DIOPLUS–LINK

Digital I/O Interface plus Analog Input

HCS DIO-PLUS LINK
1 manual with link caution sticker
1 fd unshielded
1 ribbon cable
small parts bag
1 label

- no disk
- no insert

Rev. 1.0

***** CAUTION *****

PLEASE READ THE ENTIRE MANUAL ** BEFORE ** ATTEMPTING ASSEMBLY !!
derstand the significance of each component and jumper setting
BEFORE ' assembly and applying power. CHECK AND RECHECK !
'AILURE TO DO SO WILL PUT YOUR WARRANTY AT RISK "

***** NOTICE *****

It is very important to understand the
function of R15 ** BEFORE ** you install it.
Please read the entire manual
before using the board.

CIRCUIT CELLAR INC.

4 Park Street ● Vernon, CT 06066

TECHNICAL MANUAL

DIOPLUS-LINK

Digital I/O Interface plus Analog Input

Technical Manual

Release 1.0
5/10/93

Circuit Cellar Inc.
4 Park St.
Vernon, CT 06066

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Microcontroller Revolution

'Expandable,' the catch phrase of the 80's, is taking on new meaning in the 90's. The ability to add functions to a small microcontroller through an expansion bus has been a hot selling 'feature' for many companies. Today's cost-conscious product developer may not be willing to pay for that flexibility. Their product is well defined and must be minimal in cost. Expansion capabilities require additional parts, real estate, and power that is wasted in many cases where expansion will not be used.

What many need is an 8031/8052 controller in a plain brown wrapper, that is optimized for these minimal-configuration applications.

The COMM-LINK2 board meets this criteria. Optimized both for single-use, drop-in solutions as well as volume OEM applications, this new microcontroller is designed to be as small and cost effective as possible.

Measuring only 3.5 by 5.2 inches, the COMM-LINK2 board contains an 8031 (or 80C52) processor, EPROM and RAM memory, 12-bits of parallel I/O, and an RS/232-RS/485 serial port.

A single 5 VDC regulated supply is necessary for operation or this can be obtained from a 9-12 VDC unregulated input by the on-board linear regulator.

8031 Family Pin Description

Port 0	pins 39-32	8-bit open drain bidirectional I/O (multiplexed low-order data/address for external memory)
Port 1	pins 1-8	8-bit quasi-bidirectional I/O
Port 2	pins 21-28	8-bit quasi-bidirectional I/O (high-order address for ext. memory)
Port 3	pins 10-17	8-bit quasi-bidirectional I/O (secondary functions as follows: **RXD/data** Serial Channel's receiver **TXD/data** Serial Channel's transmitter ***INT0** Interrupt 0/counter gate 0 input ***INT1** Interrupt 1/counter gate 1 input **T0** Counter 0 input **T1** Counter 1 input ***WR** write for external data memory ***RD** read for external data memory
ALE	pin 30	Address latch enable
***PSEN**	pin 29	read for external program memory
***EA**	pin 31	tied to logic high for executing code masked within the 8x5x series processors with internal ROM or tied to logic low to disable internal ROM and fetches all instructions from external program memory

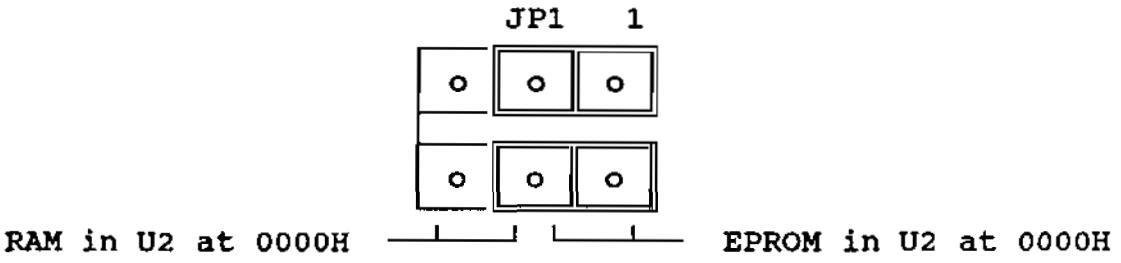
External Addressing Space

The COMM-LINK2 microcontroller can directly address 64K of external memory. That is, overlapped DATA/CODE memory, for an "anything goes here" space.

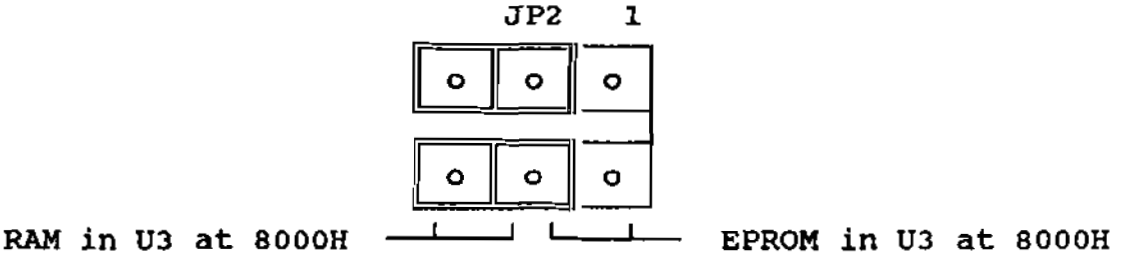
Combinations of 32K RAMs and EPROMs are allowed on the COMM-LINK2 board. **When using the 8031, your EPROM code starts execution at 0000H. When using the 80C52 (masked with BASIC in the internal ROM), RAM must be at 0000H.**

Device Type Selection

Two memory sockets are provided on the COMM-LINK2 board (U2 & U3). Each memory socket has a jumper used in selecting the type of address space assigned to the socket. JP1 selects the device type for U2 and JP2 selects the device type for U3. The selection made determines where the control lines are connected on the memory socket. RAM and EPROM devices require slightly different configurations. The following is an example of memory configuration when using an 8031.



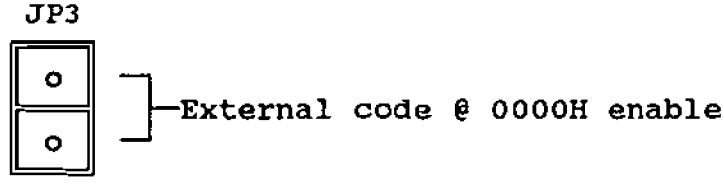
JP1 shows EPROM in U2 starting at address 0000H



JP2 shows RAM in U3 starting at address 8000H

External Code Selection

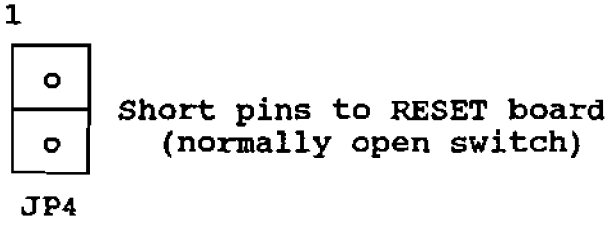
The 8031 microcontroller requires *EA (pin 31 on the micro) to be pulled down to a logic low level. This instructs the processor to start executing machine language code starting at address 0000H. The 8052 is masked with BASIC and will run internal code (BASIC interpreter) if *EA is pulled up to a logic high. Pulling *EA low on an 8052 will disable BASIC and execute code starting at 0000H (similar to an 8032).



JP3 shows a jumper installed on JP3 enabling external code execution

Resetting the COMM-LINK2

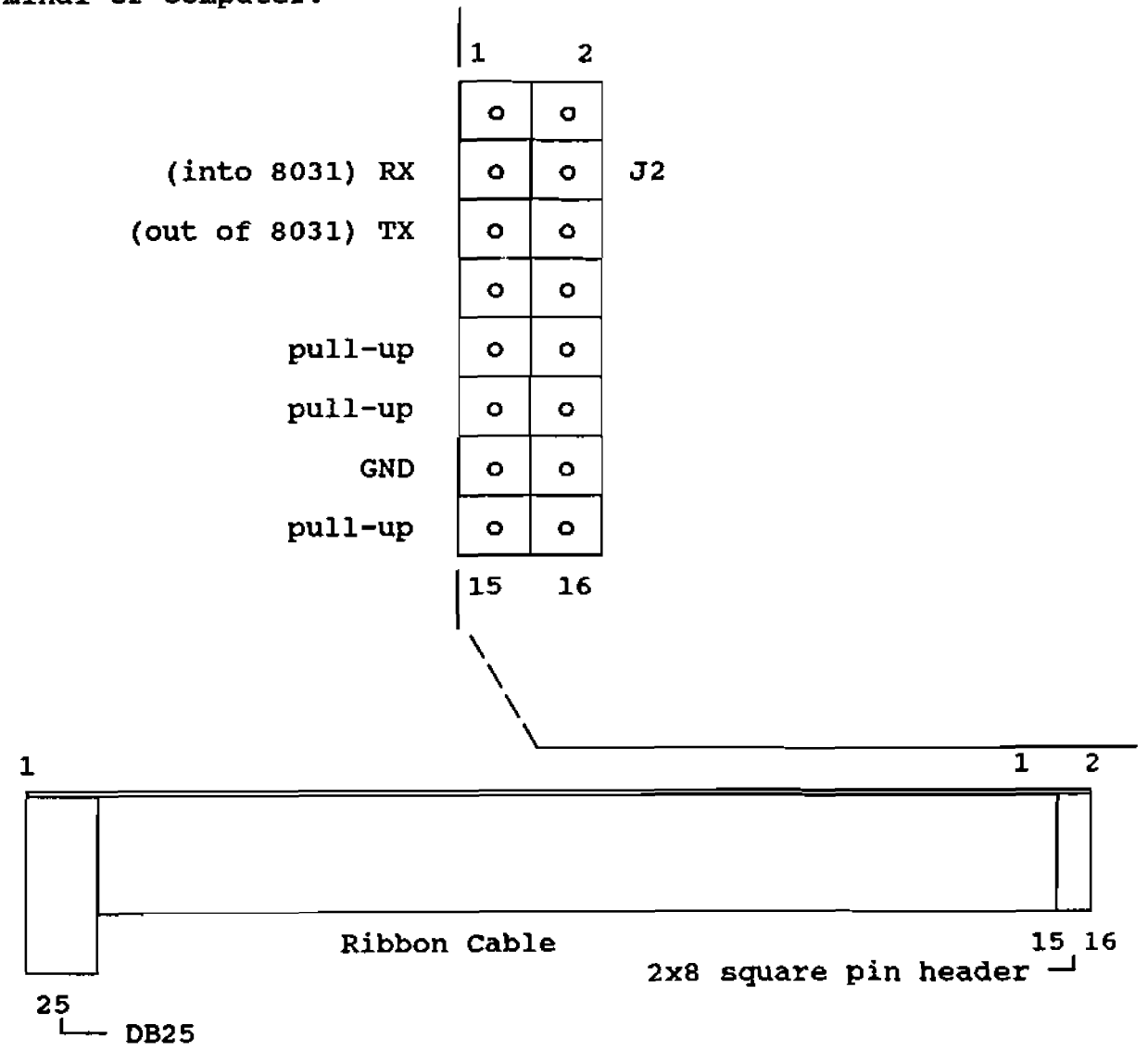
Reset of the COMM-LINK2 board occurs when a normally open push-button switch is attached to JP4 and momentarily pressed. A logic high is applied to the system RESET line and held momentarily high by an R/C circuit.



Use JP4 for connecting a normally open push-button switch as an external system RESET

RS-232 Communications

The COMM-LINK2 contains a full-duplex serial channel. TTL-level serial signals are converted to ±10-volt RS-232-compatible signals by U7, the MAX232 device. A 16-lead flat ribbon cable made with a DB-25 at one end (for connection to DTE terminal device) and a 16-pin plug (for connection to JP2) will permit serial communication with a dumb terminal or computer.

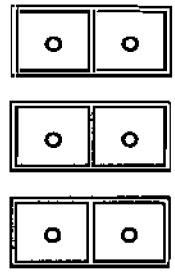


Cable required for RS-232 communications

To eliminate unwanted noise on the RX input to the processor, remove the unused line driver chip. (U7-MAX232 or U8-75176)

RS-485 Communications

RS-485 communications over a single twisted pair can accommodate multiple (up to 32) devices. Since each device can transmit and receive, certain protocols must be adhered to in order to prevent message collisions. The simplest being "listen to the line and transmit only if free." (The protocol you use will depend on the application and is beyond the scope of this manual). JP5 enables termination resistors on the twisted pair and should be installed **only on** the microcontrollers located at the extreme **ends** of the twisted pair (one at each end). U8, the 75176 RS-485 device, draws as much current as the rest of the COMM-LINK2 board. If you don't require RS485 communications removing U8 will reduce overall power requirements.



JP5 shows all jumpers installed to terminate the RS-485 lines (Valid only for boards installed at opposite ends of the network)

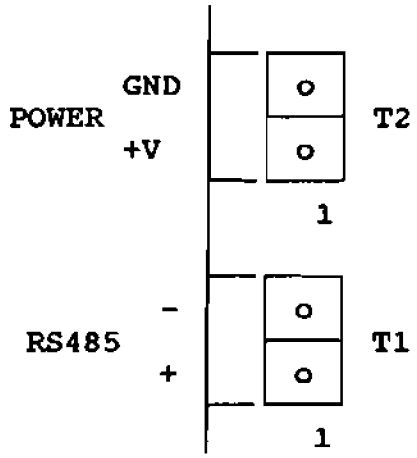
The 100 ohm termination which is across the RS485 twisted pair may be needed on the node **at the end** of the twisted pair daisy chain. The pull-up and pull-down resistors **are required** to assure that the twisted pair is in the idle state when no RS485 driver is active. It is suggested that any termination be done on the last node.

To eliminate unwanted noise on the RX input to the processor, remove the unused line driver chip. (U7 or U8)

RS485/Power Connections

Four screw-terminal connections are used for connecting power and the RS485 network to the COMM-LINK2 board. This allows the COMM-LINK2 board to operate remotely with only a four wire cable (i.e. telephone cable). Of course you could use the COMM-LINK2 board as a stand-alone controller using RS-232 as the communications medium.

T1 is a two position screw terminal block used for RS-485 twisted-pair communications. T2 is used as the power supply input, requiring either 9-12 volts of unregulated DC from a remote supply on a separate pair of wires. Or you may use a local 5 VDC regulated supply (with the zero ohm jumper at R15 installed). **DO NOT INSTALL** R15 unless you are powering the board with 5V.



Screw terminal blocks for Power and RS485 Communication

POWER for the COMM-LINK2

Use T2 for attaching the power supply connections to the COMM-LINK2 board. The input can be any unregulated DC voltage from 9-12 volts. A series diode protects the COMM-LINK2 board from accidental voltage reversals. The unregulated DC powers a linear voltage regulator on the COMM-LINK2 board which provides the nominal 5.0 volts.

Alternately, a regulated 5.0 volts can be used as input. When the input is a regulated 5.0 volts, the user must install a zero ohm jumper at R15. This bypasses the linear regulator and series diode. Caution: Voltage reversal protection is eliminated when a jumper is placed at location R15.

COMM-LINK, the Basic Network Node for the HCS II

The HCS II is an expandable, network-based, intelligent-node, industrial-oriented supervisory control system which, in its minimal configuration, performs quite suitably as a home control system. HCS II incorporates direct digital inputs and outputs, direct analog inputs and outputs, real time or Boolean decision event triggering, X-10 transmission or reception, infrared remote control transmission and reception, remote displays as well as a master console, and it has the capability to perform as a complete badge monitoring and personnel tracking system.

The HCS II system architecture consists of a central supervisory controller connected to up to 31 other functional modules (called links) via an RS-485 serial network. The system controller and the links can operate independently and do not need the system controller or other links to function. This allows easy testing or incorporation as intelligent subsystems in other control equipment. The subsystem links all share a common 8031 controller board (generically called a COMM-LINK) with the I/O customized for each application.

The supervisory controller is quite literally the brains of the system. While every Link has its own processor, they each rely upon the supervisory controller for timing, control commands, and overall system coordination.

The supervisory controller is a 9.218 MHz 64180-based single board computer. It has two serial ports, up to 96K bytes of memory (32K bytes are battery-backed), an eight channel 8-bit or 10-bit A/D, a real time clock-calendar, and 24-bits of parallel I/O (an additional 48-bits of parallel I/O can be added if required). These parallel I/O bits can be further conditioned by externally connecting them to opto-isolators, relays, or drivers. Depending upon your application you may find that the supervisory controller is all you need.

One of the serial ports performs as a dedicated 9600 bps serial RS-485 connection to the various network links. The wire from this port can be up to 4000 feet long (as opposed to 50 feet for RS-232). The second port connects (RS-232) to a PC/AT which functions as the master console. Programs running on the master console allow the user to enter and store control sequences which will be subsequently compiled and downloaded to the supervisory controller's non-volatile memory. The master console also acts as an on-line real time display of all control activity in the system. When these downloading or display functions are not required, the master console can be turned off to reduce system power consumption.

Besides the Supervisory Controller, the HCS II system consists of a multitude (none to 31) of specialized-function network nodes which facilitate remote data acquisition, closed-loop control, and display. With the exception of the ADIO-LINK, all comm-links consist of the same generic 8031 computer with only the external parallel I/O circuitry and operating software being different. The generic COMM-LINK board is configured with minimal components. It accommodates up to 64K bytes of either RAM and/or EPROM memory. The single serial port is configured to operate both RS-232 and RS-485. When connected to the Supervisory Controller in normal operation, the connection is via a twisted pair to the RS-485. Additional line balancing and termination resistors are included. According to the driver chip manufacturers, this net can be 4000 feet long. This is dependent on network media quality.

The available I/O on the comm-link circuit is limited to the PORT1 bits of the processor, interrupt lines, and T0 and T1. When used as a powerline interface, these lines connect to the TW-523 X-10 module; when used as an infrared gateway, these lines connect to infrared LED driver logic and an IR receiver; when used as an LCD display, these lines supply character data to the LCD. In addition, to facilitate additional link designs or modifications to the existing circuits, the COMM-LINK1 PC boards contain a prototyping area.

The RS-232 is reserved for local non-system direct testing or use (of course, you could also operate it stand-alone with RS-485). Each link has a unique command set and, for multiple units of the same type, a unique address. By connecting the link to the serial port of a terminal or any PC running a terminal emulation program, you can directly command the comm-link to do any activity which it would normally do for the Supervisory Controller.

With the PL-LINK alone, for example, you could directly control all X-10 on/off, dim/bright functions from a PC. In addition, because the PL-LINK is "smart" it offers the user the added capability to "listen" to the power line and record whether any other X-10 codes have been transmitted (either manually or automatically, from any other transmitter), and it will automatically "refresh" desired X-10 modules at a prescribed refresh rate. Intelligent links simplify testing and problem diagnosis. More often than not, the location where sensors are placed have no convenient AC power outlet and 5 volts is no longer 5 volts if run over any length of a twisted pair. To remedy this, the individual network links will operate on a 9-12 VDC input.

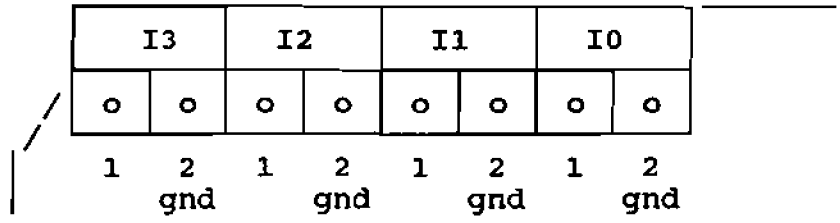
While the comm-link circuitry runs on 5 volts, the design incorporates a linear regulator so that the 5V can be derived from a wide-ranging DC input. The intention is to promote connecting the individual links via a 4-wire cable, rather than just a 2-wire twisted pair, when local power is unavailable. Two wires supply RS-485 while the other pair supplies +12V and ground (actually 9-12V is fine. Higher voltages require a larger heatsink on the regulator). Of course, using the regulator is optional, and the board can be operated (jumper selectable) on +5V.

Digital Inputs

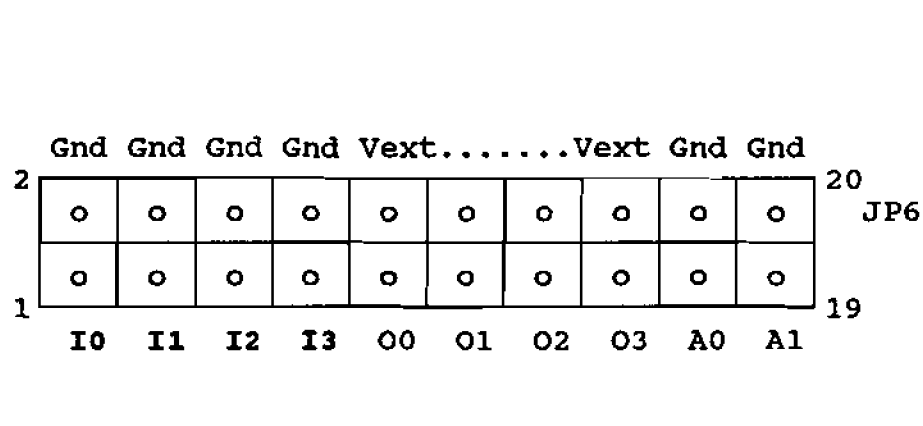
The DIOPLUS-LINK accepts either a contact closure (input grounded) or high voltage (+/- 30VDC) at each input. Screw terminal blocks I0-I3 are used for input connections. Alternately, the same inputs are available on JP6.

Connect a **contact closure** (relay contacts or push-buttons) across terminals 1 and 2 of any of the input terminal blocks (I0, I1, I2, and I3). An onboard pull-up resistor forces the input into a logic '1' state until the N.O. contact is closed forcing the input to a logic '0' state.

Connect **high voltage DC** inputs to terminal 1 of each of the input terminal blocks I0, I1, I2, and I3. These signals must be referenced to ground terminal 2 of each of the input terminal blocks. The presence of a positive voltage (up to +30VDC) forces the input to a logic '1' state until the voltage goes to ground (or negative, down to -30VDC) which forces the input to a logic '0' state.



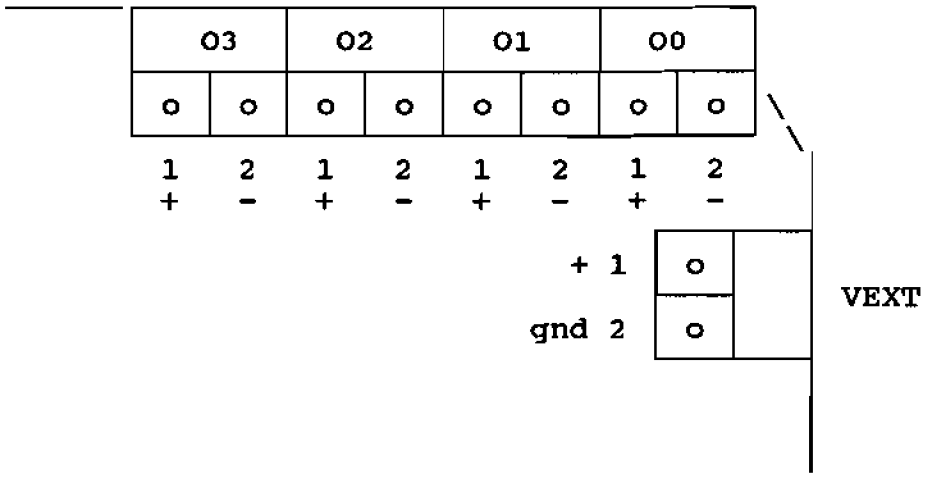
Screw terminals for Digital Inputs I0-I3 on the DIOPLUS-LINK



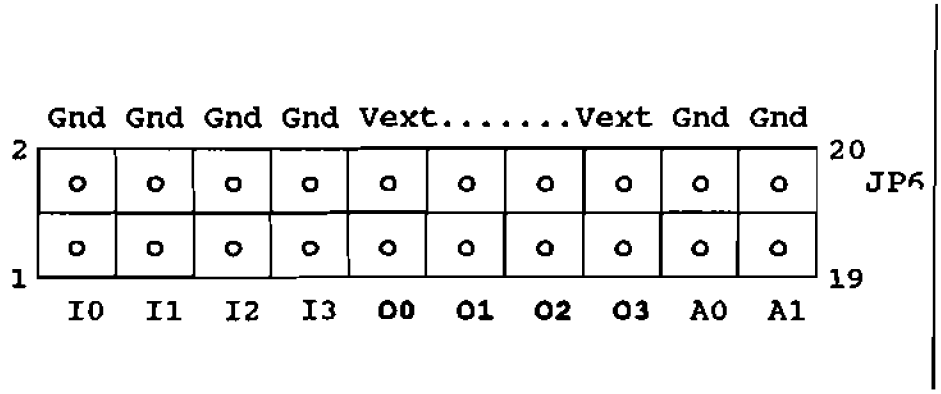
In addition to the screw terminals, the Digital Inputs are available on the square pin header JP6.

Digital Outputs

The DIOPLUS-LINK uses a quad latch with open-collector outputs as a means of supplying high voltage DC control. The external voltage must be the same for all devices used on any or all of the four outputs. These external devices could be bells, alarms, relays, solenoids, or any device. Total capacity of this part is up to 50 volts DC at 1/2A (total current shared among all four inputs). The external driving source (up to 50VDC) is connected to the screw terminal block VEXT. Devices to be controlled are connected across terminals 1 and 2 of each of the four output screw terminal blocks O0, O1, O2, and O3. The positive side to pin 1 and the negative side to pin 2.



Screw terminals for Digital Outputs O0-O3 on the DIOPLUS-LINK

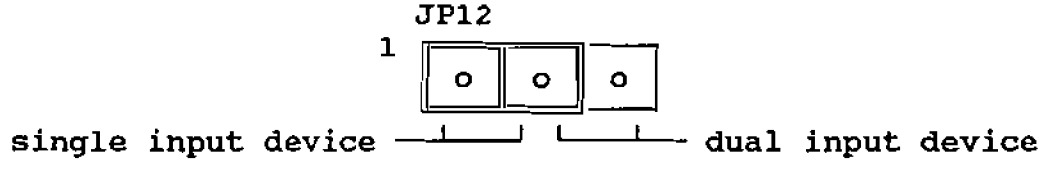


In addition to the screw terminals, the Digital Outputs are available on the square pin header JP6.

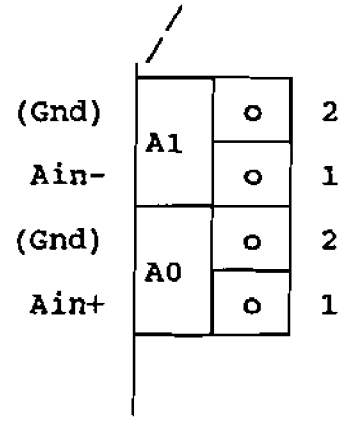
Analog Input

The DIOPLUS-LINK offers either a single differential analog input or a pair of independent single ended analog inputs. The standard device has 8-bit resolution with a 0-5 volt input range. Eight bit resolution means the 5 volt input span is broken down into 256 (2 to the eighth) steps (or 256-1 parts). The voltage presented to the A/D input is reported to the user as one of those steps (0-255). 5 volts divided by 255 parts is about 19.6 millivolts between steps. If step number 43 is reported, then the actual voltage being input must be 43 times 19.6 mV, or 0.84 volts.

If the device in your board is an ADC0831, an LTC1092, or an LTC1292 you have a single channel differential input A/D (the ADC0832 may be used as a single differential input also). Configure JP12 as a single input device.



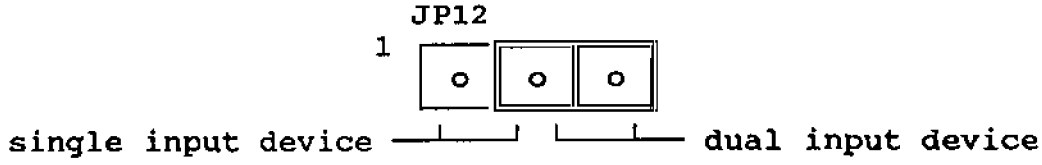
JP12 shows the A/D (U5) configured as having a single input channel



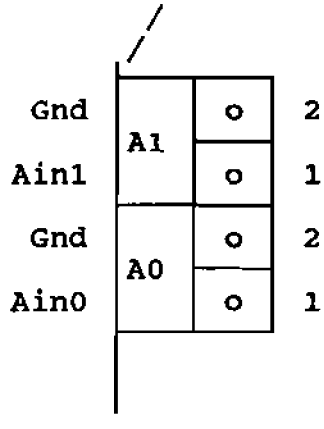
As a differential analog input, connections must be made to Ain+ and Ain-, with the most positive voltage at Ain+. **At no time may the voltage at any input be less than zero volts or greater than +5 volts.**

A typical application might include a Centigrade or Fahrenheit temperature probe (i.e. Micromint's TP1 or TP2). Since most temperature probes have outputs which do not match an A/D's 0-5 volt input, a signal conditioner must be used. A signal conditioner provides offset and gain adjustment of the temperature probe's output producing an output which can take full advantage of the A/D's range.

If the device in your board is an ADC0832, you may use it as a dual channel single ended A/D. Configuring JP12 as a dual input device will enable channel selection.



JP12 shows the A/D (U5) configured as having two input channels



As a single-ended analog inputs, connections must be made between Ain and ground for each channel, with the most positive voltage at Ain. **At no time may the voltage at any input be less than zero volts or greater than +5 volts.**

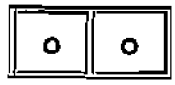
Heartbeat LED

The heartbeat LED (LED1) gives the user feedback about the operational status of the DIOPLUS-LINK. A steady blinking at once a second means all is OK.

Interactive Mode

The DIOPLUS-LINK is designed to support both the HCSII's network through RS-485 and interactive standalone mode through RS-232. Connected as an RS-232 peripheral device, the interactive mode skips all the network protocol and allows the user to send commands directly to the DIOPLUS-LINK. This gives direct access to set and query the I/O on the DIOPLUS board.

Interactive mode is enabled by placing a jumper block on JP13. Upon a board reset, the DIOPLUS-LINK enters the interactive mode whenever JP13 is enabled. Remove jumper JP13 for use with the HCSII network.



JP13

JP13 shows a jumper on JP13 enabling the interactive mode

DIOPLUS-LINK Software

Setup your board as suggested for an 8031 based system, with the DIOPLUS-LINK EPROM in U2 and a RAM in U3 (using the default settings shown in this manual). Upon power-up or reset, LED3 will blink about once a second. This gives you a bit of reassurance right away that the system is operating correctly.

Heartbeat LED flash codes:

Failure	Blink Code
None	steady blinking (1Hz)
Bad EPROM	long, short
Bad external RAM	long, short, short
Other hardware fault	no blinking

If the LED is not blinking, here are some things to check:

1. Shorting jumper positions
2. RAM, EPROM, and jumper positions
3. Power Supply connections
4. 5 volts on U1 pin 40 to ground (pin 20)
5. Reset U1 pin 9 low
6. ALE U1 pin 30 oscillating (about 2MHz)

Bit usage for the LCD-LINK Monitor

P1.7	Analog *enable	
P1.6	Digital Input *enable	
P1.5	Digital Output *enable	
P1.4	EEPROM *enable	
P1.3	D3 data bus	
P1.2	D2 data bus	
P1.1	D1 data bus	
P1.0	D0 data bus	
P3.3	INT1	not used
P3.2	INT0	Heartbeat LED
P3.5	T1	not used
P3.4	T0	network direction control

Getting Started - LCD-LINK Monitor

For RS232 Use (N1-network mode default):

1. Set your Communications program to 9600 b/s 8N1.
2. With the power off, remove 75176 transceiver chip and install MAX-232.
3. Connect your computer's serial port to J2.
4. Verify commands to satisfy yourself that it works...
   Prefix all commands with "! ADP0 " (note spaces!)
   ADP0 is the default address, to change, use the A command
   There is no command echo in this mode

If you have trouble, insert shorting jumper JP13 and reset the CPU to enter "interactive" mode (N0-interactive mode):
A Descriptive banner appears.
Do not use the prefix with the commands in the interactive mode.

For Network Use (N1-network mode default):

1. Set your Communications program to 9600 b/s 8N1.
2. With the power off, install the 75176 transceiver and remove MAX-232.
3. Connect PC through an RS-485 converter.
   Your software must enable/disable RTS correctly!
   Make sure JP13 has no jumper when you turn power ON.

Checksums

Network mode transmissions can be validated by using a checksumed transmission. The "!" prefix indicates a non-checksumed command, while a "#" prefix includes a checksum. The command and response syntax is as follows:

#xx addr command

where:

#	prefix w/checksums
xx	checksum byte in hex
blank	ASCII 32 (20 HEX)
addr	nodes' network addr
blank	ASCII 32 (20 HEX)
command	command text
<CR>	ASCII 13 (0D HEX)

$xx addr response

where:

$	prefix w/checksums
xx	checksum byte in hex
blank	ASCII 32 (20 HEX)
addr	nodes's network addr
blank	ASCII 32 (20 HEX)
response	response text
<CR>	ASCII 13 (0D HEX)

Compute the checksums as follows:

1. Assemble the command by stuffing "00" (30 HEX 30 HEX) in the checksum field (do not include the quotes)
2. Add up all the characters in the command including checksum
3. Find the 2's complement of the total's lower byte
4. Convert this into ASCII characters and replace the checksum

Verify the checksum as follows:

1. Remove the command's checksum and replace it with "00"
2. Convert the checksum characters to a binary byte
3. Add up all the characters including the replaced checksum
4. Add the original checksum's binary byte
5. If the lower byte = zero then it verifies correctly

DIOPLUS-LINK Command Set

This is a list of the commands you can use to set or query the DIOPLUS-LINK. When used with the HCS II, these commands are generated as needed by the supervisory controller in response to the XPRESS program you have created.

A=str Set network address to string (16 characters max)
(default ADP0)

C Set hardware configuration and write to EEPROM

NOADC	no ADC installed
ADC0831	8 bit, 1 differential input
ADC0832	8 bit, 2 single-ended inputs or 8 bit, 1 differential input
LTC1092	10 bit, 1 differential input
LTC1292	12 bit, 1 differential input

D Dump program status (debugging use)

E Show and clear error flags (debugging use)

Ln Set logging mode (bit mapped)

L	report current mode
L0	disable (default)
L32	show device decoding

Nn Set network/interactive mode

N	report current mode
N0	set interactive mode
N1	network mode (no error messages) (default)
N2	network mode with command echo and error msgs
N3	same as N1 with command echo

Q Query inputs (immediate data, not stored samples)

Q AI	-> AI=003F
Q DO	-> DO=03 (only using LSB)
Q DI.2	-> DI.2=1
Q AI,DI,DO	-> AI=00FE,DI=0F,DO=00

RESET perform power-on reset, must be completely spelled out

S Set outputs

S DO=05	(only using LSB)
S DO.0=1	

X Erase EEPROM contents, resulting in a blank EEPROM
Using Reset after X will restart board with defaults

Notes

You can query the output of the digital output driver even though it is a write-only device. The firmware maintains a copy of the most recent S command value and returns that in response to the Q command.

The S command will set the value of an "input only" device such as the ADC chip, but the firmware suppresses the write commands. The next Q command will return the actual data read from the device as though the S command has not happened.

I/O Devices

The DIOPLUS-LINK command set uses these mnemonics for the I/O hardware:

Name	Function
AI	Analog Input (ADC converter)
DI	Digital Input (74LS386 digital input buffer)
DO	Digital Output (UCN8500 digital output driver)

Analog-to-Digital Converter

The ADC converter may be one of the several different chips providing different capabilities:

ADC0831	8 bit, 1 differential input
ADC0832	8 bit, 2 single-ended inputs or 8 bit, 1 differential input
LTC1092	10 bit, 1 differential input
LTC1292	12 bit, 1 differential input

You must use the C command to tell the firmware which ADC chip is installed in the board and set JP12 to match the chip. The default configuration is an ADC0831.

The ADC0831, LTC1092, LTC1292 have only one input. You may use either of these commands to read the current value:

```
Q AI
Q AI.0
```

The converted value is always reported as four hexadecimal digits. The bits from the ADC are right-justified, so the ADC0831/32 converters use only the low-order byte.

Although the ADC0832 has two inputs, the firmware defines four channels to control the chip's operation:

```
Q AI.0    differential, input 0 positive
Q AI.1    differential, input 1 positive
Q AI.2    single-ended, input 0
Q AI.3    single-ended, input 1
```

The returned value will be in the 16-bit format described above.

For all converters, if the voltage on the positive input pin is less than that on the negative input pin, the converter will return zero. There is no provision for negative differential voltages.

The firmware drives the converters with a 150KHz, 50% duty-cycle clock. Conversions take place only when the firmware decodes the Q AI command; the ADC chip is idle and deselected at all other times.

All of the converters produce a zero "dummy bit" during conversion, which the firmware verifies while reading the data bits. If the dummy bit is missing (either because the ADC is also missing or has failed) the firmware will return FFFF instead of a random value. In manual mode it will also display an error message.

Digital Inputs and Outputs

The firmware supports both "broadside" and bit-wise updates and queries for the digital I/O ports. To set or read all four bits at once, use these commands:

```
Q DI
S DO=05
```

You may also read the DO port with the Q command:

```
Q DO
```

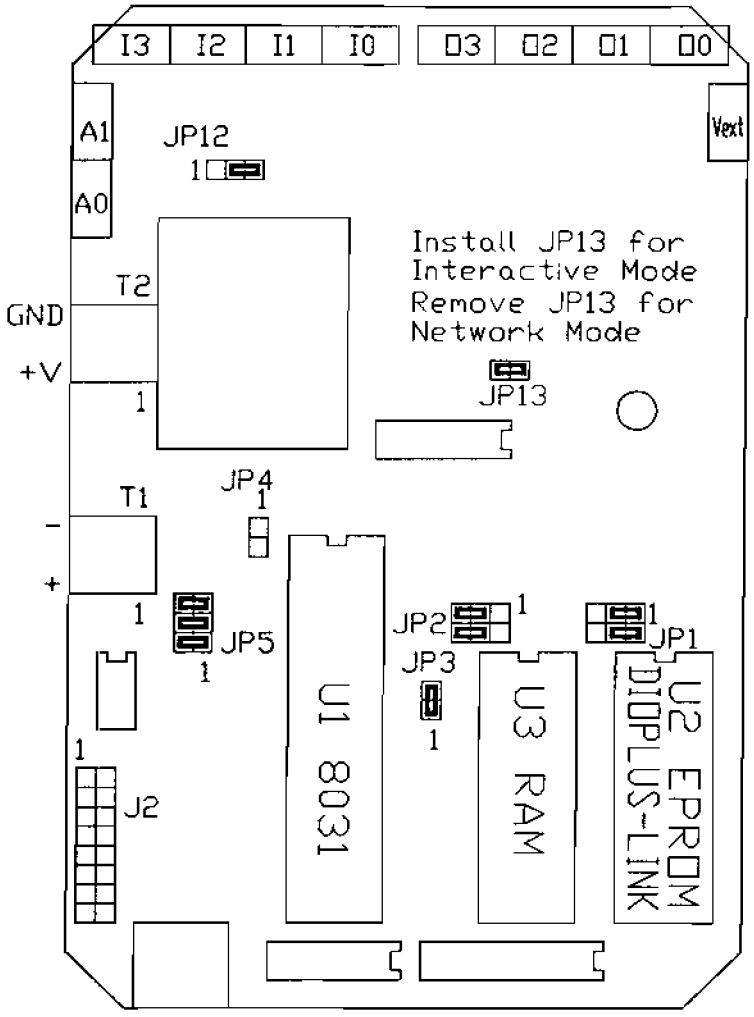
to find the most recent value written to the port.

The firmware uses only the low-order nibble of the value you provide, so you can use a single hexdigit to set the port:

```
S DO=5
```

To read or update a single bit, use the commands:

```
Q DI.1
Q DO.3=1
```



Default Jumper Configurations for the LCD-LINK

Interactive Standalone Mode

Enable JP7 and reset the DIOPLUS-LINK, and follow the directions for RS232 Use, under the section "Getting Started - DIOPLUS-LINK Monitor"

Upon RESET you should see a sign-on banner similar to:

```
ADIO-Plus Networked Analog & Digital I/O, Version 0.1a
  for use with COMM-Link Version 2 hardware
  Copyright 1992 Circuit Cellar, Inc.
Initializing device information
  Setting default configuration
Configuration:
  ADC type 1 = ADC0831
Writing EEPROM data
ADP0 >
```

Enter the letter A to display the network 'Address'

```
 ADP0 >A
Net address is ADP0
```

Change the address to any character string (16 characters max)

(ADP0 through ADP7 are the only addresses allowable for network use) Address assignment will be retained in EEPROM.

```
ADP0 >A=ADP1
  Writing EEPROM data
ADP1 >A
Net address is ADP1
```

Enter a 'D' to Dump the program status

```
ADP1 >D
Net address [ADP1 ].  Stack used 4B/7F.
T0Ticks 71
EEPROM contents
00:4441   10:0000   20:0000   30:0000
01:3050   11:0000   21:0000   31:0000
02:0020   12:0000   22:0000   32:0000
03:0000   13:0000   23:0000   33:0000
04:0000   14:0001   24:0000   34:0000
05:0000   15:0001   25:0000   35:0000
06:0000   16:0001   26:0000   36:0000
07:0000   17:0000   27:0000   37:0000
08:0007   18:0000   28:0000   38:0000
09:0000   19:0000   29:0000   39:0000
0A:0001   1A:0004   2A:0000   3A:0000
0B:0000   1B:0000   2B:0000   3B:0000
0C:0011   1C:0000   2C:0000   3C:0000
0D:0000   1D:0000   2D:0000   3D:4150
0E:0000   1E:0004   2E:0000   3E:BEB0
0F:0000   1F:0000   2F:0000   3F:8B2A
```

Enter an 'E' to show and clear the Error flags

```
ADP1 >E
Error flags 00.  Network checksum errors 0
```

Enter an 'Lx' to change the logging mode
- L reports the current mode
- L0 disables logging
- L32 shows device decoding

```
ADP1 >L1
```

Now a display string will show logging

```
APD1 >S DO=0

[Device DO ID 02, all channels/drivers]
Write 0000 to device ID 0002
```

Now turn the logging back off

```
APD1 >L0
```

Enter an 'N' to display the current Net mode

```
ADP1 >N
Net mode is 0
```

Enter a 'Q' to display the status of a device

```
ADP1 >Q DI
DI=00
```

or

```
ADP1 >Q AI
AI=0000
```

Use the 'X' command to clear the EEPROM of configuration data

```
ADP1 >X
EEPROM contents erased
Use RESET command to write default configuration

ADP1 >
```

Generic Instructions for Kit Assembly

Tools Required for Assembly:

Low Wattage or Temperature Controlled Soldering Iron
Rosin Core Solder
Lead Cutters

Additional Tools to Ease the Assembly:

Needle-Nose Pliers
Lead Bender
Solvent for removing Rosin (flux)
Screwdriver

Tools for trouble-shooting (and their use):

Oscilloscope	Viewing AC/DC signals
Logic Probe	Indicating Logic Levels (activity)
Continuity Checker	Determining Shorted or Open Traces
Volt/Ohm Meter	Checking Power Supply, Logic Levels, or continuity

Familiarize yourself with all of the parts included in the kit. Pay particular attention to proper orientation of parts. Markings might include a bump, hole, number, arrow, or notch indicating pin1 (or the pin1 end) of ICs and sockets. A stripe may indicate a plus or minus potential lead of a capacitor or the cathode of a diode. An LED might indicate the cathode by a notch or flat side on the girth of the component.

Inspect the PC Board prior to installing any parts. If held up to a lamp, you can usually see the signal traces fairly clearly. Eye each trace for defects, a copper short between adjacent traces or pads, or a break in the copper trace. Verify any traces that look shorted by first looking at the schematic to verify they should not be connected and then checking the traces for continuity. You should check traces which seem to be broken for continuity as well. Circuit Cellar Inc. inspects each and every board for manufacturing defects; we feel confident that the components packaged for you are free from defects. However, inspecting your PCB is much easier before any parts are inserted which would obscure a defect from view.

The best approach to use in building a kit is to choose the smallest (or shortest) parts to install first. Start with any small signal diodes. Use the FOIBSAT method on each part or group of parts. Find, Orient, Insert, Bend, Solder, And Trim each part. Find the part, verify it using the parts list and silkscreen layout. Orient the part correctly using markings on the part and the silkscreen layout. Insert the part into its designated location, forming the component leads if necessary. Bend over the component leads to prevent the part from falling out, preferably in the direction of the connecting circuit board trace. Solder each lead filling in the area between the lead and its plated through hole. And finally, Trim the leads to prevent shorting between traces, components, or holes.

Continue with the 1/4 watt resistors, IC sockets, and smaller monolithic capacitors. Next, insert all the square pin headers and jumpers. These can't be easily bent and will simply fall out if not handled one at a time. Start by soldering only one or two pins, flipping over the board to check that the header isn't tilted, then fix by reheating the soldered pin and/or complete by soldering the rest of the header's pins. Follow up with the larger components, resistors, capacitors, and axial semiconductors.

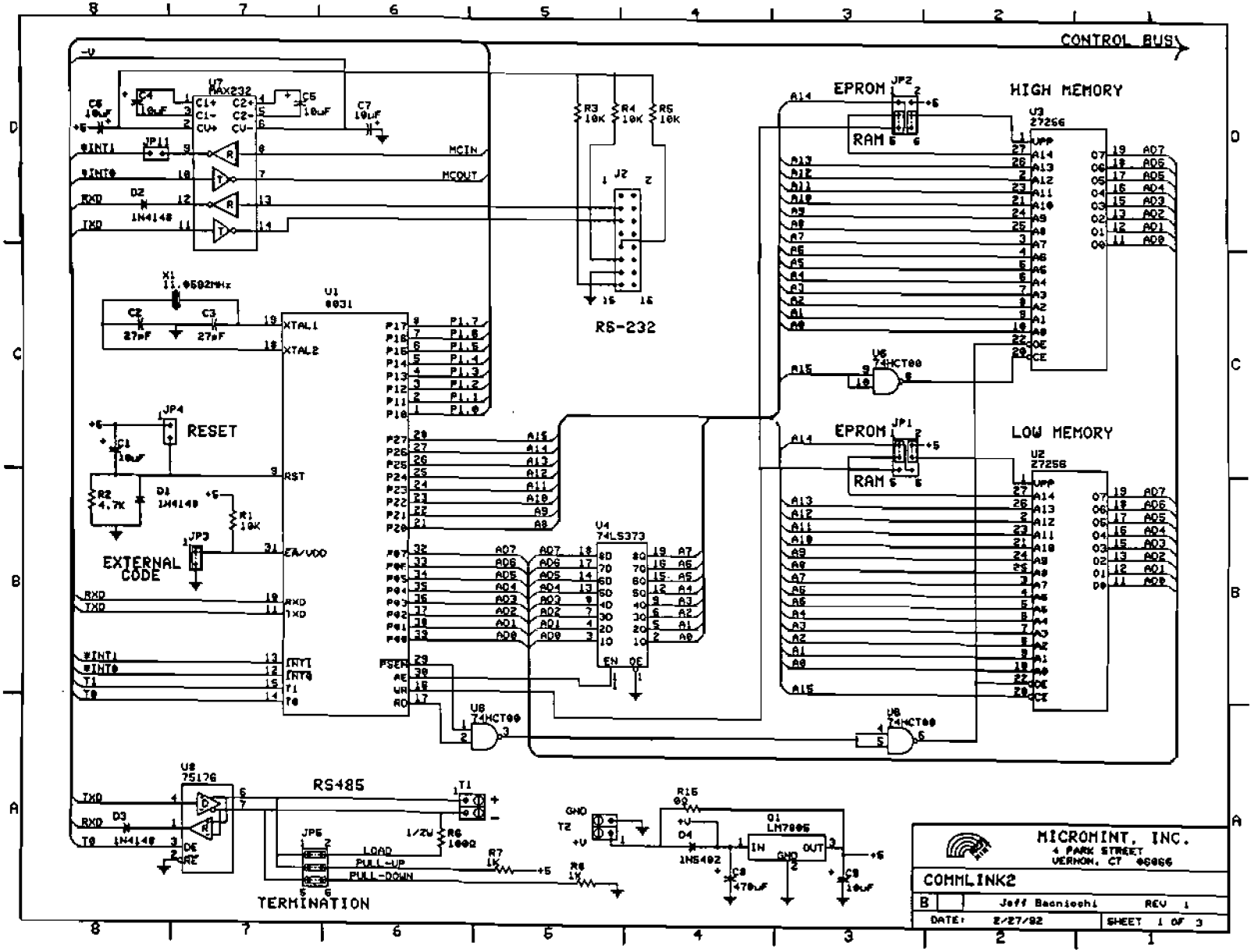
Finally, the taller, odd-shaped components are added, transistors, LEDs, crystals, potentiometers, connectors, heatsinks, etc.

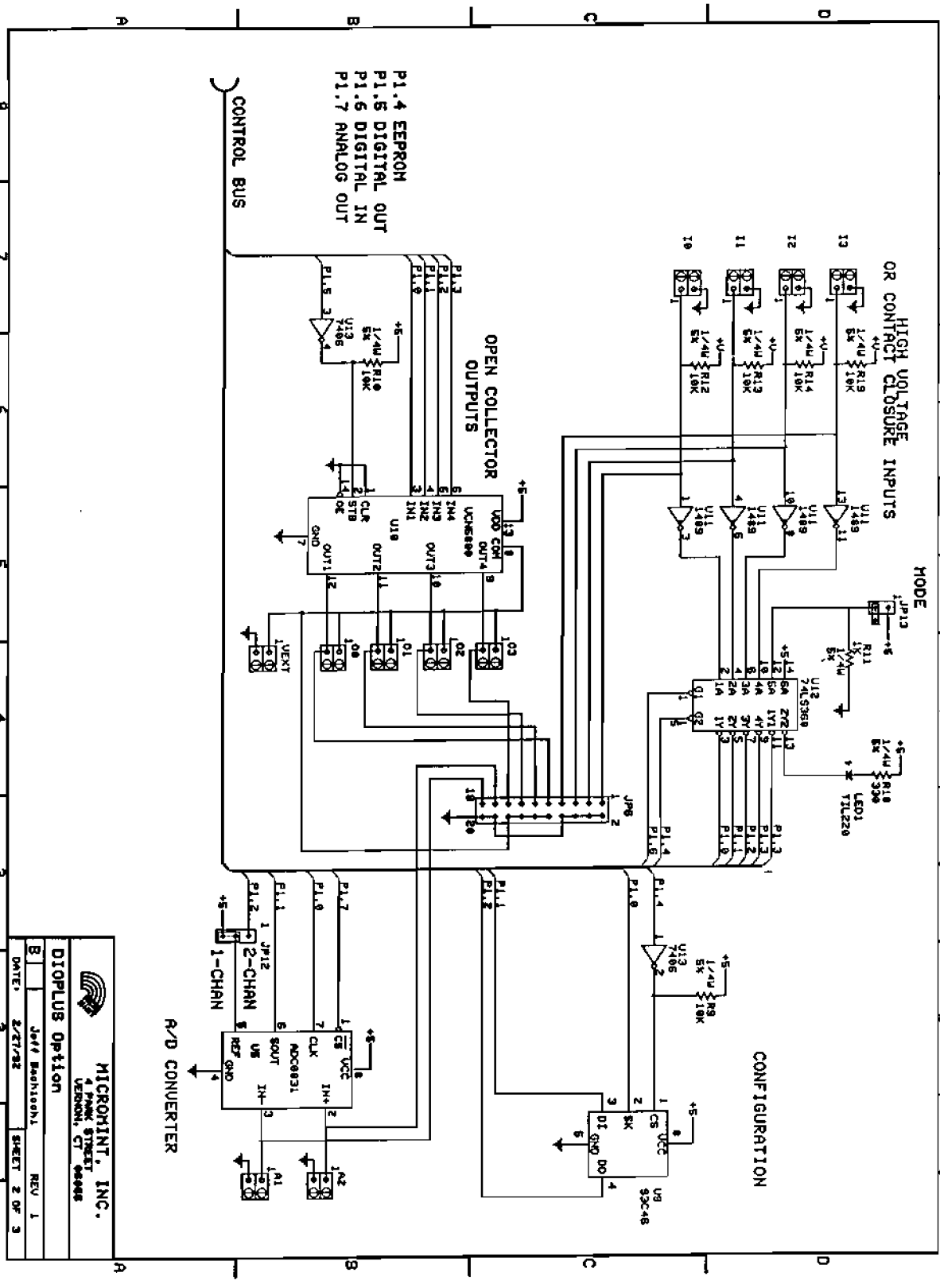
Do not be alarmed if every component on the silkscreen is not found within the kit. Only the parts listed in the DIOPLUS part's list are needed. The generic COMM-Link PC board can be used for a number of link modules when populated with different parts and the appropriate firmware.

Prior to installing the ICs, it is a good idea to give the PCB another inspection. Look for unsoldered or untrimmed leads. Cleaning the solder side of the PCB with a flux remover will make inspection easier, not to mention less sticky.

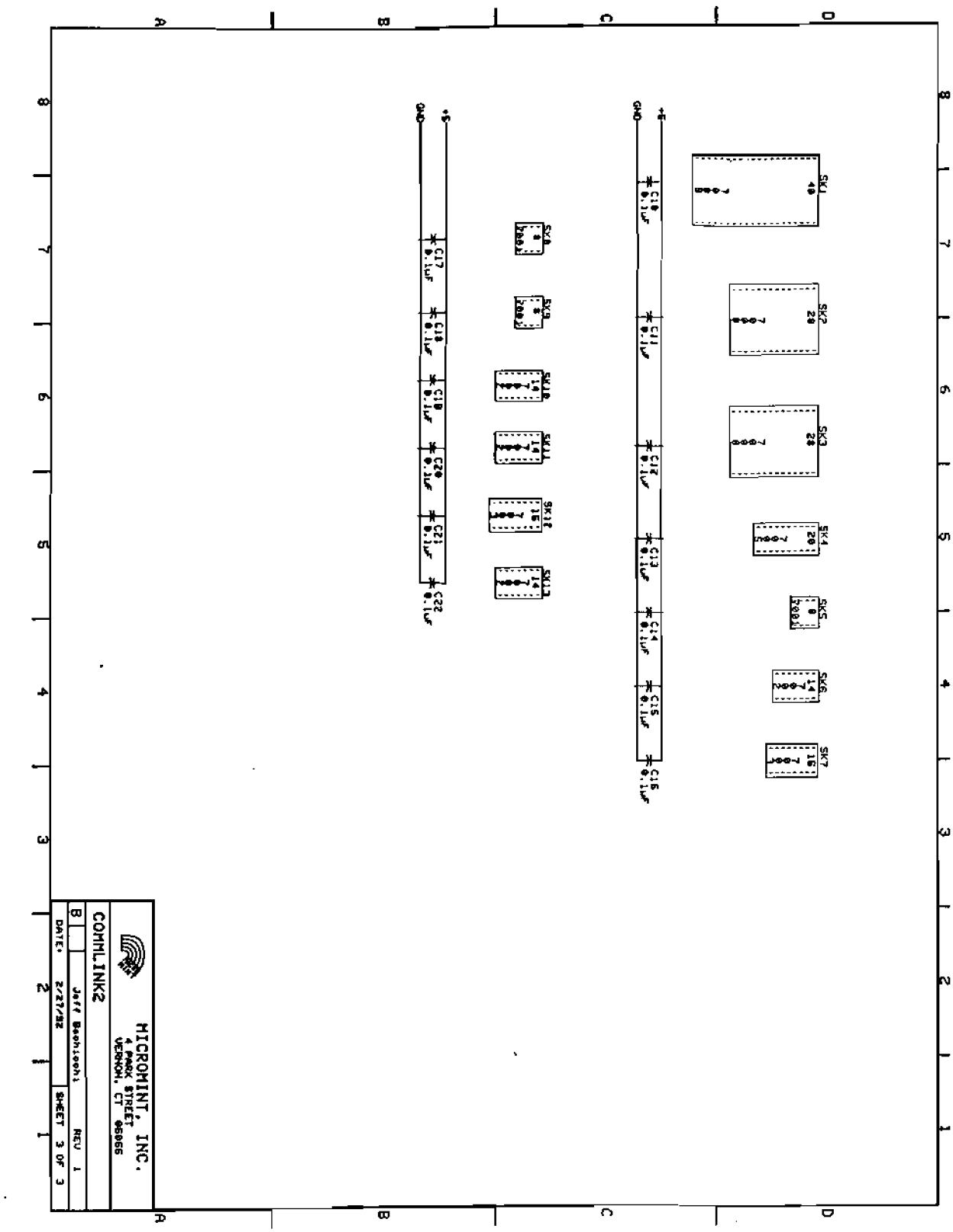
Another suggestion is to use a volt-ohm meter and measure the resistance between ground and any power supply input. A short circuit here could ruin your power supply and won't allow your board to operate properly. Power-up the board before inserting the ICs and check for VCC at a number of points on the board.

Refer to the parts list and silkscreen for proper IC orientation and insertion. This concludes the assembly instructions, now refer to the section on "Getting Started".

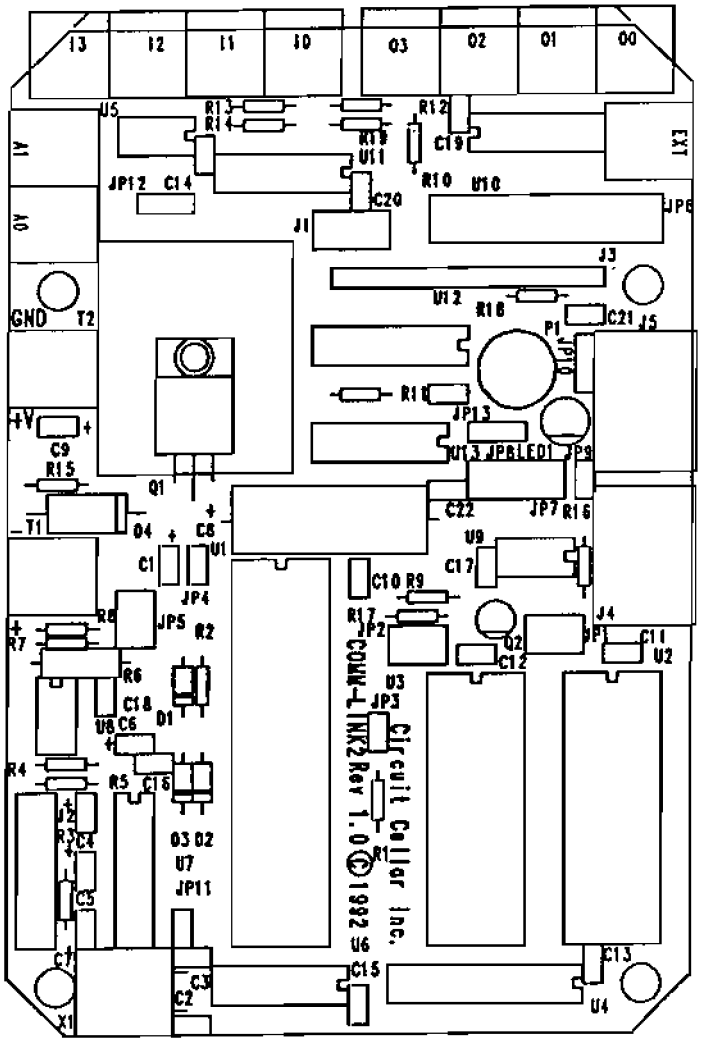

CONTROL BUS
MAX232
MCIN
MCOUT
RXD
TXD
RS-232
8031
XTAL1
XTAL2
RESET
RST
EXTERNAL CODE
EA/VDD
P1.7
P1.6
P1.5
P1.4
P1.3
P1.2
P1.1
P1.0
74LS373
PSEN
ALE
RD
74HCT00
EPROM
RAM
HIGH MEMORY
LOW MEMORY
Z7256
RS485
TERMINATION
LOAD
PULL-UP
PULL-DOWN
LM7805
1N5402
MICROMINT, INC.
4 PARK STREET
VERNON, CT 06066
COMMLINK2
Jeff Bacciochi
REV 1
DATE: 2/27/92
SHEET 1 OF 3



DIOPLUS SCHEMATICS (2 of 3)



DIOPLUS SCHEMATICS (3 of 3)



Silkscreen for the DIOPLUS

PARTS LIST for the DIOPLUS

DESIGNATION	PART#	DESCRIPTION
Printed Circuit Board		
PCB1		COMM-Link2 printed circuit board
Integrated Circuits		
U1	8031	Microcomputer
U2	27(C)256	DIOPLUS pre-programmed EPROM
U3	6264/62256	8K/32K RAM (8K standard)
U4	74LS373	Octal Latch
U5	ADC0831	8-Bit A/D
U6	74LS00	Quad 2-Input NAND
U7	MAX232	RS-232 Dual Transmitter/Receiver
U8	75176	RS-485 Transmitter/Receiver
U9	9?(C)46	1024-Bit Serial EEPROM
U10	UCN5800	Quad Latch/Driver
U11	MC1489	Quad Receiver
U12	74LS368	Hex Tristate/Inverter
U13	7406	Hex Open-Collector Inverter
Resistors		
R7, R8, R11	1K	1/4W, 5%, (brn-blk-red)
R2	4.7K	1/4W, 5%, (yel-vio-red)
R1, R3-R5, R9-R10, R12-R14, R19	10K	1/4W, 5%, (brn-blk-org)
R6	100Ω	1/4W, 5%, (brn-blk-brn)
R18	330Ω	1/4W, 5%, (org-org-brn)
Capacitors		
C2, C3	27pF	Monolithic
C10-C22	0.1μF	50V Monolithic
C1, C4-C7, C9	10μF	16V Tantalum
C8	470μF	25V Axial
Semiconductors		
D1-D3	1N4148	Small Signal Diode
D4	1N5402	3A Diode
Q1	7805	5 volt regulator
LED1	TIL220	LED

PARTS LIST for the DIOPLUS (continued)

DESIGNATION	PART#	DESCRIPTION
Connectors		
JP3, JP4, (JP13)	1x2	Square-Pin Header (not used)
JP12	1x3	Square-Pin Header
JP1, JP2, JP5	2x3	Square-Pin Header
J2	2x8	Square-Pin Header
T1, T2, A0, A1, I0-I3, O0-O3, VEXT	1x2	Screw-Terminal Block
Sockets		
SK5, SK8, SK9	8-Pin	IC Socket
SK6, SK10, SK11, SK13	14-Pin	IC Socket
SK7, SK12	16-Pin	IC Socket
SK4	20-Pin	IC Socket
SK2 & SK3	28-Pin	IC Socket
SK1	40-Pin	IC Socket
Miscellaneous		
X1	11.0592MHz	Crystal
HS1		Heat Sink
SJ1-SJ11		Shorting Jumper
N1		4-40x1/4 Nut
S1		4-40x3/8 Screw