The Serial/Parallel/AD expansion board adds one or two 16C550 high speed UARTs (with FIFO) and a bidirectional parallel port to the LogicFlex SBC. This board also has a socket to accept an analog to digital converter. A-D functions are provided by the Maxim MAX197, a 12-bit, 8 channel data acquisition chip. PC compatible serial and parallel ports added to the LogicFlex provide additional I/O necessary for many demanding applications. This manual covers both the 2 port and 4 port boards. These boards are functionally equivilant except additional components are installed on the 4 port board.

Features:

Serial ports:

COM3 – 7 wire DTE (computer) port	RS-232 signal levels
COM4 – 2 wire DCE (peripheral) port	16C550 High Speed UART
COM5 – 8 wire DTE (computer) port	16 Byte FIFO for each port
COM6 – 8 wire DTE (computer) port	115kB maximum speed

Parallel port:

Bi-directional
DOS compatible as LPT1

Analog Inputs (optional):

12-bit Resolution	Software Selectable Input Range (0-5, ±5, 0-10, ± 10)
8 Channels	Internal Voltage Reference
6 µS Acquisiton Time	

System requirements:

LogicFlex SBC	26pin dual row to DB25F cable
40-pin bus cable	Stacking standoffs
10pin dual row to DB9F cable	

Configuration:

The only configuration required is the setup of interrupts. COM3 and 4 can use either IRQ5 or 6. A unique IRQ must be assigned to each port, they cannot share one IRQ. To configure COM3 for IRQ5 and COM4 for IRQ6, install jumpers on JP1 to short pins 1-3 and 2-4. Move the jumpers to short pins 3-5 and 4-6 if IRQ6 is required for COM3 and IRQ5 for COM4. The ports can be used without interrupt connections, if desired. The IRQs for COM5 and COM6 are fixed: COM5 uses IRQ14 and COM6 uses IRQ7. The base addresses of the serial ports are fixed. See Table 1.

	Base Address	IRQ
COM3	0x3E8	5 or 6
COM4	0x2E8	6 or 5
COM5	0x368	14
COM6	0x268	7
LPT1	0x378	NA
A/D	0x278	NA

Table1: Port Addresses and IRQs

Installation:

A 40-pin bus cable is required to connect the expansion card to the LogicFlex computer. Connect J1 on the LogicFlex to J1 on the expansion card observing proper polarization of the cable. Mount the expansion card to the LogicFlex using 7/8" stackable standoffs. Connect the serial, parallel, and analog signal cables as required.

If analog inputs are required, install the MAX197 chip in the 28 pin socket at U8. Pin 1 of the A/D is oriented toward the right side of the PCB, AWAY from the bus connector. Be sure that all of the chip pins install in the socket and are not bent.

Cables:

COM3, COM5 and COM6 are configured as DTE ports, generally used to communicate with peripheral devices. COM3 implements 7 data and control signals and is electrically identical to COM1 on the LogicFlex board. COM5 and COM6 implement all 8 RS-232 data and control signals. COM4 is configured as a DCE port, generally being used to connect the

LogicFlex to another computer. This port is a 3 wire port, electrically identical to COM2 on the LogicFlex 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 Tables 2a, 2b, and 2d for connector pinouts.

LPT1 is configured for connection to a printer. This port can also be used for bidirectional 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 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.

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.

J2			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

J3			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

J4			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

J5,6			COM5,6
DCD (in)	1	2	DSR (in)
RxD (in)	3	4	RTS (out)
TxD (out)	5	6	CTS (in)
DTR (out)	7	8	RI (in)
GND	9	10	N/C

Table 2d: COM5,6 Pinout

J7	Analog Inputs
1	Analog 0
2	Analog 1
3	Analog 2
4	Analog 3
5	Analog 4
6	Analog 5
7	Analog 6
8	Analog 7
9	GND
10	+5 V
11	GND
12	GND

Table 2e: Analog Pinout

Software:

The serial and parallel ports are PC compatible. BIOS support is provided for LPT1. Refer to Table 1 for the COM port base addresses. 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 bidirectional 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	Δ DCD	Δ RI	Δ DSR	Δ 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 A/D is accessed through I/O port 0x278. Commands are written to this address and the conversion result is read from this address. The command byte controls the multiplexer address and input range as well as clock and power-down functions. Data is read out as a 16 bit word. Software will write the command, wait at least 6µS and then read the conversion result. See table 5 below, the MAX197 datasheet, and the example programs on the LogicFlex development CD or JKmicrosystems website for programming information.

	7	6	5	4	3	2	1	0
Base	Command Register (write only)							
	PD1	PD0	ACQMOD	RNG	BIP	A2	A1	A0
	SET TO ZERO (0)	SET TO ONE (1)	SET TO ZERO (0)	0 = 5V 1 = 10V	0 = Unipolar 1 = Bipolar	000 = Channel 0 001 = Channel 1 010 = Channel 2 011 = Channel 3 100 = Channel 4 101 = Channel 5 110 = Channel 6 111 = Channel 7		
Base	Data Register (read only)							
	Conversion Result, Low Byte							
Base+1	Data Register (read only)							
	MSB (BIP=1) 0 (BIP=0)	MSB (BIP=1) 0 (BIP=0)	MSB (BIP=1) 0 (BIP=0)	MSB (BIP=1) 0 (BIP=0)	Conversion Result, High Nibble			

Table 5: A/D Registers

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. Example programs are available.

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 Revision        Date           Author         Changes
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 B               14 MAR 03      EW             Add 4 port board documentation, A/D option information
 A               22 Oct 01      EW             First Issue - From 94-0010
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