

Flashlite 386Ex

User's Manual

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Overview

The Flashlite 386Ex single board computer is based on the Intel 386Ex microcomputer. The 386Ex is a high-performance, 32-bit, single-chip micro-computer that is software compatible with the Intel 80386 family of microprocessors. DOS compatibility allows development in a familiar environment. The high endurance flash memory eliminates the EPROM programming without worry of damaging the onboard non-volatile memory with repeated program cycles. Applications are uploaded directly into the flash disk.

Software development for the Flashlite is remarkably simple and quick. Programs are written on a PC compatible computer in the language of your choice. After your application has been compiled or assembled and linked into .EXE or .COM form, it is uploaded to the Flashlite's flash disk with your favorite telecommunications program using X-Modem protocol. The application can then be tested and debugged through the console serial port. When the application is running to your satisfaction, the startup batch file can be modified so that the application will load and execute upon reset or powerup.

Features

- 25Mhz Intel 386Ex Processor
- 128k / 512k Bytes RAM Memory
- 512k Bytes Flash Memory, Expandable to 1 Meg
- 2 High Speed PC Compatible Serial Ports
- 1 Serial Port Configurable as RS-232 or RS-485
- 3 PC Compatible Counter/Timers
- 2 Enhanced DMA Channels
- Watchdog Timer and Clock/Calendar
- 36 Digital I/O lines
- High-Efficiency Switching Power Regulator

Operation

The Flashlite is configured with two 'disk drives' A: and B:. Drive A: contains the operating system, the BIOS, and utility programs essential to the operation of the Flashlite 386Ex. Drive A: is read-only. Drive B: is read/write and contains optional utility programs and is available for user files and applications.

The serial port commonly known as COM2: on the PC is the console for the Flashlite. The port is configured for 9600 baud, 8 data bits, 1 stop bit, no parity and uses hardware handshaking. This is the primary mode of communicating with the Flashlite. DOS and the BIOS treat the console port as the logical devices STDIN and STDOUT. The second port is addressed and assigned interrupt vectors the same as COM1: on a PC.

When power is applied to the Flashlite or when it comes out of reset, the board goes through its startup procedure then starts DOS. A simple AUTOEXEC.BAT file is executed and then the board is ready to use. The batch file performs several functions before the user is given control. The DOS search path is set, the DOS prompt is set, and finally, an attempt is made to execute a file named STARTUP on the B: drive. This provides a convenient way for custom applications to execute immediately after initialization of the Flashlite. If you wish to have your application start automatically, create a batch file named STARTUP.BAT that invokes the program. It is possible but not recommended to rename your application STARTUP.EXE or STARTUP.COM. If this is done and the program locks up, typing CNTL-C at bootup may not break the program and exit to the dos prompt.



Although the flash memory devices used have a guaranteed lifetime of over 10,000 write cycles, it is possible for an application to quickly wear them out. The flash memory is intended to store programs and setup data which is normally not changed. Avoid storing data or frequently changed information on the flash disk.

Memory Configuration

The 386Ex processor is initially configured in real mode with a physical address space of 1 megabyte. The following tables show the memory maps of the 128K RAM and 512K RAM Flashlites.

128K RAM Memory Map

Hex Address	Decimal	Function
E0000-FFFFFF	896K-1024K	Flash - U11
C0000-DFFFF	768K-896K	Flash - U11
A0000-BFFFF	640K-768K	Flash - U11
80000-9FFFF	512K-640K	Flash - U11
60000-7FFFF	384K-512K	Unused
40000-5FFFF	256K-384K	Unused
20000-3FFFF	128K-256K	Unused
00000-1FFFF	0-128K	RAM - U16

512K RAM Memory Map

Hex Address	Decimal	Function
E0000-FFFFFF	896K-1024K	Flash - U11
C0000-DFFFF	768K-896K	Flash - U11
A0000-BFFFF	640K-768K	Flash - U11
80000-9FFFF	512K-640K	Flash - U11
60000-7FFFF	384K-512K	RAM - U16
40000-5FFFF	256K-384K	RAM - U16
20000-3FFFF	128K-256K	RAM - U16
00000-1FFFF	0-128K	RAM - U16

A 32-pin DIP socket is provided for additional flash, RAM, or EPROM data. This memory can be accessed by reprogramming the chip select unit in the 386Ex or by entering protected mode.

Future software enhancements may include BIOS support for memory management beyond 1 megabyte.

I/O Configuration

The 386Ex is initially configured for enhanced DOS mode. This mode provides access to the traditional PC/AT peripherals such as UARTS, counter/timers, and the interrupt controller at their usual I/O port addresses. Other 386Ex peripherals are accessible in expanded I/O space.

For addressing and programming the peripherals specific to the 386Ex, please refer to the Intel386Ex Embedded Microprocessor User's Manual. The manual is available in PDF format from our web site at <http://www.jkmicro.com>

Jumper Settings

Jumper JP1 determines the state of port B, bit 2.

PB2 = I/O (default)	PB2 = Ground
JP1 Open	JP1 Shorted

Jumper JP2 determines whether or not VCC is available on the PLC bus

PLC Bus VCC Off (default)	PLC Bus VCC On
JP2 Open	JP2 Shorted

Jumper JP3 selects one of two possible interrupt inputs that can be connected to pin 17. In the default configuration, IRQ 4 is used internally for COM1: and IRQ 6 is made available on the bus.

J13 Pin 17 = IRQ 6 (default)	J13 Pin 17 = IRQ 4
JP3 1-2	JP3 2-3

Jumper JP4 selects one of two possible interrupt inputs that can be connected to pin 15. In the default configuration, IRQ 3 is used internally for COM2: and IRQ 5 is made available on the bus.

J13 Pin 15 = IRQ 5 (default)	J13 Pin 15 = IRQ 3
JP4 1-2	JP4 2-3

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Jumper JP5 determines whether or not V+ is available on the PLC bus

PLC Bus V+ Off (default)	PLC Bus V+ On
JP5 Open	JP5 Shorted

Jumper JP6 determines the function of digital I/O Port B, bit 3. With the jumper removed, this bit is used as a general purpose digital I/O. With the jumper installed, this bit indicates whether or not a power fail condition exists.

PB3 = I/O (default)	PB2 = Powerfail
JP6 Open	JP6 Shorted

The Flashlite 386Ex can boot from either U11, a 32 pin PLCC IC, or U6, an optional 32 pin DIP IC. The default boot chip is U11. By selecting U6 as the boot chip and installing a properly programmed flash or EPROM, field software changes can be easily accomplished.

Boot U11 (default)	Boot U6
JP7 2-3	JP7 1-2
JP8 1-2	JP8 2-3

The optional chip at U6 can be either a static RAM or flash/EPROM depending upon the setting of JP9.

U6 Flash (default)	U6 RAM
JP9 1-2 & 3-4	JP9 2-3 & 4-5

Jumper JP10 selects the power source for the static RAM at location U16. When VCC is selected, the power to the static RAM will come on and off with the applied power to the Flashlite board. When VBAT is selected, the static RAM will be powered by the lithium battery when the board is powered down.

U16 PWR=VCC	U16 PWR=VBAT
JP10 2-3	JP10 1-2

Jumper JP11 selects VCC or VBAT for U6.

U6 PWR=VCC	U6 PWR=VBAT
JP11 1-2	JP11 2-3

Setup and Operation

To begin development with the Flashlite 386Ex, you will need a PC compatible computer with a telecommunications program and a free serial port. Connect the Flashlite's connector J11 to the PC's serial port with a 9-pin ribbon cable, PN 86-0000. Run the telecommunications program and configure the serial port for 9600 baud, 8 data bits, 1 stop bit and no parity. Apply power to the Flashlite, using our A/C adapter PN 88-0002 or a source of DC, 7-37 volts. J4 pin 1 (square pad on bottom of board) is positive.

The Flashlite should respond with a welcome message and a B:\> prompt. Do a DIR command to look at the directory of drive B. If you do not get a welcome message or echo of the characters that you type, you need to check your serial port setup. To test everything but the Flashlite, remove the serial cable from J11 and jumper pins 3 and 5 with a wire or paper clip. If characters typed on the keyboard are not echoed on the screen, the problem is with your setup. You must resolve the problem before you can continue.

If you were able to do a DIR, take a few minutes to explore the contents of the Flashlite's file system. You will find all of the essential utilities on drive A and some optional programs on drive B. Drive A is write-protected and cannot be altered. Drive B is read/write and can be changed or reformatted. Typing the command BASIC BJ will run a simple Tiny Basic blackjack program.

After you have looked at the programs on the Flashlite, the next step is to try a file download. This is the procedure for getting a file from your PC to the Flashlite. On the Flashlite, type the command UP. The program will respond with a prompt for a file name. Enter the file name of the program you wish to download and press Enter. If you don't have a program ready, you can send any small file such as your AUTOEXEC.BAT file. The Flashlite will begin sending a polling character to your PC.

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On your PC, start the download, usually by pressing the PgDn key. The telecomm program should respond by requesting the file name and protocol. Enter the file name and select X-Modem for the protocol. The transfer should start and when it is complete, you should get a new B:\> prompt on the screen. If the transfer does not work, the problem is most likely the Carrier Detect signal (pin 1 on the DB-9 connector) into the PC being sensed as low or false. Make sure that the signal is at least +3 volts into your PC if you are not able to download.

If the download terminated without problems, you have a working development environment for the Flashlite controller. At this point, you may wish to download the files EDIT.COM and BASIC.COM from the Flashlite to your PC. Start the download on the Flashlite by typing DOWN BASIC.COM and pressing Enter. On your PC, begin the transfer, usually by pressing PgDn.

After the file is transferred, repeat the process with EDIT.COM. If you accidentally erase these files, they can be found on our web site.

The Flashlite 386Ex has a battery-backed clock calendar. Time and date can be set with the following commands:

B:\>TIME 13:30:00 Set the time to 1:30 pm

B:\>DATE 2-19-98 Sets the date to Feb. 19, 1998

The console output and input can be disabled on the Flashlite with the QUIET and NOQUIET commands. This is useful for applications where both serial ports must talk to hardware devices without disturbance from console messages. Before we look at the QUIET and NOQUIET commands, an overview of the Flashlite bootup procedure might be helpful.

When power is applied to the Flashlite, one of the first things the Bios initialization code does is check for a CNTL-C character typed at the console. If this character is typed as soon as the board is powered up or reset, a flag is set which overrides the

quiet state of the console. When DOS runs its AUTOEXEC.BAT file on drive A, the state of the CNTL-C flag is also checked and any user application set to run on drive B is not loaded. This insures that a hung application or quiet console can always be interrupted. If the CNTL-C flag is set, the clock/calendar is not read on startup.

Running QUIET.COM will turn off both input and output on the console port, allowing applications to use it as COM2. Pressing CNTL-C immediately after reset or powerup will restore the console until the next reboot. Running NOQUIET.COM will restore the default setting of an active console.

If the CNTL-C flag is not set, the autoexec file will attempt to transfer control to a file named STARTUP on drive B. DOS also looks for and, if present, loads CONFIG.SYS from drive B.

The programs EDIT and BASIC are documented elsewhere in this manual.

Programming the Digital I/O Ports

The Flashlite 386Ex has six I/O ports controlling a total of 36 bits. For the most part, these bits are configurable in groups for either input or output.

Port A, I/O Address 60 Hex

Bit	7	6	5	4	3	2	1	0
Name	PA.7	PA.6	PA.5	PA.4	PA.3	PA.2	PA.1	PA.0
Default	IN	IN	IN	IN	IN	IN	IN	IN
Pin	J2-11	J2-13	J2-15	J2-17	J2-19	J2-21	J2-23	J2-25

Port A is located at I/O address 60 hex and is configured as a group as either inputs or outputs. The default configuration is inputs. To make all bits output, set bit 4 of I/O address 63 hex to a zero, preserving the state of the other bits.

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Port B, I/O Address 61 Hex

Bit	7	6	5	4	3	2	1	0
Name	PB.7	PB.6	PB.5	PB.4	PB.3	PB.2	PB.1	PB.0
Default	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT
Pin	J2-12	J2-14	J2-16	J2-18	J2-20	J2-22	J2-24	J2-26

Port B is located at I/O address 61 hex and is configured as a group of either inputs or outputs. The default configuration is outputs. To make all bits input, set bit 1 of I/O address 63 hex to a one, preserving the state of the other bits.

Note that PB.1 is used to gate the PC speaker output and PB.2 can be used to read the status of JP1. If JP1 is closed, Port B must not be configured as outputs.

Port C, I/O Address 62 Hex

Bit	7	6	5	4	3	2	1	0
Name	PC.7	PC.6	PC.5	PC.4	PC.3	PC.2	PC.1	PC.0
Default	OUT	OUT	OUT	OUT	IN	IN	IN	IN
Pin	J14-5	J14-7	J14-9	J14-11	J14-18	J14-17	J14-20	J14-19

Port C is located at I/O address 62 hex and is configured as 2 groups of 4 bits each. The default configuration for bits PC.0 to PC.3 is inputs. To make these bits outputs, set bit 0 of I/O address 63 hex to a zero.

The default configuration for bits PC.4 to PC.7 is outputs. To make these bits inputs, set bit 3 of I/O address 63 hex to a one. When reconfiguring the I/O status of these pins, be sure to preserve the state of the other bits.

Port D, I/O Address FA02 Hex

Bit	7	6	5	4	3	2	1	0
Name	-	-	-	-	PD.3	PD.2	PD.1	PD.0
Default	-	-	-	-	IN	IN	IN	IN
Pin	-	-	-	-	J7-4	J7-3	J7-2	J7-1

Port D is located at I/O address FA02 hex and is configured as a group as either input or output. The default configuration of Port D is input. To configure Port D as outputs, set bit 0 of I/O address FA00 hex to a one.

Port E, I/O Address FA03 Hex

Bit	7	6	5	4	3	2	1	0
Name	-	-	-	-	PE.3	PE.2	PE.1	PE.0
Default	-	-	-	-	IN	IN	IN	IN
Pin	-	-	-	-	J7-8	J7-7	J7-6	J7-5

Port E is located at I/O address FA03 hex and is configured in three groups. The default configuration is input. To configure PE.0 and PE.1 as output, set bit 1 of I/O address FA00 to a one. To configure PE.2 as an output, set bit 2 of I/O address FA00 to a one. To configure PE.3 as an output, set bit 3 of I/O address FA00 to a one. In each case, be sure to preserve the other bit settings.

Port F, I/O Address F860 and F862 Hex

Bit	7	6	5	4	3	2	1	0
Name	PF.7	PF.6	PF.5	PF.4	-	-	-	-
Default	IN	IN	IN	IN	-	-	-	-
Pin	J12-4	J12-3	J12-2	J12-1	-	-	-	-

The data on Port F can be read by inputting I/O address F860 hex. The default configuration is input. Each bit of Port F can be individually configured for input or output. To configure a bit for output, write a zero in that bit position to I/O address F864 hex. To output data on Port F, write the data to address F862 hex.

RS-485 Configuration

The COM2 port of the Flashlite can be configured and used for RS-485 communications. In order to avoid conflicts with DOS and the Bios, it is first necessary to move the console to COM1. This can be done by running the utility program CON2COM1. Please note that COM1 (J6) is pinned out as DTE and you must use a null modem to connect it to a PC serial port

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To enable RS-485 operation and disable RS-232 on COM2, clear bit 6 of I/O port F872 hex. To transmit RS-485 data, set bit 1 of I/O port F826 hex. To receive data, clear the bit. In both cases, be sure to preserve the other bit settings of these two ports.

Two utility programs are available to aid RS-485 development. 485RX accepts RS-485 data and displays it on the console. 485TX accepts console data and puts it out the RS-485 port. These programs are available on our utilities disk and web site.

Watchdog Timer

The Watchdog Timer is a feature of the 386Ex processor chip. Please refer to the Intel386EX Embedded Microprocessor User's Manual for programming information.

Supported Bios Functions

Int 10h, Video Driver, functions 9 and Eh

Int 11h, Get Equipment Configuration

Int 12h, Get Memory Size

Int 13h, Disk Driver, Functions 0-4

Int 14h, Serial Port Driver, Functions 0-3

Int 16h, Keyboard Driver, Functions 0 and 1

Int 19h, Boot System

Int 1Ah, Real Time Clock Driver, Functions 0-5

Int 1Ch, Hook Timer Tick Interrupt

IRQ0, Timer Tick Interrupt

DOS

The Flashlite uses XDOS, compact operating system for embedded applications. The XDOS command structure is nearly identical to MS/PC DOS version 3.3. The switches for the dir command have been changed and expanded. XDOS does not support redirected input or output with the use of < and >, but does support pipes (|). None of the external DOS commands are available due to size constraints. XDOS does not support installable file system functions.

DOS Command Reference

In the list below, XDOS commands are followed by a **function** description and their **format** including available **parameters** and **switches**. Items in **boldface** type must be entered. Captials or lowercase letters may be used. Items in *italics* are parameters. Those in **boldface italics** must be entered, those in [] are optional. All switches are optional. They are shown as [/X]. Spaces and punctuation are to be included. An ellipsis ... following items means that you may repeat the items as often as needed. Do not enter the ellipsis or the square brackets. Most XDOS commands allow the use of **wildcards** in filenames and extensions. When wildcards (?=one character, *=any character or characters) are used, the command is executed once for each matching file.

Common parameters are:

- [d:] drive specification - a letter followed by a colon (:), e.g. A:, if no drive is specified, the default drive is used.
- [*path*] the path DOS must take in traveling from one directory to another; directory names are separated by a backslash (\).
- [*filename*] up to eight characters used to name a file.
- [*.ext*] a three character extension may be added to a filename; an extension is separated from a filename by a period

CD / CHDIR

Function: Changes the current directory

Format: **CD** or **CHDIR** [[d:]path]

COPY

Function: Copies a file, combines two or more files into one file, or transfers data between files and DOS devices

Format: **COPY** [d:][path]filename[.ext][switches]
[+[d:][path]filename[.ext][switches]
[d:][path][filename[.ext]][switches]

Switches: /V - verify the contents of new file
/A - copy file in ASCII format
/B - copy file in binary format

DATE

Function: Displays or changes the current DOS date.

Format: **DATE** [mm-dd-yy]

DEL / ERASE

Function: Deletes (erases) one or more files from a disk

Format: **DEL** or **ERASE** [d:][path][filename[.ext]]

DIR

Function: Lists directory entries

Format: **DIR** [d:][path][filename[.ext]][switches]

Switches: /a - display file attributes
/b - sort by file size (in bytes)
/d - sort entries by date and time
/f - display entries by alphabetic file name order
/n - display entries in directory order (do not sort)
/s - include system and hidden files in output
/h - display this Help screen (any invalid key)

MD / MKDIR

Function: Creates a subdirectory

Format: **MD** or **MKDIR** [d:]path

PATH

Function: Specifies directories that DOS is to search when trying to locate executable files

Format: **PATH** [[*d:*]path[;[*d:*]path ...]]

PROMPT

Function: Sets the DOS system prompt

Format: **PROMPT** [*text*]

Text: **Resulting Character(s):**

\$t The current time stored by DOS

\$d The current date stored by DOS

\$p The current directory

\$v The version of DOS being used

\$n The default drive

\$g The character >

\$l The character <

\$b The character |

\$q The character =

\$\$ The character \$

\$_ Carriage return plus line feed

REN

Function: Renames a file

Format: **REN** [*d:*][*path*]**filename**[.ext] **filename**[.ext]

RD / RMDIR

Function: Deletes a subdirectory

Format: **RD** or **RMDIR** [*d:*]**path**

TIME

Function: Displays or changes the current DOS time

Format: **TIME** [*hh:mm:ss.xx*]

TYPE

Function: Display the contents of a file

Format: [*d:*][*path*]**filename**[.ext]

VER

Function: Displays the DOS version number

Format: **VER**

VOL

Function: Displays the volume label of specified drive

Format: **VOL** [*d:*]

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Utilities

The Flashlite comes preloaded with several utilities to aid system development. These utilities are located on the A: drive of the Flashlite.

UP.COM

This utility facilitates uploading files to the Flashlite via the console port using the X-MODEM transfer protocol. The utility requires the user to supply the name of the incoming file. Unless otherwise specified, the file is placed in the active directory of the current drive. Be sure that B: is the current drive or a write-protect error will occur when UP tries to write to the read-only A: drive.

```
B:\>up V-25 File Upload Program Version 1.1
```

```
Enter filename then upload file with X-Modem protocol ...  
Press Cntl-A then Enter to Abort...
```

```
> test.exe
```

FORMAT.COM

If it becomes necessary to reformat the B: drive, FORMAT provides this function. CAUTION, all information on the drive will be lost during the formatting process.

```
B:\>format
```

```
Flashlite FLASH Drive Format Program -Version 3.0  
System will reboot after successful format...
```

```
Press 1 to initialize Drive B as 418 KB disk  
Press ESC to exit with no changes
```

```
>1
```

```
Flash Drive is now formatted
```

```
Rebooting system...
```

EDIT.COM

A simple line editor is included to allow quick creation and modification of batch files or other text files. EDIT is similar to

Microsoft's EDLIN provided in earlier versions of MS-DOS. It allows list, insert, delete, and modify. Upon exit, a backup of the original file is created (filename.BAK) and the edits are saved. If a backup file with the same name already exists, it is overwritten. A list of commands and their usage is available by entering 'h' at the edit prompt (>>). The name of the file to edit must be supplied following the command EDIT on the command line.

```
B:\>edit test.bat
Flashlite Line Editor v1.0
Enter h for help

New File: test.bat
>> i
0: @echo Batch file being processed...
   1: mytsr
   2: myapp
   3: ^Z
>> l
0: @echo Batch file being processed...
   1: mytsr ->
   2: myapp
>> q
Save before exit (Y,n): y
File Saved
```

BASIC.COM

MICRO-BASIC is a compact, full featured, BASIC language interpreter that allows immediate development and testing of small programs on the Flashlite. Most of the examples in this document written in BASIC will run in MICRO-BASIC. Due to its size, the list of supported commands and functions is smaller than some other common BASIC languages, but it does provide some functions only found in large development packages. MICRO-BASIC supports a limited number of variables and arrays and only character/string and integer data types. MICRO-BASIC was written and is provided free of charge courtesy of Dave Dunfield of Dunfield Development Systems. Dunfield Development Systems provides a complete line of quality microprocessor development tools. See the Contact Information section for more details.

QuickBASIC Console I/O

Some of the code produced by Microsoft QuickBASIC and QuickBASIC Professional compilers does not execute properly on the Flashlite. In the case of console I/O, we believe that QuickBASIC is generating code for specific hardware and software not present on the Flashlite controller.

There are two problems with console I/O. The first is that a PRINT statement will not send output to the console port. To output text to the console, open "cons:" as a file and print to it. The second problem is that an INPUT statement will not echo the data entered by the user. To work around this problem, we have added a feature which allows the application to enable a console echo function in the BIOS. This feature is enabled by setting the byte at 40:8Ah to a one. Likewise, the local echo is disabled by setting 40:8Ah to a zero.

The following BASIC code demonstrates both of these workarounds:

```
start:
    OPEN "o", 1, "cons:"           \ console output
    PRINT #1, "What's your name? " \ get string
    GOSUB echoOn                  \ turn on local echo
    INPUT name$                   \ get the name
    GOSUB echoOff                 \ turn off local echo
    PRINT #1, ""                  \ go down a line
    PRINT #1, "Hi , "; name$      \ print line and name
    END

echoOn:
    DEF SEG = &H40                 \ BIOS data seg
    POKE &H8A, 1                  \ set local echo flag
    RETURN

echoOff:
    DEF SEG = &H40                 \ BIOS data seg
    POKE &H8A, 0                  \ clear echo flag
    RETURN
```

Connector Pinouts

J2 Port (A and B)

GND	1	2	VCC
GND	3	4	VCC
GND	5	6	STXCLK/
GND	7	8	SRXCLK/
SSIORX/	9	10	SSIOTX/
PA.7	11	12	PB.7
PA.6	13	14	PB.6
PA.5	15	16	PB.5
PA.4	17	18	PB.4
PA.3	19	20	PB.3
PA.2	21	22	PB.2
PA.1	23	24	PB.1
PA.0	25	26	PB.0

J14 PLC (or Port C)

GND	1	2	V+
N/C	3	4	DC IN
PC.7 (STB/)	5	6	GND
PC.6 (A3)	7	8	GND
PC.5 (A2)	9	10	GND
PC.4 (A1)	11	12	GND
N/C	13	14	N/C
N/C	15	16	N/C
PC.2 (D2)	17	18	PC.3 (D3)
PC.0 (D0)	19	20	PC.1 (D1)
N/C	21	22	N/C
N/C	23	24	N/C
V+	25	26	GND

J6 COM1:

IN DCD	1	2	IN DSR
IN RXD	3	4	OUT RTS
OUT TXD	5	6	IN CTS
OUT DTR	7	8	N/C
GND	9	10	N/C

J11 Console (or COM2:)

PULLUP	1	2	N/C
OUT TXD	3	4	PULLUP
IN RXD	5	6	PULLUP
N/C	7	8	PULLUP
GND	9	10	N/C

J13 Extended Bus

GND	1	2	IRQ8
LBA/	3	4	D15
BS8/	5	6	D14
IO/	7	8	D13
W-R/	9	10	D12
D-C/	11	12	D11
ADS/	13	14	D10
IRQ3	15	16	D9
IRQ4	17	18	D8
A24	19	20	A23
A22	21	22	A21
A20	23	24	A19
VCLK	25	26	GND

J10 LPT (Host Parallel Port)

STROBE/	1	2	AUTO/
D7	3	4	ERROR/
D6	5	6	N/C
D5	7	8	SLCT IN/
D4	9	10	GND
D3	11	12	GND
D2	13	14	GND
D1	15	16	GND
D0	17	18	GND
ACK/	19	20	GND
BUSY/	21	22	GND
PE/	23	24	GND
SLCT	25	26	GND

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J9 Processor Bus

GND	1	2	VCC
GND	3	4	VCC
MREQ/	5	6	D7
MSTB/	7	8	D6
IOSTB/	9	10	D5
RW/	11	12	D4
REFRQ/	13	14	D3
RESET/	15	16	D2
IORD/	17	18	D1
IOWR/	19	20	D0
A9	21	22	A19
A8	23	24	A18
A7	25	26	A17
A6	27	28	A16
A5	29	30	A15
A4	31	32	A14
A3	33	34	A13
A2	35	36	A12
A1	37	38	A11
A0	39	40	A10

J3 Speaker

1	SPEAKER
2	AUX
3	GND
4	VCC

J12 Port F

1	PF.4
2	PF.5
3	PF.6
4	PF.7
5	GND

J5 RS-485

1	DATA+
2	GND
3	DATA-

J4 Power

1	7-34 VDC
2	GND

J7 Ports D and E

PD.0	1	2	PD.1
PD.2	3	4	PD.3
PE.0	5	6	PE.1
PE.2	7	8	PE.3
GND	9	10	GND

J1 Power

1	7-34 VDC
2	RESET/
3	GND

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Notes