

EX2 USER'S GUIDE

Form 412-001009 – October, 2000

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Description

The EX2 daughter card is an expansion card for the LC4. The EX2 provides two, independent, full-duplex serial communications ports and a 24-line bidirectional parallel port. The parallel port provides a direct interface to 4-, 8-, 16-, and 24-point I/O module mounting racks. One communication port can be RS-232 with full handshaking or a multidrop compatible RS-422/485 port. The second port is RS-422/485 compatible only.

Dimensions

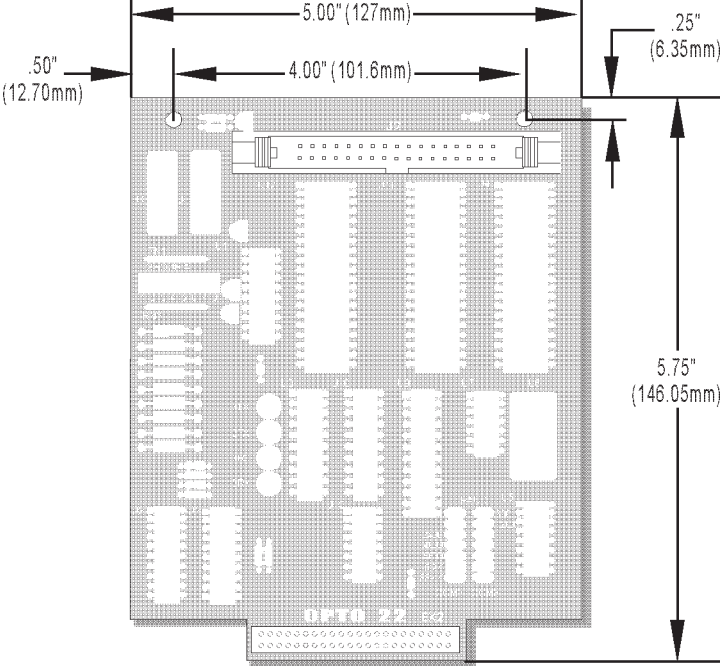


Figure 1: EX2 Card Dimensions

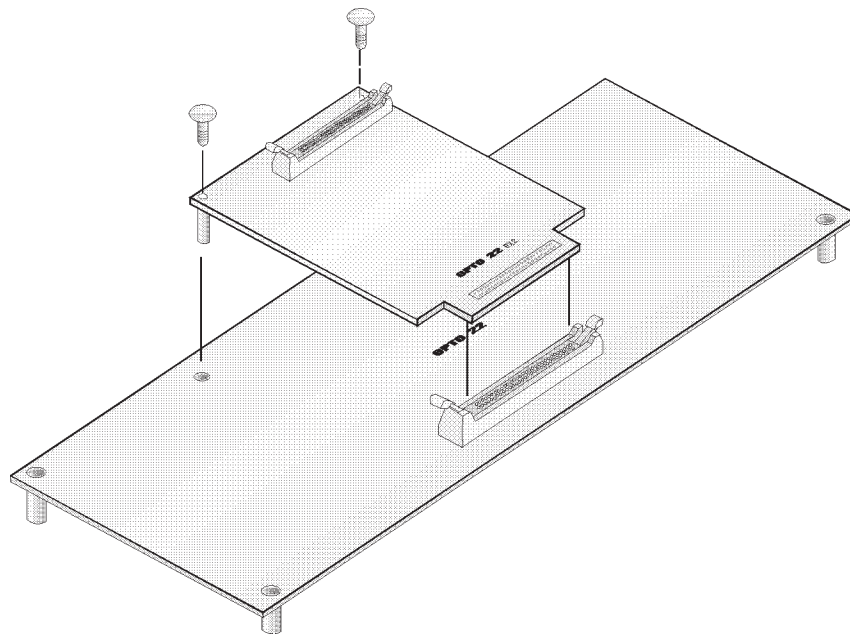


Figure 2: EX2 Mounting

Serial Ports

The communications ports use a Z80 Dual Asynchronous Receiver Transmitter (DART) device which is directly accessible from LC4 BASIC and FORTH. The DART registers reside at I/O locations 70 to 73 hex. Baud rates for each serial port are selectable via jumpers labeled "BAUD". The serial ports are labeled as COM 2 for the combination RS-232/RS422/485 port and COM 3 for the RS/485 port. The RS-422/485 lines of both ports are accessible from the female 9-pin D-shell connector labeled J3. The RS-232 lines are accessible from the male 9-pin D-shell connector labeled J4.

LED indicators are provided for the transmit and receive lines of both serial ports. The RS-232 lines are wired-OR with the RS-422/485 lines on the COM 2 port so that two different devices can be permanently connected together. However it is important to note that only one device can access the port at any one time or characters will be erroneous.

A jumper block labeled "Group A" provides termination and bias resistor connections for both RS-422/485 ports.

RS-232 Connection Pin Descriptions

Pin	Description
1	No Correction
2	Transmit (TX)
3	Receive (RX)
4	Request-to-Send (RTS)
5	Clear-to-Send (CTS)
6	No Connection
7	Ground (GND)
8	No Connection
9	Data Terminal Ready (DTR)

RS-422/485 Connection Pin Descriptions

Pin	Description
1	COM 2 Transmit + (2TX+)
2	COM 2 Transmit - (2TX-)
3	Ground (GND)
4	COM 3 Transmit + (3TX+)
5	COM 3 Transmit - (3TX-)
6	COM 2 Receive + (2RX+)
7	COM 2 Receive - (2RX-)
8	COM 3 Receive + (3RX+)
9	COM 3 Receive - (3RX-)

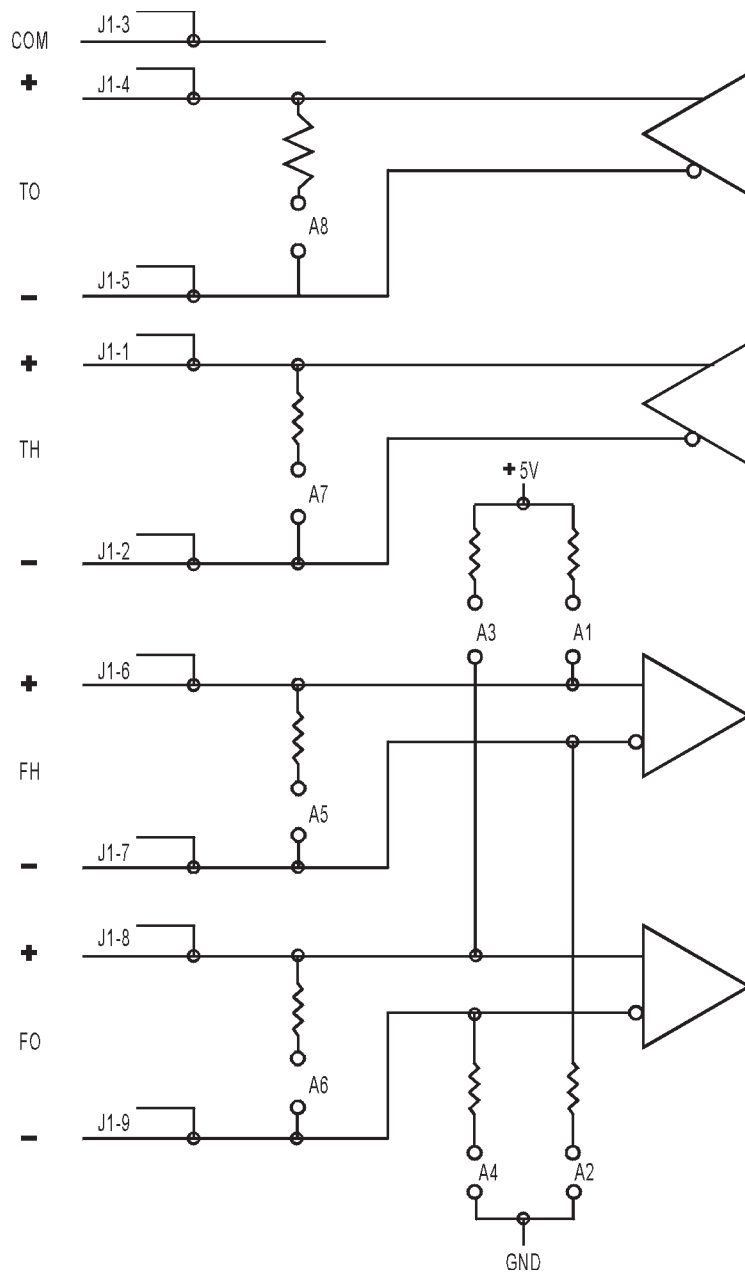


Figure 3: Group A Communications Jumpers

Parallel Port

The parallel interface consists of two 6821 Peripheral Interface Adapter (PIA) chips which provide a total of 24 lines of unbuffered bidirectional I/O lines. The registers of the PIA for the lower 16 lines resides at I/O locations 80 to 83 hex. The registers of the PIA for the upper 8 I/O lines (port A of 6821) resides at I/O locations 88 to 8B hex. The second PIA's port B is not connected. The parallel lines are accessed via connector J2 on the EX2 daughter card. Ports CA and CB on both PIA's are unused.

Pin	Description
J2-1	PIA2-A7
J2-3	PIA2-A6
J2-5	PIA2-A5
J2-7	PIA2-A4
J2-9	PIA2-A3
J2-11	PIA2-A2
J2-13	PIA2-A1
J2-15	PIA2-A0
J2-17	PIA1-B7
J2-19	PIA1-B6
J2-21	PIA1-B5
J2-23	PIA1-B4
J2-25	PIA1-B3
J2-27	PIA1-B2
J2-29	PIA1-B1
J2-31	PIA1-B0
J2-33	PIA1-A7
J2-35	PIA1-A6
J2-37	PIA1-A5
J2-39	PIA1-A4
J2-41	PIA1-A3
J2-43	PIA1-A2
J2-45	PIA1-A1
J2-47	PIA1-A0

NOTES: PIA1 is at I/O address 80–83 hex.
PIA2 is at I/O address 88–8B hex.
All even numbered pins on J2 are connected to ground.

Programming

There are 8 I/O locations used by both PIA devices. These locations are shown in the following table:

Address	Register	I/O Lines
80 hex	Data Reg. A	J2-47 to J2-33
81 hex	Control Reg. A	
82 hex	Data Reg. B	J2-31 to J2-17
83 hex	Control Reg. B	
88 hex	Data Reg. A	J2-15 to J2-1
89 hex	Control Reg. A	
8A hex	Unused	
8B hex	Unused	

Programming the PIA devices requires that the devices first be initialized. Each I/O line is configurable as an input line or an output line and therefore a configuration byte must be written to each port. The following steps show the sequence of operations for initializing a port.

1. Write a 0 to the corresponding control register.
2. Write the configuration byte to the data register. (Setting a bit to 1 sets the corresponding I/O line to an output. Setting a bit to 0 sets that I/O line to an input).
3. Write a hex 34 to the control register.

Example:

The following BASIC example initializes the I/O lines at J2-47, J2-45 as outputs and lines J2-43 through J2-33 as inputs. Remember, the PIA devices are I/O mapped and require the use of the OUT and INP () statements in BASIC, (or the P! and P@ words in FORTH).

```
100 OUT &h81,0           'set control reg. A
110 OUT &h80,3           'first two bits = 1, rest = 0
120 OUT &h81,&h34       'reset control reg. A
```

After initialization, data can be read or written by accessing that port's data register. The following example reads the status of the input lines J2-47 through J2-33.

```
200 STATUS% = INP(&h80) AND &h03 'read and mask off first two bits
```

The following example shows how to activate I/O lines J2-47 and J2-45 and leave all others off.

```
300 OUT &h80,&hFC       'Turn on first two bits
```

Serial Ports

The two serial ports on the EX2 daughter card can be accessed using the BASIC statements, OPEN, ON COM..., PRINT #, and INPUT #.

