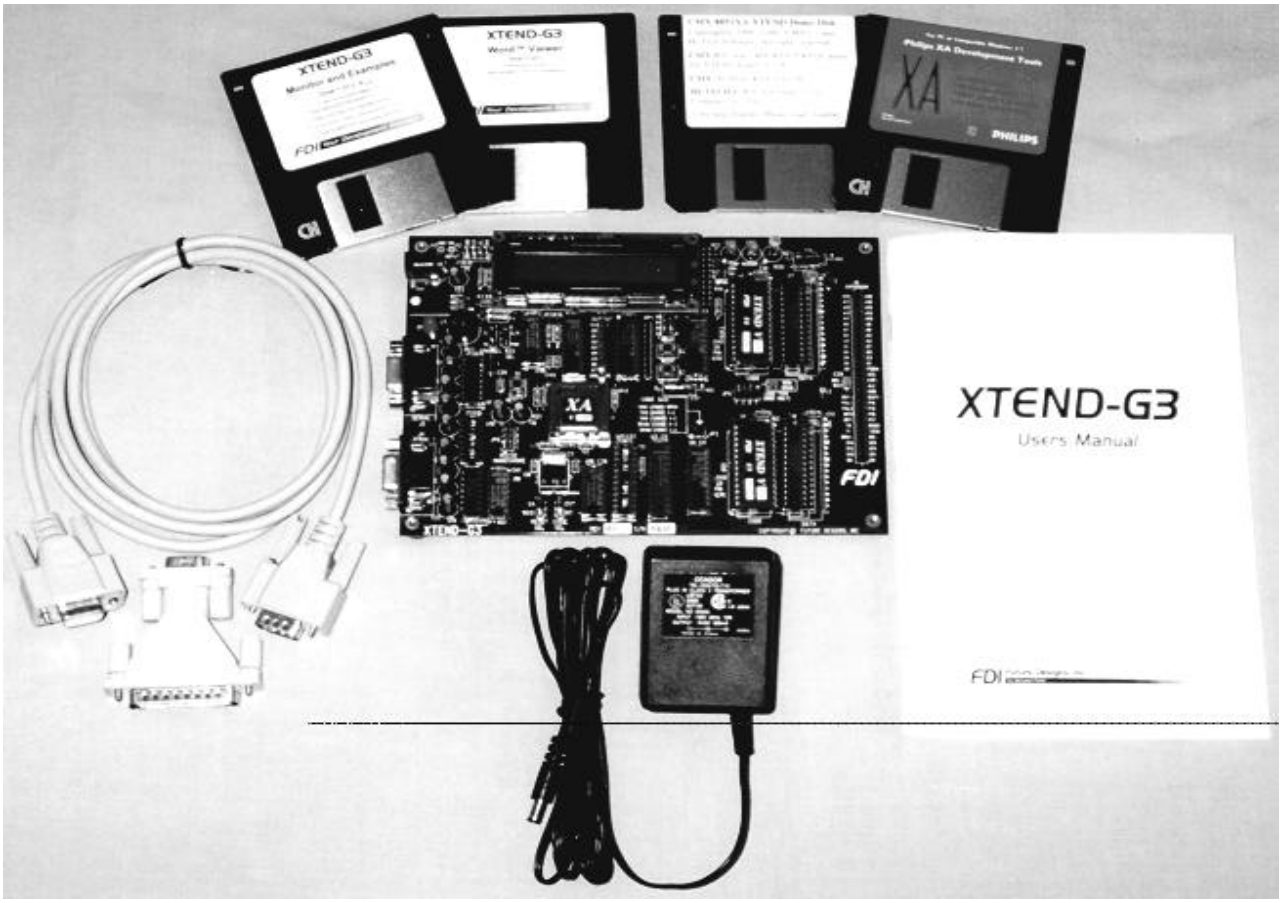
XTEND-G3©

Users Manual



FDI Future Designs, Inc.
Your Development Partner

We would like to acknowledge the following people without whose support this product would not have been possible:
From Philips Semiconductors: Marco Kuystermans, Kent Lowman, Rao Raghavendra, Paul Seerdan, Mike Thompson
From CMX: Chuck Behrmann.

Revision 8,03/23/97 11:35 AM
Printed in the United States of America

Table of Contents

1. INTRODUCTION

This new version of the XTEND-G3 development kit provides support for the ROMLESS XA without giving up any of the enhanced debug and emulation type features of the new XMON software monitor. This means users can now download and debug code using features such as single step, go with breakpoints and disassembly. The XTEND-G3 provides a single platform to ease XA development and also serve as a prototype or target board.

The XTEND-G3 now also provides support for FLASH memory which will be used in the future for easy software upgrades of XTEND units in the field or at customer sites.

Please let FDI know if you have any questions or problems with the XTEND products.

2. QUICK-START

This section describes how to get the XTEND-G3 board running as quickly as possible without going through the normal XTEND Windows-based installation procedures. The Windows-based interface is not necessary to operate the XTEND-G3, but facilitates movement between the XTEND user interface and other Windows-based XA development tools and software. For the normal Windows-based installation see the section titled - **Installing the XTEND-G3 Software**

The XTEND-G3 utilizes a standard female DB-9 RS-232 port for communication to the host PC and a Wall Power Supply for power. These are both included with the standard XTEND-G3 kit. The following steps may be followed for a Quick-Start of the XTEND-G3 kit in a DOS or Windows environment:

NOTE: The default serial port utilized in this procedure AND utilized by the Windows-based installation software is COM2. IF YOU HAVE

A DEVICE ALREADY USING COM2, CONFIGURE THE SOFTWARE FOR ANOTHER SERIAL PORT BEFORE ATTEMPTING TO USE THE XTEND KIT.

1. Connect male end (pins) of the supplied serial cable to J4 (Serial 1) of the XTEND-G3 board (See Section 8.2 for physical location of J4)
2. Connect the female end (sockets) of the serial cable to an available DB-9 serial port of your host PC. (COM2 is preferred) For DB25 type serial ports, a standard DB9-to-DB25 adapter is provided.
3. On the PC, start your modem communications software. (Windows V3.xx Terminal, Windows 95 Hyperterminal, or a DOS-based program such as QMODEM)
4. On the PC, configure your modem software with the following suggested serial port settings:

   9600 bits per second
   8 data bits
   1 Stop bit
   No Parity

   Note: The actual baud rate setting is relative since the XTEND will autobaud to most common baud rates.

5. Plug the included power supply into an available 110V AC outlet. For International (220V) power supply support, see section 2.3 Power Requirements for ordering information.
6. Plug the DC connector at the end of the power supply cable into the receptacle J3 of the XTEND-G3 board (See Appendix A for physical location of J3).
7. **The XTEND will blink the LED 3-times and place a sign on message on the LCD.** It will then change the LCD display message to "Hit any PC key" and begin polling the Serial 1 UART for a character to autobaud with. The user should then press [CR] or [ENTER] on the PC keyboard to initiate the auto-baud sequence on the XTEND.
8. The XTEND-G3 XMON software monitor should display a sign-on message, the list of currently supported commands and the 'XTEND>' prompt.

If for some reason the prompt does not appear or the LED does NOT blink:

1. Re-check each step above
2. Push the reset button (S1) on the XTEND-G3 board
3. Remove the XA-G3 from the PLCC socket (U1) and verify that it is seated correctly.
4. Reset the XTEND, verify that the LED blinks, and press a different key on the PC keyboard.
5. Try a different baud rate setting on the PC.
6. Verify that the FLASH devices have not been corrupted by inadvertent writes by user software.

3. GUIDE TO YOUR XTEND-G3 KIT

3.1. Kit Contents

The following is a list of items included in the Standard XTEND-G3 Kit:

1. XTEND-G3 Printed Circuit Board Assembly
2. One RS-232 Cable and One DB9-to-DB25 adapter.
3. XTEND-G3 Software on diskette(s)
4. Philips Semiconductors XA Tools Software Diskette
5. Wall Power Supply (For U.S. Shipments only)
6. XTEND-G3 Users Manual and Schematics
7. CMX RTX RTOS Demo Package
8. HITECH XA C Compiler Demo Package from CMX

3.2. Specifications

The ***XTEND***, **X**A **T**rainer and **E**xpandable **N**arrative **D**esign, is designed to provide the user with a low cost, stable hardware and software platform for application development with the XA-G3. In many cases the *XTEND* may serve as a quick prototype for the actual user application. With the use of the optional expansion boards, which include a wire-wrap or prototype area, the user can quickly and easily get a new design running with the XA-G3.

The *XTEND* includes the following features:

1. Philips XA-G3 Microcontroller Socket for 44-pin PLCC supporting both internal and external code execution

2. 128KB Standard FLASH ROM Code Space, expandable to 256KB (dual sockets for 16-bit access)

3. Code Space supports EPROM, FLASH (5V), NVSRAM, or SRAM

4. 64KB Standard High-Speed Data Space SRAM, expandable to 256KB (dual sockets for 16-bit access)

5. Two DB-9 RS232 Serial Communications Ports with Optional Hardware Handshake. RS232 Cable and DB25 adapter included.

6. On-board speaker for tone generation

7. LCD Interface for character type LCD Modules with 16 character LCD included

8. 60-pin Expansion Header for Full Expansion Capability (1MB memory and I/O supported)

9. 9 VDC Input with on-board 5V regulator, UL Approved Power Supply included

10. 5.25” x 7.25” 2-layer PCB with Full Silk-screen Information

11. 2.5” x 1” wire-wrap area on-board

12. Four TTL User Inputs via double-row header

13. Two User Input Pushbuttons

14. Eight TTL User Outputs via single-row header

15. Users Manual and Schematics Included

16. Optional I2C Interface/Monitor

The *XTEND* hardware, software and documentation are designed and written with your ease of use in mind. The intent is to provide the user with a well documented platform which can easily be modified to support different user and application requirements.

The XA-G3 assembly language or reference design software is structured and thoroughly documented so that any user can easily modify the basic functions to suit their needs. The CMX RTX Real-Time Operating System which is running on the board is also well documented and thoroughly explained so that a user can easily add or modify functions of the basic operating system. The internal XA-G3 monitor allows host communication with a PC and provides an easy platform for user software development and modification. Complete software for all the *XTEND* functions is provided on the enclosed disks and may be freely modified and used.

For flexibility the *XTEND* supports both internal and external memory operation on the XA-G3. This allows the user to operate in single-chip mode, if memory allows, and thus preserve the XA-G3’s I/O and hardware functions for other uses. The *XTEND* also supports external memory operation with up to 256KB each of code and data memory. The external code space can be populated with EPROM, FLASH or NVSRAM for flexibility.

The *XTEND* provides two RS232 serial communications ports which are connected to the two high-speed UART's on the XA-G3. This allows rate conversion between two RS232 devices, or serial buffering between a host computer and a printer, and intelligent data stream monitoring.

Through software, the *XTEND* also supports an optional I2C interface and bus monitor. This allows communication between any I2C compatible source and the *XTEND* and also allows the user to monitor I2C bus activity between other devices.

3.3. Power Requirements

The XTEND-G3 is powered by a wall mounted UL and CSA listed power supply designed for 110VAC outlets. It provides 9V DC at 500 milliamps. Any user supplied DC power source of 7.5V to 12V DC would also work fine since the XTEND-G3 utilizes an on-board 5V regulator. The current requirement for the standard XTEND-G3 board is approximately 300mA and varies according to configuration options. If there are additional user circuits or expansion boards present, a larger power supply may be required.

The power connector on the XTEND-G3 board is a 2.1mm phono plug with center positive polarity. There is also a set of alternate power input pads located at J12 & J13 that can be used to provide unregulated DC power to the board. For International Applications where a 220V Power Supply is required, or for larger power supply options, contact Condor Power Supplies at phone number (408) 745-7141 or DigiKey at (800) 344-4539.

3.4. Operating Frequency

The XTEND-G3 operates at a standard frequency of 24MHz. This frequency is determined by the crystal located at Y1, immediately adjacent to the XA-G3. The user can change the operating frequency of the XTEND by replacing the crystal with any frequency desired.

The XTEND board will support any maximum XA-G3 operating frequency supported by Philips Semiconductors. Please refer to the XA-G3 data sheet for minimum and maximum values.

If the XA-G3 UARTs are being used, the user should also pay attention to the relationship between the XA-G3 operating frequency and the baud rate range supported.

3.5. Optional Oscillator Usage

The XTEND supports the use of a ‘canned’ oscillator instead of a crystal for applications that require one. This may be desirable in applications where the user requires the oscillator to drive additional circuits or external loads on the expansion bus. This is supported via a few simple changes to the XTEND board:

1. Remove the crystal Y1.
2. Install a Half-sized oscillator in Y2 location. (See Bill of Material in Appendix C for availability details)

Note: The XTEND (Rev C) provides a buffered clock output even when using a crystal. This buffered clock is available on the XTEND board and also to the expansion connector through the optional PAL (U17).

3.6. Autobaud Operation

The XTEND monitor, XMON, provides an autobaud capability that will automatically configure the serial port (of the XTEND) to virtually any standard baud rate (from the PC). The following table illustrates the various XA operating frequencies that autobaud was tested at, and the test results:

XA Freq. MHz	**Baud Rate**			
	19200	**9600**	**4800**	**1200**
8	N	Y	Y	Y
10	Y	Y	Y	Y
12	Y	Y	Y	Y
14.318	Y/N	Y	Y	Y
16	Y	Y	Y	Y
19.6608	Y/N	Y	Y	N
22.1184	Y	Y	Y	N
24	Y	Y	Y	N
25	Y	Y	Y	N
32	Y	Y	Y	N

Results will vary dependent on the XA operating frequency, the character sent for autobaud, the baud rate selected and even the PC. If you encounter problems, please try a different PC baud rate.

3.7. Jumpers

The XTEND-G3 has 9 user selectable jumpers for configuring various functions on the board. See Appendix A for the actual physical location of these jumpers.

The following table illustrates the DEFAULT jumper settings:

JP #	Default	Description
JP1	1-2	External Code ROM Enabled
JP2	1-2	29EE512 Code Device Enabled
JP4	1-2,3-4,5-6,7-8	User Input Jumpers Loaded
JP5	1-2	XA-G3 Reset Selected
JP6	Open	RS-232 Handshake Disabled
JP7	1-2	Timer 2 Selected for Speaker
JP9	1-2,3-4,5-6,7-8	ROM in Code Space Sockets
JP10	1-2	LED S/W Controlled
JP11	1-2	Temperature Sensor Enabled
JP12	1-2	Temperature Reference Enabled

The following list describes the usage of each jumper:

JP1 - External Code ROM Enable: Jumper 1-2 to operate the XA-G3 from external code space (i.e. ROMLESS operation). Make sure the external EPROM's are installed properly, Even/Low Byte in U5 and Odd/High Byte in U6. When static RAMs are utilized in the XA code space sockets, the 'Download' mode from the monitor should be used to download program data before installing this jumper. Jumper 2-3 to operate the XA-G3 from its internal 32KB EPROM code space.

NOTE: JP1 indirectly drives the -EA/WAIT input of the XA-G3. The -EA function is ***only*** sampled by the XA-G3 at power-up or when a hardware reset is performed by depressing the reset switch S1.

JP2 - Code Space Size: This jumper determines the size of the installed devices in the wide (0.600”) code space sockets (U5 & U6). **When 0.300” SRAMs are utilized in the code space sockets, the JP2 setting does not matter.**

Utilize the following table to determine the proper setting:

Devices Installed	Jumper Position (JP2)
32K x 8 EPROM or FLASH (‘256)	Open
64K x 8 EPROM or FLASH (‘512)	1-2
128K x 8 EPROM or FLASH (‘010)	1-2
32K x 8 SRAM (0.600”)	2-3
128K x 8 SRAM (0.600”)	1-2
SRAM in 0.300”	Don't care

JP5 - Reset Select: This jumper allows the use of the XA-G3 or a user provided 87C51 in the same socket on the XTEND. Note that the 87C51 is only supported in “single-chip” mode on the XTEND. When this jumper is loaded in position 1-2, a low true reset is provided for use with the XA-G3. When the jumper is loaded 2-3, a high true reset is provided for use with an 87C51.

JP6 - RS232 Handshake Enable: This jumper allows the user to selectively enable/disable handshake capability for both serial ports. The handshake signals are connected to port pins of the XA-G3.

Note: When these port signals are utilized as serial handshake signals, they are not available for their alternative functions as listed in section 2.6

Serial Signal	Jumper Position (JP6)	XA-G3 Port
RTS Serial 1	1-2	P3.5 (T1)
RTS Serial 2	3-4	P3.4 (T0)
CTS Serial 1	5-6	P3.3 (INT1)
CTS Serial 2	7-8	P3.2 (INT0)

JP7 - Speaker Select/Enable: This jumper allows the user to enable the speaker by selecting one of two XA-G3 timer output signals to drive the speaker. The options are Timer 0, or Timer 2. Since Timer 1 is primarily used for the baud rate generation for the serial ports (i.e. for the monitor), it is not an option. The speaker will emit sound only when the proper timer is selected and the output is enabled. Consult the XA-G3 data book for proper programming of the timers.

The speaker has an impedance of 50 ohms and an operating range of 50Hz to 8kHz.

Timer Utilized	Jumper Position (JP7)
Speaker Disabled	Off/No Connect
Speaker driven by Timer 2	1-2
Speaker driven by Timer 0	2-3

JP9 - Code Space Device Type: This jumper block defines what type of device is installed in the code space sockets (U5 & U6). The code space sockets support SRAM in 0.300” or 0.600” wide packages as well as standard EPROM’s and FLASH devices in a 0.600” wide DIP package. The jumper block is only required for determining which type of 0.600” device is installed as shown below:

Note: When 0.300” SRAMs are utilized in the code space sockets, the JP9 setting does not matter.

Code Space Device	Jumper Position (JP9)
EPROM/FLASH	1-2,3-4,5-6,7-8
SRAM in 0.600”	1-3,5-7,2-4,6-8
SRAM in 0.300”	Don't care

JP10 - LED Select: This jumper allows the use of the LED as either a software controlled user output (via the map register), or a simple power-on indicator. When jumpered 1-2, the LED is controlled via the map register (74HCT259), bit Q4. The address for this bit is 0xB8008H. Writing this location with a ‘1’ turns the LED off, and writing a ‘0’ to this location turns the LED on.

When jumpered 2-3, the LED provides a ‘power indicator’ function. When power is supplied to the XTEND, the LED will be on.

JP11 & JP12 - Temperature Sensor Enable: These jumpers enable/disable the temperature sensor and temperature reference from the XA output ports. To utilize the temperature functions, both jumpers should be loaded 1-2. To disable the temperature functions, both jumpers should be loaded 2-3. This allows port pins P3.4/T0 and P3.5/T1 to be utilized for other applications.

3.8. XA-G3 Port Utilization

The following table defines the usage of each port of the XA-G3 on the XTEND-G3 board:

Port.Bit	**Name**	**Usage**
0.0 - 0.7	Data D0-7 & Addr A4-11	Lower address/data bus
1.0	WRH- (Write high byte)	Write control for Data MSB
1.1	A1 (address bit 1)	Address Bus
1.2	A2 (address bit 2)	Address Bus
1.3	A3 (address bit 3)	Address Bus
1.4	RXD1 (Serial Rcv)	Serial Port 2 & Expansion
1.5	TXD1 (Serial Xmt)	Serial Port 2 & Expansion
1.6	T2 (Timer 2)	Speaker,Exp, & I2C
1.7	T2EX (Timer 2 Ext)	Expansion & I2C
2.0 - 2.7	Data D8-15 & Addr A12-19	Upper address/data bus
3.0	RXD0 (Serial Rcv)	Used only for 1st Serial Port
3.1	TXD0 (Serial Xmt)	Used only for 1st Serial Port
3.2	INT0 (Interrupt 0)	Serial Port 2 CTS & Exp
3.3	INT1 (Interrupt 1)	Serial Port 1 CTS & Exp
3.4	T0 (Timer 0)	Serial Port 2 RTS, Exp, & Speaker
3.5	T1 (Timer 1)	Serial Port 1 RTS & Exp
3.6	WRL- (Write low byte)	Write Control for Data LSB
3.7	RD- (Read Control)	Read Control for Data

Several port pins of the XA-G3 have multiple applications on the XTEND board. The following table lists the multiple function ports:

	Optional Uses		
Port Bit/Name	Primary	Alternate 1	Alternate 2
Port 1.6 / T2	I2C Clock	Speaker	
Port 1.7 / T2EX	I2C Data		
Port 3.2 / INT0	CTS1		
Port 3.3 / INT1	CTS0		
Port 3.4 / T0	RTS1	Temp Sensor	Speaker
Port 3.5 / T1	RTS0	Temp Reference	

Notes:

1. All of these signals ALSO go to the expansion connector. IF the expansion connector is used, care must be exercised to avoid hardware conflicts on these signals.

2. When these port signals are configured for one option, the other possible options are not available. The user should be aware of these potential hardware conflicts when configuring these signals for a particular application.

3. When Timer 1 is used internally as the baud rate generator for the UART utilized by XMON, the external pin (P3.5/T1) may be used as an I/O. Note: Timer 1 interrupt is NOT available for user programs since XMON requires it.

4. The Temperature Sensor and Reference may be disconnected by placing jumpers JP11 & JP12 in position 2-3.

Please refer to the XTEND-G3 schematics for complete hardware details of these multi-function pins. The schematics are included in the kit.

3.9. Optional PAL U17 Definition

The Optional PAL device located at U17 is utilized to decode future expansion boards and peripherals. This device is not included in the standard XTEND kit, but a template of the PAL source code is included on the XTEND Diskette, (‘XTC_EXP.PLD’). This file should be modified by the user for proper interface to the users requirements.

3.10. PAL U3 Definition

The PAL Device located at U3 is utilized to decode the code space devices, data space devices, the LCD and Wait-State generator, as well as the user input and output ports. The device utilized is typically a 22V10 device with a maximum speed of 15ns at 24MHz. Slower devices may be utilized when the XA-G3 is operated at lower frequencies. The 22V10 is used in combinatorial configuration, i.e. there are no clock-latched outputs. The use of a 22V10 allows the user to implement a wide variety of additional functions without having to change devices.

The following is a listing of the PAL source code developed with CUPL. This file is included on the XTEND Diskette, ’XTRC.PLD’ and ‘XTRC.JED’.

```
Name     XTRC          ;
Partno   XXXXX        ;
Date     7/30/96       ;
Revision 02            ;
Designer MH            ;
Company  FDI           ;
Assembly XTRC          ;
Location XTRC          ;
Device   P22V10        ;
Format   J             ;
/*************************************************************************/
/*              FUTURE DESIGNS, INC                                      */
/*                XTEND  BOARD                                                */
/*                                                                       */
/*     CONTROL AND DECODE PLD FOR ON-BOARD FUNCTIONS                     */
/*    ==> (ONLY WORKS WITH REV B OR LATER PWB ONLY!!  <===               */
/*                                                                       */
/*************************************************************************/
/* APPROVED DEVICES: P22V10, P20L8, G20V8                                */
/*************************************************************************/

/**  Inputs  **/
Pin  1     = ALE          ;    /* XA-G3 ADDRESS LATCH ENABLE       */
Pin  2     = !PSEN        ;    /* PROGRAM STORE ENABLE             */
Pin  3     = !OWAITI      ;    /* ON-BOARD WAIT INPUT              */
Pin  4     = !WRL         ;    /* WRITE LOW-BYTE ENABLE            */
Pin  5     = !RD          ;    /* READ ENABLE                      */
Pin  6     = !EXTROM      ;    /* CODE SPACE SELECT INT/!EXT       */
Pin  7     = !RST         ;    /* RESET                            */
Pin  8     = MAP0         ;    /* MEMORY MAP BIT 0                 */
Pin  9     = MAP1         ;    /* MEMORY MAP BIT 1                 */
Pin 10      = A15         ;    /* ADDRESS 15                       */
Pin 11      = A16         ;    /* ADDRESS 16                       */
Pin 13      = A17         ;    /* ADDRESS 17                       */
Pin 14      = A18         ;    /* ADDRESS 18                       */
Pin 23      = A19         ;    /* ADDRESS 19                       */

/**  Outputs  **/
Pin 15     = !RAM         ;    /* EXTERNAL RAM SELECT              */
Pin 16     = !ROM         ;    /* EXTERNAL ROM SELECT              */
Pin 17     = WAIT         ;    /* WAIT SIGNAL TO XA                */
Pin 18     = !MAP         ;    /* MAP REGISTER/SLEEP ENABLE        */
Pin 19     = ELCD         ;    /* ON-BOARD LCD ENABLE              */
Pin 20     = !RRD         ;    /* CODE SPACE READ/DATA READ        */
Pin 21     = PAL1         ;    /* EXPANSION INTERCONNECT           */
Pin 22     = !UIO         ;    /* USER INPUT/OUTPUT SELECT         */


/** Equations **/
ROM =   (PSEN & !A19 & !A18 & !MAP1 & !MAP0 ) #
      (!PSEN & !A19 & A18 & !MAP1 & !MAP0 ) #
      (PSEN & !A19 & !A18 & !A17 & !A16 & !A15 ) #
      (PSEN & !A19 & !A18 & !A17 & A16 & !MAP1 & MAP0 ) #
      (!PSEN & !A19 & A18 & !A17 & !A16 & !A15 & !MAP1 & MAP0) #
      (!PSEN & !A19 & A18 & !A17 & A16 & !MAP1 & MAP0 ) #
      (PSEN & !A19 & !A18 & !A17 & MAP1 & !MAP0 ) #
      (!PSEN & !A19 & A18 & !A17 & MAP1 & !MAP0 ) #
      (!PSEN & !A19 & A18 & MAP1 & MAP0) ;
/*************************************************************
```

```
ENABLE EXTERNAL CODE SPACE DEVICES (EPROM, FLASH, OR SRAM)
 >>>> ALWAYS ENABLE THE LOWER 32KB IN CODE SPACE <<<<
MAP=00- CODE SPACE AT ADDRESS RANGE 0x00000 TO 0x3FFFF
      DATA SPACE AT ADDRESS RANGE 0x40000 TO 0x7FFFF
MAP=01- CODE SPACE AT ADDRESS RANGE 0x00000 TO 0x07FFF
====> DEFAULT MODE FOR XMON <========
      CODE SPACE AT ADDRESS RANGE 0x10000 TO 0x1FFFF
      DATA SPACE AT ADDRESS RANGE 0x40000 TO 0x47FFF
      DATA SPACE AT ADDRESS RANGE 0x50000 TO 0x5FFFF
MAP=10- CODE SPACE AT ADDRESS RANGE 0x00000 TO 0x20000
      DATA SPACE AT ADDRESS RANGE 0x40000 TO 0x60000
MAP=11- CODE SPACE AT ADDRESS RANGE 0x00000 TO 0x07FFF
      DATA SPACE AT ADDRESS RANGE 0x40000 TO 0x7FFFF
MAP=11 IS USED FOR FLASH REPROGRAM MODE
*************************************************************/

RAM = (!PSEN & !A19 & !A18 & !A17 & !A16 & !A15) #
      (!PSEN & !A19 & !A18 & !MAP1 & !MAP0 ) #
      (!PSEN & !A19 & A18 & !A17 & !A16 & A15 & !MAP1 & MAP0 ) #
      (PSEN & !A19 & !A18 & !A17 & !A16 & A15 & !MAP1 & MAP0 ) #
      (!PSEN & !A19 & !A18 & !A17 & MAP1 & !MAP0 ) #
      (!PSEN & !A19 & A18 & A17 & MAP1 & !MAP0 ) #
      (PSEN & !A19 & !A18 & A17 & MAP1 & !MAP0 ) #
      (PSEN & !A19 & !A18 & !A17 & !A16 & A15 & MAP1 & MAP0 ) ;
/*************************************************************
ENABLE EXTERNAL RAM (IN DATA SPACE SOCKETS)
  >>>> ALWAYS ENABLE THE LOWER 32KB IN DATA SPACE <<<<
MAP=00- DATA SPACE AT ADDRESS RANGE 0x00000 TO 0x3FFFF
      CODE SPACE >>>> NONE <<<<
MAP=01- DATA SPACE AT ADDRESS RANGE 0x00000 TO 0x07FFF
      DATA SPACE AT ADDRESS RANGE 0x48000 TO 0x4FFFF
      CODE SPACE AT ADDRESS RANGE 0x08000 TO 0x0FFFF
MAP=10- DATA SPACE AT ADDRESS RANGE 0x00000 TO 0x20000
====> DEFAULT MODE FOR XMON <========
      DATA SPACE AT ADDRESS RANGE 0x60000 TO 0x7FFFF
      CODE SPACE AT ADDRESS RANGE 0x20000 TO 0x40000
MAP=11- DATA SPACE AT ADDRESS RANGE 0x00000 TO 0x07FFF
      DATA SPACE NO UPPER REGION, FLASH REPROGRAM MODE
      CODE SPACE AT ADDRESS RANGE 0x08000 TO 0x0FFFF
*************************************************************/

ELCD = !PSEN & A19 & A18 & !A17 & !A16 & !A15 & !RST & ( RD # WRL) ;
/* ENABLE THE LCD AT 0xC0XXX ON READS OR LOW-BYTE WRITES*/

UIO = !PSEN & A19 & !A18 & A17 & A16 & !A15 & !RST ;
/* USER INPUT/OUTPUT PORT MAPPED AT 0xB0XXX */

MAP = !PSEN & A19 & !A18 & A17 & A16 & A15 & !RST ;
/* S/W CONFIG REGISTER/OPTIONAL EXPANSION WAIT
                                          MAPPED AT 0xB8XXX */

RRD = PSEN # RD ;
/* 'OR' PSEN AND READ FOR ALL MEMORY DEVICES */

WAIT = (!EXTROM & RST) # ( WAIT & !EXTROM & ALE )
       # OWAITI ;
/* ENABLE EXT ROM EXECUTION IF THE 'EXT ROM' JUMPER IS INSTALLED
  OR DRIVE FOR ON-BOARD WAITS */
```

3.11. Serial Port Connection

The XTEND monitor, XMON, uses Serial Port 1 (J4). Please note that the MAX232 Serial Interface IC (U9) provides TxD *AND* RxD for BOTH serial ports (J4 *AND* J5).

The XTEND-G3 kit utilizes DB9 female serial port connectors that are designed for a one-to-one connection to a PC-AT Compatible Serial Port. If a replacement cable is required, a simple one-to-one connection from a DB9 female to a DB9 male connector will work.

The following table lists the pinout of the XTEND serial ports:

Pin Number	Signal Name	Description
1	No Connect	Unused Pin
2	Transmit Data	Transmit from XA-G3
3	Receive Data	Receive to XA-G3
4	No Connect	Unused Pin
5	Ground	System Ground
6	No Connect	Unused Pin
7	Clear To Send	From Computer
8	Request To Send	To Computer
9	No Connect	Unused Pin

Note: CTS and RTS are NOT used by the XTEND software monitor but are optionally supported in hardware for user applications as required. If these signals are required, the user should populate the empty socket at U10 with a MAX232 or equivalent Serial Interface IC.

3.12. External Memory Timing

The XA-G3 utilizes variable memory timing configurations programmed via two internal registers of the processor, BTRH and BTRL. The XTEND uses the default XA-G3 values of BTRH = 0ffh and BTRL = 0efh to support the widest variety of memory device speeds possible. The user can optimize these values to comply with the desired XA operating frequencies and memory speeds.

Consult the XA-G3 databook for complete definitions of the programming of these registers.

3.13. Low Voltage Operation (3V Vcc)

The XA-G3 is capable of operation at low voltages such as 3V that are used in many typical battery operated applications. The XTEND supports this alternative voltage level via a few simple changes:

1. Verify that the XA-G3 being used is a 3V version of the part
2. Change the voltage regulator (7805) to a 3V regulator
3. Change the 74ABT373 (if used) in locations U2 & U4 to 74LV373 parts.
4. Install proper low voltage EPROM's and Data SRAMs if required.
5. Change the RS-232 driver IC to a proper low voltage part. (MAX3232 or equivalent)
6. Change any other necessary logic parts from 'HCT' type to 'HC' or 'LV' type parts which support 3V operation.

4. INSTALLING THE XTEND-G3 SOFTWARE

There are two diskettes included in the XTEND-G3 kit:

- XTEND-G3 Disk contains the Windows 3.1 installation program and the Windows 95 installation program, as well as the XTEND-G3 Software and Examples.
- Philips Semiconductors XA Development Tools Diskette which includes the XA assembler, simulator and 8051-to-XA translator.

Note: Be sure to run the proper installation program for the version of Windows being utilized:

For Windows 3.1/3.11, utilize A:\INSTALL.EXE – This installation SHOULD NOT be used for Windows-95-based environments.

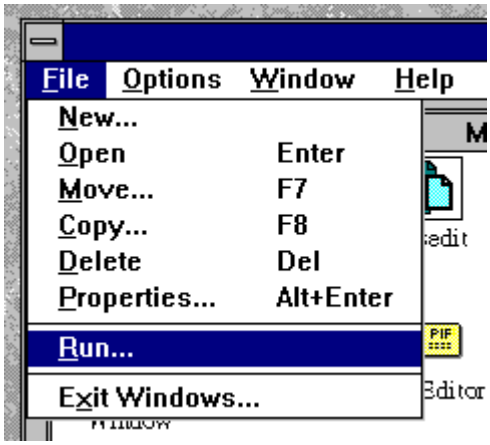
For Windows 95, utilize A:\WIN95\INSTALL.EXE – This installation SHOULD NOT be used for Windows versions prior to Windows 95.

It is recommended that the Philips Semiconductors XA Development Tools Software be installed first. This will create the proper directory structure for the XTEND software. For details on installation of the Philips XA Development Tools, refer to the 'README.DOC' file on the Philips diskette.

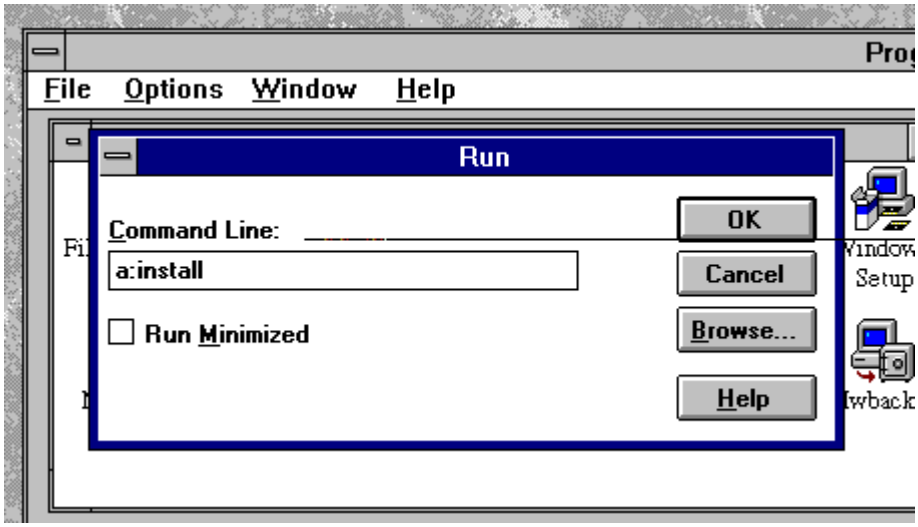
4.1. Windows V3.1 / V3.11 Installation

To install the XTEND-G3 Windows V3.1 / V3.11 interface software:

1. Start Windows on your PC
2. Insert Disk #1 into the floppy drive
3. From the 'File' menu, hit 'Run...' (screen example shown below)



4. Type ‘a:install’ and hit the ‘ENTER’ key. (Drive ‘a’ is assumed, if you are using drive ‘b’, type ‘b:’ instead of ‘a:’) (screen example shown below)



5. At this point the Windows interface will be automatically installed, and a new program group will be created with the XTEND interface program icon.
6. To start the XTEND interface program, double click on it with the mouse, or hit ‘ENTER’ when the icon is highlighted.
7. The default serial port utilized is COM2. If a different serial port is required, change the port under the ‘Settings’/’Communications’ menus from the XTEND terminal software.
8. Please also verify that Flow Control, under the Settings/Communications menu is set to “None”

The XTEND-G3 XMON software monitor and sample applications software will be copied to the location specified by the XTEND installation software. The default location for the XTEND installation software is the 'XA\XTEND' directory created by the installation of the Philips Semiconductors XA Development Tools Software. You may specify a different location for the software to be installed, but remember to make note of the difference.

4.2. Windows 95 Installation

To install the XTEND-G3 Windows 95 interface software:

1. Start Windows 95 on your PC
2. Insert Disk #1 into the floppy drive
3. From the 'Start' menu, select Run...'
4. Enter the following information in the block: "a:\win95\install.exe"
5. Select 'OK'
6. Follow the directions of the install program for selecting the target directory to install to.

The Windows 95 installation installs a Hyper-Terminal setting file called 'XTEND.HT' onto the hard disk and creates a short-cut from the main Windows 95 screen. To initiate the interface to the XTEND, make sure the serial cable is connected properly and double-click on the 'short-cut' XTEND.

5. XMON MONITOR FUNCTIONS

The new XMON software monitor allows development and debug of user code without the need for EPROM or OTP XA-G3 devices. The XMON software is executed from external FLASH or EPROM using a ROMLESS XA device. User code is downloaded into RAM (which is mapped into Code space) and can then be executed or modified for debug. The XMON monitor allows user code to execute (including interrupts) while XMON remains in the background. However, XMON maintains control of the XA system so that breakpoints, single step and other functions can be correctly executed. XMON also traps and contains unexpected interrupts and events so the user can deal with them accordingly.

This debug method requires some tradeoffs vs. doing debug with a full blown In Circuit Emulator or ICE.

The XMON Monitor included with the XTEND-G3 kit allows communications with the host PC and provides basic debug capabilities for the XA-G3. Remember that the monitor utilizes UART0, port pins P3.0 and P3.1 (RxD0 & TxD0), Timer T1 for baud rates and Control Signals -WRL and -RD on port pins P3.6 and P3.7. Code space is also mapped into RAM space at 40000H so the user could possibly write over his own downloaded code. The user can modify or corrupt these ‘shared’ resources and thus cause the monitor to fail so think about what you’re doing. If you mess up just push RESET.

Currently XMON only uses RAM in external data space from 07000h to 08000h. All XMON variables and stack are contained in this area so all other data space RAM is available to the user. Consult the appendix for details on RAM space addresses.

Please consult the README.TXT file or FDI's website for updates on RAM and resource usage for new XMON versions.

Note: User applications should NOT enable or modify the watchdog timer registers during debug. This will cause a conflict with the XMON software monitor. Once the debug process is complete (using XMON), the watchdog timer initialization MUST be included for the user application to function properly.

Basic functions of the XMON monitor include:

- Serial Host Communication
- Register Dump/modify
- External Data Memory Dump/Modify
- External Code Memory Load (from RS232)
- Code Disassembly
- Execute Code with up to 4 user defined breakpoints supported
- Single-step through code
- Force a breakpoint using the ESCAPE key on the PC

Note: Please be sure to see the 'README.TXT' file on the XTEND diskette for the latest information about the monitor.

5.1. XMON Monitor Command List

The following is a list of the commands available:

Function	Description	Syntax
DI	Disassemble	DI *start_addr*
DL	Download (hex) File	DL
DR	Display SFR Registers	DR
DM	Display Memory	DM[.C][.B|.W]*start_addr length*
FM	Fill Memory	FM[.B|.W]*start length pattern*
GO	Execute User Program	GO [*start_addr*], [b1],[b2],[b3],[b4]
HE	Display Help	HE [*cmd*]
MM	Modify Memory	MM[.B|.W]*addr*
MR	Modify Register	MR *reg_name*
SS	Single Step	SS [*start_addr*]

NOTES:

1. Information inside of the brackets, such as [*addr*] or [*cmd*] is optional. [*cmd*] is the optional command for which additional help is desired.

2. Italicized text, such as *addr, start,* or *length* specifies a value the function will use.

3. [.C] specifies to perform the function in Code Space instead of Data Space

4. [.B|.W] specifies **B**yte or **W**ord (default) actions.

5. The '**D**ump **M**emory' and '**F**ill **M**emory' commands have two modes of operation, '**B**yte' or '**W**ord'. The syntax for these is; '**DM.B** or **FM.B** ' and '**DM.W** or **FM.W** ', respectively. If no mode is specified, '**Word**' mode is utilized as the default. When the '**Dump Memory'** function is used in '**W**ord' mode, the word is displayed in high-byte then low-byte format.

6. The '**D**own**L**oad File' command **requires** the user to transmit an 'Intel-compatible' hex file for completion. The XTEND prompt will not return until a hex file is downloaded or the reset switch is activated.

7. User programs must be ORG'd at 0x8120h for use with the DownLoad command.

8. To terminate the **M**odify **M**emory entry, enter a period '.'

9. For **S**ingle**S**tep, use a CR to continue to step through the code and a period '.' to terminate the **S**ingle**S**tep

10. When **G**o is executed without a specified breakpoint (or a breakpoint is not reached), the user may force a breakpoint by using the ESCAPE key on the PC keyboard. This requires the PSW value in the user code to be 08E00h or lower to allow the ESCAPE key to be recognized. See section 5.2.2 for further information.

Please see the following quick examples for information about XMON operation.

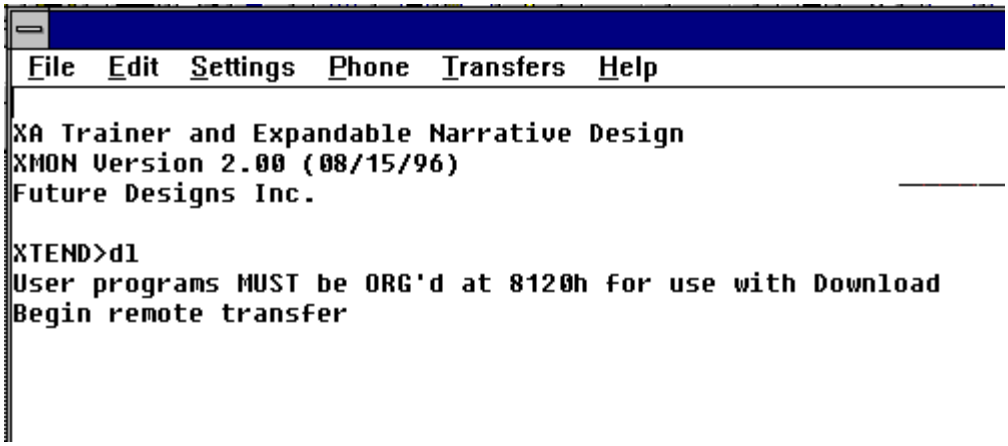
5.2. Monitor Examples

5.2.1. Download

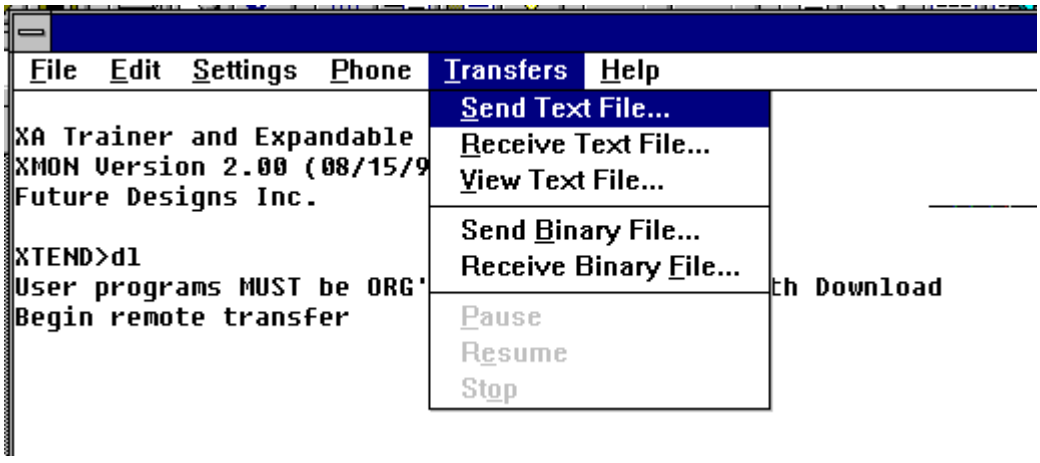
1. The DownLoad command requires the following steps in order to complete the transfer:

   Note: The following example is for **Windows 3.1/3.11**. The steps required to transfer a file via **Windows 95** are slightly different due to the differences in HyperTerminal. Consult the HyperTerminal users guide for detailed instructions on transferring an ASCII file.

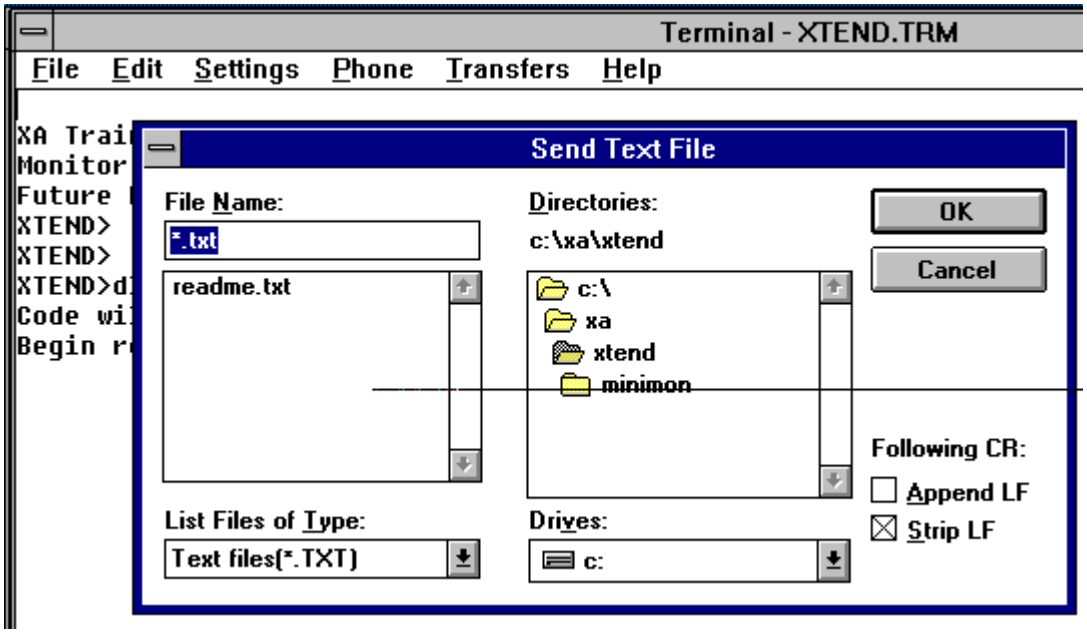
   Enter the **D**own**L**oad command and hit [ENTER].



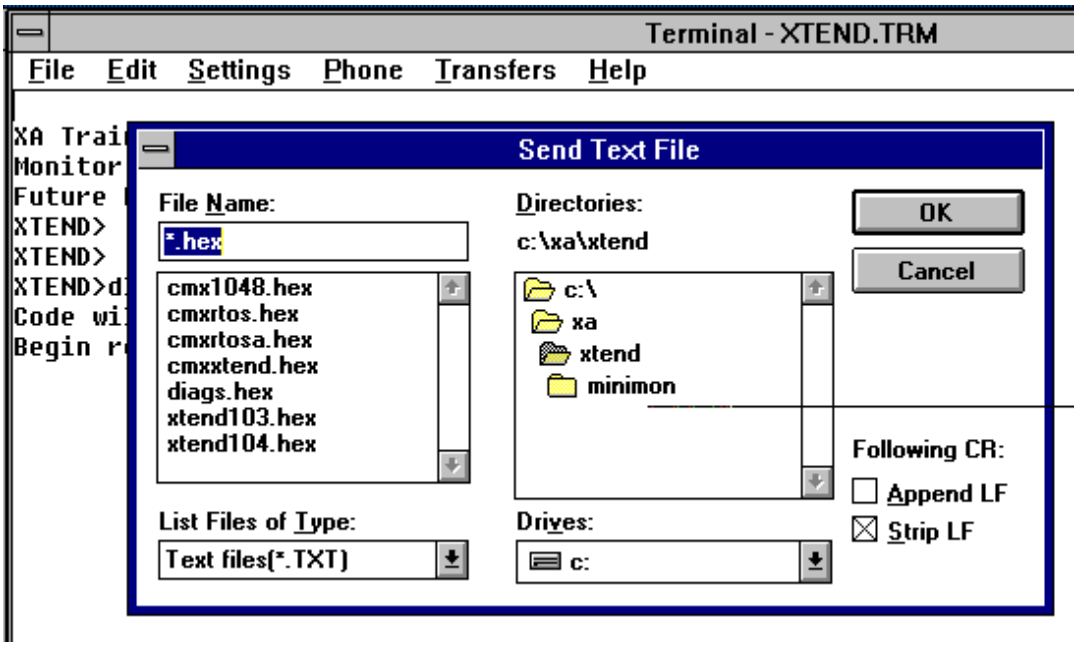
   Select **Transfers** in the Windows Terminal menu.



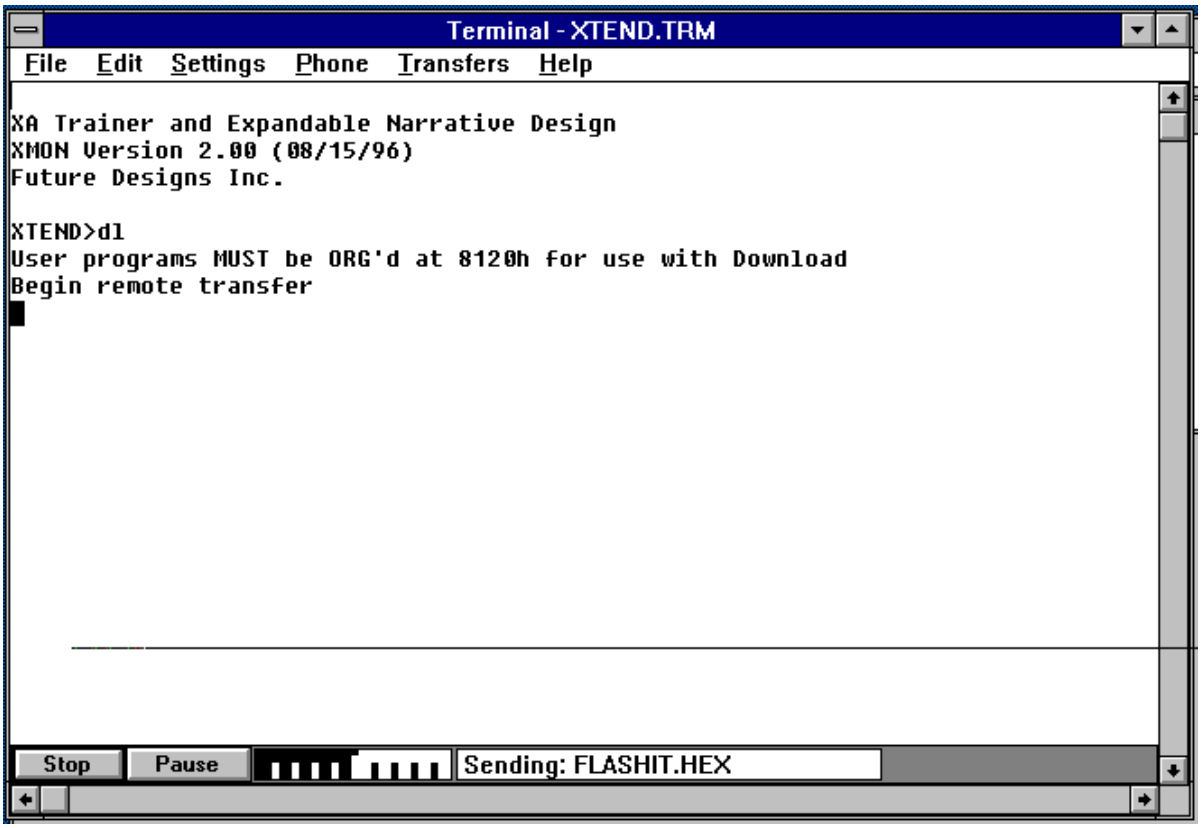
Select **Send Text File...**



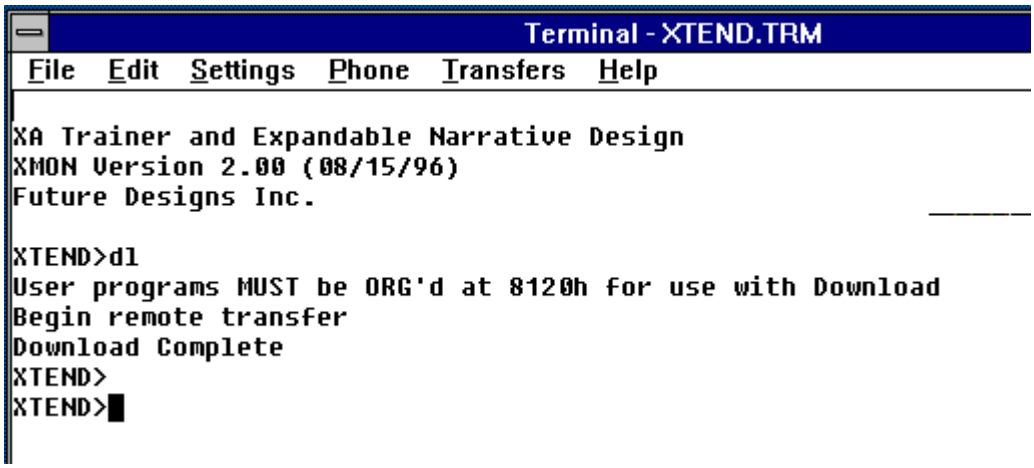
Change to the desired directory, here shown as the XA Tools directory, and enter ***.hex** under **File Name:**



Select the file that you desire to transmit to the XTEND. The Windows Terminal Software will initiate the transfer and a status bar will appear at the bottom of the Windows Terminal screen displaying the progress of the data transfer.



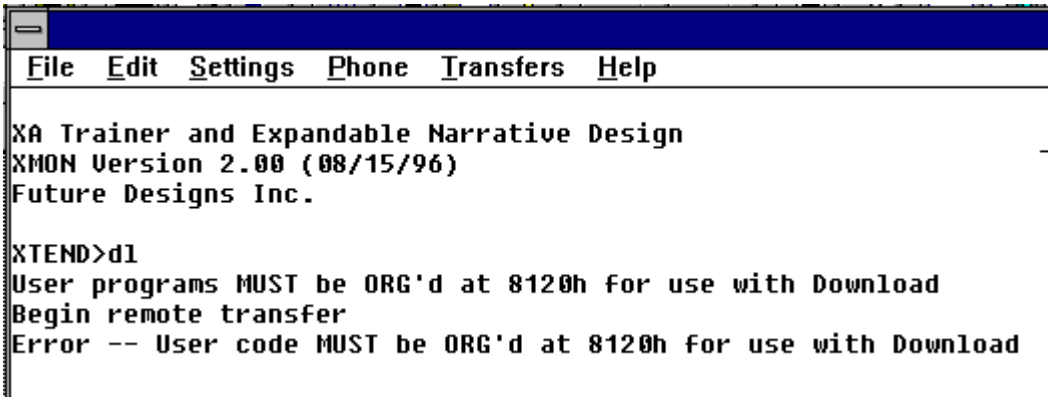
Once the transfer is complete, the XTEND will return a **'Download Complete'** message and return to the command entry mode.



At this point, you are ready to start debugging your code or executing the code that has been downloaded.

Download Errors:

If the user code has not been ORG'd properly, i.e. at 0x8120h, the following error message will be displayed:



Once this error is encountered, the download will be aborted and the remaining data will be discarded. The user should correct the offset problem and re-send the data.

Download Notes:

The START of the actual code must be changed from 0120H to 8120H. This 32K offset allows the code to be executed and debugged using the XMON monitor on the XTEND. XMON occupies the first 32K of XA code space on the XTEND. It is not possible for XMON to simply add an 8000H offset to the users hex file since all relative addressing coded inside the user instructions would be incorrect. When debug using XMON is complete, the code can be re-ORG'ed to 0120H for programming in an actual EPROM or OTP XA.

Interrupt Vectors are unchanged but are moved to 8000H by XMON during the download. XMON provides automatic "soft" branching to these user interrupt vectors so no changes in the user file are necessary for interrupts to work correctly when running under XMON. The only difference between these "soft" vectors under XMON and actual XA Interrupt Vectors is the small additional delay or interrupt latency added by XMON to branch to the user vector.

Notice that XMON uses the Breakpoint, Trace, Timer 1, Serial 0 Rx and Serial 0 Tx interrupts and thus does NOT pass user vectors for these interrupts. All other Interrupts are available to the user code and the appropriate vectors are passed by XMON to support operation of interrupts from these relocated vectors. XMON also provides an Error Handler for any interrupts which do not have vectors to user handler routines.

5.2.2. Code Execution and Breakpoints

XMON supports up to 4 user-defined breakpoints with the 'GO' command. The breakpoints must be defined all on the same command line with the 'GO' command:

XTEND>GO [*start_addr*],[*b1*],[*b2*],[*b3*],[*b4*]

[*start_addr*] is the address for the GO command to begin execution. If no starting address is provided, the GO command will utilize the value of the User PC.
[*b1..b4*] are the individual breakpoints defined by the user. The breakpoints should be separated by a comma (',').

If the user enters the 'GO' command with NO Breakpoints, (GO forever), it is possible to stop the user program at the current instruction with no specific breakpoints. This is done by pressing (ESC) on the PC keyboard. This character causes control to be returned to XMON just as if a Breakpoint had been encountered.

Note: Use of this feature requires that user code not load a value of 8F00H in the XA PSW. This value loads an "0FH" to the XA Interrupt Mask and blocks the Serial0 interrupt from passing the ESC character to XMON. For breakpoints with ESC to be supported user code should only load 8E00H or smaller values to the PSW.

5.2.3. Single Step

The ‘SS’ (**Single-Step)** command can be utilized to execute user code one instruction at a time. Below is an example of single stepping through code (recall that the user program MUST start at 8120H). As you can see the monitor display for this function includes the Working Register Set. Single stepping can be continued by hitting RETURN or terminated with a period (‘.’) .

```
XTEND>ss 8120
008120  99780200     MOV     R7,#0200
 R0=0000   R1=0000   R2=0000   R3=0000   R4=0000   R5=0000   R6=0000
R7=2000

008124  964540FE     AND     440,#FE
 R0=0000   R1=0000   R2=0000   R3=0000   R4=0000   R5=0000   R6=0000
R7=0200

008128  96481F00     MOV     41F,#00
 R0=0000   R1=0000   R2=0000   R3=0000   R4=0000   R5=0000   R6=0000
R7=0200

00812C  96485DA5     MOV     45D,#A5
 R0=0000   R1=0000   R2=0000   R3=0000   R4=0000   R5=0000   R6=0000
R7=0200
```

5.2.4. Modify Memory

Modify memory at address 4000H in byte format and then use display memory to verify the pattern which was written.

```
XTEND>mm.b 4000
004000  00  01
004001  00  23
004002  00  45
004003  00  67
004004  00  .

XTEND>dm.b 4000 20
004000  01 23 45 67 00 00 00 00  00 00 00 00 00 00 00 00 .#Eg............
004010  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 ................
```

5.2.5. Display Special Function Register Set

Display the Special Function Register set for the XA-G3. The SFR name and hex address are displayed along with the current contents of the register.

```
XTEND>dr
System:
[46A]BCR  =06    [443]CS  =00   [440]SCR   =00      [402]PSW51 =00   [427]IEH =01
[469]BTRH =FF    [441]DS  =00   [403]SSEL  =00      [401]PSWH  =8F   [426]IEL =80
[468]BTRL =EF    [442]ES  =00    [404]PCON  =00     [400]PSWL  =00    [47A]SWE =00
[41F]WDCON=00 [45F]WDL =00  [45D]WFEED1=00  [45E]WFEED2=00  [42A]SWR =00
[4A0]IPA0 =00     [4A1]IPA1=00  [4A2]IPA2  =00      [4A4]IPA4  =07       [4A5]IPA5=00
Timers:
[451]TH0 =00       [453]TH1 =FF   [459]TH2   =00       [410]TCON =C0    [411]TSTAT=08
[450]TL0 =00       [452]TL1 =EF   [458]TL2   =00       [45C]TMOD =01
[455]RTH0=00      [457]RTH1=FF  [45B]T2CAPH=00  [418]T2CON=00
[454]RTL0=00      [456]RTL1=B3   [45A]T2CAPL=00  [419]T2MOD=00
UARTs:
[420]S0CON=54  [421]S0STAT=00  [460]S0BUF=0D  [461]S0ADDR=00
[462]S0ADEN=00
[424]S1CON=00  [425]S1STAT=00  [464]S1BUF=FF  [465]S1ADDR=00
[466]S1ADEN=00
Ports:
[430]P0=73          [431]P1=FD          [432]P2=FF          [433]P3=FF
[470]P0CFGA=FF  [471]P1CFGA=FF  [472]P2CFGA=FF  [473]P3CFGA=FF
[4F0]P0CFGB=FF  [4F1]P1CFGB=0F  [4F2]P2CFGB=FF  [4F3]P3CFGB=D2
User Registers
 PC=000000  R0=0000 R1=0000 R2=0000 R3=0000 R4=0000 R5=0000 R6=0000
R7=2000
XTEND>
```

5.2.6.Modify Register

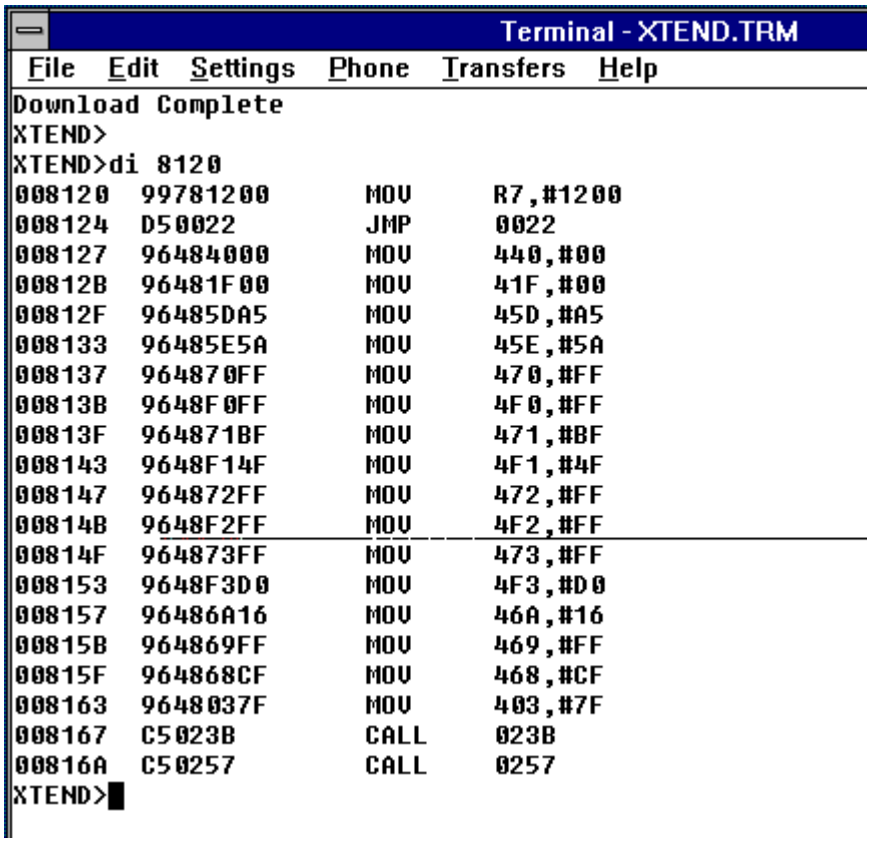
The user may alter the contents of any XA-G3 register as shown:

```
XTEND>MR ES
[442] ES = 00C0
```

Care should be taken not to corrupt the XA-G3 resources used by the XMON monitor or to place the XA-G3 into an invalid configuration mode.

5.2.7. Disassemble

This function disassembles the data starting at the specified address and displays the XA-G3 source code.



5.2.8. Turning LED On

The on-board LED may be connected to a software controllable port or used as a power-on indicator. While connected under software control, the user can write location 0xB8008h with a ‘1’ to turn the LED off and with a ‘0’ to turn the LED on.

To turn the LED OFF;
XTEND>**fm.b b8008 1 1**

To turn the LED ON;
XTEND>**fm.b b8008 1 0**

5.2.9. Place the XA in Idle Mode

Modify PCON to place the XA in idle mode. Notice that the XTEND prompt doesn't come back after this action. Now hit RETURN on the PC and notice that the XA wakes up from idle mode since the UART generated an interrupt. This gives the original XTEND prompt that wasn't returned after entering idle mode and also another prompt to correspond to the additional RETURN.

```
XTEND>mr pcon
[0404]PCON = 00   01
```

5.2.10. Command Script Example

The following is an example of a command script file that will: turn the LED on, fill a region of memory with zeros, dump a region of the filled memory (to verify the fill command), fill another region of memory with a pattern (1234) , dump a region of the section filled (to verify the fill command), and turn on the speaker (using the T2 setting on jumper JP7) with a tone output.

```
                        ;Turn the LED on
FM.B B8008 1 0          ;Modify map register
MR P1CFGB               ;Modify register P1CFGB
FF                      ;Change its value to FFh
                        ;Fill memory with specified data
FM 3000 1000 0          ;Fill data memory from 3000h with 0h
DM 3000 30              ;Dump 30h words of data memory
FM 4000 800 1234        ;Fill data memory from 4000h with 1234h
DM 4000 30              ;Dump 30h words of data memory
DM 6000 30              ;Dump 30h words of data memory
                        ;Turn Speaker on
MR T2CON                ;Modify register T2CON
4                       ;Change its value to 4h
MR T2MOD                ;Modify register T2MOD
2                       ;Change its value to 2h
MR T2CAPH               ;Modify register T2CAPH
C0                      ;Change its value to C0h
```

This file is included on Disk 1 of the XTEND Software kit as 'COMMAND.TXT'. Before initiating this command file transfer, you should enter the '**Settings**' menu and then the '**Text**

Transfers...' menu and set '**Flow Control'** to '**Line at a Time**' and '**Transfer a Line at a Time'**to '**Delay Between Lines 10/10 Sec'**.

To invoke this command script, initiate a text transfer as shown in the download command example (Section 5.2.1). Enter the correct filename 'COMMAND.TXT' to start the command file transfer.

Do not use the 'Download' command in XMON when performing a command script file transfer.

Note: The comments shown beside the command lines are for reference only, and will NOT appear in the actual file COMMAND.TXT .

When finished with the command file transfer, you may want to return the original settings to expedite download of hex files.

5.2.11.LCD Initialization and Use

The 16 character LCD module utilized on the XTEND is an industry standard character-based display. The display is memory mapped at 0C0000h for commands and 0C0002h for data (characters).

The following is an example of the initialization commands required for the LCD through XMON:

```
XTEND>fm.b c0000 1 38      << Sets 8-bit interface, 2 lines of display
XTEND>fm.b c0000 1 c       << Activates the display
XTEND>fm.b c0000 1 1       << Clears the display and homes the cursor
```

The following is an example of how to write the characters "ABC" to the LCD through XMON:

```
XTEND>fm.b c0002 1 41      << Writes ASCII value for "A"
XTEND>fm.b c0002 1 42      << Writes ASCII value for "B"
XTEND>fm.b c0002 1 43      << Writes ASCII value for "C"
```

6. EXPANSION CAPABILITIES

6.1. Expansion Connector

The XTEND-G3 includes an expansion connector to support custom user circuits or to facilitate a handy debug probing location. This connector includes most of the signals (both multiplexed and de-multiplexed) from the XA-G3.

An optional PL22V10 PAL (U17) socket is provided on the XTEND-G3 board already pre-wired for expansion support.

- Future Expansion Boards under development include:

  ⇒ I2C Expansion Board with LCD, Keypad, Real Time Clock and Serial EEPROM

  ⇒ Prototype Board with Wire-wrap ‘Pad-per-hole’ Area

  ⇒ Philips Multichannel Datacomm Board (26C94/26C198)

  ⇒ DRAM Expansion board with CPLD for control

  ⇒ Virtually any type may be custom designed

Several signals on the expansion connector have multiple functions, which would not fit the space available for silkscreen labels. These signals are detailed in the table below. For full details on the use of the alternate functions, consult the Philips XA Databook.

Name in Silkscreen	Alternate Function	Alternate Description
WAIT	EA#	External Access
WRH#	A0 / P1.0	Address 0
P14	RxD1	Serial 2 Receive
P15	TxD1	Serial 2 Xmit
P16	T2	Timer 2 Output
P17	T2EX	Timer 2 External Control
T1	BUSW	Bus Width
RxD0	P3.0	Port Pin
TxD0	P3.1	Port Pin
INT0	P3.2	Port Pin
INT1	P3.3	Port Pin

6.2. On-Board Expansion

The XTEND-G3 supports the following on-board optional memory and I/O expansion capabilities:

- Up to 256KB of on-board Code Space EPROM or SRAM is supported.

  To expand the code space from 128KB to 256KB:
  1. Remove the 29EE512 FLASH EPROM's from U5 & U6.
  2. Insert the new devices into the code space sockets, remember, 28-pin devices are justified downward in the socket. If Programmed EPROM's or FLASH devices are utilized, the EVEN (low byte) device should be inserted into U5 and the ODD (high byte) device should be inserted into U6.
  3. Set the code space size jumper (JP2) according to instructions in Section 2.5 .
  4. Set the code space device jumper (JP9) according to instructions in Section 2.5

- Up to 256K of on-board Data Space SRAM is supported.

  To expand the data space from 64K to 256K:
  1. Remove the 32Kx8 SRAM's in U7 & U8
  2. Insert the 128Kx8 SRAM's into the data space sockets U7 & U8.
  3. There are no jumpers to change.

The following is a list of suggested part numbers:

Part	Part Number	Description
EPROM	27C256-15, 27C512-15, 27C010-15	32K, 64K, or 128K x 8 150ns
FLASH	PH29EE512, PH29EE010 (SST Brand)	64K, or 128K x 8 120ns
SRAM (0.3")	MOSEL MS62256H-20NC, Toshiba TC55328AP-20, ISSI IS61C256AH-20, Sharp LH52258AD-20	32Kx8 20ns (15ns may be substituted)
SRAM (0.6")	Toshiba TC551001PL10	32Kx8 70ns -100ns

- Additional I/O capabilities beyond those of the XA-G3 are provided by on-board user input/output ports. The user input port is provided by the use of a 74LV244 (or 74HCT244) (U13) and a 4-pin header (JP4). These inputs have on-board pull-up resistors (RP1) and individual ground pins adjacent to the signal pins on the header (JP4). In addition to the input header, the user input port utilizes the two pushbutton switches, S2 (Mode) & S3 (Select). The following table illustrates the mapping of the user input port:

Port Bit Number	Function
0	JP4 pin 1-2
1	JP4 pin 3-4
2	JP4 pin 5-6
3	JP4 pin 7-8
4	Temperature Sensor Input
5	Temperature Reference Input
6	Switch S2 (MODE)
7	Switch S3 (SELECT)

  The on-board 8-bit user output port is provided by the use of a 74LV273 (or 74HCT273) (U12) and a 10-pin header (JP8). The user output header has Vcc connected to pin 1 and ground connected to pin 10. Both of these ports are mapped at B0000h in the data space of the XA-G3. This address may be changed easily by modifying the source file for the PAL, compiling a new JEDEC file and re-programming the PAL.

- On-board Wire-wrap Area for prototyping of end-user circuits

7. APPLICATION EXAMPLES

Included on the first XTEND-G3 diskette is an application example file for the XA-G3 called ‘XADEMO.ASM’. This file may be used as a starting point to develop XA assembly language applications. The user can adjust the initialization values to suit a specific application and then just edit in any desired code functions.

The file XADEMO.ASM includes standard XA assembly language software to:

- Set-up and configure the XA SFR’s
- Initialize the Bus and I/O ports
- Initialize the Timers
- Initialize Serial Port 2
- Send a sign-on message through Serial Port 2 to a PC at 9600 baud
- Echo back characters that are typed on the PC connected to Serial 2
- Read bit 0 of the user input port jumper
- Write this value out to bit 0 of the user output port
- Light the LED if the bit 0 input jumper is set
- Use Timer0 to drive one of two different frequency tones to the speaker based on the bit 0 input jumper setting

Also included is an example file called ‘TEMPSENS.ASM’ which reads the on-board temperature sensor and displays the current temperature on the LCD. This code also monitors the MODE and SELECT pushbuttons and records a button push on the LCD.

8. CMX RTOS REAL-TIME KERNEL

There are two versions of the CMX RTOS included with the XTEND, one for download and execution on the XTEND, and one for demo purposes on the PC.

The CMX Real-Time Kernel included with the XTEND-G3 kit is a limited function demonstration version. Fully functional production versions are available directly from CMX. CMX can be contacted at (508) 872-7675 or via e-mail at cmx@cmx.com. CMX also provides a website at: http://www.cmx.com

The CMX RTX Real-Time Operating System features:

- No Royalties on Embedded Code
- All Source Code Supplied
- Extremely Fast Context Switch Times
- Very Low Interrupt Latency Times
- Scheduler and Interrupt Handler written in Optimized Assembly for Speed
- Supports Pre-emption, Cooperative Scheduling and Time Slicing (interrupts can task switch and use OS functions)
- Supports Nested Interrupts
- ROMable and User Configurable
- All CMX functions contained in Library

9. HITECH XA C COMPILER DEMO

The enclosed CMX Diskette also contains the HiTech XA C Compiler demo package:

HITECH Directory -- Contains a fully functional 8051XA C Cross Compiler from Hi-Tech Software. The only restrictions are that there can only be 2 C files and that each C file does not generate more then 500 lines of assembly code or 1000 bytes, which ever is less.

XADEMO.EXE - The XADEMO.exe is a self extracting executable. Please create a directory on your hard drive called HT_XA. Then copy the XADEMO.EXE into that directory. Then just run XADEMO and then read 'readme.txt'.

This version of the HiTech compiler will compile complete programs, but you will be limited to a maximum of two modules per project, and each module is limited to 500 lines of generated assembler or 1000 bytes, whichever is less. To run the compiler, just invoke the program HPDXA.EXE.

There are a couple of example programs in the EXAMPLES directory. You can also try the old standard "Hello world" program. The library provided will output any printf() characters to serial port 0, at 38400 baud (assuming a 20MHz xtal). There is a module SERIAL.C in the EXAMPLES directory that you can customize for different baud rates. Include this in your program and it will override the library version.

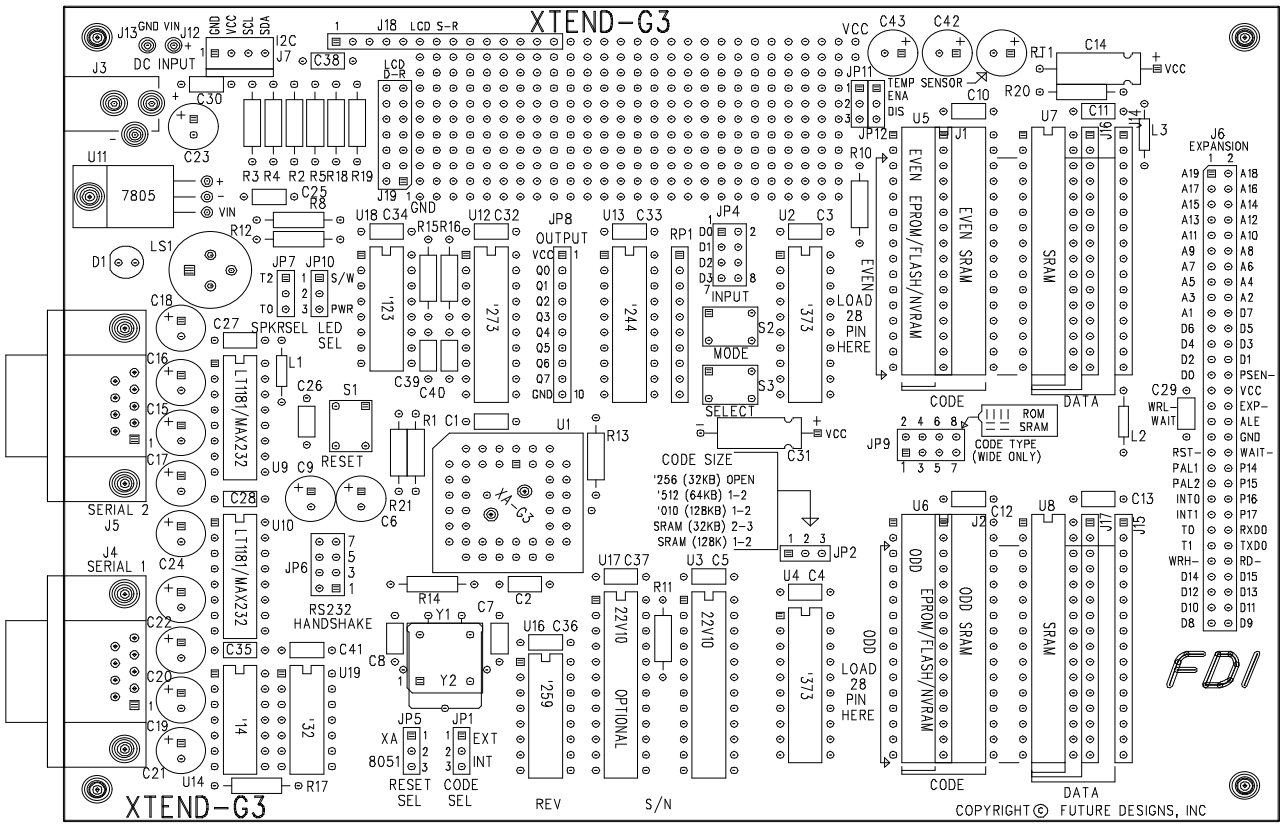
To start a new project, select Make/New Project and answer the questions. The default memory addresses will work for most small programs. Don't forget to add source files to the Source file list. You can compile a single source file using the Compile menu. It will compile the file currently loaded into the edit window.

This demo version does not include the command line driver, which is included in the full package. The HITECH compiler is available in the United States directly from CMX, an authorized HITECH Distributor. See the file "RESELLERS" for worldwide reseller contact information, or contact HITECH Software directly at (Australia) 617-3300-5011 or at http://www.hitech.com.au

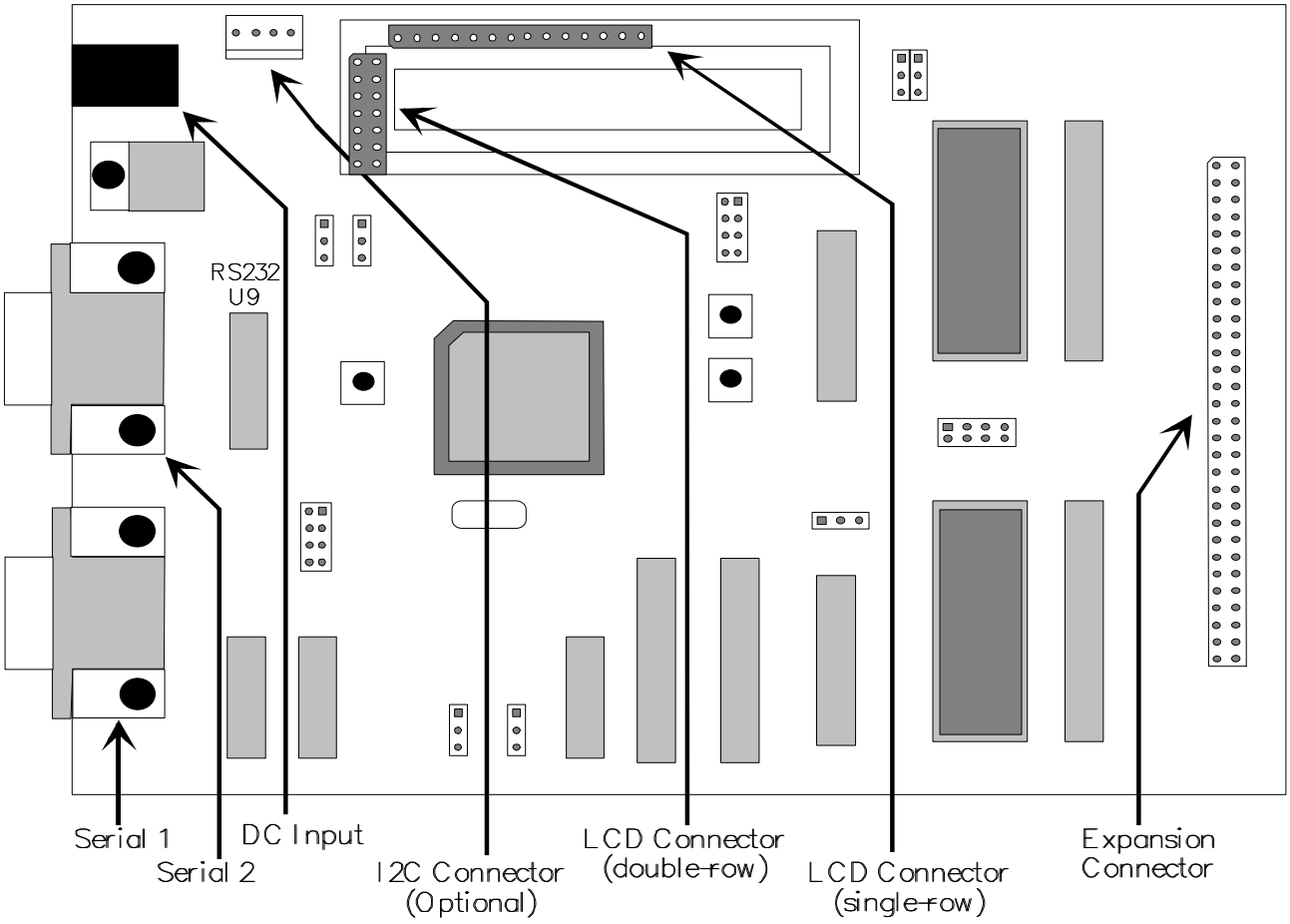
See the file HPD.TXT for some tips on using HPDXA.

10. APPENDIX A - CONNECTOR AND JUMPER LOCATIONS

10.1.XTEND-G3 Board Layout

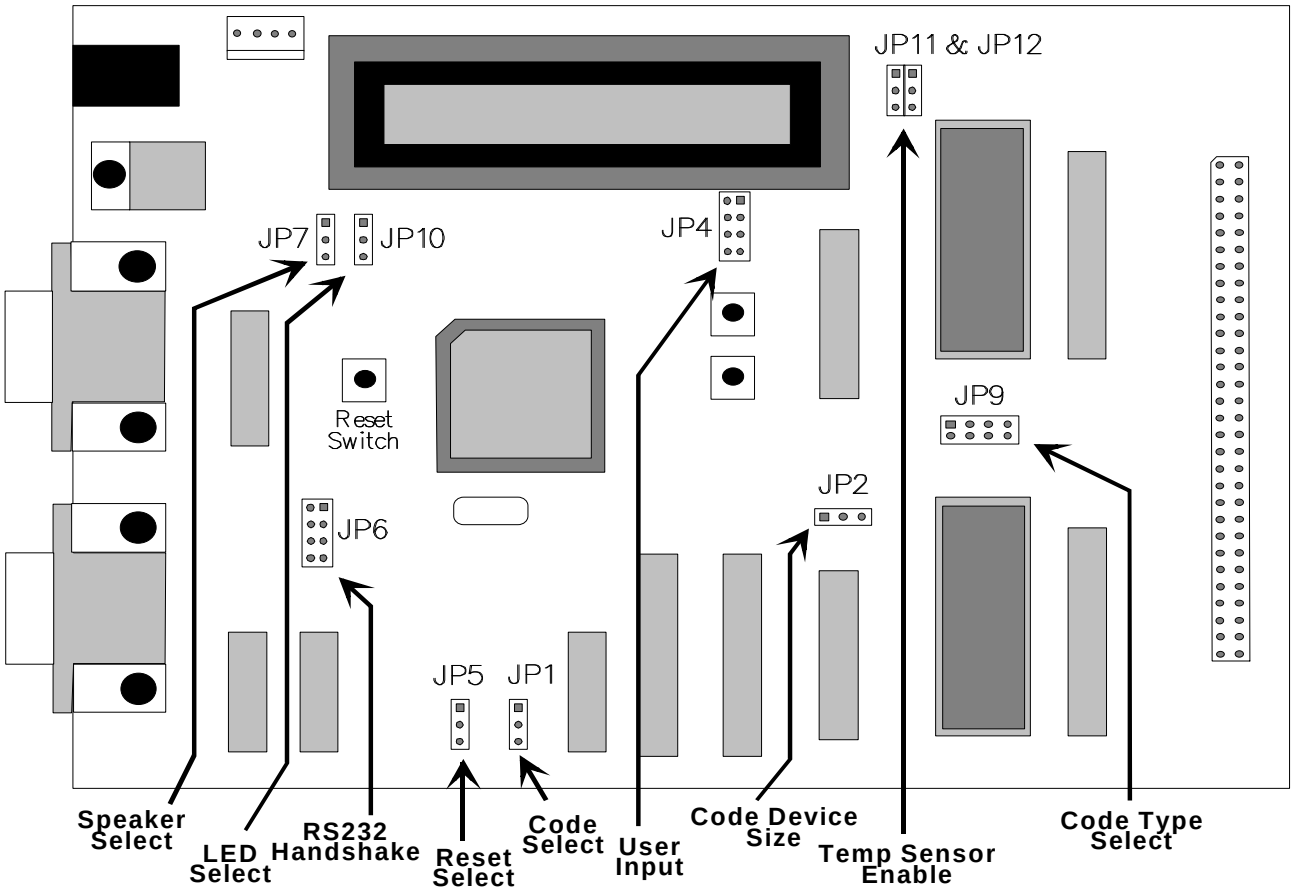


10.2.Connector Locations



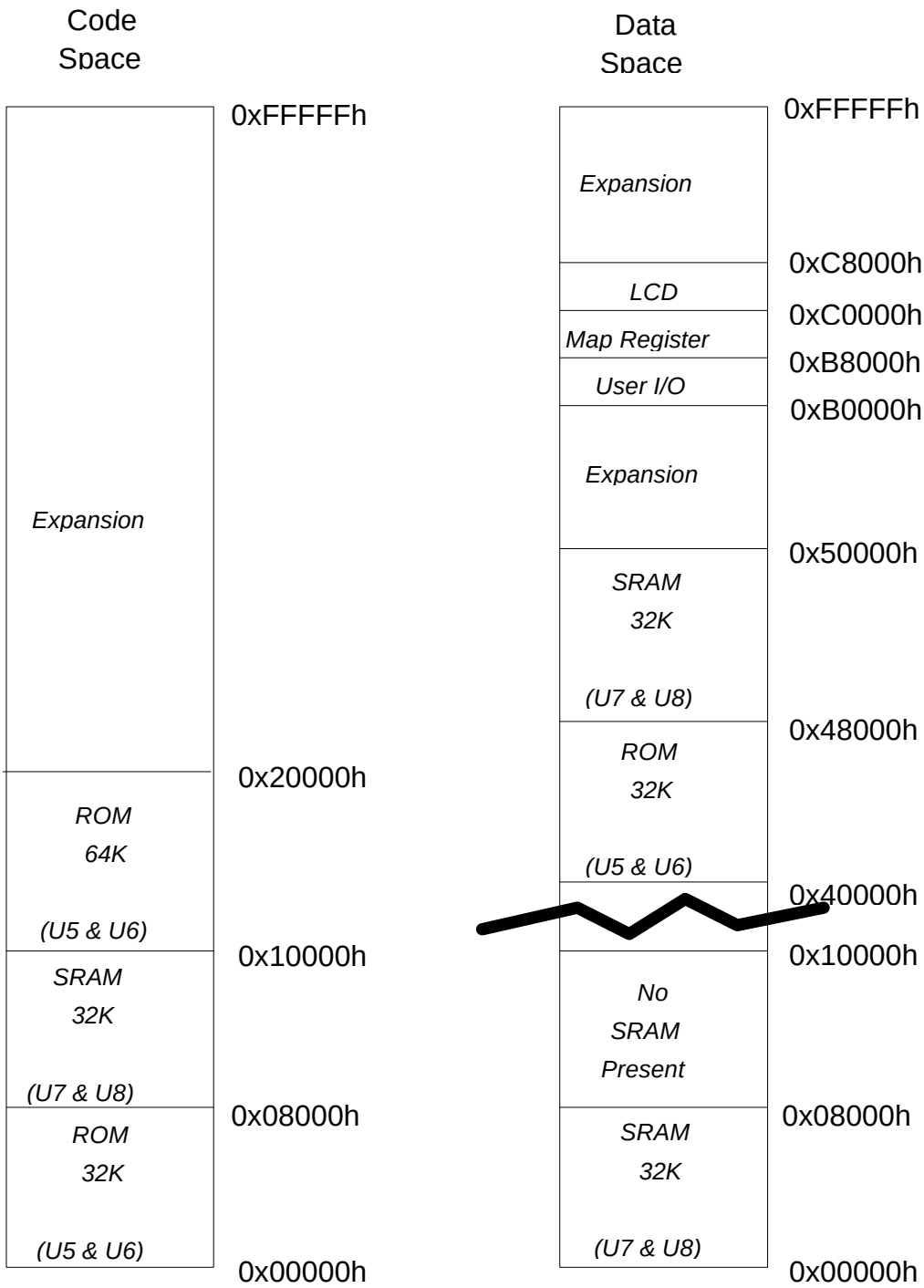
NOTE: The RS232 IC (U9) supports BOTH serial ports. i.e. This device provides the transmit AND receive signals for BOTH serial 1 AND Serial 2. The empty socket at location U10 can be populated with a part such as Maxim MAX232CPE for optional handshake support on BOTH serial ports. Do NOT move the IC from U9 to U10, this will result in neither serial port working.

10.3.Jumper Locations



11. APPENDIX B - MEMORY MAP FOR XTEND

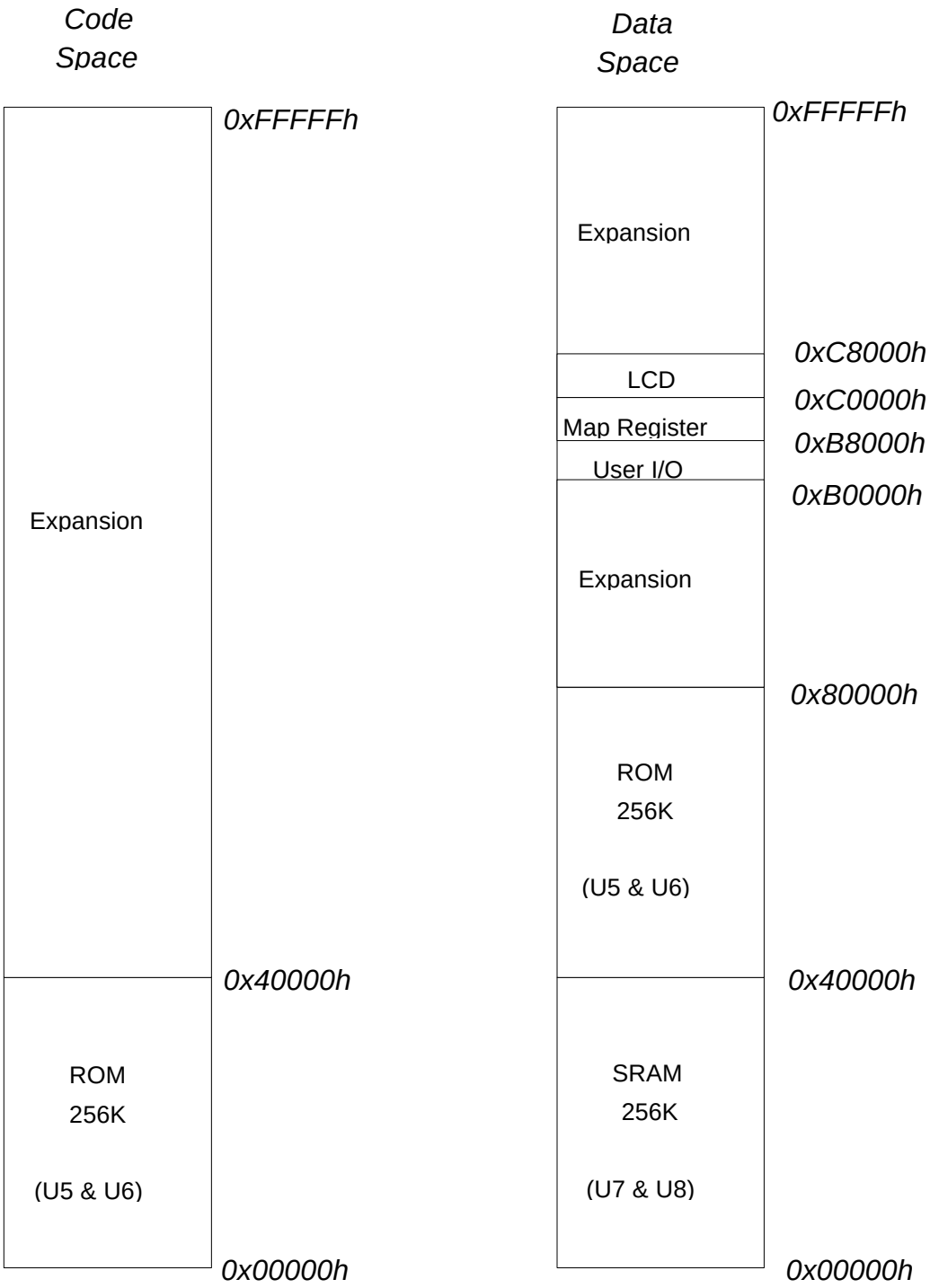
11.1. MEMORY MAP - DEFAULT FOR XMON



Default Memory Map for use with XMON
32KB Overlay, Map=01

XMON resides in code space from 0x0000h-0x8000h and user code is downloaded into SRAM in code space at 0x8000h-0x10000h.

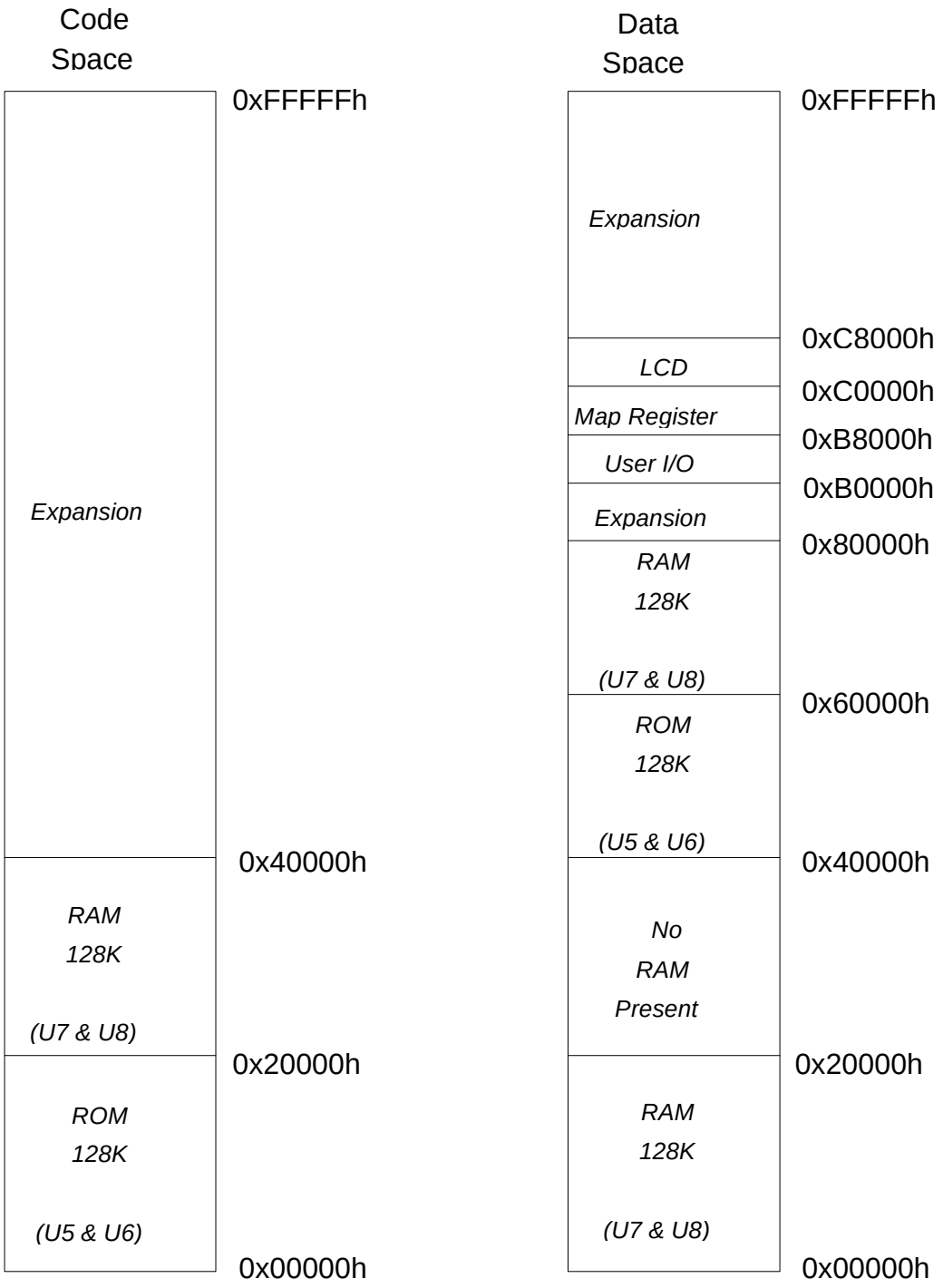
11.2. MEMORY MAP - TARGET MODE



Memory Map for Target Mode
No Overlay, Map=00

Standard map for use of the XTEND as a user target board rather than a development tool. This setting is the power-on default without any user initialization.

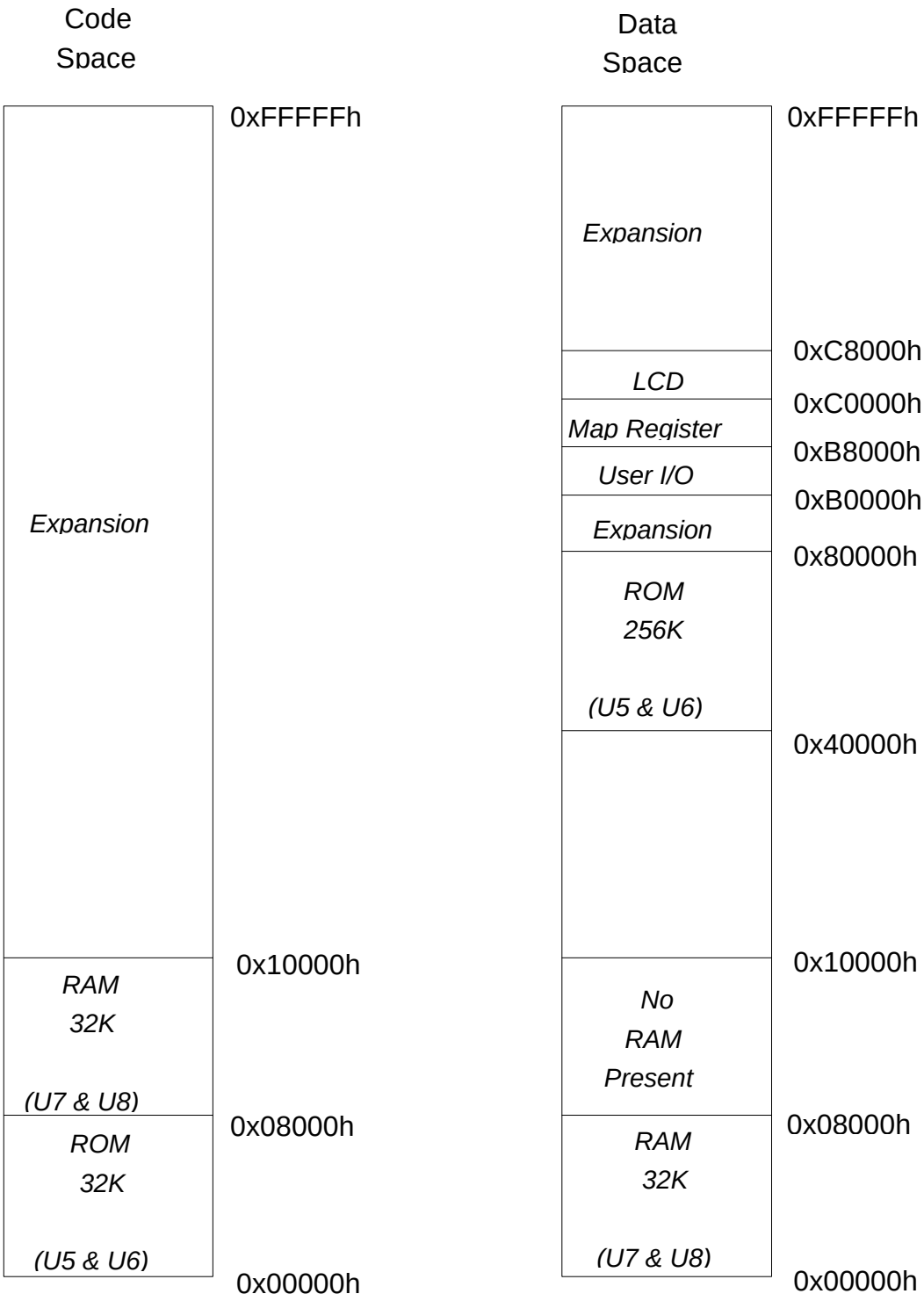
11.3. MEMORY MAP - 256KB SRAM



Memory Map for use with XMON and 256KB Data Memory
128KB Overlay, Map=10

This map setting supports the large (256KB) memory option on the XTEND. Please refer to the 'README.TXT' on the XTEND Diskette for XMON support for this option.

11.4. MEMORY MAP - FLASH REPROGRAM MODE



FLASH Reprogram Mode
32KB Overlay, Map=11

This mode supports FLASH reprogramming by mapping the FLASH ROMs into data space at 0x40000h so it can be written in the XA Harvard Architecture.

12. APPENDIX C - PARTS LIST

Item	Qty	Reference	Part	Vendor	P/N
1	24	C1-5,C10-13	0.1UF,Z5U,50V	Digikey	1210PHCT-ND
		C25-30,C32-38,C40,C41			
2	12	C6,C9,C15-C24	10UF,Radial,35V	Jameco	29891
3	2	C7,C8	33PF,COG,100V,5%	Digikey	1016PHCT-ND
4	2	C14,C31	10UF,Axial,35V	Digikey	
5	1	C39	470PF,COG,100V,5%	Digikey	
6	2	C42,C43	10UF,Radial,Tantalum, 16V	Digikey	
7	1	D1	LED,RED,T1-3/4	Jameco	XC556R
8	7	JP1,JP2,JP5,JP7,JP10-12	JMP3,3x1,0.100"	Jameco	109575
9	3	JP4,JP6,JP9	HEADER 8,4x2,0.100"	Jameco	
10	1	JP8	HEADER 10,10x1,0.100"	Jameco	103392
11	4	J1,J2,J15,J17	SOCKET,SIP16,0.100"	DigiKey	ED7016-ND
12	1	J3	POWER JACK,2.1MM,PWB	Condor	22HP037 2.1mm
13	2	J4,J5	DB9 FEMALE,RA-PCB,	Jameco	104951
14	1	J6	HEADER 30X2,,	Jameco	68574
15	1	J7	HEADER 4,4x1,0.100"	Jameco	117559
16	1	J18	SOCKET14, 14X1, 0.025" SQ	DigiKey	
17	1	J19	SOCKET14, 7X2, 0.025"SQ	DigiKey	
18	1	LS1	SPEAKER, PCB MNT	Jameco	10424
19	3	L1,L2,L3	FERRITE BEAD	DigiKey	
20	1	RP1	10K SIP, 10PIN	Jameco	
21	1	RT1	TEMP SENSOR	DigiKey	
22	8	R1-3,R10,R11,R13,R19,R21	10K,1/4W,5%	ANY	29911
23	4	R4,R5,R14,R17	22,1/4W,5%	ANY	65736
24	2	R8,R18	470,1/4W,5%	ANY	31165
25	1	R12	220,1/4W,5%	ANY	31149
26	1	R15	3.3K,1/4W,5%	ANY	
27	1	R16	220K,1/4W,1%	ANY	
28	1	R20	1K,1/4W,1%	ANY	
29	1	SKT1	PLCC44,PTH,	Jameco	71618
30	2	SKT3,SKT17	DIP24,300mil,	Jameco	39378
31	12	U5-10 & U13,U16,U18	DIP16,300mil,	Jameco	112221
32	4	U2,U4,U12,U13	DIP20,300mil	Jameco	112248
33	3	S1,S2,S3	SW PUSHBUTTON,,	DigiKey	P8009S-ND
34	1	U1	XA-G3-PLCC,44pin,	Philips Semi	
35	2	U2,U4	74ABT373,DIP20,	Philips	
36	1	U3	PL22V10-15,DIP24,	Philips	
37	2	U5,U6	FLASH 29EE512, DIP32	SST	
38	2	U7,U8	32KX8 20NS SRAM,300mil,	ANY	
39	1	U9	MAX232/LT1181,DIP16,	Jameco	24811
40	1	U11	LM7805CT,TO-220,	Jameco	51262
41	1	U13	74HCT244,DIP20	Philips	
42	1	U12	74HCT273,DIP20	Philips	
43	1	U14	74HC14,DIP14	Philips	
44	1	U16	74HCT259,DIP16	Philips	
45	1	U18	74HCT123,DIP16	Philips	
46	1	U19	74HCT32,DIP14	Philips	
47	1/0	Y1	24MHZ,HC49U/S,	Jameco	102656/14402
48	0/1	Y2	24MHz, Oscillator	Jameco	102779

Replacement parts are available from:

Digi-key Corporation 701 Brooks Ave. South Thief River Falls, MN 56701-0677 Orders: 1-800-344-4539	JAMECO Electronic Components 1355 Shoreway Road Belmont, CA 94002-4100 Orders: 1-800-831-4242

13. APPENDIX D - XTEND 87C51 SUPPORT

The XTEND also supports the use of an 87C51 (or equivalent derivative) in the XA-G3 socket with the following assumptions:

1. The device must be operated *ONLY* in single-chip or internal memory mode. This is necessary because of the differences in the external address/data bus between the 87C51 and the XA-G3.
2. The additional VCC and Ground pins (pin 1 and pin 23) on the XA-G3 will be connected to NC on the user installed 87C51 family microcontroller. This should not be a problem since these NC pins on all Philips 87C51 microcontroller derivatives are not internally bonded to the device.
3. JP5 (Reset Select) must be set for an 8051.
4. JP1 (Code Select) must be set for Internal Code Selection.
5. The PAL device located at U3 will need to be changed to support operation of an 87C51 type device. This is necessary because an 87C51 has an -EA pin which requires a constant '1' or High level to keep the device operating from internal code memory. On the XA, this pin is a combination function, -EA/WAIT. The XTEND drives the -EA/WAIT low during RESET, but then uses the WAIT function to support high-speed XA-G3 access to the slow LCD peripheral. PAL files to support the use of an 87C51 on the XTEND (XTRC51.PLD and XTRC51.JED) are available either on the XTEND diskette or on the FDI website.

This XTEND support for 87C51 family devices allows the user to easily benchmark 8-bit 80C51 application performance vs. the new 16-bit high performance XA-G3.

14. TECHNICAL SUPPORT

Technical support for the XA-G3 is provided by Philips Semiconductors. Please contact your local Philips sales office or Field Applications Engineer. Additional support may be obtained by calling the Philips XA Hot Line at 408-991-51XA or via e-mail XA_Help@scs.philips.com.

Technical support for the XTEND Development Kit is provided by ***Future Designs, Inc.*** Please fax your support question to 205-830-9421 or e-mail it to **teamfdi@aol.com** for the fastest response.

FDI also provides a Web site at:

http://members.aol.com/teamfdi/teamfdi.htm

This web site provides the latest product information, monitor updates, pal updates etc. for the XTEND. You may also call ***FDI*** at 205-830-4116.

15. GENERAL SALES INFORMATION

Authorized sales representatives for the XTEND family of products include:

In the U.S. contact ELCOM 205-830-4001

In Europe, contact Ashling Microsystems 01256 811 998

The XTEND-G3 is also available from any authorized Philips distributor as part number P51XTEND-SD (12NC: 9352-336-70112).