



CYB-550

**Kit for Stepper Motor
Prototyping Applications**

*This manual contains advance product information
of which certain details are subject to change.*

Cybernetic Micro Systems, Inc. software products are copyrighted by and shall remain the property of Cybernetic Micro Systems, Inc. Duplication is subject to a license from Cybernetics. Cybernetic Micro Systems, Inc. reserves the right to improve design or performance characteristics. Cybernetic Micro Systems, Inc. assumes no responsibility for the use of any circuitry other than circuitry embodied in Cybernetic products. No other circuit patent licenses are implied.

Information furnished by Cybernetic Micro Systems, Inc. is believed to be accurate and reliable. However, no responsibility is assumed by Cybernetic Micro Systems, Inc. for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent right of Cybernetic Micro Systems, Inc. Further, Cybernetic Micro Systems, Inc. reserves the right to revise this publication and to make changes from time to time in the content hereof without obligation to notify any person or organization of such revision or changes; and Cybernetics assumes no responsibility for any errors which may appear in this document and makes no commitment to update the information contained herein.

Because of the wide variety of applications in which this product may be used, Cybernetic Micro Systems makes no claim as to the product's fitness for any given application. It is therefore the user's responsibility to ensure the safety and viability of using this product in his application. This product should only be used in critical life sustaining applications after thorough and rigorous testing under actual operating conditions.

The following are trademarks of Cybernetic Micro Systems, Inc:

Bin-ASCII	CY300	CY512
Analog-ASCII	CY325	CY525
ASCII-analog	CY327	CY545
CY232	CY360	CY550
CY233-LINC	CY480	CY600
CY250	CY500	CY750

Copyright 1993 by CYBERNETIC MICRO SYSTEMS, INC.

All rights reserved; no part of this publication may be reproduced without the prior written permission of

Cybernetic Micro Systems, Inc.
P.O. Box 3000
San Gregorio, California 94074 USA

4-Phase Stepping Motor Manufacturers

AEROTECH, INC.
101 Zeta Dr.
Pittsburgh PA 15238 USA
(412) 963-7470

AIRPAX
NORTH AMERICAN PHILIPS
604 West Johnson Avenue
Cheshire CT 06410 USA
(203) 271-6000

AMERICAN ELECTRONICS INC.
P.O. Box 3070
Fullerton CA 92634 USA
(714) 871-3020

B&B MOTOR & CONTROL CORP.
B&B Long Island City
Apple Hill Commons
Burlington CT 06013 USA
(203) 673-7151; (800) 638-7807

BERGER-LAHR CORP.
41170 Joy Road
Plymouth MI 48170 USA
(313) 459-8300

BODINE ELECTRIC CO.
2500 W. Bradley Place
Chicago IL 60618 USA
(312) 478-3515

CANON USA
ELECTRONIC. COMPS. DIV.
One Canon Plaza
Lake Success NY 11042 USA
(516) 488-6700

CLIFTON PRECISION
LITTON SYSTEMS, INC.
Marple at Broadway
Clifton Heights PA 19018 USA
(215) 622-1000

CROUZET CONTROLS, INC.
1083 State Pkwy.
Schaumburg IL 60173 USA
(312) 843-2200

DENSITRON CORP. OF AMERICA
2039 Hwy. 1 S., P.O. Box 1318
Camden SC 29020 USA
(803) 432-5008

EASTERN AIR DEVICES
MOTOR DIVISION
1 Progress Drive
Dover NH 03820 USA
(603) 742-3330

ECM MOTOR COMPANY
1301 E. Tower Road
Schaumburg IL 60196 USA
(312) 885-4000

ELECTRIC MOTOR
ENGINEERING
1847 Victory Blvd.
Glendale CA 91201 USA
(818) 502-1866

HAYDON SWITCH &
INSTRUMENT
1500 Meriden Road
Waterbury CT 06705 USA
(203) 756-7441

HURST MANUFACTURING CORP
EMERSON ELECTRIC CO.
P.O. Box 326
Princeton IN 47670 USA
(812) 385-2564

ICON CORPORATION
156 6th Street
Cambridge MA 02142 USA
(617) 868-5400

INLAND MOTOR
4020 East Inland Road
Sierra Vista AZ 85635 USA
(602) 459-1150

ISKRA ELECTRONICS INC.
222 Sherwood Ave.
Farmingdale NY 11735 USA
(516) 753-0400; (800) 862-2101

JAPANESE PRODUCTS CORP.
7 Westchester Plaza
Elmsford NY 10523 USA
(914) 592-8880

MESUR-MATIC ELECTRONICS
CORPORATION
10 Colonial Road Suite 6
Salem MA 01970 USA
(617) 745-7000

MICRO MO ELECTRONICS INC.
742 2nd Avenue S.
St. Petersburg FL 33701 USA
(813) 822-2529

MOLON MOTOR & COIL
CORPORATION
3737 Industrial Avenue
Rolling Meadows IL 60008 USA
(312) 259-8700

MOTION CONTROL GROUP
AMERICAN PRECISION IND.
3229 Roymar Road
Oceanside CA 92054 USA
(619) 439-7500

NOVATRONICS OF CANADA LTD
677 Erie Street, P.O. Box 610
Stratford, Ontario, Canada N5A 6V6
(519) 271-3880

ORIENTAL MOTORS USA
2701 Plaza Del Amo Suite 702
Torrance CA 90503 USA
(213) 515-2264

PORTESCAP U.S. INC.
36 Central Avenue
Hauppauge NY 11788 USA
(516) 234-3900

P M I MOTION TECH.
KOLLMORGEN CORP.
49 Mall Drive
Commack NY 11725 USA
(516) 864-1000

PACIFIC SCIENTIFIC MCD
4301 Kishwaukee Street
Rockford IL 61109 USA
(815) 226-3100

SINGER COMPANY
Route 70
Black Mountain NC 28711 USA
(704) 686-3811

STOCK DRIVE PRODUCTS
DIV. OF DESIGNATRONICS INC.
2101 Jericho Turnpike
New Hyde Park NY 11040 USA
(516) 328-0220; (516) 328-3300

SUPERIOR ELECTRIC CO.
383 Middle Street
Bristol CT 06010 USA
(203) 582-9561

VERNITRON CORP.
VERNITECH DIVISION
300 Marcus Boulevard
Deer Park NY 11729 USA
(516) 586-5100

WARNER ELECTRIC BRAKE &
CLUTCH
449 Gardener Street
South Beloit IL 61080 USA
(815) 389-3771



CYB-550

**The CYB-550 Multi-Purpose
Motor Control Prototyping Board
for the CY545 and CY550**

**Cybernetic Micro Systems
P.O. Box 3000
San Gregorio CA 94074 USA**

**Phone: (415) 726-3000
Fax: (415) 726-3003
Telex: 910-350-5842**

Table of Contents

Overview of the CYB-550 Board	1
CYS 545 Data Sheet.....	2
CYB-550 Specifications	3
Tools Required	3
CYB-550 Component Locations and Values	4
Parts List	5
CYB-550 Basic Board.....	5
Options.....	8
Assembly Procedure.....	9
Assembled CYB-550 (with Options).....	16
CYB-550 Theory of Operation.....	17
The CY545/550.....	17
The CY233	18
CY545 CTS/Signal Considerations.....	19
The Serial Driver/Receiver.....	20
The Memory Interface.....	21
The HP Display	21
The Thumbwheel Switch Interface.....	22
CYB550 Schematic	24
Power and I/O.....	26
Jumper Functions	27
W1 Address Signals.....	27
W2 Memory Size Jumpers	27
W3 Parallel Port	27
W4 Motor Support Signals.....	28
W5 Serial Turnaround Jumper.....	28
W6 Network +5 Volts	29
W7 CY545 SwSel Jumper	29
W8 Additional Busy Signal - User Defined.....	29
W9 Buffered User Bits	30
Wire Wrap Area	30

Power Connector Pinouts.....	31
J1 Power Header	31
J2 DIN Power Connector.....	31
SW1 Network Address Switch.....	32
SW2 Jog Switch.....	32
SW3 User Bit Switch.....	33
SW4 Serial Chip Select Switch	33
SW5 Reset Switch (Push Button)	34
J3 Double Serial Jack	35
J4 Optional DB9 Serial Connector.....	35
The Serial Cable	35
DB25 to RJ11 Connector	36
Daisy Chaining CYB-550s - Networks.....	37
CY233 Network Communications	37
CY545/550 Serial Communications	37
Final Assembly and Checkout	38
CY545 Tests	39
Basic Test	39
Serial Interface Test	40
Parallel Interface Tests	40
Additional CY545/550 Commands	41
HP Display Exercise.....	42
Local Memory Exercise	42
CY233 Tests	43
The CYS 545 Stepper Motor Control Panel Software.....	45
CYS 545 Meta Commands.....	46
The Operating Modes of the Environment.....	50
Avoiding Trouble	50
Stepper Motor Manufacturers.....	BC

The CYB-550 Multi-Purpose Motor Control Prototyping Board for the CY545 and CY550

Overview

The CYB-550 (replacing the CYB-545) is an unusually versatile prototyping board designed to provide more than just motor control. The primary design is in support of the CY545 and CY550 Stepper Motor System Controllers. The CY545 and CY550 are able to control numerous peripherals, including an LED display and external memory, while the CY545 additionally accepts thumbwheel switch inputs.

In a maximum configuration, the CYB-550 will support Motor control signals, jump, loop, and wait program features, serial I/O, power connections, LED display, and up to 32K external program memory! This kind of power is unprecedented, and we believe you will find many uses for a system this small, complete, and powerful. (However, if all you want is a convenient prototyping board to support Stepper Motor development based on the CY545 or CY550, you are not obligated to use any of the extra features, and they do not cost any more since they are optional. But the CYB-550 has been designed to allow their use if you want to take advantage of them, and clearly, in its maximum configuration, the CYB-550 is a powerhouse.)

In support of either the basic CY545/550 system or a more complete CYB-550 based instrument, the CYB-550 also accommodates a CY233 Local Intelligent Network Controller (LINC) in such a way that up to 255 CYB-550s can be linked on one serial RS-232 line (IBM-PC COM1 or equivalent). This allows up to 255 Motors to be controlled by one PC!

The CY233 40-pin socket may be omitted and the parallel data bus is then available to the user if the Network chip is not desired. The board provides a parallel TTL interface between this socket and the CY545/550. This allows you to use a parallel host, such as 8051s or EPROM 8751s, to control the CY545/550. There are approximately six square inches of wire wrap area available for thumbwheel switches, power drivers, A/Ds, D/As, op amps, etc.

Basic Kit Without CY545 or CY550 (Requires Assembly) @ 11 MHz
CY545 or CY550 Stepper System Controller Chip

Options:

LED Display	HDSP-2112	8-character LED Display
Memory	X2864	Xicor EEPROM
CY233	CY233	Network Controller Chip
Power-4	WM063	Elpac Power Supply
Serial Cable	4RJ-DB25F	4-conductor modular cable with DB25

Panel Software for Stepper Control

CYS 545

*Provides Stepper Motor Control
from an IBM PC*

The CY545B implements serial communications signals (Txd,Rxd,CTS) to easily control a stepper motor from the serial port of an IBM PC. The CY545B may be used on the CYB550 prototyping board, and, with the addition of the CYS545 front panel software package, can provide a complete IBM-PC based stepper motor control system. The motor can be controlled directly from the PC, or external memory may be downloaded for later stand-alone operation.

The CY545B has numerous motor control signals such as pulse, direction, programmable accel/decel, rates up to 27,000 steps/second, and up to 16M steps per motion. It also provides programming features such as jump, loop, and wait, with eight user-

definable I/O lines. All of these features, in addition to an 8-Character LED display and external EEPROM, are accessible through the software package.

The CYS545, uses COM1 or COM2 to directly communicate with the stepper controller. Enter, change, or read back motor stepping parameters stored in the CY545B; write and save external programs to external EEPROM; or read and edit the externally stored programs. As a learning tool, the software filters each command for proper format, parameter values, and appropriateness, and the help screens include command summaries and a pinout diagram.

The 125K byte program requires a CY545B and an IBM-PC or compatible with: 256K RAM, DOS 2.1 or greater, floppy or hard drive, and COM1 or COM2 serial port.

Parameter Display

```

POSITION P=00000000
MAX RATE R=00100
SLOPE S=00220
FIRSTRATE F=00014
NUM STEPS N=00000200
MEM ADDR Y=00003
USER BITS B=65535
D:11111111 U:11111111
            
```

Memory Display

00,	00,	00,	00,	00,	00,	00,	00,
000	016	032	048	064	080	096	112
001	017	033	049	065	081	097	113
002	018	034	050	066	082	098	114
003	019	035	051	067	083	099	115
004	020	036	052	068	084	100	116
005	021	037	053	069	085	101	117
006	022	038	054	070	086	102	118
007	023	039	055	071	087	103	119
008	024	040	056	072	088	104	120
009	025	041	057	073	089	105	121
010	026	042	058	074	090	106	122
011	027	043	059	075	091	107	123
012	028	044	060	076	092	108	124
013	029	045	061	077	093	109	125
014	030	046	062	078	094	110	126
015	031	047	063	079	095	111	127

Page 1

Command Entry

```

CY545 v1.00
© CMS 1990
Cybernetic Micro
Systems, Inc.

> Command Line
            
```

Elapsed CY545 [N] MEMORY [N] Code Space[512]

Date:02-20-90 Time:5:43pm [000:00] COM [1] HP-LED [N] Baud Rate [9600]

<ESC>	BAUD	RESET protocol	MEMory ON/OFF	WRITE memory	ERASE memory
<F1>HELP	COM	CYS45 ON/OFF	MEMory size	READ memory	EDIT memory

2

CYB-550 Specifications

- The CYB-550 board may communicate with the host computer over a standard three-wire RS-232 interface, or it may be used in a stand-alone configuration with an on-board parallel or serial host.
- Supports CY545 and CY550 Stepper Motor Controllers.
- The board can operate at standard baud rates between 300 and 19,200 baud.
- One LED indicates when the 5V power supply is on.
LEDs on 4 Motor Control Lines.
LEDs on 8 User Bit Lines.
- Compact size 100mm x 160mm (approximately 4" x 6.3") single height Eurocard format. Wire wrap area included for customization.
- Power requirements:

Board voltage: +5V (825 mA max) for basic board w/all options.
+5V (375mA max) for basic board w/all options except display.

Optional + and - voltage connections are provided for custom circuits.
RS-232 voltages are generated internally.

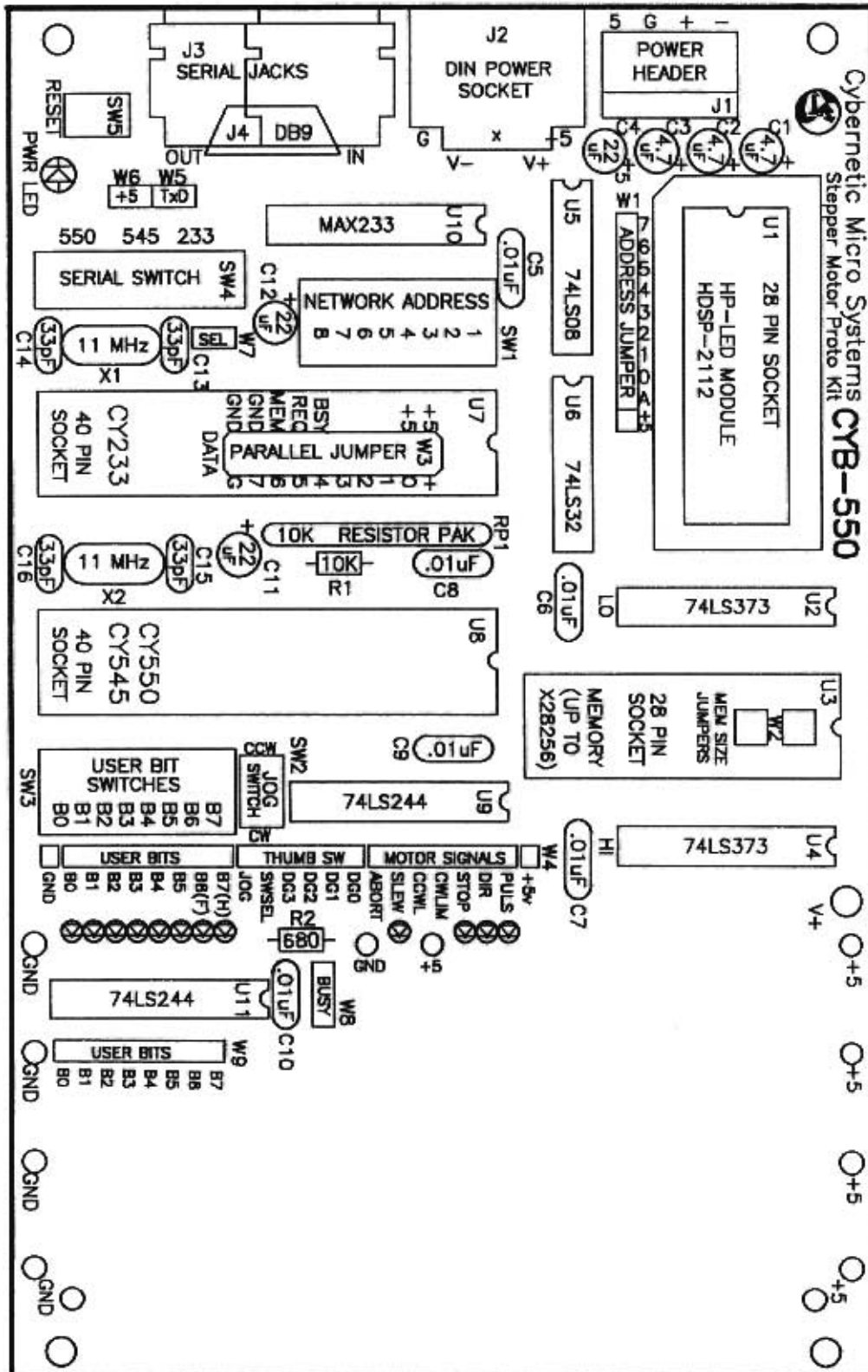
Tools Required

Assembly of the CYB-550 may require the following tools:

- A pair of needle-nose pliers
- A pair of small diagonal cutters
- A soldering iron
- Some rosin core solder
- A Volt-Ohm-Milliamp meter for testing

NOTE: Before assembling this board, you may wish to read the sections following Theory of Operation in order to decide if you will want to modify any of the board configurations. It may NOT be necessary to install some of the components, depending on your application.

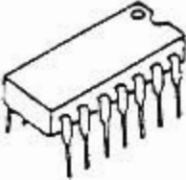
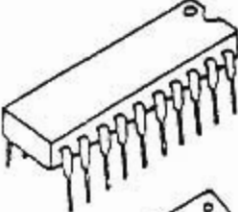
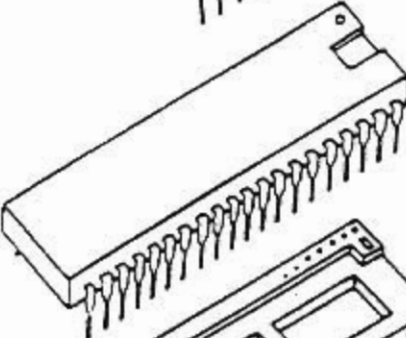
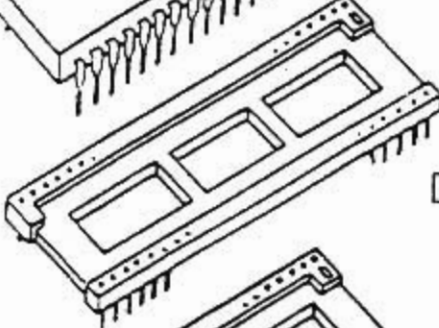
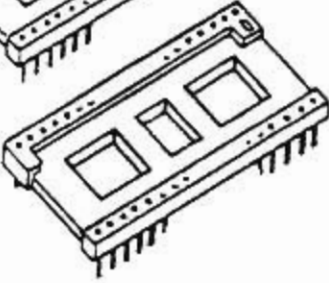
CYB-550 Component Locations and Values

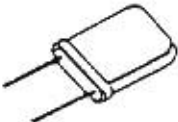



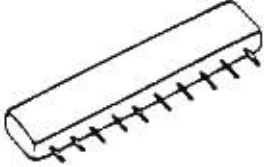
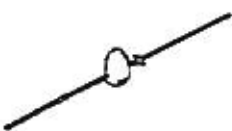
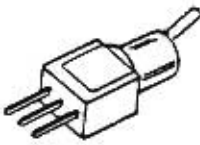


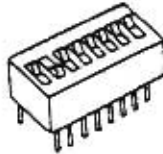


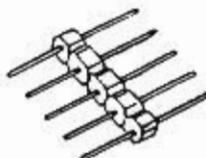
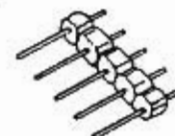
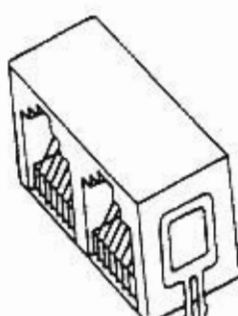
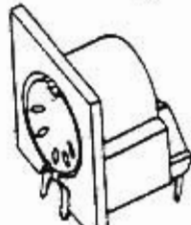
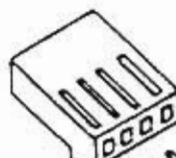
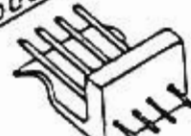

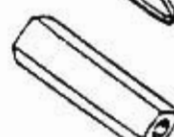

Parts List

The following parts list describes the parts included with the CYB-550. Check the kit to be sure it is complete. The novice assembler may also use this opportunity to become more familiar with the various types of components supplied. **NOTE: DO NOT REMOVE INTEGRATED CIRCUITS FROM THE CONDUCTIVE FOAM UNTIL READY TO USE.**

CYB-550 Basic Board

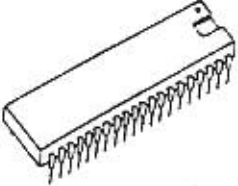
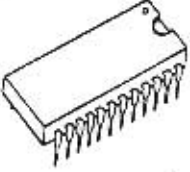
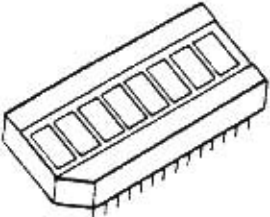
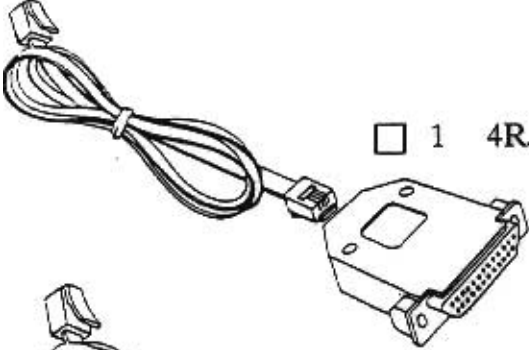
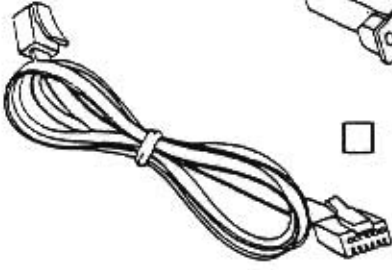
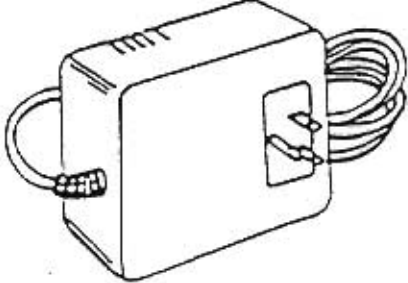
	QTY	PART #	DESCRIPTION
	<input type="checkbox"/> 1	CYB550PWB	Printed Wiring Board
	<input type="checkbox"/> 1	CYB550Man	Assembly Manual
	<input type="checkbox"/> 1	7408	Quad 2 input AND gate
	<input type="checkbox"/> 1	7432	Quad 2 input OR gate
	<input type="checkbox"/> 1	MAX233	RS-232 driver/receiver
	<input type="checkbox"/> 2	74LS244	Octal Tristate Buffer
	<input type="checkbox"/> 2	74LS373	Octal Latch
	<input type="checkbox"/> 1	CY545 or CY550	Stepper System Controller
	<input type="checkbox"/> 2	C89-40-01	40 pin low profile IC socket
	<input type="checkbox"/> 2	C89-28-01	28 pin low profile IC socket

	QTY	PART #	DESCRIPTION (cont)
	<input type="checkbox"/> 2	MP110	11 MHz Crystal
	<input type="checkbox"/> 6	TCD103M	0.01uF 50V ceramic disc capacitor
	<input type="checkbox"/> 4	CCD330	33pF ceramic disc capacitor
	<input type="checkbox"/> 3	513D475M063JA4	4.7uF 63V single-ended electrolytic capacitor
	<input type="checkbox"/> 3	513D226M025JA4	22uF 25V single-ended electrolytic capacitor
	<input type="checkbox"/> 1	R680	BLU-GRY-BRN-gld 680 ohm 1/4 Watt Resistor
	<input type="checkbox"/> 1	R10K	BRN-BLK-ORG-gld 10K ohm 1/4 Watt Resistor
	<input type="checkbox"/> 1	CSC10A-01-10K	10K ohm Resistor Pak 10 pin SIP
	<input type="checkbox"/> 13	HLMP-6600	Red LED w/internal Resistor
	<input type="checkbox"/> 1	TT 11EG PC-1	3 position toggle switch
	<input type="checkbox"/> 1	Alco-FSM	Push Button Reset Switch
	<input type="checkbox"/> 1	MMS-43	4P3T Slide Switch
	<input type="checkbox"/> 2	76SB08	8 position DIP Switch

	QTY	PART #	DESCRIPTION (cont)
	<input type="checkbox"/>	1 CA-S36 SP100-230-930	33 headers, wire-wrap (strips)
	<input type="checkbox"/>	1 CA-S36 SP100-230-430	29 headers, solder tail (strips)
	<input type="checkbox"/>	1 TM2REA-1212	Double RJ11 Jack for RS-232
	<input type="checkbox"/>	1 WMPCBA	180° 5-pin DIN power socket
	<input type="checkbox"/>	1 09-50-3041	4 pin housing, .156 centers, with locking ramp
	<input type="checkbox"/>	1 09-65-1041	4 pin polarized Header, .156 centers, .045 round post
	<input type="checkbox"/>	4 08-50-0106	Crimp pins for above housing
	<input type="checkbox"/>	4 4309	Hex Nylon threaded spacer, 4-40 x 3/4"
	<input type="checkbox"/>	4 2501	Nylon Screw, binding head, 4-40 x 3/8"

NOTE: Certain items may have other values or part numbers substituted for those indicated. These will not affect performance of your kit.

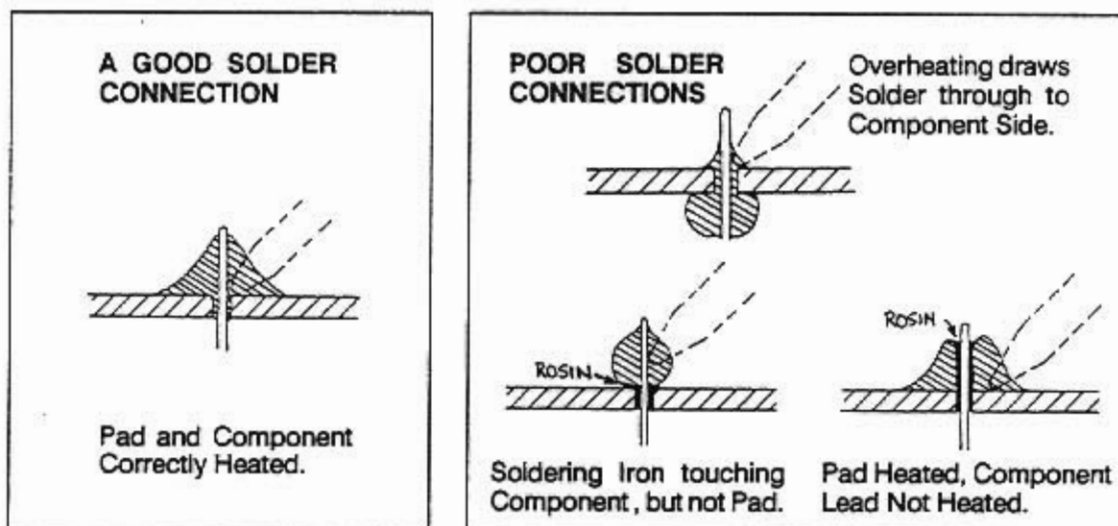
Options

	QTY	PART #	DESCRIPTION
	<input type="checkbox"/> 1	CY233	Serial/Parallel Network Controller IC
	<input type="checkbox"/> 1	X2864AP-45	Memory Chip 8K x 8 EEPROM
	<input type="checkbox"/> 1	HDSP-2112	8 character LED Display Module
	<input type="checkbox"/> 1	4RJ-DB25F	4-conductor modular cable with DB25 connector for CY545 serial signals
	<input type="checkbox"/> 1	6RJ-DB25F	6-conductor modular cable with DB25 Connector transmits all CY550 serial signals
	<input type="checkbox"/> 1	Power-4	Elpac WM063 Power Supply +5 @380mA, +12 @180mA, -12 @180mA, and GND (Will supply adequate power for board w/all options except Display. Will work w/display in the default mode, but not in the full brightness mode.)

Assembly Procedure

The CYB-550 will be assembled in stages, with similar components installed at the same time. Soldering technique is very important when assembling a PC board. The soldering iron tip should be kept reasonably clean during soldering. This usually requires that it be wiped on a damp sponge after every few components. While the iron is not being used, a slight residue of solder on the tip will keep it from overheating, prolonging the tip life. Components should be installed so they rest fairly close to the board surface on the component side (front side, with silk screened printing). Components with long leads (resistors, capacitors) should have the leads cut before soldering. Leads should extend between 1/8 and 1/4 inch from the solder side (back side) of the board.


To solder a component in place, install the component at the proper location on the board. This may require bending the leads of some parts. All components are installed from the component side of the board. Be sure that all leads show through the solder side before soldering, especially when installing the integrated circuits. If required, cut the leads from the solder side of the board. The component is now ready to solder in place. Heat the component lead and the board pad to which it will be soldered for one to two seconds, from the solder side. Then, with the iron still in place, apply some solder to the area. Keep the iron in place until the solder flows around the component lead and pad, then remove. The whole procedure should take from two to five seconds, depending on the size of the component and the board area to which it is attached. When properly done, solder will flow through the hole in which the component is placed, and be visible from the component side. **CAUTION: DO NOT OVERHEAT THE COMPONENT DURING SOLDERING. THIS MAY DAMAGE THE PART.** Also, if the parts are not heated enough, cold solder joints and connections will result. A properly soldered component will have the solder firmly and smoothly melted around both the component lead and over the pad to which it is attached. Solder should flow through the mounting hole and be visible from the component side, but the part should not be overheated and damaged in the process.



The following pages give a step-by-step procedure for assembly of the CYB-550, including photographs of the completed Board.


RESISTORS

The resistors will be the first components installed on the CYB-550. To install each resistor, the leads must be bent and cut to fit. Resistors are installed as follows:

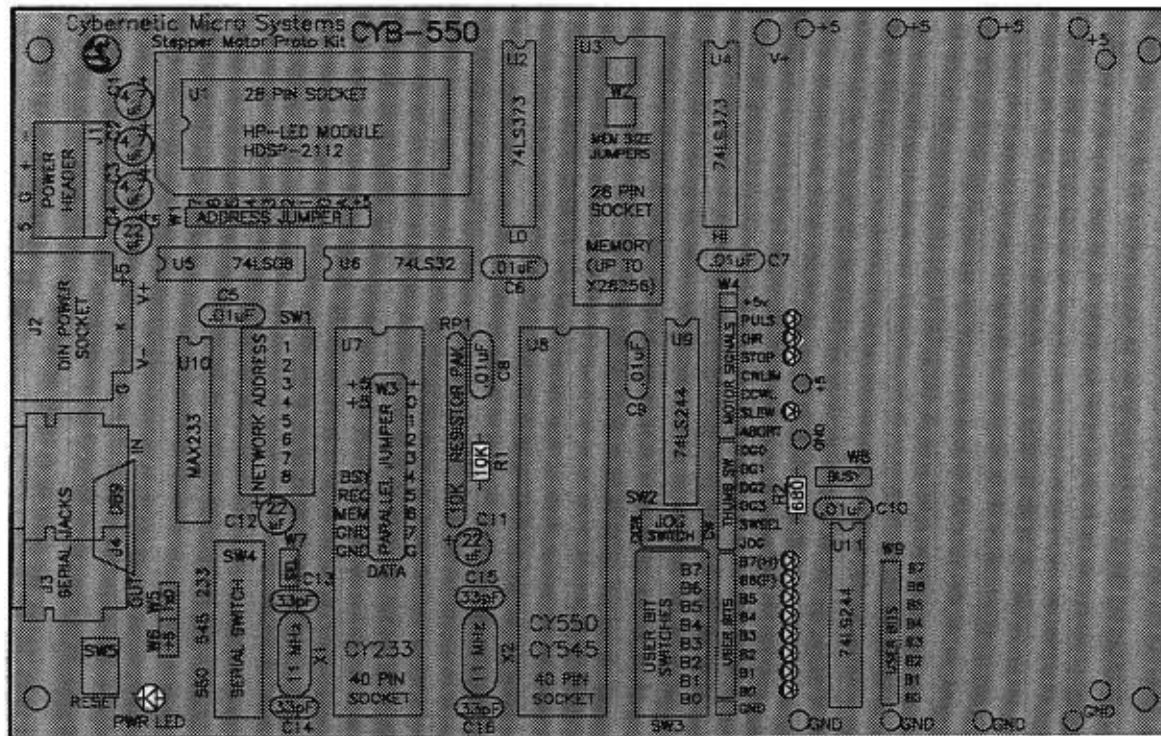
-  Install the 10K ohm resistor (brn-blk-org-gld) in location R1.
- Install the 680 ohm resistor (blu-gry-brn-gld) in location R2.

DIODES

There is one miniature light emitting diode (LED) indicating power is applied to the CYB-550 and additional LEDs on the outputs of the CY545/550. The LEDs are polarized and must be installed properly to work. The cathode (negative) side is indicated by a bar across the lead, and is shown as a bar on the silkscreen. This cathode side should face the edge of the board. The positive or anode side of the LED is shown on the silkscreen as a triangle and is connected to +5 volts.

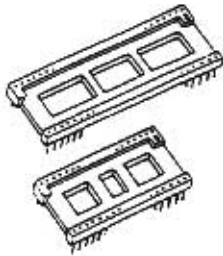
-  Install the Power LED at location PWR, next to SW5 reset switch.
- Install 12 LEDs near the wirewrap area of the board next to W4.

Note:
The negative side of the LED may be indicated by a painted silver stripe on LED body.

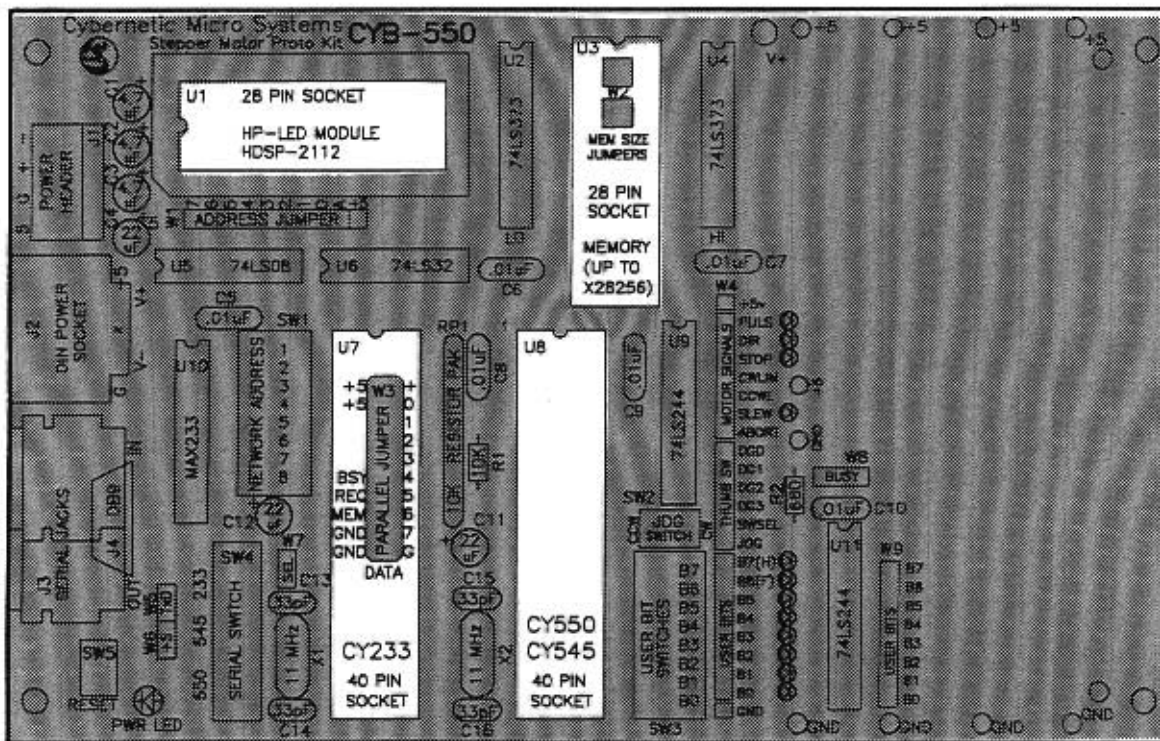


INTEGRATED CIRCUIT SOCKETS

Solder tail sockets are provided for the CY545/550, CY233, Memory, and LED Display. The sockets have a notch or other marking to designate the pin 1 side, and should be installed to match the patterns of the CYB-550 silkscreen.



- Install the 40 pin solder tail sockets in locations U8 for the CY545/550, and U7 for the CY233 if the parallel interface is not being used. (See "Strip Line Headers" before installing socket in U7)
- Install the 28 pin solder tail sockets in locations U1 and U3 if using the LED Module and the Memory options.





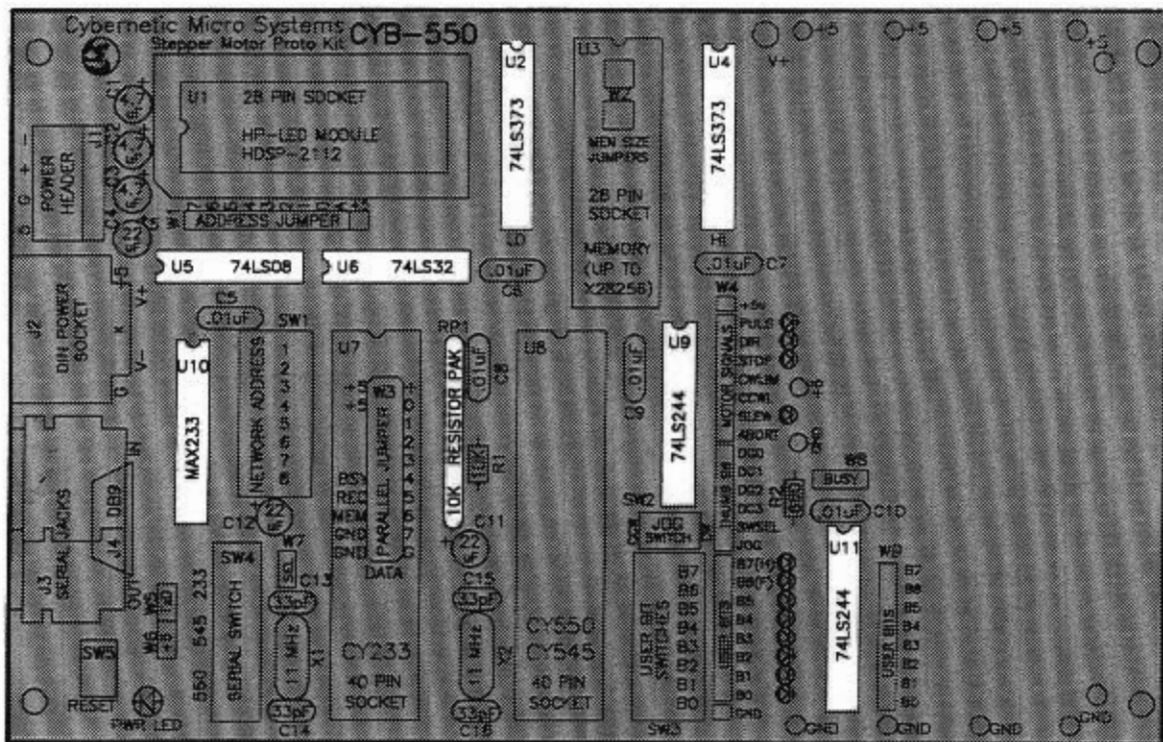
INTEGRATED CIRCUITS

The Integrated Circuits (ICs) are the next components to be installed. They are the most sensitive to damage from static electricity and overheating during soldering. When handling the ICs, touch the pins as little as possible. Keep them in the conductive foam until ready to install. In order to fit the pins into the hole patterns, it may be necessary to bend them in slightly, so they are perpendicular to the IC package. This is most easily accomplished by laying the IC on its side on the work surface and pushing on the body until the pins are straight. This procedure should be repeated for each side. The ICs must



be properly oriented when installed. Any part installed backwards will be damaged when power is applied to the CYB-550. Each IC package has a notch or dot on one end, which corresponds to the pin 1 side of the IC, and should be installed to match the notched pattern of the silk screen. Before soldering the IC in place, be sure every pin is through the proper hole in the pattern. It is very difficult to remove and correct a pin problem once the IC is soldered. Finally, during soldering, heat the pins just enough to make a good solder bond. If the ICs are overheated during soldering, they may be damaged. Be sure to solder each pin and be careful to not leave any solder bridges between the pins.

-  Install the 7408 in location U5.
-  Install the 7432 in location U6.
- Install the two 74LS373s in locations U2 and U4.
- Install the two 74LS244s in locations U9 and U11.
- Install the MAX233 in location U10.
- Install a 10-pin 10K ohm resistor SIP in location RP1. The common pin of the resistor pak, indicated by a dot or other marking, should match the square pad on the board, nearest the RP1 label.



CAPACITORS

Capacitors will be installed next. Leads should be trimmed to the proper length before soldering. The ceramic disc capacitors have no polarity, while the electrolytic capacitors are polarized and must be installed with the proper orientation. All polarized capacitors are noted by a "+" on the board and a "+" or "-" on the capacitor body. The capacitors are installed as follows:



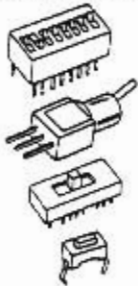
- Install four 33 pF ceramic discs in C13, C14, C15, C16.
- Install six 0.01 uF ceramic discs in C5, C6, C7, C8, C9, C10.



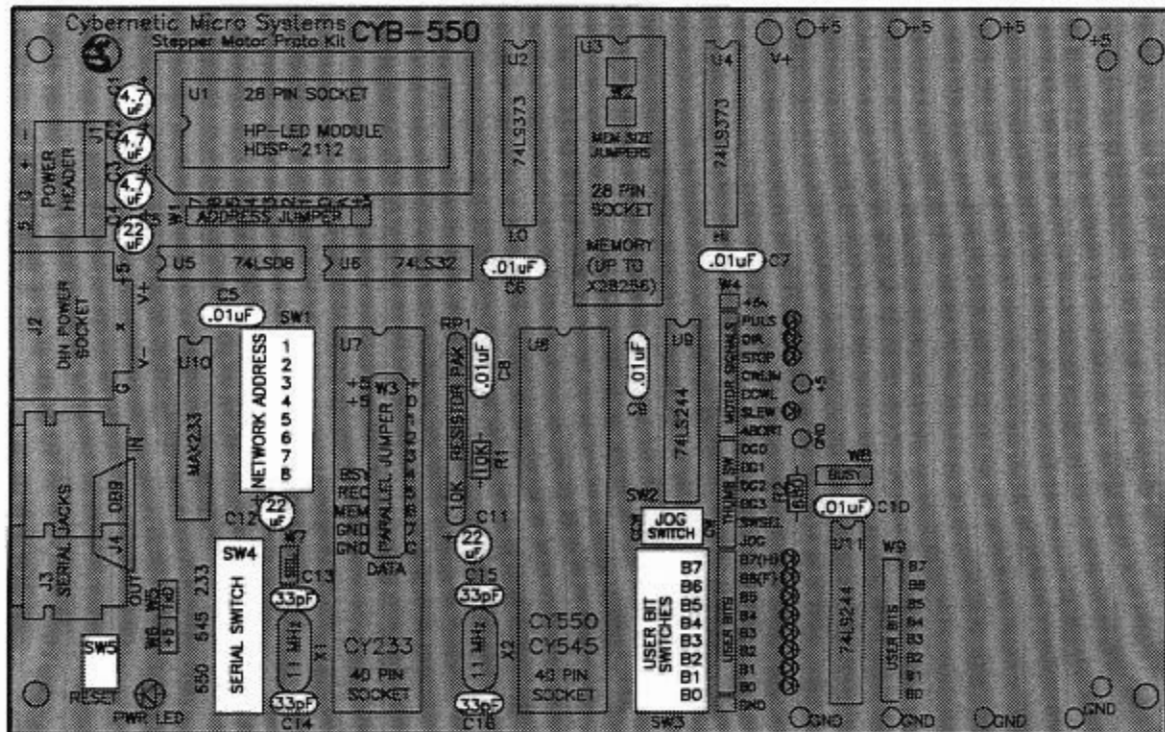
- Install the three 22 uF electrolytic capacitors in C4, C11, C12.
- Install the three 4.7 uF electrolytic caps in C1, C2, C3.

SWITCHES

There are five switch locations on the CYB-550, at locations SW1 to SW5. There is no electrical polarity to these switches. However, the 8 position DIP switches at SW1 and SW3 have a proper orientation, due to the numbering scheme of the 8 switches, requiring switch position number one to match the pattern on the board.

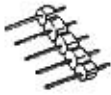
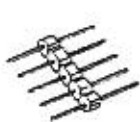


- Install the two 8-position DIP switches at locations SW1 and SW3.
- Install the 3-position toggle switch in location SW2.
- Install the 3 position slide switch at location SW4.
- Install the push button reset switch at location SW5.



STRIP LINE HEADERS

Wire wrap posts are provided in single-row strips which are broken into the appropriate lengths and soldered into the jumper pads. Jumpers are then wired together by wrapping a short piece of wire wrap wire between the appropriate posts or by using shorting plugs. Solder tail posts, which have one section slightly longer than the other, are also used on the CYB-550. The solder tail posts should be inserted with the short, solder tails protruding through the board to the solder side. This leaves the slightly longer section of the post available on the component side for attaching the jumper wires. Wire wrap posts, which have one section much longer than the other, should be inserted with the longer wire wrap tails protruding through the solder side of the board. Connections from these jumpers would be wired from the solder side.



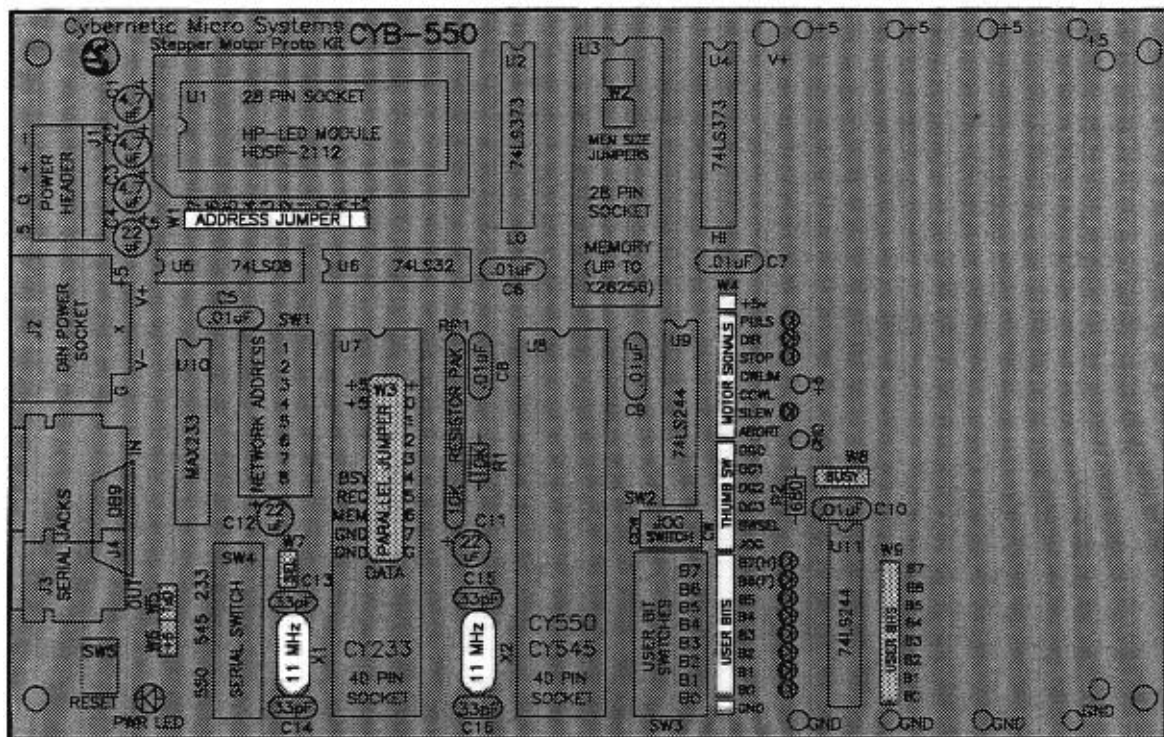
- Install wire-wrap posts in jumpers W1 and W4.
- Install solder tail posts in W3 only if a parallel interface is used. If you are not sure whether a parallel interface will be used, then W3 headers may be inserted on the back of the board and socket U7 may then be inserted on the front of the board.
- Location W2 does not use posts. Posts may optionally be installed in locations W5 - W9, but are not necessary to operate the board. They would be used for special options as explained in the "Jumper Functions".

CRYSTALS

There are two 11 MHz crystals on the CYB-550, one each for the CY545/550 and the CY233. The crystals are installed standing up, to minimize occupied board space.



- Install two 11 MHz crystals in locations X1 and X2.



CONNECTORS

The CYB-550 is supplied with a double female RJ11 telephone-style serial connector for the RS-232 interface. The receptacle should face away from the board.



- Install the RJ11 RS232 connector in location J3. A female DB9 pattern at location J4 occupies the same space as the RJ11 pattern, and you may use your own DB9 female connector instead of the RJ11.

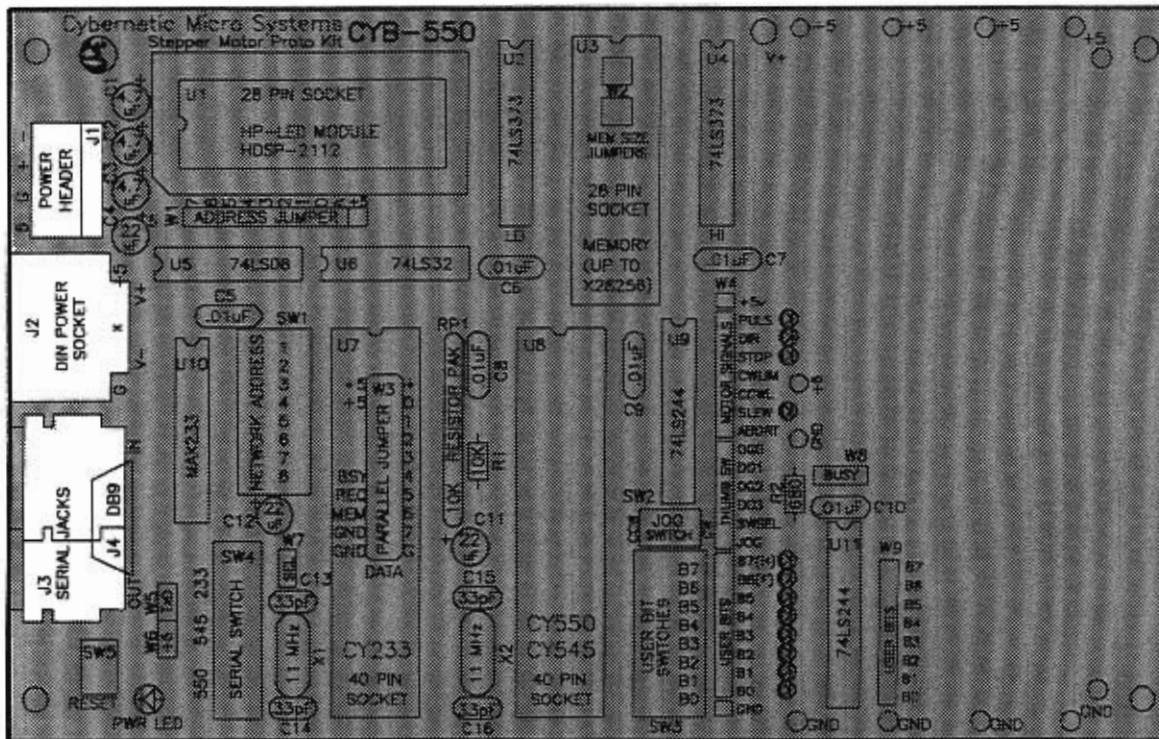
Two power connectors are supplied with the board: a 180° 5-pin DIN connector and a 4-pin power header. The header half of the 4-pin power connector is installed on the board, and the connector housing and crimp pins are for fabricating a connection to your power supply. You may install either or both connectors.



- Install the 5-pin DIN power connector in location J2.



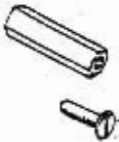
- Install the 4-pin power header in location J1. The connection pins should face the edge of the board.



Clean the board according to the following instructions and follow the "Final Assembly and Checkout" procedures at the end of this manual before inserting the CY233 and CY545/550 in the 40 pin sockets at U7 and U8, or the LED display and Memory chip at U1 and U3. Be careful to match the notch in the chip with the silkscreen pattern on the CYB-550.

When all the parts have been installed, the board should be cleaned to remove the solder flux residue which results from the soldering operation. It is only necessary to clean the solder side of the board. The board should be cleaned with rubbing alcohol, which does not leave a residue. It is often helpful to use a toothbrush or similar device to help scrub the board. Once the flux has been removed, the solder side may be scrubbed with a mild soap and water solution, then rinsed with clean water. Do not immerse the board, as this may damage some components. Rather, rinse the solder side of the board gently under running water. The board should be reasonably clean and free of flux when this operation is complete. Dry the board gently to remove all water. Do not apply power to the board until it is completely dry.

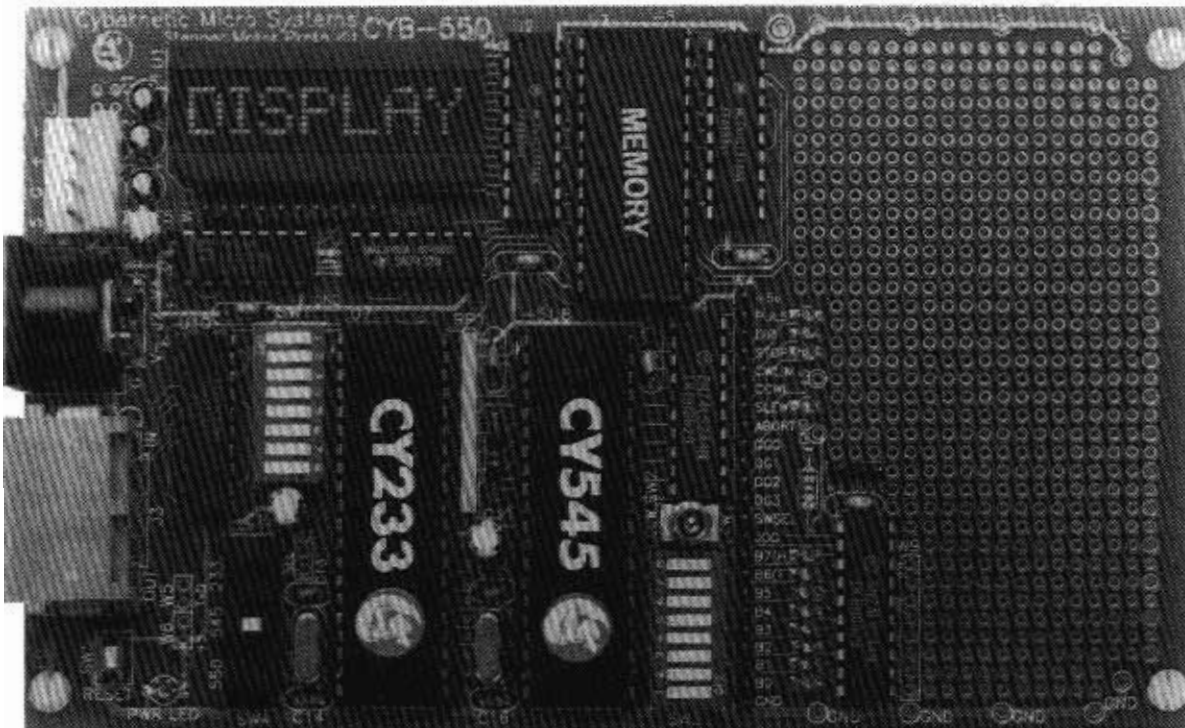
The screws and spacers are used as feet for the four corners of the CYB-550 board.



- Install the 4 spacers and screws on the four corner mounting holes.

This completes the main assembly procedure. The following sections explain the theory of operation, which must be understood to determine the proper jumper connections and switch settings. Then the jumper options are explained and the connector pinouts are listed. This will allow the user to make the cables necessary to connect the board to the local computer, the power supply, motor driver, and other parts of the system, as required.

Assembled CYB-550 (with Options)



CYB-550 Theory of Operation

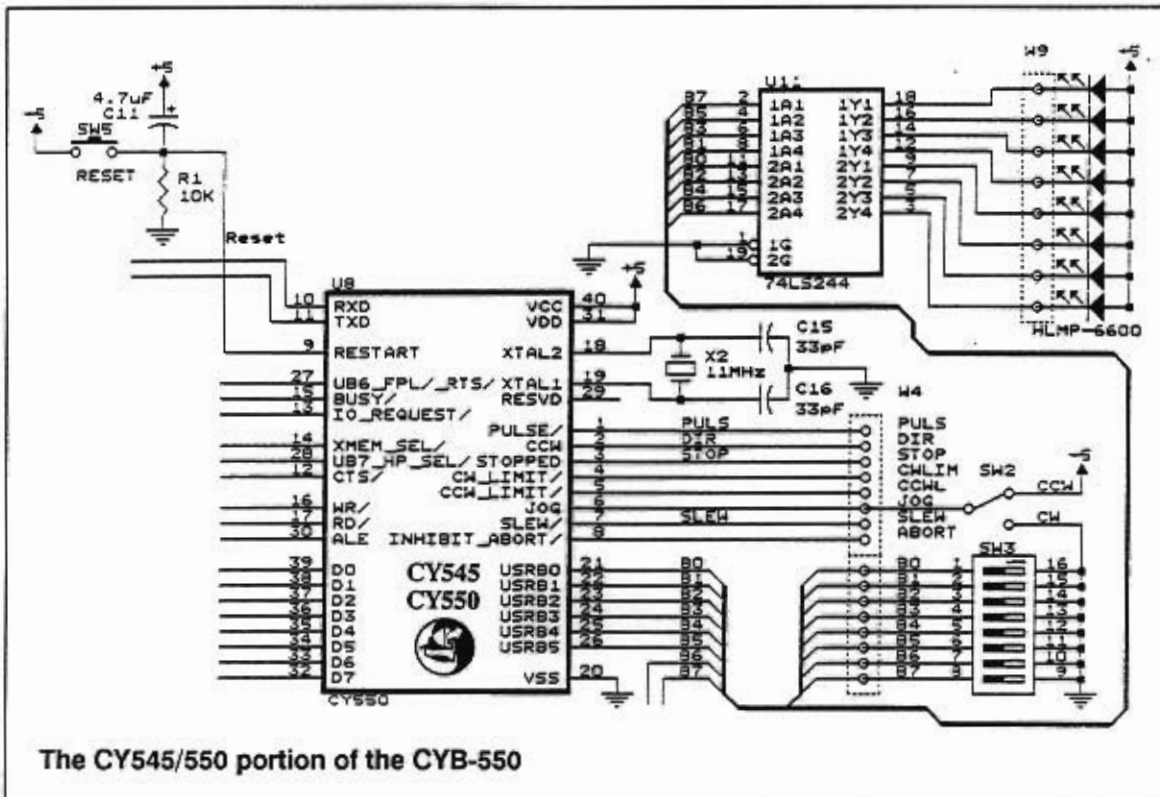
The CYB-550 Prototyping Board implements the basic support circuits for the CY545 or CY550 Stepper System Controller chip. This includes the CY545/550 itself, the CY233 LINC for networking multiple CY545/550s, local external memory, a local HP LED display, partial thumbwheel switch interface, and a wire wrap prototyping area. The CYB-550 schematic is included in this section, and is the basis for this discussion.

The CY545 /CY550

The CY545/550 is the key component of the CYB-550 board. It is the Stepper System Controller, and is described in detail in the CY545 or CY550 User Manual. Included are descriptions of all pin functions and commands. This information will not be repeated here.

Support circuits for the CY545/550 include a crystal circuit, which provides the basic timing for the device. The default value for this crystal is 11 MHz, which allows the CY545/550 to generate all the standard serial baud rates. Also included are a 4.7 uF capacitor and 10K ohm resistor, which provide an automatic reset when power is applied to the board.

The CY545/550 motor control signals are brought to wire wrap posts at W4, where they may be connected to interface circuits for your motor power driver, limit switches, and other direct motor control functions.



The CY545/550 User Bits are also brought to wire wrap posts at W4, and may be used as required by your application. The User Bits are also available at W9, but are outputs only because W9 signals have been buffered by the 74LS244.

The data bus signals of the CY545/550 are connected to the other components on the board, as are the appropriate control signals. The data bus is also available at header W3, along with the parallel command interface control signals, for connecting the CY545 in parallel to a host system.

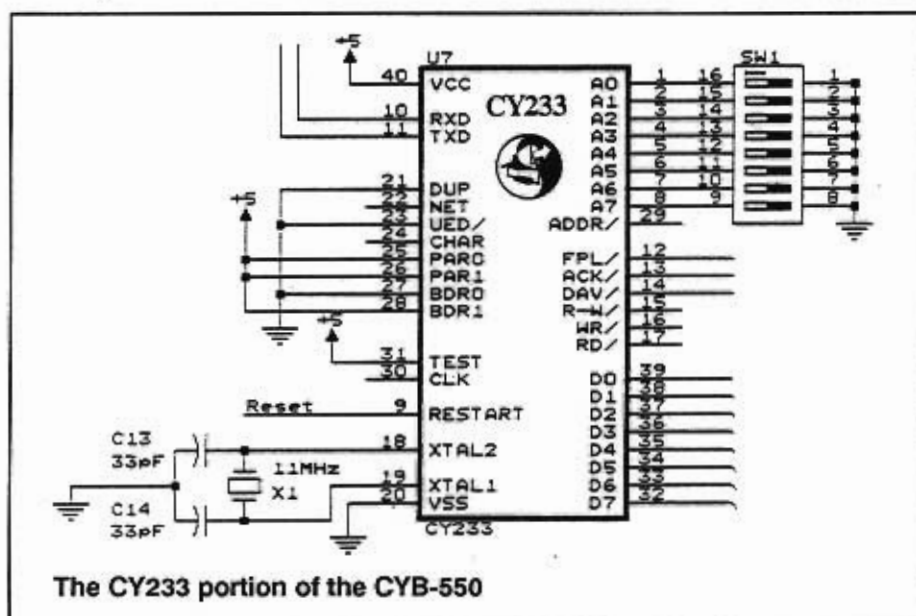
The serial lines connect to the chip select switch SW4, then to the MAX233 transmitter/receiver, and through it to the RJ11 serial interface jack.

The CY233

The CY233 option allows the CYB-550 to be used in a Network mode, with multiple CYB-550 boards controlled from one host serial port. The CY233 operates with address support and message based serial communications, or in the UART mode, with simple serial to parallel data transfers.

Support circuits for the CY233 include a separate crystal oscillator and an automatic power on reset circuit, shared with the CY545/550.

The CY233 address lines are connected to address switches, making it easy to select a decoded mode address. This allows up to eight CYB-550 boards to be controlled by one serial port. If more than eight boards must be controlled from the same port, the CY233 must be operated in encoded mode, which requires you to cut the U-E-D signal trace from ground, and add custom address decoding circuits. Details of encoded mode are discussed in the CY233 User Manual. For the default decoded mode, simply close one of the switches to select the address for that CYB-550. The other switches should be left open.



The data transfer handshake signals are connected to the appropriate CY545/550 signals, implementing the proper parallel interface between the CY233 and the CY545/550. The data bus signals are directly connected between the CY233 and CY545/550

The serial lines also connect to the chip select switch SW4, then to the MAX233, and through it, to the RJ11 serial jack. For convenience in daisy chaining multiple boards together, the RJ11 jack is a dual jack, with an input side and an output side. The CY233 received data signal is connected from the input side, while the transmitted data signal may be connected to the input jack or to the output jack, as required.

The CY233 mode control signals are hard wired on the CYB-550. The signals are floating, connected to +5 volts, or connected to ground, selecting 2400 baud, no parity, 8-bit data, ASCII characters, decoded 1-of-8 addressing, slave mode, and echo invalid. These modes may be altered by cutting traces where needed, and reconnecting the signals as required by the new modes. All traces are accessible on the solder side of the CYB-550. Refer to the CY233 User Manual for connections and functional details of the other possible modes.

CY545 CTS/ Signal Considerations

When using a CY545, there are multiple functions assigned to User Bit 6, pin 27. With a CY233, this pin performs the FPL/ function directly with the CY233. The signal function is automatic when the parallel interface is selected, with FPL/ driven low by the CY545 when there are data to output, such as a response to a query command or parallel output of a quoted message.

When the CY545 direct serial interface is used, without a CY233, User Bit 6 can optionally be used as a Clear To Send (CTS/) signal. This must be selected by a mOde command, with bit 5 of the O command argument set. See the CY545 User Manual for more details.

The CTS/ signal cannot be enabled automatically within the CY545, since the active level for this signal is low, which conflicts with the level if the signal is used as FPL/ instead. This would cause handshake functions with the CY233 to fail all the time! Thus, the user must issue a mOde command to enable CTS/.

Since CTS/ defaults to the off state at power up, this can sometimes cause problems with host system serial drivers that expect CTS/ to be active before sending any commands to the CY545. There are two options for solving this problem. First, enable the host serial driver without CTS/ testing, and issue a mOde command to the CY545 to enable CTS/. Then re-enable the host serial driver with CTS/ testing on. We show an example program, written in BASIC, in the CY545 User Manual that performs this function. If the host system CTS/ testing cannot be disabled to send the mOde command, the second option must be used. In this case, the mOde command to enable the CY545 CTS/ signal can be put in a local, external, non-volatile memory for the CY545, along with the "Auto Start" key, which will cause the CY545 to automatically execute the mOde command at every reset. Note that this approach can also be used to set the CY545 baud rate to a fixed value, if desired, by use of another mOde command.

An example command sequence to automatically enable CTS/ from the local memory is shown below:

Y 0 < cr >	Set memory pointer address to zero
E < cr >	Following sequence is recorded to memory
< Ctrl-R > 4V	"Auto Start" key sequence 12h, 34h, 56h
O 0A0h	mOde command selects ASCII, enables CTS/ and selects serial interface
. . .	include any other "Auto Start" commands here
0 < cr >	Stop external memory command execution
Q < cr >	End of memory content definition

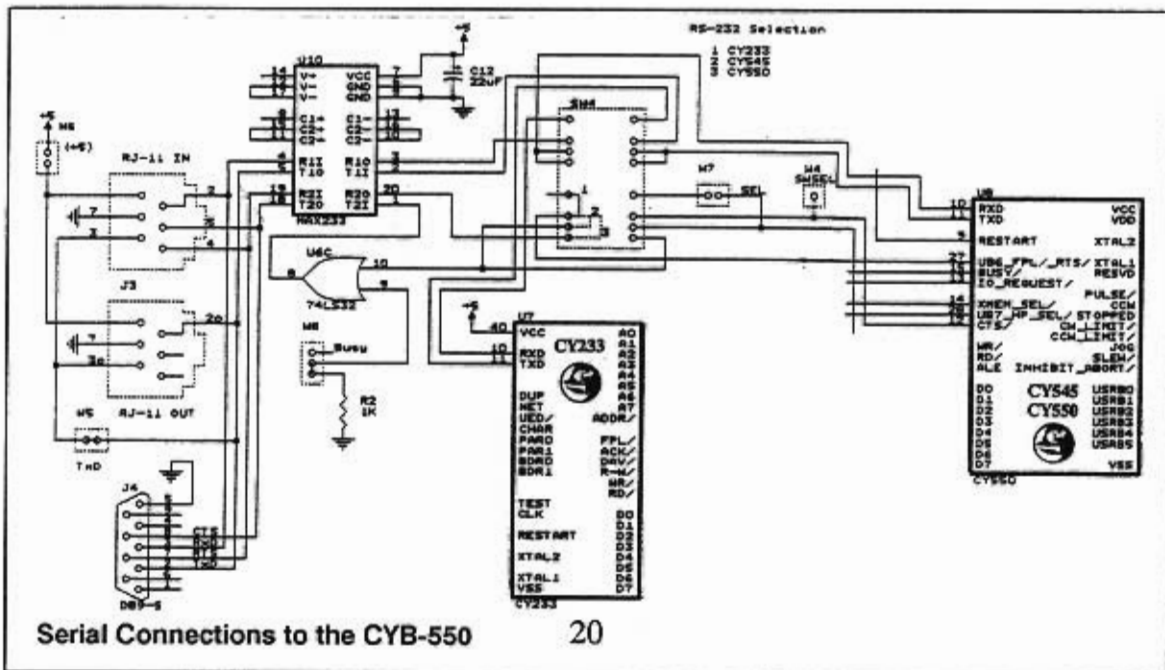
The above sequence of memory based commands, starting with the mOde command, will be executed every time the CY545 is reset, since the "Auto Start" key sequence is recorded in the first three locations of the memory.

For more details on external memory support, see the CY545 User Manual. This CYB550 board already has circuitry designed to support a local external memory. The /M memory option includes a 2864 8K x 8 EEPROM memory, which is writable and non-volatile.

The Serial Driver/Receiver

The CYB-550 serial interface is supported by the MAX233 chip, which has internal voltage generation and two sets of drivers and receivers. With the internal RS232-level voltage generator, the MAX233 requires only a +5 volt connection, allowing all circuitry on the CYB-550 to operate off of only one +5 volt power supply.

One set of drivers and receivers is connected through a chip select switch to the Transmit and Receive lines of either the CY233, CY545 or CY550. The second set is connected through the switch to the CTS and RTS lines of the CY545/550.

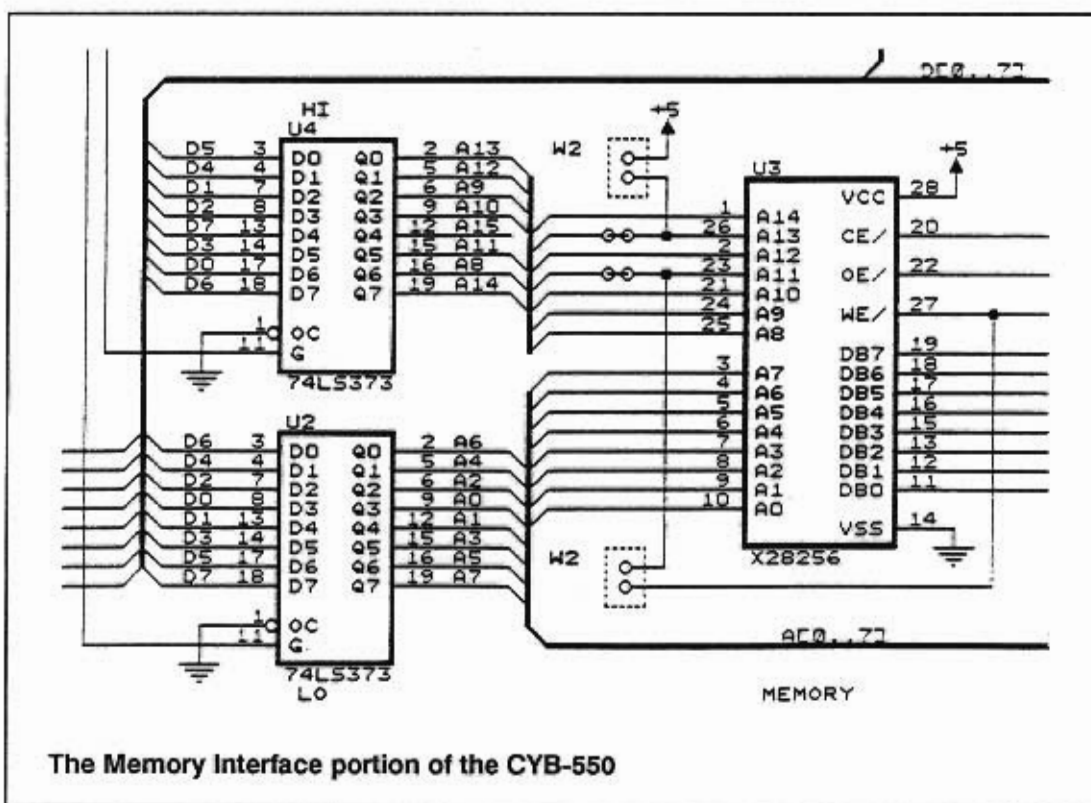


The Memory Interface

The memory interface of the CYB-550 is designed to accept a variety of different memory devices, including SRAM, EPROM, and EEPROM. The memory option supplied by Cybernetic Micro Systems uses an EEPROM, so that the memory contents can be written through the CY545/550, and the contents will be retained when power is removed from the board.

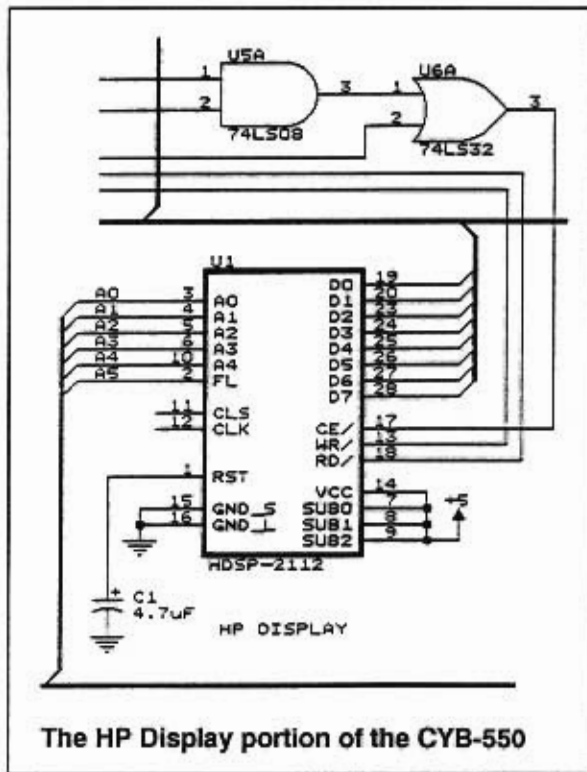
The memory chip fits into a 28 pin socket, wired to accept up to a 256 Kbit (32 Kbyte) memory. However, smaller memories will also work, and 24 pin memories require a jumper change at W2.

The addresses for the memory, display, and thumbwheel switch interfaces are generated by the CY545/550 data bus, and are latched by the 74LS373s near the memory. Only the memory chip uses the high byte of the address, while all the interfaces use the low byte.



The HP Display

The CYB-550 also supports the HDSP-211x displays from Hewlett Packard. These are 8 character LED displays, with all drivers, character generator, and refresh logic in one module.



The HP Display portion of the CYB-550

The display is directly controlled by the CY545/550 when the proper output mode is selected, using the mMode command. The lower address lines are used to select the internal register and character locations of the display, while the control signals generate chip select and read/write strobes.

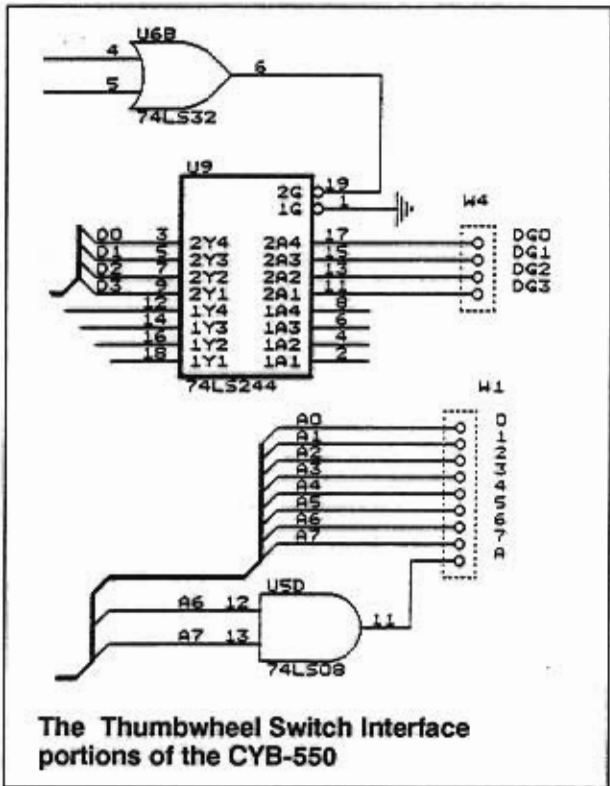
When the CYB-550 is used with the memory and display options, a complete stand-alone motor controller can be implemented. The CY545/550 uses the memory to obtain the desired command sequence, and uses the display to inform the operator of the status, or to prompt for input as required. No host computer is needed in this configuration, once the memory contents are defined!

The Thumbwheel Switch Interface

Also implemented on the CYB-550 board is a partial thumbwheel switch interface for the CY545. This includes the address lines, a 74LS244 buffer, with proper enabling logic, and the combination of address lines A6 and A7, ANDed by a 74LS08.

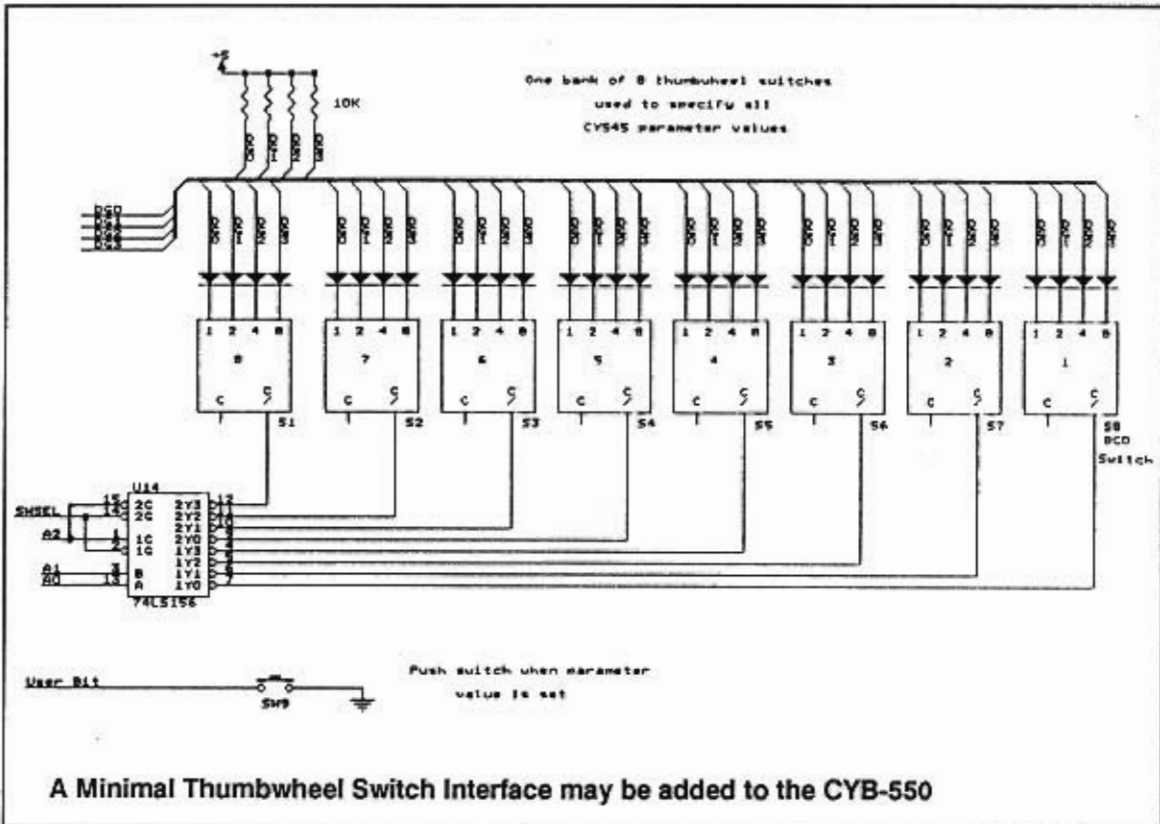
To complete the interface, you must add a 74LS138 for each group of parameters that require thumbwheel switch inputs, plus a 74LS156 for each individual parameter, plus the thumbwheel switches themselves. The complete interface is discussed and shown in the CY545 User Manual.

Note that the CY550 does not support thumbwheel switches.



The Thumbwheel Switch Interface portions of the CYB-550

It is also possible to implement a minimal thumbwheel switch interface, with one set of 8 thumbwheels used to control the values of all parameters. Such an interface requires only the addition of a 74LS156, plus the 8 thumbwheel switches, and is shown below:



To use this interface, you must set the proper parameter value into the thumbwheel switches before they are read by the CY545. This will usually involve a prompt message from the CY545, telling the operator to enter the specific parameter, for example, "Enter Rate Now".

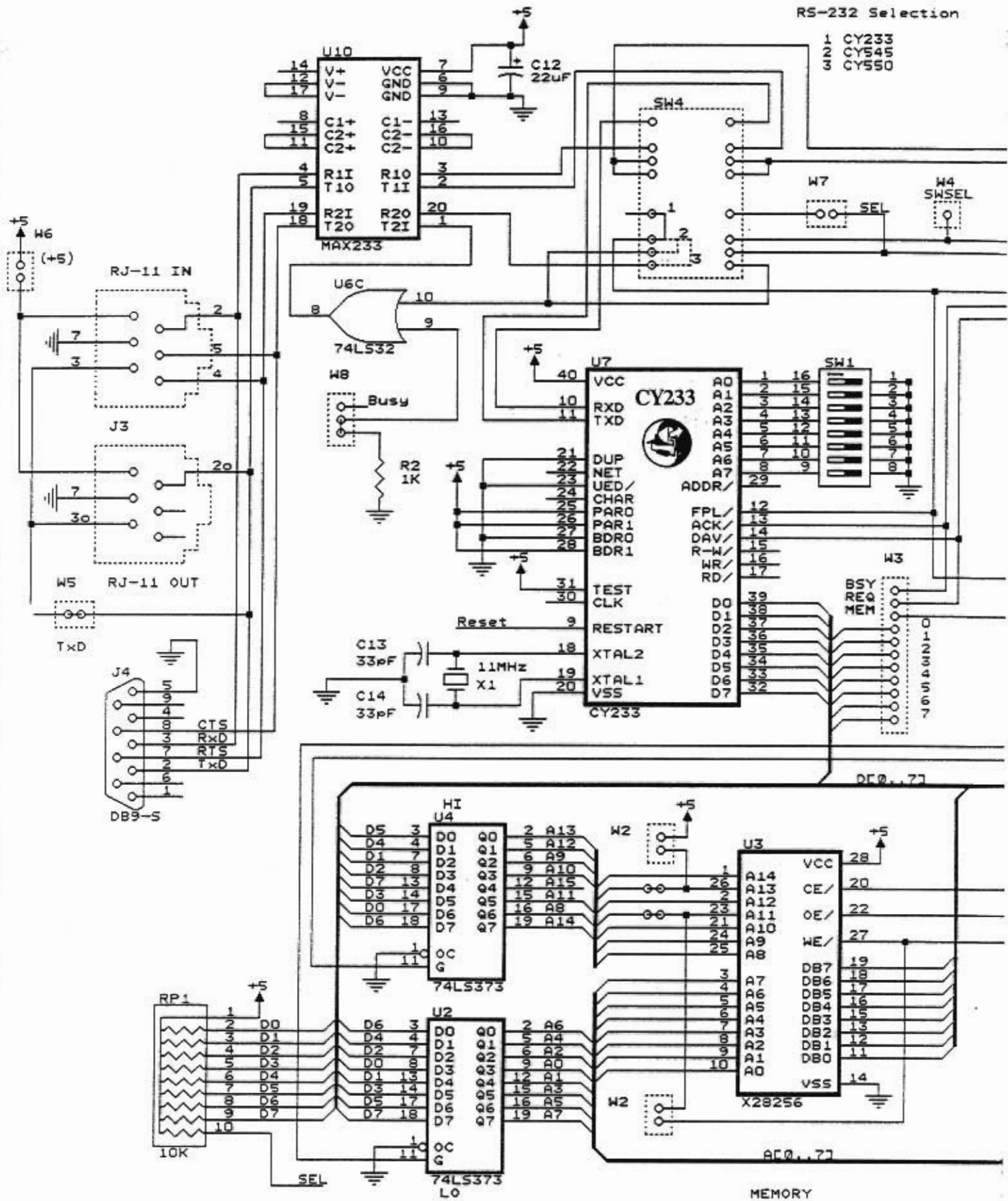
The CY545 must then wait for the number to be set before the thumbwheels are read. This could be done by waiting for one of the user bits to change state, with the operator pushing an enter button after the thumbwheels have been set.

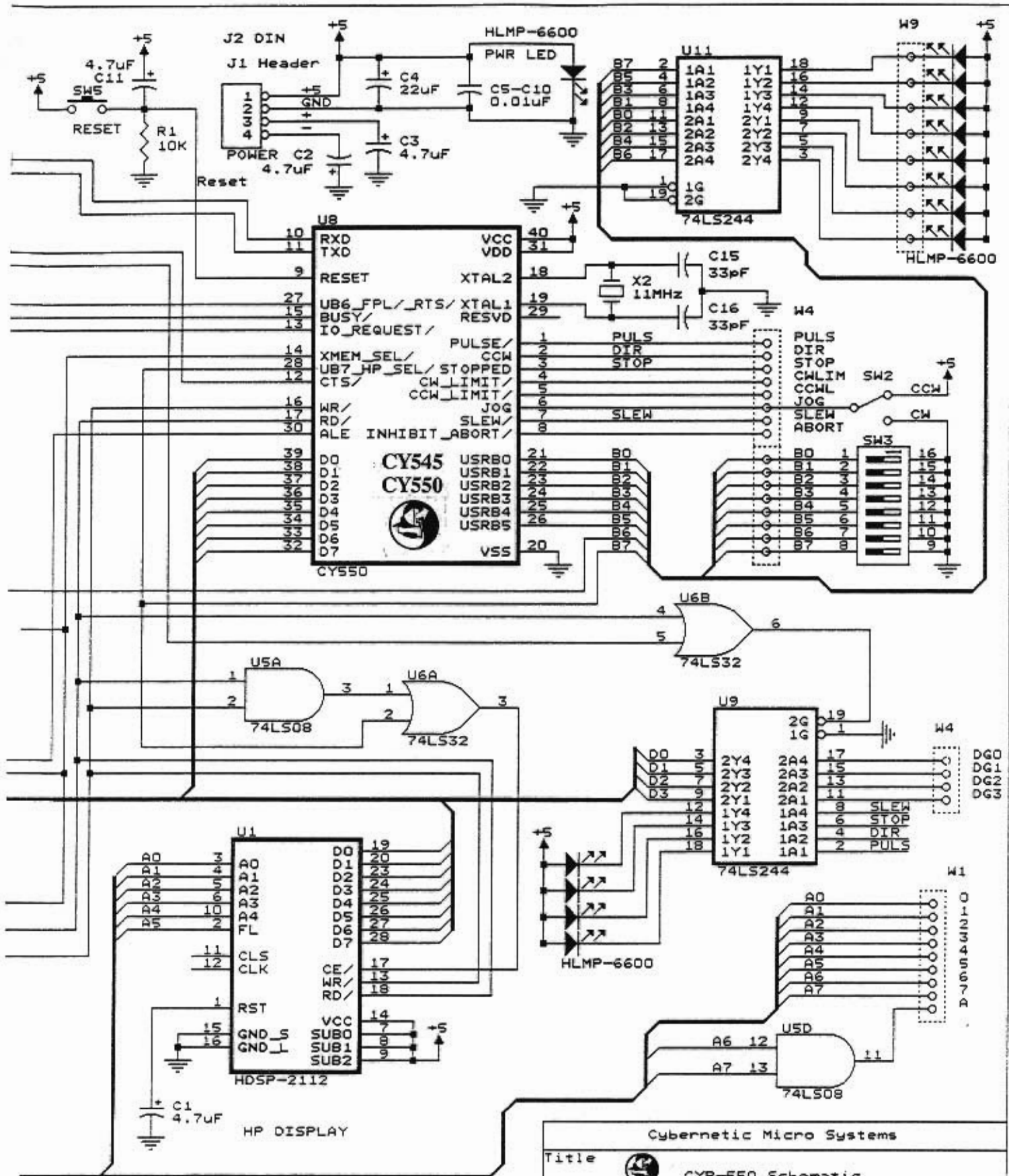
Now the CY545 can read the parameter, with the proper command following the wait for user bit, such as "R # < cr >".

This sequence must be followed for each parameter read from the switches, since all parameters are read from the same set of switches.

RS-232 Selection

- 1 CY233
- 2 CY545
- 3 CY550



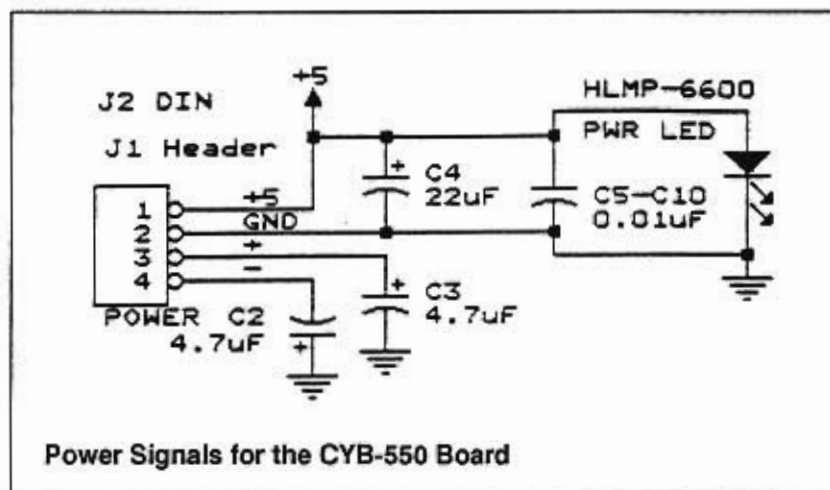


Power and I/O

The final section of the CYB-550 board covers the power supply inputs and signal I/O functions. The board uses only +5 volts, since the RS-232 driver voltages are generated internally by the MAX233. When +5 volts is supplied, an indicator LED will be on, showing that power is applied.

There are two power connectors on the CYB-550. One is a four pin, polarized header (J1), with matching connector supplied. This allows you to wire your own supplies into the board. Note that the extra "+" and "-" voltages are not used by the CYB-550 circuitry, but are available in case you need them in your wirewrap application.

The second power supply connector is a 180° 5-pin DIN connector, at location J2. This connector is compatible with the Elpac WM 063 series of power supplies. These supplies also make a "+" and "-" voltage available if required by your application.



Location J3 is the RJ11 dual jack, used for RS-232 serial communications. The RS-232 signals are connected through J3 and J4, and then are switched to the CY545/550 or the CY233 through switch SW4. You may optionally install a DB-9S connector in J4 in place of the RJ11 dual jack.

Finally, the wire wrap area may be used for any custom circuits required by your application, including motor power driver interfaces, and completion of the thumbwheel switch interface.

Jumper Functions

Various options on the CYB-550 circuit design are selected by connecting the appropriate jumper pads together. Each jumper group is indicated by a "W" jumper number, with individual jumper pads in each group designated by unique labels. Small wire wrap posts are provided in a strip with the CYB-550. These posts may be broken to the appropriate length and soldered into the jumper pads. Jumpers may then be connected by shorting plugs or wire wrap wires between the pads involved.

The following sections describe each jumper and discuss the possible connection options. All jumpers are also shown on the CYB-550 schematic.

W1 Address Signals

W1
07
06
05
04
03
02
01
00
0A

The low address signals from the 74LS373 are brought to W1 (labeled 0 through 7). These signals may be used for further decoding in custom CY545 thumbwheel switch circuitry. The signal labeled "A" is the combination of A6 and A7, ANDed through a 74LS08. This signal provides the enable to the third 74LS138 of a full thumbwheel switch interface design. See the CY545 Thumbwheel Circuit Diagram in the CY545 User Manual for more details. The CY550 does not support Thumbwheel Switches.

W2 Memory Size Jumpers

Two sizes of memory packages, 24 pin or 28 pin, may be used on the CYB-550. The default size is the 28 pin configuration. To use a 24 pin Memory, the traces connecting the two pairs of round pads may be cut on the back of the board. Then a wire may be soldered between the pairs of square pads, as shown in the figure.



W3 Parallel Port

W3
+5 0 +
+5 0 0
0 0 1
0 0 2
0 0 3
BSY 0 4
REQ 0 5
MEM 0 6
GND 0 7
GND 0 G

The parallel data bus is brought to W3 for use in parallel interfaces to the board. The support signals for a parallel interface, XMEM, BUSY, and IO REQUEST are also available on this jumper, as are +5 volts and Ground. A 2x10 or 2x8 header may be used in this location. Three spare posts are available for any use.

W4 Motor Support Signals

W4	+5v	
	PULS	⊗
	DIR	⊗
	STOP	⊗
	CWLIM	
	CCWL	
	SLEW	⊗
	ABORT	
	DG0	
	DG1	
	DG2	
	DG3	
	SWSEL	
	JOG	
	B7(H)	⊗
	B6(F)	⊗
	B5	⊗
	B4	⊗
	B3	⊗
	B2	⊗
	B1	⊗
	B0	⊗
	GND	

The first section of W4 provides access to most of the CY545/550 motor support signals. The second set supports the thumbwheel switches, and the third set accesses the user bits. The signals may be used as required by your circuit and application.

LED indicators on Pulse, Direction, Stopped, and Slew light up when the signals go low. Thus, you'll see lights with each step pulse, CW direction, when stepping, and when slewing at the maximum step rate.

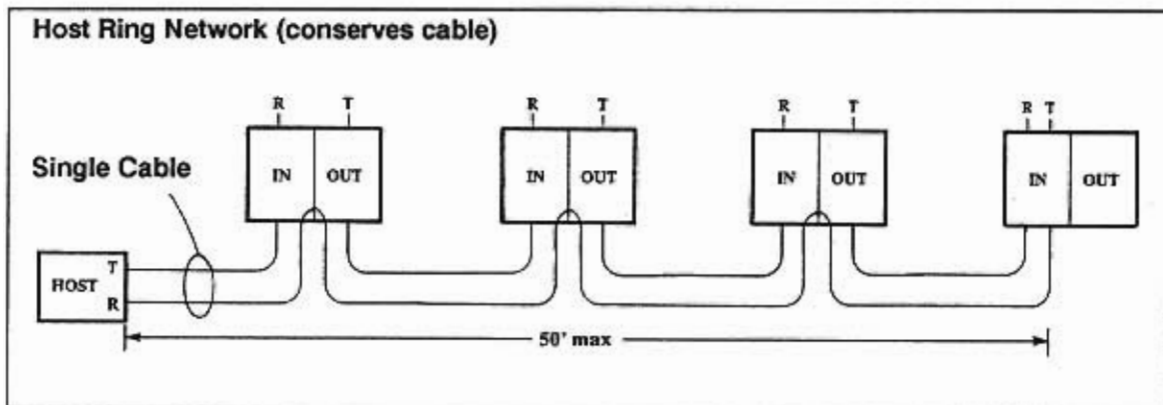
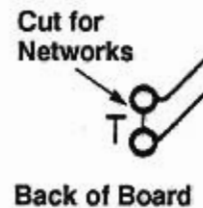
LED indicators on User Bits are off when the bits are high, the power-on state. The LEDs light up as the bits go low. Thus, when using CTS/ with the CY545, B6 lights up when the chip is Ready and turns off when Busy.

The wire wrap area is located next to jumper W4, making it especially easy to add the necessary interface circuits between the CYB-550 and any external connections.

Note that the CY545/550 provides limited drive current on its signals, so buffers may be required when the signals drive off-board connections. For example, buffers or opto-isolators may be required between the CY545/550 and the power driver stage for the stepper motor. This would be most critical on the Pulse and Direction signals of the CY545/550.

W5 Serial Turnaround Jumper

This jumper is hardwired closed and provides a serial turnaround of Tx/D when only a single RJ11 Jack is used (the IN jack). This is the case for most single board serial applications and for the terminating board of a network. For networking applications, the trace connecting the two pads should be cut, and Tx/D will only transmit on the OUT jack as shown below:



W6 Network +5 Volts

The +5 volt power supply may be networked through a series of boards via the serial cable. To take advantage of this feature, connect the W6 pads together and use a 6-wire serial cable between the boards. Do NOT bring the +5 volts back to your IBM-PC or Host. Use a four-wire cable to the Host.

○ open
○ No +5 volts on RJ11

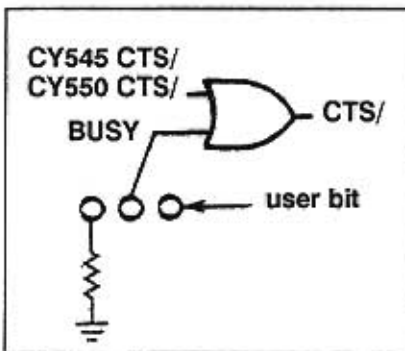
○ closed
○ +5 volts passed through

W7 CY545 SwSel Jumper

W7
SEL

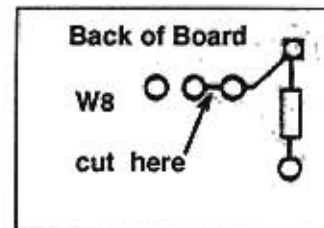
Since pin 12 of U8 is used for CTS on the CY550 and for SwSel on the CY545, the pin is left open when the CY233 is the object of serial communications. If the Serial Chip Select switch is set to the CY233 position, a CY545 is in U8, and if you are using the thumbwheel switch input, then you will need to connect the pads at W7 to enable SwSel. If using the CY233 and the CY550, then the jumper **must** be left open. All other cases are "don't care".

W8 Additional Busy Signal - User Defined

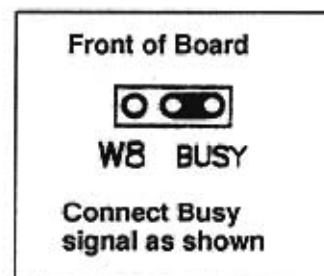


The CY545 and CY550 provide a clear-to-send (CTS) signal that remains high while the chip is busy processing commands. There may be times, such as when executing stored routines, that you may want a "program busy" signal in addition to the standard CTS. This signal, generally a user bit, may be brought to W8. When the User bit input to W8 is high, or CTS from the chip is high, a busy, or high, will be sent on CTS to the host computer. When **both** signals are low, the computer may resume sending commands.

To use W8, you will need to cut the trace connecting the center post of W8 to a pull-down resistor. The resistor provides a constant Ready signal. Bring any unused user bit (except UB6) to the outer post marked "BUSY". Then Jumper the BUSY post to the center post, using a wirewrap wire or shorting plug.



To abandon the double busy, move the shorting plug over to the left pair of posts to again enable the pull-down resistor. Alternatively, the user bit switch may be closed, to pull the signal to ground, for a constant Ready.



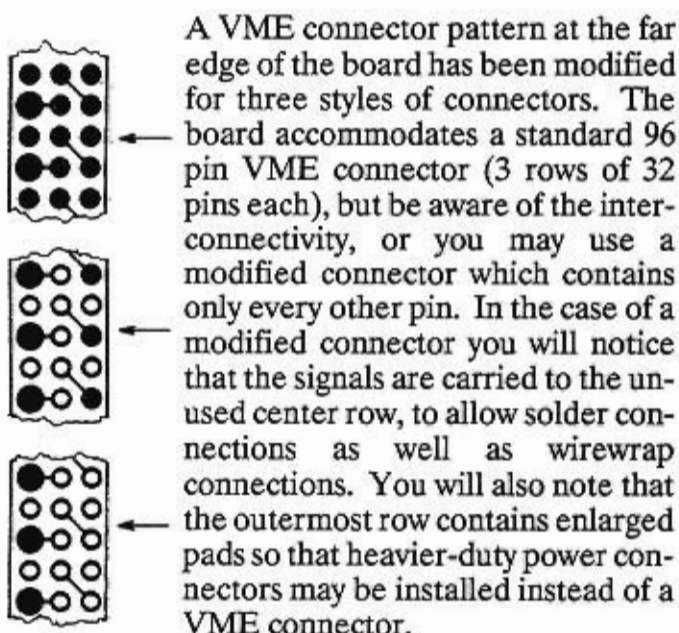
At power-on or reset, the user bits default high, and your selected user bit would need to be set low prior to enabling the CTS mode (see CY545 Mode Command). To use the BUSY signal in a stored program, the bit should be set high (i.e. B_0) at the beginning of the program, and should be set low (/B_0) at the end of the program.

W9 Buffered User Bits

The 8 bidirectional user bits are brought to W4. The signals then pass through the 74LS244 at U11. These buffered signals are tapped at W9 to provide Output-Only user bits for custom circuitry. The signals at W9 are repeated on 8 pads beneath the 74LS244 at U11.

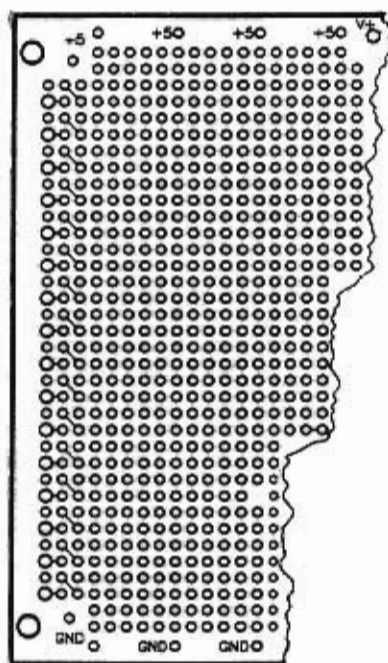
Wire Wrap Area

A wirewrap area is provided for custom circuitry such as the thumbwheel switches or power drivers. Both +5V and GND are brought to pads at the top and bottom edges of the board, and a single larger pad near U4 provides access to an additional power supply.



VME Style Connector

Back of Board



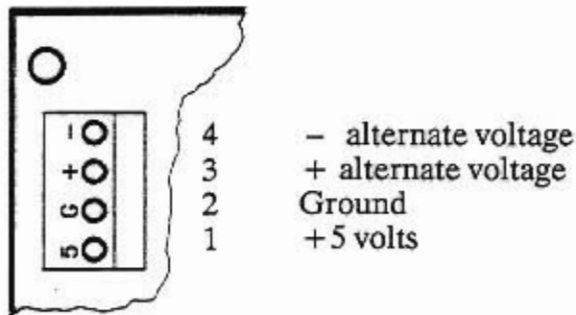
Wirewrap

Power Connector Pinouts

J1 Power Header

Connector J1 is used to bring power to the CYB-550 circuits. It is a standard 4 pin header, with pins on 0.156" centers. The mating connector is also supplied with the CYB-550. Pin 1, the +5 volt input, is physically closest to J2, while pin 4, the negative voltage input, is closest to the edge of the board. The alternate + voltage is also brought to a pad near the wirewrap area if needed for motor driver voltage.

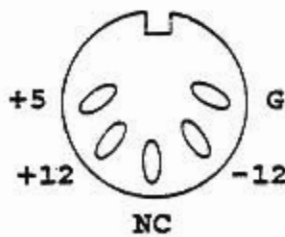
J1 Power connector



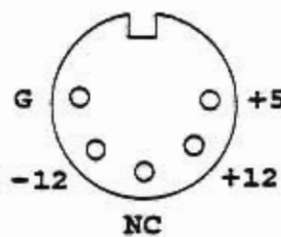
J2 DIN Power Connector

The connector at J2 is the alternate power supply connector for the board. The 5-pin 180° 1/2 inch diameter DIN receptacle is compatible with the Elpac WM 063 series of wall mount regulated power supplies. Power supplies with incompatible connectors may be used by removing the supply's output connector and replacing it with a custom wired DIN plug on the power supply output lines, using the figures below for reference.

Board Receptacle



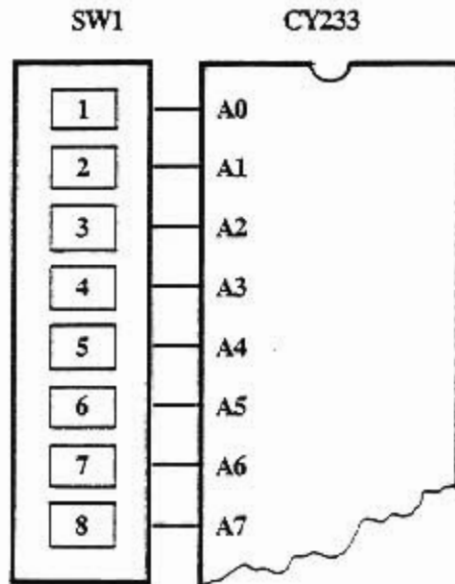
Power Supply Plug



Note that the CYB-550 board only requires the +5 volt supply (the RS-232 voltage levels are generated on the board by the Max233), so the + and - voltages on J1 and J2 may be unused. These additional supply inputs are provided to support custom circuits, as required by the application.

SW1 Network Address Switch

The Address Switch (SW1) is an 8 position DIP Switch (SPST Make-or-Break) package. The eight positions are connected to the CY233 address lines A0 - A7, and provide one-of-eight addressing for use in network configurations. Closing only one switch selects the address for the board by connecting that address line to ground. If the address mode is not used, the eight switches are ignored and become available to the user for any purpose.



More than eight boards may be networked using encoded addressing in the wirewrap area. See the CY233 manual for details.

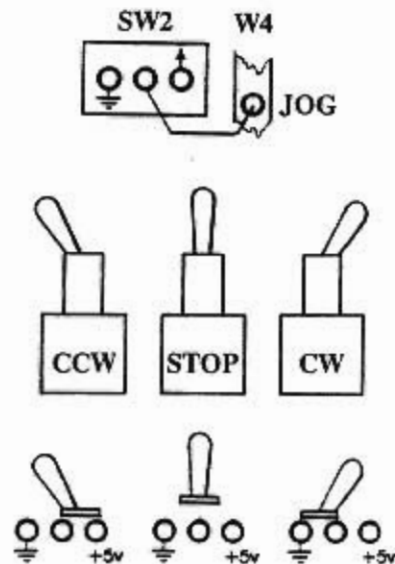
If the CY233 is not used, it may be desirable to omit the DIP switch and use wirewrap posts for custom applications. You will note an additional row of holes in SW1 to accommodate a double row of wirewrap posts.

SW2 Jog Switch

The Jog switch is a SPDT switch which connects the JOG line High, floating, or Low (Make-Break-Make). The Jog line is always tested by the CY545 and will cause the motor to Jog continuously CW or CCW while the switch is tied to either GND or +5 volts, respectively. The motor will stop stepping when the switch is returned to the center position.

The Jog line is also brought to a post on W4, so if the post is used in an active interface, the switch should either be set in the center position or be omitted from the board entirely to avoid conflicts.

If the switch is omitted from the board, it should be noted for future reference that the labels on the face of the board at SW2 (CW and CCW) refer to the switch action (see figure), which is opposite from the electrical polarity of the actual pads on the board. The pads on the back of the board are labeled according to the electrical polarity rather than the switch position.

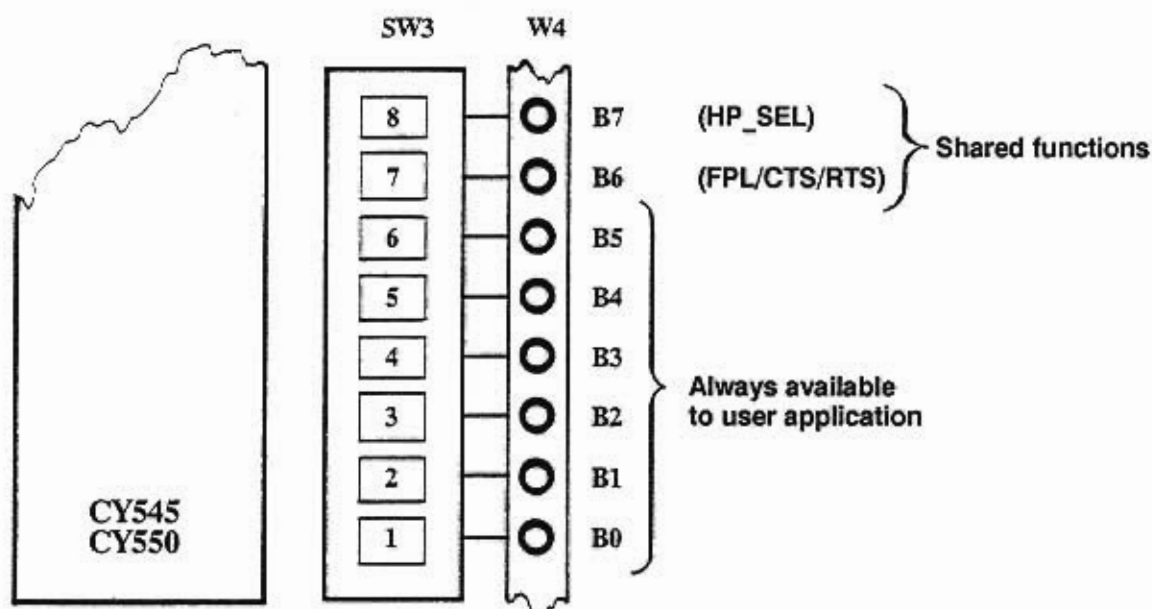


SW3 User Bit Switch

The User Bit Switch (SW3) is an 8 position DIP Switch (SPST, Make-or-Break) package. The eight positions are connected to USB0 - USB7, and provide a connection to ground when the switch is closed (the signals are internally held high when the switches are open). The first 6 switch positions are dedicated to the user bits, while the upper 2 user bits are shared functions.

User Bit 6 (Switch 7) is shared as the FPL signal for the CY233, CTS for the CY545, and RTS for the CY550. Since all of these are serial communications functions, User bit 6 should be left open if using any serial communications.

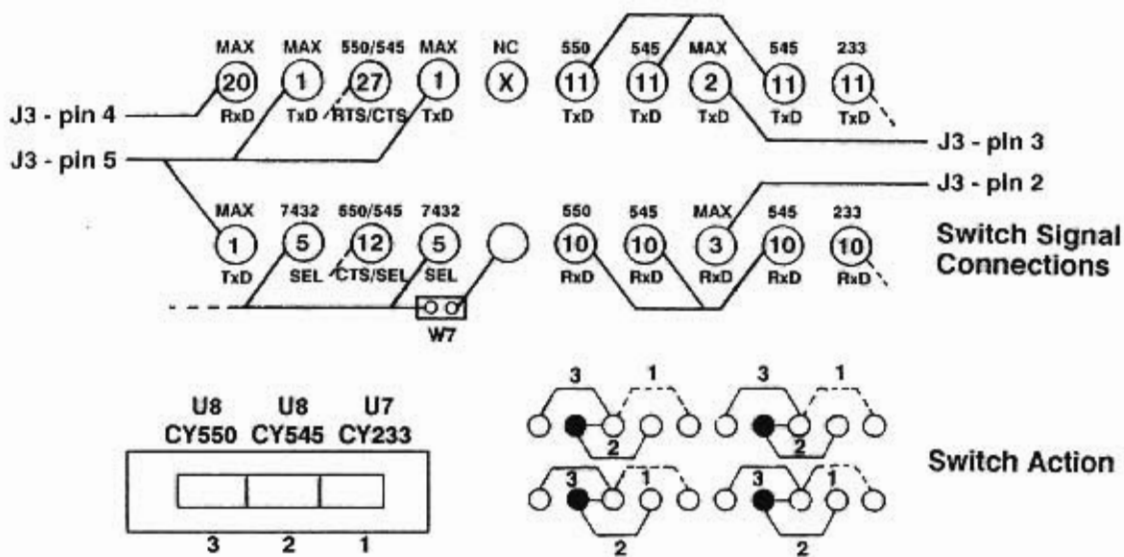
User bit 7 (Switch 8) is shared with HP-SEL and is not available as a user bit if the HP Display is used. It should be left open in this case.




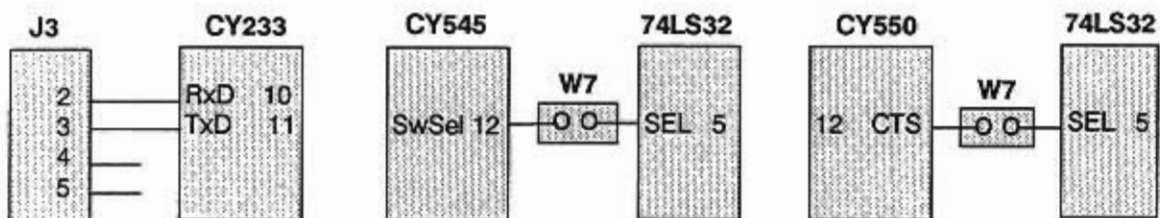
These eight user bit signals are also brought to posts at W4 and to an additional row of pads under the switch to allow interfacing to external circuitry. If these lines are driven by this other circuitry, then the switches should be set in the open position, or else the DIP Switch may be entirely omitted from the board.


SW4 Serial Chip Select Switch

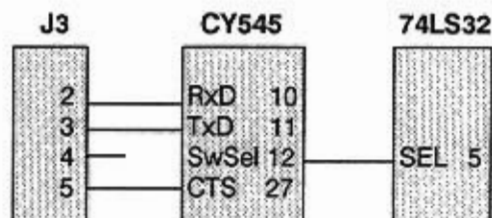
The chip select switch at location SW4 directs serial communications from the RJ11 Serial jack, through the Max233, to either the CY233, CY545, or CY550. This complicated switching is provided by a 4P3T switch. A standard 4P3T switch has a pin pattern that provides polarity. This board has been designed to accept the switch in either polarity, allowing the use of various vertical or right angle switches, if desired. Although Break-before-Make action is preferred, Make-before Break has no harmful effect. The switch positions provide the following connections:



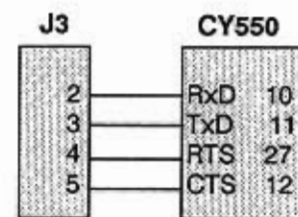

 Position 1 connects the CY233 serial signals to the RJ11 and can connect the CY545 SwSel signal to the thumbwheel circuitry if jumper W7 is used. (See discussion of W7.)




 Position 2 connects the CY545 serial signals to the RJ11 and connects SwSel to the thumbwheel circuitry.




 Position 3 connects the CY550 serial signals to the RJ11.

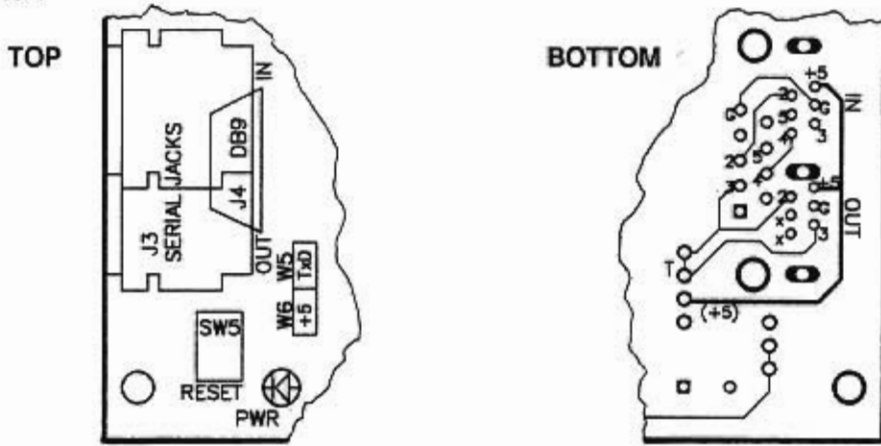


SW5 Reset Switch (Push Button)

The Reset switch at SW5 is a normally-open push button switch. Pressing the button pulls the CY545/550 and CY233 Reset lines high, providing a hardware reset of both U7 and U8. An extra pad is provided beneath the switch, connected to the combined reset lines, so that you may access the reset from external circuitry.

J3 Double Serial Jack

The RJ11 telephone style jack accepts a four- to six-wire telephone cable. The pin numbers on the RJ11 serial Jack1 (IN) and Jack2 (OUT) at location J3 are labeled to correspond with the pin numbers of an IBM PC compatible DB25 connector. The signals TxD, RxD, CTS, RTS, and GND are available at J1 IN and J1 OUT. A +5 volt signal is also available at J1 IN and J1 OUT for use in a multi-board network by connecting the pads at jumper W6. The +5v signal should not be connected to the host computer.



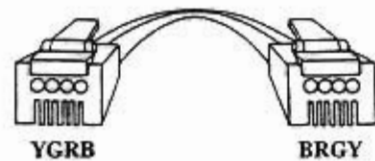
J4 Optional DB9 Serial Connector

A DB9 pattern is provided at location J4 with pads labeled to correspond with the pin numbers of an IBM PC compatible DB25 connector, consistent with the RJ11 labels above. The pattern is wired for a female DB9S connector for an IBM-AT computer, and the only signals connected are Gnd, TxD, RxD, CTS, and RTS. You may install your own DB9 connector instead of the RJ11 jacks.

The Serial Cable

The double RJ11 is designed for use with data-type cables, where pin 1 polarity is maintained. Cybernetic Micro Systems provides this style of cable with its products. When using the single RJ11, the data-type cable is recommended, but a standard phone cable will work as long as the proper adjustments are made within the DB25 connector. When using both serial jacks in a network, only data type cables should be used.

Standard Phone Cables:



Data Cables are recommended and maintain pin 1 polarity:

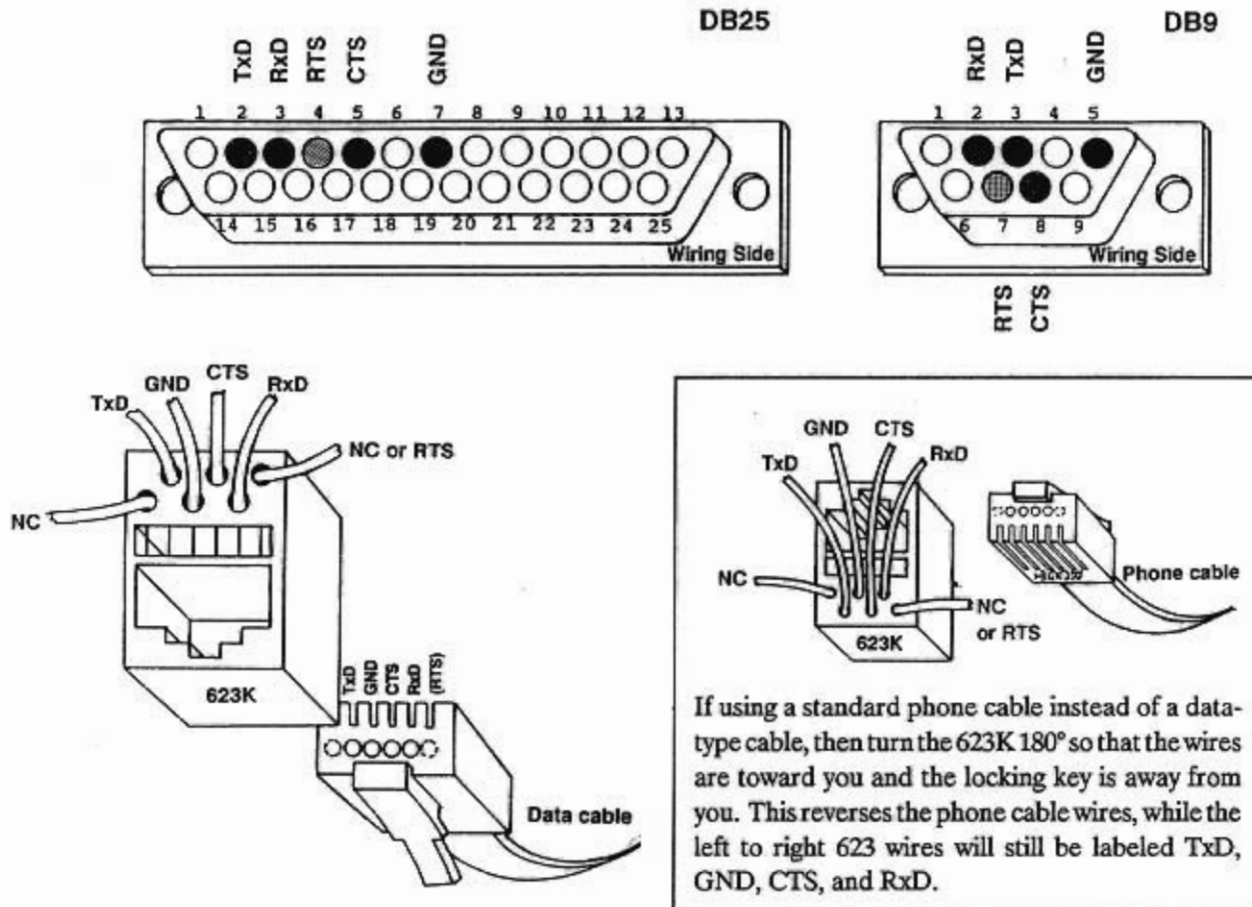


DB25 to RJ11 Connector

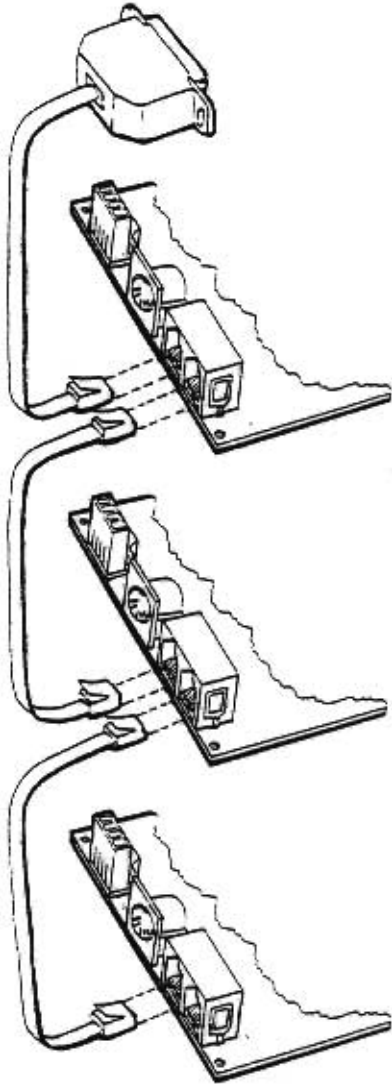
Making your own connector: The RJ11 insert on the RJ11-to-DB25 connector is often designated 623K. Looking at the side of the 623 with the wires, you will see that there are two rows of wires offset from each other. The wire colors and the direction of the offset vary with brands. In making a 4-wire connection, select the inner four wires and line them up left to right as follows:



Lay out the components to be connected, as shown below. When using a data-type cable, the 623 should be positioned so that the locking key for the cable is toward you and facing down. The wires should be facing up and should be on the end away from you. The wiring side of the DB connector should be facing up, with the computer side of the DB facing down. Connect the 4 signals as shown in the figure. If using the 2 extra outside lines for custom circuitry, connect them last. Note that the pin labels refer to the signals as seen from the IBM-PC.



Daisy Chaining CYB-550s - Networks



The CYB-550 can be used in a serial network. Connections between boards can be made via 4-wire cables or 6-wire cables with telephone type jacks. The 6-wire cables can carry both data signals and power as shown in the figure.

The RJ11 jack on the board is capable of delivering up to 6 signals. The 4 inner signals (4-wire cable) transmit TxD, RxD, CTS, and Gnd. The 2 outer signals (6-wire cable) transmit +5v and RTS. When connecting several boards in a serial network, it may be advantageous to transmit the power signals through the network, with power originating on the terminating board, using W6.

Remember not to connect any power transmission signals to the host computer.

CY233 Network Communications

The CY233 serial communications parameters are hardwired on the CYB-550 to select 2400 baud, no parity, one stop bit, 8-bit data, ASCII characters, decoded 1-of-8 addressing, slave mode, and echo invalid. If any other baud rate or protocols are needed for the system, these signals may be altered on the back of the CYB-550. Refer to the CY233 manual for details on different parameters.

CY545/550 Serial Communications

The CY545 and CY550 are designed for adaptive serial communications from 300 - 19,200 baud after the receipt of 2 carriage returns. The protocol is fixed as no parity, 8-bit data, one stop bit, and ASCII characters. CTS is active in the CY550 and may be set active in the CY545 using the mOde command.

Final Assembly and Checkout

This section will discuss the completion of the CYB-550 board and initial operation. The remaining tasks are concerned mainly with connections between the board and the rest of the system, whether it be a terminal or computer. The user must decide, based on the specific requirements, which jumpers will be used. The appropriate jumper pads for the various options must then be connected together.

- Install jumpers as required.

Next, cables must be made for any applications circuits, connecting the data interface, and the power supplies. See the listing of connector pinouts for the appropriate signal, those lines which are not used may be left disconnected. They do not require any special terminations.

- Construct connection cables as required.

Before the board is connected to the power supply, perform a careful visual inspection to insure that all parts have been placed in the right locations and that LEDs, electrolytic capacitors, and ICs observe the proper polarities. This is very important for proper operation of the board.

- Perform visual inspection for correct part placement.
- Install board standoffs at the four corners.
- Connect the +5 volt logic supply and turn it on.

Now, use a VOM to see that +5 volts can be measured at various points on the board. In particular, +5 volts should be across C4, and at the power supply pins of all the ICs. No part on the board should be hot from applications of power.

- Check for +5 volts to various components on board.
- Turn off power supply.

NOTE: NEVER LEAVE THE POWER SUPPLIES ON WHEN CHANGING CONNECTIONS OR ADDING PARTS TO THE BOARD.

When the board checks out satisfactorily, the CY545 or CY550 may be installed into the 40 pin socket at location U8 and the CY233 may be installed at location U7. Be sure to observe proper polarity when installing these parts. The notch on the pin 1 side should face the middle of the board. Install the part by starting the pins on one side into the socket, without pushing them completely into the socket. Then do the same on the other side. Once all the pins have been started, gently push the entire part into the socket until the pins are well seated. Be sure that none of the pins are bent or go under the part. They should all fit smoothly into the socket.

- Insert a CY545 or CY550 into the socket at location U8.
- Insert the optional CY233 into the socket at location U7.
- Do not install the optional Memory or Display until the initial tests have been completed.
- Connect the optional serial cable to J3.
- Turn on power.

The capacitors on the Reset line of the CY545/550 should provide an automatic reset on power up.

CYB-550 Debugging

The following section explains a check-out procedure for the CYB-550 board.

CY545/550 Tests

The following steps provide a basic test of the CY545/550. To check the CY545/550 serial interface will require a serial terminal, or a computer with a terminal emulator program. You must be able to send ASCII characters from the keyboard and display received data. Checking the CY545/550 parallel interface, if used, will require more software development, since you must drive the eight data lines from an I/O port, and control the CY545/550 handshake signals as well.

Basic Test

- To check basic operation of the CY545/550, apply power.
- Toggle the Jog switch (SW2) CW and CCW.
- The CY545/550 should step at about 15 steps per second when the Jog switch is activated, and the CCW signal should be low when the Jog switch is in the CW position. The PULS LED will flicker while stepping, the STOP LED will light while stepping and turn off when stopped, and the DIR LED will light in the CW direction and turn off in CCW direction.
- Return the switch to the center "off" position.

In case of difficulty with one of the steps above, be sure that the parts have been installed correctly (especially those with fixed polarity), jumpers are connected properly, and cables are wired according to the connector pinouts listed.

Serial Interface Tests

- Select the CY545 or CY550 position on switch SW4.
- Connect the CYB-550 RJ-11 serial jack to your computer or terminal.
- Configure the communications for 8 data bits and no parity, with your desired baud rate, or use the CYS-545 software package for the IBM-PC, which automatically sets up communications and performs some initialization tests.
- Send two carriage return characters to adapt the CY545/550 baud rate. (Not required when using the CYS-545, which automatically performs this function.)
- Send the command:
+ < cr > .
- The CCW signal will go from high to low, lighting the DIR LED.
- Send the command:
- < cr > .
- The CCW signal should return high, turning off the DIR LED.

If the above sequence works successfully, you are commanding the CY545/550 through the serial port. Continue with additional commands shown below.

Parallel Interface Tests

- Connect your host system to the CY545/550 parallel interface at W3.
- Place the "+" command on the data bus, ASCII value 2Bh.
 - D0 = 1
 - D1 = 1
 - D2 = 0
 - D3 = 1
 - D4 = 0
 - D5 = 1
 - D6 = 0
 - D7 = 0
- Lower the IO_REQUEST line.

- Wait for the BUSY line to go low, then bring IO_REQUEST high again.
- When IO_REQUEST is brought high, BUSY will return high.
- Wait for BUSY to return high, then place the carriage return code on the data bus, value 0Dh.

```
D0 = 1
D1 = 0
D2 = 1
D3 = 1
D4 = 0
D5 = 0
D6 = 0
D7 = 0
```

- Generate the IO_REQUEST handshake strobe again, interacting with the BUSY signal.
- Upon completion of the above sequence, CCW will go low, lighting the DIR LED.
- Repeat the above sequence, with the "-< cr >" command. The ASCII code for "-" is 2Dh. The CCW signal will return high and the DIR LED will turn off when this command is sent.

If the above sequence works successfully, you are commanding the CY545/550 through the parallel port. Continue with additional commands shown below.

Additional CY545/550 Commands

- Try to toggle a User Bit signal using "B 16< cr >" and "B 0< cr >" for User Bit 0. Remember the single space character between the command letter and the argument value. The LED on User Bit 0 will toggle on and off.
- Try to step 200 steps (CY545) or 10 steps (CY550) with the default parameters, using "G< cr >".

HP Display Exercise

- Turn off power.
- Install the optional HP LED display and reapply power.
- If you are using the local HP LED display, issue the command:
O 85h < cr >
to enable the use of the display.
- Issue the query command:
? R < cr >
- The CY545 should respond by displaying "**R = 00100**" on the local display, or out the serial port if the above mOde command has not been issued. The CY550 will respond "**R = 00000**".

Local Memory Exercise

- Turn off power.
- Install the optional Memory Chip and reapply power.
- Issue the following command sequence to test the memory:
Y 50 < cr >
E < cr >
"Mem Test < cr >
"0 < cr >
Q < cr >
Y 50 < cr >
X < cr >
- After the "X" command is issued, the CY545 should display the message "**Mem Test**" on the local display or out the serial port.

At this point, the major CY545/550 components are working. Other command sequences may be tried to exercise additional features. If a thumbwheel switch interface is being used, you may check this by using a parameter value of "#", then performing a query to check that the proper value is being read from the switches. Other command sequences are shown in the CY545 User Manual.

CY233 Tests

This check-out of the CYB-550 board will require at least a serial terminal. A computer with a terminal emulator program will also work well. The only requirements are the ability to control transmitted characters and the ability to display received characters. (A BASIC language driver that performs this function on an IBM-PC class computer is provided in the CY233 Users Manual.)

We will assume this CYB-550 board is set for address 01 in describing the following tests. If you use a different address, substitute your selected address for that shown. When an invalid address is needed, be sure to use an address different from the one(s) selected for your board.

- Set the board for address 01 by closing the second switch (position 2) on SW1.
- Set the CY233 for ASCII Character mode and Echo Invalid. Choose parity, baud rate, and other functions to match those of your serial test system.
- The default settings of the CYB-550 board provide 2400 baud, 8 data bits, no parity, ASCII Character mode, decoded addressing, and Echo Invalid. Try to set your system to match these selections. Otherwise, you must cut some of the traces on the CY233 mode selection signals.
- Connect your test terminal to J3, the serial input connector. Select the CY233 position on switch SW4.
- Reset the CY233 by pressing the Reset Button or by cycling the power supply.
- Send a message with an invalid address to the CY233:
W03Test < cr >
where "< cr >" is the carriage return character. There are no spaces between the CY233 command and the message.
- The CY233 should echo back:
W03Test < cr >

The echo will start after the W command and 03 address have been received. If the echo is correct, the CY233 is functioning, with baud rates, parity, etc. matching those selected for your terminal.

If no echo occurs, be sure to verify your operating mode selections, connections to J3, switch SW4, etc.

- Now send to the CY233:
W01O 81h < cr >
W01? S < cr >
- Since each is a valid message, the CY233 will not echo it, but after the W and 01 are received, each character in the data portion of the message will be passed in parallel to the CY545/550. The commands will change the mode of the CY545/550 to output to the CY233, then query for the value of the slope parameter.
- The CY545 and CY233 will respond with:
R01S = 00220 < cr >
 The CY550 and CY233 will respond with:
R01S = 00000 < cr >
- When the above sequence is successful, you may send any message to the CY545/550, commanding it to change its parameters, execute a motion, etc.

This completes the test of the CYB-550 board. The CY545 or CY550 and CY233 have been checked, and messages have been passed between the CY233 and the CY545/550. If the above tests failed, be sure to carefully check the assembly of the board, all jumper connections, and all switch settings. Try to verify that serial data is getting to the RxD signal at J3 when your terminal is transmitting, and that the data reaches the CY233 at its RxD pin, pin 10. You can also check if the CY233 is alive, by seeing that the Restart line, pin 9, is low during normal operation, and that a 1.8 MHz clock is being generated from the CLK line, pin 30.

If the above tests do not resolve the problem, contact Cybernetic Micro Systems.

The CYS545 Stepper Motor Control Panel Software

for the CYB-545 & CYB-550 Prototyping Boards

© Copyright 1990-1992 Cybernetic Micro Systems Inc.

System Requirements:

- CY545B Stepper Motor Controller.
- Works only marginally with CY550 Stepper Motor Controller.
- CYB-550 (or CYB-545 RevB modified to add CTS).
- Com1 or Com2 Serial Port with Txd, Rxd, and CTS
- IBM PC or compatible with 256K memory.
- DOS 2.1 or greater.
- Floppy drive or hard disk.
- Monochrome or color, text or graphics, monitor.
- This software may be copied or renamed.

To invoke the CYS545 Panel software type

CYS545

The software comes up using the following default values:

CY545 active, 512 Bytes of external memory, memory not active,
Com 1 @ 9600 baud, CGA display.

All of these values may be changed from within the program. Alternatively these options may be selected at invocation by adding any desired switch settings to the command line.

Command line options are:

/N	No CY545	
/M[bytes]	use Memory [at specified byte size]:	/D color Display color:
	5 = 512 bytes 8 = 8192	0 Black for Monochrome
	1 = 1024 bytes 6 = 16384	1 Blue on black - default
	2 = 2048 bytes 16 = 16384	2 Green on black
	4 = 4096 bytes 3 = 32767 (32K-1)	3 Cyan on White
/C	Com 2	4 Red on White
/B rate	Baud rate from 300 to 9600	5 Magenta on Grey
/S speed	use 3 or 4 for '386 and '486 machines	

HINT: If you plan to use the same settings all the time, then place the command line in a DOS batch file, such as:

```
COPY CON: STEPBAT
CYS545 / C / D0 / M8192 / N
^Z
```

This will set COM 2, Monochrome display, 8K bytes of memory (8Kx8 or 64K bits, same as the X2864), and will leave the CY545 off line, thus not reading all of that memory until told to do so at the command line. The /M switch only uses the first digits of the byte size to set the number of K bytes of memory.

If the CY545 is detected online, then the chip is ready to accept instructions from the command line. If the CY545 is not detected, the program reverts to pseudo command entry for practice sessions. The CY545 communications can then be turned on with the CY545 ON command, which retains all of the parameters that were set in the practice session. To turn on the CY545 and start clean, use RESET instead of CY545 ON.

CYS545 Meta Commands

- <ESC> key** Pressing <ESC> from the command line exits the program and returns to DOS. Typing *ESC* or *EXIT* or *QUIT* at the command line will also exit the program. Pressing <ESC> from any other function, terminates that function and returns to the command line.
- <F1> or HELP** Available only at the command line, HELP displays the CYS545 meta command summary, the CY545 command summary, and the CY545B pin configuration. The screen color may be changed from the Meta-command help menu using <F2>, and will take effect upon returning to the command screen.
- value =** A decimal or hexadecimal value with a leading or trailing = will return the decimal and hexadecimal values of the number, up to a 16M limit. It will also return a modulo 256 number, useful for converting an absolute memory address to a local page address, for page limited jump parameters. A value entered here as 1K or 16M will return 1024 or 16777216.
- COM2** Sets Com 2 as the serial communications port.
COM1 or COM Sets Com 1 (the default) instead.
- BAUD** Sets the Com port baud rate to 9600 and resets the CY545 to adaptively change the chip's baud rate.
- BAUD rate** Sets the specified rate from 300 to 9600 baud, based on the first number seen in the parameter. Also resets the CY545.

RESET	Reinitializes the Com port and reads the CY545 register values. Does not affect external or defined memory and does not reset the CY545.
CY545	Same as CY545 ON.
CY545 ON	Turns on CY545 communications and resets the chip's parameters to match those displayed on the screen.
CY545 OFF	Turns off communications with the CY545 and allows command entry on the screen for practice sessions.
SPEED <i>value</i>	Some faster 80386 and 80486 computers are too fast for this program's CY545 read operations. Speed adds delay multipliers to the program execution. The default speed is 1, and 3 or greater is recommended for fast machines.
MEM ON	Turns on memory options.
MEM OFF	Turns off memory options.
MEM <i>size</i>	Turns on memory and sets size to any number from 1 to 32767 bytes (32K-1). If the value is zero or is not present, then memory is turned off.
READS	Same as READ, but with sound turned on.
READ	Reads external memory as defined by the Memory Size statement. If actual memory is smaller than the definition, then memory will be read as many times as necessary to read the defined number of bytes. As memory is read, it will not be displayed until a carriage return is encountered. So areas of program code will read and display quickly, while blank sections of memory will accumulate and will take longer to appear on the screen. If memory contains no carriage returns, then an error message appears and hardware must be reset before continuing. If the CY545 is offline, then the Read command has no effect.
WRITE	Writes the currently defined number of bytes, regardless of actual program length, into external memory starting at address zero. If nothing is in the software's program buffer, then null bytes will be written to memory. If defined memory is shorter than real memory, then real memory will be only partially filled, as would be expected. If defined memory is larger than real memory, then a wrap-around will occur in real memory, which is a serious problem. The resulting real memory will have the last part of defined memory overwriting what had just been written into the beginning of real memory. If the CY545 is offline, then the Write command has no effect.

WRITE *addr* Same as the Write command, except that the program is loaded at the designated absolute starting address in external memory. This could be dangerous if your program has jump and loop commands, which use addressing. However, if the offsets are always multiples of 256 then page-size addresses would not need to be altered. The offset feature can be very useful for setting up a series of similar programs, which could then be edited to change only a few parameters in each one. If the CY545 is offline, then this command has no effect.

This command does not affect defined screen memory. Use the MEM Size command and READ memory command to view the relocated code on the screen.

FILL *char* Writes the defined character to all memory locations as defined by the currently specified memory size. If defined memory is smaller than real memory, then only the beginning of real memory will be filled. If defined memory is larger than real memory, then real memory may be filled several times with no ill effects. If the CY545 is offline, then only defined screen memory is filled.

FILL Same routine as Fill *char*, except that instead of the user-defined characters, the default values sent to memory are carriage returns. This is useful in CY545 memory management. When programs are subsequently written to different locations in memory, the spaces between programs will already be filled with carriage returns. If memory routines make jumps to bad addresses, then rather than becoming lost in unintelligible instructions (such as FF streams), the CY545 is more likely to encounter two successive carriage returns, which will cause the CY545 to abort external program execution and return to the host. The only adverse effect of filling memory with carriage returns is that it will take much longer to read and display memory.

AUTO If using external memory, this command will write the AutoStart sequence to the first three bytes of memory. Upon power-up or hardware or software reset, the CY545 will execute from external memory, starting at the first command following the 3 AutoStart bytes. To disable, use either the E-command or the Edit feature to overwrite a carriage return or NOP to at least one byte in the AutoStart sequence.

You will note that this software forces the memory pointer to address *three* when starting, in order to keep the first three bytes (0,1,2) available for the AutoStart feature. If not forced to address *three*, the CY545 would normally default to address *one* if the AutoStart feature were not present.

EDIT

Instead of entering instructions at the command line, the cursor moves into the external memory display area. Using the cursor keys to move around, you may now edit the code that got there from a Read command or from program entry mode (E-command). You could also write new code directly, but that is not advisable, since the command entry line checks the validity of your commands, and the Edit mode does not.

The edit mode does not write anything to real external memory. You must exit the edit function with the <ESC> key and use the Write command to save your changes externally.

Edit commands are:



To move around in memory use the Arrows: Up, Down, Left, and Right, as well as PgUp, PgDn, Home, and End.



Tab marks text downward from the current address.

BS will erase the markers upward.

Marked code can then be deleted or pushed out <INS> the indicated amount beginning at the lesser address. Any other key deactivates the markers, and restores the screen.



will delete the current single character, or marked block of text, and will pull up all remaining code to close the gap. If you have a lot of defined memory, then this will take a while.



will push down all the code one byte, or the amount marked, and will fill the gap with an FF character. Now you can type a new character in the newly created gap. Insert will not work if there is code at the end of your defined memory. (Use the End key to check before inserting).

These features are useful for changing "P 99" to "P 100", etc. After a delete or insert, take a look at your page boundaries and Jump and Loop commands to be sure your pointers are set to the proper locations.



A period will be converted to 255, or FF, and can be used to manually erase bytes of code.



A carat is a reserved CY545 command that will pass through the CY545 without being executed, so it can be used as a NOP. It must be followed immediately by a carriage return, for a 2-byte command; or it can be followed by a space, a valid numeric parameter, and a carriage return, for a 4-byte, or longer, command.

The Operating Modes of the Environment

The CYS545 Panel Software supports two CY545 operating modes (Live command Execution and External Stored Program) at two levels (with or without hardware.)

Live Commands: In Live command mode, all commands, except the Meta commands, are sent directly to the CY545 for execution. Since the CY545 will not allow the use of stored program manipulation commands during live command mode, the Loop, Jump, and related commands are trapped at the command line. You will also not be allowed to change the CY545 operating mode because the mode is explicitly set to operate with this software. Any changes to the mode will hang up the software. This mode setting is why the HP-LED is not directly supported, and why the software does not support reading the Jog position during stepping.

Using Live command mode without a CY545 will allow you to experiment with the panel software environment without hanging up the software. The exception to that might be if you set a Com port that happens to have a device on it, such as a serial printer or mouse, which will cause the software to return an error message before continuing.

Stored Program: In Stored program mode, you may not use the Meta commands except HELP and ESC. Certain CY545 commands are not permissible in external memory, such as E and X, so these are trapped at the command line. You may implement the HP-LED and change operating modes in memory. However, if you want the CY545 to return to this software environment after running an external program that has changed the mode, you should change the mode back to `0 0A0h` before you exit from your last memory routine.

If you use Stored program mode without a CY545, you will still be able to write valid code for external memory. This code will reside in memory in the software environment, and if you do decide to bring your hardware online, you can load the stored program to external memory at that time.

Avoiding Trouble

Now here is how you can get into trouble:

1. When the program is invoked, presumably with the CY545 online, the software reads the com port. If there is no device, or if the device is not a CY545, then the port times out and the software comes up in non-CY545 mode. Check the hardware and serial switch and connections, or change Com ports, and type RESET to try again.
2. If you put a program in stored memory, with the AutoStart sequence in the first three bytes of memory, the CY545 will run that code after a reset. If you forgot to put stop commands (`0 < CR >`) in your code, it may never finish and come back to you. And of course, every time you reset the part, it continues to run that code. If you hold the XMEM_SEL line low during a reset, then the CY545 will bypass the AutoStart feature

and come up in command mode. You can then type RESET to bring the CY545 back online. Now you can read memory and edit the erroneous code.

3. Likewise, if you use the X-command to run external code that goes away to never-never land and will not return to command mode, you must reset the hardware and then type RESET at the software command line. However, if your software is already hung up from the run-away memory routine then type <Ctrl-Alt-Del>.

4. When the CY545 is running an external program, its CTS line goes ready between each stored command that it executes. This enables the user to interrupt the stored program routine. Because this software has no way of knowing when the program is finished (as you can see, the CTS line is not a valid indicator), you must be careful not to attempt a new command stream prematurely. Setting a user bit in your program could alert you to the completion of the program, if you are unable to tell from motor motions.

5. If you would like to use the external Jog switch, then do not type any commands to the CY545 while the switch is active. The CY545 does not respond with a CTS in this mode, so commands sent to the CY545 while it is jogging could be split into fragments that the CY545 will misinterpret. If you accidentally type a command while jogging, you will receive an error message. You should immediately reset the hardware and then type RESET. Any other attempts to recover from this situation appear to write fragments of code into external memory. During normal operation, after the Jog switch is returned to the no-step position, you can type a carriage return at the command line and the position will update in the Parameter Display window.

6. If you would like to use the Jog position readout or otherwise use the HP-LED display, you may do so from external memory. Here are two sample routines that will set up the mode, write to the display, and then return properly to this software environment:

Addr	Code	Comments for Jog Switch
	Y 3	set the pointer for code entry.
	E	set external mode and enter the following code.
03	O 095H	set CY545 mode to display Jog position on HP-LED .
10	B 0	preset UserBit 0 high (LED off) so it may later be pulled low.
14	"Jog Now < CR >"	send prompt message to display.
24	T 10h,24	Jump back to address 24 Tll UserBit 0 is low (LED on). Now you can use the Jog switch and the position will be displayed on the HP-LED. After setting the Jog switch to the no-step position, pull UserBit 0 low to reset the mode and return to this software.
33	"Done < CR >"	send message to display.
40	O 0A0H	set CY545 back to serial mode - very necessary.
47	0	exit to command mode.
	Q	quit writing to external memory.
	Y 3	reset pointer to start of code to be executed.
	X	now execute the stored program.

Addr	Code	Comments for HP-LED Display
	Y 64	set the pointer for code entry.
	E	set external mode and enter the following code.
64	O 0A5H	set CY545 mode to talk to parallel HP-LED display, and no longer talk serially to this software.
71	"Stepping < CR >"	send message to display.
82	P 5000	start stepping.
89	/B 0	clear bit 0 low (LED on), to indicate we reached the position.
94	P 0	return to home position.
98	B 0	set bit zero high again (LED off), to indicate back home again.
102	"Stopped < CR >"	send message to display.
112	O 0A0H	set CY545 back to serial mode - very necessary.
119	O	exit to command mode.
	Q	quit writing to external memory.
	Y 64	reset pointer to start of code to be executed.
	X	now execute the stored program.

7. When the motor is busy stepping, the CY545 will not listen to commands. So be patient, and be careful. Look at the position display before issuing a stepping command. If the Position is somewhere around 16 million and you want to go to position zero, prepare to go to lunch. If you set the fastest possible parameters, R = 255, F = 255, S = 255, and send the part stepping 16 million steps, it will take about 15 minutes at 11 MHz. If you use the default parameters, come back in about half an hour. If you don't have time for lunch, then press the < ESC > key, which will release the software from the stepping routine, but which has no effect on the busily stepping CY545. Reset the hardware and then type RESET to gracefully continue.

8. While reading or writing memory, you can not communicate with the CY545, but the keyboard will buffer commands. Very large memories will take almost a minute to read, depending on the baud rate. Then the program will return to the keyboard and execute whatever you typed into the keyboard buffer.

9. If you ever reset the external hardware, always perform a keyboard RESET or CY545 ON command to re-establish communications before trying to continue with any other commands. Although we've attempted to trap most of the situations which could hang up the software, it's not possible to eliminate all situations. If you discover one we haven't mentioned here, please document it, < Ctrl-Alt-Del >, and let us know the circumstances that produced it.

CY550

The CY550 accepts commands on the fly. This feature limits its use with the CY545 Panel Software. Rather than updating position readout at the end of a motion, the readout will occur immediately. Pressing the CR key at the end of a motion will update the final register display. Also, the extra CY550 commands will not be supported, and the extended CY550 rate parameters will not be allowed. However, it will allow the basic stepping commands, useful for testing your system configuration.