

The Ethernet/Serial/Parallel expansion board combines a highly integrated, full function, IEEE 802.3 Ethernet controller with 16C550 high speed UARTs (with FIFO) and a bi-directional parallel port for users requiring local area network connectivity or additional peripherals. PC compatible serial and parallel ports provide additional I/O necessary for many demanding applications. The Ethernet port is a 16 bit design that supports direct connection to a 10BASE-T network, jumperless configuration, internal receive and transmit frame buffers, and other features that reduce CPU overhead and maximize throughput. These features added to the Flashlite386Ex or LogicFlex yield a quick and cost effective solution for applications such as networking, embedded web and serial protocol conversion.

## Features:

### Ethernet:

- IEEE 802.3 Ethernet
- 10 MB/sec 10BASE-T
- RJ-45 Connector
- 16 bit interface
- Full duplex operation
- Automatic polarity detection/correction
- Packet driver included
- NE2000 Compatible

### Serial ports:

- COM3 – wired as DTE (computer)
- COM4 – wired as DCE (peripheral)
- RS-232 signal levels
- 16C550 High Speed UART
- 16 Byte FIFO for each port
- Configurable Interrupts (3,4,5,6)
- 115kB maximum speed

### Parallel port:

- Bi-directional
- DOS compatible as LPT1

### System requirements:

- Flashlite386Ex SBC, BIOS version 3.2 or greater
- 40-pin bus cable
- 26-pin bus cable
- 10pin dual row to DB9F cable
- 26pin dual row to DB25F cable
- Stacking standoffs

## Configuration:

The only configuration required is the setup of interrupts. To configure the serial port install jumpers on JP1 as outlined below. Jumpers JP10 and JP11 on the Flashlite 386Ex need to be verified as well. The serial ports can be used without interrupt connections. The Ethernet controller is configured in software. The device defaults to IRQ9. Short JP4 1,2 for IRQ5 or JP3 1,2 for IRQ6. When configuring the COM ports, you must first select between IRQ 3/5 and IRQ 4/6, then select which COM port gets which IRQ. It is not possible to use IRQ 3 and 5 or IRQ 4 and 6 simultaneously. The Ethernet controller requires an interrupt to function and cannot share an interrupt with the serial port or other peripherals.

	Expansion Card JP1	Flashlite JP10	Flashlite JP11
COM3, IRQ3	Short 1,3	N/A	2,3
COM3, IRQ4	Short 3,5	2,3	N/A
COM3, IRQ5	Short 1,3	N/A	1,2
COM3, IRQ6	Short 3,5	1,2	N/A
COM3, IRQ Disabled	1, 3, 5 Open		
COM4, IRQ3	Short 4,6	N/A	2,3
COM4, IRQ4	Short 2,4	2,3	N/A
COM4, IRQ5	Short 4,6	N/A	1,2
COM4, IRQ6	Short 2,4	1,2	N/A
COM4, IRQ Disabled	2, 4, 6 Open		

Table 1: Jumper Configuration

## Installation:

A 40-pin bus cable and a 26-pin bus cable are required to connect the expansion card to the Flashlite386 computer. If a card with only the serial/parallel ports is to be installed and interrupts are not used for the serial ports, the 26-pin cable is not required. Connect J1 on the Flashlite386 to J1 on the expansion card and J13 on the Flashlite386 to J2 on the expansion card observing proper polarization of the cable. Mount the expansion card to the Flashlite386 using 7/8" stackable standoffs. Connect the serial, parallel, and Ethernet cables as required.

## Cables:

COM3 is configured as a DTE port, generally used to communicate with peripheral devices. This port is electrically identical to COM1 on the Flashlite386 board. COM4 is configured as a DCE port, generally being used to connect the Flashlite386 to another computer. This port is electrically identical to COM2 on the Flashlite386 board. A 10pin dual row header to 9pin D-type connector may be required to connect the expansion card to a peripheral or computer. See the table 2a and 2b for connector pinouts.

LPT1 is configured for connection to a printer. This port can also be used for bi-directional I/O if desired. A cable connecting the 26pin dual row header to a 25pin D-type female connector may be required. See the table 2c for connector pinouts.

The Ethernet port will connect directly to a 10BASE-T network via the RJ45 jack. See the table 2d for connector pinouts.

The following tables show the signal name (direction) for each pin. N/C indicates no connection and PULLUP indicates a 1kΩ pullup resistor. Specified signal directions for the parallel port are for power on default and do not reflect any changes made by user software.

J5		COM3:	
DCD (in)	1	2	DSR (in)
RxD (in)	3	4	RTS (out)
TxD (out)	5	6	CTS (in)
DTR (out)	7	8	N/C
GND	9	10	N/C

Table 2a: COM3 Pinout

J4		COM4:	
PULLUP	1	2	N/C
TxD (out)	3	4	PULLUP
RxD (in)	5	6	PULLUP
N/C	7	8	PULLUP
GND	9	10	N/C

Table 2b: COM4 Pinout

J6		LPT1:	
Strobe (out)	1	2	Auto Feed (out)
D0 (out)	3	4	Error (in)
D1 (out)	5	6	Initialize (out)
D2 (out)	7	8	Select (out)
D3 (out)	9	10	GND
D4 (out)	11	12	GND
D5 (out)	13	14	GND
D6 (out)	15	16	GND
D7 (out)	17	18	GND
Acknowledge (in)	19	20	GND
Busy (in)	21	22	GND
Paper Empty (in)	23	24	GND
Selected (in)	25	26	GND

Table 2c: LPT1 Pinout

J3		Ethernet
Pair 1	4,5	N/C
Pair 2	1,2	Tx Data
Pair 3	3,6	Rx Data
Pair 4	7,8	N/C

Table 2d: Ethernet Pinout



Pin numbering on RJ45 cable plug

NOTE: Outputs refer to signals driven by the board and received by a peripheral. Inputs are driven by a peripheral and received by the board.

## Software:

The serial and parallel ports are PC compatible. BIOS support is provided for LPT1. The COM3 base address is 3E8h and COM4 is at 2E8h. The parallel port address is 378h. Refer to Tables 3 and 4 for basic serial/parallel register definitions and the TL16C552 data sheet for complete information regarding register definitions, programming the on-chip the FIFOs, and the bi-directional capabilities of the parallel port. NOTE: When using interrupts, bit 3 of the Modem Control Register must be high in order for UART interrupts (configured in the Interrupt Enable Register) to generate hardware interrupts.

	7	6	5	4	3	2	1	0
Base	Receive/Transmit Holding Register / Divisor Latch Low (DATA)							
	Data In, Data Out							
Base+1	Interrupt Enable Register (IER)							
	0	0	0	0	Modem Status	Receive Line Status	Transmit Buffer Empty	Receive Buffer Full
Base+2	Interrupt Identification Register / Divisor Latch High (IIR)							
	Reserved	Reserved	Reserved	Reserved	Reserved	Interrupt Source 00=Modem Status 01=Transmit Buffer Empty 10=Receive Buffer Full 11=Receiver Line Status		Interrupt Pending (0=Pending)
Base+3	Line Control Register (LCR)							
	Divisor Latch Access	Send Break	Parity 000=None, 001= Odd, 011=Even, 101=Mark, 111=Space			Stop Bits, 0=1, 1=2	Word Length, 00=5, 01=6, 10=7, 11=8	
Base+4	Modem Control Register (MCR)							
	0	0	0	Loop Back Test	Ext. Int. Enable	Out1	RTS	DTR
Base+5	Line Status Register (LSR)							
	Reserved	Transmit Register Empty	Transmit Buffer Empty	Break Interrupt	Framing Error	Parity Error	Overrun Error	Receive Buffer Full
Base+6	Modem Status Register (MSR)							
	DCD	RI	DSR	CTS	$\Delta$ DCD	$\Delta$ RI	$\Delta$ DSR	$\Delta$ CTS

Table 3: UART Registers

	7	6	5	4	3	2	1	0
Base	Data Register (read/write)							
	Data In, Data Out							
Base+1	Status Register (read only)							
	Busy/	ACK/	Paper Empty	Selected	Error/	Print/	Reserved (1)	Reserved (1)
Base+2	Control Register (read/write)							
	Reserved (0)	Reserved (0)	Direction 0=Output	Interrupt Enable	Select (output)	INIT/	Auto Feed	Strobe

Table 4: Parallel Port Registers

The Ethernet controller requires a software driver (included) to interface with network software or other programs. The supplied packet driver configures the chip interrupt, base address and other necessary parameters. The packet driver is called NE2000.COM. Upload the required file to the Flashlite386 after installing the expansion board.

To install the packet driver, type: `B:\> NE2000 0x60`

The 0x60 is the software interrupt that programs will use to communicate with the driver. The number could be different, but 60h is common. The driver will install using the default interrupt (IRQ9) and I/O base address (300h) and will use the onboard MAC (Media Access Control) number.

When the driver has loaded, it will indicate the media type (twisted pair), the system type, software interrupt, port address and MAC number. The controller and driver perform several checks on the network media at startup in order to determine the optimum configuration. After the driver has been installed, network software will be able to communicate with the Ethernet adapter and the network.

Users of previous revision Ethernet boards may want to upload the file FLASHPKT.BAT in order to maintain software compatibility. The FLASHPKT batch file simply invokes the NE2000 packet driver, passing along any command line arguments. Both the NE2000 driver and the FLASHPKT batch file generally reside in the B:\BIN directory.

Users will probably want to modify their STARTUP.BAT file to load the packet driver when the board is powered up.

## Applications:

Programming for the serial and parallel ports is the same as for a PC. Some care must be taken to configure the interrupts as described previously. The only departure from compatibility with standard PC/AT UART is the interrupt enable bit located in the MCR. These bits are set in the BIOS, but users must be sure they remain set if serial interrupts are used. FIFO features are not supported in the PC/AT UART. Example programs are available.

Some care is required when setting up the Flashlite386 on a network. Contact the Network Administrator if there are any questions about the required information. When working with a TCP/IP network, obtain the following information before starting your configuration: IP Address, Subnet mask, Name Server Address (DNS), and Gateway address. This information will be required during the configuration process. Other types of LANs require node names, workgroup names, etc. Proceed cautiously, networks can be easily disrupted when nodes are added without careful configuration.

The RJ-45 connector is configured to connect directly to a network hub with a straight through patch cord. For connection to a PC (without a hub), a crossover cable is required. This cable swaps the Tx and Rx pairs and is wired 1-3, 2-6, 3-1, 6-2. See Table 2d for plug pin numbering information.

Revision	Date	Author	Changes
C	28 JUL 03	EW	Fix Jumper references for Flashlite (was JP3,J4)
B	11 OCT 01	EW	Remove COM4/5 stuff, see 94-0021A
A	Feb 00	EW	First Issue - Realtek ethernet