Inter-Office Memorandum

To	File	Date	March 13, 1981
From	L. Stewart	Location	Palo Alto
Subject	Alto-1822 Installation and Testing	Organization	CSL

XEROX

Filed on: [Ivy]<Alto-1822>Installation.memo

This document describes installation and testing procedures for the Alto-1822 interface.

Alto-1822 Installation Notes

This is a brief discussion of how to install an Alto-1822 interface in an Alto I or an Alto II. If you intend to control the device from Mesa, you must use an Alto II with either Mesa ROMs or a 3K CRAM.

Alto II

A standard Alto II has nearly all the required signals on slot 18. However, to install an Alto-1822 there, a few wires need to be added. If any of the J18 pins mentioned already have wires, stop and find out why! If slot 18 is already used, slot 17 or 19 will work just as well.

Alto Signal Name	From	To	1822 Signal Name
AUSYSCLK	J14-72	J18-72	AuSysClk
5ACT*	J11-102	J18-118	ITAc'
TASKB*	J10-14	J18-117	TASKB'
WAKE5*	J11-60	J18-112	WakeIT"

In principle, it is possible to wire several devices to TaskA* or TaskB*, and the Alto-1822 drives pin J18-117 with an open collector gate to permit this mode of operation. In practice, it is thought that the 1822 is the *only* device providing this capability, so it is not too useful.

Alto I

An Alto I has much less standard wiring. To install an Alto-1822 in slot 2, the following wires (at least) need to be added.

Alto Signal Name	From	To	1822 Signal Name
AUSYSCLK	J7-72	J2-72	AuSysClk
-TASKB	J6-14	J2-117	TASKB'
-5ACT	J7-102	J2-118	ITAc'
-WAKE5	J7-60	J2-112	WakeIT"
OKTORUN	J2-1	J2-11	OKToRun
-SIO	J3-41	J2-41	SIO'

In addition to the signals mentioned above, the following signals must be present at whatever slot you use:

BUS[00]-[15]
DBARC
F1[0]-[3]
F2[0]-[3]
NEXT[6]-[7]
OKTORUN
RESET

Cabling

The Alto-1822 internal cable is a 40 conductor ribbon cable with a 40 pin PC Card edge connector at the board end and a DB-37S connector at the Alto rear connector panel. Install it in the obvious way! The keyway on the Alto-1822 board occupies wires 33 and 34 of the 40 pin PC edge connector.

An Alto-1822 external cable is somewhat more complicated. Depending on the situation, it should be either a 'Local-Host' cable or a 'Distant-Host' cable. The former are for runs of up to about 30 feet, the latter for runs up to about 1000 feet. Arpa Packet Radio units use Distant-Host wiring exclusively. Refer to 'AICables.memo' and BBN-1822 for additional information.

There is a design bug in the Alto-1822 interface having to do with proper termination of the Distant-Host signals. BBN report 1822 specifies that each pair be terminated at the transmitting end, but the 1822 board as delivered does not provide termination. If distant-host service is required, the fix is to solder-tack 180 ohm 1/4 watt resistors on the bottom surface of the PC board accross the outputs of the 75114 line drivers. Refer to page 6 of the schematic diagrams.

Testing

AITest.run is a general menu-based bcpl test program for the Alto-1822. It includes both hardware test facilities and enough knowledge of protocol to exchange packets with either the Arpanet or the Arpa Packet Radio net.

Attached to this memo is an Alto screen image of the test program. When first started, the program will load Alto-1822 microcode which is linked into the program and execute a silent boot to get the 1822 task running. A polling process is also started which executes a no-op 1822 function and reports the device status in the Status area of the screen. The left portion of the status region contains the following fields:

ICount: The difference between the input control block pointers and the start of the input buffer (number of words input so far).

OCount: Same as ICount, except refers to the output buffer.

IPost, OPost, CPost: The contents of the input, output, and control post locations of the 1822 control block.

The right portion of the status region contains strings which describe the state of the IMP and Host ready relays and the state of the "IMP was Down" flipflop. (The *Clear IWD* button may be used to reset the latter indication if the IMP is Up.) The rest of the status region displays strings which report unusual status conditions such as Input Buffer Empty or Buffer Overrun.

The uppermost portion of the AITest.run menu contains functions which will load a packed RAM image microcode file (*Load uCode*), execute a silent boot (*Silent Boot*), and perform a sequence of

tests on the hardware (*Test All*). These three functions use parameters which may be altered in the Parameter region of the menu. The *STOP!* button is used to halt the loop tests *Echo*, *CAPEcho* and *Chat* and to stop the *Listen* test if no packets are arriving. *Quit* exits the program.

The Parameter region of the menu contains numerous fields. In general, the way to change a value is to use the left mouse button to select one of the named boxes and then type in the new value, ending with <ESC> or <CR>. *Loop* and *Size* respectively control the number of packets and the packet length in words to be used in the echo tests *Echo* and *Chat*. *Contents* and *Type* offer alternative ways to control the contents of echo packets. *Command* controls the command word sent to the hardware when the *Send Command* button is pushed. Refer to AISWSpec.memo for details of some useful commands. *Boot Vec* sets up the Alto Reset Mode Register value for use with the *Silent Boot* function and the menu item immediately below contains the filename used by the *Load uCode* function. For fun, you can boot from disk by setting *Boot Vec* 177777, and pushing *Silent Boot* -- now no longer silent!

The remainder of the menu items in the Parameter field operate somewhat differently. *Interrupts* uses the three mouse buttons to separately toggle interrupt enables for 1822 Control functions, Input functions, and Output functions. These three enable bits are displayed as "c", "i", and "o". When activated, they print their corresponding letters in the Commentary window whenever the microcode posts status. The *Update* item both enables and disables the status polling process and sets the interval used for polling. The right mouse button toggles the process and the left mouse button sets the interval in 60Hz ticks.

The *Mode* button toggles between Arpanet and Packet Radio modes, causing the appropriate host number to appear in the *Host* window. The *Host* window can then be left-button selected to change the program's idea of the local host number. The *IMP* field applies only to the Arpanet and should be set to the number of the local IMP.

The Low Level Functions area of the menu generates various useful command functions and sends them to the hardware. *Send Command* transmits the command word from the parameter region, it is rarely needed. *Master Reset* generates a global reset to the 1822 board. *Clear IWD* attempts to reset the hardware IMP Was Down flip flop. It will fail if the IMP still has its ready relay open. *Relay* toggles the 1822 host relay. *Test* toggles the internal board loopback function. *CAP Echo* is really a high level function. It sets up the software to receive packets up to the buffer capability of the program (16,384 bits), and transmit them back out. In essence, *CAP Echo* turns the Alto into an outward facing software loopback plug.

The High Level Functions region of the menu contains other kinds of tests. *Interrupts* really only verifies that the microcode is alive, since the Alto interrupt system is all microcode. It enables the interrupts and then generates 1822 board commands to generate them. (*Test* must be ON, otherwise bogus packets would be sent to the IMP.) *Test BLZ* checks to see whether the 1822 board and microcode act correctly when given a zero length buffer for transmission. *Scatter* and *Gather* test the scatter read and gather write functions of the "AINcode" version of the 1822 microcode. *Listen* is often useful. It simply enables the input logic and waits for a packet to arrive, then prints various things about it in the Commentary window. If no packet arrives, the mode can be exited by pushing the *STOP!* button. *Echo* generates and transmits *Loop* packets of length *Size* and listens for their return. Received packets are checked for equality with the transmit buffer. Correct packets print "!", erroneous packets print "?", and if nothing comes back, a timer process prints occasional "~"s and transmits the next packet. This is a one-outstanding-packet test and does NOT use any protocol, so the packets would be very confusing to an IMP. *Check Buffers* compares the first *Size* words of the input and output buffers and prints the number of differing words. *Chat* is somewhat like *Echo* except that it understands Arpanet and Packet radio protocols and generates true echo packets addressed to the IMP or PRU according to the *Mode*. Both *Echo* and *Chat* may be halted with *STOP!*. In both cases, the packet contents may be altered with *Type* and *Contents*.

The final button, *Edit*, brings up a secondary menu which may be used for examining and altering any of the packet buffers in the program. The various buffers are the main input and output buffers, and the packet headers for Arpanet no-op messages and echo messages, and Packet Radio

terminal-on-packets and echo packets. The Arpanet protocol logic uses 96 bit leaders, and the Packet Radio protocol is CAP version 5.6. To select and browse a particular buffer, use the left mouse button on, say, *1 Buffer*, to bring up the first 8 words of the buffer. The middle and right buttons then step forwards or backwards througth the buffer in 8 word steps. Selecting one of the data items allows that word to be changed. The packet editor will refuse to change anything past *Size*. The *Print* button prints in the commentary the input and output buffers in 8 word chunks, and their exclusive OR, if there are any differences.

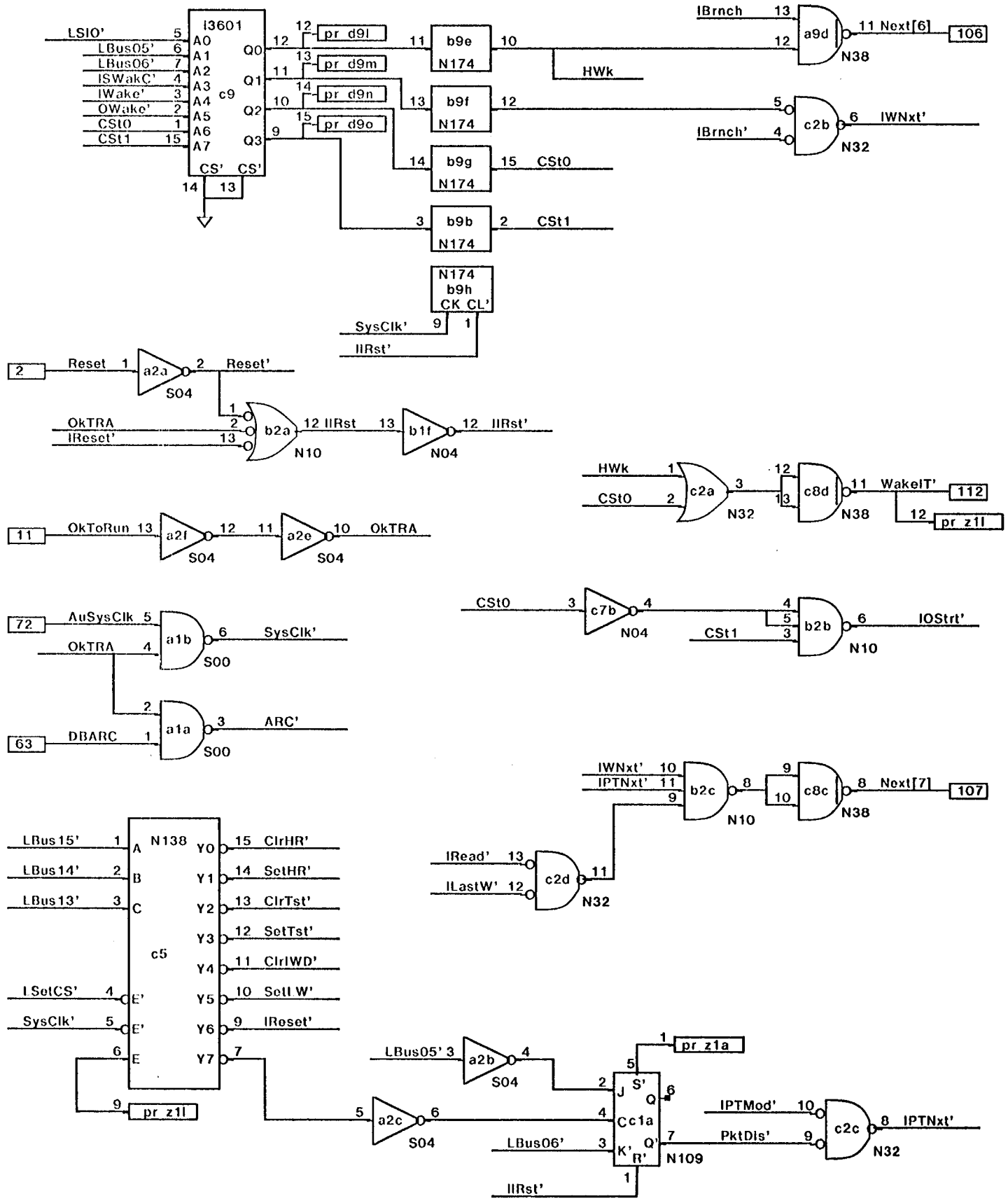
If the Edit menu is in view, the edit menu *Quit* button must be pushed to return to the main menu.

Operations

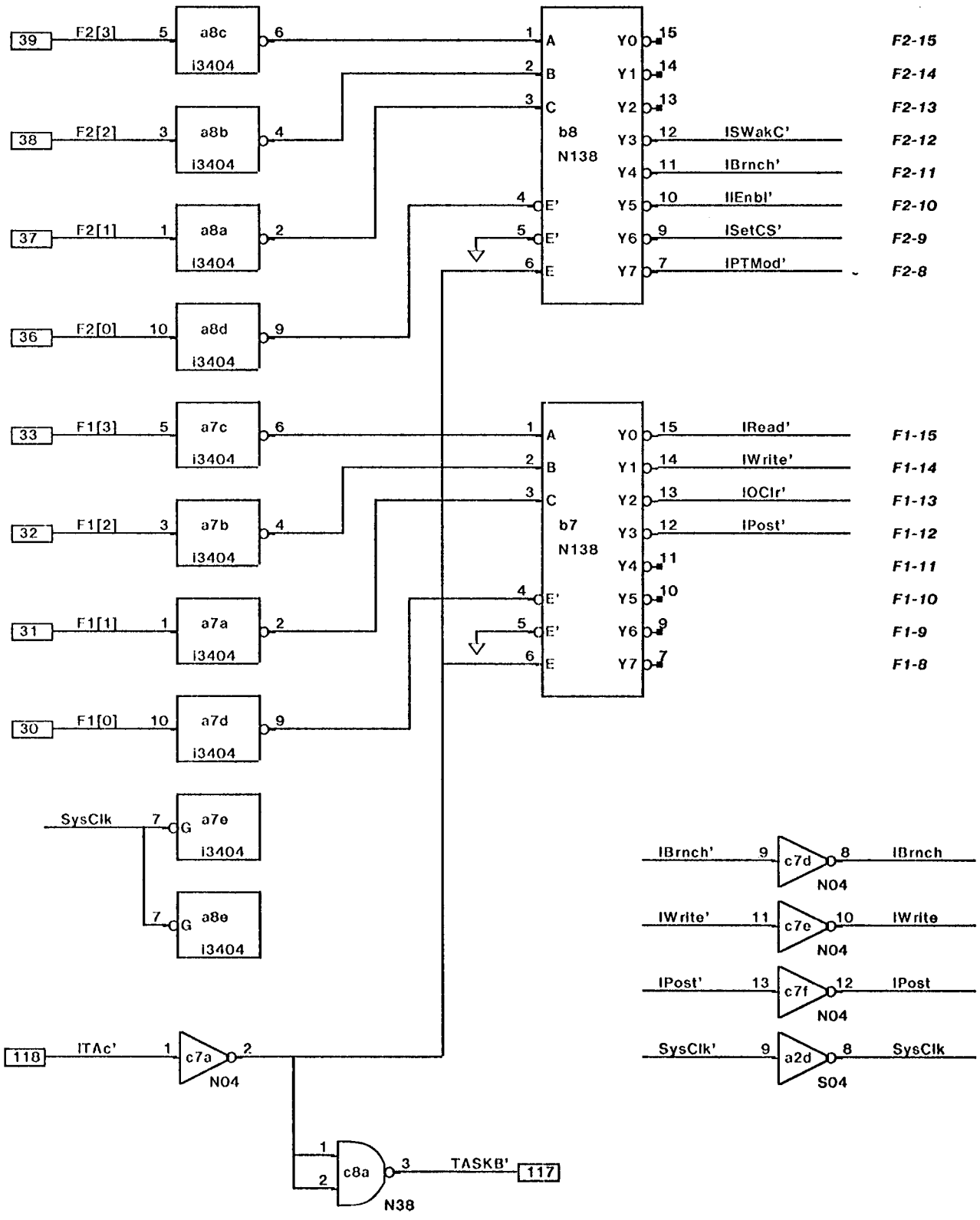
After the 1822 board is installed, pause before conecting any cables and run AITest.run. If *Test All* prints anything "Bad", there is no sense going any further. If there are "Control Timeout" messages coming from the polling process, then either the 1822 board is not plugged in, or the wakeup logic is broken somewhere. Remenber, the right mouse button with turn off the *Update* process. For the echo tests to work without the cable to the IMP, the internal loopback test *Test* must be ON. Try *Loop* 100 and *Size* 120 with *Type* Random.

Once these initial tests work, hook up the cable to the IMP or Packet radio and check out the ready relay logic. *Test* must be OFF to do this. An IMP will flap its ready relay if the host doesn't accept a packet within 15 seconds or so. The *Listen* test is good to try next. Various Arpanet hosts may send random packets. *Listen* prints some facts about them. Packet Radio Units send Repeater-On-Packets periodically. This test will serve to tell if the input logic works. Of course, be sure that the Arpanet NCC has turned on the IMP port! AITest.run tells how to interpret incoming packets on the basis of the *Mode* switch.

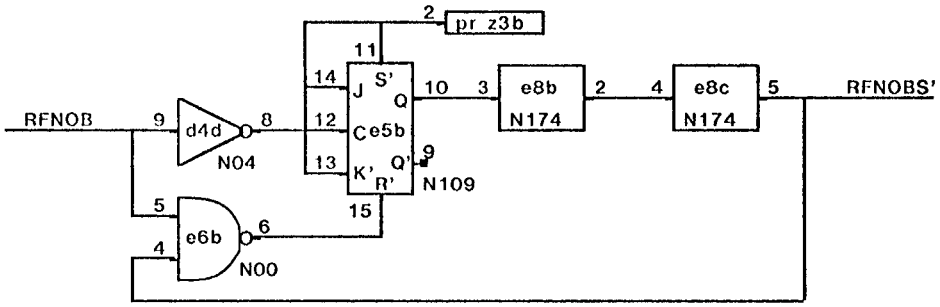
Once confidence has arrived, gingerly set *Loop* 5 or so, and *Size* 20, and push *Chat*. The test program will send three no-ops of the appropriate kind, then start sending echo packets addressed to the IMP or PRU. If they come back, you win! Of course, this test works extremely well if *Test* is ON. Also try a loopback plug at the IMP or PRU end of the 1822 cable. If there is reason to suspect that the hardware works, but the protocols in AITest are obsolete, select *CAP Echo* and ask the appropriate network control center to send you some echo packets.

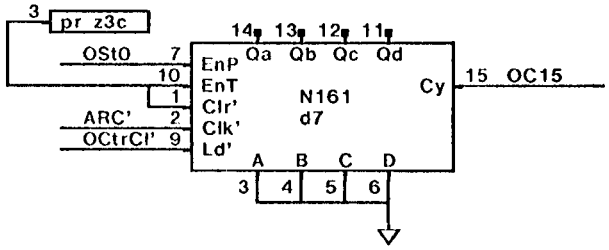


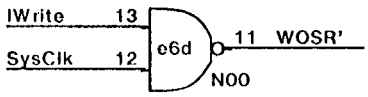
XEROX PARC	Project ville-1822	Control	File AI01pg.sil	Designer L. Stewart	Rev L	Date 09/08/78	Page 01 of 2

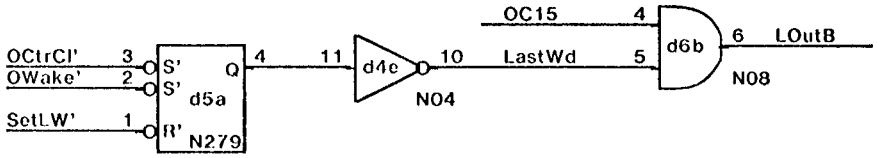


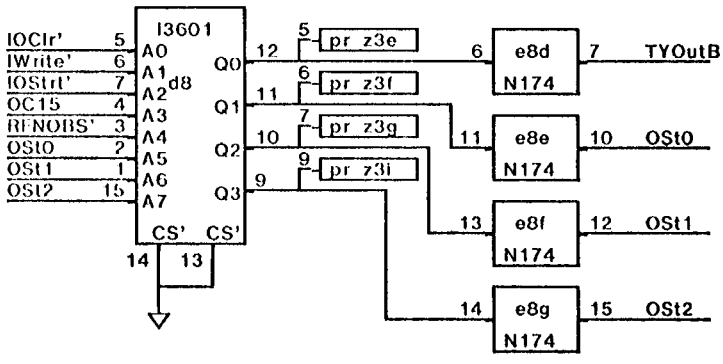
XEROX PARC	Project Alto-1822	Function Decode	File Alt02pc.sil	Designer L. Stewart	Rev L	Date 09/08/78	Page 02 of 8

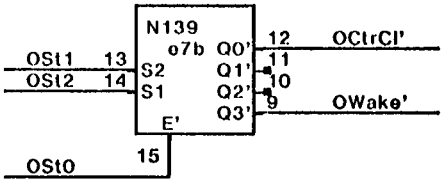


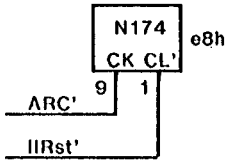




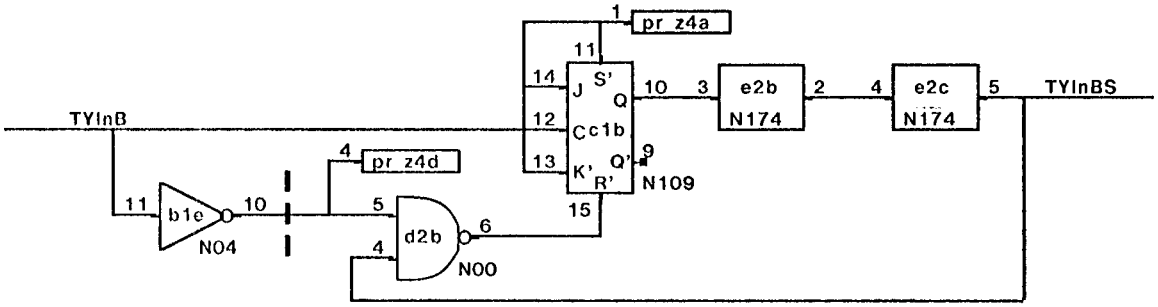




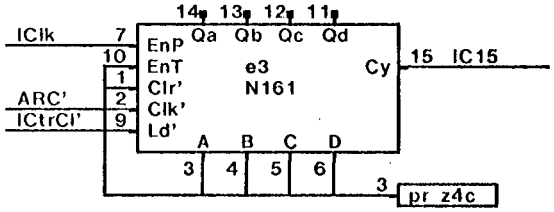


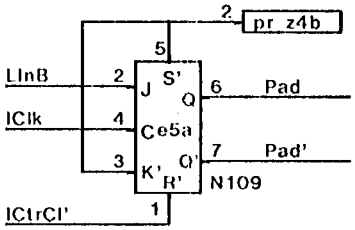


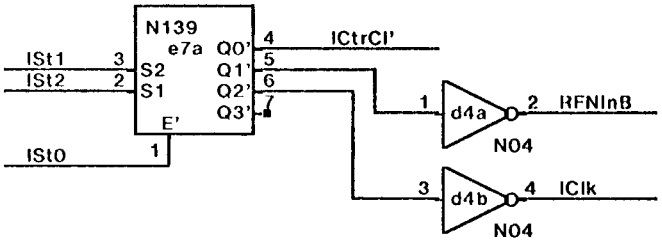
XEROX PARC	Project Alto-1822	Output Control	File A103pc.sil	Designer L. Stewart	Rev I	Date 09/08/78	Page 03 of 8

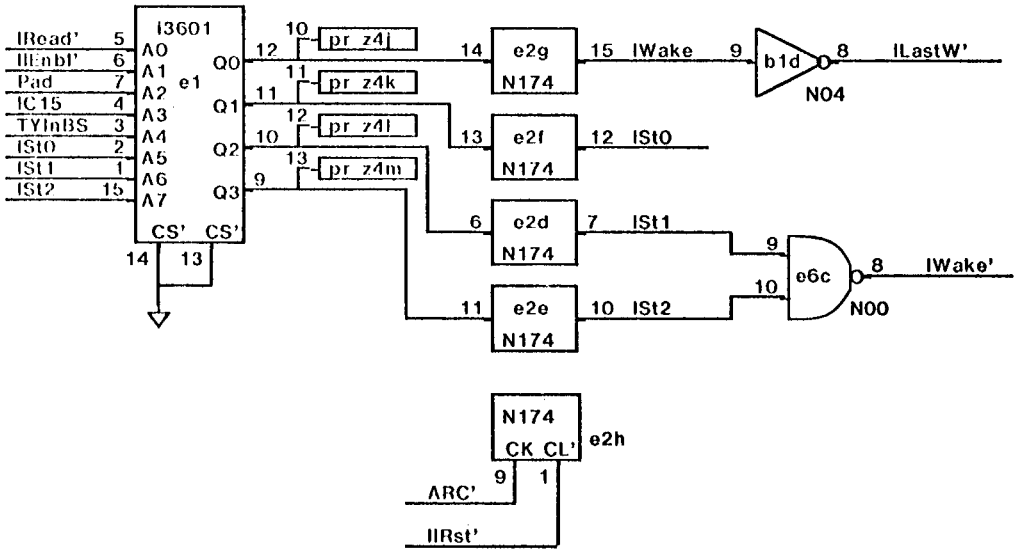


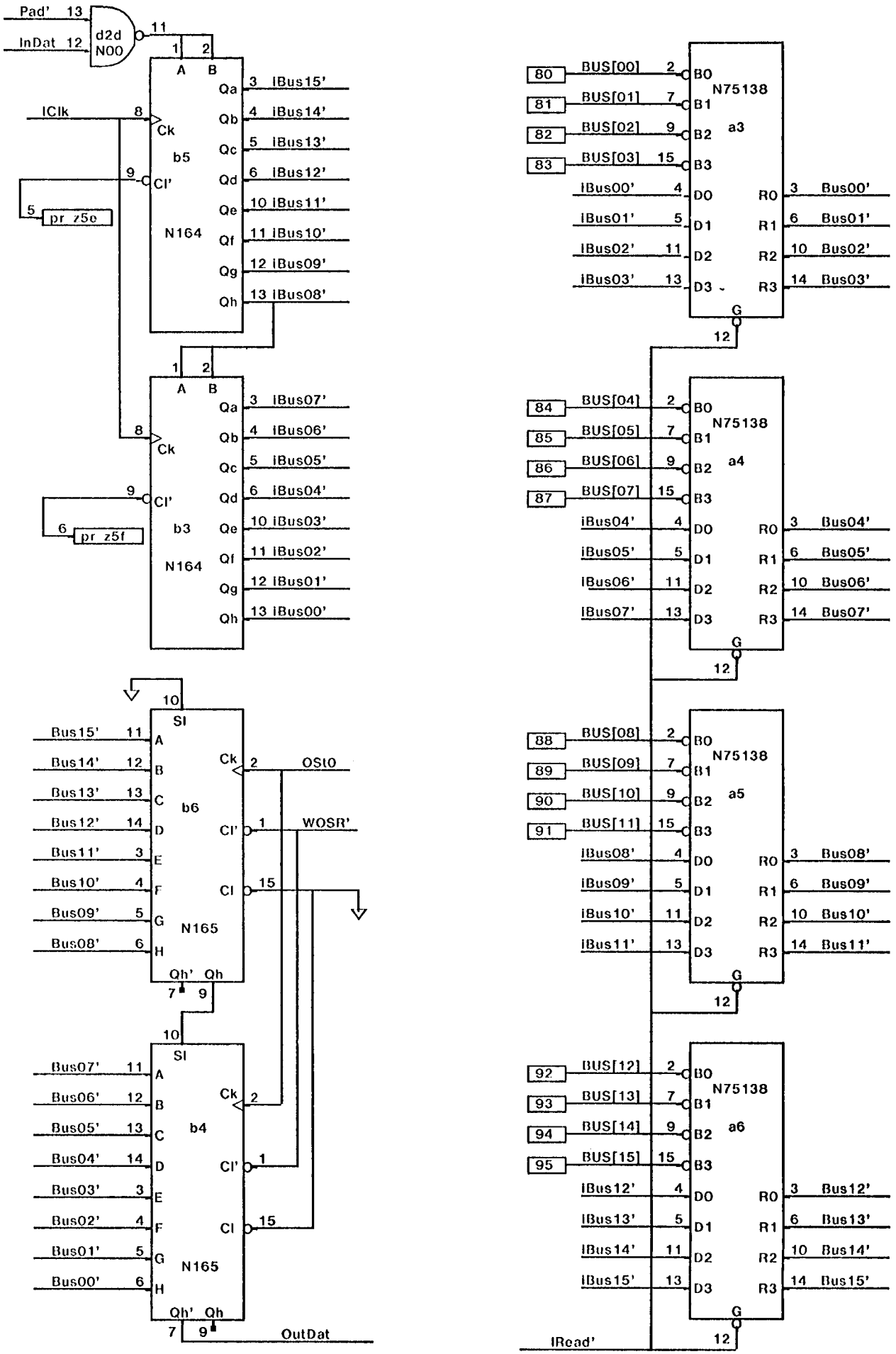
Note: Set up for 4-way handshaking.
For 2-way handshaking, tie top input
of N00 high.



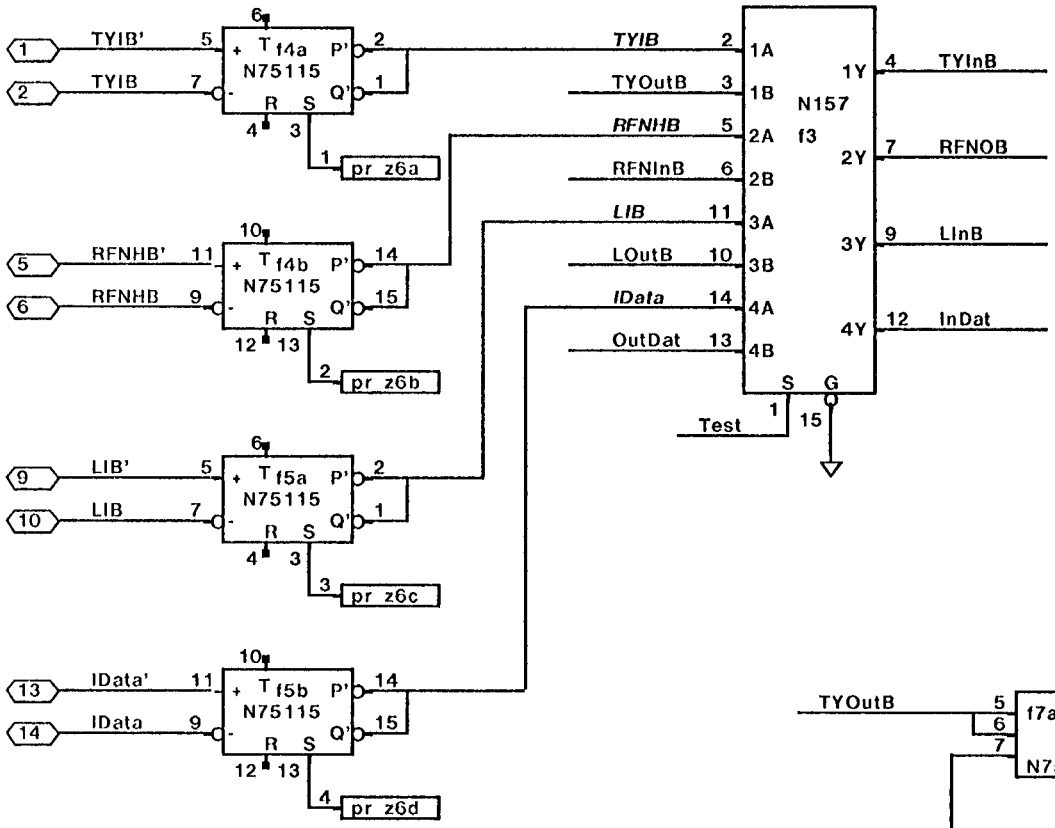


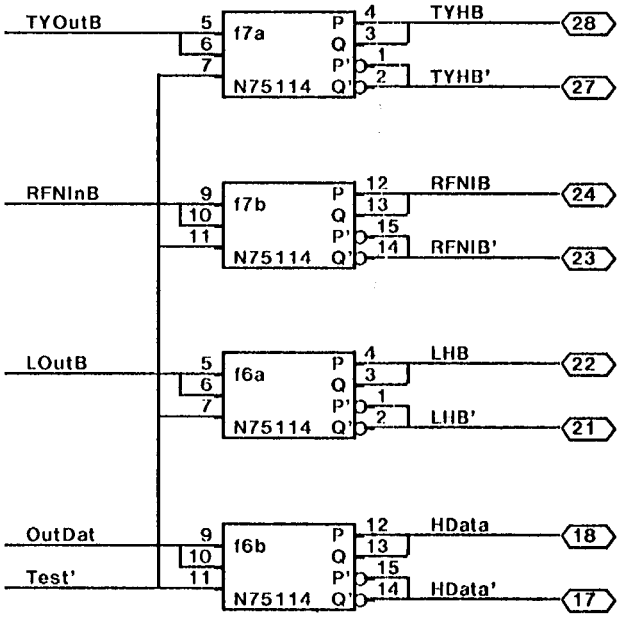






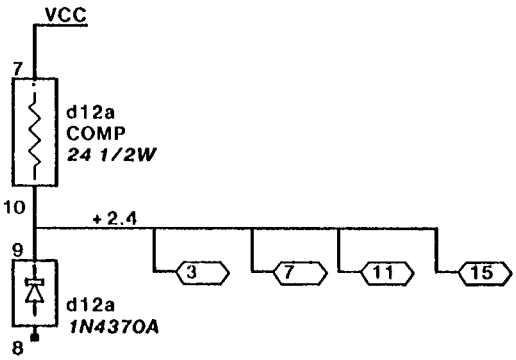
XEROX PARC	Project Alto-1822	Data Paths	File AI05ps.sil	Designer L. Stewart	Rev 1	Date 09/08/78	Page 05 of 9



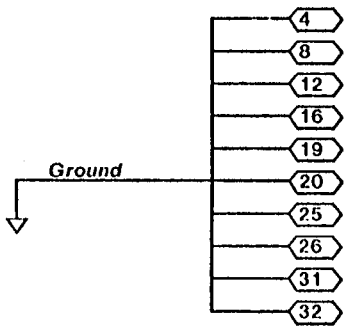


Note:

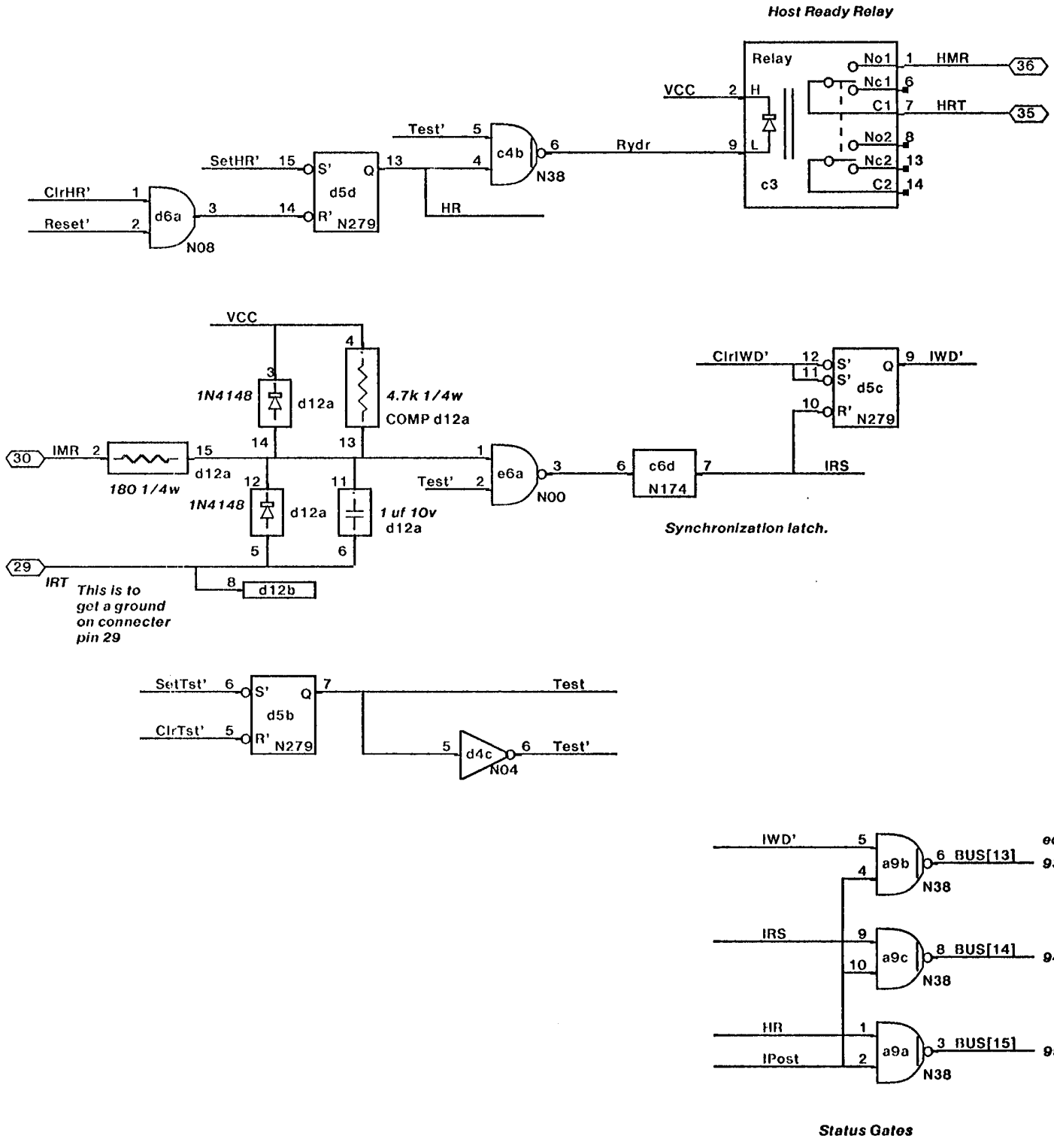
For use with Local Host style interface, use only high sides of input and output drivers. Let the low side of the output drivers float and tie the low side of the receivers to about 2 volts.



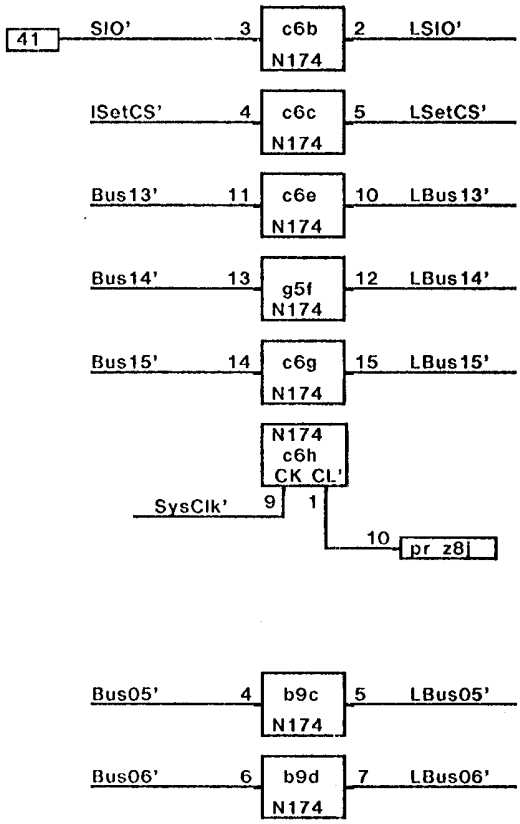
Note:
Pin 8 is ground on the PC board.



XEROX	Project		File	Designer	Rev	Date	Page



XEROX PARC	Project Alto-1822	Ready Lines, Status	File AlO7pc.sil	Designer L. Stewart	Rev J	Date 09/08/78	Page 07 of 8


41
SIO'
3
c6b
N174
2
LSIO'
ISetCS'
4
c6c
N174
5
LSetCS'
Bus13'
11
c6e
N174
10
LBus13'
Bus14'
13
g5f
N174
12
LBus14'
Bus15'
14
c6g
N174
15
LBus15'
N174
c6h
CK CL'
SysClk'
9
1
10
pr z8j
Bus05'
4
b9c
N174
5
LBus05'
Bus06'
6
b9d
N174
7
LBus06'

Alto 1822 Interface cable descriptions

These pages describe various cables and connectors used with Alto-1822 interfaces.

Filed on: [Ivy]<Alto-1822>AICables.memo

Last Modified by L. Stewart November 5, 1978 3:51 PM

Alto internal cable 1822 interface (PC version)

One end is a 40 conductor PC edge connector and the other is a DCC-37S. The wire is 40 conductor ribbon cable.

DCC-37S connector	Alto card connector	Signal name
1	1	TYIB'
20	2	TYIB
2	3	+2.4
21	4	GND
3	5	RFNHB'
22	6	RFNHB
4	7	+2.4
23	8	GND
5	9	LIB'
24	10	LIB
6	11	+2.4
25	12	GND
7	13	IData'
26	14	IData
8	15	+2.4
27	16	GND
9	17	HData'
28	18	HData
10	19	GND
29	20	GND
11	21	LHB'
30	22	LHB
12	23	RFNIB'
31	24	RFNIB
13	25	GND
32	26	GND
14	27	TYHB'
33	28	TYHB
15	29	IRT
34	30	IMR
16	31	GND
35	32	GND
17	33	blank
36	34	blank
18	35	HRT
37	36	HMR
19	37	blank

38	blank	Not wired at DCC-37
39	blank	Not wired at DCC-37
40	blank	Not wired at DCC-37

Alto 1822 Interface External Extension Cable

One end is a DCC-37P connector and the other is a DCC-37S. The wire is Belden 8775 - 11 shielded pairs or equivilent. The horizontal lines indicate the pairs and corresponding shields.

DCC-37S connector	Wire color	Signal name
1	Red	TYIB'
20	Blue	TYIB
2		+2.4
21	Shield	GND
3	Red	RFNHB'
22	Green	RFNHB
4		+2.4
23	Shield	GND
5	White	LIB'
24	Black	LIB
6		+2.4
25	Shield	GND
7	Red	IData'
26	White	IData
8		+2.4
27	Shield	GND
9	Orange	HData'
28	Black	HData
10	Shield	GND
29	Shield	GND
11	Red	LHB'
30	Black	LHB
12	Green	RFNIB'
31	Black	RFNIB
13	Shield	GND
32	Shield	GND
14	Brown	TYHB'
33	Black	TYHB
15	Red	IRT
34	Yellow	IMR
16	Shield	GND
35	Shield	GND
17		blank
36		blank
18	Blue	HRT
37	Black	HMR
19		blank

Alto 1822 PRU cable

One end is a DCC-37P connector and the other is a MIL 48-16R18-31P. The wire is Belden 8775 - 11 shielded pairs or equivilent. The horizontal lines indicate the pairs and corresponding shields.

Notes: The Parc PRU cable is wired with all the color pairs reversed and the ASD PRU cable uses a different kind of wire... These colors should be taken only as a recommendation.

DCC-37S connector	PRU connector	Wire color	Signal name
1	6	Red	TYIB'
20	5	Blue	TYIB
2		+2.4	
21	31	Shield	GND
3	8	Red	RFNHB'
22	7	Green	RFNHB
4		+2.4	
23	31	Shield	GND
5	2	White	LIB'
24	1	Black	LIB
6		+2.4	
25	31	Shield	GND
7	4	Red	IData'
26	3	White	IData
8		+2.4	
27	31	Shield	GND
9	24	Orange	HData'
28	23	Black	HData
10	31	Shield	GND
29	31	Shield	GND
11	22	Red	LHB'
30	21	Black	LHB
12	18	Green	RFNIB'
31	17	Black	RFNIB
13	31	Shield	GND
32	31	Shield	GND
14	20	Brown	TYHB'
33	19	Black	TYHB
15	14	Red	IRT
34	13	Yellow	IMR
16	31	Shield	GND
35	31	Shield	GND
17		blank	
36		blank	
18	12	Blue	HRT
37	11	Black	HMR
19		blank	

Alto 1822 interface to IMP adapter Cable

One end is an DBC-25P and the other is a DCC-37P.

All signal pairs such as 20,21 22,23 ..... 34,35 should be twisted pairs. The colors are for the Maxc2 adapter cable. Groups of wires separated by horizontal lines indicate the cable pairing. The colors are only intended as a suggestion. Note that pins 16 and 35 of the DCC-37P are used twice. (This cable is used between Maxc2 and the IMP).

DCC-37P	DBC-25P	Wire	Signal name
1 jump to 2			TYIB' - 2.4v
20	5	Red	TYIB
21	18	White	GND
3 jump to 4			FRNHB' - 2.4v
22	7	Green	RFNHB
23	20	Brown	GND
5 jump to 6			LIB' - 2.4v
24	1	Yellow	LIB
25	14	Brown	GND
7 jump to 8			IData' - 2.4v
26	3	Orange	IData
27	16	Brown	GND
28	8	Red	HData
10	21	Brown	GND
30	6	Violet	LHB
29	19	White	GND
31	2	Blue	RFNIB
13	15	White	GND
33	4	Green	TYHB
32	17	White	GND
15	11	Green	IRT
16	24	Black	GND
34	12	Red	IMR
16	25	Black	GND
18	9	Yellow	HRT
35	22	Black	GND
37	10	Blue	HMR
35	23	Black	GND

Alto - 1822 Interface Distant host test plug

This plug loops back the Alto-1822 interface using 'Distant-Host' signals

Plug type DCC-37P

On the DCC-37P connector	Jumper pins			
TYIB'	1	to	14	TYHB'
TYIB	20	to	33	TYHB
RFNHB'	3	to	12	RFNIB'
RFNHB	22	to	31	RFNIB
LIB'	5	to	11	LHB'
LIB	24	to	30	LHB
IData'	7	to	9	HData'
IData	26	to	28	HData
IRT	15	to	18	HRT
IMR	34	to	37	HMR

Alto - 1822 Interface Local host test plug

This plug loops back the Alto-1822 interface using 'Local-Host' signals

Plug type DCC-37P

On the DCC-37P connector	Jumper pins			
TYIB'	1	to	2	+2.4v
RFNHB'	3	to	4	+2.4v
LIB'	5	to	6	+2.4v
IData'	7	to	8	+2.4v
TYIB	20	to	33	TYHB
RFNHB	22	to	31	RFNIB
LIB	24	to	30	LHB
IData	26	to	28	HData
IRT	15	to	18	HRT
IMR	34	to	37	HMR

1822 Cable Breakout Box

This is a 122 pin edge-connector wire-wrap board plus several scotchflex to DB-37 adaptors. It is a debugging tool really.

DCC-37 connector	Alto card connector	Card A connector	Card B connector	Signal name
1	1	1	23	TYIB'
20	2	62	84	TYIB
2	3	2	24	+2.4
21	4	63	85	GND
3	5	3	25	RFNHB'
22	6	64	86	RFNHB
4	7	4	26	+2.4
23	8	65	87	GND
5	9	5	27	LIB'
24	10	66	88	LIB
6	11	6	28	+2.4
25	12	67	89	GND
7	13	7	29	IData'
26	14	68	90	IData
8	15	8	30	+2.4
27	16	69	91	GND
9	17	9	31	HData'
28	18	70	92	HData
10	19	10	32	GND
29	20	71	93	GND
11	21	11	33	LHB'
30	22	72	94	LHB
12	23	12	34	RFNIB'
31	24	73	95	RFNIB
13	25	13	35	GND
32	26	74	96	GND
14	27	14	36	TYHB'
33	28	75	97	TYHB
15	29	15	37	IRT
34	30	76	98	IMR
16	31	16	38	GND
35	32	77	99	GND
17	33	17	39	blank
36	34	78	100	blank
18	35	18	40	HRT
37	36	79	101	HMR
19	37	19	41	blank
	38	80	102	blank
	39	20	42	blank
	40	81	103	blank