	DTMF Receive	I	
46	F	1,3	Flash		
48	H	1,3	Hold		
49	I		Identify		
4C	L	1,2	Line Analysis	BDFIRTV	17 sec.
4D	M	1,2	Monitor	BDFIRTV	17 sec.
4F	O	1,2	Originate	FIT	17 sec.
50	P		Pause 5 Seconds		
52	R		Rotary Dialing		
54	T		Tone Dialing		
56	V	3	Voice Data Local		
57	W	1	Wait for Dial Tone	BFIRTVM	5 sec.
58	X		Enable Audio Output		
5A	Z		Coupler Mode On		
61	a	1,3	DTMF Tone A	I	
62	b	1,3	DTMF Tone B	I	
63	c	1,3	DTMF Tone C	I	
64	d	1,3	DTMF Tone D	I	
69	i		Identify Revision		
6C	l		Line Statistics (1200 bps)	I	
6D	m	1	Detail Monitor	I	
70	p		Pause 2 Seconds		
76	v		Voice Data Off	!	
78	x		Audio Output Off		
7A	z		Coupler Mode Off		

NOTES:
1. These functions will take the phone line "off-hook".
2. If successful these functions establish a modem connection.
3. These functions break an existing modem connection, if any.

All functions may return the "A" Information-Byte if they are aborted during execution.

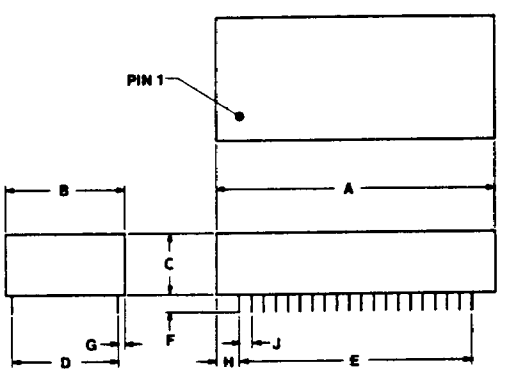
Information Bytes

When a specified function has been performed and is unable to complete properly, an information byte is returned to indicate the nature of the error. The following list summarizes all possible information byte responses. Specific information bytes available in response to each FUNCTION are listed in the FUNCTIONAL SUMMARY.

HEX	CHAR	NAME
41	A	ABORT
42	B	BUSY
44	D	DIAL TONE
46	F	FAILED
49	I	INAPPROPRIATE
4D	M	MODEM
52	R	RING BACK
54	T	TIMED OUT
56	V	VOICE
76	v	VOICE
3F	?	INVALID FUNCTION
21	!	UNIMPLEMENTED
31	1	DTMF "1"

DIM	INCHES		METRIC(mm)	
	MIIN	MAX	MIN	MAX
A	2.255	2.305	57.1	58.6
B	.985	1.015	25.0	25.8
C	.490	.510	12.4	13.0
D	.890	.910	22.6	23.1
E	1.890	1.910	48.0	48.5
F	.125	------	3.1	-----
G	.040	.060	1.0	1.5
H	.180	.200	4.5	5.1
J	.090	.110	2.3	2.8

PIN = 0.020" X 0.014"
RECOMMENDED HOLE SIZE = 0.045"



Mechanical Specifications