
COMMODORE

AMIGA 2000

Technical Manual

3/87

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Amiga Hardware Konzept

1

AMIGA HARDWARE - KONZEPT

Das 68000-System des Amiga

- * Der OSA Amiga 2000
- * Die Slots des OSA Amiga 2000
- * Die Brücke

Die typische Arbeitsweise des AMIGA:

- Agnus, Paula und Denise
- Modularer Aufbau mit Steckplätzen
- Für Coprozessoren ausgelegt
- PC-Steckplätze für besondere MS-DOS Programme
- Automatische Kartenverwaltung durch Amiga-DOS
- Der integrierte PC nach dem Industriestandard
- Der Amiga als Doppelcomputer
- Dual-Port-RAM liest IFF- und ASCII - Formate
- 8088 und 80286 auch als Coprozessor
- Schnittstellen
- Register
- Multitasking für eine neue Software-Generation

Der OSA Amiga 2000

Nach der erfolgreichen Einführung des Amiga 1000 entstand der Wunsch, die Leistungsfähigkeit dieser Maschine mit der Flexibilität einer offenen Systemarchitektur zu kombinieren. Das Ergebnis ist ein zum Amiga 1000 völlig kompatibler Rechner, der jedoch den jeweiligen Anforderungen entsprechend konfiguriert werden kann.

Neben der leistungsfähigen 68000 CPU, den schnellen Graphikchips und dem CD-ähnlichen, digitalen Audioteil wurden ein Bussystem für Steckkarten sowie eine batteriegepufferte Echtzeituhr integriert. Das Netzteil wurde verstärkt und Einbaumöglichkeiten für insgesamt drei Laufwerke vorgesehen.

In der Standardversion hat der OSA Amiga 2000 bereits 1,25 MB Hauptspeicher. Das Gehäuse ist ähnlich der PC-Serie aufgebaut und bietet Platz für insgesamt neun Steckkarten. Sieben dieser Plätze sind für Speicher, Peripherie und Coprozessoren vorgesehen, ein Steckplatz kann eine andere Haupt-CPU aufnehmen, ein Steckplatz ist für Video-Anwendungen gedacht. An der Geräterückseite befinden sich Steckverbinder zum Anschluß von Druckern, Modems und weiteren Diskettenlaufwerken sowie Audio- und Videoausgänge. Schlitze in der Rückwand sind vorgesehen für Steckverbinder von Erweiterungskarten.

Die Tastatur wurde auf insgesamt 96 Tasten (europäische Version) erweitert und in der Breite der PC-Tastatur angepaßt.

Die Slots des OSA Amiga 2000

Durch Steckplätze kann der OSA Amiga 2000 entsprechend aufgerüstet werden. So kann man bei Bedarf Speicher in Schritten von 2 MB addieren, eine Harddisk einbauen und weitere Coprozessoren installieren.

Es gibt einen besonderen Steckplatz für eine weitere Haupt-CPU. Hier könnte z.B. ein 68020 installiert werden. Multiuser-Betriebssysteme wie z.B. Unix benötigen eine MMU (Memory Management Unit); ein 68020-System benötigt einen 32-Bit Speicherbus. So könnte man hier eine Karte installieren, die einen 68020 mit Cache-Speicher, MMU und 1 MB Hauptspeicher enthält. RAM-Erweiterungen für dieses 32 Bit-System lassen sich in den normalen Bausteckplätzen installieren; die zusätzlichen 16 Datenleitungen könnte man als Flachbandkabel ausführen.

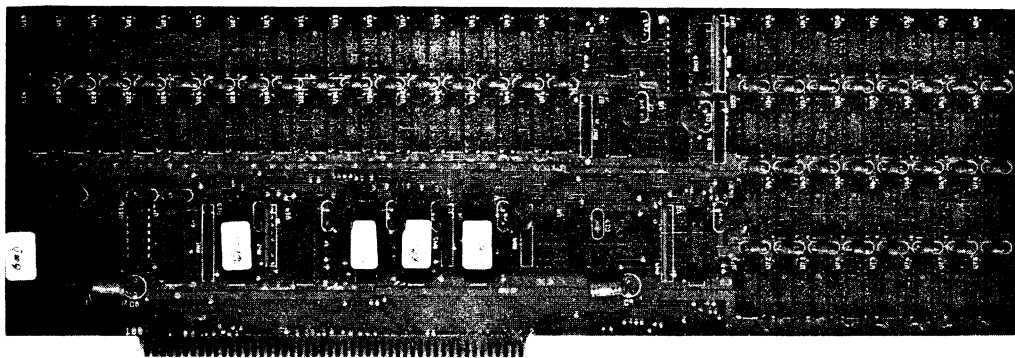


Abb. 2: Steckkarte mit 2 MB RAM-Erweiterung.

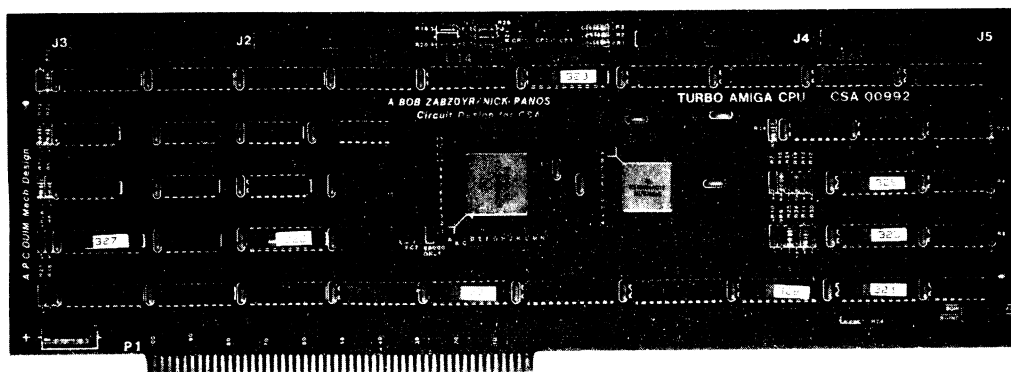
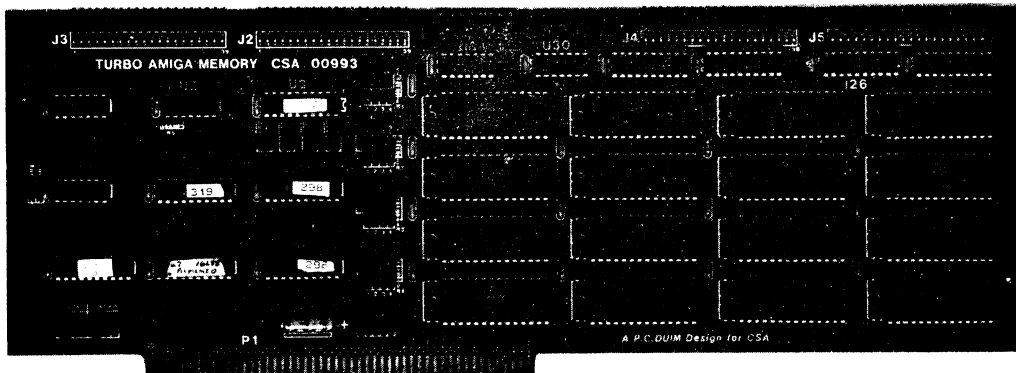


Abb. 3: Steckkarten für 32 bit CPU 68020, kombinierbar mit dem Arithmetik-Prozessor 68881.

Die Brücke

Im OSA Amiga 2000 gibt es zwei überlappende Bussysteme, die durch eine Brückenkarte miteinander verbunden werden. Eines dieser Bussysteme ist die Erweiterung für den 68000, das andere System ist zunächst leer. Durch die Brückenkarte kann es in Betrieb genommen werden.

So gibt es z.B. eine Karte mit einem 8088-Coprozessor, der seinerseits einen PC-kompatiblen Bus steuern kann. Der 8088 kommuniziert über ein Dual-Port-RAM mit dem 68000 und kann gleichzeitig lokal übliche PC-Erweiterungskarten betreiben. Damit stellt diese Karte eine Brücke zwischen zwei Welten dar: Die Verbindung zwischen der Amiga-Welt und der PC-Welt. Der 8088 macht den OSA Amiga 2000 zu einem echten Hybridsystem, das die Vorzüge beider CPUs in sich vereinigt. So kann man in entsprechenden Anwendungen zur Entlastung des 68000 I/O-Operationen mit dem 8088 abwickeln. Man kann allerdings auch MS-DOS auf dem 8088 laufenlassen. Dieses Betriebssystem findet hier eine völlig kompatible PC-Umgebung vor.

MS-DOS kann in einem Fenster des OSA Amiga 2000 ablaufen und fügt sich damit völlig konform in das Multitasking-Betriebssystem des 68000 ein. Daß MS-DOS Programme auf dem 8088 ablaufen, ist für den Anwender nicht direkt sichtbar. Er sieht lediglich eines von mehreren Workbench-Fenstern mit einem Programm. Neben MS-DOS können natürlich auch Betriebssysteme wie CP/M 86, Concurrent CP/M oder Concurrent DOS verwendet werden.

Das gesamte Spektrum der PC-Erweiterungskarten steht auch dem 68000 zur Verfügung. Es gibt spezielle Programme zum Datenaustausch zwischen den Systemen. Festplatten können partitioniert und so von beiden Betriebssystemen gleichzeitig benutzt werden.

Auch Betriebssysteme wie Unix könnten den 8088 als internen Koprozessor nutzen oder mit seiner Hilfe MS-DOS in UNIX integrieren.

Damit ist der OSA Amiga 2000 nicht auf ein einziges Betriebssystem festgelegt, sondern bietet auch hier die Vorzüge einer völlig offenen Systemarchitektur. Auch die Brücke ist nicht auf einen einzigen Prozessortyp festgelegt. Die lokalen Steckplätze sind auch von den Prozessoren wie 80286 oder 80386 nutzbar. Deshalb hat die Brücke den Namen "Janus" bekommen.

Janus hatte zwei Gesichter und konnte gleichzeitig in die Vergangenheit und in die Zukunft blicken.

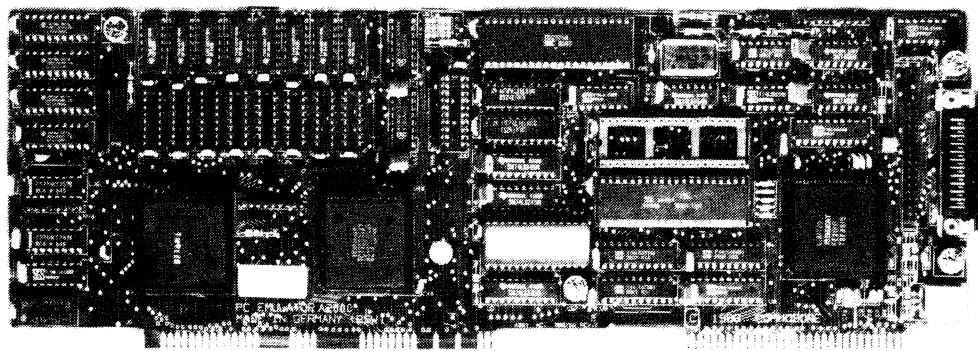


Abb. 4: Brückenkarten mit Co-Prozessoren 8088 und 80286 lassen den Amiga OSA zum XT/AT-kompatiblen MS DOS-Rechner werden. Hier die XT-kompatible Karte.

Datenübersicht AMIGA 2000 OSA OPEN SYSTEM ARCHITECTURE

Prozessoren/Controller

CPU:	Motorola 68000, 16/32 bit
Taktfrequenz:	7,14 Mhz
Co-Prozessoren:	3 Co-Prozessoren für DMA, Video, Graphik und Sound
Grafik- und Zeichentrick-Chip "Agnus"	<div><div>Bit-Blitter</div><div><ul style="list-style-type: none">- Hochgeschwindigkeits-Datentransfer mit Verknüpfung von Daten aus drei verschiedenen Quellen für die Bewegung von Objekten- schnelles Linien-Zeichnen und Flächen-Füllen mit 1 Mio Punkte pro Sekunde, baut 60 Bilder pro Sekunde auf</div></div>

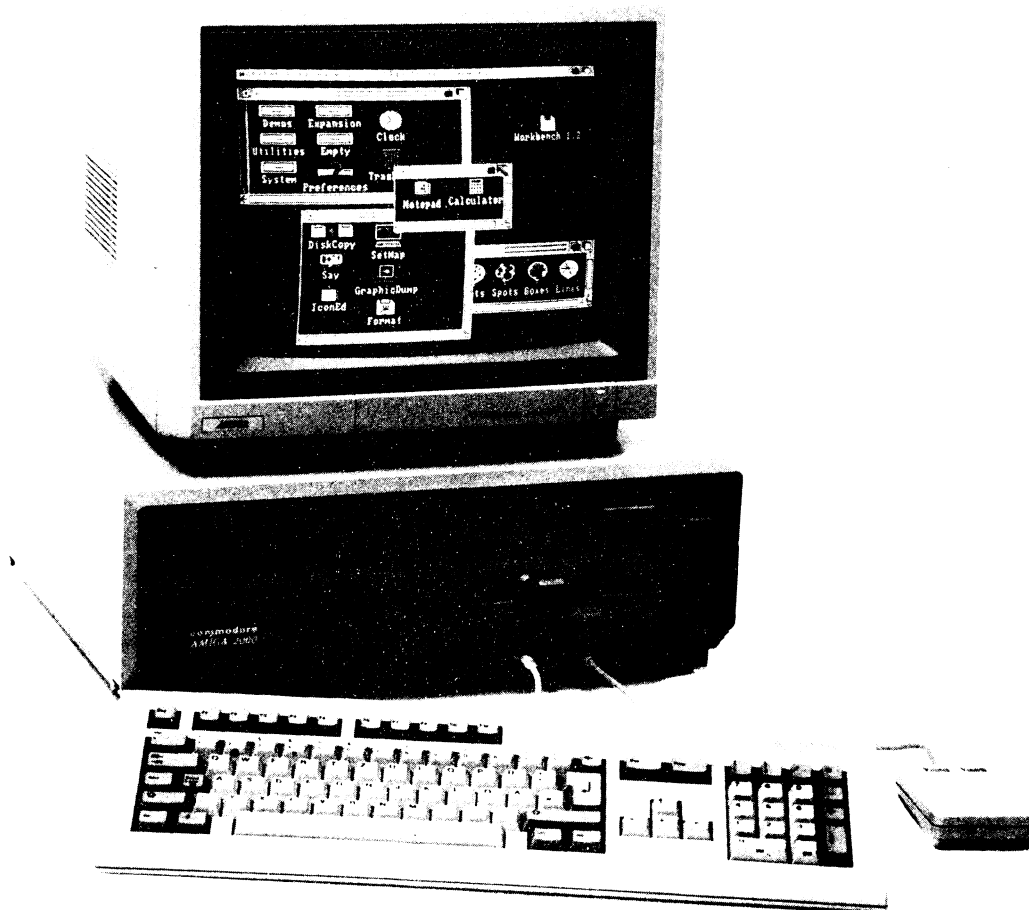


Abb. 5: Amiga 2000 mit OSA Offener System Architektur

- erkennt Kollisionen zwischen zwei bewegten Objekten

Copper/Coprozessor

- ist mit Bildschirm synchronisiert, wird von Rasterstrahl gesteuert
- versorgt die Register von Agnus, Paula und Denise
- kontrolliert 25 DMA-Kanäle

Video Chip "Denise":

Graphik Modus:

- 320 x 256
- 320 x 512
- 640 x 256
- 640 x 512

Farben

- 32 bei 320 Spalten
- 16 bei 640 Spalten aus 4096 Farbtönen
- bis zu 4096 Farbtöne je nach Betriebsart gleichzeitig darstellbar

Text Modus:

- wahlweise 60 oder 80 Zeichen breit, zu 25 Zeilen in Farbe

Sprite-Controller/8

- faßt auf Wunsch zwei Sprites zusammen
- Kollisionsdetektor mit Prioritätenfestlegung bei Überschneidung

Video-Display:

625 Zeilen vertikal, Frequenz 50 Hz
Videospeicher max. 512 kB

Port-Chip "Paula": DMA-Steuerung

- steuert den RAM-Zugriff aller berechtigten Bausteine

I/O-Steuerung

- serielle Schnittstelle
- parallele Schnittstelle
- Control-Ports
- Tastatur
- Audio-Ausgabe
 - 4 Tonkanäle für zwei Stereoausgänge
 - programmierbare Amplitude und Sampling-Rate
 - 9 Oktaven
 - komplexe Wellenform
 - Amplituden- und Frequenzmodulation
- Audio-Eingabe
 - Steuerung eingelesener Naturstimmen oder von Musik-Originalen (über Spezialinterface)

Speicher

Speicherkapazität: 1,25 MB

- 1 MB RAM
- 256 KB ROM für Kickstart 1.2
- Arbeitsspeicher intern in 2 MB-Schritten auf 9,5 MB RAM aufzurüsten/
mit AutoConfig-Funktionen

Massenspeicher: integriert

- 1 x 3 1/2 Zoll Mikro Floppy-Disk
- 880 KB formatiert

Einschübe für optionale halbhohe Laufwerke

- 1 x 3 1/2 Zoll Mikro Floppy-Disk oder Harddisk
- 1 x 5 1/4 Zoll Floppy-Disk oder Harddisk (für den Einsatz im MS-DOS-Format)

extern

- 2 Amiga Floppy Disks
- 3 1/2 oder 5 1/4 Zoll
- 3 Floppy Disks/MS-DOS formatiert
in Verbindung mit Amiga-Brückenkarten

Externe Systeme

- optische Speichersysteme
- Videorecorder

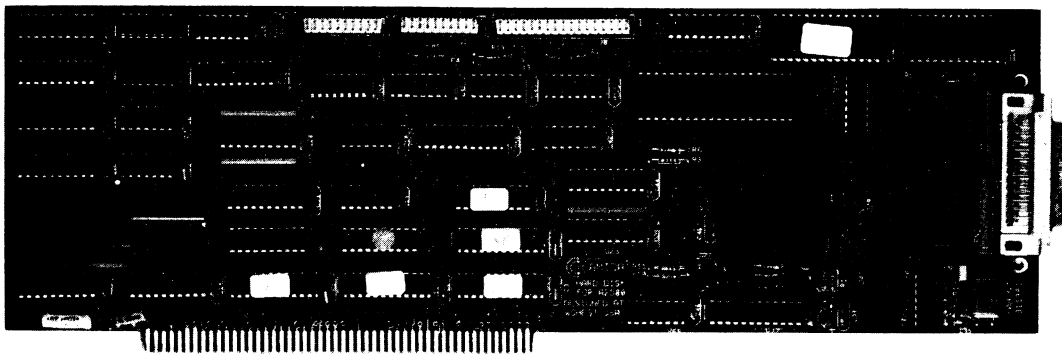


Abb. 7: Steckkarte mit Harddisk-Controller

Eingabeelemente

Tastatur

- prozessorgesteuert
- 96 Tasten
- separater Rechenblock
- separate Cursor-Tasten
- 10 Funktionstasten
- Tastatur abnehmbar
- Help-Funktionstasten

Maus

- zwei Bedienungsknöpfe
- optomechanisch

Audio-Eingabe

- über HiFi-Geräte, Videorecorder, CD-Player
- Mikrofon/Verstärker
- Musikinstrumente mit Midi-Interface

Video-Eingabe

- mit Genlock-Interface / Synchronisation von Computer mit Videoquellen und Darstellung als hintere Bildebene auf Monitor
 - über Videokamera
 - Bildplatte
 - Fernseher
 - Bildschirmtext
 - Scanner
- Bildbe- und verarbeitung über Video-Digitalisierung

Schnittstellen

Seriell:

Programmierbarer Port

- Baudraten bis 31.250
- RS 232 C
- Midi über Adapterstecker
- PC Standardbelegung

Parallel:

Programmierbarer Port

- für Ein- und Ausgabe
- normalerweise als Centronics konfiguriert
- PC Standardbelegung

Controller-Ports:

2 Ports

- Maus
- Grafiktabellen
- Lightpen
- Steuerknüppel
- Drehregler

Video/Audio: 2 Ports
 - Cynch Stereo/Audio
 - RGB analog, digital

Tastatur: 1 Port

System-
 Steckplätze: Insgesamt 7
 - 2 Steckplätze mit kombinierten Amiga -
 PC/AT-Positionen
 Amiga CPU-Bus
 - 1 Steckplatz (86 pin) für CPU-Extension
 wie MC 68020/68881
 Amiga System-Bus
 - 5 Steckplätze (100 pin) mit AutoConfig-
 Funktionen
 Erweitertes Bus-System
 - 2 Steckplätze PC/AT-kompatibel (Vollformat)
 - 2 Steckplätze PC kompatibel

Video-
 Steckplatz: 1 Videosteckplatz für interne NTSC/PAL-Coder
 für Composite-Video, internes Genlock usw.

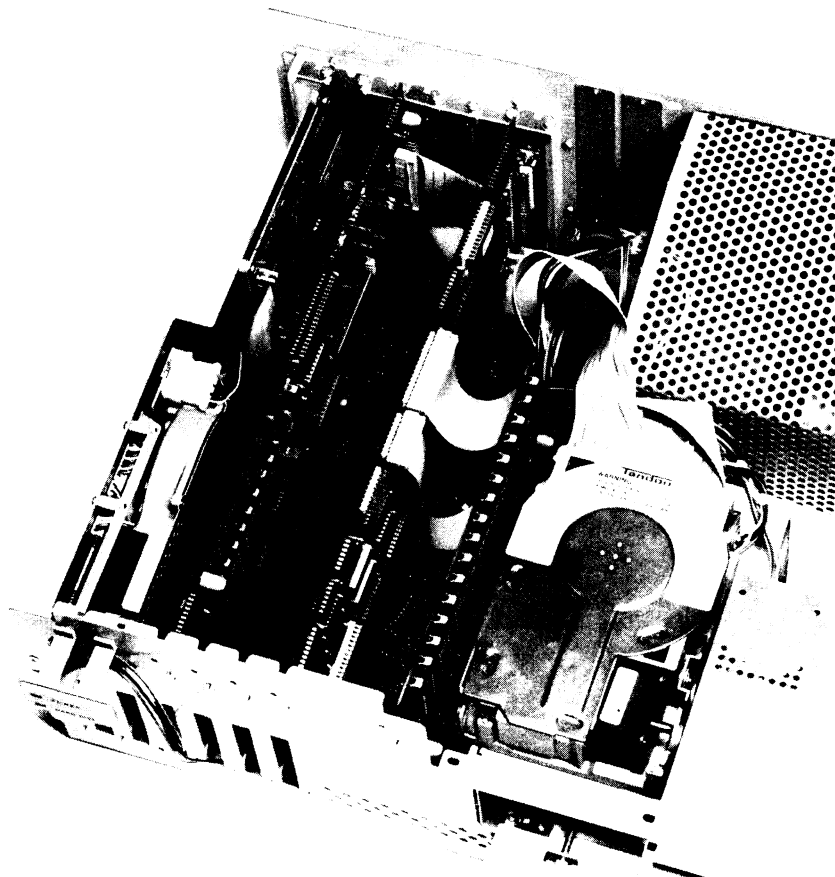


Abb. 8: Harddisks gibt es mit Fronteinschub und für zusätz-
 liche Speicheraufgaben auch als File Card (auf Steckkarte
 vorne links)

Ausgabemedien

Monitor:	Color Monitor - 14 Zoll
Sprach/Sound- ausgabe:	Eingebauter Lautsprecher oder über externe Tonquellen, 4 unabhängige Soundkanäle als 2 Stereokanäle konfiguriert
Datenfernüber- tragung:	Übertragung von digitalisierten In- formationen aus Texten, Grafiken, Bildern, Sprache und Musik je nach Datenleitung
Netzteil:	220 Volt, 50 Hz 200 Watt für Basisgerät und Erweiterungen

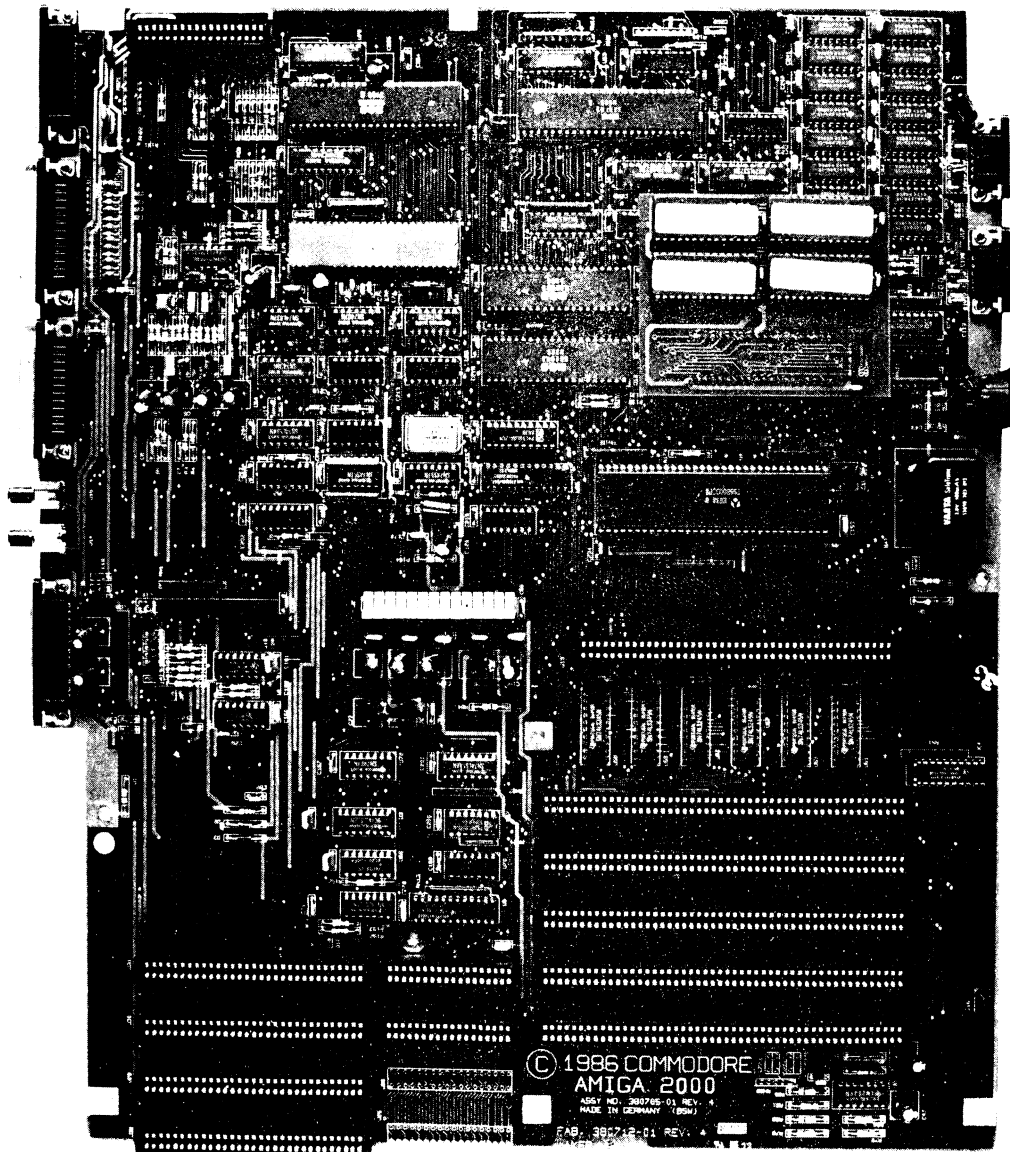


Abb. 10: Amiga-Hauptplatine mit CPU 68000, 3 Co-Prozessoren für DMA, Video, Graphik/Sound, 7 System-Steckplätzen und einem Video-Steckplatz.

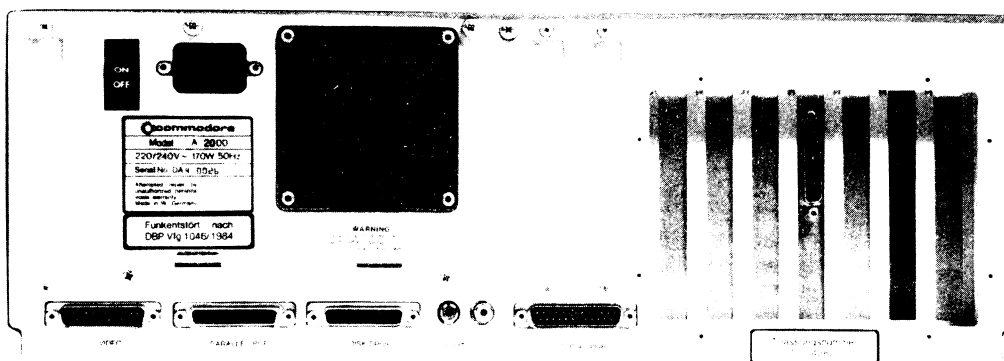
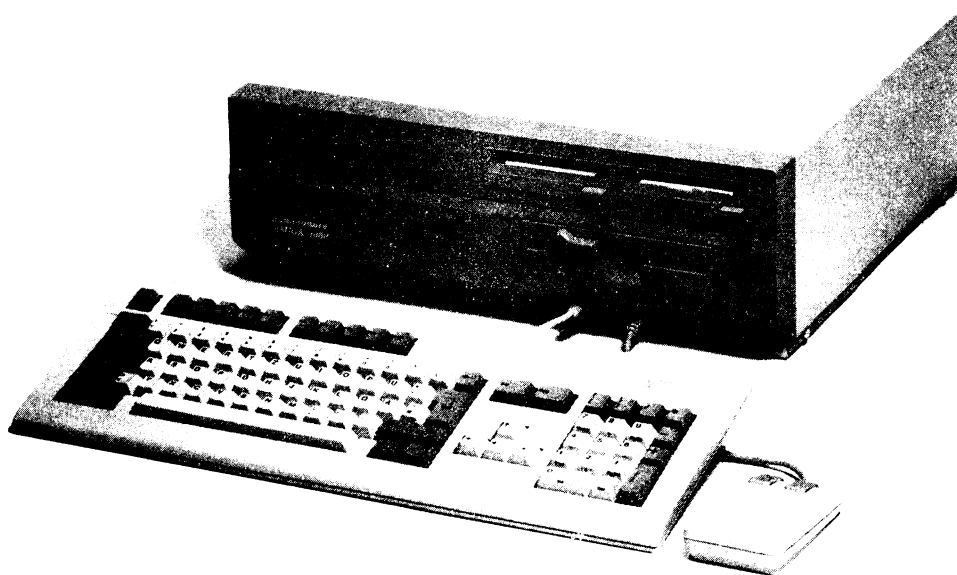
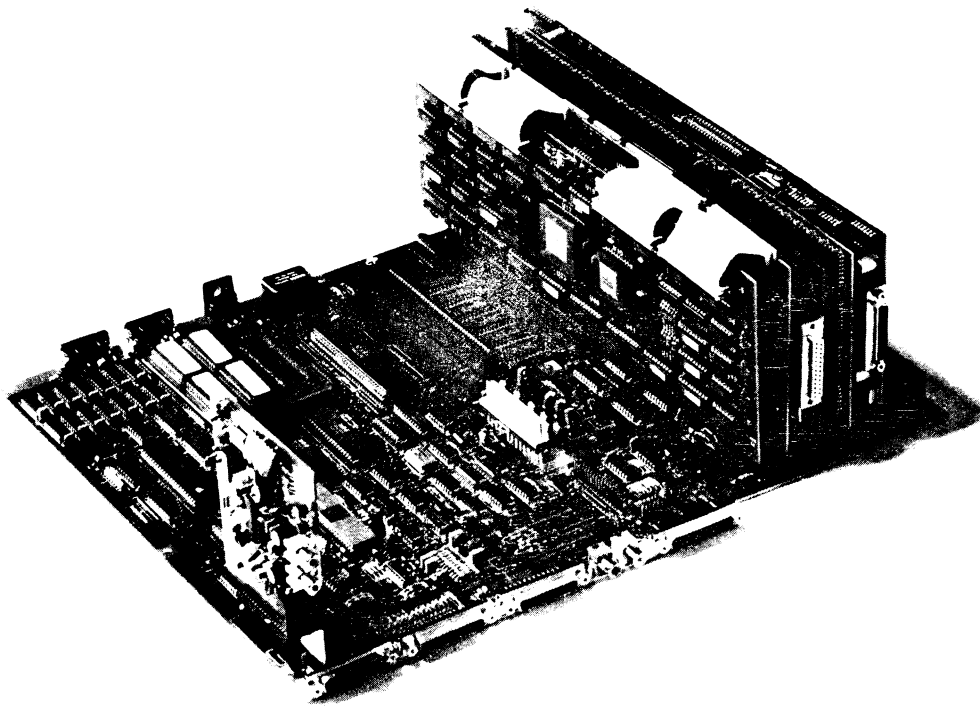


Abb. 11: Hauptplatine mit Steckkarten, vorne links Video-Steckkarten

Abb. 12: Gehäuse Amiga 2000 für CPU, Massenspeicher, Schnittstellen und System-Erweiterungskarte

Abb. 13 Schnittstellen, übersichtlich auf der Rückseite

OSA-Brückenkarten
von Commodore

XT-kompatible
Steckkarte: Erweitertes Prozessor-System 8088

- ermöglicht ein 8088 Co-Prozessor-system mit XT-Kompatibilität
- benutzt AutoConfig-Funktionen des Amiga
- kann um Arithmetik-Coprozessor 8087 erweitert werden

Daten auf 8088-
Seite

Taktfrequenz: 4,77 Mhz

Interfaces: - 1 interne Floppy Disk 5 1/4"

- 1 externe Floppy Disk 5 1/4"
- MS-DOS formatiert
- 360 oder 720 KB
- Parallel-Port/Centronics, PC-kompatibel emuliert Amiga Parallel-Port

AT-kompatible
Steckkarte: Erweitertes Prozessor-System 80286

- ermöglicht ein 80286 Co-Prozessor-system mit AT-Kompatibilität
- benutzt AutoConfig-Funktionen des Amiga
- kann um Arithmetik-Coprozessor 80287 erweitert werden

Daten auf 80286-
Seite

Taktfrequenz: 8 Mhz

Interfaces: - 1 interne Floppy Disk 5 1/4" 1,2 MB

- 1 interne Floppy Disk 3 1/2" 720 KB
- MS-DOS formatiert
- Parallel-Port/Centronics, PC/AT-kompatibel emuliert Amiga Parallel-Port

Identische Daten
8088 und 80286

Arbeitsspeicher: 512 KB RAM

Festwertspeicher: 16 KB BIOS ROM

Steckplätze: 3 PC bzw. AT-kompatible für Vollformat

- Harddisk-Controller
- Kommunikations-Adapter
- Graphik-Adapter

Tastatur: XT- bzw. AT-Tastatur emuliert durch Amiga-Tastatur

Video-Display: PC bzw. AT monochromer Textmodus und Colormodus werden in separaten Amiga DOS-Fenstern gleichzeitig emuliert

System-Software: MS-DOS 3.2

Kartentyp: Benutzt Amiga-Bus (100 pin) und PC/AT-Bus-System in kombinierter Position

Daten auf Amiga-Seite

Inter System-Kommunikation:

- 64 KB Dual Port-RAM als Inter Prozeß-Buffer
- 64 KB Dual Port Scratch-Memory auf Amiga-Seite
- Interrupt-Logik
- Janus Emulations-Software

Bus Interface-Typ: Schneller Dual Port-Speicher, schneller CPU-Zugriff mittels DMA

Kartengröße: Vollformat Amiga-Karte

Stromversorgung: über das Gerät

Eingeschlossen: Janus Emulations-Software auf 3 1/2" Floppy Disk

Arbeitsprinzip der Amiga-Hardware in OSA

Offener System Architektur

Die Motorola 68000 CPU bearbeitet Programme überlappend, im sogenannten "Pipelining". Das Holen des nächsten Befehls überlappt sich mit der Dekodierung und Ausführung der zwei vorhergegangenen Befehle.

Agnus, Paula und Denise

Für den schnellen Grafikaufbau hat der Video-Chip namens "Agnus", ein für diesen Zweck extra konstruierter Bit-Blitter, Zugriff auf einen eigenen Speicherteil, das Chip-RAM. Agnus sorgt für den Hochgeschwindigkeits-Datentransfer und ist dabei in der Lage, Daten aus drei verschiedenen Quellen für die Bewegung von Objekten zu verknüpfen! Agnus erkennt Kollisionen zwischen bewegten Objekten kontrolliert 25 DMA Kanäle. Er hat also sehr viel mit der Geschwindigkeit zu tun und er ist es auch, der das schnelle Füllen und Zeichnen von "Denise" ermöglicht.

Der Prozessor "Paula" regelt den Zugriff der Coprozessoren auf den Speicher, so daß sie nicht mit der Haupt CPU kollidieren. Ihm obliegt die DMA-Steuerung. Jeder Prozessor im Amiga kann dadurch mit seiner optimalen Geschwindigkeit arbeiten, ohne auf andere Prozessoren Rücksicht nehmen zu müssen. Paula bewältigt aber auch die gesamte I/O-Steuerung. Dazu gehören zunächst die Steuerung der seriellen Schnittstelle, der parallelen Schnittstelle, des Control-Ports, der Tastatur, der Audio-Eingabe und der Audio-Ausgaben.

Letztere bewältigt immerhin vier Tonkanäle für zwei Stereoausgänge mit programmierbarer Amplitude und Sampling-Rate, 9 Oktaven, beliebige Wellenformen und neben der Amplituden- auch die Fre-

quenzmodulation. Die Audio-Eingabe liest selbst Naturstimmen über Mikrofon und - über Spezialinterface - Musik-Originale ein.

Denise verwaltet die Grafik und die insgesamt 4096 Farben. Er steuert die Sprites und die sogenannten "Playfields". Das sind mehrfarbige Grafiken, die eine fast beliebige Größe haben und die ausschnittsweise bewegt werden können. Der Blitter "Agnus" ist in der Lage, etwa eine Million Punkte pro Sekunde zu zeichnen. Er unterstützt damit den Grafikprozessor Denise. Auf diese Weise werden beispielsweise Flächen mit nicht mehr sichtbarer Geschwindigkeit gefüllt, sie sind "einfach da". 60 Bilder baut der Amiga in der Sekunde auf, das ist schneller, als der Wechselstrom die Phase wechselt. Dieses hohe Tempo ist vor allem in der Animation wichtig, denn es reicht aus, um Zeichentrickfilme darzustellen.

OSA Amiga 2000: Modularer Aufbau mit Steckplätzen

Mit 23 Adressleitungen und dem Adress-Strobe für nieder- und höherwertiges Byte kann die 68000 CPU 16 MB direkt adressieren. 1,25 Megabyte sind Standard im neuen OSA Amiga 2000. Auf über 9 MB kann aufgerüstet werden. Eine Echtzeituhr ist natürlich integriert. Interessant ist auch die Möglichkeit, den verwendeten Prozessor durch einen anderen, leistungsfähigeren der Motorola-Linie zu ersetzen, etwa den 68020 mit Cache-Speicher oder durch den 68030. Über die Steckplätze lassen sich Karten mit 8088-, 80286- und künftig sogar mit 80386 - Karten nachrüsten. Das geht, weil der MMU- ("Memory-Management-Unit-") Konnektor für die Aufnahme einer weiteren CPU-Karte vorgesehen ist. Der OSA Amiga 2000 arbeitet damit als hochleistungsfähige Workstation in der Intel- oder in der Motorola-Linie oder mit beiden.

Auf der Amiga-Seite sind sieben Steckplätze vorhanden. Mit den genannten High-End-Prozessoren kann dann auch die Verbindung zu UNIX hergestellt werden. Die anderen sechs Steckplätze können weiteren Speicherplatz aufnehmen (bis zu 8 MB), eine Harddisk-Karte, ein Meßsystem oder anderes.

Für Coprozessoren ausgelegt

Für umfangreiche rechenintensive Programme aus dem CAD/CAM Bereich, der Forschung usw. ist der Anwender mit Sicherheit dankbar für die Möglichkeit, mathematische Coprozessoren einzusetzen. Diese Coprozessoren laufen dann im gleichen Takt wie die "Master-CPU" und verfügen über eigene Interrupts.

PC-Steckplätze für besondere MS-DOS-Programme

Die beiden äußeren Slots liegen mit den PC-Steckplätzen in einer Linie. Die sogenannte Brückenkarte verbindet den Amiga-Bus mit dem PC- bzw. AT- Steckplatz. Neben dieser XT/AT-Karte hat dann noch eine PC-typische Erweiterung Platz. So kann in der Amiga-Umgebung typische MS-DOS - Software laufen, z.B. unter Verwendung der EGA-Karte.

Der gesonderte Video-Steckplatz bietet sich natürlich an, um mit einer Video-Karte professionelle Bilder und Filme auf den Monitor zu zaubern.

Automatische Kartenverwaltung durch Amiga-DOS

Nach dem Einschalten wird geprüft, welche Slots besetzt sind und wieviel Speicherplatz diese Erweiterungen benötigen. Der entsprechende Speicherplatz wird nacheinander zugewiesen. Wenn man des Guten zuviel tut und z.B. die letzte Karte den Speicherplatz überschreitet, ignoriert das Betriebssystem diese Karte. Sie kann dann nicht benützt werden, aber sie stört auch nicht. Gegenüber dem Amiga 1000 ist ein Kick-Start-ROM hinzugekommen. Zum Starten des Systems wird also nur noch die Work- bench-Diskette benötigt.

An sich könnte der Amiga ein reines System für Spezialisten sein, wie etwa für Grafik- und Video-Fans. In diesem Bereich zeigt er überragende Fähigkeiten, man denke nur an Programme wie DPaint2. Infolge des schnellen Rechnens sind auch kleine Zeichen-

trickfilme kein Problem. Die bisher auf dem Amiga erstellten Animationen sind äußerst eindrucksvoll. Trotzdem ist bewußt auf seine Einbettung in die MS-DOS-Welt hingearbeitet worden.

Der integrierte PC nach Industriestandard

Die bekannten Schwächen des Originals und seiner Clones sollten den Amiga nicht behindern. Herausgekommen ist ein in den Amiga integrierbarer PC auf XT- oder AT-kompatibler Basis.

"Janus" nennen die Entwickler die Brückenkarte, die Amiga- und PC-Bus zusammenfügt. Sie enthält ihren eigenen Prozessor mit 4,77 MHz-Takt, einen eigenen Speicher mit 512 KB und einen eigenen Floppy-Controller. XT- und AT-kompatible Karten sind also eigenständige MS-DOS-Systeme. Sie verfügen über eigene Peripherie und über eigene Schnittstellen. Lediglich für die Harddisk ist vorgesehen, daß sie in Bereiche (Partitions) eingeteilt werden kann, die jeweils nur vom Amiga bzw. nur vom MS-DOS aus angesprochen werden können.

Neben dem Steckplatz für die Brückenkarte finden sich drei weitere Slots, die für PC-typische Erweiterungen genutzt werden können. Man kann also z.B. seine EGA-Karte aus dem PC entfernen, sie in einen Amiga PC - Steckplatz einsetzen und mit den gewohnten Programmen auf dem Amiga arbeiten. Wie schon beschrieben, können dann ganz einfach Bilder, Texte und Tabellen in Amiga-DOS Programme übernommen werden.

Der Amiga als Doppelcomputer

Damit ist es dann auch möglich, mit zwei Bildschirmen an dem System zu arbeiten. Einer ist mit der PC-Karte verbunden, der andere zeigt, was der Amiga macht. Sinnvoll ist diese Ergänzung aber nur, wenn der Amiga mit in die Verarbeitung der Daten im PC-Teil eingebunden wird und umgekehrt.

Die Brückenkarte enthält ein eigenes PC-Bussystem, das selbständig behandelt werden könnte. Doch das wäre schade, denn die PC-Erweiterung ist eben deshalb interessant, weil die MS-DOS-Welt in die Amiga-Umgebung eingebettet werden soll.

Im Normalfall wird demgemäß ein Amiga-Programm abgearbeitet. Der Bildschirm zeigt die bekannten Fenster - und in einem dieser Fenster läuft eben das MS-DOS Programm. Dazu ist es notwendig, daß beide voneinander wissen. Die Verbindung der beiden Bussysteme ist recht komplex. Sie werden ständig in einem 14-MHz-Takt miteinander synchronisiert.

Dual-Port-RAM liest IFF- und ASCII - Datenformate

Ein zweites Problem ergibt sich aus der Tatsache, daß die Daten von beiden Systemen gelesen werden sollen. Sie haben aber unterschiedliche Formate, so daß ein einfaches Übertragen nicht möglich ist. Eigens für diesen Zweck existiert ein 128 KB Dual-Port-RAM. Auf dieses RAM können sowohl der Amiga als auch die PC-Karte zugreifen. Der Amiga arbeitet intern mit dem IFF Datenformat (IFF = Interchange File Format). IFF ist eine internationale Standardisierung für die interne Darstellung von Daten im Computer. Sie schließt neben der Darstellung von Schriftzeichen auch die Darstellung von Bild und Ton mit ein.

Das unterschiedliche Datenformat (IFF beim Amiga und ASCII bei MS-DOS) wird durch Einspiegeln des RAM-Bereichs ausgeglichen. Das geschieht, indem beide unter verschiedenen Adressen auf das Dual-Port-RAM zugreifen.

8088 und 80286 auch als Coprozessor

Neben dem selbständigen Abarbeiten von MS-DOS Programmen ist es auch möglich, beide Systeme enger zu verbinden. In diesem Falle übernehmen 8088/80286 als Coprozessor Teilaufgaben, etwa für eine sehr schnelle Ein- oder Ausgabe. Oder beide Prozessoren führen zusammen Floating-Point-Operationen durch.

Schnittstellen

Die parallele und die serielle Schnittstelle sowie die Maus- und Joystick-Anschlüsse sind genormt und bedürfen keiner weiteren Erläuterung. Zum Anschluß der Monitore stehen zwei Stecker zur Verfügung. Der Modulator enthält alle vom SCART-Stecker bekannten Signale, allerdings in anderer Anordnung. Der Video-Anschluß verarbeitet die Farbsignale natürlich ebenfalls getrennt. Zu den analogen Farbsignalen verfügen beide auch über digitale Farbsignale. Die interne Floppy-Schnittstelle entspricht dem Standard für 3,5 Zoll- und 5 1/4 Zoll - Laufwerke.

Register

Der OSA Amiga 2000 benutzt acht 8-bit-Register zur Kontrolle der wichtigsten Funktionen. Eines der wichtigsten Register ist das Interrupt-Status-Register. Bei sieben Prioritätsstufen und einer Fülle von Interrupt-Berechtigten wird es ständig gebraucht. Es existiert sogar zweimal: Zum Einen gibt es Auskunft über den Interrupt-Status des Amiga. Das andere enthält die Daten des PC-Teils. Vom OSA Amiga 2000 aus kann auf Seiten des PC auch ein Interrupt ausgelöst werden, jedoch sind sie dann nur von der Amiga-Seite her zu bedienen.

Bis auf den Interrupt #7 können alle Interrupts maskiert werden, so daß die Ursache eines Interrupts im Programmlauf sofort zu identifizieren ist. Durch Einschreiben in das betreffende Register können vom Programm her Hardware-Funktionen ausgelöst werden. So kann beispielsweise über das Benutzen des "PC negate Reset" der PC gestartet werden.

Das Mode-Register enthält die Informationen über Schnittstellenbenutzung, Keyboard und Monitor (Farbe oder Schwarzweiß). Mit den beiden bits SEL1 und SEL2 werden die Anfangsadressen für das PC- bzw. AT-Memory festgelegt.

Multitasking für eine neue Software-Generation

Schon mit dem eigenen Prozessor ist die Maschine äußerst leistungsfähig. Insbesondere die von vornherein integrierte Multitasking-Fähigkeit ist von besonderer Bedeutung. Im üblichen Single-Betrieb verbringt der Computer den größten Teil seiner Zeit mit Warten: auf Eingaben, auf Speicherverwaltung usw. Ein geschickter Programmierer kann seine Programme so gestalten, daß Teilprogramme, die Ergebnisse für andere Programmteile produzieren, mit jenen zusammen ablaufen.

Sieben Interruptstufen (die höchste Priorität besitzt #7, das ist ein nicht maskierter Interrupt) helfen gleichfalls bei der Gestaltung möglichst flexibler Programme. Der am häufigsten benutzte Interrupt ist #2. Er wird von den Schnittstellen und dem XT-Emulator verwendet.



Abb. 19: Typisches Beispiel für Amiga Multitasking: im unteren Fenster Graphik, darüber Textverarbeitung, links Taschenrechnerfunktionen und oben rechts die Anzeige der Echtzeituhr.

Amiga System-Software

2

A M I G A
S Y S T E M - S O F T W A R E

Irgendwo zwischen "mir" und den Chips!

- System-Software: Verbindung zwischen Mensch und Maschine
- Starten des Systems: Kickstart oder Workbench - oder beide
- Die System-Software macht das Multitasking
- Amiga -DOS ist offen für alle Erweiterungen

Irgendwo zwischen "mir" und den Chips!

Bei dem Versuch, die Position von System-Software in einem Gesamtsystem zu beschreiben, tappt man gedanklich irgendwo in den - je nach Standort - geheimnisvollen oder interessanten Tiefen eines Computers. Jedermann ahnt, daß diese Art von Software benötigt wird, um die einzelnen Bits der Hardwareregister zu steuern. Auch kann das, was sich als Bildschirmmeldung zeigt, nicht zufällig in das System implementiert worden sein.

An dieser Stelle ist man gar nicht mehr so weit von der eigentlichen Intention und Aufgabe von System-Software entfernt. Sie ist das Medium, mit dem ein großer Teil der Idee und Philosophie des Gesamtsystems Amiga zum Anwender transportiert wird, auch wenn sie hauptsächlich die Bits und Bytes im System hin- und herschaufelt. So ist es die System-Software, die die Ideen in Aktionen umsetzt, ohne den Benutzer selbst damit zu belasten, wie er seine Ideen dem Computer am besten mitteilt. Er soll intuitiv mit dem System umgehen und es für sich einsetzen lernen.

System-Software: Verbindung zwischen Mensch und Maschine

Als Verbindung zum Benutzer stehen vom Amiga Tastatur und Maus als Eingabe- und primär der Monitor als Ausgabe-Medium zur Verfügung. An dieser Stelle tritt die System-Software als Vermittler auf den Plan und offeriert damit dem Anwender eine der Stärken des schon vorgestellten Amiga-Konzepts: Die Bildschirmausgabe ist so gestaltet, daß der Benutzer seine eingegebenen Aktionen direkt verfolgen und kontrollieren kann. WYSIWYG! (What-you-see-is-what-you-get!). Zu den weiteren Merkmalen von bedienerfreundlichen Computersystemen gehören zweifelsohne:

- Leichtes Kennenlernen des Systems durch Probieren (Anklicken von Icon's)
- Einfaches (Wieder-)Erkennen von Zusammenhängen im System (Fenstertechnik)
- Bekannte Strukturen (DOS-Befehle)
- Unterstützung intuitiven Handelns.

Der Benutzer soll eine ganz leichte Kontrolle über das System haben. Er bekommt deshalb immer eine Situationsmeldung vom System:

- Aktionen fordern Bestätigung = OK
- Ausweg vorhanden = CANCEL
- Aktionen geben Feedback = WAIT

Starten des Systems: Kickstart oder Workbench - oder beide

Um diese Features in das System Amiga zu integrieren, wurde unter der freundlichen Oberfläche eine leistungsfähige System-Software implementiert, die die komplexe Hardware des Amiga steuert und kontrolliert. Ein wesentlicher Teil dieser Software wird bereits mit dem Einschalten des Amiga aktiviert: Der im ROM implementierte KICKSTART in der neuesten Version 1.2.

Was ist nun eigentlich dieser "Kickstart"?

Er enthält die wesentlichen Teile der Software, die z.B. im altbekannten PC im BIOS (als ROM) und im speicherresidenten Teil des DOS (wird beim Booten von der Floppy oder der Harddisk geladen) zu finden sind. Um die in dieser Maschine steckenden Ideen zu begreifen, müssen wir ein wenig tiefer in das komplexe Software-System zwischen Benutzer und der eigentlichen Hardware eindringen.

Im Folgenden sind die wesentlichen Software-Elemente des Kickstarts mit ihren wichtigsten Aufgaben angeführt:

- EXEC:

Hardware-nächster allgemeiner Teil der System-Software

- kontrolliert den 68000 Prozessor des Amiga
- teilt den verschiedenen TASKS ihrer Priorität entsprechende Zeitscheiben der Prozessorzeit zu und ordnet diese Tasks in Warteschlangen (Multitasking)
- verwaltet die System INTERRUPTS
- kommuniziert über MESSAGES mit anderen Prozessen.

- Amiga-DOS:

Verwaltet das File System des Amiga

- Steuerung von Stapel-Jobs, Batch Verarbeitung
- startet, unterbricht und informiert über Prozesse im System
- Command-Line-Interpreter (CLI) schafft eine PC-ähnliche Umgebung - prompt, zeilenorientiert
- Beinhaltet Kommandos und Utilities zur Steuerung des Systems.

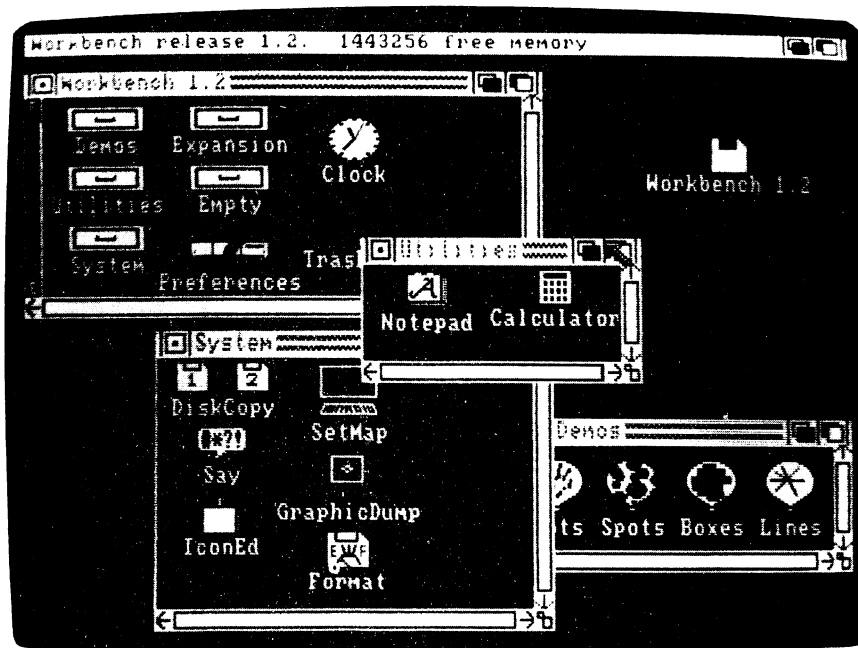


Abb. 20: Amiga Workbench 1.2 als mausgesteuerte Benutzeroberfläche.

- DEVICES:

Spezielle Treiber für die verschiedenen Baugruppen der Hardware. Schnittstellen zwischen der multitaskingfähigen Software und der singletaskingfähigen Hardware

Beispiel: Zwei Prozesse wollen auf die Floppy zugreifen, die jedoch nur einen Datenstrom zur gleichen Zeit bearbeiten kann. Im Task-Disk Device Treiber werden beide Anforderungen verwaltet und nacheinander bearbeitet.

- Track Disk-Device steuert einen oder mehrere Floppy-Laufwerke
- Keyboard Device nimmt Eingaben von der Tastatur entgegen
- Input Device sammelt und verteilt die Eingaben von Tastatur, Maus und anderen Prozessen
- Console Device konvertiert den Roh-Input des Input Device in ASCII oder entsprechende Formate und bereitet Escape-Sequenzen auf
- Gameport Device koordiniert Maus- und Joystickaktionen
- Audio Device kontrolliert den Audioausgang des Amiga
- Serial und Printer Device kommunizieren mit den entsprechenden Ports des Amiga.



Abb. 21: Die Amiga-Workbench wird per Diskette geladen, während Kickstart 1.2 im ROM resident ist.

Die Steuerung der Bildschirmausgabe nimmt eine Sonderstellung ein, da sie aus einer Sammlung von Text- und Graphikausgaberoutinen besteht, die von INTUITION zur Ausgabe auf den Monitor benutzt werden.

- **INTUITION:**

Verantwortlich für alle graphischen Aktionen auf dem Amiga-Monitor. Benutzt Routinen der Graphic- und der Layer-Bibliothek für Ausgaben auf den Bildschirm.

- Öffnen, Schliessen, Verschieben und Aktivieren von WINDOWS und SCREENS als deren Hintergrund
- Steuerung der Pull Down-Menüs
- Kontrolle der GADGETs
- Steuerung der REQUESTER
- Anzeigen von System- oder Programmfehlern durch ALERTs
- Koordination von Signalen im System (EVENTS)

Beispiele für INTUITION zeigen die Abbildungen 22,23 und 24 auf der Seite 49.

Die System-Software macht das Multitasking

Wie gerade erwähnt, laufen alle Aktivitäten der besprochenen Module gleichzeitig im System. Schon bevor ein Benutzer auch nur eine Aktion gestartet hat, arbeiten Tasks im Amiga parallel, miteinander kommunizierend und sich gegenseitig unterstützend; das ist echtes Multitasking!

Die Multitaskingfähigkeit des Amiga ist vom Anwender leichter zu steuern, wenn vorher die Workbench von der Diskette geladen wurde. Jetzt stehen ICONs, DRAWERs und alle besprochenen Features von INTUITION zur Verfügung. Durch "Anklicken" mehrerer Programm-Icons nacheinander werden im Multitasking alle Programme gleichzeitig aktiviert.

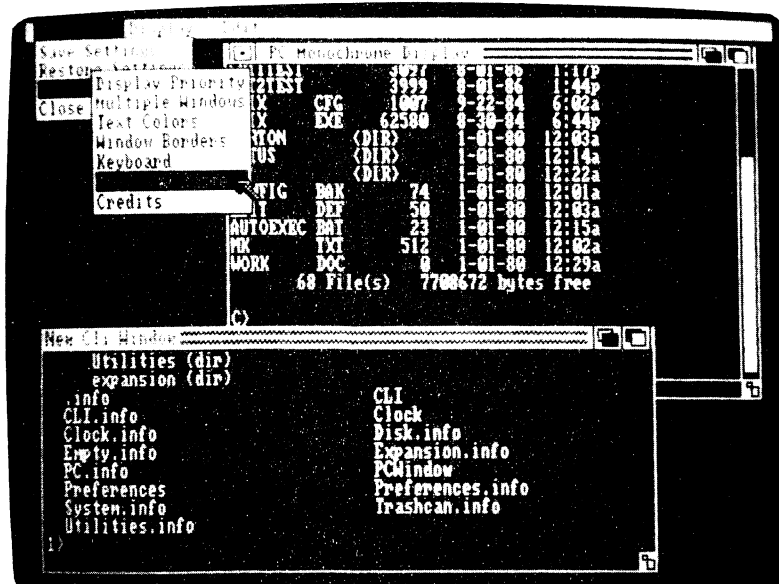
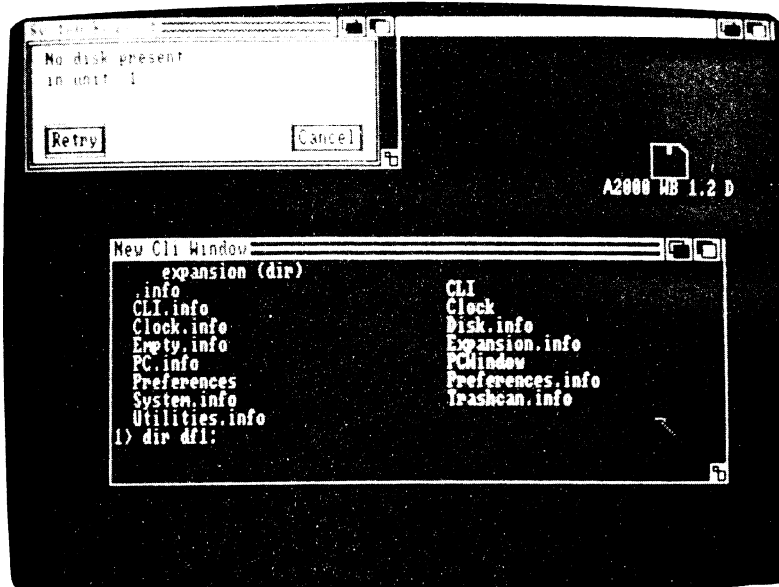
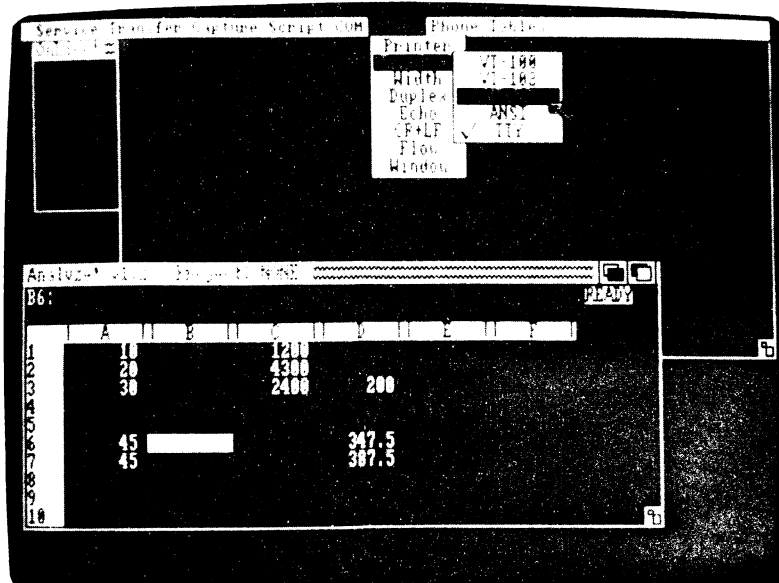


Abb. 22,23,24: Beispiele für Arbeitsweise INTUITION

Amiga-DOS ist offen für alle Erweiterungen

Auf die Workbench- und Applikationsprogramme wird an anderer Stelle eingegangen. Im Folgenden ist die Erweiterung und Ausbaufähigkeit der System-Software anhand einiger Beispiele erläutert.

- KEYMAPS:

Mit der Workbench Diskette stehen dem Anwender zwölf unterschiedliche Tastatur-Tabellen für alle europäischen und nordamerikanischen Länder zur Verfügung. Die System-Software liefert alle Routinen und Utilities (SETMAP), um diese oder weitere Tabellen (Keymaps) für andere Länder oder spezielle Keyboards in den bereits besprochenen Console-Device Treiber einzubinden.

- FONTS:

Der Amiga stellt seinem Benutzer schon mit der WORKBENCH acht verschiedene Zeichensätze in unterschiedlichen Zeichengrößen zur Verfügung, die mit geeigneten Utilities (Font-Editor) verändert oder neu kreiert werden können. Hier zeigt sich der Amiga für jede Art von Textprozessing flexibel und anpassungsfähig.

- DEVICE Treiber:

Ein spezielles Sub-Directory der WORKBENCH enthält alle verfügbaren Device Treiber, um die verschiedenen internen und externen Baugruppen des Amiga in das Software System einzubinden. Die MOUNTLIST beschreibt die logischen Eigenschaften und Formate der aktivierbaren Device Treiber.

- Printer Treiber:

In den Printer Treibern, einer Untergruppe der beschriebenen Device Treiber, sind die speziellen Eigenschaften der üblichsten Drucker beschrieben. Die WORKBENCH wird mit 16 Drucker-treibern ausgeliefert, deren Anzahl laufend zunimmt.

- EXPANSION Library:

Mit der EXPANSION Library bietet der Amiga die Möglichkeit, die System-Software um weitere System Routinen zu erweitern. Besonders der neue Amiga 2000 nutzt dieses Feature, um die

Erweiterungsboards in den Slots in die Software-Umgebung einzubinden. Jedes neue Board, welches dem System neue Eigenschaften offeriert (PC/XT-Emulator, Harddisk-Controller), kommuniziert mit Hilfe einer Sammlung von System-Routinen mit der System-Software. Diese neuen Routinen werden von der automatischen System-Konfiguration (AUTOCONFIG) in der Expansion Library gefunden und der entsprechenden Hardware in einem der Amiga Erweiterungsslots zugeordnet. Damit wird diese für den Amiga ansprechbar und steht dem System und so dem Anwender zur Verfügung.

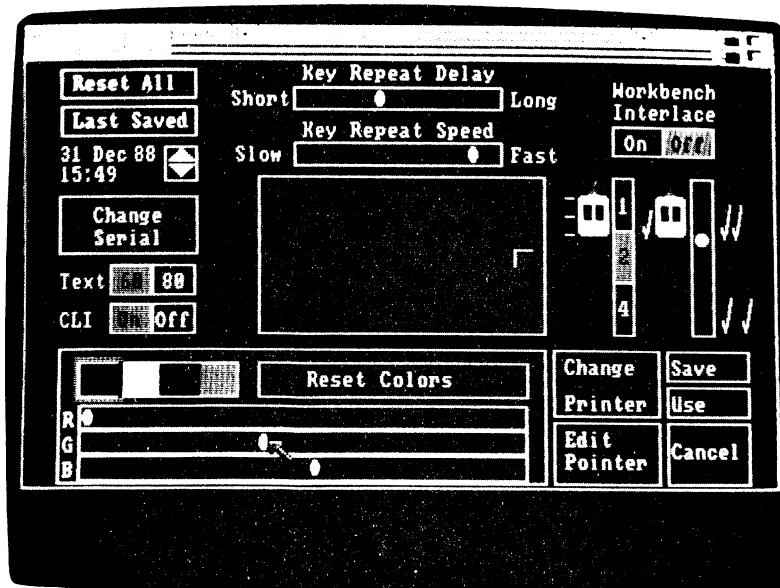
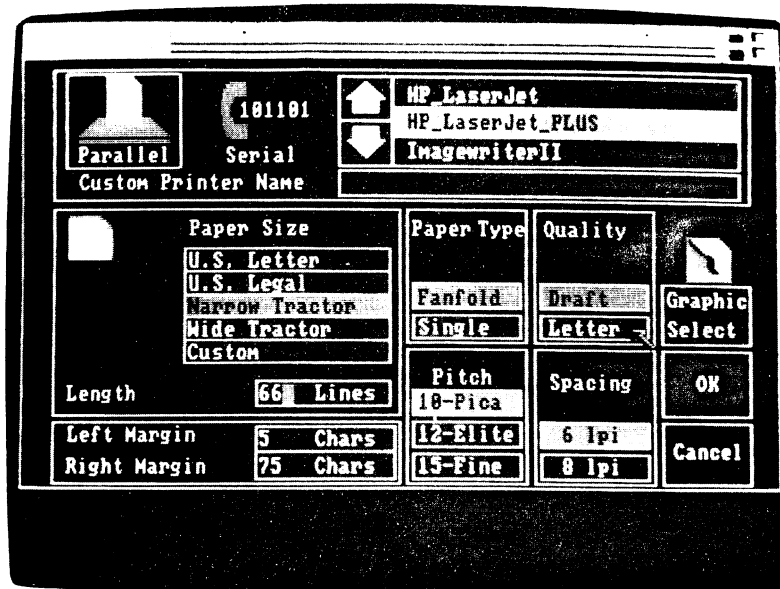


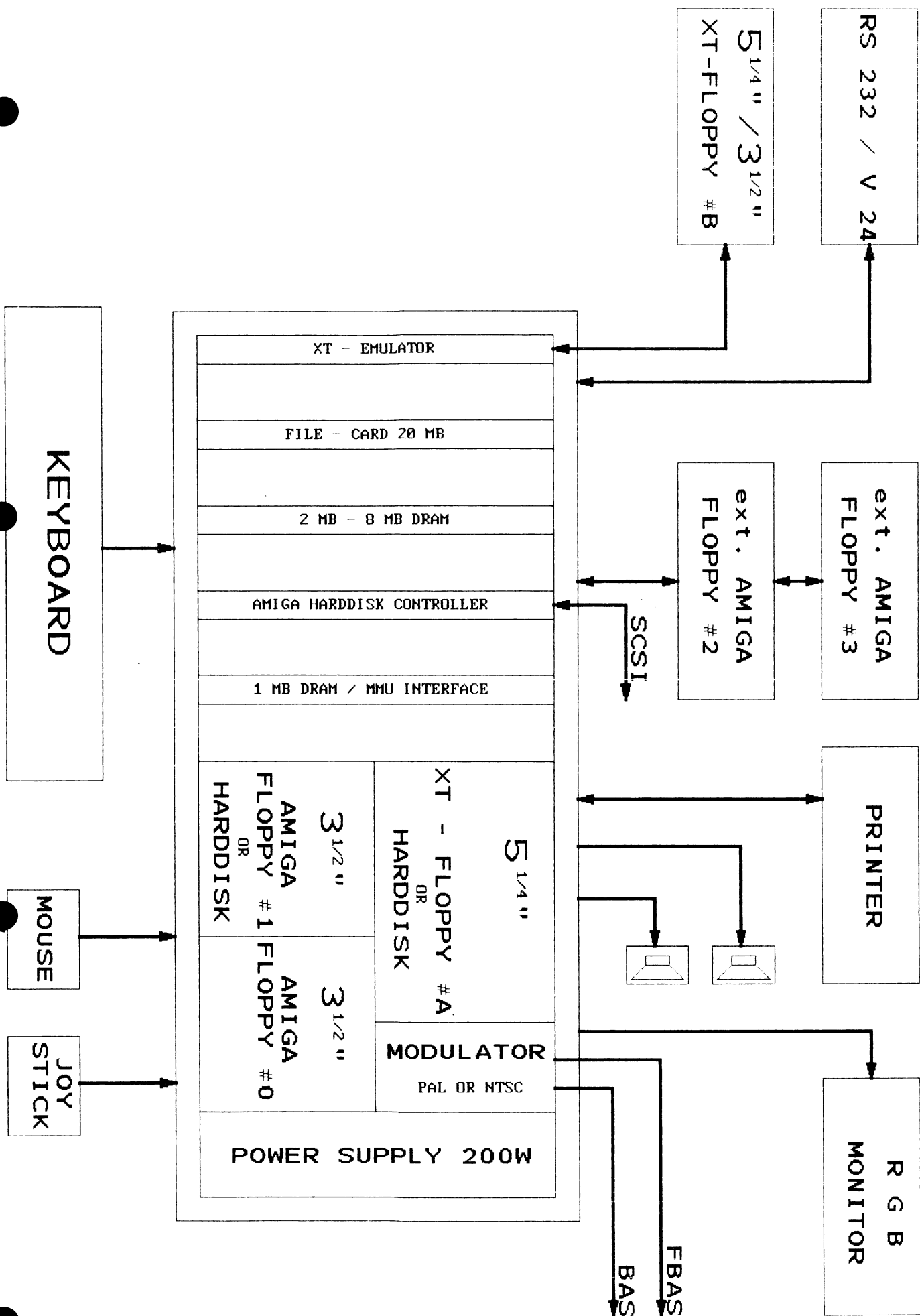
Abb. 25 u. 26: Das Amiga-Betriebssystem stellt eine Reihe von wertvollen Tools zur Verfügung, hier Beispiele für Druckeranpassung und Farbmischung.

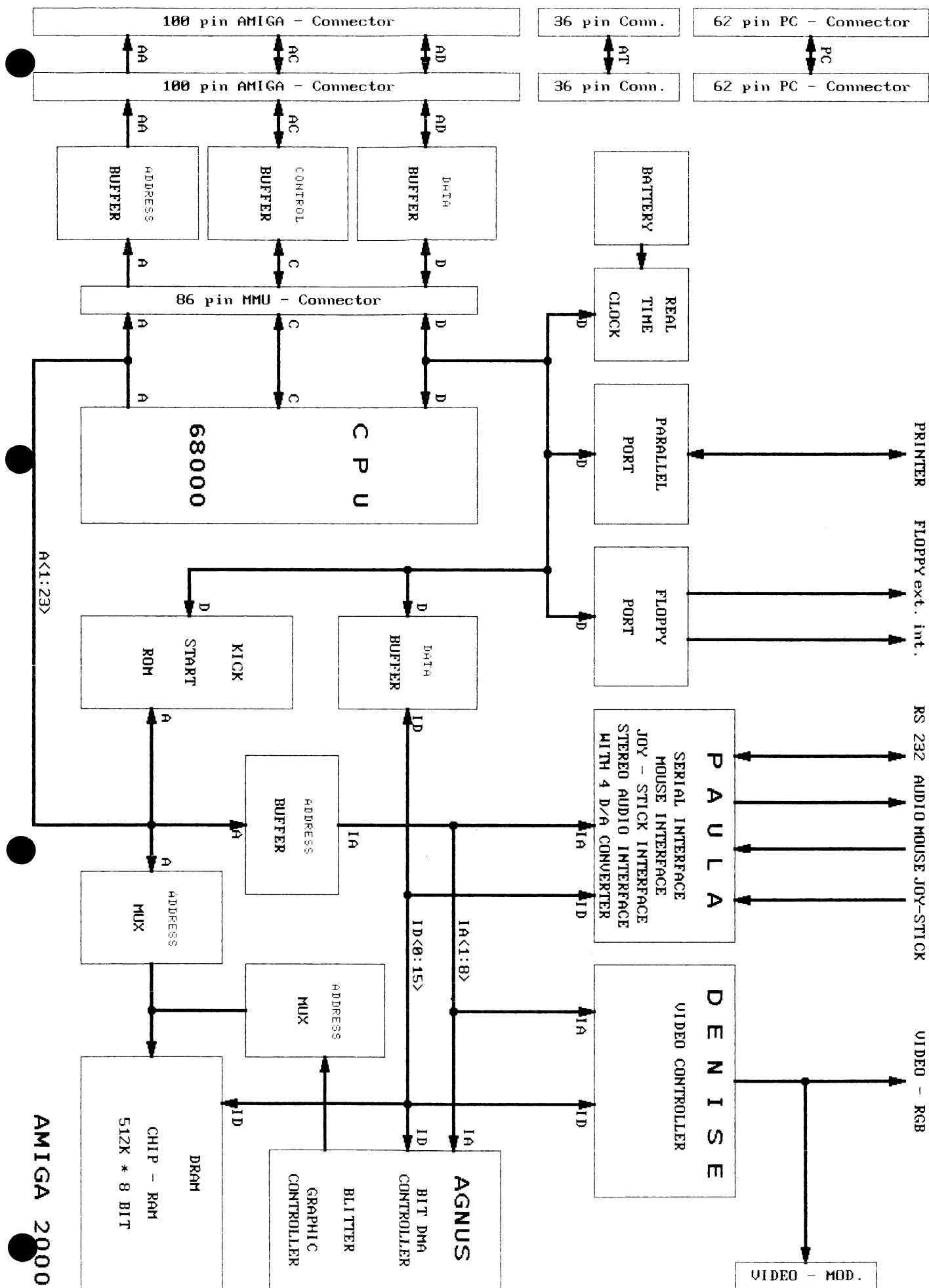
Amiga Hardware

3

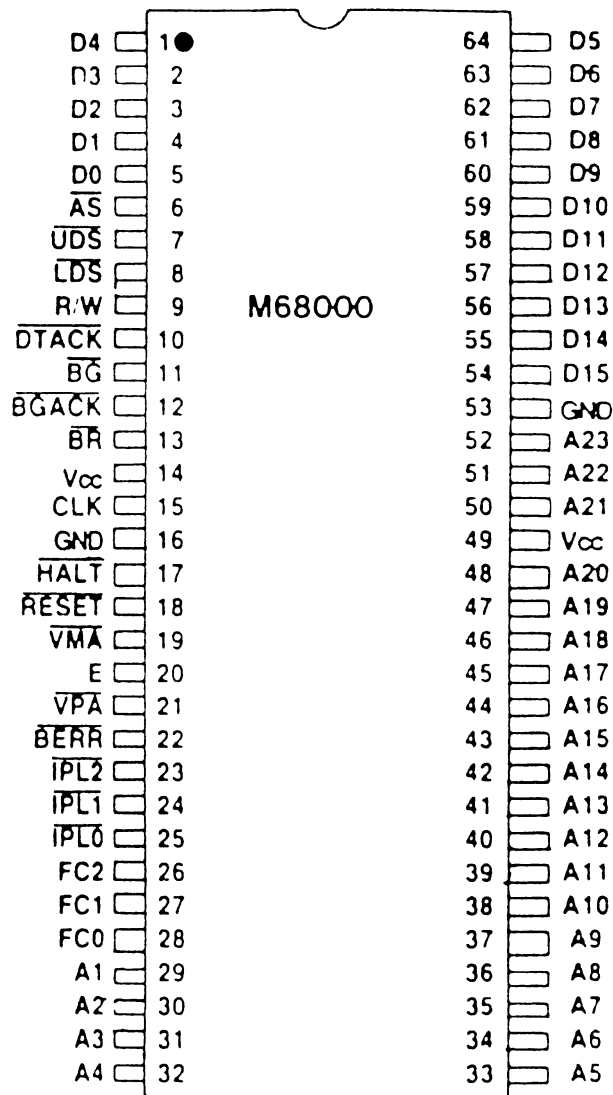
Adressbelegung A2000

000000	Chip-Ram
080000	Spiegelung des Chip-Ram
200000	EXPANSION
A00000	reservierter Bereich
BFE000	CIA - A
BFD000	CIA - B
C00000	reservierter Bereich
DC0000	Echtzeit-Uhr
DFF0000	Custom - Chips
E00000	reservierter Bereich
E80000	Config - Bereich
F00000	Cartridge
F80000	Kickstart
FC0000	Spiegelung des Kickstart
FFFFFF	





— MC 68000 —
U1



Signalbeschreibung MC 68000

Signalname	Signal- name	Tristate	Funktion
A1-A23	A	ja	Adressleitungen
D0-D15	E/A	ja	Datenleitungen
AS	A	ja	Adress-Strobe
R/W	A	ja	Lesen/Schreiben
UDS, LDS	A	ja	Obere u. untere Daten-Strobes
DTACK	E	nein	Datentransfer-Quittung
BR	E	nein	Busanforderung
BG	A	nein	Buszuteilung
BGACK	E	nein	Buszuteilungs-Quittung
IPL0, IPL1, IPL2	E	nein	Interrupt/Priorität
BERR	E	nein	Busfehler
RESET	E/A	nein*	Rücksetzen
Halt	E/A	nein*	Halt
E	A	nein	Synchrontakt
VMA	A	ja	Gültige Speicheradresse
VPA	E	nein	Gültige Peripherieadresse
FC0, FC1, FC2	A	ja	Function Code
CLK	E	nein	Takt
Vcc	-	-	Speisespannung +5V
GND	-	-	Masse

* open drain

CUSTOM ANIMATION CHIP

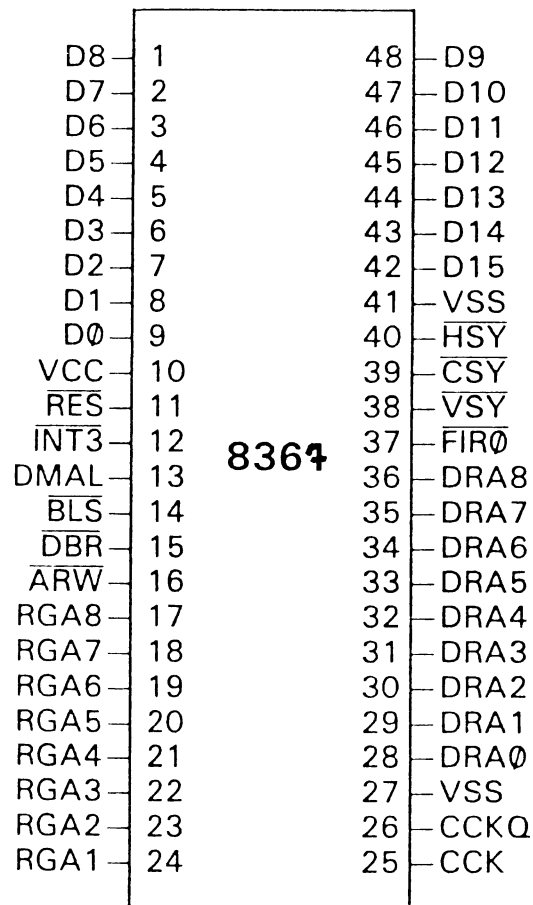
— Agnus —

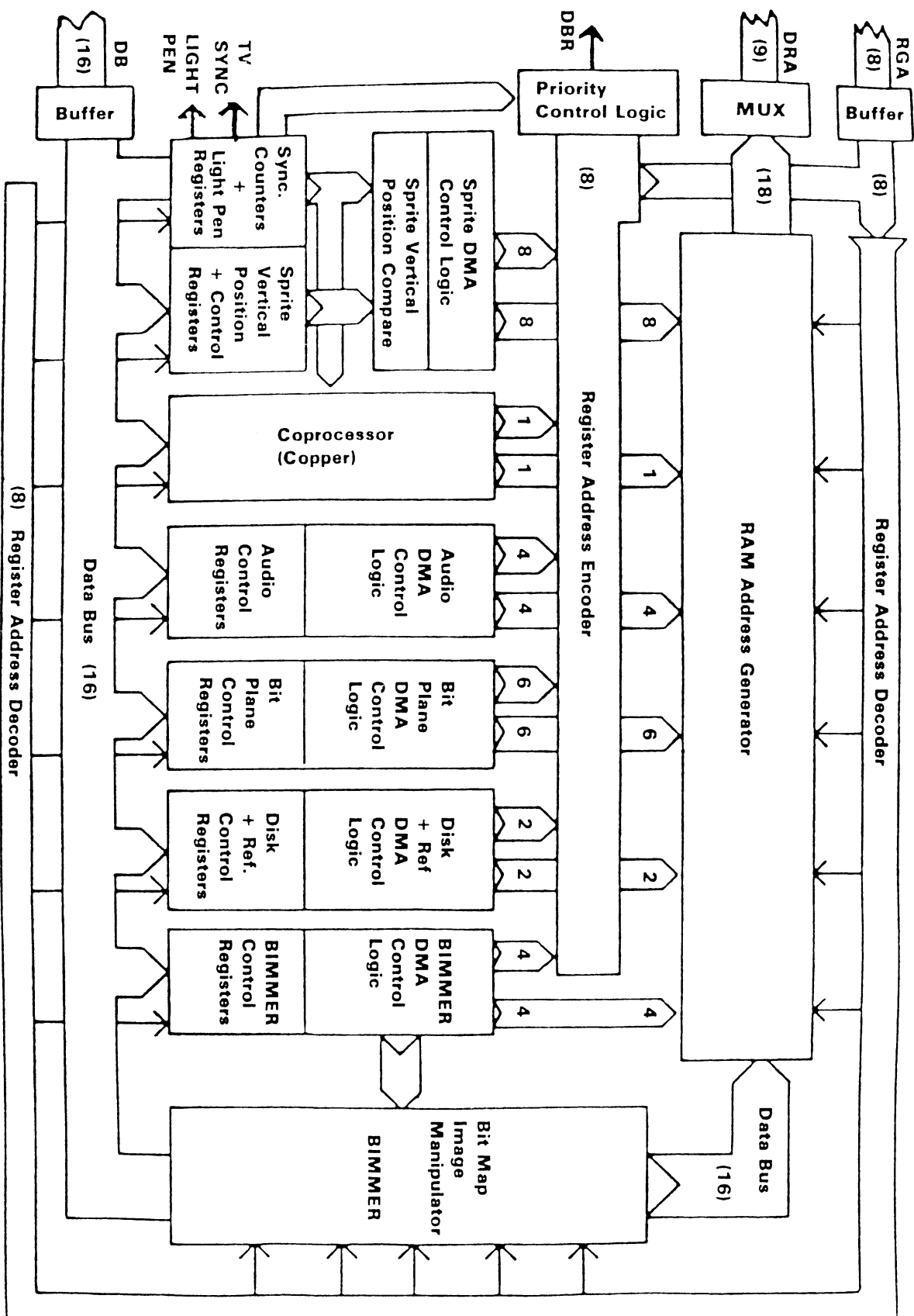
FEATURES:

- Bit Blitter — Uses Hardware to Move Display Data — Allows High Speed Animation — Frees the CPU for other Concurrent Tasks
- Display Synchronized Coprocessor
- Controls 25 DMA Channels — Allows the Disk and Sound to Operate with Minimal CPU intervention

Memo :

-- 8367 AGNUS --
U 50





AGNUS BLOCK DIAGRAM

CUSTOM SOUND/PERIPHERALS CHIP

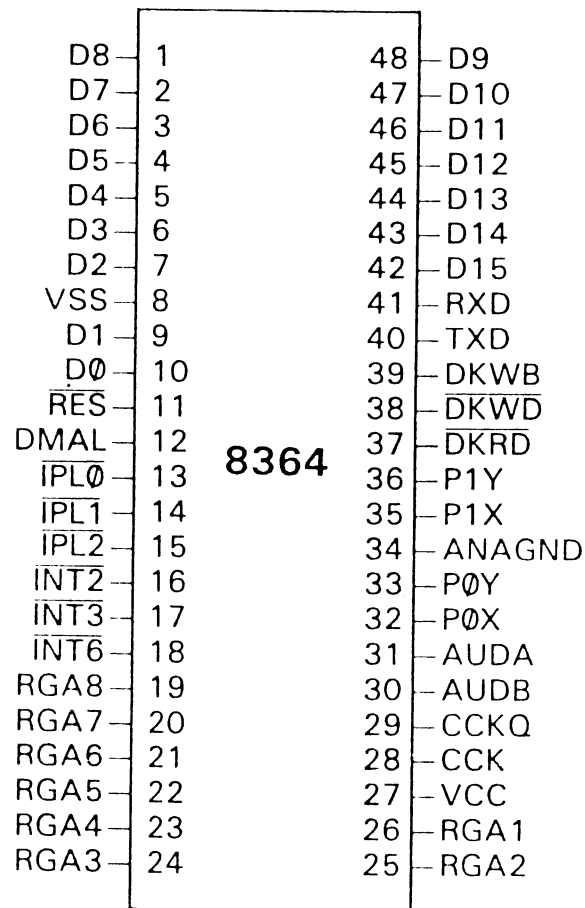
— Paula —

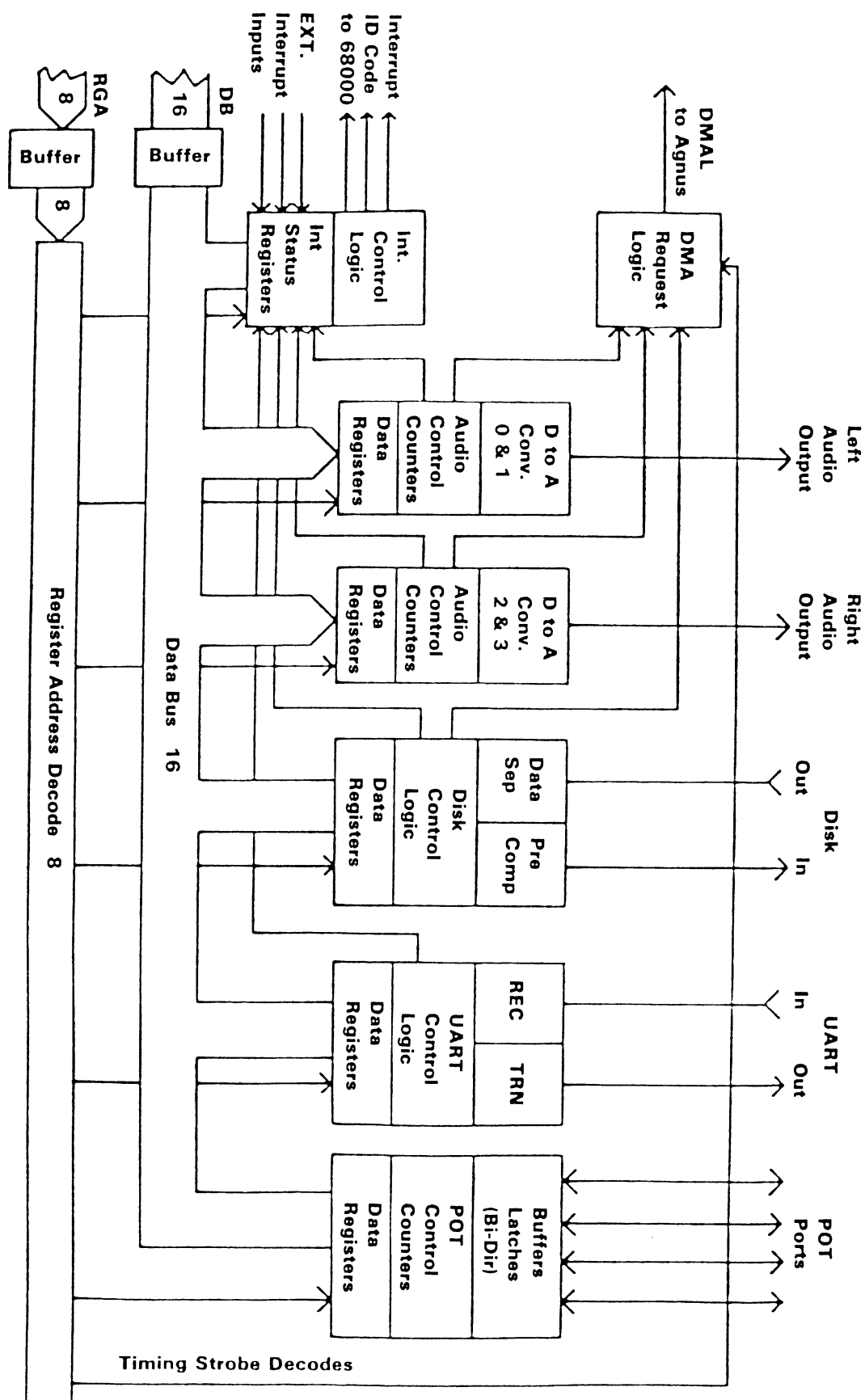
FEATURES:

- Four Voices of Sound Output configured as Two Stereo Channels
- Nine Octaves
- Complex Waveforms
- Uses both Amplitude and Frequency Modulation
- I/O Controls for Disk Data and Controller Ports
- Microdisk Controller
- Interrupt Control System

Memo :

-- 8364 PAULA --
U 55





PAULA BLOCK DIAGRAM

CUSTOM GRAPHICS CHIP

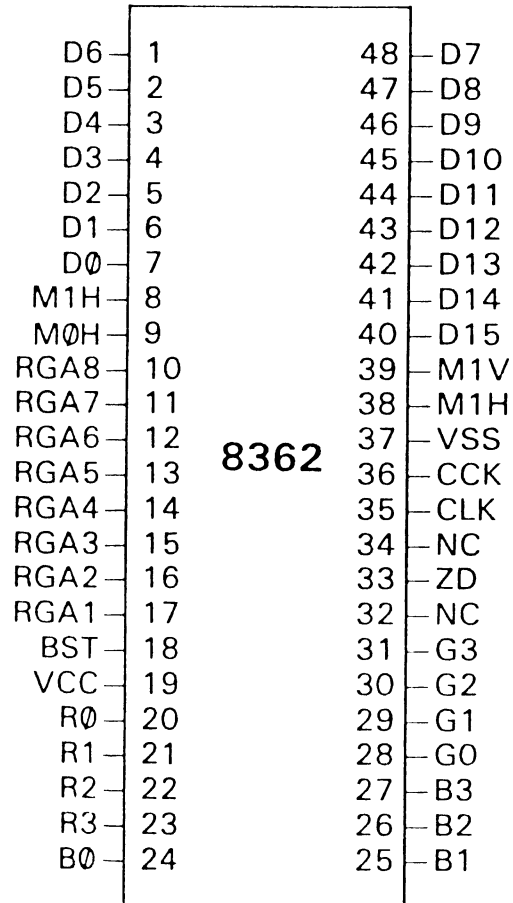
— Denise —

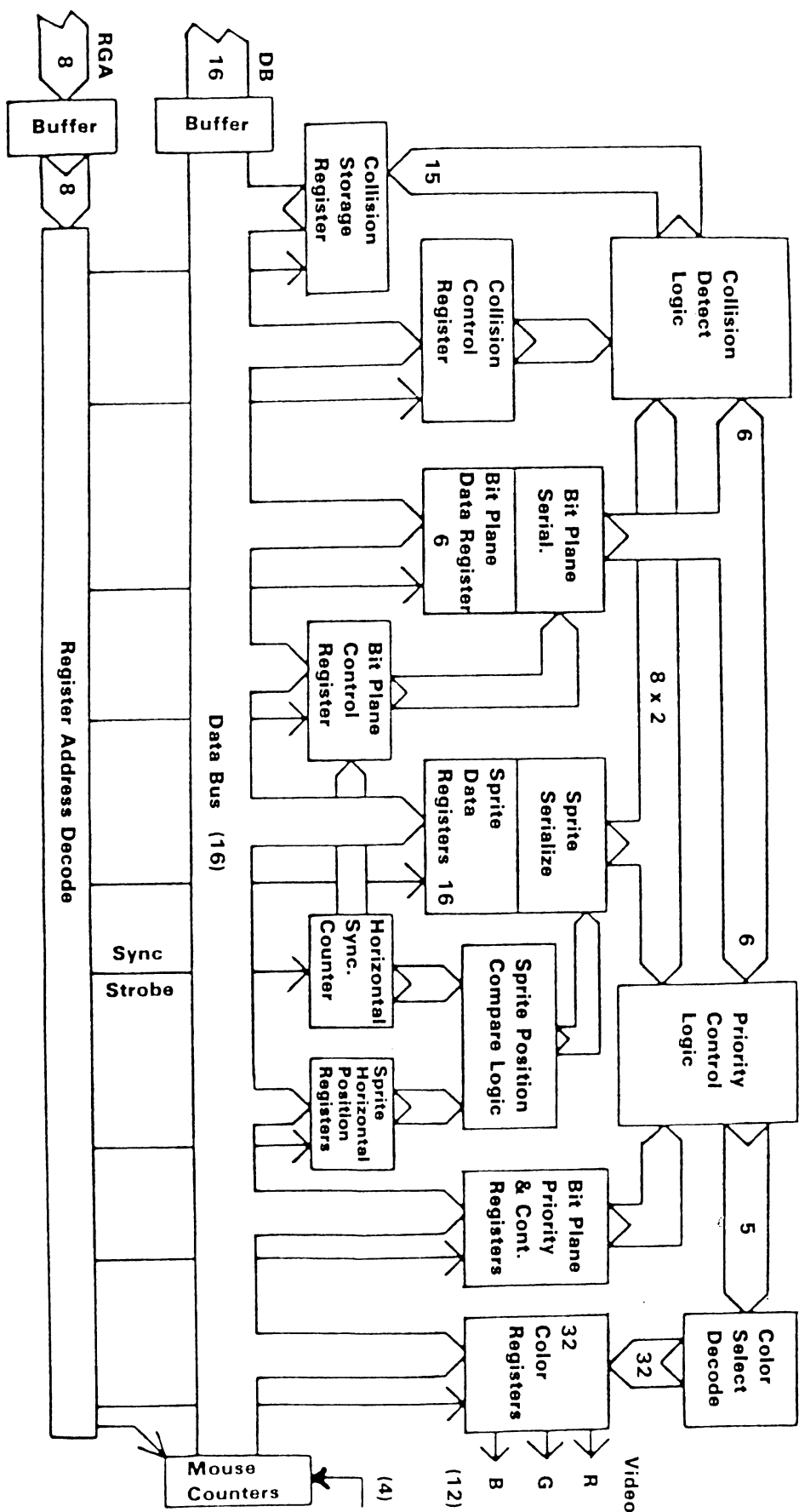
FEATURES:

- Many Different Resolutions 320 X 200 up to 640 X 400
- 4096 Colors on a TV or RGB Monitor
- Eight Re-usable Sprite Controllers
- 60 or 80 Column Text
- Same Software for All TVs and Monitors

Memo :

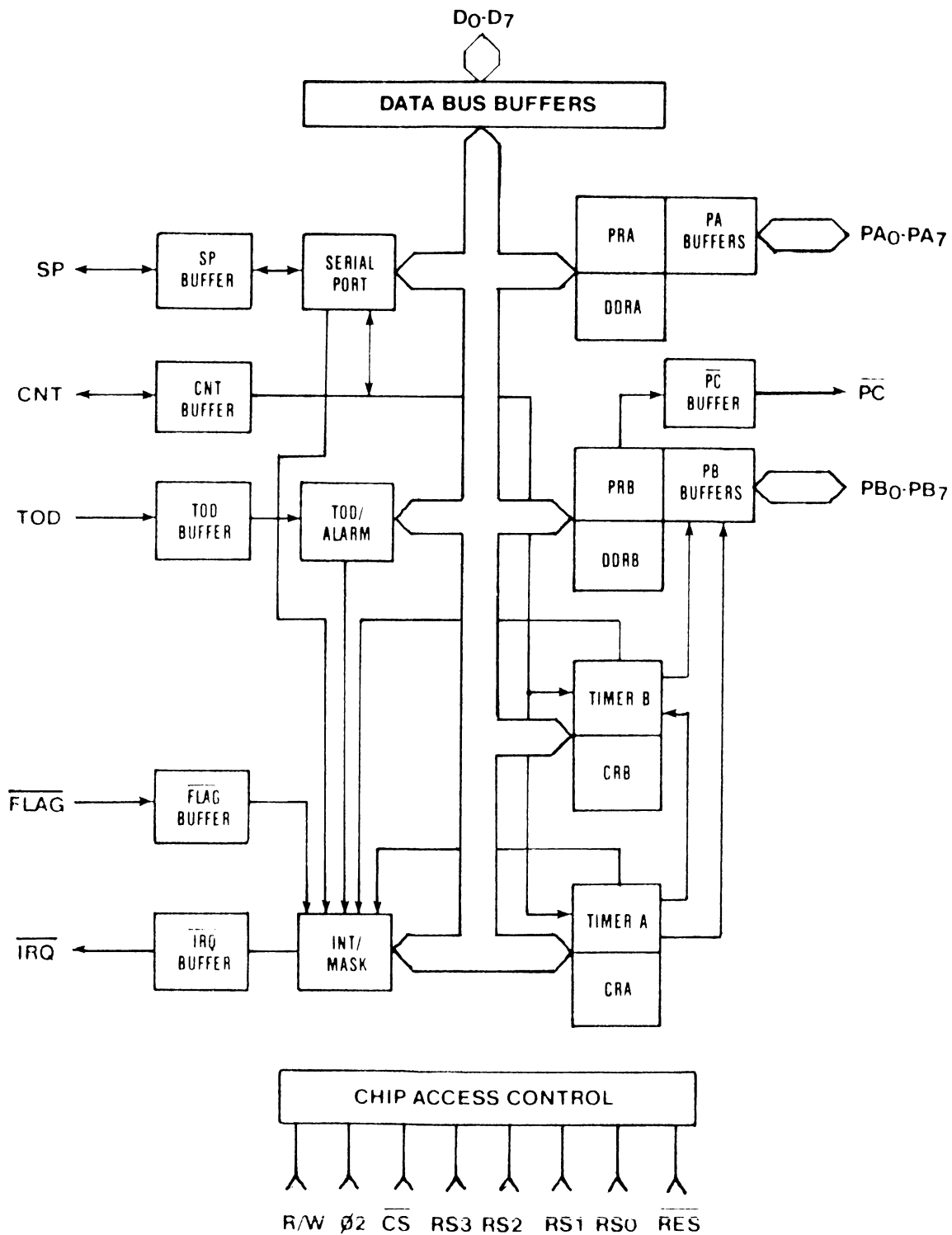
-- 8362 DENISE --
U 76



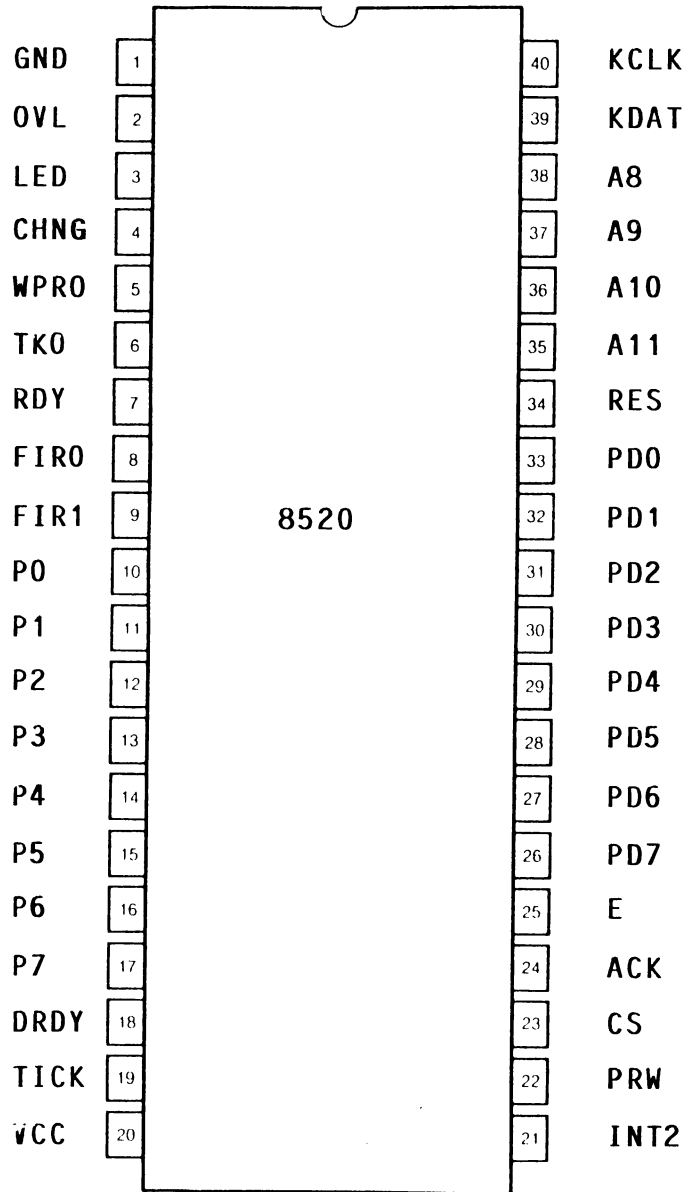


DENISE BLOCK DIAGRAM

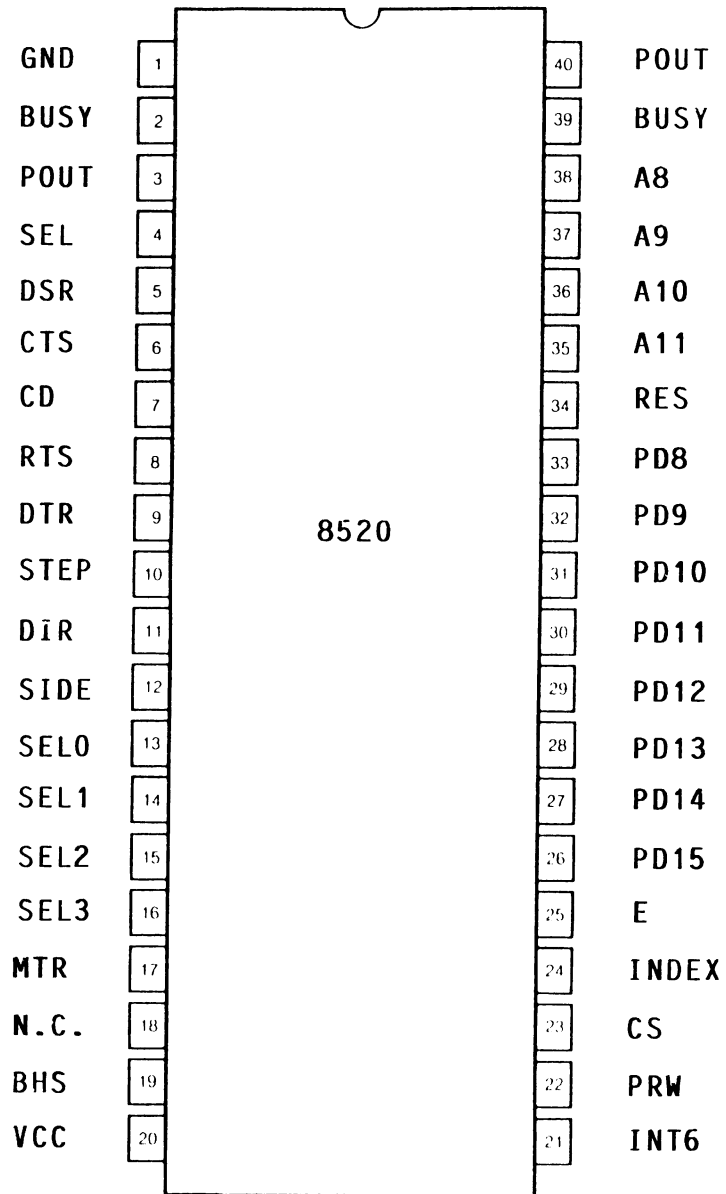
Allgemeines Blockdiagramm Portbausteine 8520 U 10 / U 11



**— PORT 8520 —
U10**

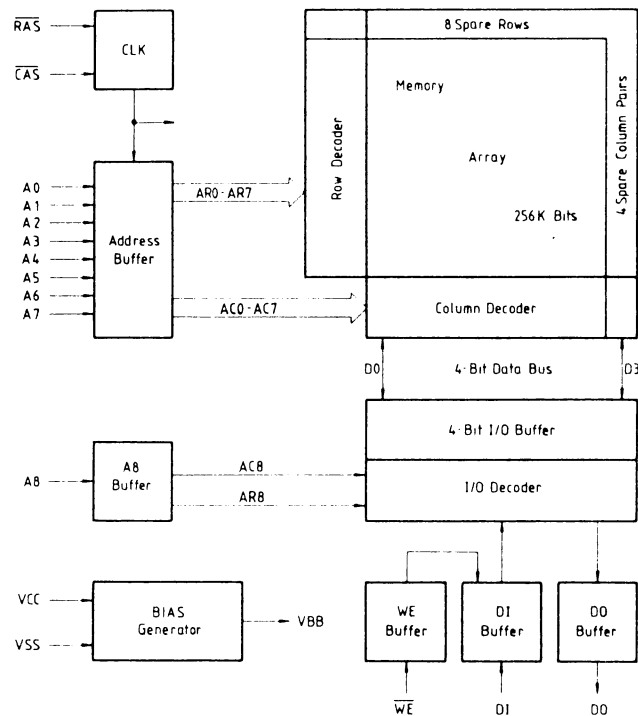


— PORT 8520 —
U11

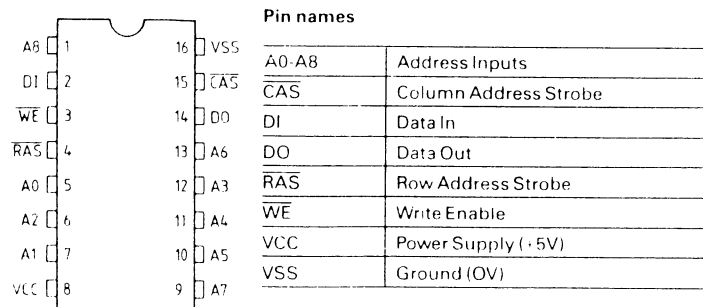


-- 256 K * 1 DRAM --

a) Block-Diagramm



b) Pin-Belegung

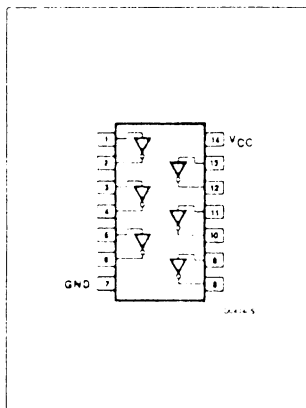




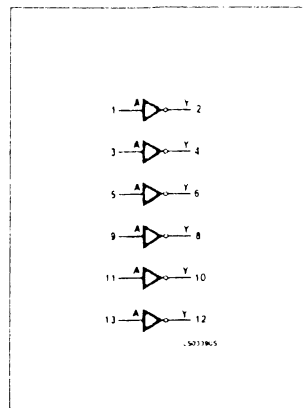
74 LS 04

Inverter

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

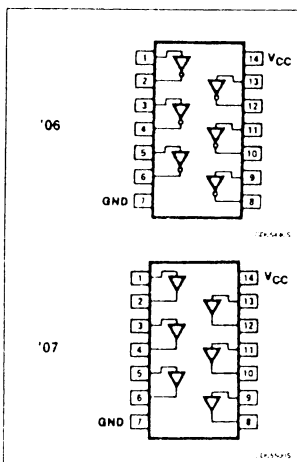
INPUT		OUTPUT
A		Y
L		H
H		L

H = HIGH voltage level
L = LOW voltage level

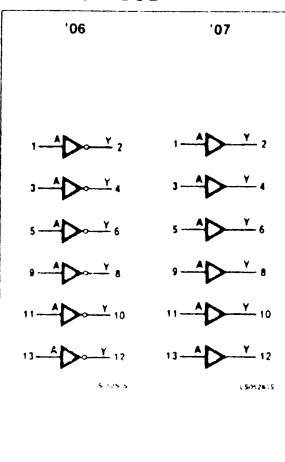
7407

Buffer

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

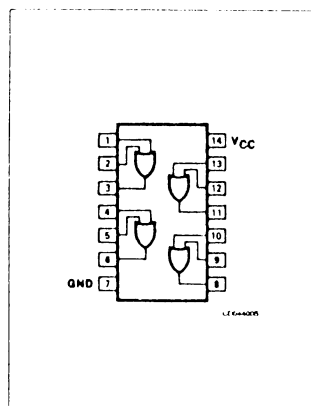
'06		'07	
INPUT	OUTPUT	INPUT	OUTPUT
A	Y	A	Y
H	L	H	H
L	H	L	L

H = HIGH voltage level
L = LOW voltage level

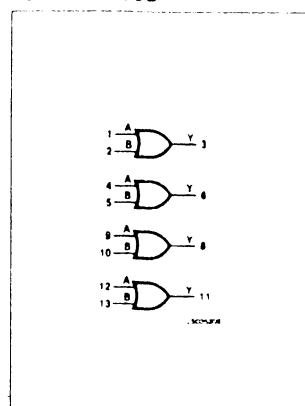
74 LS 32

Or Gate

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	H

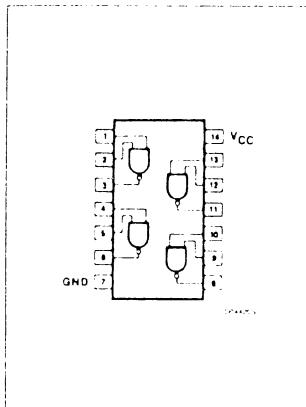
H = HIGH voltage level
L = LOW voltage level



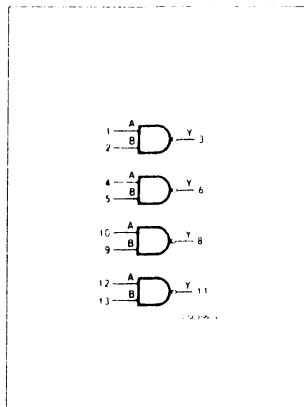
74 38

Nand Buffer

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

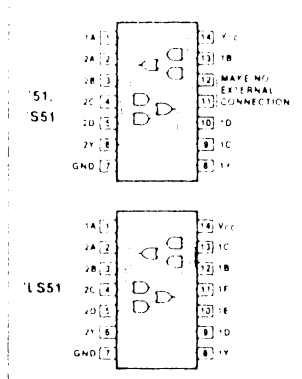
INPUTS		OUTPUT
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

H = HIGH voltage level
L = LOW voltage level

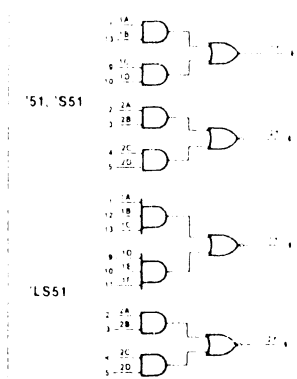
74 S 51

2Input And-Or-Gate

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

'S1, 'S51, 1/2 'LS51

INPUTS				OUTPUT
A	B	C	D	Y
H	H	X	X	L
X	X	H	H	H

All other combinations

'LS51

INPUTS						OUTPUT
A	B	C	D	E	F	Y
H	H	H	X	X	X	L
X	X	X	H	H	H	H

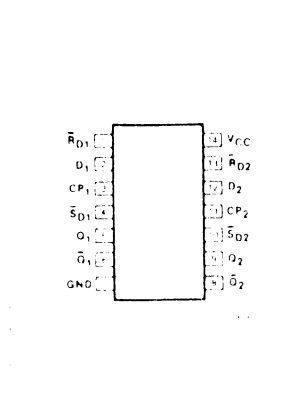
All other combinations

H = HIGH voltage level
L = LOW voltage level
X = Don't care

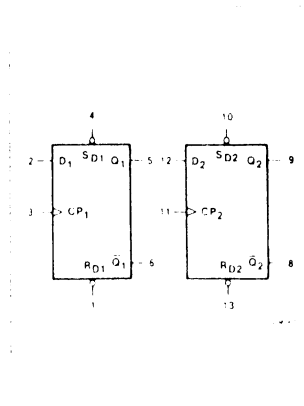
74 LS 74

Dual D-Type Flip-Flop

PIN CONFIGURATION



LOGIC SYMBOL



MODE SELECT — FUNCTION TABLE

OPERATING MODE	INPUTS			OUTPUTS	
	S _D	R _D	CP	Q	Q̄
Asynchronous Set	L	H	X	X	L
Asynchronous Reset (Clear)	H	L	X	L	X
Undetermined ⁽¹⁾	L	L	X	X	X
Load "1" (Set)	H	H	↑	H	L
Load "0" (Reset)	H	H	↑	L	H

H = HIGH voltage level, steady state
L = LOW voltage level, steady state
X = HIGH voltage level one setup time prior to the LOW to HIGH clock transition
↑ = LOW voltage level, steady state
↓ = LOW voltage level one setup time prior to the LOW to HIGH clock transition
X = Don't care
↑ = LOW to HIGH clock transition

NOTE:

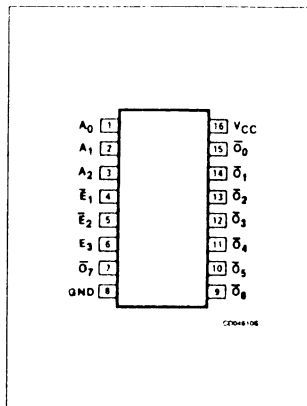
(1) Both outputs will be HIGH while both S_D and R_D are LOW, but the output states are unpredictable if S_D and R_D go HIGH simultaneously.



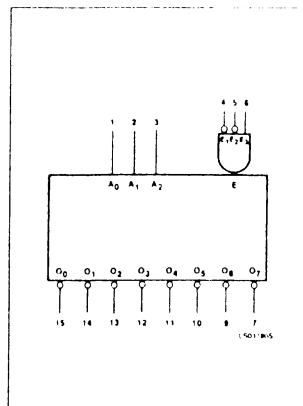
74 LS 138

1 of 8 Decoder / Demultiplexer

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

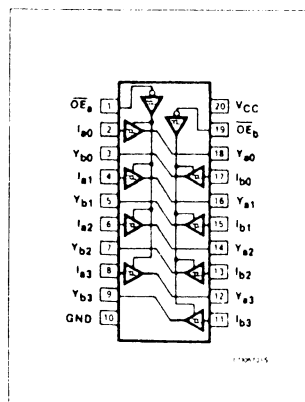
INPUTS						OUTPUTS							
E ₁	E ₂	E ₃	A ₀	A ₁	A ₂	O ₀	O ₁	O ₂	O ₃	O ₄	O ₅	O ₆	O ₇
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H = HIGH voltage level
L = LOW voltage level
X = Don't care

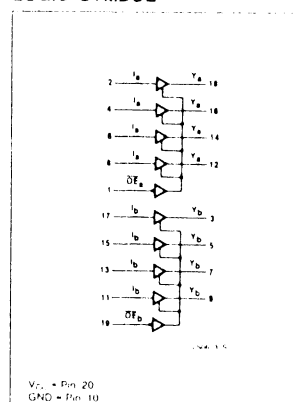
74 LS 244

Octal Buffer

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

INPUTS				OUTPUTS	
OE _a	I _a	OE _b	I _b	Y _a	Y _b
L	L	L	L	L	L
L	H	L	H	H	H
H	X	H	X	(Z)	(Z)

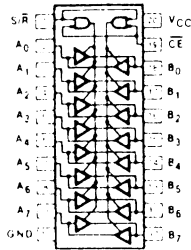
H = HIGH voltage level
L = LOW voltage level
X = Don't care
(Z) = HIGH impedance (off) state



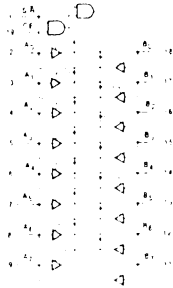
74 LS 245

Octal Transceiver

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

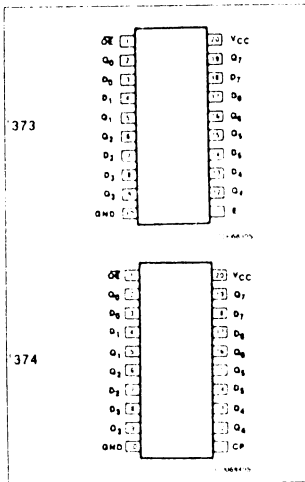
INPUTS		INPUTS/OUTPUTS	
CE	S/R	A _n	B _n
L	L	A = B	INPUTS
L	H	INPUT (Z)	B = A
H	X		(Z)

H = HIGH voltage level
L = LOW voltage level
X = Don't care
(Z) = HIGH impedance (off) state

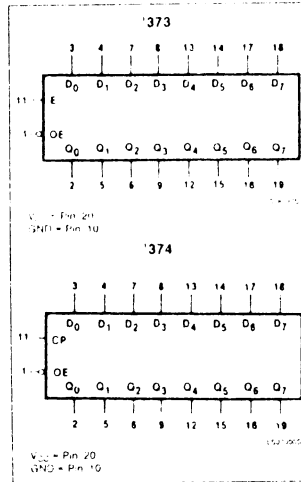
74 LS 373/374

Latch

PIN CONFIGURATION



LOGIC SYMBOL



MODE SELECT — FUNCTION TABLE '373

OPERATING MODES	INPUTS			INTERNAL REGISTER	OUTPUTS
	OE	E	D _n		Q ₀ - Q ₇
Enable and read register	L	H	L	L	L
	L	H	H	H	H
Latch and read register	L	L	L	L	L
	L	L	H	H	H
Latch register and disable outputs	H	L	L	L	(Z)
	H	L	H	H	(Z)

MODE SELECT — FUNCTION TABLE '374

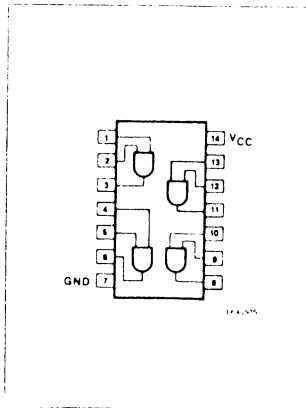
OPERATING MODES	INPUTS			INTERNAL REGISTER	OUTPUTS
	OE	CP	D _n		Q ₀ - Q ₇
Load and read register	L	↑	L	L	L
	L	↑	H	H	H
Load register and disable outputs	H	↑	L	L	(Z)
	H	↑	H	H	(Z)

H = HIGH voltage level
h = HIGH voltage level one setup time prior to the LOW to HIGH clock transition or HIGH to LOW OE transition
L = LOW voltage level
l = LOW voltage level one setup time prior to the LOW to HIGH clock transition or HIGH to LOW OE transition
(Z) = HIGH impedance (off) state
↑ = LOW to HIGH clock transition

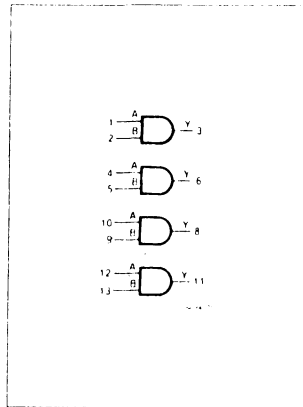
74 F 08

And Gate

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

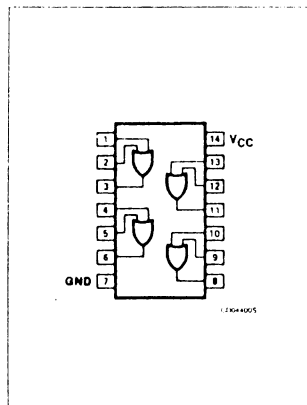
INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

H = HIGH voltage level
L = LOW voltage level

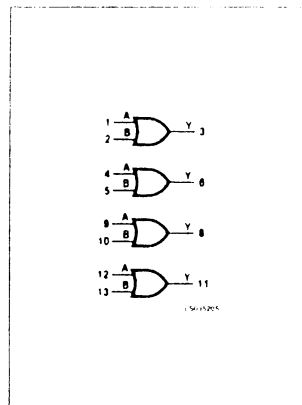
74 F 32

Or Gate

PIN CONFIGURATION



LOGIC SYMBOL



FUNCTION TABLE

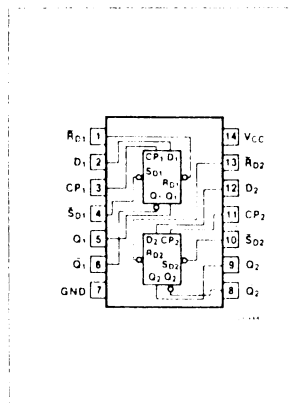
INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	H

H = HIGH voltage level
L = LOW voltage level

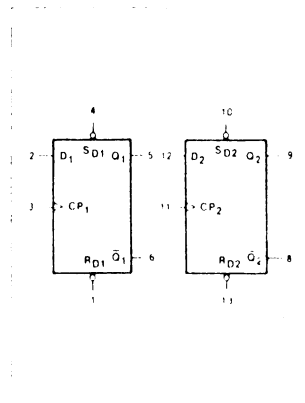
74 F 74

Dual D-Type Flip-Flop

PIN CONFIGURATION



LOGIC SYMBOL



MODE SELECT — FUNCTION TABLE

OPERATING MODE	INPUTS			OUTPUTS	
	S ₀	R ₀	CP	Q	Q̄
Asynchronous Set	L	H	X	X	H
Asynchronous Reset (Clear)	H	L	X	X	L
Undetermined ⁽¹⁾	L	L	X	X	X
Load "1" (Set)	H	H	↑	h	h
Load "0" (Reset)	H	H	↑	l	h

H = HIGH voltage level steady state
h = HIGH voltage level one setup time prior to the LOW to HIGH clock transition

L = LOW voltage level steady state

l = LOW voltage level one setup time prior to the LOW to HIGH clock transition

X = Don't care

↑ = LOW to HIGH clock transition

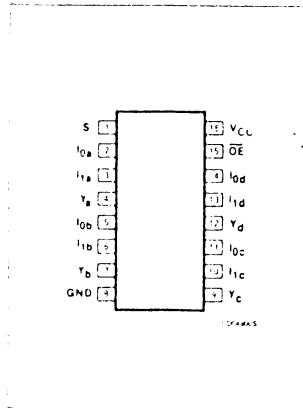
NOTE:

(1) Both outputs will be HIGH if both S₀ and R₀ go LOW simultaneously.

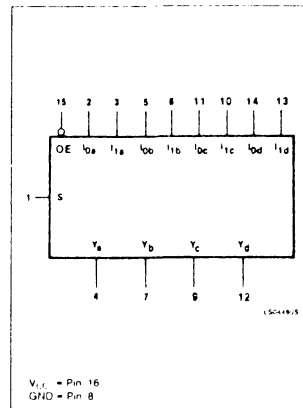


74 F 257 2Line to 1Line Multiplexer

PIN CONFIGURATION



LOGIC SYMBOL



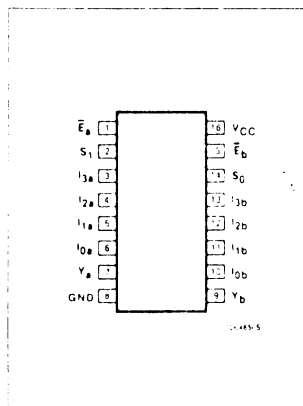
FUNCTION TABLE

INPUTS				OUTPUT
OE	S	I ₀	I ₁	Y
H	X	X	X	(Z)
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

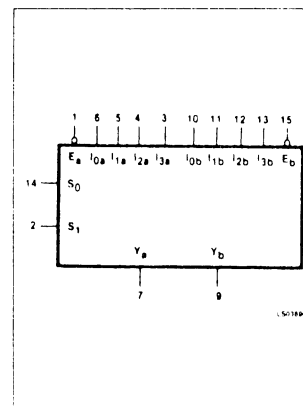
H = HIGH voltage level
L = LOW voltage level
X = Don't care
(Z) = HIGH impedance (off) state

74 F 153 4Line to 1Line Multiplexer

PIN CONFIGURATION



LOGIC SYMBOL



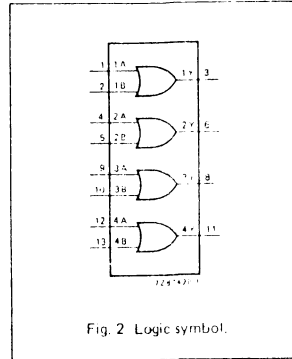
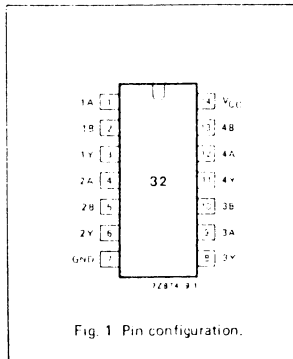
FUNCTION TABLE

SELECTS INPUTS		INPUTS (a or b)					OUTPUT
S ₀	S ₁	E	I ₀	I ₁	I ₂	I ₃	Y
X	X	H	X	X	X	X	L
L	L	L	L	X	X	X	L
L	L	L	H	X	X	X	H
H	L	L	X	L	X	X	L
H	L	L	X	H	X	X	H
L	H	L	X	X	L	X	L
L	H	L	X	X	H	X	H
H	H	L	X	X	X	L	L
H	H	L	X	X	X	H	H

H = HIGH voltage level
L = LOW voltage level
X = Don't care

74 HCT 32

Or Gate



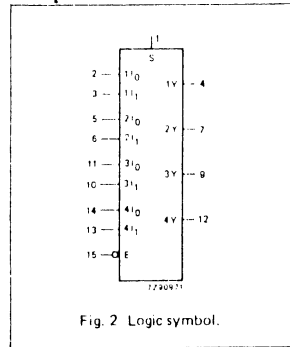
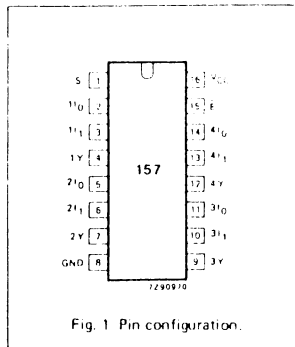
FUNCTION TABLE

INPUTS		OUTPUT
nA	nB	nY
L	L	L
L	H	H
H	L	H
H	H	H

H = HIGH voltage level
L = LOW voltage level

74 HCT 157

2line to 1line Multiplexer



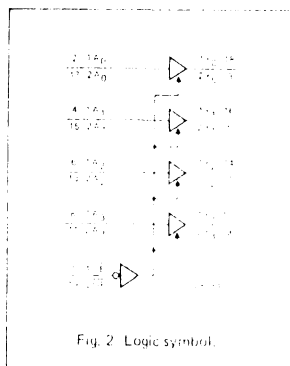
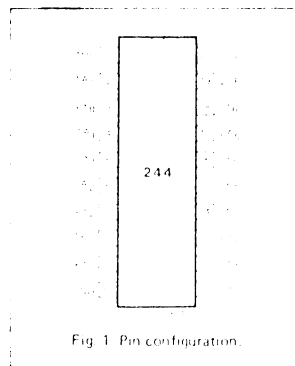
FUNCTION TABLE

INPUTS				OUTPUT
\bar{E}	S	nI ₀	nI ₁	nY
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

H = HIGH voltage level
L = LOW voltage level
X = don't care

74 HC 244

Octal Buffer



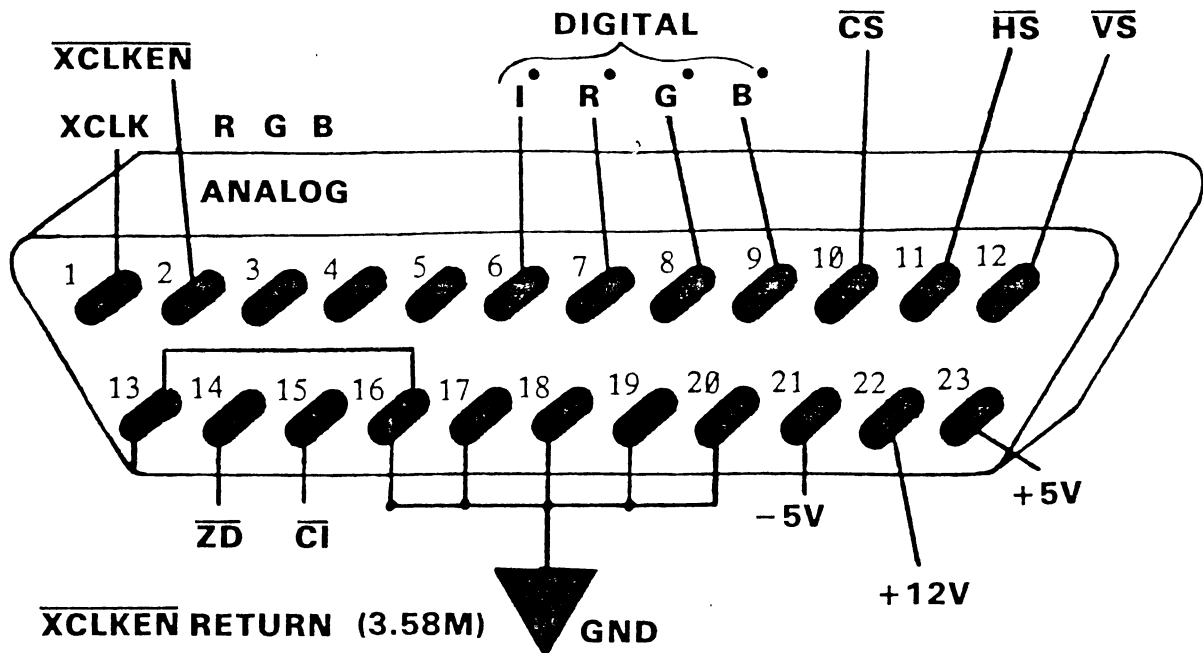
FUNCTION TABLE

INPUTS		OUTPUT
nOE	nA _n	nY _n
L	L	L
L	H	H
H	X	Z

H = HIGH voltage level
L = LOW voltage level
X = don't care
Z = high impedance OFF state

VIDEO CONNECTORS

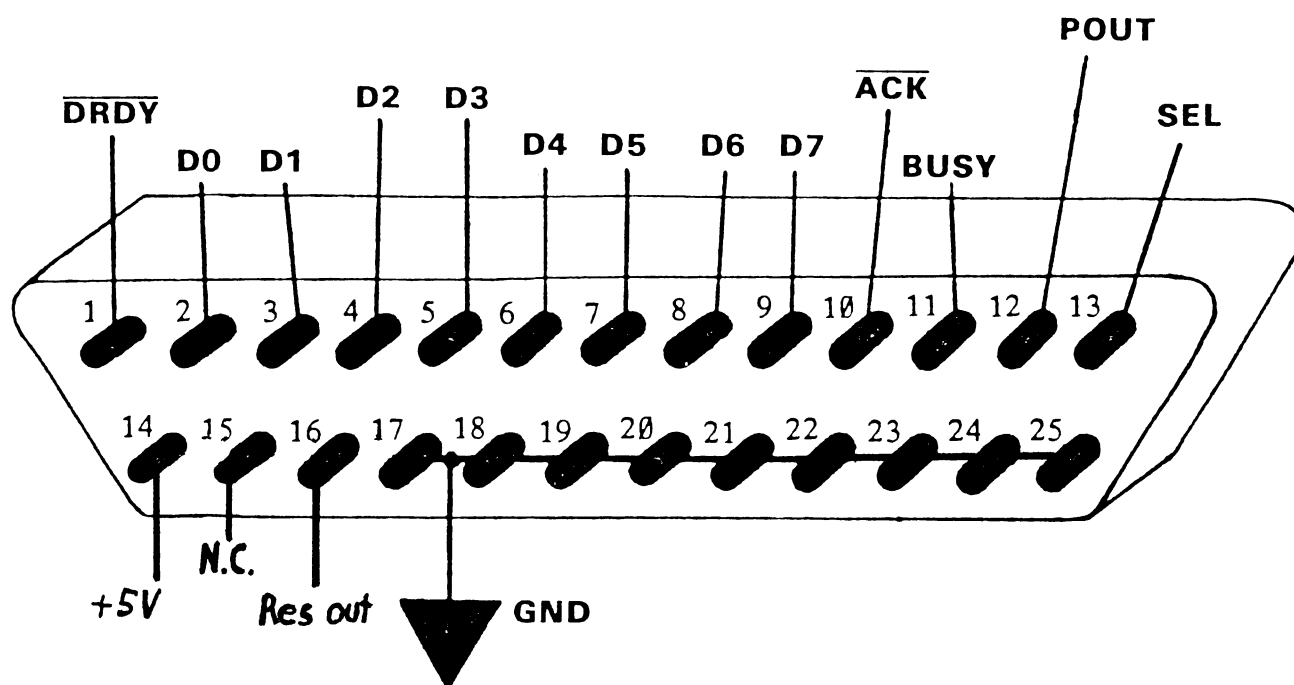
— J3 RGB —



PIN	LINE	FUNCTION
1	/XCLK	External Clock Input
2	/XCLKEN	External Clock Enable
3	R	Analog Red
4	G	Analog Green
5	B	Analog Blue
6	I	Digital Intensity
7	R	Digital Red
8	G	Digital Green
9	B	Digital Blue
10	/CS	Composite Sync — Active Low
11	/HS	Horizontal Sync — Active Low
12	/VS	Vertical Sync — Active Low
13	GNDRTN	Return for XCLKEN
14	/ZD	Zero Detect — Active Low
15	/C1	Color Clock 3.58 MHz
16-20	GND	Ground
21	-5V	- 5 VDC Power
22	+12V	+ 12 VDC Power
23	+5V	+ 5 VDC Power

PARALLEL PORT

— 74 —



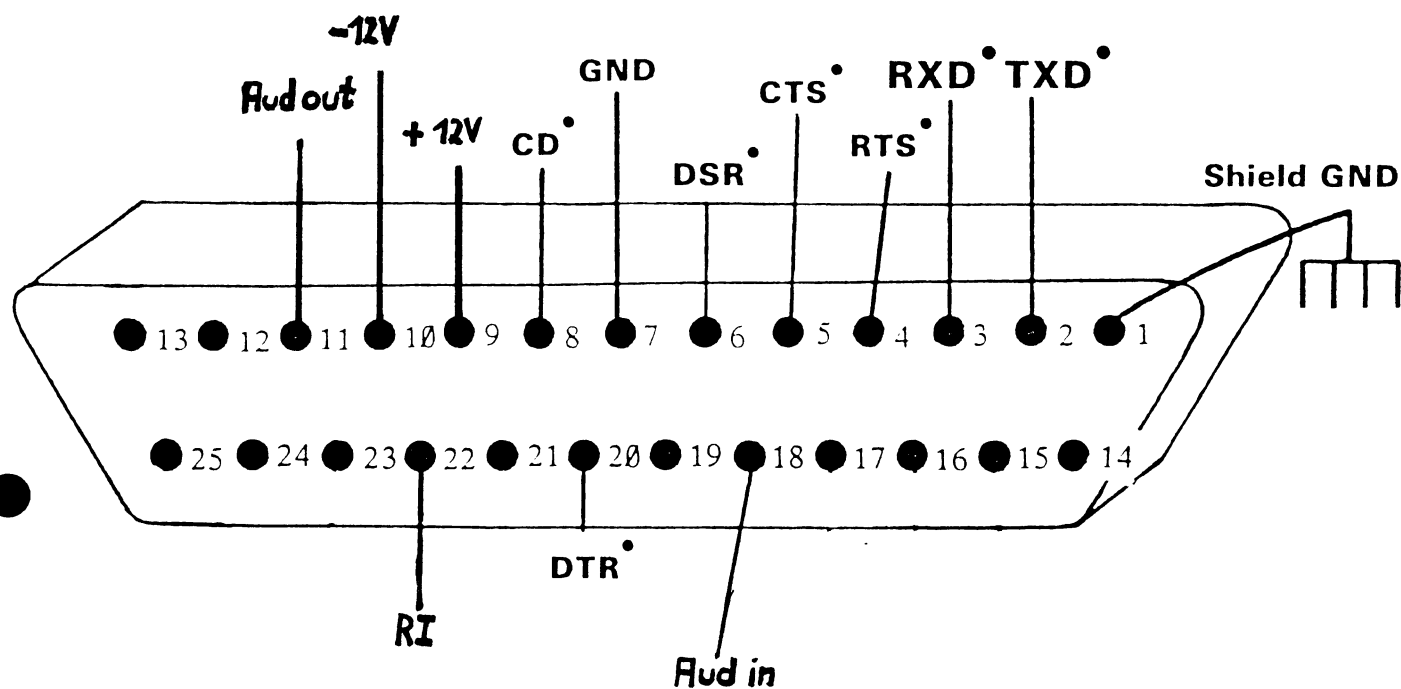
PIN	LINE	FUNCTION
1	$\overline{\text{DRDY}}$	Data Ready - Active low
2-9	D0-D7	Data lines 0-7
10	$\overline{\text{Ack}}$	Acknowledge - Active low
11	Busy	Busy
12	Pout	Paper out
13	Sel	Select
14	+5V	5 VDC Supply
15	N.C.	
16	Res	Reset out - Active low
17-25	GND	Signal Ground

Signalbeschreibung der Centronics-Schnittstelle

DRDY	Dieses Signal wird aktiv, wenn die Daten (Data 0-7) stabil sind. Es weist den Drucker an, die anliegenden Daten zu übernehmen. Das Signal ist normalerweise High und wird LOW, wenn Daten übernommen werden sollen (LOW aktiv).
BUSY	Wenn der Drucker keine Daten übernehmen kann, aktiviert er dieses Signal (HIGH aktiv). In folgenden Fällen tritt dieser Zustand ein: 1. Kurz nach der Datenübernahme 2. Während des Druckvorganges 3. Drucker nicht bereit (Off-Line) 4. Wenn der Drucker gestört ist
ACK	Dieses Signal stellt die Quittung dar, daß die Daten vom Drucker übernommen worden sind und er bereit ist, neue Daten zu empfangen (LOW aktiv).
POUT	Dieses Signal meldet, daß kein Papier mehr im Drucker vorhanden worden ist (High aktiv).
SLCT	Dieses Signal quittiert, daß der Drucker ausgewählt worden ist (High aktiv)
DATA 0-7	Auf diesen Leitungen werden die Informationen (8 Bit) parallel übertragen: HIGH Pegel bei logisch *1* LOW Pegel bei logisch *0*

SERIAL PORT

— J6 —



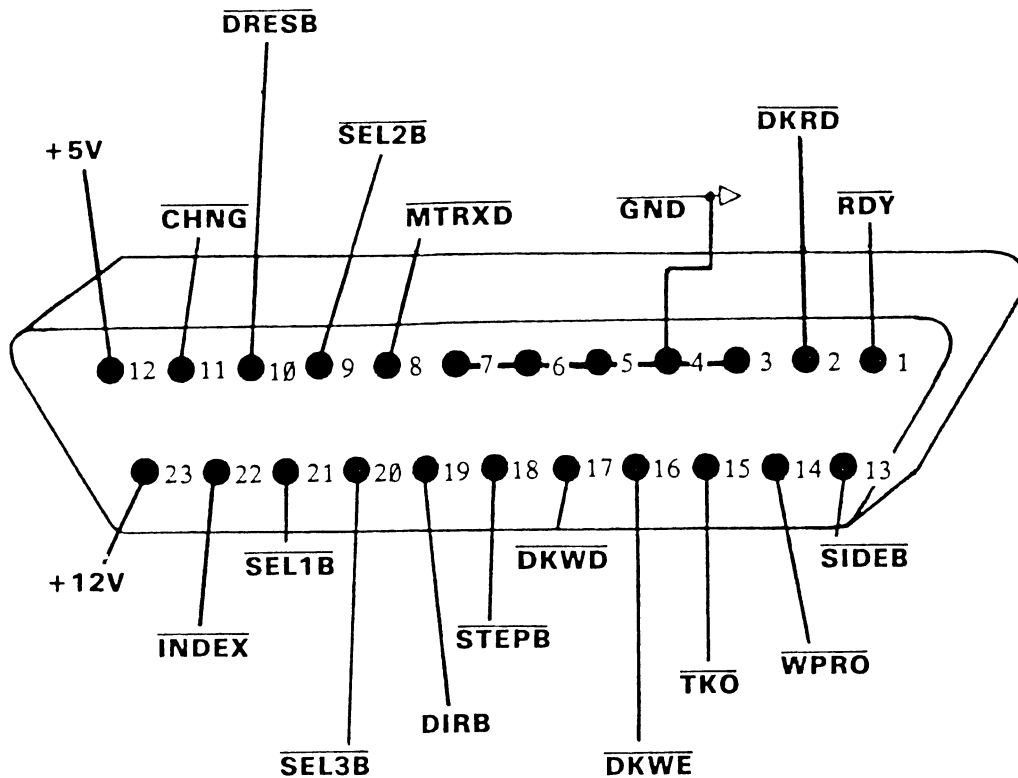
PIN	LINE	FUNCTION
1	SHIELD	GND
2	TXD	Transmit Data
3	RXD	Receive Data
4	RTS	Request to send
5	CTS	Clear to send
6	DSR	Data set ready
7	GND	GND
8	CD	Carrier detect
9	+12 V	12 Volts Power (100 mA)
10	-12 V	
11	AUDOUT	Audio out
18	AUDIN	Audio into Amiga
20	DTR	Data Terminal Ready
22	RI	Ring indicator

Signalbeschreibung der seriellen Schnittstelle

Signalname	Signalrichtung	Bedeutung
TxD	Ausgang	Transmit Data Sendedaten vom PC zur Peripherie
RxD	Eingang	Receive Data Empfangsdaten von der Peripherie zum PC
DSR	Eingang	Data Set Ready Zeigt an, daß ein Peripheriegerät betriebsbereit ist.
CTS	Eingang	Clear to Send zeigt an, daß ein Peripheriegerät empfangsbereit ist.
DTR	Ausgang	Data Terminal Ready zeigt dem Peripheriegerät, daß die serielle Schnittstelle des PC betriebsbereit ist (siehe auch DSR)
RTS	Ausgang	Request to Send Zeigt dem Peripheriegerät an, daß die serielle Schnittstelle, des PC Daten senden will (Siehe auch CTS)
CD	Eingang	Carrier Detect Modemsignal. Es zeigt an, daß ein angeschlossenes Modem einen Träger empfängt.

EXTERNAL DISK CONNECTOR

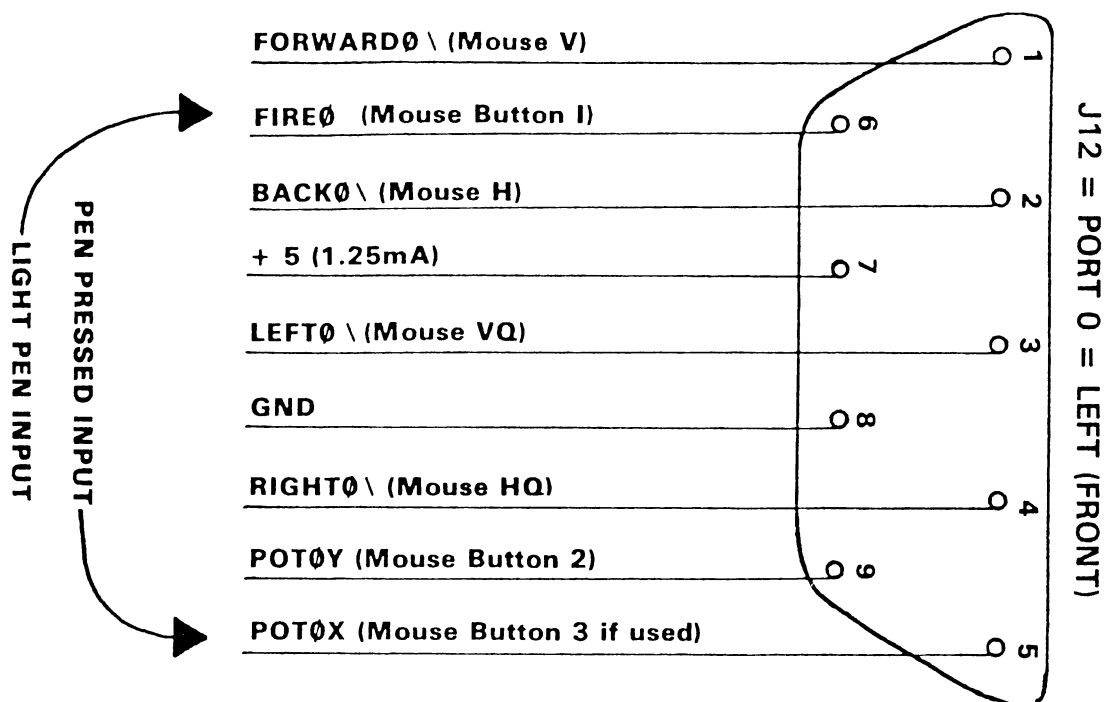
— J7 —



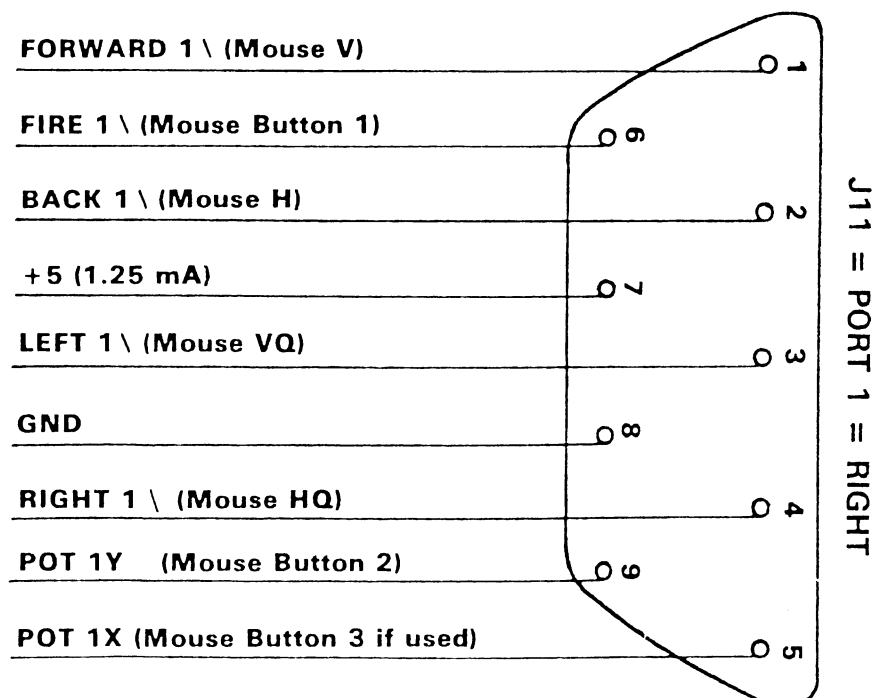
PIN	LINE	FUNCTION
1	/RDY	Disk Ready — Active Low
2	/DKRD	Disk Ready Data — Active Low
3-7	GND	Ground
8	/MTRXD	Disk Motor Control — Active Low
9	/SEL2B	Select Drive 2 — Active Low
10	/DRESB	Disk RESET — Active Low
11	/CHNG	Disk has been Removed from Drive — Latched Low
12	+5	5 VDC Supply
13	/SIDEB	Select Disk Side — 0 = Upper 1 = Lower
14	/WPRO	Disk is Write Protected — Active Low
15	/TKO	Drive Head Position over Track 0 — Active Low
16	/DKWE	Disk Write Enable — Active Low
17	/DKWD	Disk Write Data — Active Low
18	/STEPB	Step the Head — Pulse, First Low then High
19	DIRB	Select Head Direction — 0 = Inner 1 = Outer
20	/SEL3B	Select Drive 3 — Active Low
21	/SEL1B	Select Drive 1 — Active Low
22	/INDEX	Disk Index Pulse — Active Low
23	+12	12 VDC Supply

MOUSE/JOYSTICK/LIGHTPEN PORTS

— J11 and J12 —



Port 0 is closer to Front



DASH NO	Q2 NTSC	Q1 PAL	ITEM	PART-NUMBER	DESCRIPTION	DES	NOTES
	REF REF	REF REF	Q1	380 710 - 01	SCHEMATIC		
	REF REF	REF REF	Q2	380 711 - 01	PCB ARTWORK		
	1	1	Q3	380 712 - 01	FABRICATION		
			Q4				
			Q5				
	1	1	Q6	390 084 - 01	IC, 68000 CPU 8 MHz	U 1	PROD OF PAL 20LB P/N: 380771-01
	1	1	Q7	380 713 - 01	IC, PAL EN	U 26	PROD OF PAL 16LB P/N: 380219-01
	1	1	Q8	380 714 - 01	IC, PAL CAS	U 27	PROD OF PAL 20LB P/N: 380771-01
	1	1	Q9	380 715 - 01	IC, PAL BUFFER CTR.	U 5	
			10				
			11				
	1	1	12	380 717 - 01	IC, PAL ARBITER	U 64	PROD OF PAL 16R6 P/N: 380220-01
	-	1	13	252 362 - 01	IC, 8367 AGNUS, PAL VERSION	U 50	
	1	-	14	252 125 - 01	IC, 8361 AGNUS, NTSC VERSION	U 50	MOS
	1	1	15	252 126 - 01	IC, 8362 DENISE	U 76	MOS
	1	1	16	252 127 - 01	IC, 8364 FAULA	U 55	MOS
	1	1	17	318 073 - 01	IC, 6242 B, RTC	U 65	VENDOR: OKI
	S	S	18	318 073 - 01	IC, 6242 B, RTC	U 65	SUB FOR ITEM 17
	2	2	19	318 029 - 01	IC, 8520	U 10, 11	MOS
			20				
			21				
	1	1	22	315 C93 - 01	IC, ROM 2MBIT, HN 62402 P	U 2	ACC.TIME 200 NS, VEND:HITACHI
	S	S	23	380 773 - 01	PCB ASSY, PIGGY BOARD		SUB. FOR ITEM 22
	16	16	24	380 223 - 01	IC, DRAM 256KX1, 150 NS	U 34-49	ONLY T1
			25				
			26				
			27				
	1	1	28	901 523 - 09	IC, LM 2901	U 20	
			29				
	1	1	30	901 523 - 14	IC, LF 347	U 56	OR EQUIVALENT
			31				
	3	3	32	901 522 - 30	IC, 7407	U 12,13,72	
	1	1	33	901 522 - 09	IC, 7438	U 16	
	2	2	34	901 525 - 10	IC, 74 S 51	U 21, 22	
			35				
			36				
	1	1	37	901 521 - 02	IC, 74 LS 04	U 14	

DASH NO.	Q2	Q1	ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
	NISC	PAL					
	1	1	38	901 521 - 31	IC, 74 LS 32	U 15	
	1	1	39	901 521 - 06	IC, 74 LS 74	U 68	
	1	1	40	901 521 - 16	IC, 74 LS 138	U 3	
	3	3	41	901 521 - 13	IC, 74 LS 244	U 6, 8, 54	
	1	1	42	901 521 - 86	IC, 74 LS 148	U 4	
	6	6	43	901 521 - 46	IC, 74 LS 245	U 58-63	
	2	2	44	901 521 - 29	IC, 74 LS 373	U 7, 9	
	1	1	45	901 521 - 43	IC, 74 LS 374	U 53	
			46				
			47				
			48				
			49				
	1	1	50	390 092 - 03	IC, 74 F 08	U 66	
	1	1	51	390 077 - 01	IC, 74 F 32	U 33	
	5	5	52	390 092 - 04	IC, 74 F 74	U 23-25,	U 52, 70
	1	1	53	390 092 - 07	IC, 74 F 153	U 51	
	2	2	54	390 091 - 01	IC, 74 F 257	U 30, 31	
			55				
	1	1	56	380 727 - 01	IC, 74 HCT 32	U 67	
	1	1	57	380 727 - 20	IC, 74 HCT 157	U 74	
			58				
	2	2	59	252 119 - 01	IC, 74 HC 244	U 77, 78	
	1	1	60	901 882 - 01	IC, MC 1488	U 18	
	1	1	61	901 883 - 01	IC, MC 1489	U 17	
	1	1	62	906 103 - 02	DIODE ZENER, 2V7	D 5	MOTOROLA
	S	S	63	900 948 - 03	DIODE 1 N 5223	D 5	SUBST.FOR ITEM 62
	3	3	64	328 115 - 01	TRANSISTOR, 2SC 3504 NFN	Q 5-7	OR EQUIVALENT
	4	4	65	324 220 - 01	TRANSISTOR BC 337 B	Q 8-10,12	
	1	1	66	324 219 - 01	TRANSISTOR BC 327 B	Q 11	
	2	2	67	900 850 - 01	DIODE 1 N 4148	D 1, 7	
	2	2	68	900 750 - 01	DIODE 1 N 4001	D 2, 3	
	2	2	69	380 397 - 01	DIODE AA 118, GERMANIUM	D 6,8	50 MA/50V,EQUIV.AA119, AA143
	S	-	70	325 566 - 14	OSCILLATOR 28.6363 MHZ	OSC 1	SUB FOR ITEM 73
	1	1	71	900 560 - 01	CRYSTAL 32.768 KHZ	OSC 2	
	-	1	72	252 344 - 01	OSCILLATOR,28.37516 MHZ	OSC 1	
	1	-	73	325 566 - 12	OSCILLATOR, 28.6363 MHZ	OSC 1	
	1	1	74	380 721 - 01	COIL CHOKE	L1	MAT.FXC 38/VALVO 4312 020 36630

DASH NO.	Q2	Q1	ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
			149				
	3	3	150	901 751 - 57	RESISTOR METAL 4.02K .25 W, 1%	R50,61,65	
	3	3	151	901 751 - 58	RESISTOR METAL 8.06K .25 W, 1%	R52,62,66	
	3	3	152	901 751 - 59	RESISTOR METAL 287 OHM .25 W, 1%	R49,67,68	
			153				
			154				
			155				
			156				
			157				
	1	1	158	380 722 - 01	CONNECTOR 5 PIN DIN FEMALE	J 3	180°
			159				
			160				
	3	3	161	903 446 - 03	CARD EDGE CONNECTOR 2 X 18 PIN	J 8,27,28	
	4	4	162	903 446 - 02	CARD EDGE CONNECTOR 2 X 31 PIN	J 29-32	
	5	5	163	903 446 - 04	CARD EDGE CONNECTOR 2 X 50 PIN	J 20-24	
	1	1	164	903 446 - 05	CARD EDGE CONNECTOR 2 X 43 PIN	J 19	
			165				
	1	1	166	903 326 - 02	HEADER ASSY SINGLE ROW .100 CENTER	J 36	2 PIN
	1	1	167	903 326 - 03	HEADER ASSY SINGLE ROW .100 CENTER	J 16	3 PIN
	1	1	168	903 328 - 13	HEADER ASSY SINGLE ROW .156 CENTER	J 2	14 PIN, KEY 10, FRICT. LOCK
			169				
			170				
			171				
	1	1	172	903 345 - 17	HEADER ASSY DUAL ROW .100 CENTER	J 5	34 PIN, REMOVE PIN 3 AT ASSEMB.
	1	1	173	903 345 - 13	HEADER ASSY DUAL ROW .100 CENTER	J 33	26 PIN, REMOVE PIN 19 AT ASSEMB.
	S	S	174	327 032 - 03	CONN. 23 PIN, SUB MINI "D" MALE	J 9	SUB FOR ITEM 176
	S	S	175	327 033 - 03	CONN. 23 PIN, SUB MINI "D" FEMALE	J 7	SUB FOR ITEM 177
	1	1	176	310 976 - 01	CONN. 23 PIN, SUB MINI "D" MALE	J 9	
	1	1	177	310 975 - 01	CONN. 23 PIN, SUB MINI "D" FEMALE	J 7	ONLY ONE SIDE WITH RIVET DOME
	1	1	178	327 032 - 05	CONN. 25 PIN, SUB MINI "D" MALE	J 6	
	1	1	179	252 024 - 03	CONN. 25 PIN, SUB MINI "D" FEMALE	J 4	
	S	S	180	327 033 - 05	CONN. 25 PIN, SUB MINI "D" FEMALE	J 4	SUB FOR ITEM 179
			181				
	2	2	182	906 126 - 01	CONN. 9 PIN, SUB MINI "D" MALE	J 11,12	
	S	S	183	327 032 - 01	CONN. 9 PIN, SUB MINI "D" MALE	J 11, 12	SUB FOR ITEM 182
	1	1	184	903 781 - 01	WIRE JUMPER 0 OHM	J 1	SP.:12.5MM
			185				

DASH NO.	02	01	ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
	MTSC PAL						
	1	1	186	252 122 - 02	RCA PHONE JACK 3 PIN	J 15	
	1	1	187	252 122 - 03	RCA PHONE JACK 3 PIN	J 14	
			188				
	2	2	189	904 150 - 08	SOCKET IC 20 PIN	U 27,64	
	2	2	190	904 159 - 04	SOCKET IC 24 PIN	U 5, 26	(SMALL)
	3	3	191	904 150 - 06	SOCKET IC 40 PIN	U 2,10,11	
	1	1	192	904 150 - 10	SOCKET IC 64 PIN	U 1	
	3	3	193	251 313 - 01	SOCKET IC 48 PIN	U 50,55,76	
			194				
	11	11	195	906 800 - 03	SCREW, PAN HEAD M 3 X 8		SUB FOR ITEM 199
	22	22	196	905 652 - 04	LOCKWASHER EXT. TOOTH. Ø 3.2 MM		SUB FOR ITEM 199
	11	11	197	905 960 - 03	NUT HEX M 3		SUB FOR ITEM 199
			198				
	11	11	199		RIVET DOME		
			200				

C O M M O D O R E PCB ASSY A 2000

DATE: 01-26-87/M. DITTMANN P/N: 3 8 0 7 0 5 REF. 6 SHEET 7/6

DASH NO.	01 ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
	01				
	REF02	380 774 - 01	SCHEMATIC		
	REF03	380 775 - 01	PCB ARTWORK		
	1 04	380 776 - 01	FABRICATION		
	05				
	06				
	07				
	1 08	380 778 - 01	IC, EPROM KICK 1EVEN 200NS		PROD OF 27512D P/N: 380777-01
	1 09	380 779 - 01	IC, EPROM KICK 100D 200NS		PROD OF 27512D P/N: 380777-01
	1 10	380 780 - 01	IC, EPROM KICK 2EVEN 200NS		PROD OF 27512D P/N: 380777-01
	1 11	380 781 - 01	IC, EPROM KICK 200D 200NS		PROD OF 27512D P/N: 380777-01
	12				
	1 13	901 521 - 01	IC, 74 LS 00		
	14				
	4 15	904 150 - 05	IC SOCKET 28 PIN		
	16				
	5 17	380 791 - 01	IC SOCKET 40 PIN DOUBLE SIDED		SUB FOR ITEM 24
	18				
	5 19	900 020 - 01	CAP CER 0.1 UF 50V		SP.: 5 MM
	20				
	21				
	1 22	380 145 - 04	STANDOFF PLASTIC 11.0 MM		FOR HOLE 4 MM
	23				
	2 24	903 326 - 20	HEADER ASSY SINGLE ROW 20 PIN		VENDOR: MOLEX SF.: 2.54 MM
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REVISIONS			
LTR	ZONE	DESCRIPTION	DATE
1		ENGINEERING RELEASE	03-08-76
2		ENGINEERING RELEASE	10-10-86

SHIPPING - ASSY
380 701

MAIN - ASSY
380 700

BASE - ASSY
380 700

FEED - ASSY
380 700

FEED - ASSY
380 700

FEED - ASSY
380 700

FEED - ASSY
380 700

REVISIONS
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- 01 SHOWN

UNLESS OTHERWISE SPECIFIED		DRAWN BY: <i>Shelley</i>		DATE: 01-01-76	commodore	
TOLERANCES ON DECIMALS		CHKD:	ENGR: <i>Lee</i>	APPR:	DRAWING TREE	
X	XX	XXX	✓			
2	2	2	2	2		
MATERIAL		USED ON		NEXT ASSY		
FINISH		AMIGA		2000		
				SIZE		REV
				B		2
				SCALE		NONE
				SHEET		1
				OF		2

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
1		ENGINEERING RELEASE	09-11-86	<i>LC</i>
2		PILOT PRODUCTION RELEASE	02-11-87	<i>LC</i>

PART NO.	DESCRIPTION	
380 703 - 01	BASE ASSY AMIGA 2000	VDE / BSI
380 703 - 02	BASE ASSY AMIGA 2000	UL / CSA
↑ - 03	↑ 2002	VDE / BSI
- 04	2002	UL / CSA
- 05	2010	VDE / BSI
- 06	2010	UL / CSA
↓ - 07	↓ 2012	VDE / BSI
380 703 - 08	BASE ASSY AMIGA 2012	UL / CSA

3-41

1. SHEET OF SIZE
 ASSY DWG
 NOTES:

commodore	TITLE		BASE ASSY AMIGA		DRAWN BY	DATE	ENGR	SIZE	DRAWING NUMBER
					<i>gr</i>	9-11-86	<i>LC</i>	B	380703
					CHKD		APPR	SHEET	1 OF 3

QUANTITY REQUIRED PER PART / DASH NO.										ITEM	QTY	PART NUMBER	DESCRIPTION	REF DES	BEND	NOTES
08	07	06	05	04	03	02	01									
		1	1	1	1	1	1	01				380 705 - 01	PCB-ASSY, PAL			
		1	1	1	1	1	1	02				380 705 - 02	PCB-ASSY, NTSC			
		1	1	1	1	1	1	03				380 709 - 01	LED HOLDING-ASSY			
		1	1	1	1	1	1	04				380 745 - 01	PCB-ASSY RAM EXP / KICKSTART			
		2	2	1	1	2	1	05				380 742 - 01	DRIVE CABLE-ASSY II			FOR FLOPPY 3 1/2"
		1	1	1	1			06				380 012 - 07	DRIVE CABLE-ASSY			FOR FLOPPY 5 1/4"
		1	1	1	1			07				380 755 - 01	PCB-ASSY PC EMULATOR 512 KB			
		1	1	1	1	1	1	08				380 728 - 01	HOUSING BOTTOM			
								09								
		6	6	6	7	7	7	10				380 120 - 01	EXTENSION CARD PANEL			
								11								
		7	7	7	7	7	7	12				380 445 - 01	SCREW, PAN HEAD M3.5 X 5			FOR EXTENSION CARD PANEL
								13								
		3	3	3	3	3	3	14				380 727 - 01	WHEEL FOR EXTENSION SLOTS			
								15								
		15	15	15	15	15	15	15								PLACES PANEL FOR EXTENSION SLOTS
								16								PLACES PCB
								17								
		4	4	4	4	4	4	18				380 118 - 01	GUIDE FOR PCB			
		8	8	8	8	8	8	19								
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COMMODORE	TITLE: BASE ASSY AMIGA	CHKD: <i>M. G. Williams</i>	DATE: 09-12-88	ENGR: <i>LC</i>	SIZE: B	REV: 2	SHEET: 3
					380 703		

REVISIONS			
LTR	ZONE	DESCRIPTION	DATE
1		ENGINEERING RELEASE	09-15-86
2		PILOT PRODUCTION RELEASE	02-11-87

PART NO.	DESCRIPTION	
380704 - 01	CHASSIS ASSY AMIGA 2000	VDE / BSI
380704 - 02	CHASSIS ASSY AMIGA 2000	UL / CSA
↑ - 03	↑ 2002	VDE / BSI
- 04	2002	UL / CSA
- 05	2010	VDE / BSI
- 06	2010	UL / CSA
↓ - 07	↓ 2012	VDE / BSI
380704 - 08	CHASSIS ASSY AMIGA 2012	UL / CSA

1. SHEET OF SIZE
 ASSY DWG
 NOTES:

commodore	TITLE CHASSIS ASSY AMIGA	DRAWN BY Gf.	DATE 9-15-86	ENGR fa	SIZE B	DRAWING NUMBER 380704
		CHKD	APPR			SHEET 1 OF 3

[illegible]

QUANTITY REQD PER PART / DASH NO.				ITEM	Q	PART NUMBER	DESCRIPTION	REF DES	BEND	NOTES
				1						
				2						
				3		382 016 - 01	POWER ON LED ASSY			
				4						
				5		782 020 - 01	HARD DISK LEL ASSY			
				6						
				7		782 708 - 01	LED HOLDING			
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commodore

FILE: LED HOLDING ASSY, AMIGA 2000

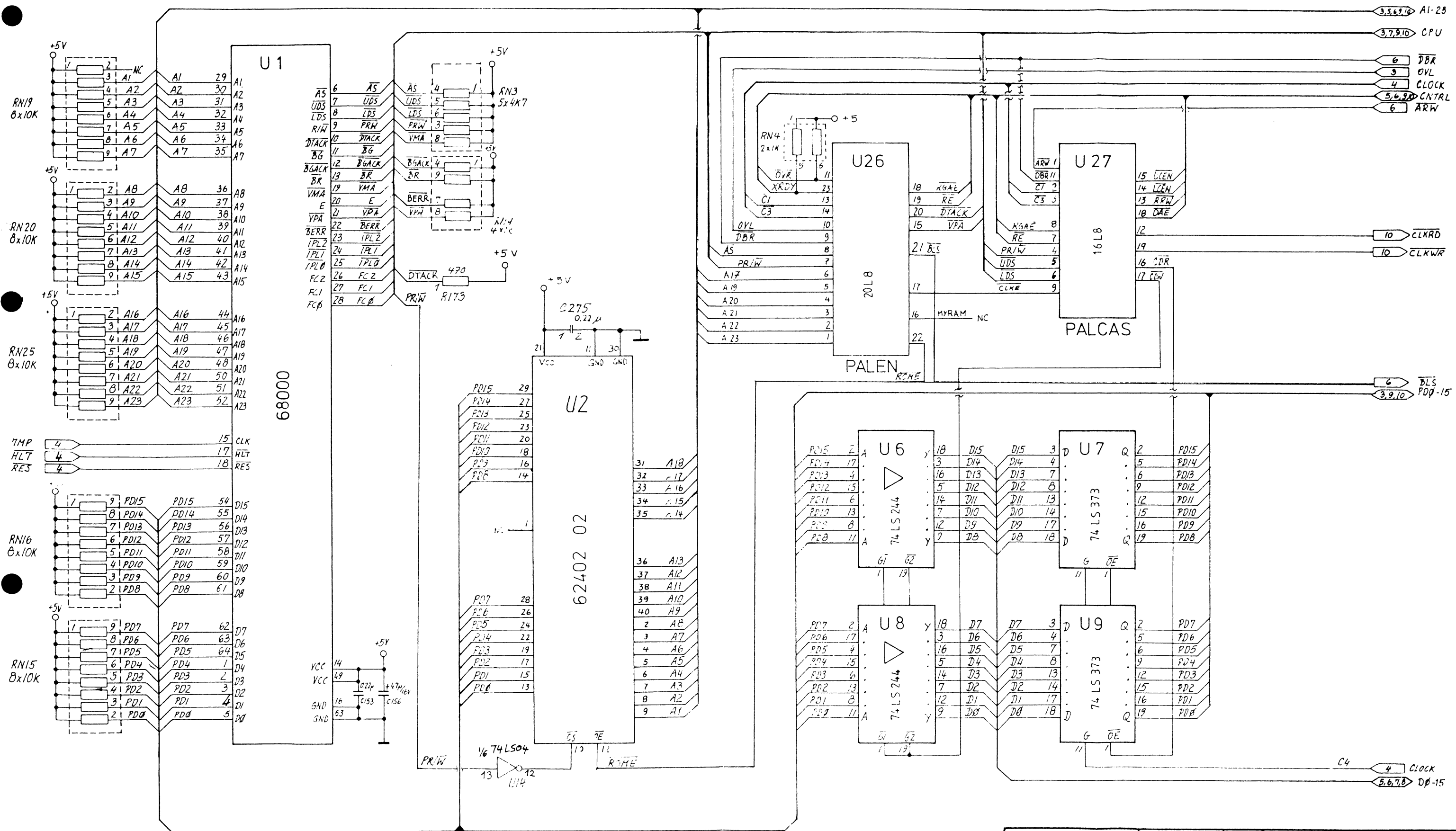
DATE: 4.11.82

SIZE: B

REV: 1

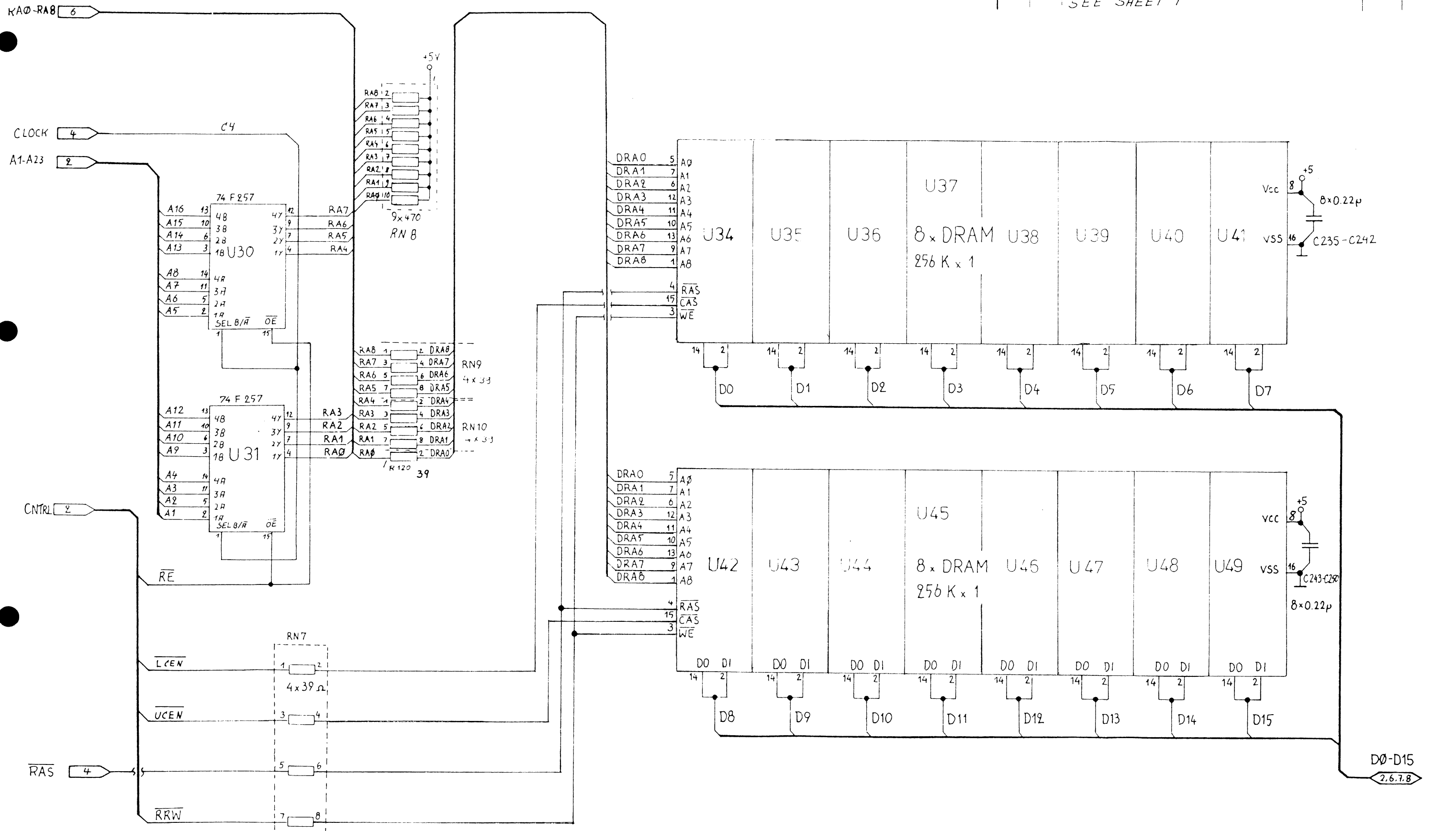
SHT: 2/3

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED



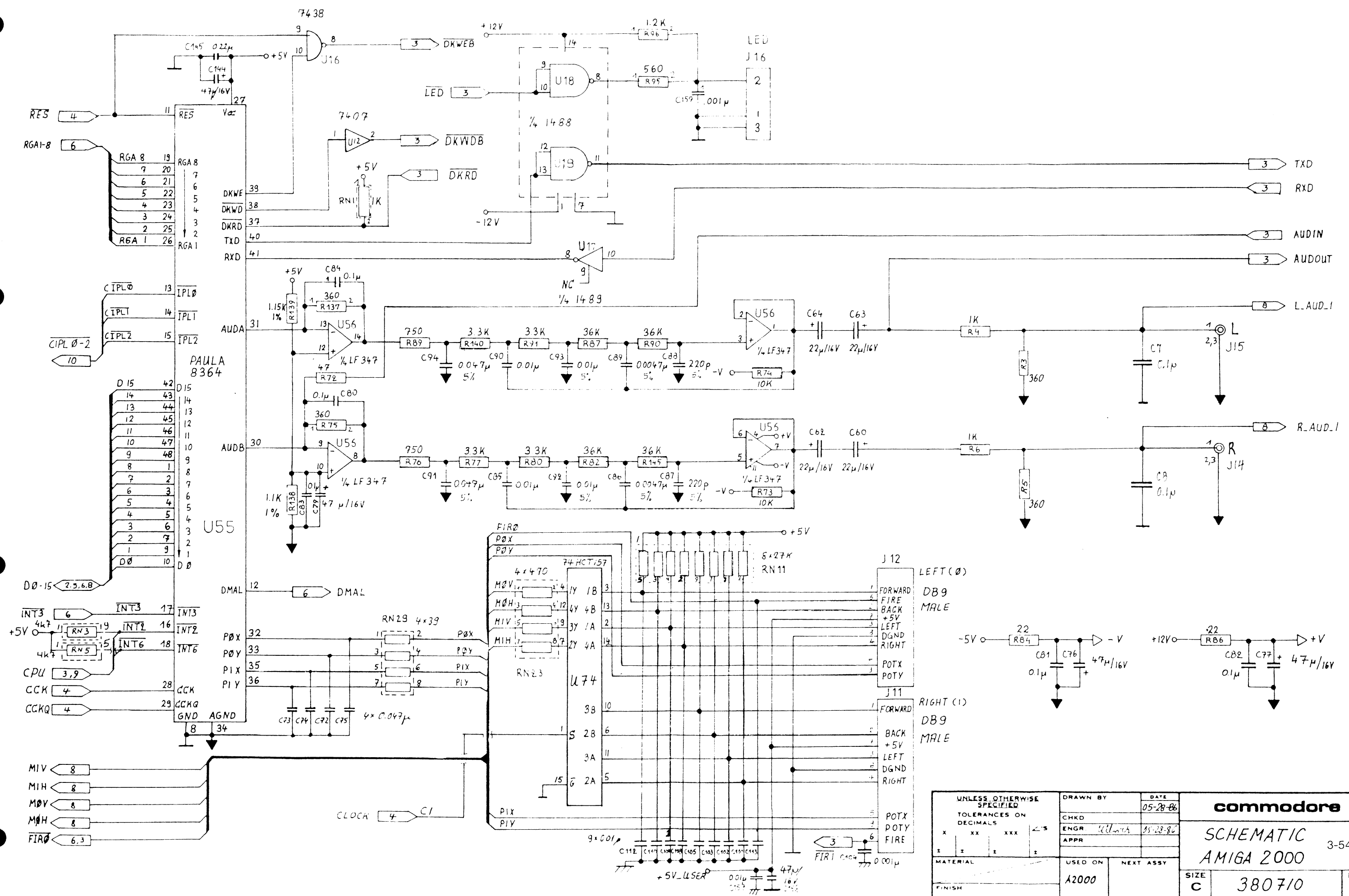
UNLESS OTHERWISE SPECIFIED		DRAWN BY <i>Jimmi J.</i>		DATE <i>05-13-85</i>	
TOLERANCES ON DECIMALS		CHKD <i>W. J.</i>			
X XX XXX		ENGR <i>W. J.</i>			
1 2 3 4		APPR			
MATERIAL		USED ON		NEXT ASSY	
FINISH		A2000			
commodore				3-49	
SCHEMATIC					
AMIGA 2000					
SIZE C		380710		REV 5	
SCALE NONE		SHEET 2		OF 1	

LTR		ZONE	REVISIONS		DATE	APPROVED
			DESCRIPTION			
			SEE SHEET 1			



UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY		DATE		commodore	
X XX XXX <S		CHKD		05-28-85			
MATERIAL		ENGR		05-28-85		SCHEMATIC	
FINISH		APPR				AMIGA 2000	
		USED ON		NEXT ASSY		3-52	
		A2000				REV 6	
						SCALE: NONE SHEET 5 OF 11	

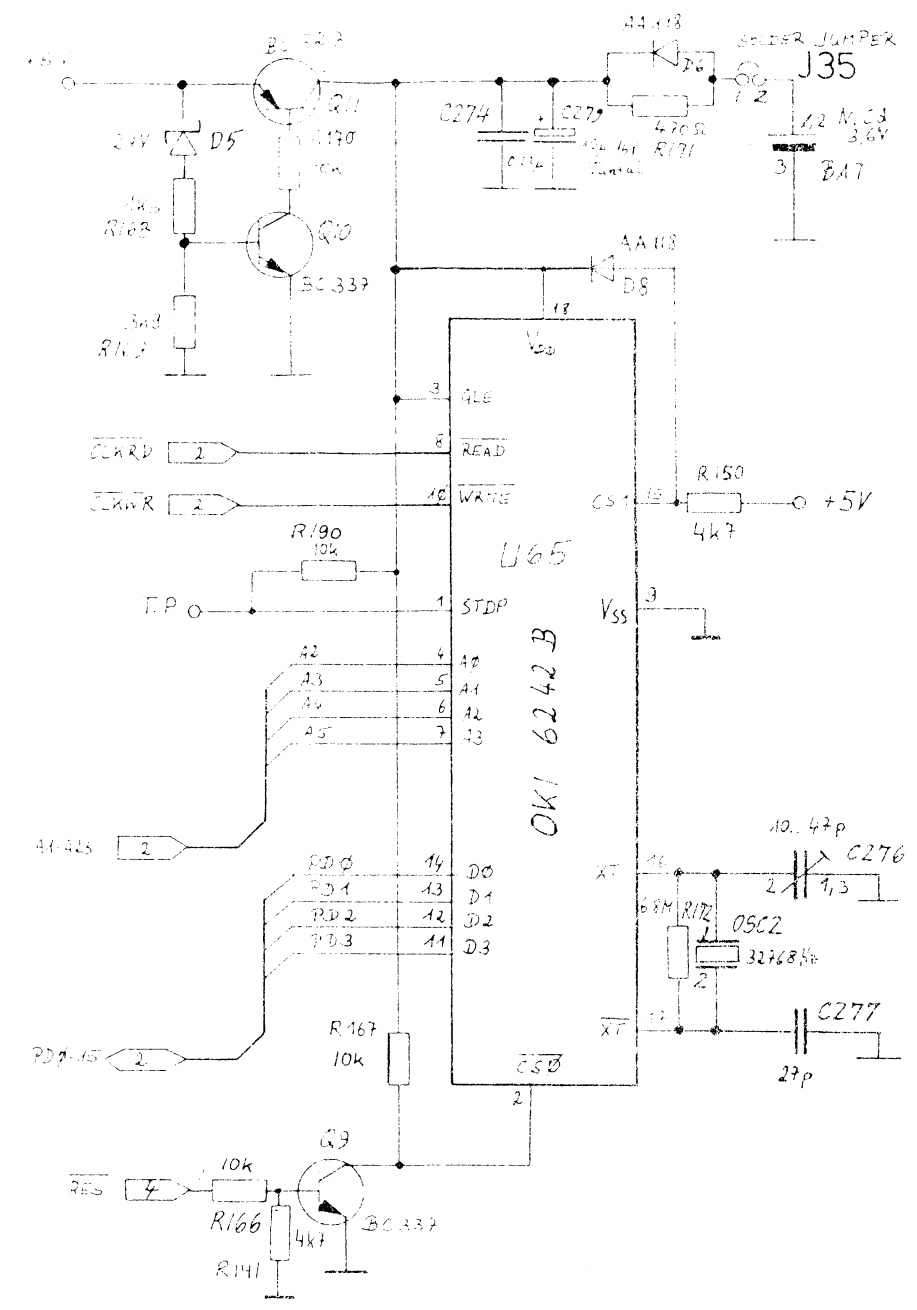
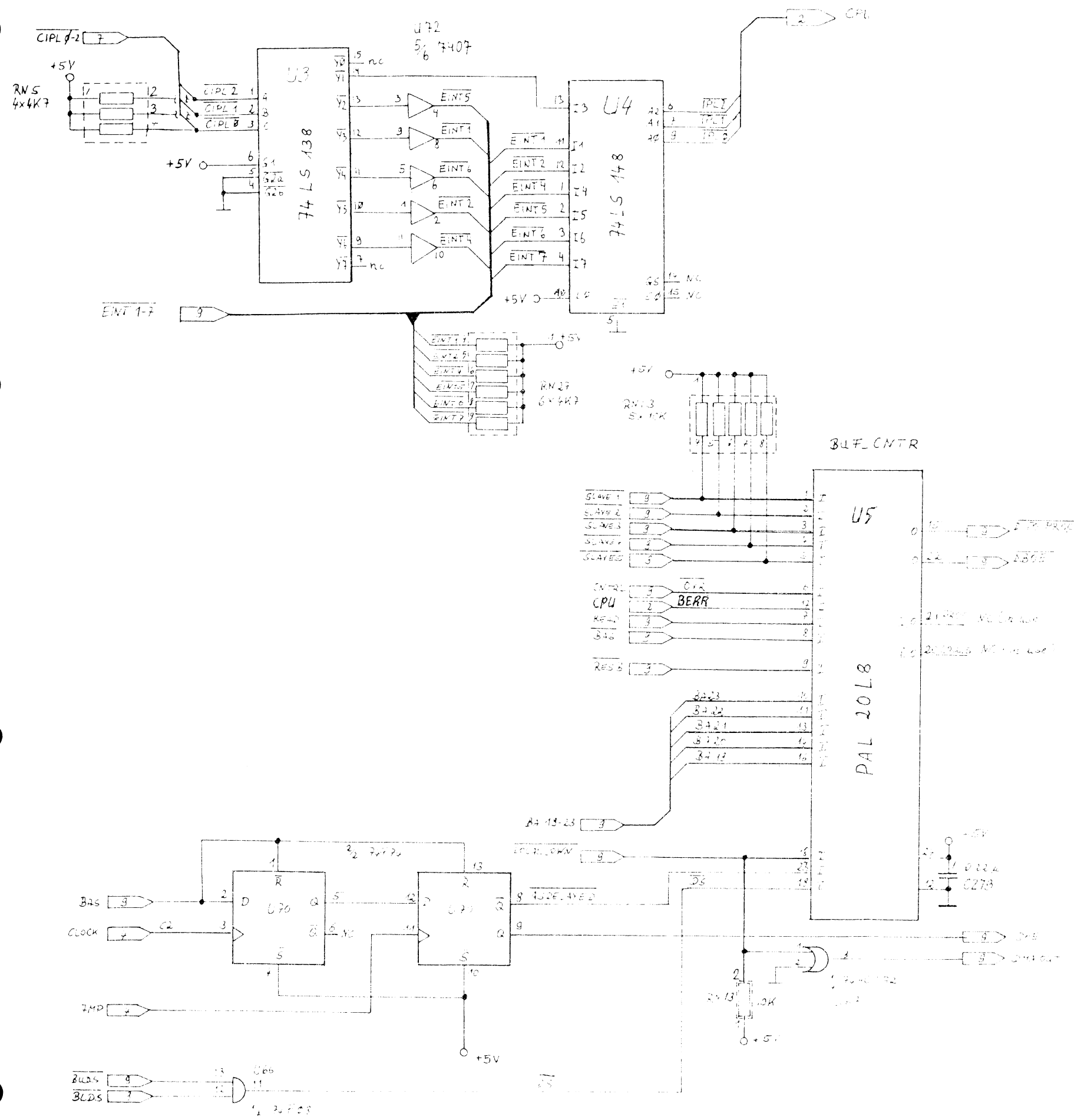
REVISIONS				DATE	APPROVED
LTR	ZONE	DESCRIPTION			
		SEE SHEET 1			



UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY	DATE
X	XX	CHKD	05-28-86
		ENGR	35-28-86
		APPR	
MATERIAL		USED ON	NEXT ASSY
FINISH		A2000	
SCALE NONE		SHEET 7 OF 11	

commodore
SCHEMATIC
AMIGA 2000
3-54
SIZE C 380710
REV 6

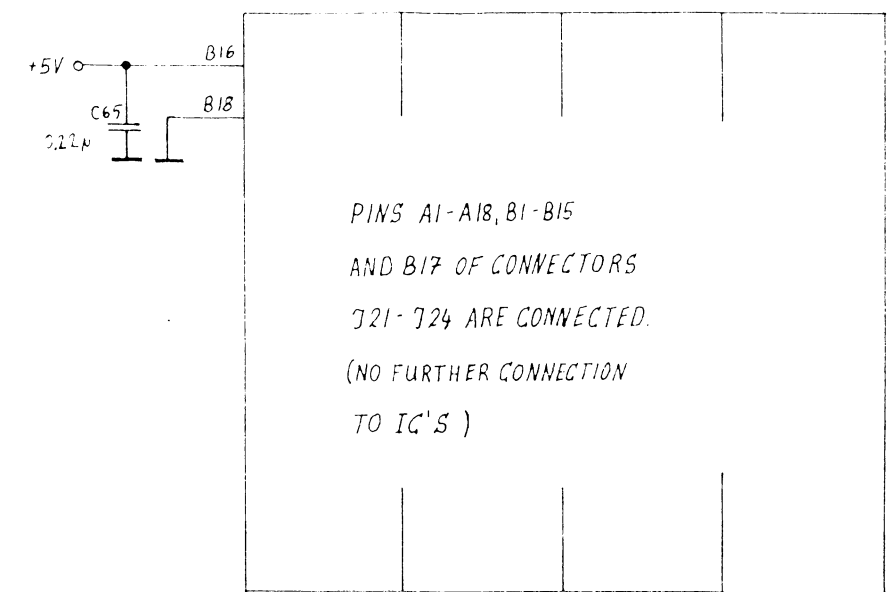
REVISIONS				DATE	APPROVED
LTR	ZONE	DESCRIPTION			



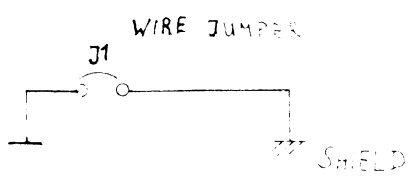
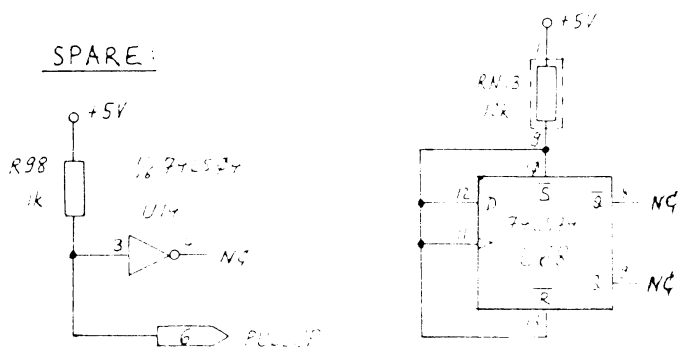
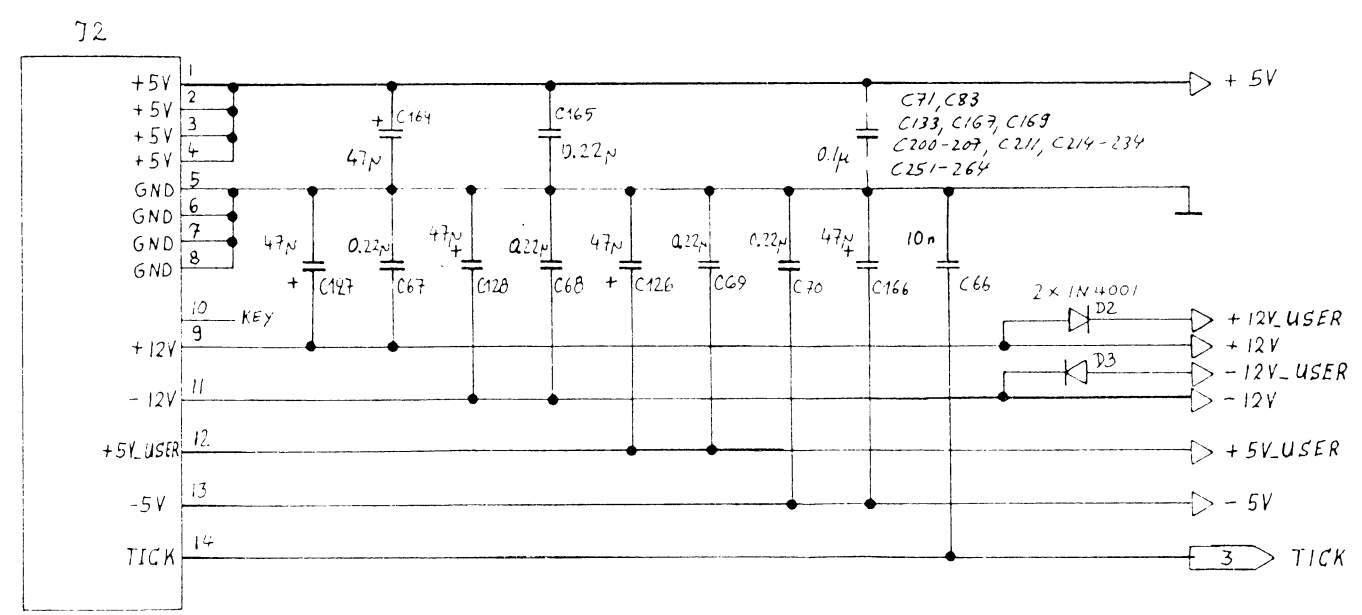
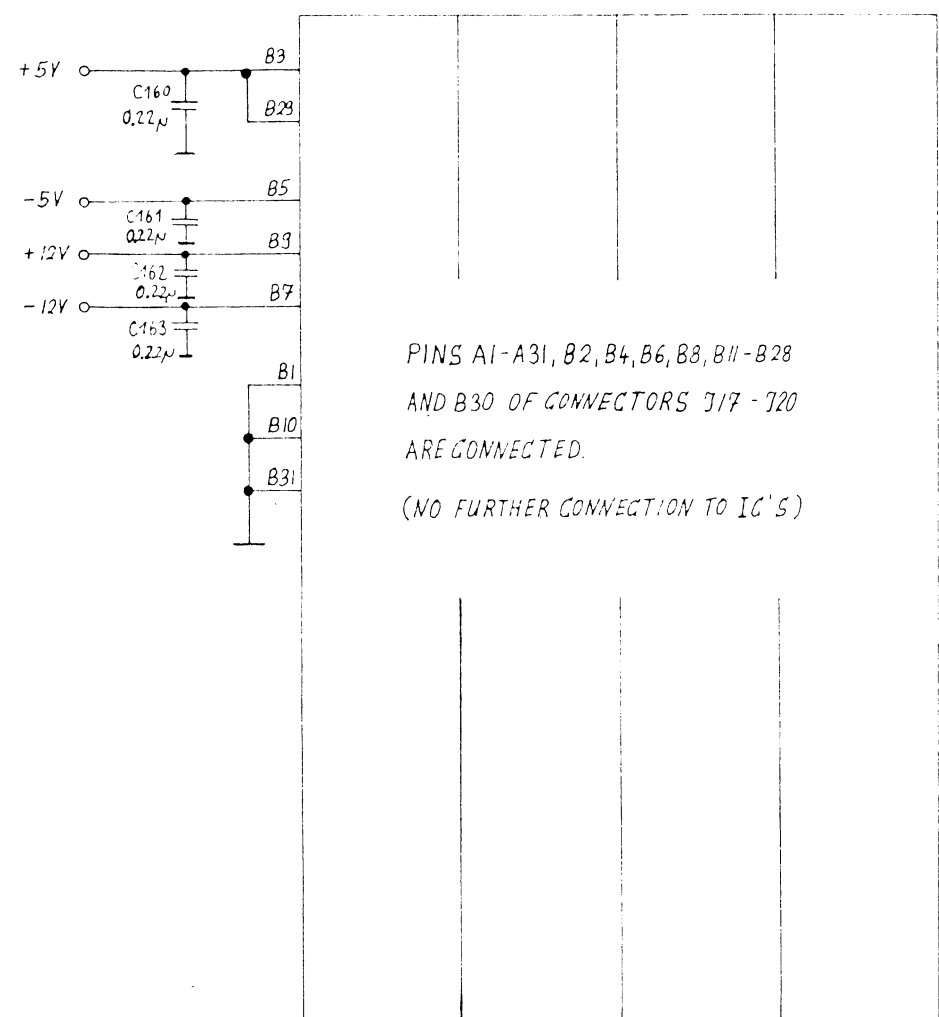
UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS				DRAWN BY G. J. J. J.		DATE 10-1-81	
X XX XXX				CHKD G. J. J. J.		ENGR G. J. J. J.	
MATERIAL				USED ON A2000		NEXT ASSY	
FINISH				SIZE C		REV 6	
SCHEMATIC AMIGA 2000				3-57		SCALE 1:1	

REVISIONS				DATE	APPROVED
LTR	ZONE	DESCRIPTION			
		SEE SHEET 1			

J25-J28
2x18 PINS



J29-J32
2x31 PINS



UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY		DATE		commodore	
X	XX	XXX	CHKO	ENGR	APPR	3-58	
MATERIAL		USED ON		NEXT ASSY		SCHEMATIC	
FINISH		A2000				AMIGA 2000	
						REV 6	
						SCALE NONE SHEET 11 OF 11	

Video Modulator-Board

4

DASH NO.

Q2 Q1 ITEM

PART-NUMBER

DESCRIPTION

DES

NOTES

NTSC PAL

REF Q1

REF Q2

1 1 Q3

Q4

Q5

1 1 Q6

- 1 Q7

1 1 Q8

Q9

- 1 Q10

Q11

5 Q12

- 1 Q13

Q14

Q15

Q16

1 1 Q17

- 1 Q18

1 1 Q19

Q20

1 1 Q21

4 Q22

3 Q23

4 Q24

- 2 Q25

4 Q26

1 1 Q27

- 1 Q28

- 1 Q29

- 2 Q30

1 - Q31

- 1 Q32

1 1 Q33

1 1 Q34

1 1 Q35

1 1 Q36

4 Q37

380 749 - Q1

380 750 - Q1

380 725 - Q1

390 085 - Q1

901 521 - Q6

252 124 - Q1

900 556 - Q9

902 671 - Q1

902 671 - Q1

901 301 - Q8

901 151 - 15

252 123 - Q1

380 301 - Q1

251 071 - 30

251 071 - Q1

900 020 - 10

900 020 - Q1

900 020 - Q1

251 070 - 18

251 074 - Q1

251 070 - 12

251 070 - 19

251 070 - 22

251 070 - 28

251 070 - 14

900 022 - Q1

251 071 - 16

900 100 - 51

900 100 - 39

FABRICATION

ARTWORK

SCHEMATIC

IC, MC1377

IC, 74 LS 74

IC, ANALOG DELAY LINE

CRYSTAL 4.433619 MHZ

TRANSISTOR 2 SC 945 A

TRANSISTOR 2 SC 945 A

CHOKE

39 uH

INDUCTOR 1.5 uH

TRANSFORMER, CHROMA BANDPASS

CAP VAR 2-40 pF

CAP CER RAD 470 pF 50V

CAP CER RAD 0.001 uF 50V

CAP CER RAD 0.01 uF 50V

CAP CER RAD 0.1 uF 50V

CAP CER RAD 0.1 uF 50V

CAP CER RAD 47 pF 50V

CAP CER RAD 0.001 uF 50V

CAP CER RAD 15 pF 50V

CAP CER RAD 56 pF 50V

CAP CER RAD 100 pF 50V

CAP CER RAD 820 pF 50V

CAP CER RAD 22 pF 50V

CAP CER RAD 0.22 uF 50V

CAP CER RAD 33 pF 50V

CAP ELECT. RAD 2.2UF/16V

CAP ELECT. RAD 22 uF/16 V

MOTOROLA

400 ns

HC 18U

OR EQUIV.

OR EQUIV.

U 1

U 2

DL 1

QU 1

T 1,2,4-6

T 3

L 1

L 2

L 3

TR 1

C 26,28,29,33

C 17,24,25

C 7,9,12,13

C 2,23

C 10,11,14,15

C 8

C 1

C 20

C 19,21

C 19

C 22

C 18

C 3

C 31

C 30

C 4,5,6,

+/- 10%, SP: 5MM

+/- 10%, SF: 5MM

SP: 5MM

SP: 5MM

SP: 5MM

SP: 5MM

KDFU/NP0, +/-5% SP: 5MM

KDFU/NP0, +/-5% SP: 5MM

KDFU/NP0, +/-5% SP: 5MM

KDFU/NP0, +/-5% SP: 5MM

KDFU/NP0, +/-5% SP: 5MM

KDFU/NP0, +/-5% SP: 5MM

SF: 5MM

+/- 10% SP: 5MM

C O M M O D O R E PCB ASSY VIDEO MODULATOR

DATE: 01-21-87/M.DITTMANN F/N: 3 8 0 7 4 8 REV. 2 SHEET 2/5

DASH NO.	Q2	Q1	ITEM	PART NUMBER	DESCRIPTION	REF DES	NOTES
NISC-PAL	1	1	38	900 100 - 30	CAP ELECTR. RAD 22 uF/25 V	C 16	
	2	2	39	900 100 - 27	CAP ELECTR. RAD 47 uF/25 V	C 27, 32	
			40				
	1	1	41	901 600 - 14	RESISTOR CARBON .50W 5% 10 OHM	R 22	
	7	7	42	901 550 - 45	RESISTOR CARBON .25W 5% 75 OHM	R 23, 25, 27, 35-38	
	3	3	43	901 550 - 89	RESISTOR CARBON .25W 5% 150 OHM	R 5, 6, 7	
	-	1	44	901 550 - 52	RESISTOR CARBON .25W 5% 220 OHM	R 14	
	2	2	45	901 550 - 52	RESISTOR CARBON .25W 5% 220 OHM	R 24, 28	
	1	-	46	901 550 - 77	RESISTOR CARBON .25W 5% 430 OHM	R 14	
	-	1	47	901 550 - 58	RESISTOR CARBON .25W 5% 470 OHM	R 18	
	1	1	48	901 550 - 113	RESISTOR CARBON .25W 5% 910 OHM	R 8	
	1	1	49	901 550 - 31	RESISTOR CARBON .25W 5% 680 OHM	R 26	
	1	1	50	901 550 - 57	RESISTOR CARBON .25W 5% 390 OHM	R 34	
	1	1	51	901 550 - 20	RESISTOR CARBON .25W 5% 10K	R 30	
	-	1	52	901 550 - 01	RESISTOR CARBON .25W 5% 1K	R 21	
	3	3	53	901 550 - 01	RESISTOR CARBON .25W 5% 1K	R 10, 12, 15	
	3	3	54	901 550 - 02	RESISTOR CARBON .25W 5% 3K3	R 9, 13, 31	
	-	2	55	901 550 - 19	RESISTOR CARBON .25W 5% 4K7	R 16, 17	
	-	1	56	901 550 - 04	RESISTOR CARBON .25W 5% 6K8	R 20	
	-	1	57	901 550 - 55	RESISTOR CARBON .25W 5% 18K	R 19	
	1	1	58	901 550 - 61	RESISTOR CARBON .25W 5% 220K	R 11	
	1	1	59	901 550 - 12	RESISTOR CARBON .25W 5% 22K	R 29	
	1	1	60	901 550 - *	RESISTOR CARBON .25W 5% 27K	R 33	
	1	1	61	901 550 - 27	RESISTOR CARBON .25W 5% 1K8	R 32	
	1	-	62	901 751 - 60	RESISTOR METAL .25W 1% 1.69K	R 2	
	2	-	63	901 751 - 56	RESISTOR METAL .25W 1% 3.92K	R 1, 3	
	-	1	64	901 751 - 61	RESISTOR METAL .25W 1% 56.2K	R 4	
			65				
			66				
			67				
	2	2	68	900 850 - 01	DIODE 1N 4148	D1, 2	OR EQUIVALENT
	-	2	69	903 781 - 01	WIRE JUMPER	JA 2, 4	
	2	-	70	903 781 - 01	WIRE JUMPER	JA 1, 3	
			71				
	1	1	72	325 573 - 01	DIN CONNECTOR 8 PIN	J 2	
	2	2	73	252 122 - 01	RCA PHONE JACK 3 PIN	J 3, 4	
			74				

DASH NO.	Q2	Q1	ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
	NTSC		75				
			76				
	2	2	77	906 800 - Ø3	SCREW PAN HEAD M 3 X 8		
	2	2	78	905 652 - Ø4	LOCKWASHER EXT.100TH. Ø 3.2 MM		
	2	2	79	905 960 - Ø3	NUT HEX M 3		
			80				
			81				
	2	2	82		RIVET DOME		
	1	1	83	380 739 - Ø2	PANEL FOR EXPANSION SLOTS		SUB FOR ITEM 77,78,79

RAM Expansion Board

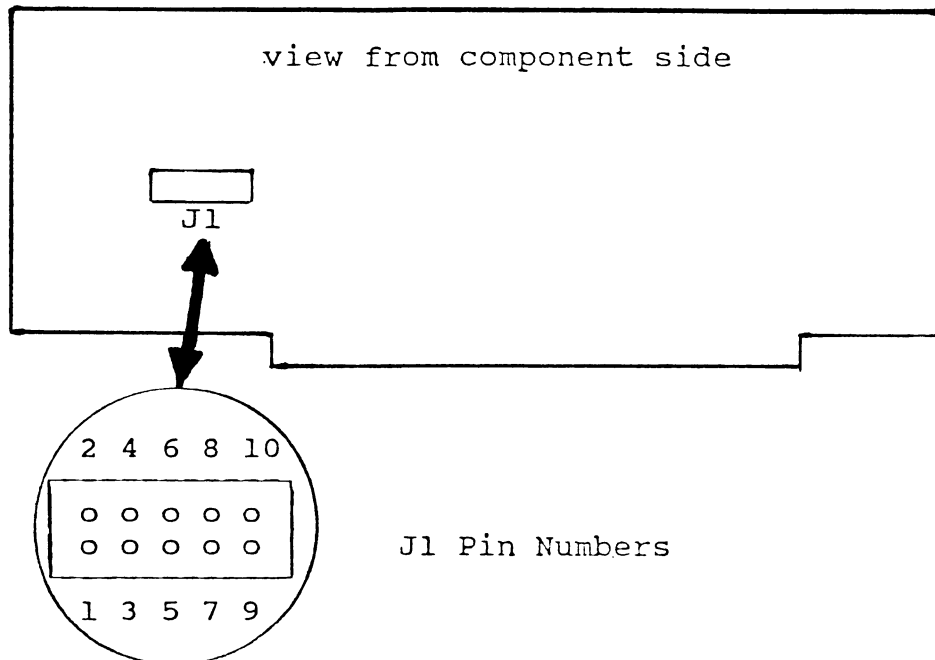
5

Jumper Positions for KICKSTART/SYSTEM RAM EXPANSION PCB

=====

Jumper J1 Location on PCB:

=====



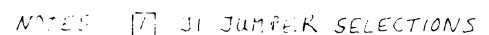
Jumper Positions:

=====

Operation Mode	Jumper Positions
0.5 MB SYSTEM RAM EXPANSION	<p>1 3 5 7 9</p>
1 MB SYSTEM RAM EXPANSION (U27-U42 stuffed)	<p>1 3 5 7 9</p>
KICKSTART RAM	<p>1 3 5 7 9</p>
KICKSTART RAM + 0.5 MB SYSTEM RAM EXPANSION (U27-U42 stuffed)	<p>1 3 5 7 9</p>

DASH NO	Q2	Q1 ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
		01				
		REF02	380 760 - 01	SCHEMATIC		
		REF03	380 747 - 01	PCB ARTWORK		
	1	1 04	380 745 - 01	FABRICATION		
		05				
		06				
	1	1 07	380 763 - 01	IC, PAL RAM DECODER, KICKSTART	U 3	PROD. OF PAL 16L8; P/N: 380219-01
	1	1 08	380 764 - 01	IC, PAL RAM CONTROL I	U 1	PROD OF PAL 16L8; P/N: 380219-01
		1 09	380 765 - 01	IC, PAL RAM CONTROL II	U 6	PROD OF PAL 16R4; P/N: 380772-01
		10				
		11				
	16	16 12	380 265-01	IC, DRAM 256K X 1 150 NS	U11-26	CAS REF. RAS REFRESH
		13				
		14				
	1	1 15	901 521 - 45	IC, 74 LS 393	U 4	
	2	2 16	380 227 - 06	IC, 74 HCT 245	U 5,8	
	1	1 17	380 227 - 03	IC, 74 HCT 244	U 2	
		18				
		19				
	2	2 20	380 227 - 04	IC, 74 HCT 158	U 9, 10	
		21				
		22				
	35	35 23	900 022 - 01	CAP CER RAD. 0.22 UF/50V	C3,8,9,12-43	
		24				
	6	6 25	900 020 - 01	CAP CER RAD. 0.1 UF/50V	C4-7,10,11	SP.: 5 MM
		26				
	2	2 27	900 101 - 09	CAP ELECTROL. 47UF /16V AXIAL	C1 -2	SP.: 5 MM +/- 10%
		28				
	4	4 29	902 422 - 07	RESISTOR PACK 4 X 68 OHM	RN1-RN4	SINGLE LINE ; 8 PIN SP.: 2.54 MM
	2	2 30	901 550 - 18	RESISTOR CARBON 2 K 2 .25 W, 5%	R 1,2	
	3	3 31	380 333 - 01	JUMPER 2.54 MM		
	1	1 32	903 345 - 05	HEADER ASSY, DUAL ROW, .100CTR.	J 1	10 PIN, SP.: 2.54 MM
		33				
	1	- 34	380 790 - 01	CONNECTOR DUAL ROW 90PIN FEM.		180°, 2.54 X 2.54
	16	16 35	904 150 - 02	IC SOCKET 16 PIN	U27-42	
	3	3 36	904 150 - 08	IC SOCKET 20 PIN	U1,3,6	
		37				

SEE SHEET 1



MAPLE	CLOSED JUMPERS
RAM - EXP. 512 KB	3-4, 5-6, 7-8 (SHAWN POSITION)
" 1 MB	3-4, 9-10 (U27-U42 STUFFED)
BACKSART RAM	1-2, 5-6, 7-8
" " + 0.5 MB	1-2, 9-10 (U27-U42 STUFFED)

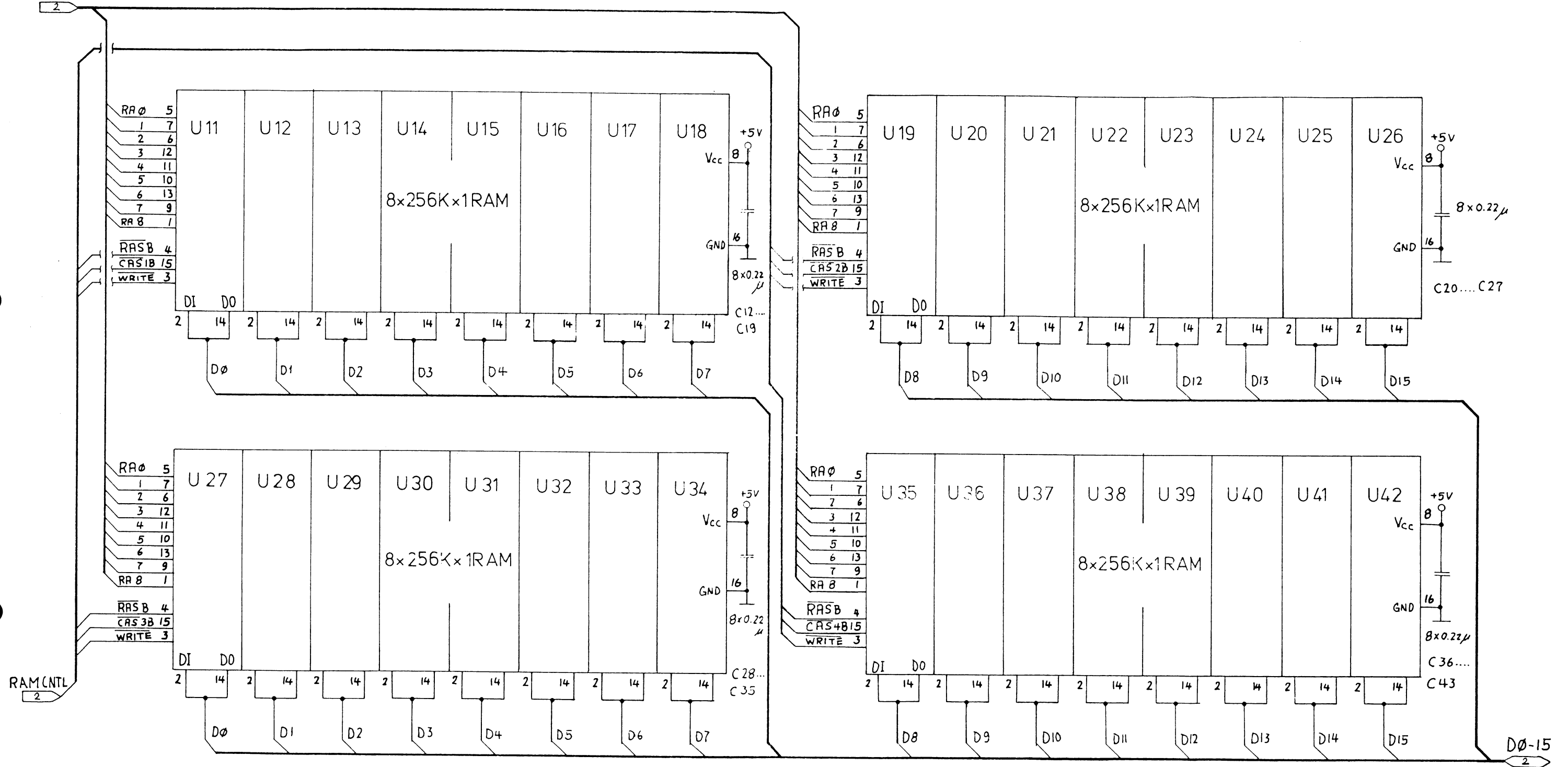
3 Dσ-15

5-3

UNLESS OTHERWISE SPECIFIED				DRAWN BY <i>[Signature]</i>		DATE 19/08/86		commodore	
TOLERANCES ON DECIMALS				CHKD <i>[Signature]</i>				KICKSTART/SYSTEM RAM-EXPANSION	
X XX XXX L'S				ENGR: <i>[Signature]</i>		08/25/86			
± ± ± ±				APPR					
MATERIAL				USED ON		NEXT ASSY		SIZE	
FINISH				A2000				C 380760	
								REV 4	
								SCALE NONE SHEET 2 OF 4	

REVISIONS				DATE	APPROVED
LTR	ZONE	DESCRIPTION			
		SEE SHEET 1			

RA0-8



5-4

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY Tavakoli		DATE 08/19/88	
X .XX XXX L'S		CHKD: 1/1		ENGR: 08/25/88	
MATERIAL		USED ON		NEXT ASSY	
FINISH		A0000			
<div> <div>commodore</div> <div>KICKSTART/SYSTEM RAM-EXPANSION</div> </div>					
SIZE C		380760		REV	
SCALE NONE		SHEET 3 OF 4			

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		

BA1 - 23

86 POL.

BA 1	29
BA 2	27
BA 3	26
BA 4	24
BA 5	21
BA 6	23
BA 7	28
BA 8	30
BA 9	32
BA 10	34
BA 11	36
BA 12	38
BA 13	39
BA 14	41
BA 15	43
BA 16	45
BA 17	47
BA 18	52
BA 19	54
BA 20	56
BA 21	58
BA 22	57
BA 23	59

75	BD 0
77	BD 1
79	BD 2
81	BD 3
83	BD 4
86	BD 5
84	BD 6
82	BD 7
80	BD 8
78	BD 9
76	BD 10
71	BD 11
69	BD 12
67	BD 13
65	BD 14
63	BD 15

90 POL.
(DUAL ROW)

BD 0	75
BD 1	77
BD 2	79
BD 3	81
BD 4	83
BD 5	86
BD 6	84
BD 7	82
BD 8	80
BD 9	78
BD 10	76
BD 11	71
BD 12	69
BD 13	67
BD 14	65
BD 15	63

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

A 1	29	BA 1
2	27	BA 2
3	26	BA 3
4	24	BA 4
5	21	BA 5
6	23	BA 6
7	28	BA 7
8	30	BA 8
9	32	BA 9
10	34	BA 10
11	36	BA 11
12	38	BA 12
13	39	BA 13
14	41	BA 14
15	43	BA 15
16	45	BA 16
17	47	BA 17
18	52	BA 18
19	54	BA 19
20	56	BA 20
21	58	BA 21
22	57	BA 22
23	59	BA 23

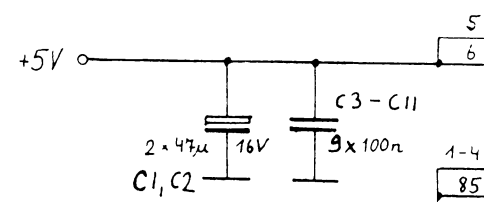
J3

BA 5	74
BD 5	72
BL 5	70
READ	68
CDAC	15
CTB	16
CSB	14
RESB	53
OV	17
DTACK	66

AS
UDS
LDS
R/W
CDAC
CT
CS
RESET
OV
DTACK

+5V

J2



74	BA 5
72	BD 5
70	BL 5
68	READ
15	CDAC
16	CTB
14	CSB
53	RESB
17	OV
66	DTACK

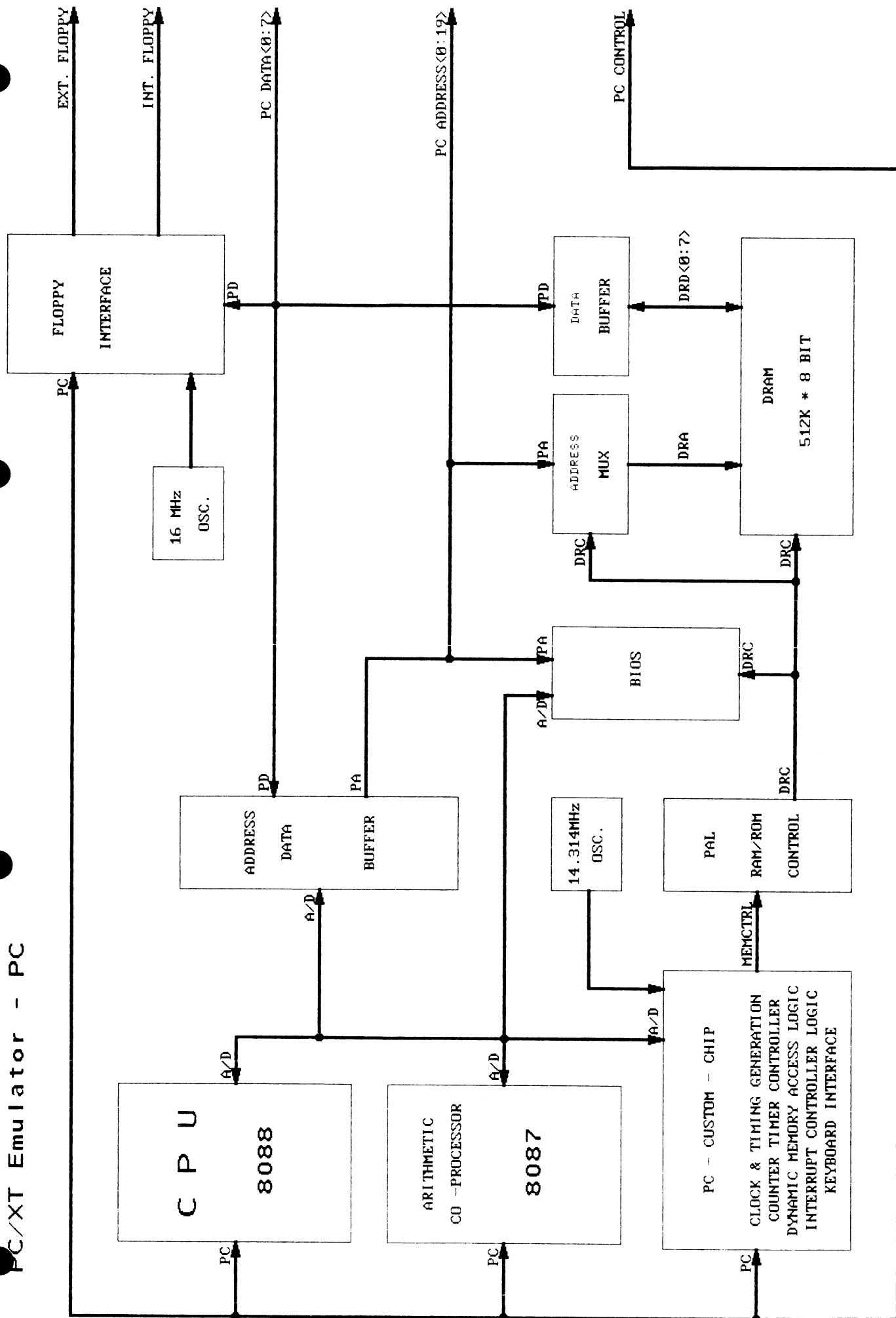
CNTRL

5-5

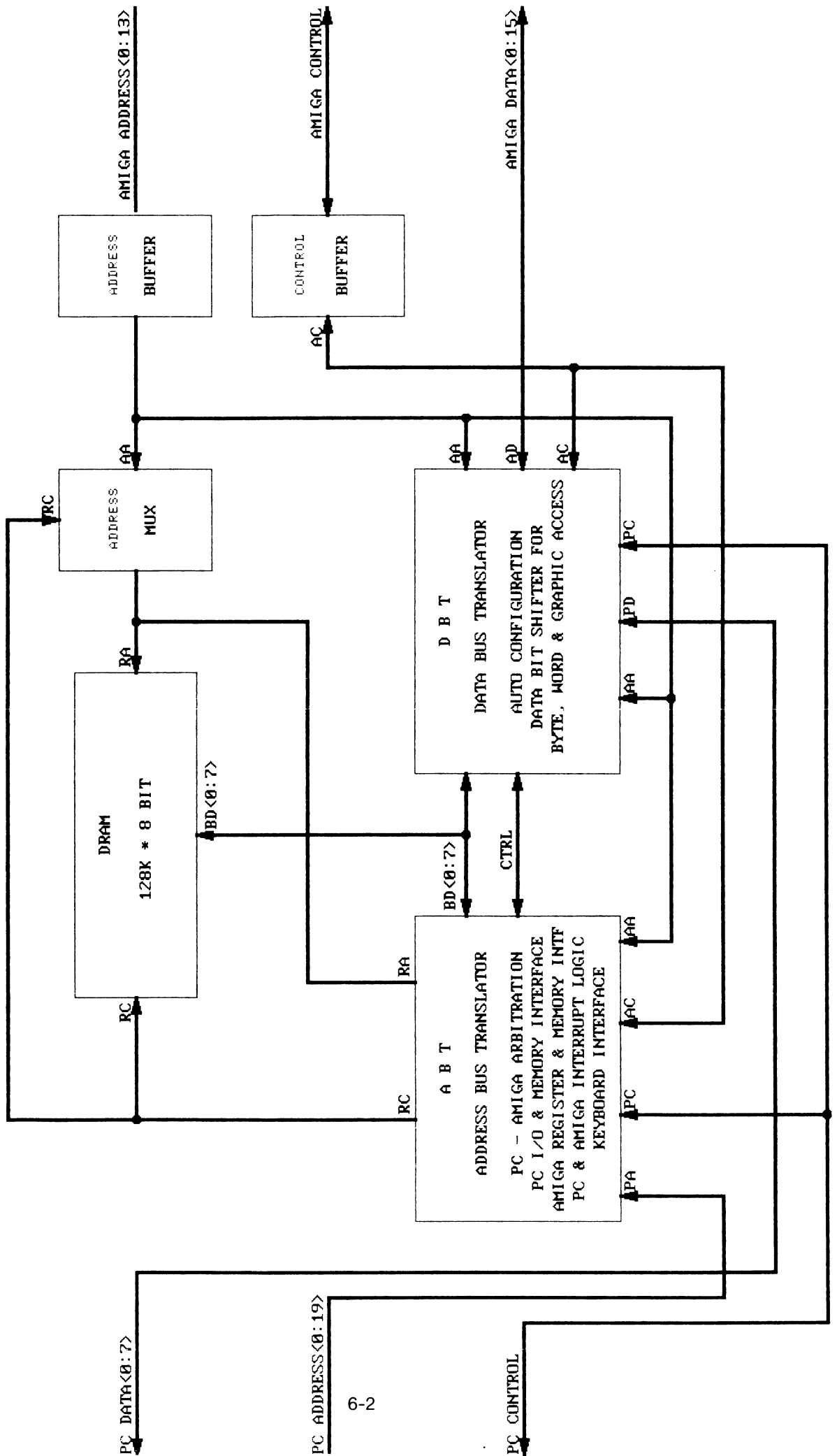
UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY: <i>Walter</i>		DATE: <i>19/08/86</i>		commodore	
X XX XXX L'S		CHKD: <i>Walter</i>		ENGR: <i>Walter</i>			
MATERIAL		USED ON		NEXT ASSY		KICKSTART/SYSTEM RAM-EXPANSION	
FINISH		A2000				SIZE C 380 760 REV 4	
						SCALE NONE SHEET 4 OF 4	

**PC
Emulator-Karte**

6



PC/XT Emulator - interface



Video-Modus der PC-Emulator-Karte

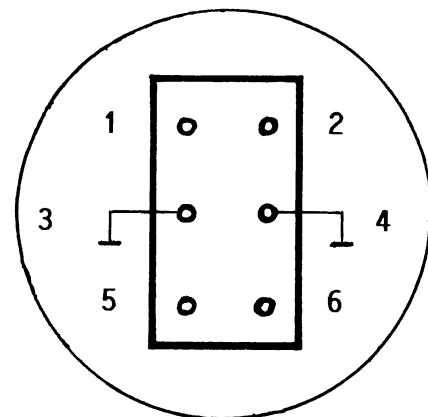
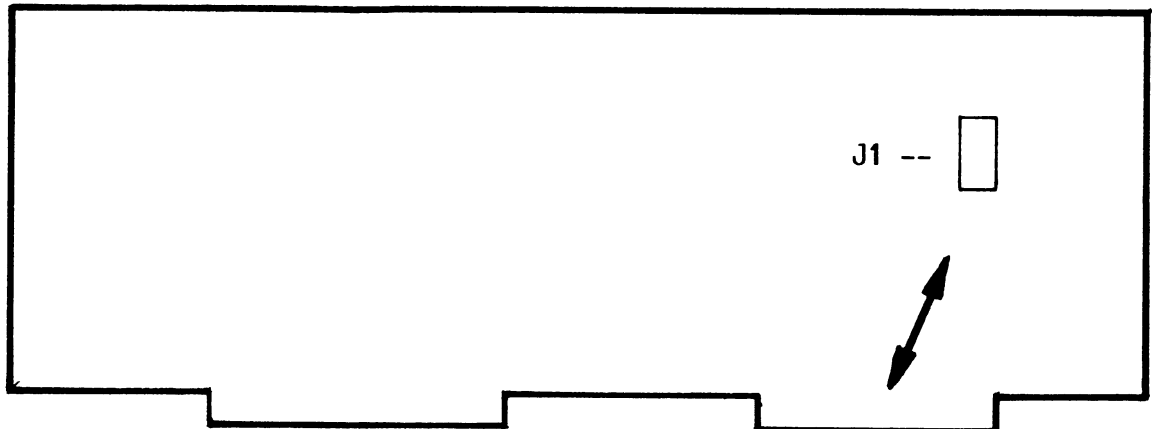
Auf der Workbench-Diskette des A2000 mit PC-Emulator befinden sich in der Schublade PC zwei Icon's mit der Bezeichnung PcMono und PcColor. Mit diesen Icon's wird der PC gestartet.

Der Video-Modus (monochrome oder color) wird vorab mittels Jumper auf der PC-Emulator-Karte festgelegt.

Entnehmen Sie die möglichen Jumper-Einstellungen auf der folgenden Seite.

Video Startup Table für PC-Emulator

Komponenten-Seite:



Startup-Modus	Jumper
Monochrome	
Color 40 * 25	
Color 80 * 25	
None	

DASH NO	Q1	ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
	01					
	REF 02		380 756 - 01	SCHEMATIC		
	REF 03		380 757 - 01	PCB ARTWORK		
	1 04		380 758 - 01	FABRICATION		
	05					
	1 06		380 658 - 01	IC, ADDRESS BUS TRANSL.	U 40	
	1 07		380 659 - 01	IC, DATA BUS TRANSL. 5718	U 41	
	08					
	09					
	10					
	1 11		380 200 - 01	IC, 8088	U 1	
	- 12		380 201 - 01	IC, 8087	U 2	OPTIONAL
	13					
	14					
	1 15		380 783 - 01	IC, PAL RAM DECODER, EMULATOR	U 29	PROD OF 16L8; F/N: 380219-01
	1 16		380 784 - 01	IC, PAL I/O DECODER	U 50	PROD OF 16L8; F/N: 380219-01
	- 17		380 785 - 01	IC, PAL CONFIGURATION	U 39	ONLY USED IF JUMPER JA1 OPEN
	18					
	1 19		380 786 - 01	IC, FE 2010	U 7	VENDOR: FARADAY
	20					
	21					
	8 22		380 223 - 01	IC, DRAM 256K X 1, 150 ns	U12-27	
	4 23		380 256 - 01	IC, DRAM 64K X 4, 150 ns	U 32-35	
	24					
	25					
	1 26		380 787 - 01	IC, FDC 9268	U 42	VENDOR: SMC
	27					
	1 28		380 788 - 01	IC, BIOS FC-EMULATOR	U 28	PROD OF 27128EPROM OR ROM 23128 TAC = 250 NS
	29					
	30					
	31					
	2 32		380 227 - 04	IC, 74 HCT 158	U 10,11	
	2 33		380 227 - 58	IC, 74 HCT 257	U 36,37	
	34					
	2 35		901 522 - 06	IC, 7406	U 43,44	
	36					
	37					

DASH NO.

Q1 ITEM

PART-NUMBER

DESCRIPTION

REF DES

NOTES

38					
1 39	901 521 - 03	IC, 74 LS 08	U 45		
1 40	901 521 - 30	IC, 74 LS 14	U 46		
1 41	901 521 - 20	IC, 74 LS 125	U 47		
1 42	901 521 - 15	IC, 74 LS 133	U 38		
1 43	901 521 - 28	IC, 74 LS 164	U 48		
1 44	901 521 - 34	IC, 74 LS 175	U 49		
2 45	901 521 - 13	IC, 74 LS 244	U 8,9		
3 46	901 521 - 46	IC, 74 LS 245	U 3,30,51		
3 47	901 521 - 29	IC, 74 LS 373	U 4-6		
48					
49					
50					
1 51	324 667 - 01	DIGITAL DELAY LINE	U 31		
52					
53					
1 54	325 566 - 10	OSCILLATOR 16 MHZ, HYBRID	OSC 1	+/- 5% +/- 50 FPM	
55				VENDOR: KINSEKI	
1 56	900 558 - 01	QUARZ 14.31818 MHZ	QU 1	HC-18U	
57					
1 58	251 070 - 18	CAP CER RADIAL 47 PF	C 52	+/- 5% SP:5 MM	
10 59	251 070 - 22	CAP CER RADIAL 100 PF	C 55,61,62	63-69 +/- 5% SP:5 MM	
2 60	251 071 - 30	CAP CER RADIAL 470 PF/50V	C 71,72	+/-10% SP:5 MM	
61					
62					
63					
20 64	900 020 - 01	CAP CER RADIAL 0.1 UF	C 3-6,8-11	30,36-38,43-49,51	
65				+/- 20%, SP:5 MM	
66					
32 67	900 022 - 01	CAP CER RADIAL 0.22 UF/50V	C 1,2,7	12-29,31-35,39-42,50	
68			CS3,54,60,70	+/- 10%, SP:5 MM	
69					
70					
71					
4 72	900 100 - 27	CAP ELECTR. AXIAL 47UF/25V	C 56-59		
73					
74					

C O M M O D O R E

PCB ASSY PC/XT EMULATOR

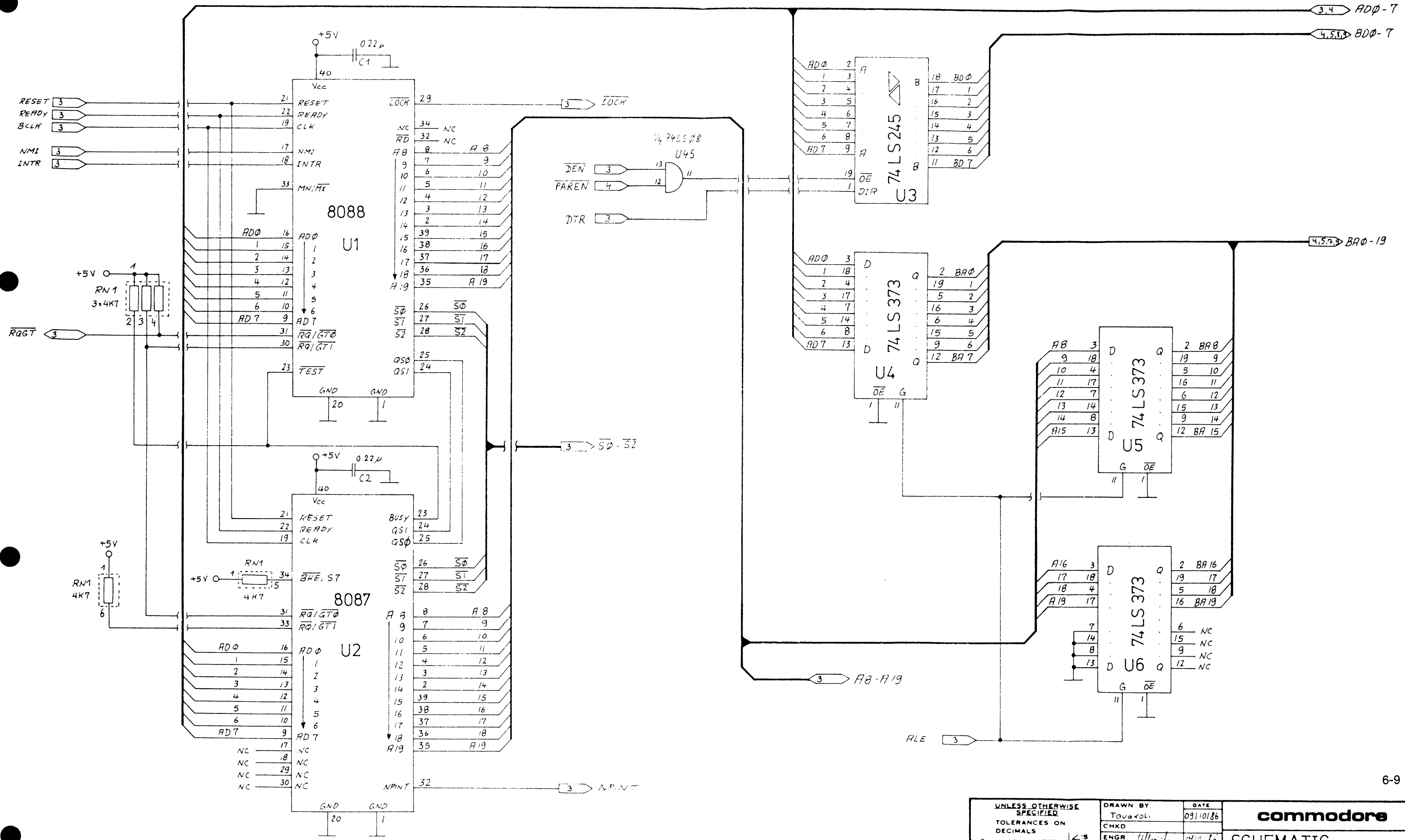
DATE: 01-21-87/M.DITTMANN F/N: 3 8 0 7 5 5

REV. 6 SHEET 3/6

DASH NO.	Q1	ITEM	PART-NUMBER	DESCRIPTION	REF DES	NOTES
	1	75	324 219 - 01	TRANSISTOR BC-327 B	T 1	
		76				
		77				
	1	78	902 417 - 03	RES PACK 4 X 1K	RN 9	SINGLE LINE 5 PIN, SP: 2.54 MM
	1	79	902 410 - 08	RES PACK 9 X 4K7	RN 10	SINGLE LINE 10 PIN, SP: 2.54 MM
		80				
		81				
	3	82	902 412 - 05	RES PACK 8 X 4K7	RN 1,2,11	SINGLE LINE 9 PIN, SP: 2.54 MM
		83				
		84				
	6	85	902 422 - 07	RES PACK 4 X 68 OHM	RN 3-8	SINGLE LINE 8 PIN, SP: 2.54 MM
		86				
		87				
	2	88	901 550 - 105	RESISTOR CARBON 33 OHM .25W 5%	R 7,8	
	2	89	901 550 - 49	RESISTOR CARBON 100 OHM .25W 5%	R 3,5	
		90				
	3	91	901 550 - 01	RESISTOR CARBON 1 K .25W 5%	R 1,10,11	
	1	92	901 550 - 18	RESISTOR CARBON 2K2 .25W 5%	R 6	
	2	93	901 550 - 19	RESISTOR CARBON 4K7 .25W 5%	R 2,9	
		94				
	1	95	901 550 - 84	RESISTOR CARBON 1M .25W 5%	R 4	
		96				
		97				
		98				
	2	99	380 333 - 01	JUMPER RM: 2.54 MM	JA 1,2	
	2	100	903 781 - 01	WIRE JUMPER		
		101				
		102				
	1	103	903 345 - 03	HEADER ASSY DUAL ROW .100CTR.	J 1	6 PIN
		104				
	1	105	903 345 - 17	HEADER ASSY DUAL ROW .100CTR.	J 3	34 PIN REMOVE PIN 3 AT ASSEMBLY
	1	106	327 033 - 01	CONNECTOR 23 PIN SUB MINI "D" FEMALE	J 4	
	S	105	310 975 - 01	CONNECTOR 23 PIN SUB MINI "D" FEMALE	J 4	SUB FOR ITEM 106
	1	108	903 326 - 02	HEADER ASSY SINGLE ROW .100 CTR.	J 2	2 PIN
	1	109	903 326 - 08	HEADER ASSY SINGLE ROW .100 CTR.	J 7	8 PIN, REM. PIN 6 AT ASSEMBLY
		110				
	1	111	904 150 - 05	IC SOCKET 28 PIN	U 28	

DASH NO.	Q1	ITEM	PART NUMBER	DESCRIPTION	REF DES	NOTES
	8	112	904 150 - 02	IC SOCKET 16 PIN	U 20-27	
	2	113	904 150 - 08	IC SOCKET 20 PIN	U 29,50	
	3	114	904 150 - 06	IC SOCKET 40 PIN	U 1,2,42	
	3	115	380 789 - 01	IC SOCKET 84 PIN	U 7,40,41	FLCC
	-	116	904 150 - 08	IC SOCKET 20 PIN	U 39	ONLY USED IF JA1 OPEN
	2	117	906 800 - 03	SCREW, PAN HEAD M 3 X 8		
	2	118	905 652 - 04	LOCKWASHER EXT. TOOTH. Ø 3.2 MM		
	2	119	905 960 - 03	NUT HEX M 3		
		120				
	2	121		RIVET DOME		SUB. FOR ITEM 117-119
		122				
	1	123	380 120 - 08	EXTENSION CARD PANEL		
		124				
		125				

REVISIONS			
LTR	ZONE	DESCRIPTION	DATE
SEE SHEET 1			
DATE		APPROVED	



6-9

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY TAVAKOLI		DATE 09/10/86	
X XX XXX		CHKD		ENGR	
Z Z Z		APPR		NEXT ASSY	
MATERIAL		USED ON A2000		SCALE NONE	
FINISH				SHEET 2 OF 9	

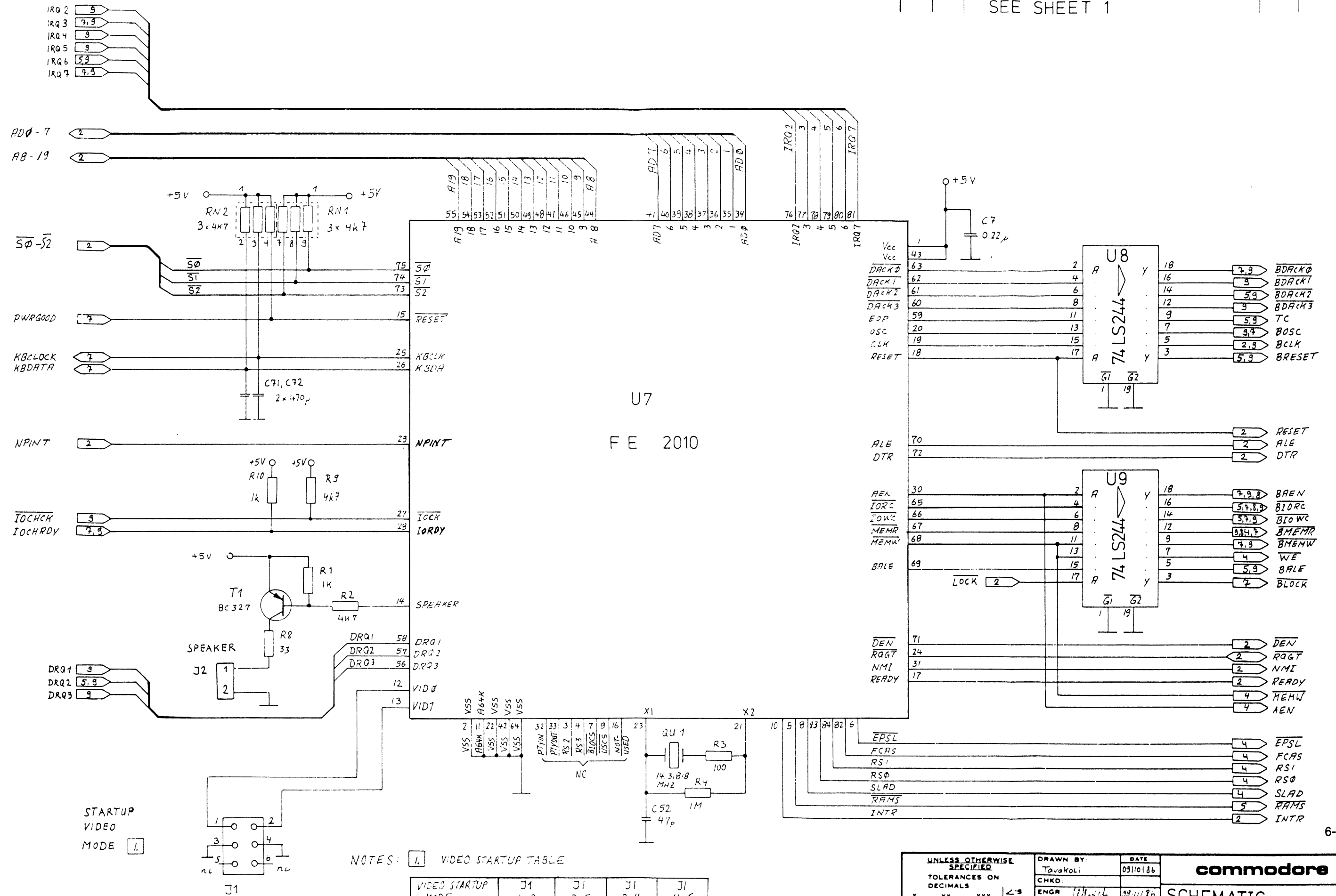
commodore

SCHEMATIC
PC-EMULATOR, A2000

SIZE
C 380 756

REV
5

REVISIONS				DATE	APPROVED
LTR	ZONE	DESCRIPTION			
		SEE SHEET 1			

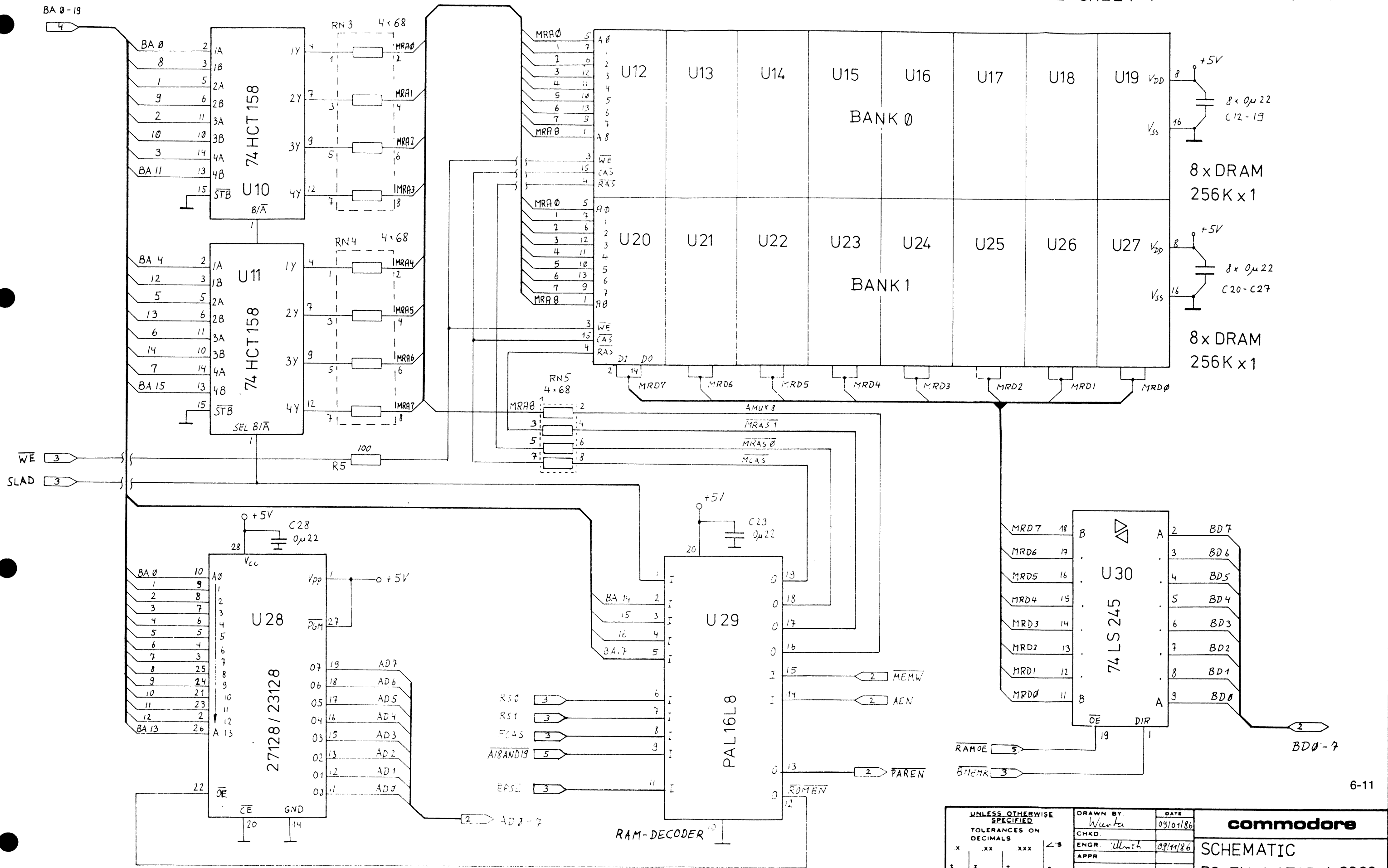


6-10

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS .X .XX .XXX <.5		DRAWN BY TavaKoli	DATE 09/10/86
MATERIAL		CHKD ENGR APPR	
FINISH		USED ON A2000	NEXT ASSY

commodore	
SCHEMATIC PC-EMULATOR, A2000	
SIZE C	380 756
SCALE NONE	SHEET 3 OF 9

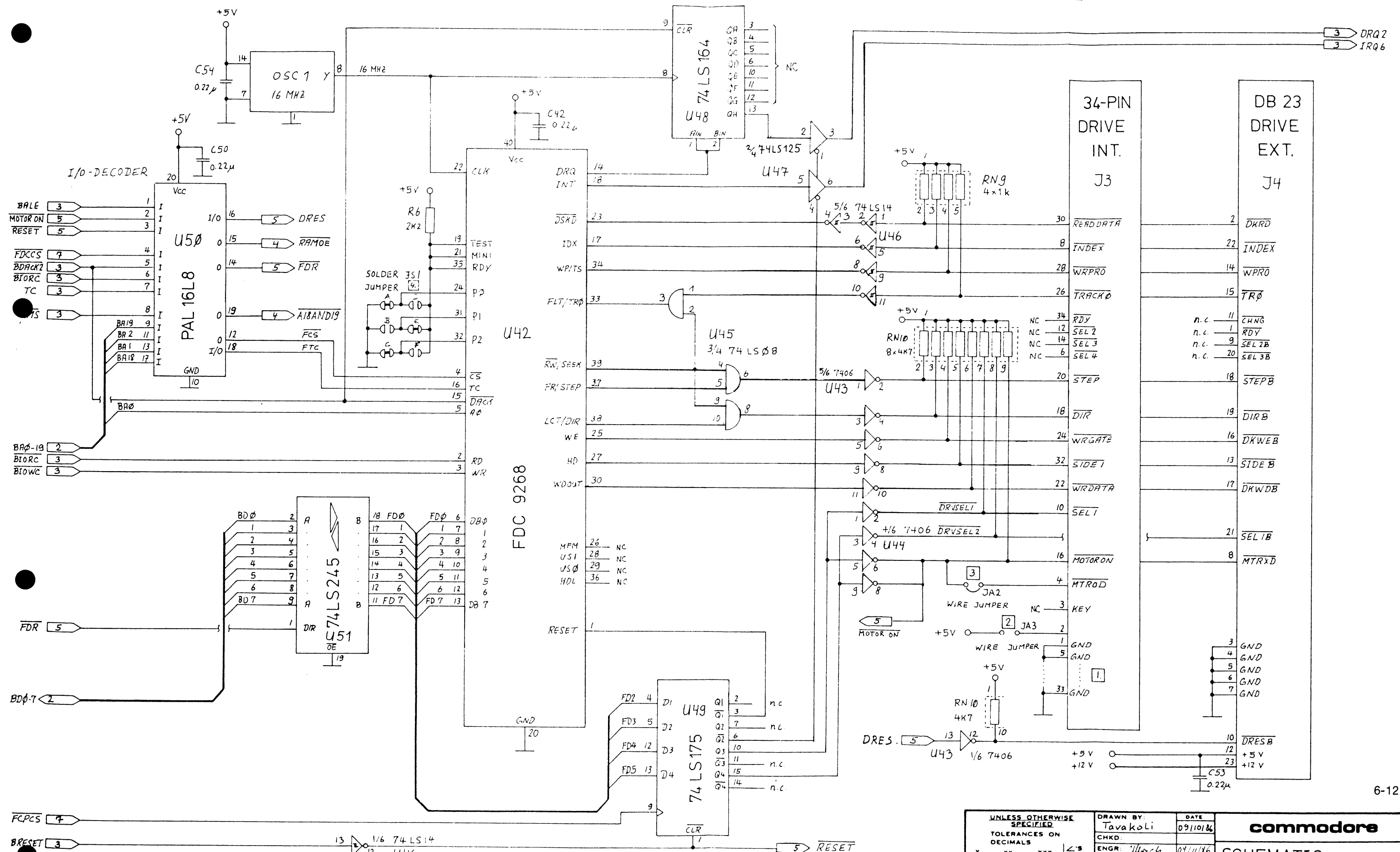
REVISIONS				DATE	APPROVED
LTR	ZONE	DESCRIPTION			
		SEE SHEET 1			



6-11

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY Walter	DATE 09/01/86	commodore
X .XX .XXX <'S		CHKD		
MATERIAL		ENGR Ulrich	09/11/86	
FINISH		APPR		
		USED ON A2000	NEXT ASSY	SCHEMATIC PC-EMULATOR, A2000
				SIZE C 380 756
				SCALE NONE SHEET 4 OF 9

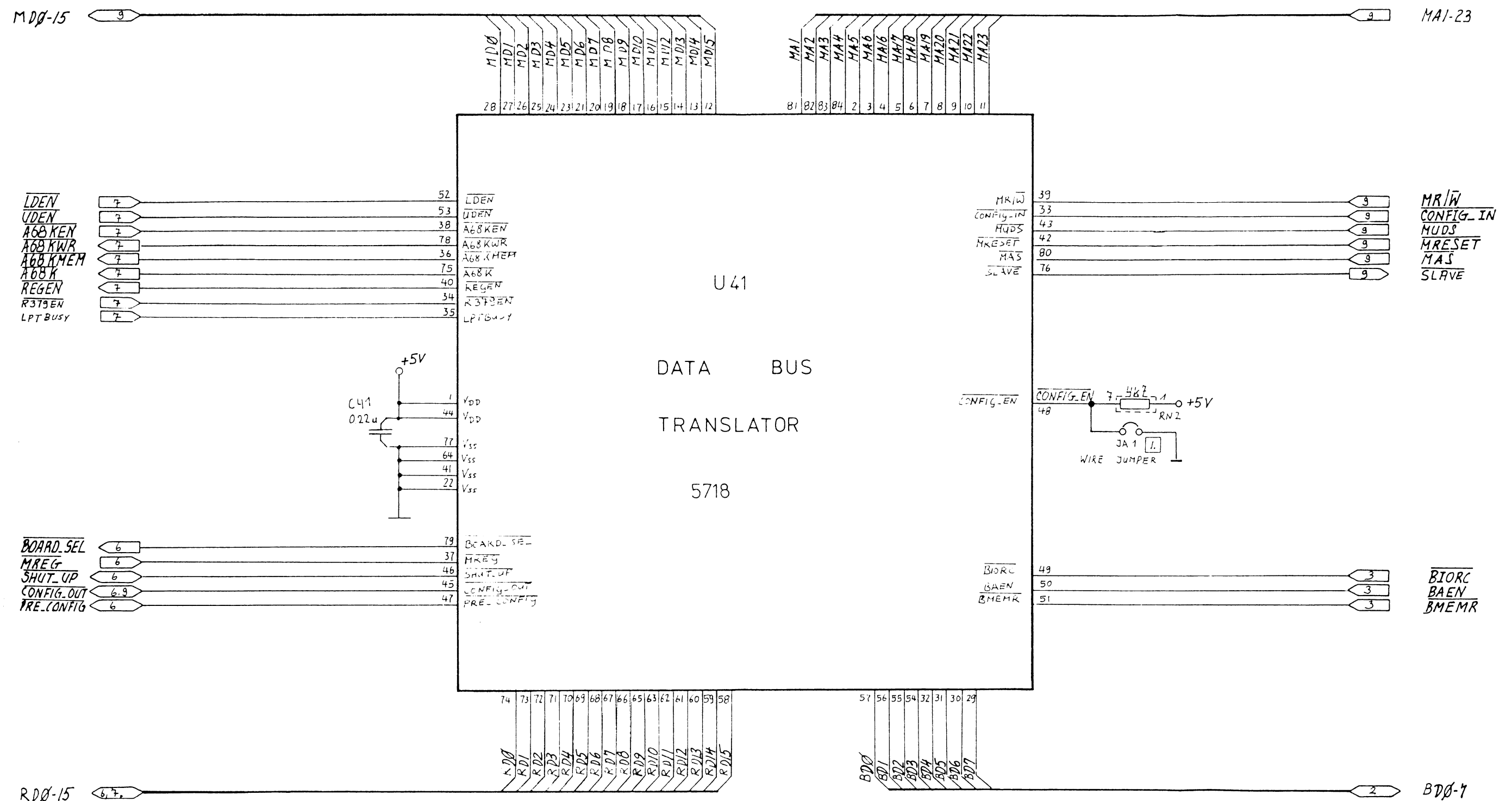
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
SEE SHEET 1				



NOTES: [1] ALL ODD PINS OF J3 CONNECTED TO GND [2] WIRE JUMPER NORMALLY OPEN [3] WIRE JUMPER NORMALLY CLOSED [4] FDC WRITE PRECOMP SELECTION DEFAULT IS 250ns

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY: TAVAKOLI	DATE: 09/10/86	commodore	
X .XX XXX <S		CHKD:		SCHEMATIC	
MATERIAL		ENGR: M. J. 09/11/86		PC-EMULATOR, A2000	
FINISH		APPR:		SIZE C 380 756 REV 5	
		USED ON: A2000	NEXT ASSY:	SCALE NONE SHEET 5 OF 9	

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		



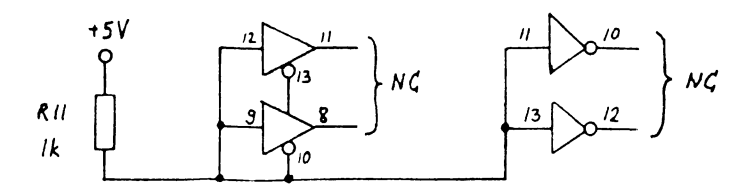
NOTES: [4] WIRE JUMPER NORMALLY CLOSED.
IF CLOSED, CONFIG PAL INTERNALLY OF
U41 IS USED. U39 MUST NOT BE INSERTED
IN THIS CASE.

UNLESS OTHERWISE SPECIFIED		DRAWN BY: <u>Warta</u>		DATE: <u>09/10/86</u>											
TOLERANCES ON DECIMALS		CHKD: <u>Warta</u>													
X .XX XXX		ENGR: <u>Warta</u>		DATE: <u>09/11/86</u>											
MATERIAL		APPR:													
FINISH		USED ON: <u>A2000</u>		NEXT ASSY:											
<table border="1"> <tr> <td colspan="2">commodore</td> </tr> <tr> <td colspan="2">SCHEMATIC</td> </tr> <tr> <td colspan="2">PC-EMULATOR, A2000</td> </tr> <tr> <td>SIZE C</td> <td>380 756</td> </tr> <tr> <td>SCALE NONE</td> <td>SHEET 8 OF 9</td> </tr> </table>						commodore		SCHEMATIC		PC-EMULATOR, A2000		SIZE C	380 756	SCALE NONE	SHEET 8 OF 9
commodore															
SCHEMATIC															
PC-EMULATOR, A2000															
SIZE C	380 756														
SCALE NONE	SHEET 8 OF 9														

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		

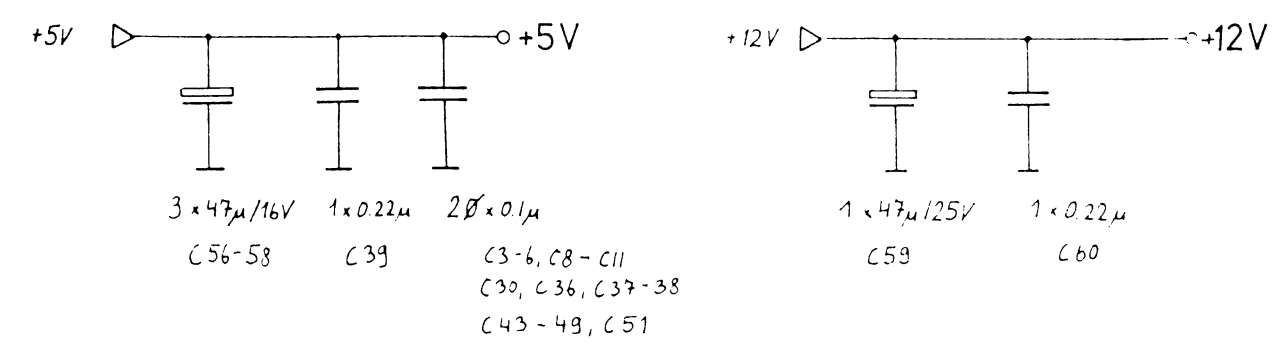
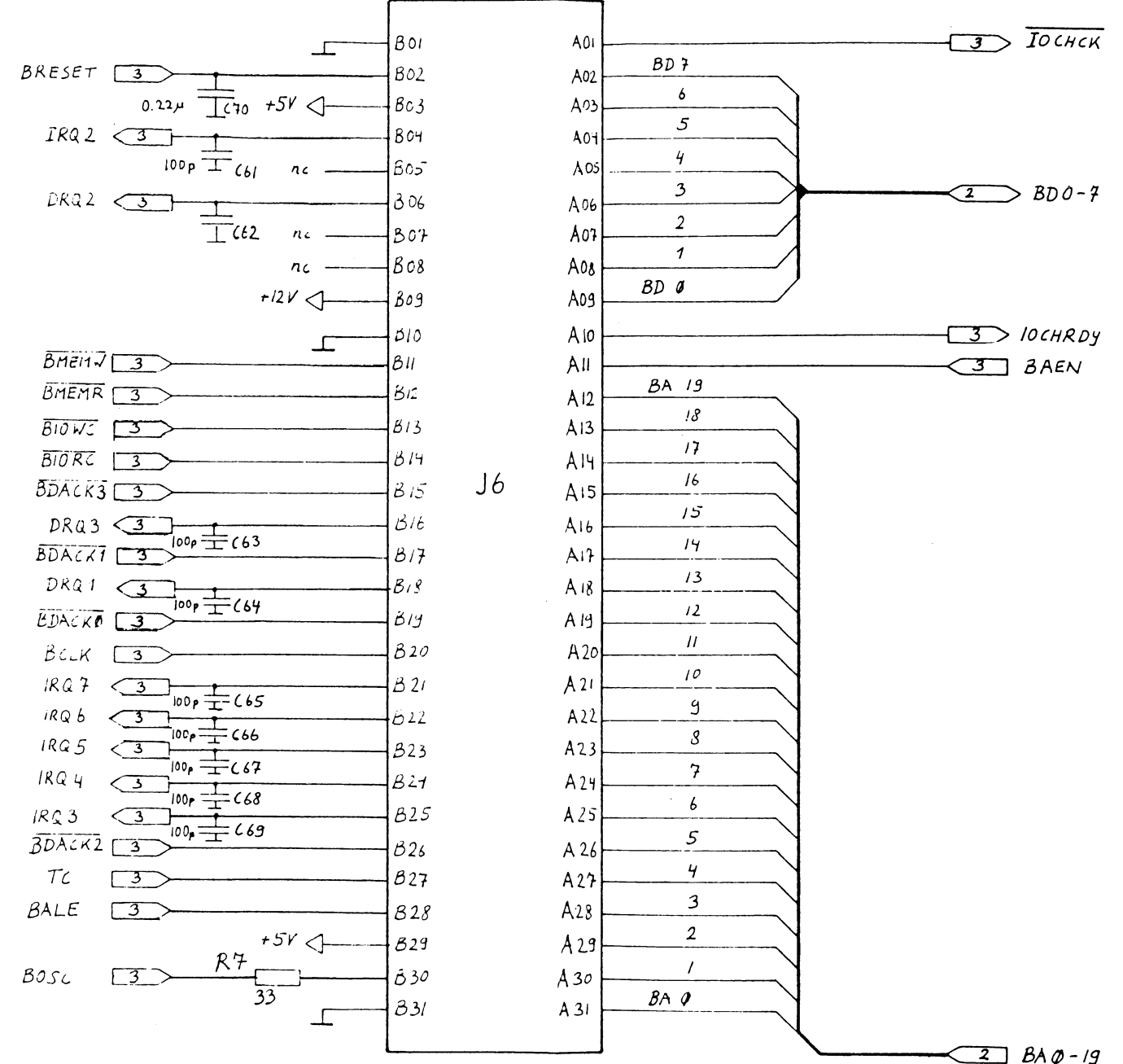
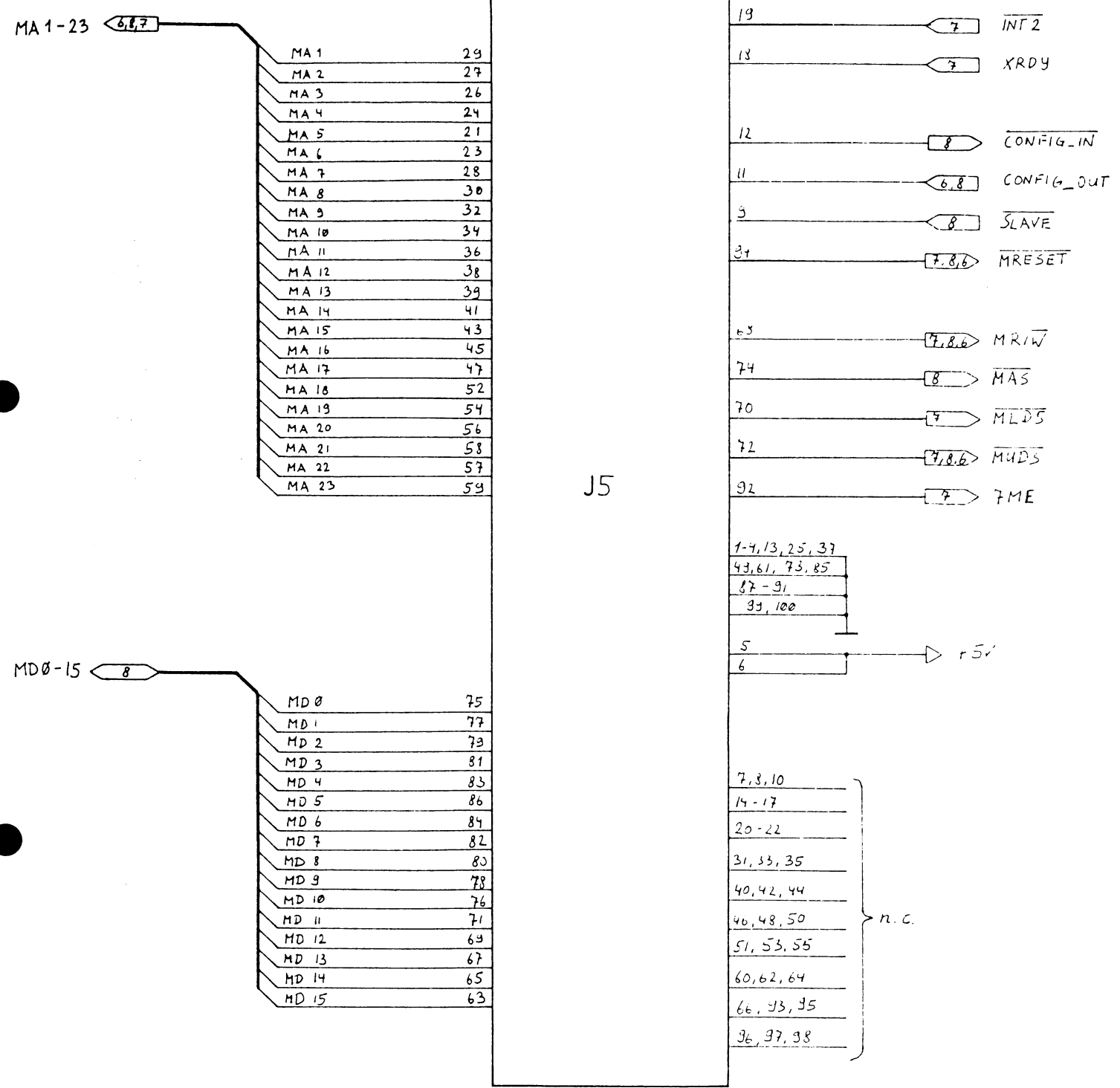
SPARE:

U47 2/4 74LS125 U44 2/6 7406



CARD EDGE
2 x 31 pol.

CARD EDGE
100 pol.



UNLESS OTHERWISE SPECIFIED TOLERANCES ON DECIMALS		DRAWN BY: Wanta		DATE: 09/08/86	
.X XX XXX <'S		CHKD:		ENGR: Wanta	
MATERIAL:		APPR:		USED ON: A2000	
FINISH:		NEXT ASSY:		SCALE: NONE	
commodore				SHEET 9 OF 9	
PC-EMULATOR, A 2000				REV 5	

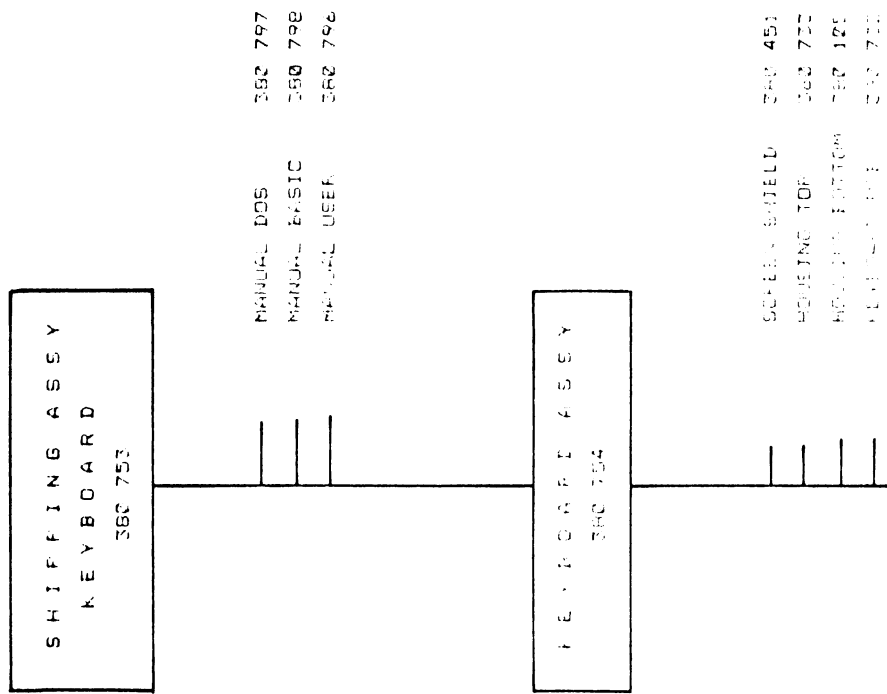
Keyboard

7

DATE	APPROVED
------	----------

DATE	APPROVED
------	----------

SEE SHEET 1



-02 SHOWN

UNLESS OTHERWISE SPECIFIED		DRAWN BY		DATE	
TOLERANCES ON:		M. J. M. Aug 10-09-88			
DECIMALS		CHKD			
.X .XX .XXX		ENGR			
		APPR			
2 2 2 2 2					
MATERIAL		USED ON		NEXT ASSY	
		AMIGA			
FINISH		2000			

PART NO.		DESCRIPTION		REVISIONS		
				DESCRIPTION	DATE	APPROVED
380 754 - 01	KEYBOARD ASSY AMIGA 2000	UK		ENGINEERING RELEASE	09-11-86	<i>[Signature]</i>
- 02		US				
- 03		GERMANY				
- 04		ITALY				
- 05		FRANCE				
- 06		SPAIN				
- 07		SWISS				
- 08		DANMARK				
- 09		NORWAY				
- 10		SWE DEN/FINL.				
380 754 - 11	KEYBOARD ASSY AMIGA 2000	ICELANDIC				

1. SHEET

ASSY DWG

NOTES:

OF

SIZE

TITLE		DRAWN BY		DATE	ENGR	APPR	SIZE	DRAWING NUMBER	SHEET
KEYBOARD ASSY AMIGA 2000		<i>[Signature]</i>		9-11-86	<i>[Signature]</i>		B	380754	1 OF 3

REVISIONS

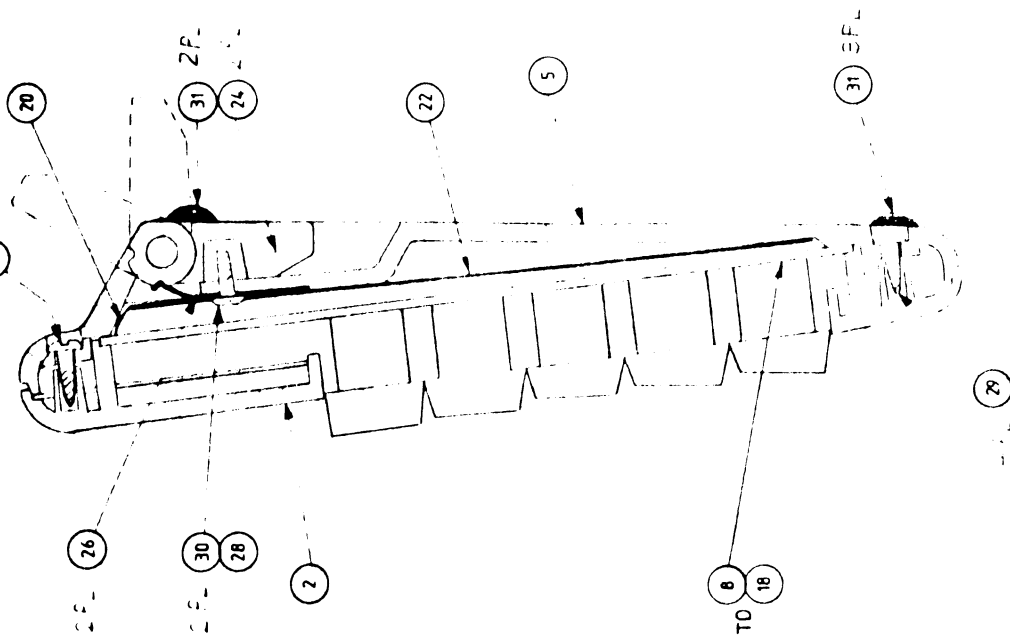
DESCRIPTION

LTR ZONE

DATE

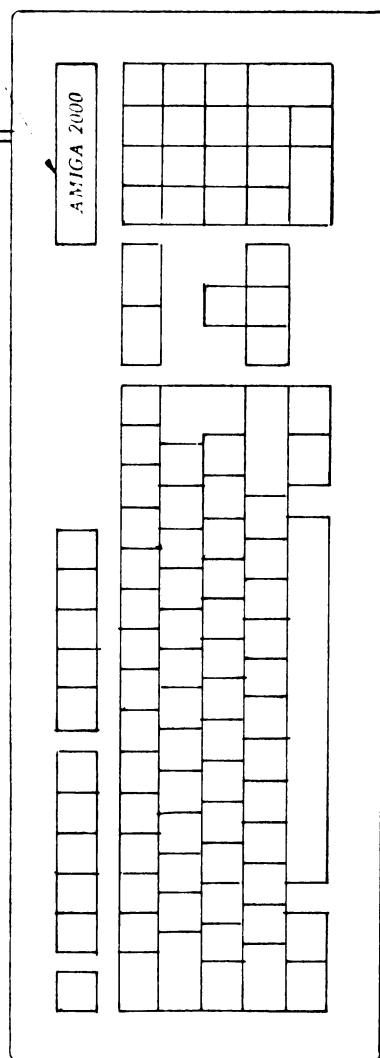
APPROVED

SEE SHEET 1



35

33



29

UNLESS OTHERWISE SPECIFIED		DRAWN BY: <i>GP</i>		DATE: 09-11-86	
TOLERANCES ON DECIMALS		CHKD:		ENGR: <i>GP</i>	
X .XX .XXX .XXX		APPR:		10-10-86	
MATERIAL:		USED ON:		NEXT ASSY:	
FINISH:		PC		AMIGA 2000	
		COMMODORE		KEYBOARD ASSY	
		SIZE: B		REV: 1	
		SCALE: NONE		SHEET: 3 OF 3	

Drive
JU 363-282 3.5"

8

DRIVE PHYSICAL SPECIFICATIONS

GENERAL

The section contains the mechanical dimensions and mounting recommendations for the JU-3X3.

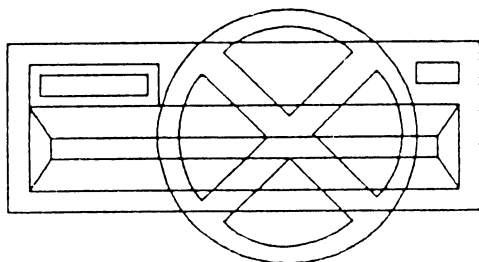
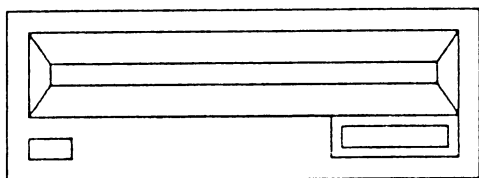
MOUNTING

NOTE

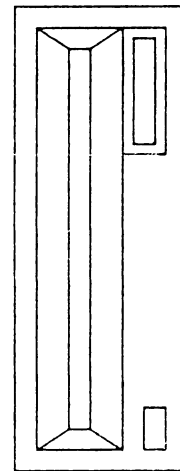
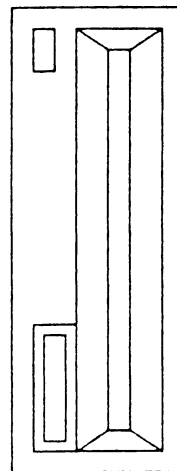
DO NOT MOUNT HORIZONTALLY WITH PCB UP
DO NOT MOUNT VERTICALLY WITH FRONT BEZEL UP/DOWN

The drive is capable of being mounted in either of the following positions

- Front Loading
- mounted vertically with door opening left or right.
 - mounted horizontally with PCB down.



HORIZONTAL



VERTICAL

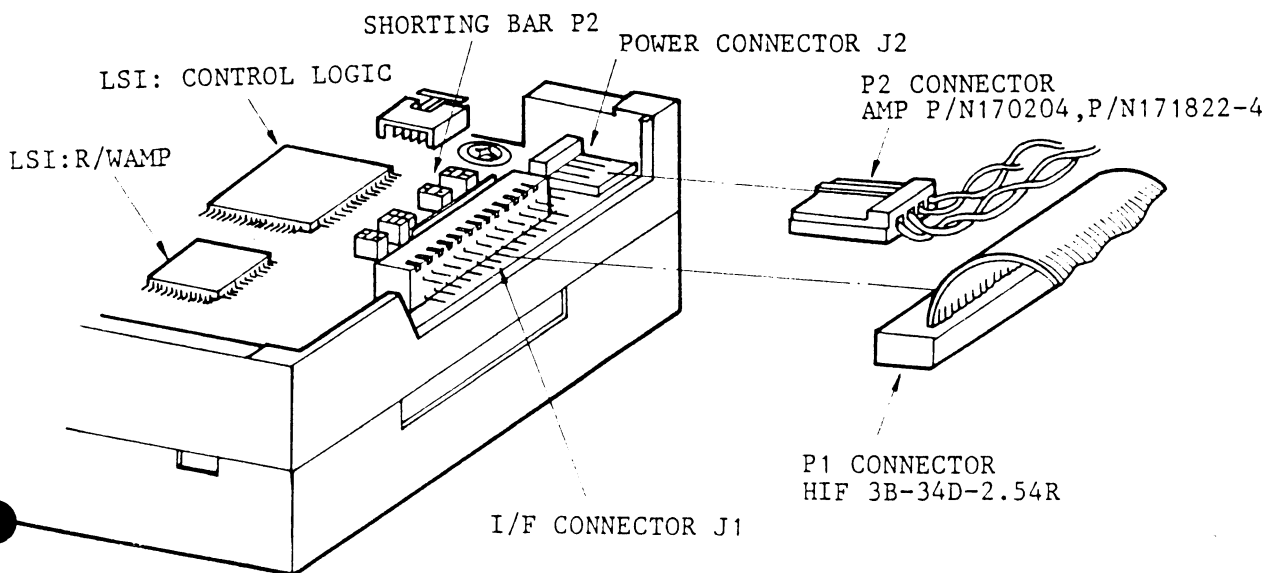
RECOMMENDED MOUNTING POSITIONS

PHYSICAL INTERFACE

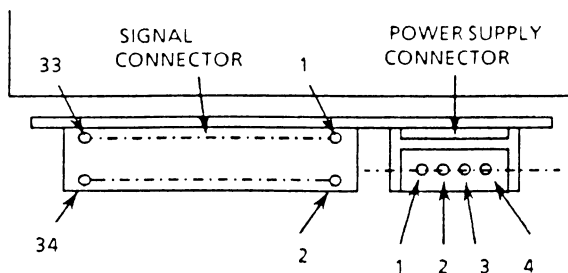
INTRODUCTION

The electrical interface between the JU-3X3 and the host system is via two connectors. The first connector, J1, provides the signal interface and the second connector, J2, provides the dc power.

This section describes the physical connectors used on the drive and the recommended connectors to be used with them.



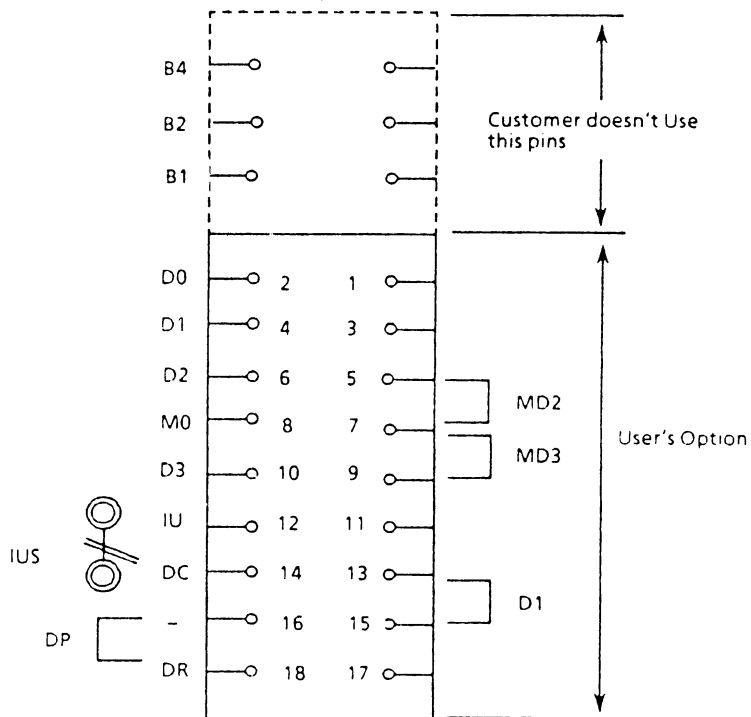
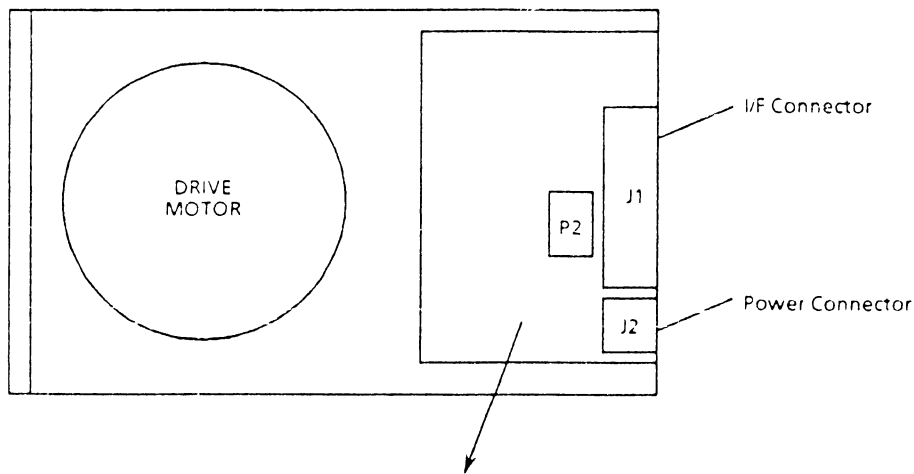
INTERFACE CONNECTORS LOCATIONS



J2 CONNECTOR PIN

1	+ 5 VDC
2	+ 5 RETURN
3	+ 12 RETURN
4	+ 12 VDC

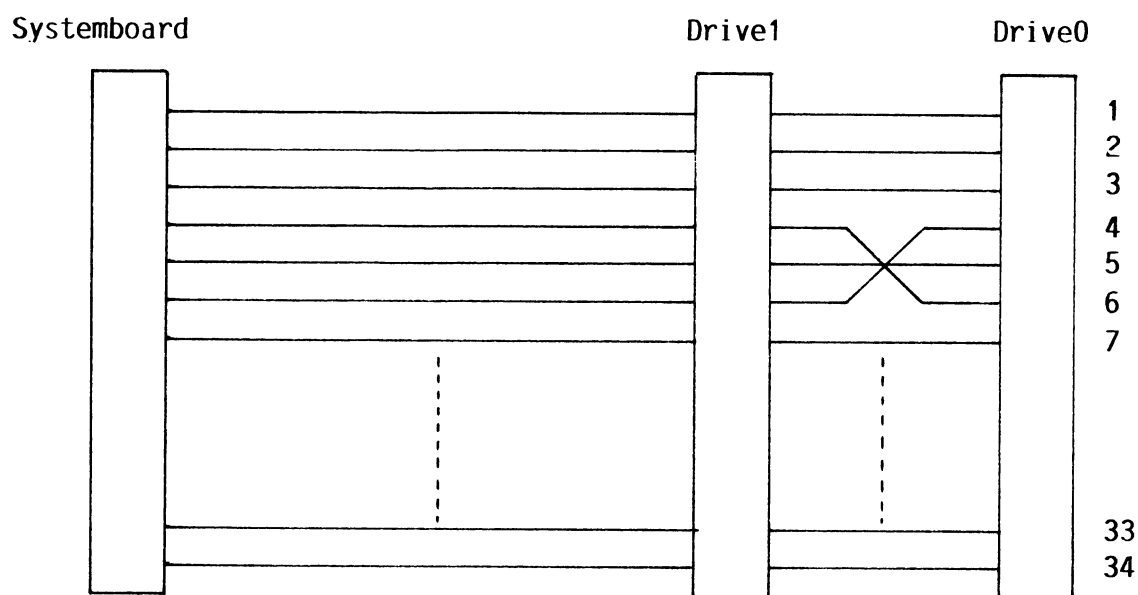
J1/J2 CONNECTOR



SHORTING BAR P2 PIN ASSIGNMENT

Anschlußkabel

Das vorhandene Anschlußkabel für die 3.5" Drives des A2000 sieht wie folgt aus:

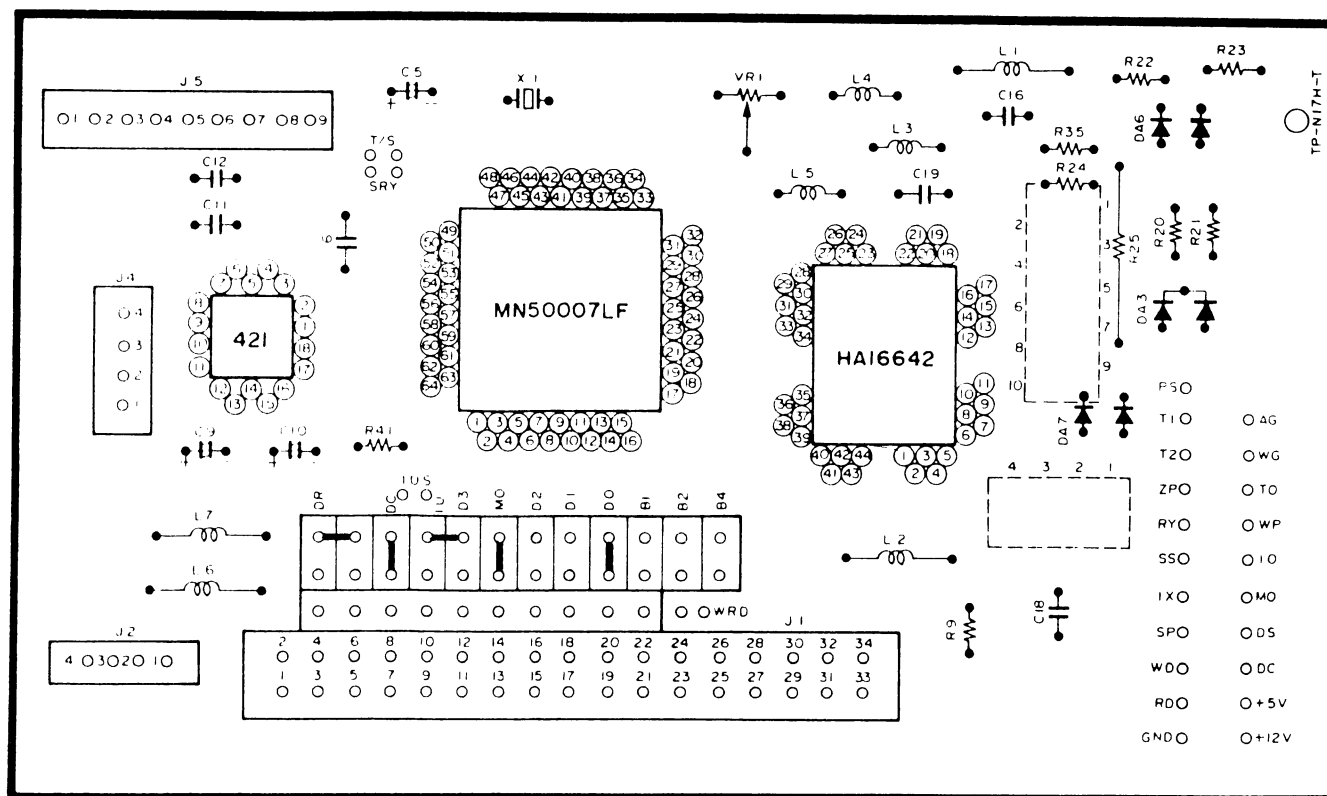


Auf den folgenden Seiten finden Sie die möglichen Jumper-Konfigurationen der 3.5" Drives bei verdrehtem und nicht verdrehtem Anschlußkabel.

Bei Aufrüstung von ein auf zwei 3.5" Drives muß beachtet werden, daß zusätzlich der Jumper J 36 auf der Hauptplatine gesetzt wird.

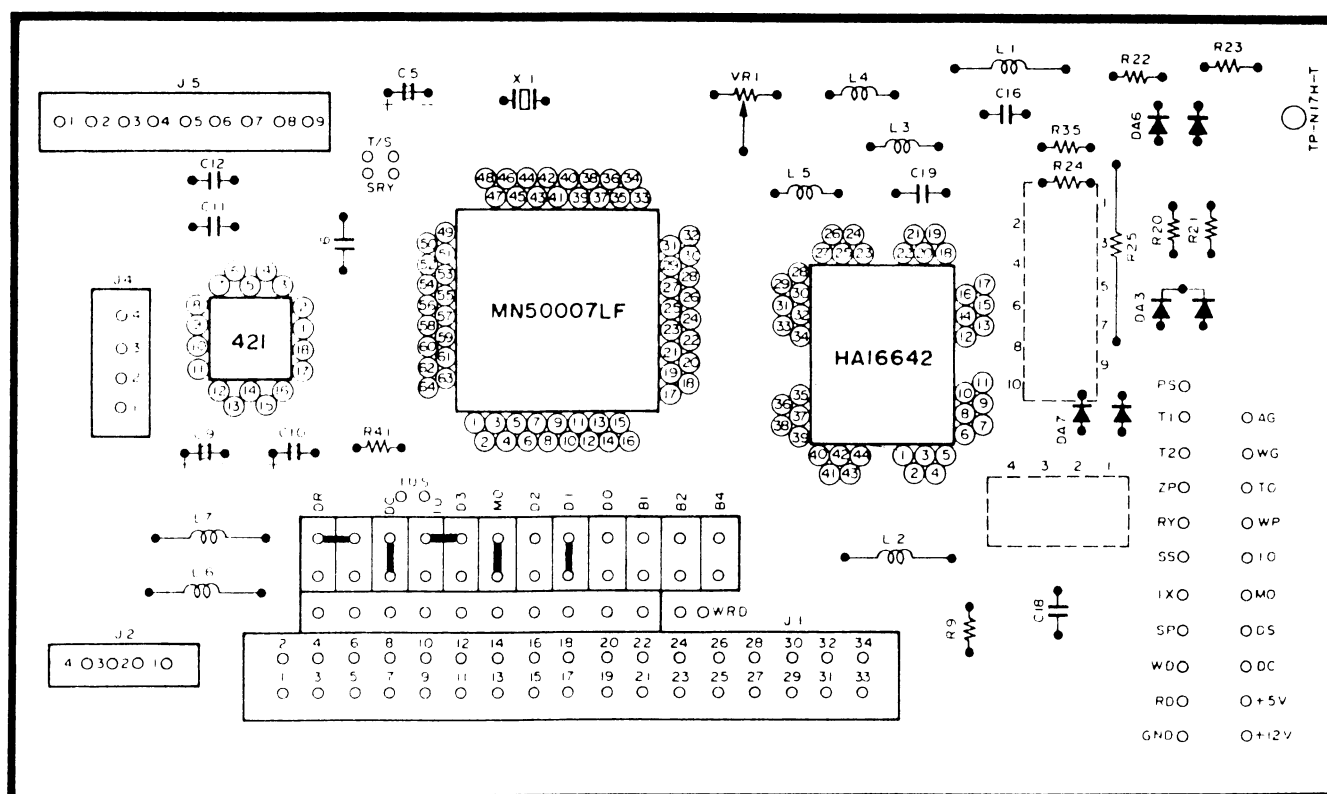
B.) Ohne verdrehtem Kabel Drive 0

Parts side.



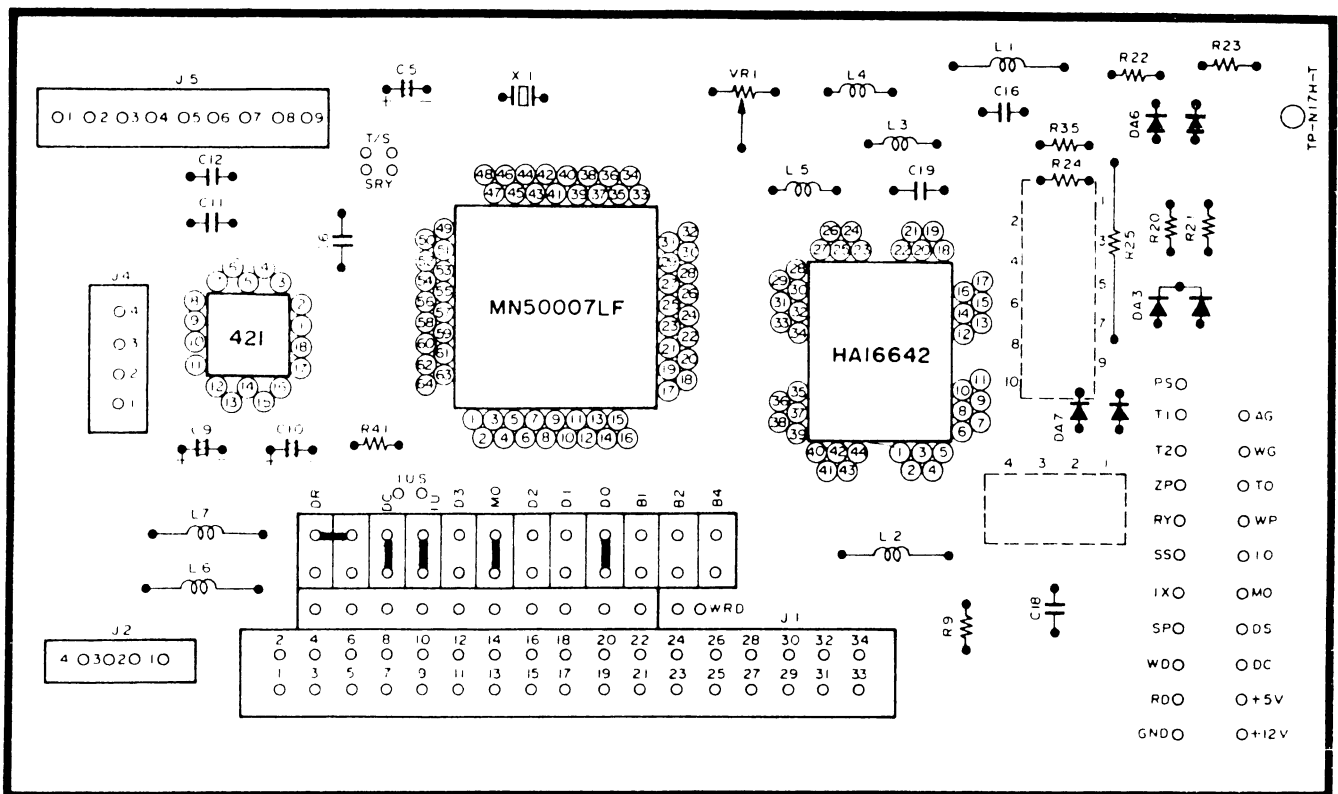
Ohne verdrehtem Kabel Drive 1

Parts side.



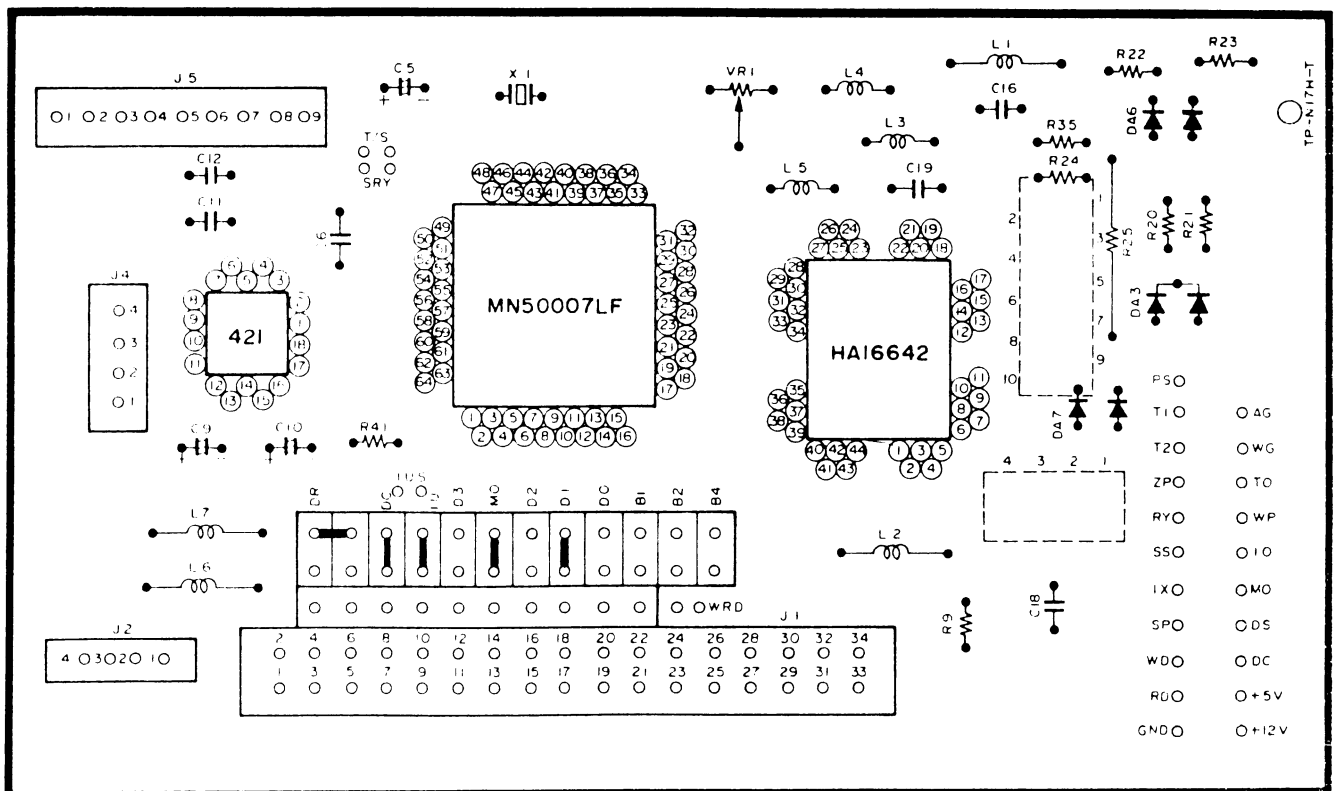
A.) Mit verdrehtem Kabel Drive 0

Parts side.

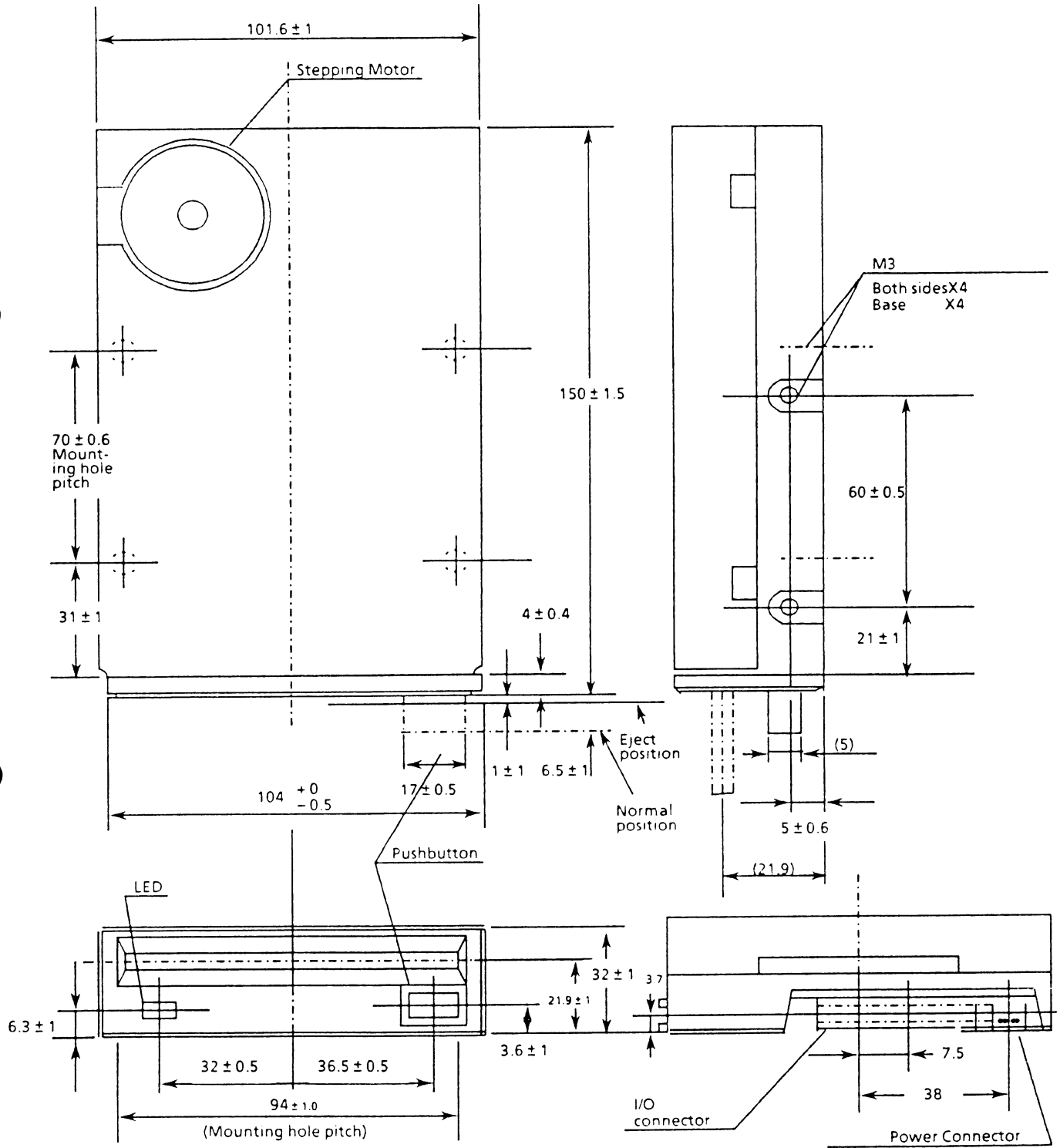


Mit verdrehtem Kabel Drive 1

Parts side.



MECHANICAL DIMENSIONS



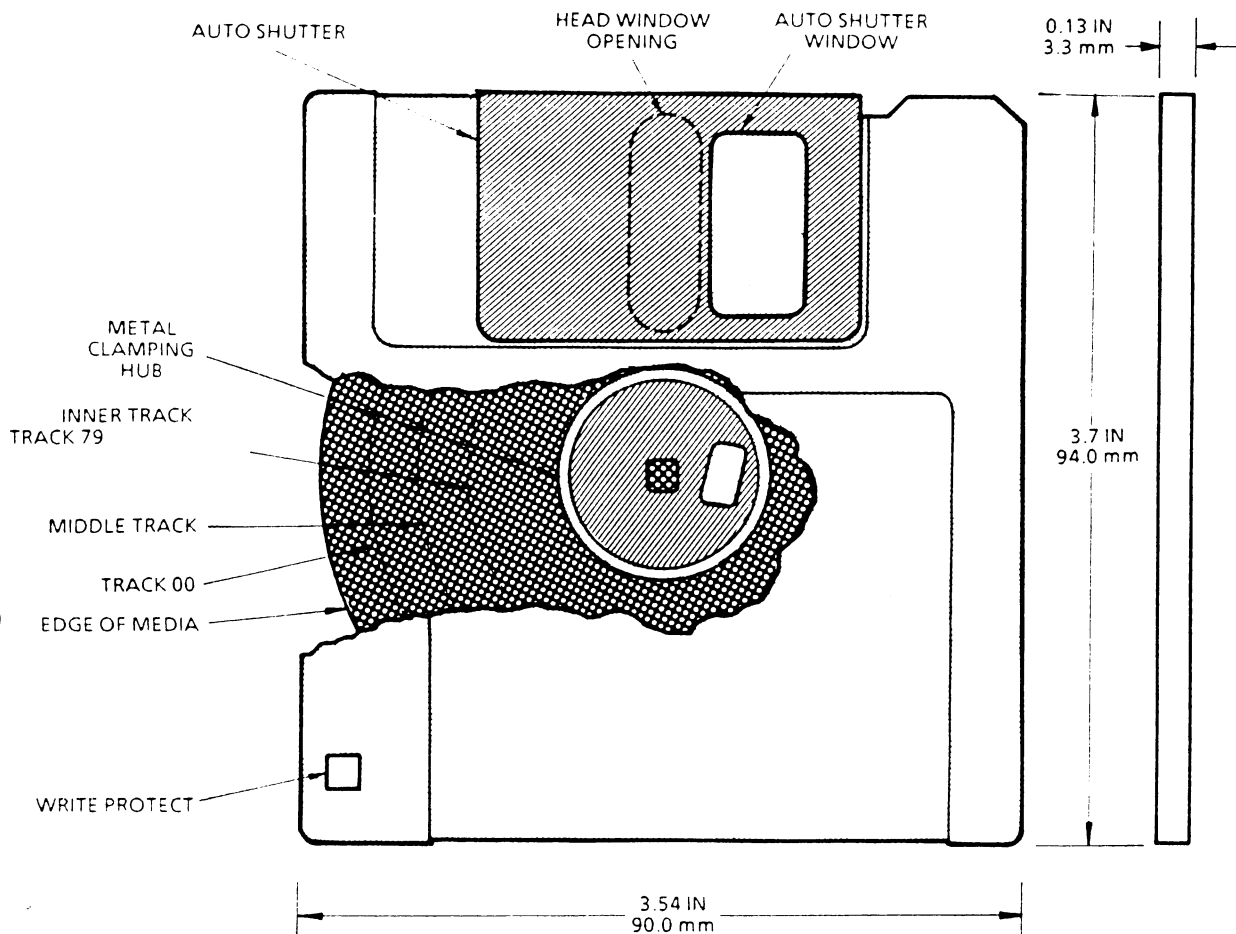
Back View

MECHANICAL DIMENSIONS

MICROCARTRIDGE HANDLING

To protect the cartridge, the same care and handling procedures specified for computer magnetic tape apply. These precautionary procedures are as follows:

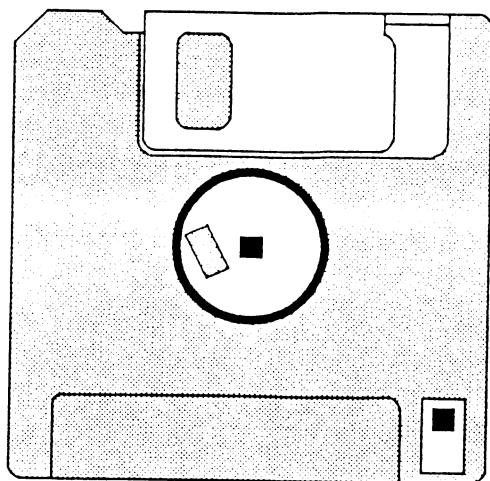
- a. Cartridges not intended for immediate use should be stored in the box.
- b. Keep cartridges away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on disk.
- c. Place ID labels in correct location, never use in reverse.
- d. Do not use erasers.
- f. Heat and contamination from carelessly dropped ash could damage disk.
- e. Do not expose cartridge to heat or sunlight.



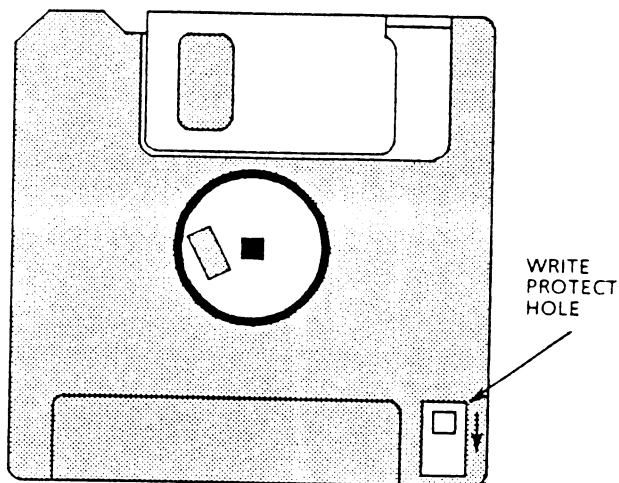
MICROCARTRIDGE NOMENCLATURE

WRITE PROTECT FEATURE

The microcartridge comes with a mechanical write protect tab. To write protect the cartridge, turn the mechanical tab as shown in figure 8-3 to uncover the write protect hole.



WRITE ENABLED
HOLE CLOSED



SLIDE MECHANICAL TAB
AS SHOWN TO OPEN HOLE
WRITE PROTECTED

BOTTOM VIEW

WRITE PROTECT OPERATION

ELECTRICAL INTERFACE

INTRODUCTION

The interface of the JU-3X3 can be divided into two categories.

- a. Signal Lines
- b. Power Lines

The following paragraphs provide the electrical definition for each line. See figure 2-1 for all interface connections.

SIGNAL INTERFACE

The signal interface consists of two categories:

- a. Control Lines
- b. Data Transfer Lines

All lines in the signal interface are digital in nature and provide signals to the drive (input) or to the host (output) via interface connector P1/J1.

Input Lines

The input signals are of three types: those intended to be multiplexed in a multiple drive system, those which will perform the multiplexing, and those signals which are not multiplexed and affect all the drives in a daisy chain system.

The input signals to be multiplexed are:

- a. DIRECTION SELECT
- b. STEP
- c. WRITE DATA
- d. WRITE GATE
- e. SIDE SELECT (JU-363 only)

The input signals which are intended to do the multiplexing are:

- a. DRIVE SELECT 0
- b. DRIVE SELECT 1
- c. DRIVE SELECT 2
- d. DRIVE SELECT 3

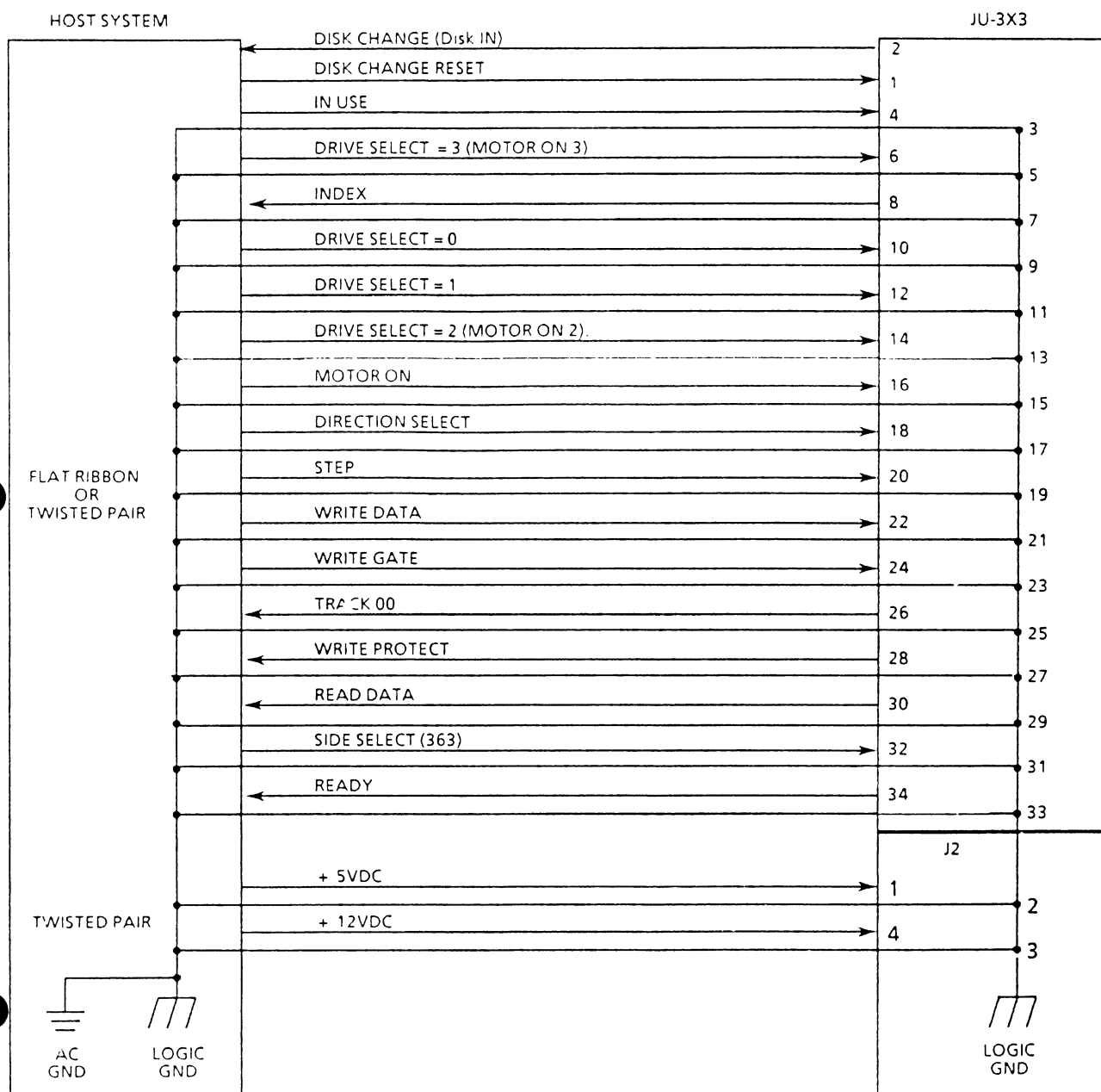
The signals which are not multiplexed are IN USE and MOTOR ON.

The input lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

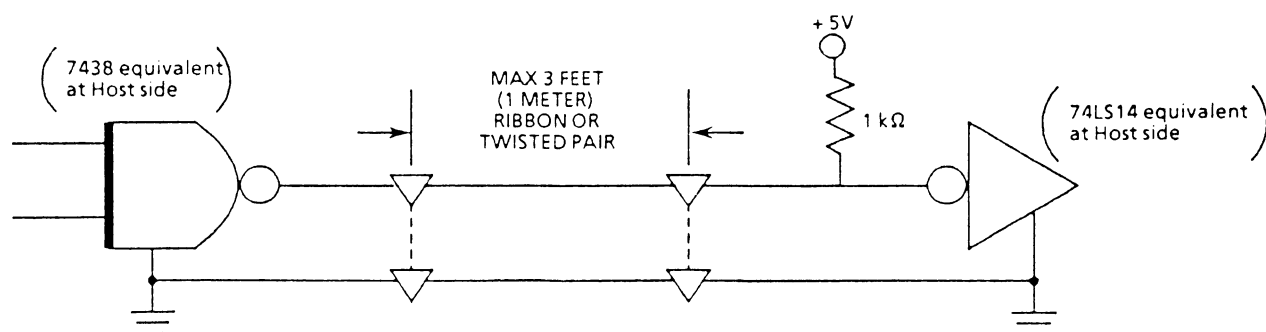
True = Logical zero = $V_{in} + 0.0$ to $+0.8V @ I_{in} = 6 \text{ mA (max.)}$

False = Logical one = $V_{in} + 2.4$ to $+5.25V @ I_{in} = 250 \mu A \text{ (open)}$

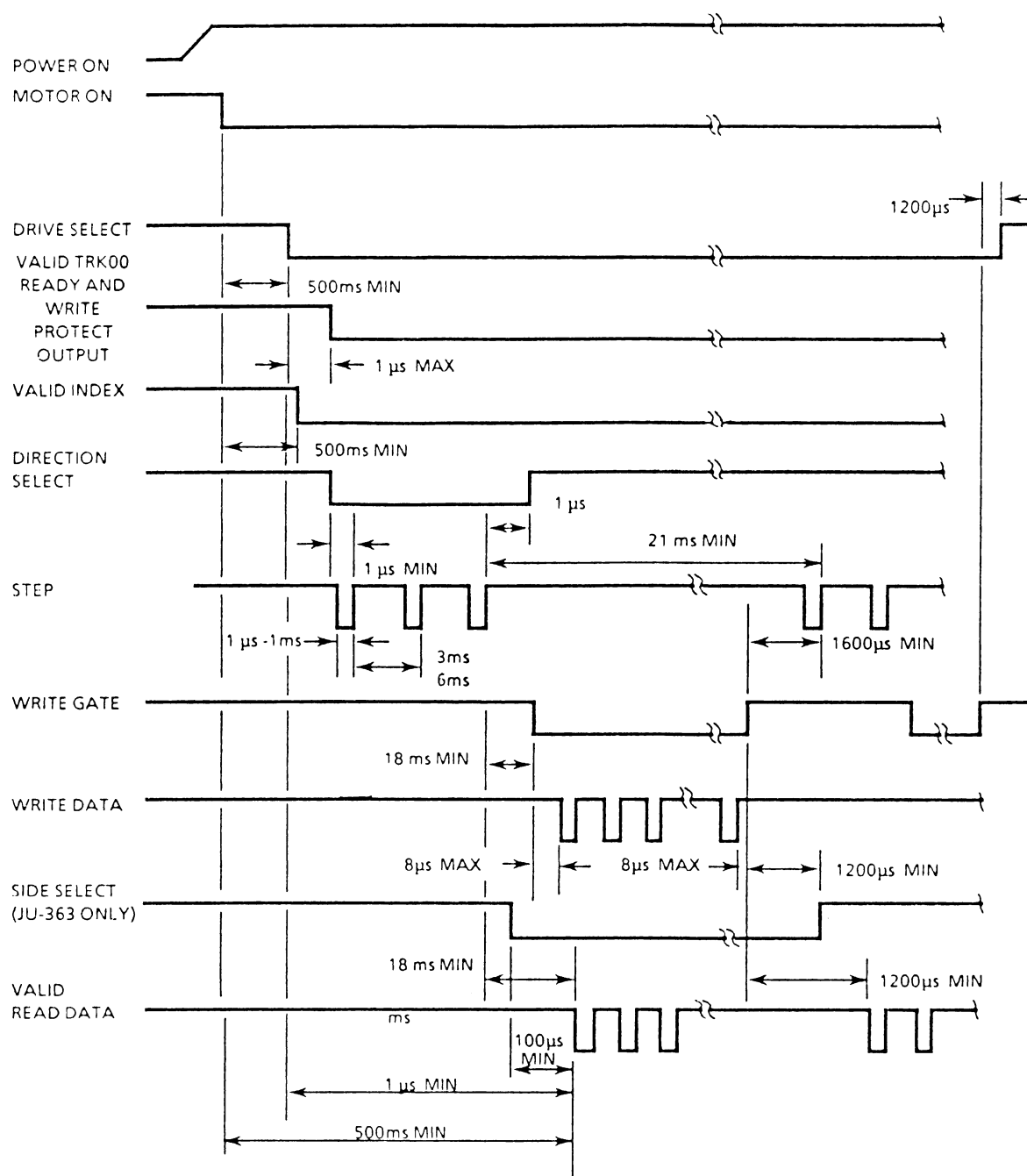
Input impedance = 1 k ohms



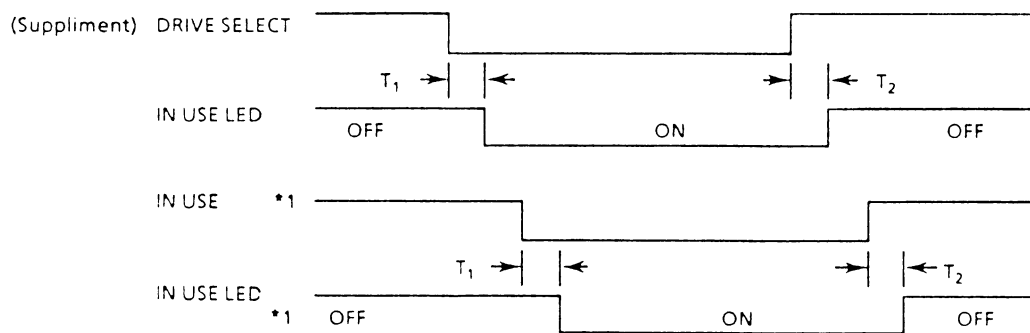
INTERFACE CONNECTIONS



INTERFACE SIGNAL DRIVER/RECEIVER



GENERAL CONTROL AND DATA TIMING REQUIREMENT



*1) PIN11 & 12 (Pin Post P2 on PCB) shorted.

$T_1, T_2 \leq 0.5ms$

Input Line Termination

The JU-3X3 has been provided with the capability of terminating the seven input lines (eight input lines at JU-363) listed below.

- a. MOTOR ON
- b. DIRECTION SELECT
- c. STEP
- d. WRITE DATA
- e. WRITE GATE
- f. IN USE
- g. SIDE SELECT (for JU-363 only)
- h. DISK CHANGE RESET

These lines are terminated through 1 k ohm resistor arrays installed on all PCB.

In a single drive system, this resistor array provides 1 k ohm input impedance for input lines. In a multiple drive system, the input impedance is varied in value from 250 ohms to 500 ohms depending on the number of used drives.

Drive Select 1 – 4

Four separate input lines (DRIVE SELECT 0 through DRIVE SELECT 3) are provided so that up to four drives in a multiplexed system may have separate input pins. Only the drive with a unique DRIVE SELECT line active will allow the drive to respond to multiplexed input lines and enable the outputs to drive their respective signal lines. A logical zero on the interface selects a unique drive select line for the drive.

Motor ON

This input, when activated to a logical zero level, will turn on the drive motor allowing reading or writing on the drive. A 0.5-second delay after activating this line must be allowed before reading or writing.

Direction Select

This interface line defines the direction of motion the read/write head(s) will take when the STEP line is pulsed. An open circuit, or logical one, defines the direction as "out". If a pulse is applied to the STEP line, the read/write head(s) will move away from the center of the disk. Conversely, if this input is shorted to ground or a logical zero level, the direction of motion is defined as "in". If a pulse is applied to the STEP line, the read/write head(s) will move towards the center of the disk.

Side Select (JU-363 only)

This interface line defines which side of a two-sided diskette is used for reading or writing. An open circuit, or logical one, selects the read/write head(s) on the side 0 surface of the diskette. A short to ground, or a logical zero, selects the read/write head on the diskette's side 1 surface. When switching from one head to the other a 100 μ s delay is required before any read or write operation can be initiated.

Step

This interface line is a control signal which causes the read/write head(s) to move in the direction of motion defined by the DIRECTION SELECT line. This signal must be a logical zero-going pulse with a minimum pulse width of 1 μ s. Each subsequent pulse must be delayed by 3 ms (JU-323, 363), 6 ms (JU-313) minimum from the preceeding pulse for normal mode.

The access motion is initiated on each logical zero to logical one transition, or at the trailing edge of the signal pulse. Any change in the DIRECTION SELECT line must be made at least 1 μ s before, and must be maintained 1 μ s after the trailing edge of the step pulse. See Figure 1-3 for these timers.

Write Gate

The active state of this signal, or logical zero, enables write data to be written on the diskette. The inactive state, or logical one, enables the read data logic and stepper logic. See figure 1-8 for timing.

Write Data

This interface line provides the data to be written on the diskette. Each transition from a logical one level to a logical zero level will cause the current through the read/write head to be reversed, thereby writing a data bit. This line is enabled by WRITE GATE being active. WRITE DATA must be inactive during a read operation. See Figure 1-9 for timings.

In Use

Normally, the activity LED on the selected drive will turn on when the corresponding DRIVE SELECT signal is active. The IN USE input instead of the DRIVE SELECT signal can activate the LED too.

Output Lines

The output control lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = $V_{out} + 0.0$ to $+0.4V$ @ $I_{out} = 6$ mA (max)

False = Logical one = $V_{out} + 2.4$ to $+5.25V$ (open collector) @ $I_{out} = 250$ μ A (max)

Track 00

The active or logical zero state of this interface signal indicates when the read/write head of the drive is positioned at track zero (the outermost track) and the stepper is locked on track. This signal is at a logical one level, or inactive state, when the read/write head is not at track 00. When the read/write head is at track 00 and an additional step out pulse is issued to the drive, LSI logic will keep the read/write head positioned at track 00.

Index

This interface signal is provided by the drive each motor revolution. Normally, this signal is at a logical one level and makes the transition to the logical zero level each time a reflector is sensed.

With soft sector media, there is one pulse on this interface signal per revolution of the diskette (200 ms). This pulse indicates the physical beginning of a track. See figure 3-4 for timing.

When using the INDEX signal, look for an edge or transition rather than a level for determining the status.

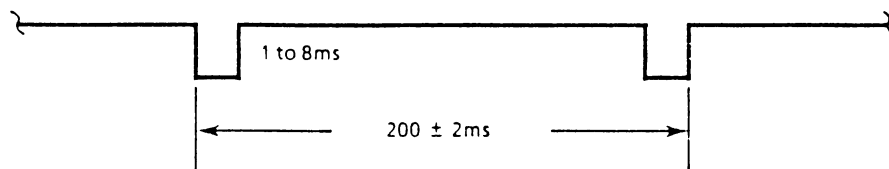


FIGURE 2-4 INDEX TIMING

Read Data

This interface line provides the "raw data" (clock and data together) as detected by the drive electronics. Normally, this signal is a logical one level and becomes a logical zero level for the active state. See Figure 1-6, 1-7 for the timing.

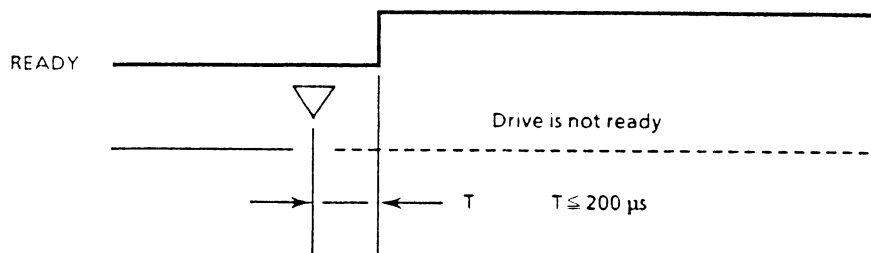
Write Protect

This interface signal is provided by the drive to indicate to the user that a write protected cartridge is installed. The signal is logical zero level when it is protected. The drive will inhibit writing with a protected diskette installed and, additionally, notifies the interface.

Ready

This interface line provides information on the status of the drive that allow the controller to operate, all the functions of the drive under the following conditions.

- A cartridge is inserted in the drive.
- The motor is on and up to speed.
- DC power is supplied to the drive.

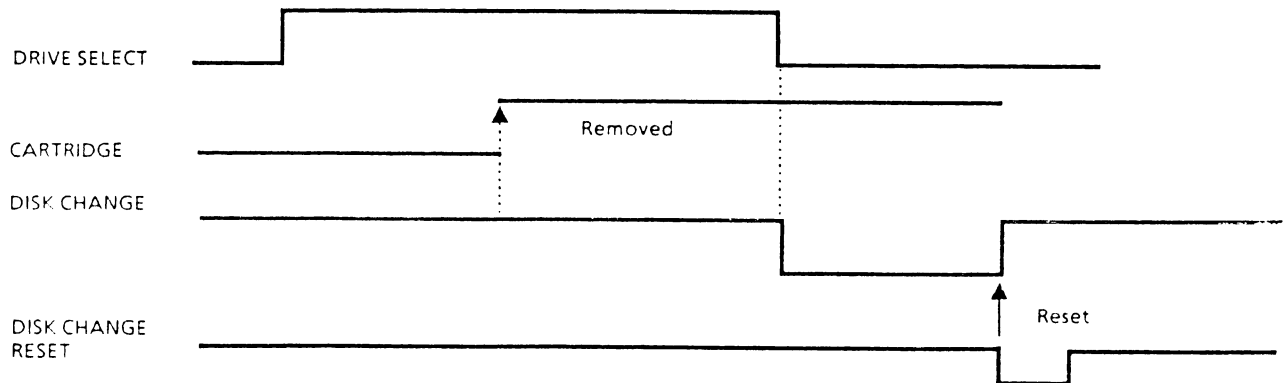


Disk Change (and Disk Change Reset)

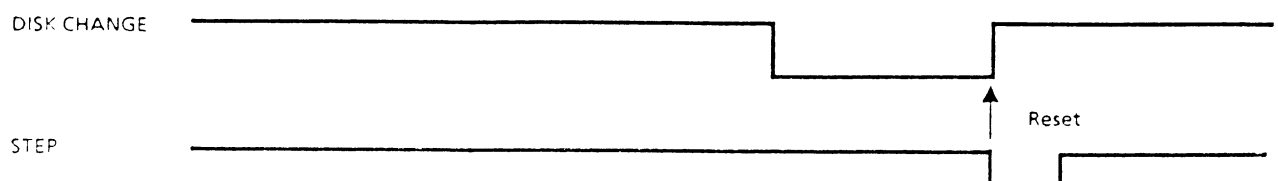
This interface signal is provided by the drive to indicate the condition that disk cartridge is ejected while the drive is deselected, and output when DRIVE SELECT line is activated.

This Disk Change line can be reset with Disk Change Reset, adding to this, if the shorting pin 16 and 18 are shorted STEP signal can reset this signal.

- Shorting bar DR (Pin 17, 18) is shorted.

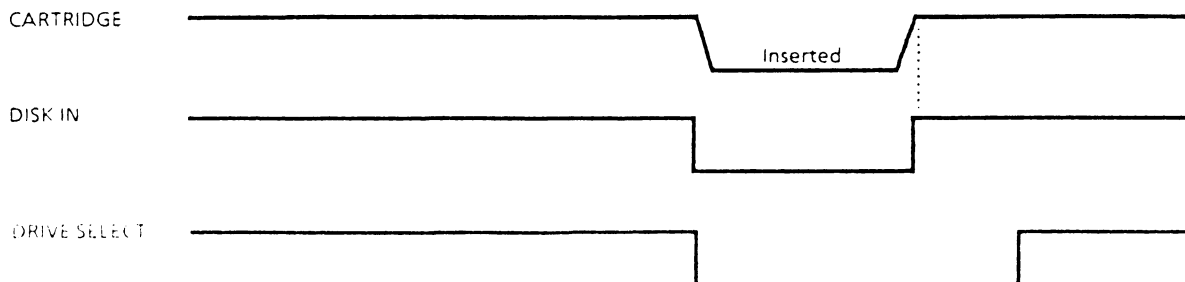


- Shorting bar (Pin 16,18) is shorted.



Disk In (Option)

This signal is output for stating the condition of cartridge inserted. When the shorting pin 13 and 15 rather than 13 and 14, are shorted with shorting plug.



Normally, the drive is shipped at shorting pin 13 and 15 being shorted.

POWER INTERFACE

The JU-3X3 required only dc power for operation. DC power to the drive is provided via J2 located on the component side of the PCB. The two dc voltages, their specifications and their J2 pin designations and outlined in table 2-1. The specifications outlined on current requirements are for one drive. For multiple drive systems, the current requirements are a multiple of the maximum current times the number of drives in the system. Figure 2-5 illustrates the JU-3X3 dc power profile.

FRAME GROUND AND SIGNAL GROUND

The aluminum base plate of the drive is at the same electrical level as signal ground. Only the mounting bracket is contracted to the frame ground. This provides protection against radiation noise from outer systems.

TABLE 2-1. DC POWER REQUIREMENTS

J2 PIN	DC VOLTAGE	TOLERANCE	CURRENT	MAX RIPPLE (p to p)
1	+ 5 VDC	± 0.25 VDC	0.25 A MAX 0.22 A TYP	50 mV MAX ALLOWABLE
2	+ 5 RETURN			
3	+ 12 RETURN			
4	+ 12 VDC	± 1.2 VDC	0.21 A MAX 0.12 A TYP	100 mV MAX ALLOWABLE

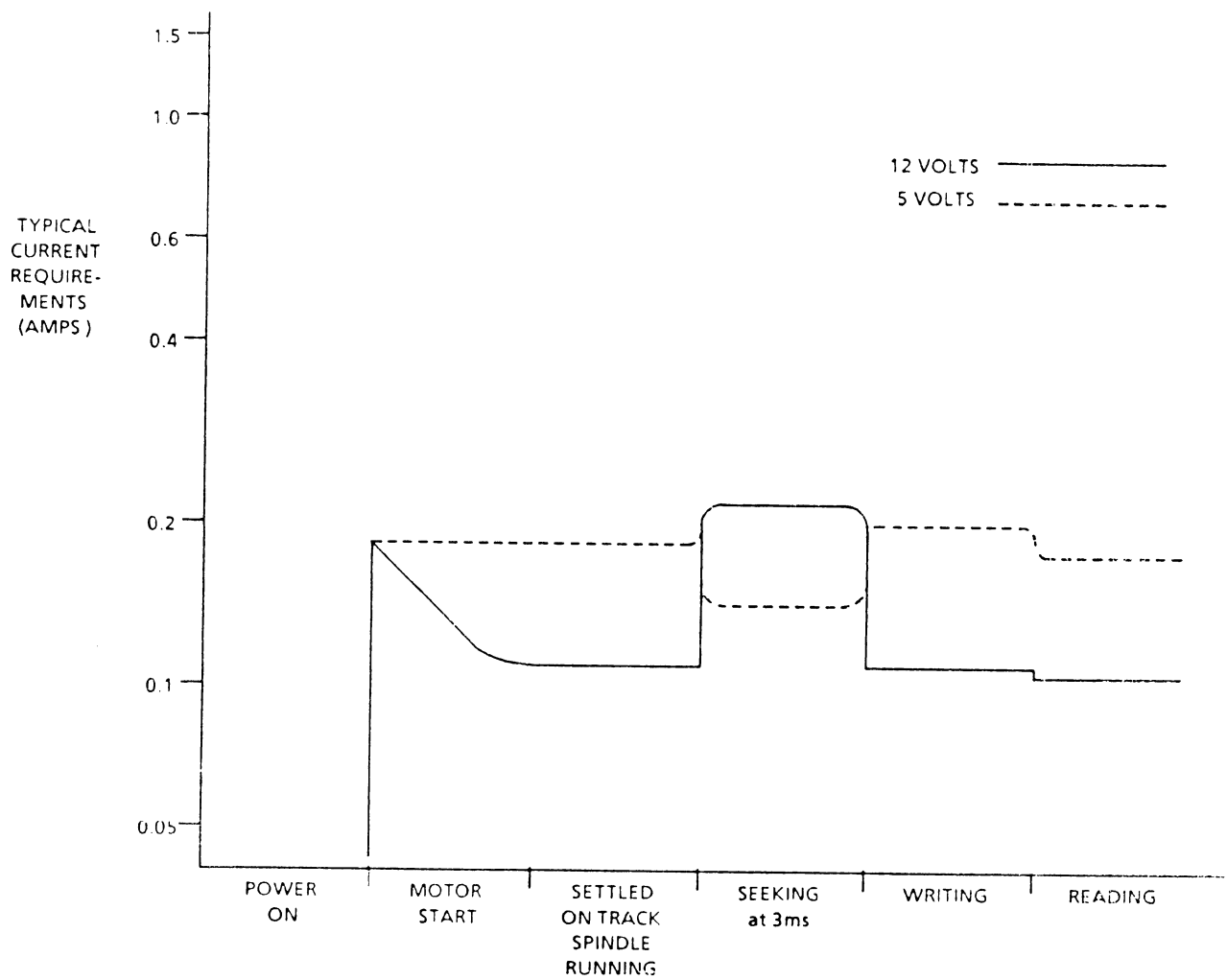
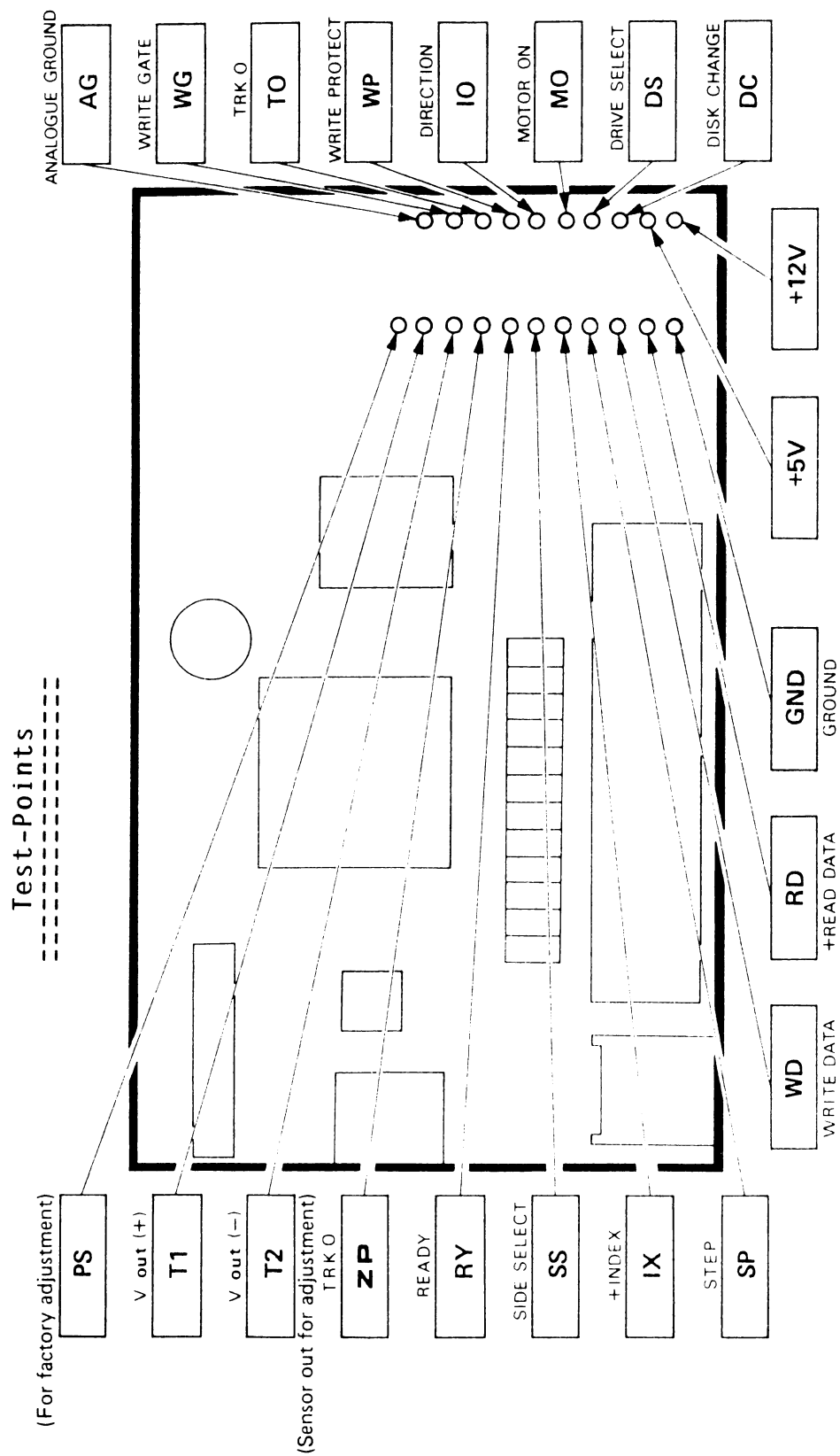


FIGURE 2-5 DC POWER PROFILE



Radial Alignment

Normally, this adjustment is not necessary.

If the stepping motor mounting screws have loosened, or if parts have been damaged, or if a compatibility error has occurred, check and re-adjust as follows:

Steps 1 through 4 apply to both the CE and DAD types, except that alignment diskettes are different between them.

1. Insert an alignment diskette.

Caution: Be sure to leave the alignment diskette indoors for 20 minutes before starting radial alignment.

2. Step to track 40.

3. Synchronize oscilloscope on IX (– INDEX), and set time base to 20 ms/division. One revolution will be displayed.

4. Connect one probe to T1 and the other to T2. Ground the probes to GND and AG. Set inputs to AC, Add, and invert one channel. Set vertical deflection to 0.1 V/division (VARIABLE PULL) for the CE type, or to 2 mV/division for the DAD type.

* Cat's Eye Type

5. Check amplitude waveforms for Side 0 and Side 1. Waveforms such as shown in Fig. 4.2 can be seen.

6. The amplitude ratio of the two waveforms should be **60% or more**. If it is not, adjust as follows:

7. Loosen the two stepping motor mounting screws.

8. Turn the stepping motor along the base by hand until the lobes of the two waveforms have approximately the same amplitude, and retighten the mounting screws. (See Fig. 4.2.)

9. Seek from track 0 to 40 and from track 79 to 40, and check that radial alignment is correct.

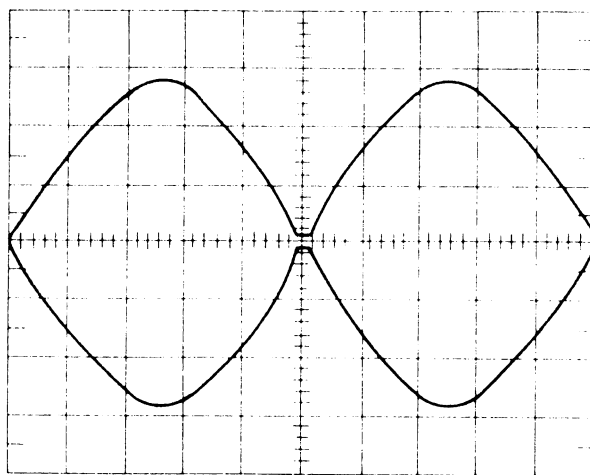
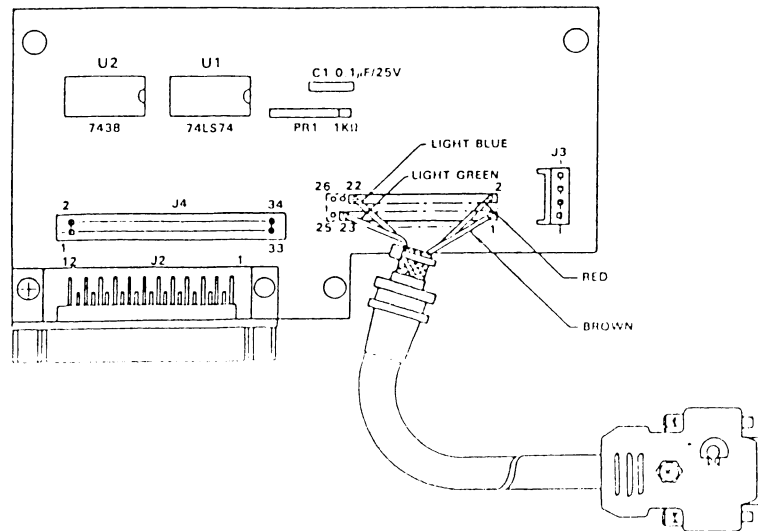
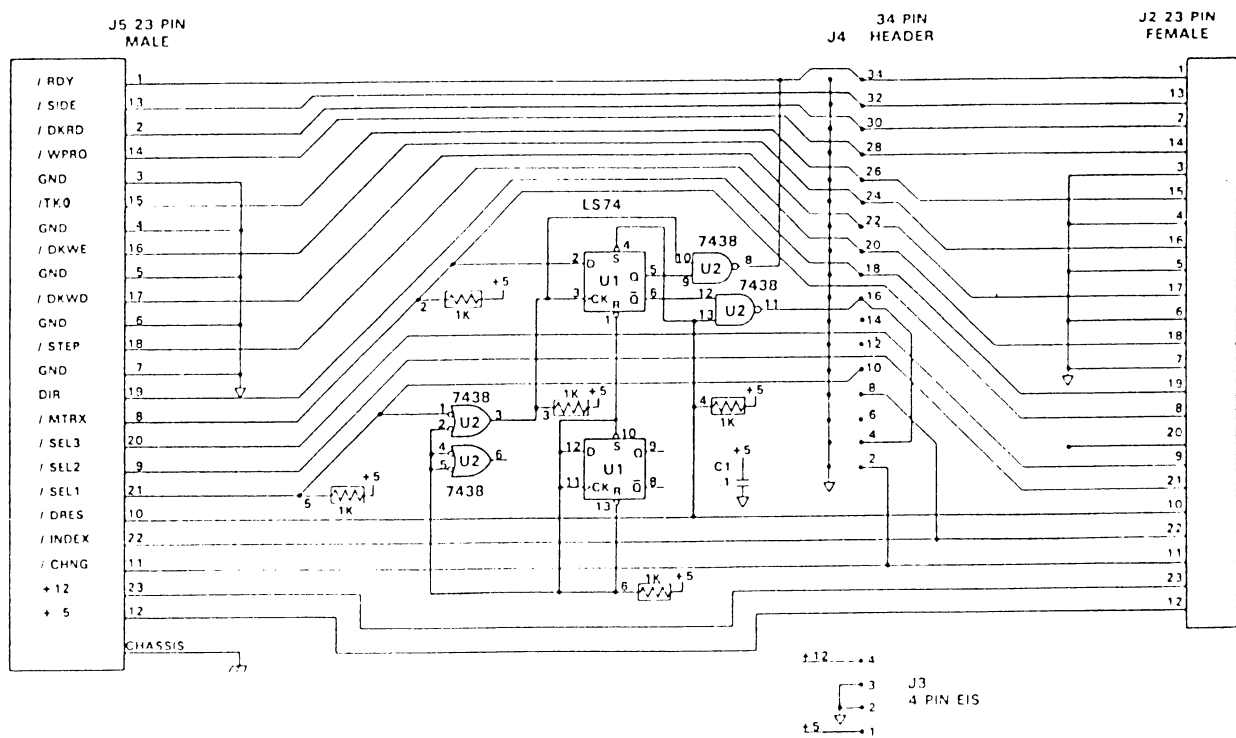


Fig. 4.2 Radial Alignment Waveforms (Cat's Eye)

INTERFACE PCB ASSY. #327204



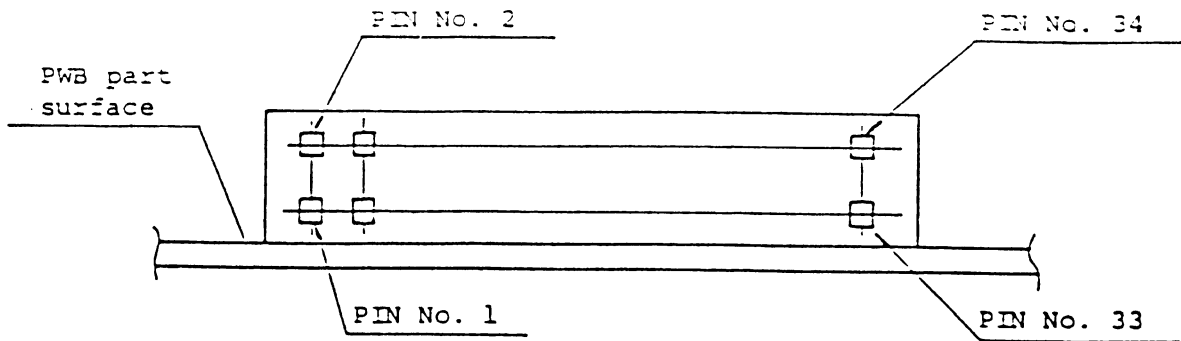
Board Layout



Interface Schematic

SIGNAL TYPES AND PIN CONFIGURATION

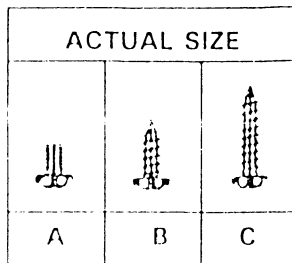
The following shows the signal connector pin configuration on the FD1035:



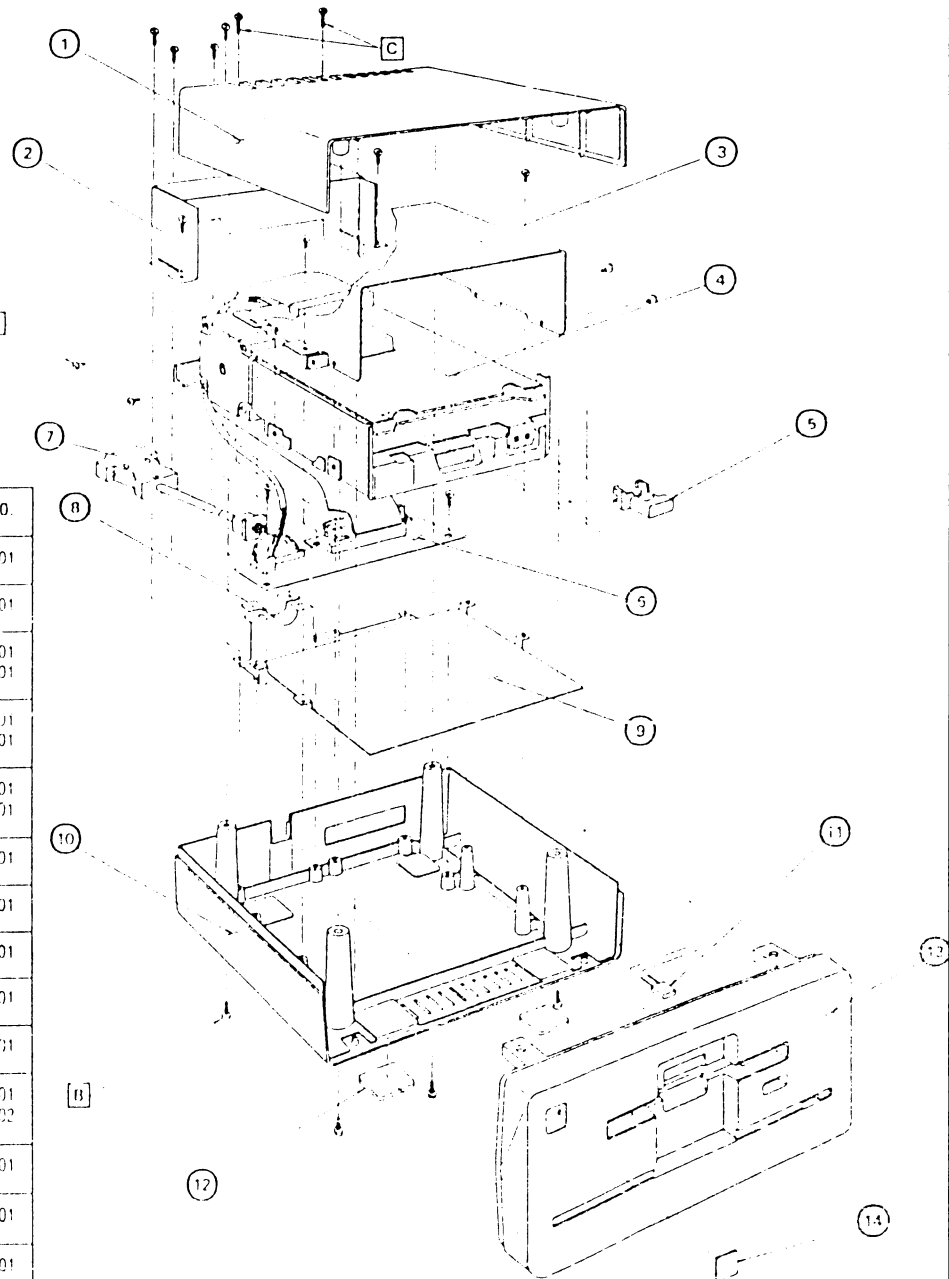
Signal name	I/O	Pin number	Pin number	Signal name
DISK CHANGE (IN USE)	Output signal	2	1	GND
DRIVE SELECT 3	Input signal	4	3	GND
INDEX	Input signal	6	5	GND
DRIVE SELECT 0	Output signal	8	7	GND
DRIVE SELECT 1	Input signal	10	9	GND
DRIVE SELECT 2	Input signal	12	11	GND
MOTOR ON	Input signal	14	13	GND
DIRECTION SELECT	Input signal	16	15	GND
STEP	Input signal	18	17	GND
WRITE DATA	Input signal	20	19	GND
WRITE GATE	Input signal	22	21	GND
TRACK 00	Input signal	24	23	GND
WRITE PROTECT	Output signal	26	25	GND
READ DATA	Output signal	28	27	GND
SIDE SELECT	Output signal	30	29	GND
READY	Input signal	32	31	GND
	Output signal	34	33	GND

2. 3.5" EXTERNAL DRIVE DISASSEMBLY

2.1 ASSEMBLY OVERVIEW



POS.	DESCRIPTION	PART NO.
1	TOP CASE	327011-01
2	RFI TOP SHIELD	327116-01
3	DRIVE MTG. BRACKET-NEC DRIVE MTG. BRACKET-PANA	327143-01 327144-01
4	3.5" DRIVE ASSY-NEC 3.5" DRIVE ASSY-PANA	327141-01 327142-01
5	DISK EJECT BUTTON-NEC DISK EJECT BUTTON-PANA	327006-01 328117-01
6	INTERFACE PCB ASSY	327204-01
7	INTERFACE CABLE ASSY	327164-01
8	CABLE CLAMP ASSY	327208-01
9	RFI BOTTOM SHIELD	327117-01
10	BOTTOM CASE	327010-01
11	LED ASSY-NEC LED ASSY-PANA	327175-01 327176-02
12	RUBBER FOOT	327053-01
13	FRONT BEZEL	327012-01
14	NAMEPLATE-AMIGA LOGO	327113-01
PARTS NOT ILLUSTRATED:		
	RIBBON CABLE ASSY-DATA	327206-01
	CABLE ASSY-POWER	327207-01
	USERS INSTRUCTION SHEET	327202-01



Assembly Overview

THE MAJOR ASSEMBLIES IDENTIFIED

Drive
Chinon F 502 L II

9

SCOPE

These Specifications apply to 5-1/4" double-sided 48-TPI minifloppy disk drive (hereafter abbreviated as FDD) CHINON F-502LII

FEATURES

The features of the F-502LII

(1) Pop-up Mechanism

With the newly employed pop-up mechanism, the disk can be loaded/unloaded with ease, preventing mischucking at disk insertion.

(2) Low Power Consumption

As a newly designed LSI (C-MOS chip) is employed in the read/write and control circuits, high performance and low power consumption are achieved. In stand by mode, power consumption is only 1.86W, and in operation mode 4.42W, making system design easy.

(3) Built-in Disk-in-sensor

With the built-in disk-in-sensor, when no disk is loaded, the motor is stopped. This extends the motor service life and reduces power consumption. When chucking the disk, the DD motor is rotated temporarily to assure the centering of the disk.

(4) Automatic Power-down Control

If no rotation commands are sent to the step motor during a given period of time, the step motor will automatically go into a "power-save" mode.

(5) Direct Drive Brushless Spindle Motor

A slim, durable, direct drive spindle motor is used and even after continuous use, no maintenance or check procedures are required.

(6) Plug Compatibility

Recording format, data transfer rate and disk rotation speed are compatible with standard size 5-1/4" drives.

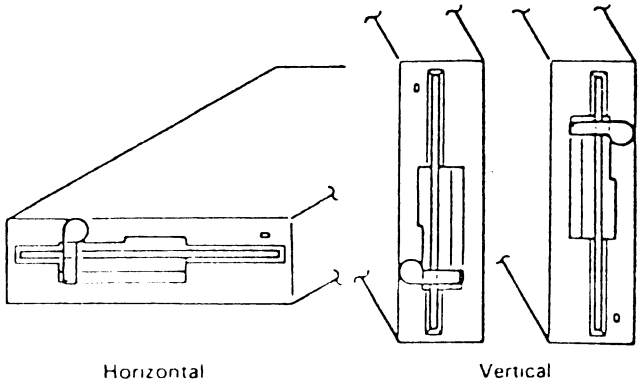
SPECIFICATIONS

Item			Specification	
			Double density	Single density
Storage capacity	Unformatted	Per disk	500 K bytes	250 K bytes
		Per track	6.25 K bytes	3.125 K bytes
	Formatted (16 sectors) (Equivalent to IBM format)	Per disk	327.68 K bytes	163.84 K bytes
		Per track	4096 bytes	2048 bytes
	Formatted (9 sectors) (Equivalent to IBM format)	Per disk	368.64 K bytes	184.32 K bytes
		Per track	4608 bytes	2304 bytes
Recording density			5876 BPI	2938 BPI
Rate of data transfer			250 K bits per second	125 K bits per second
Access time	Power-on to ready time		0.5 sec. or less	
	Single track seek time		5 ms per track	
	Average access time		86 ms	
	Settling time		20 ms	
	Average latency time		100 ms	
Rotation speed			300 rpm	
Long term speed variation			Less than +1.5%	
Instantaneous speed variation			Less than +1.5%	
Number of tracks			80	
Number of cylinders			40	
Number of heads			2	
Radius of track	Outer		0 side: 57.151 mm	1 side: 55.034 mm
	Inner		36.513 mm	34.396 mm
Number of indexes			1	
Recording mode			MFM	FM
Track density			48 TPI	

Specification

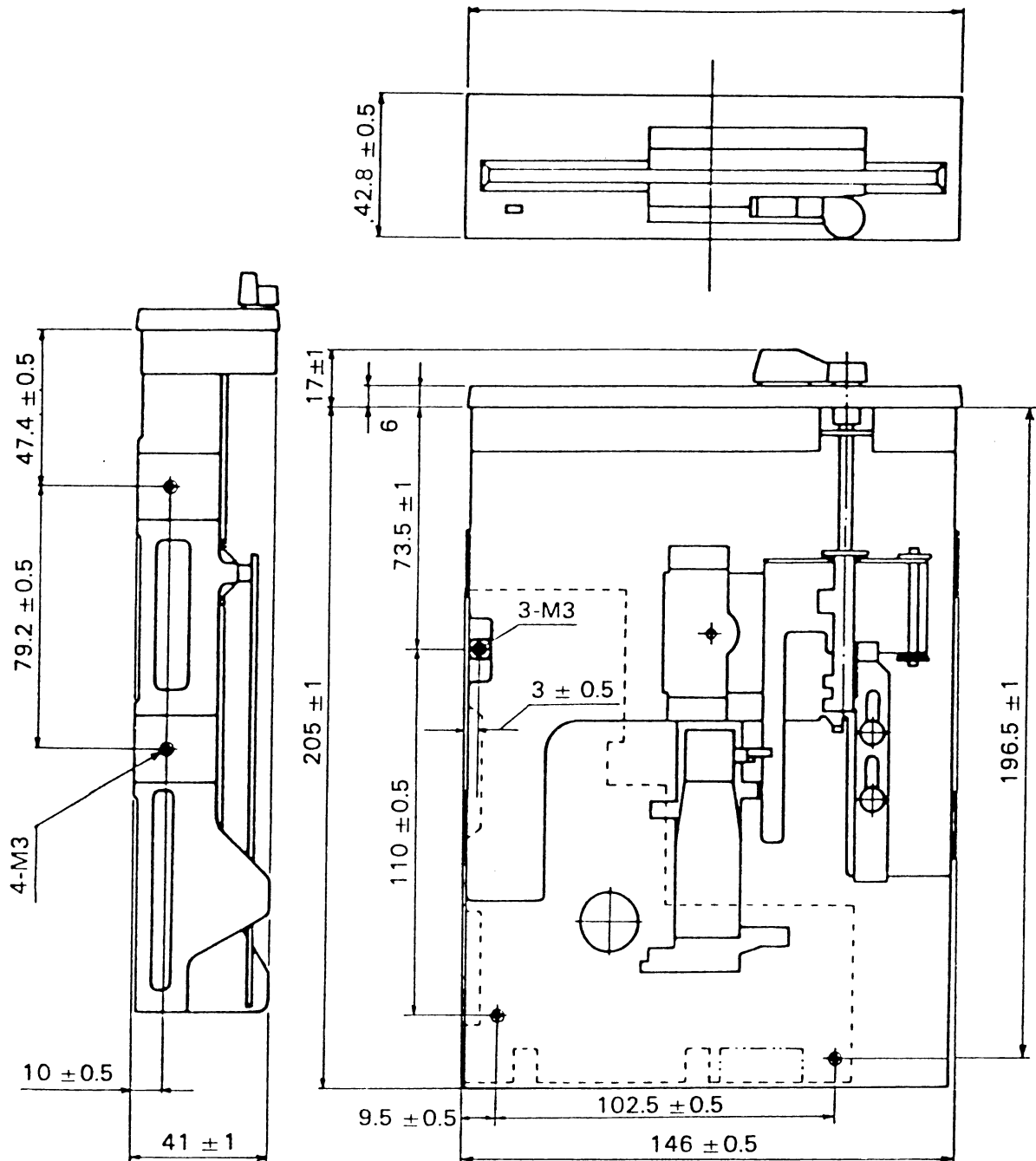
Item	Specification			
Physical dimensions	146 (W) x 41 (H) x 220 (D) mm			
Weight	Approx. 1.2 kg			
Power supply	DC +12 V \pm 5%			
	DC +5 V \pm 5%			
Power consumption		+5 V	+12 V	POWER
	Stand-by (DD motor off)	300 mA TYP.	30 mA TYP.	1.86 W TYP.
	Read operation	370 mA TYP.	160 mA TYP.	3.77 W TYP.
	Write operation	380 mA TYP.	210 mA TYP.	4.42 W TYP.
	Seek (continuance)	270 mA TYP.	500 mA TYP.	7.35 W TYP.
	Spindle Motor Starting current (0.5 sec. max.)		900 mA MAX.	
Ripple voltage allowance	DC +12 V	Less than 150 mVp-p (including spike noise)		
	DC +5 V	Less than 100 mVp-p (including spike noise)		
Noise	Less than 55 phons (class A) (separated from the drive by 1m)			
Cabinet specifications	Front panel	Material: ABS Color: Light Grey(See below)		
	Front lever	Material: ABS Color: Light Grey(See Below)		
		Maker : Shin-Nittetsu Chemical Industries. P/N : BK-8052KW-5		

Installation Conditions

Item	Specification		
Mounting position	<div></div> <p>Horizontal Vertical</p> <p>Keep the horizontal level to within 15 degrees with front panel raised.</p>		
Environment conditions	Temperature	During operation	5 ~ 45°C
		During non-operation	0 ~ 50°C
		During storage	-20 ~ 60°C
	Humidity	During operation	20 ~ 80% RH Maximum wet bulb temperature 29°C
		During non-operation	5 ~ 90% RH No dew condensation
		During storage	8 ~ 90% RH No dew condensation
Temperature change		15°C/H	
Vibration	During operation	Continuous vibration	Amplitude Less than 0.5 mm 5 ~ 25 Hz 0.25G 25 ~ 100 Hz
		Single vibration	Less than 10G (10 ms)
	During non-operation and storage (W/Protect sheet)	Continuous vibration	Amplitude Less than 7 mm 5 ~ 9 Hz 0.5G 9 ~ 100 Hz
		Single vibration	Less than 30G (10 ms)
Drop shock	Fall height in packing State: 70 cm (corner: one time, sides: three times, flat surfaces: six times)		

DIMENSIONS

Dimension for F-502LII



INTERFACE SIGNALS

The interface signal has 11 input signal lines and 5 output signal lines. See Fig. 5-1.

Signal Voltage Levels

The interface signal interfaces with the controller at the TTL level. For all signals, low is true. The I/O signal level into the drives have the following specifications.

(1) Input signal

Low level 0V to +0.40V
High level +2.40V to +5.25V
Input impedance 150 Ω

(2) Output signal

Low level 0V to +0.40V
High level +5.25V max. (by receiving the end terminator)
Output current (for low level) 48 mA (max.)
Output current (for high level) 250 μ A (max.)

Input Signals

(1) DRIVE SELECT 0 to 3 signal lines

When one of these signal lines goes into low level, the drive corresponding to the signal line is selected and the I/O gate is opened. Up to four drives can be controlled using these four signal lines. The drive corresponding to one of the DRIVE SELECT 0 to 3 signal lines is determined by the position of the short plug in the drive.

This line also controls the ON/OFF of the spindle motor. When one of the DRIVE SELECT 0 to 3 goes into low level, the spindle motor revolves. When it is set to high level, it stops.

(2) DIRECTION SELECT signal line

This signal determines the direction of movement of the head when a pulse is sent via the STEP signal line. When this signal line is set to low level and the STEP signal pulse is sent, the head moves toward the center of the disk. When it is set to high level and the STEP signal pulse is sent, the head moves away from the center.

The logic level of this signal should be held for at least 1 microsecond after the trailing edge of the STEP pulse.

(3) STEP signal line

This signal line moves the head. With the rise of a single low level pulse, this signal line changes from LOW level to HIGH level and the head moves one track in the direction determined by the DIRECTION SELECT signal.

However, this signal is not accepted when the FDD is in WRITE mode. The head is stabilized 20 ms after the trailing edge of the last STEP pulse, and the FDD is ready for data read/write operation.

(4) WRITE GATE signal line

This signal line specifies drive write and read status. When this signal line is set to low level, write enable status occurs and the data is stored on the disk surface by the WRITE DATA signal. When this signal line is set to high level, read status occurs.

After the writing operation, a period of 1.2 ms is necessary before a valid READ DATA signal appears on the interface.

(5) WRITE DATE signal line

Data written on the disk surface is transferred on this signal line. With the decline of the pulse sent to this signal line (when the signal line changes from the high level to the low level), data is written on the disk surface.

(6) SIDE SELECT signal line

This signal line selects the head.

When this signal line is set to high level, the side 0 head is selected; when it is set to low level, the side 1 head is selected. Side 0 stands for the one-sided medium recording surface.

The selection is completed 100 microseconds after the change of the SIDE SELECT signal line, and read/write becomes possible.

Output Signals

(1) INDEX signal line

Whenever the disk rotates once, this signal line outputs a low level pulse indicating the start of the track. A decline of the pulse signal (when this signal line changes from high level to low level) indicates the start of the track. However, the pulse is only output when the disk is inserted.

(2) TRACK 00 signal line

When this signal line is set to low level, the head is located at the track 00 position and the specific phase of the stepping motor is excited.

(3) WRITE PROTECT signal line

When this signal line is set to low level, the inserted disk cannot be written on. This signal line may also be set to low level even when no disk is inserted in the drive. The write function of the drive becomes inoperative when write-inhibited disk is inserted.

(4) READ DATA signal line

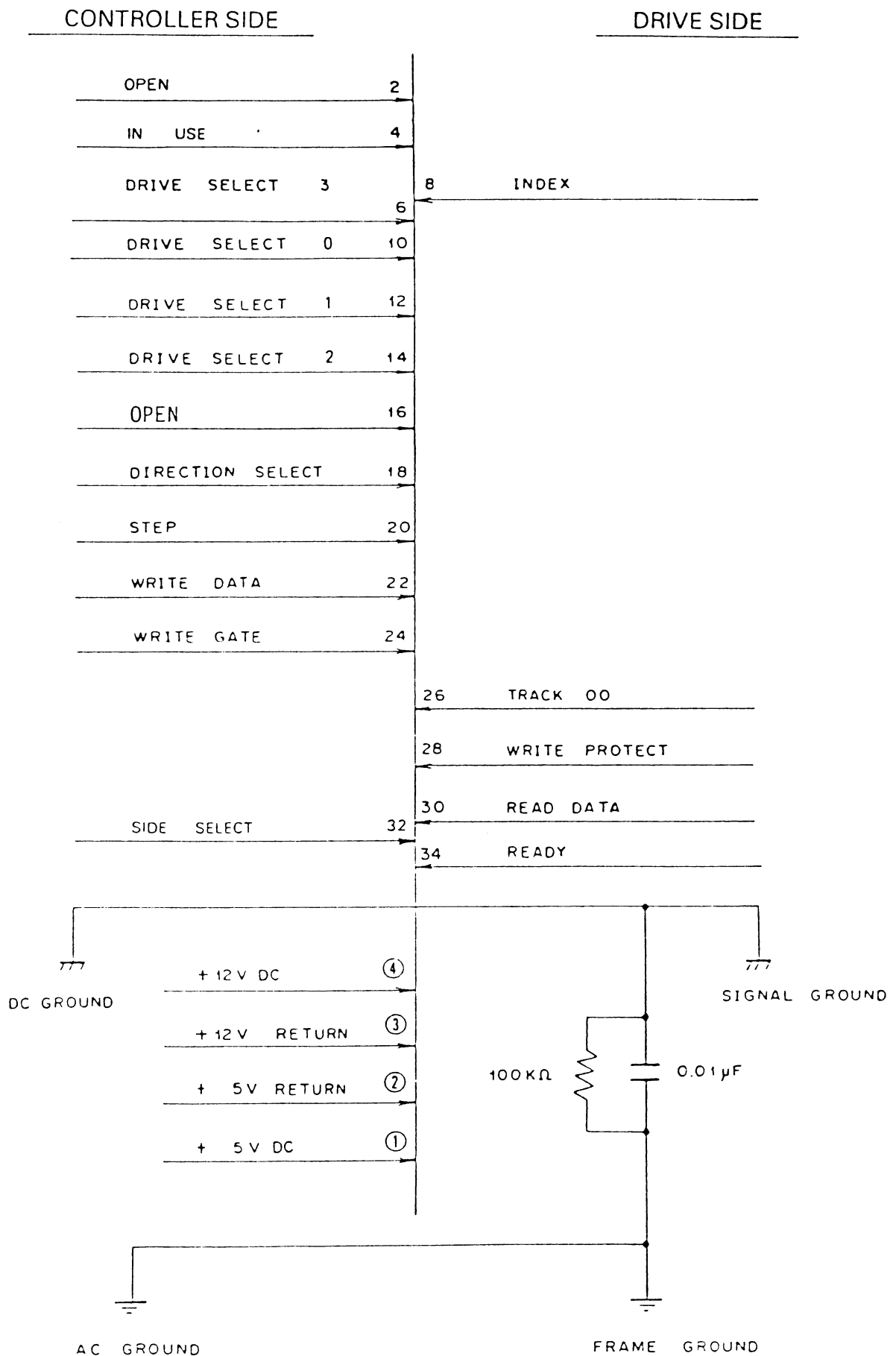
This signal line is used for the transfer of the pulse series read from the disk, in which clock pulses and data pulses are mixed. The negative-going edge (the moment of change from high level to low level) of the pulse output at this signal line indicates the readout data (clock and data pulses). (See Page 14.)

(5) READY signal line

When this output signal line is set to low level, the disk is inserted and the number of disk rotations is fixed.

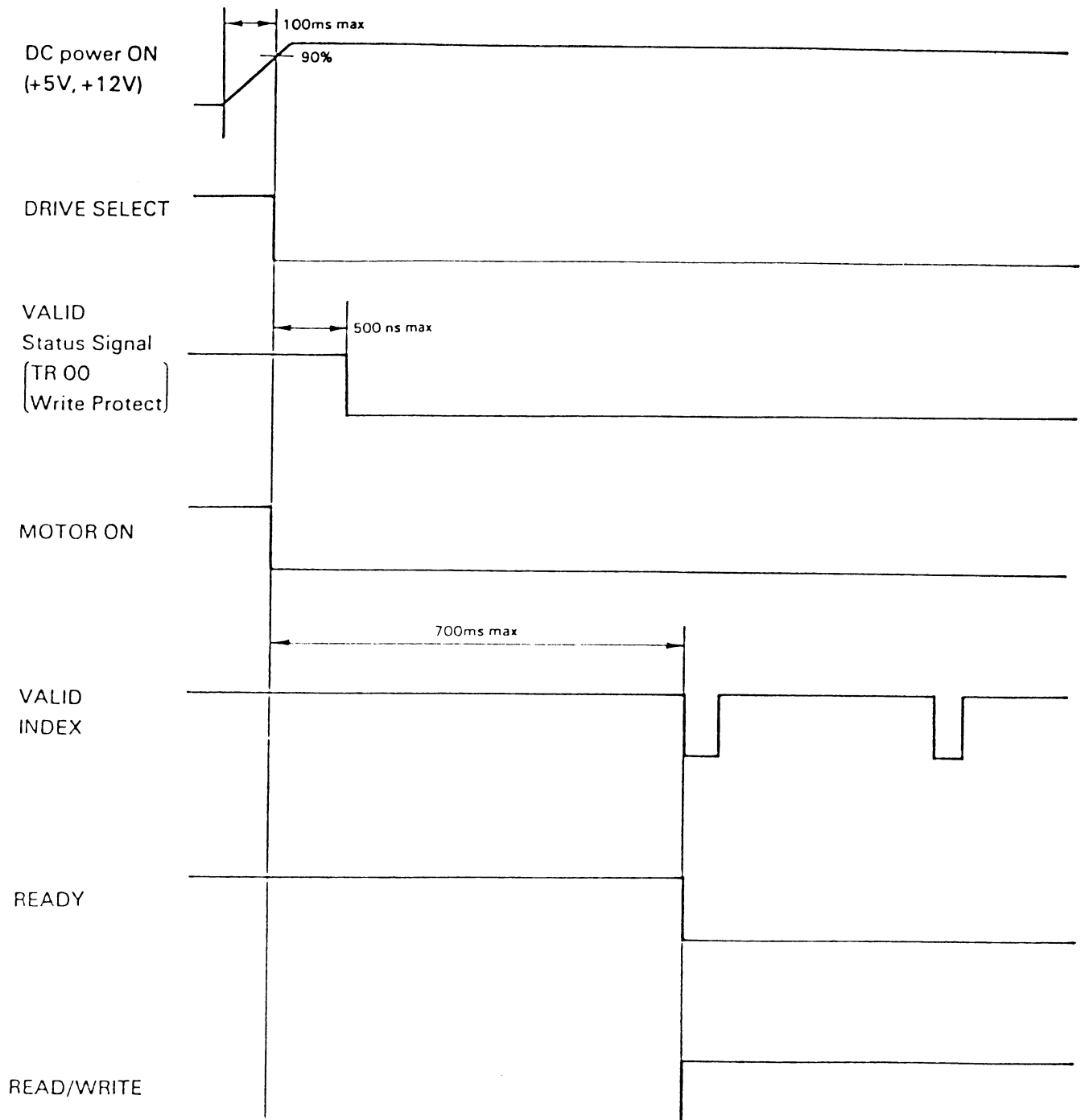
When the READY signal is ON, read and write operations can be performed on the disk. Immediately after the MOTOR ON signal is turned ON, power is supplied. After the disk is inserted, check that the READY signal is ON before performing write and read operations.

Fig. 5-1 Interface with the controller and host system

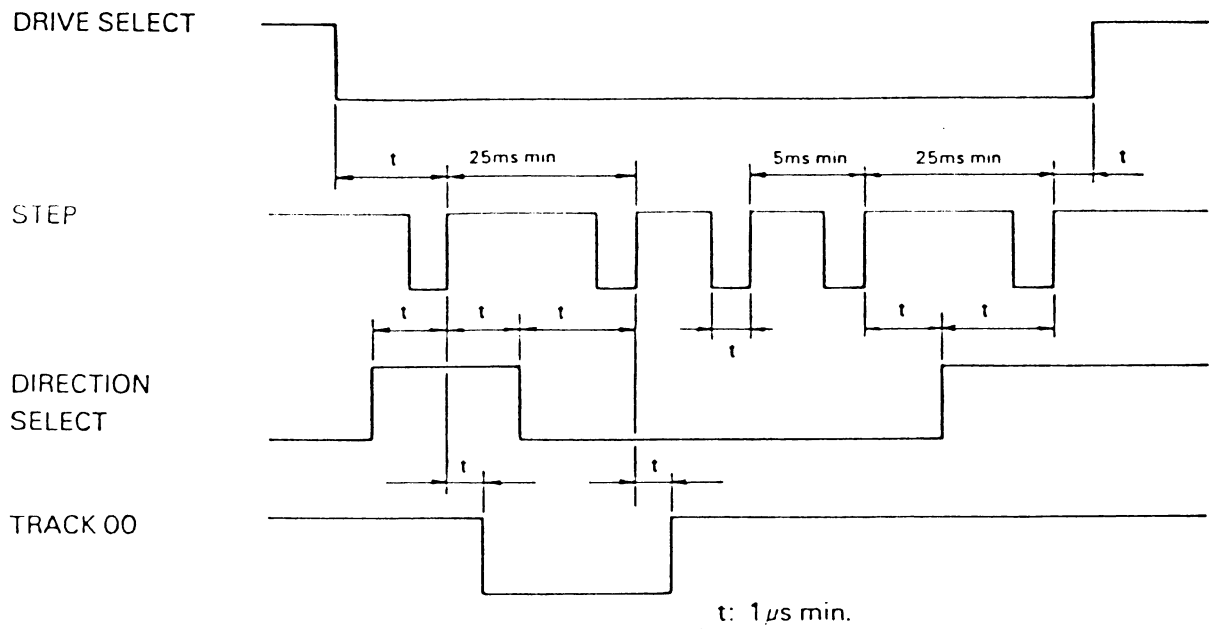


Signal Timing

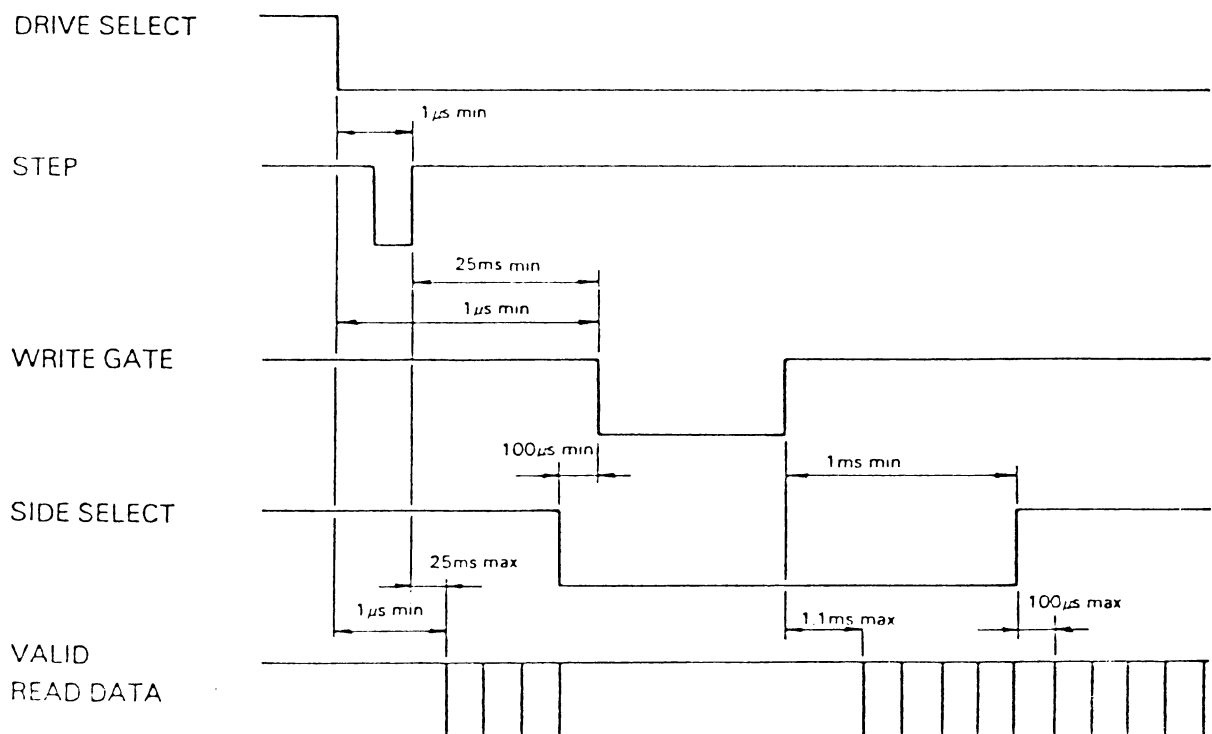
(1) Initialize sequence



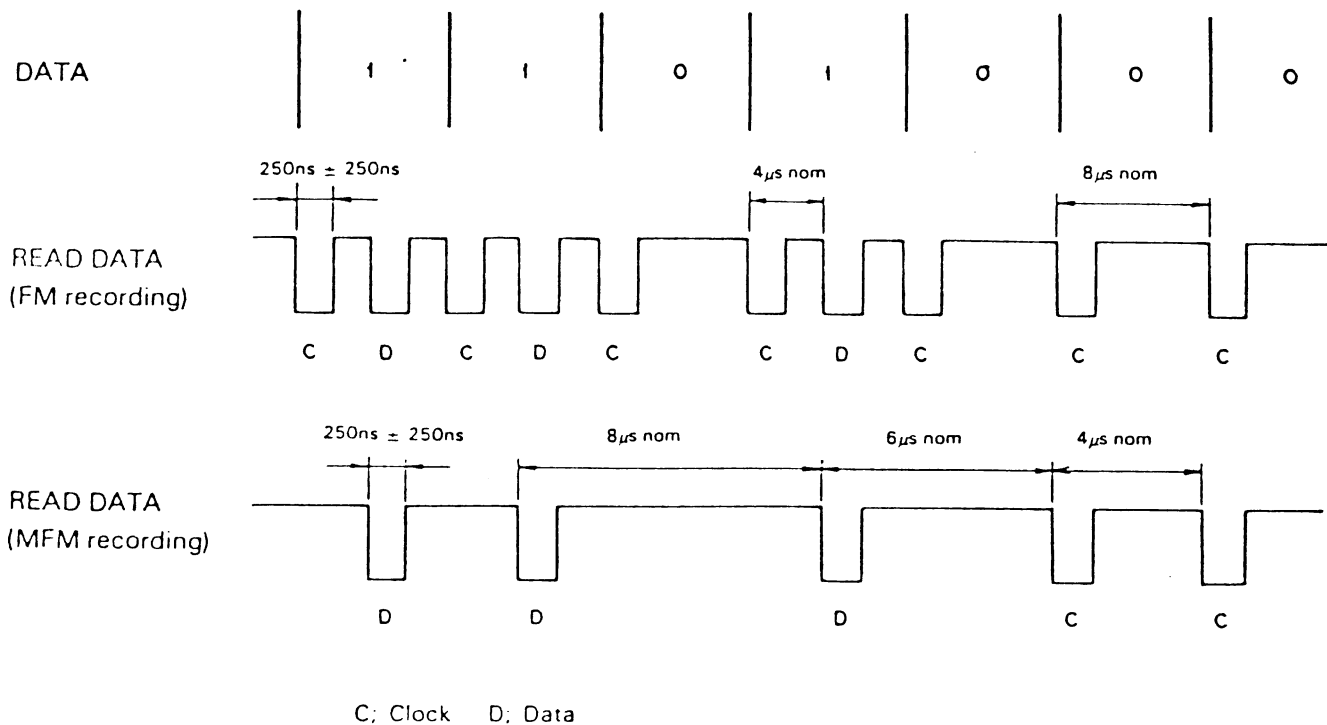
(2) Access timing



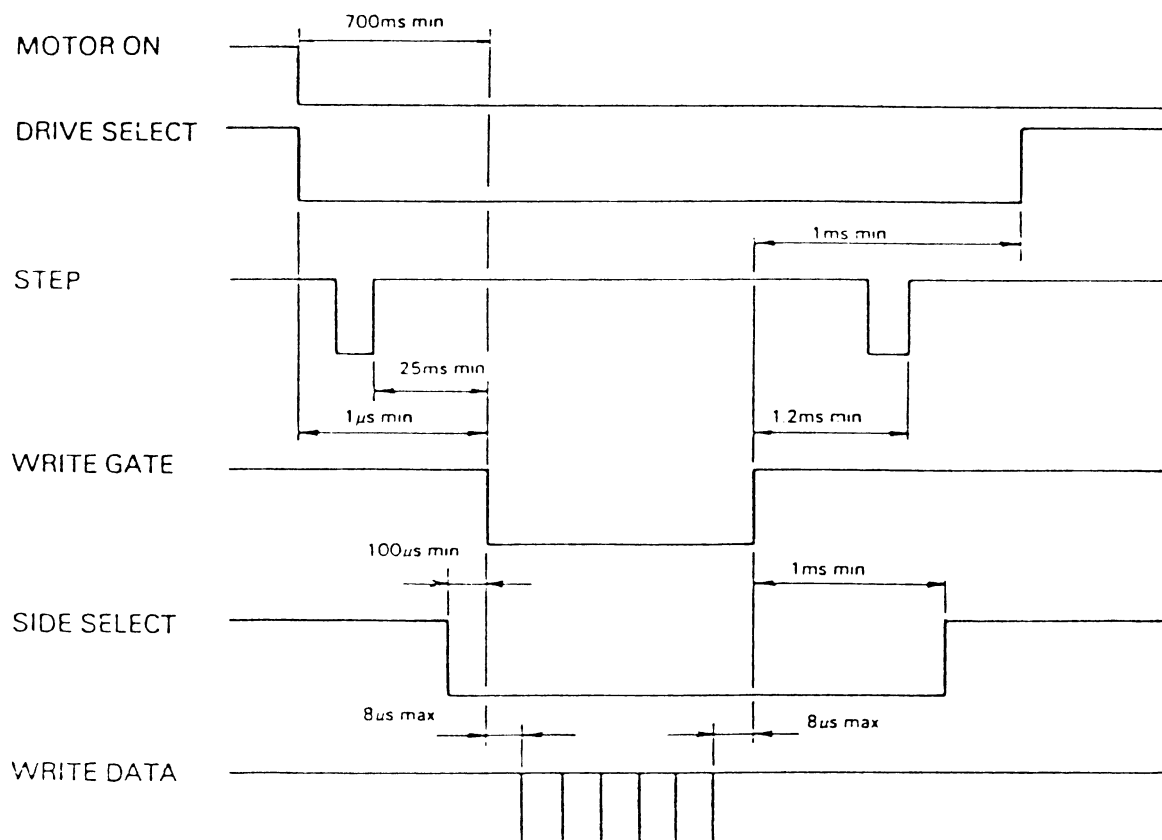
(3) Read timing



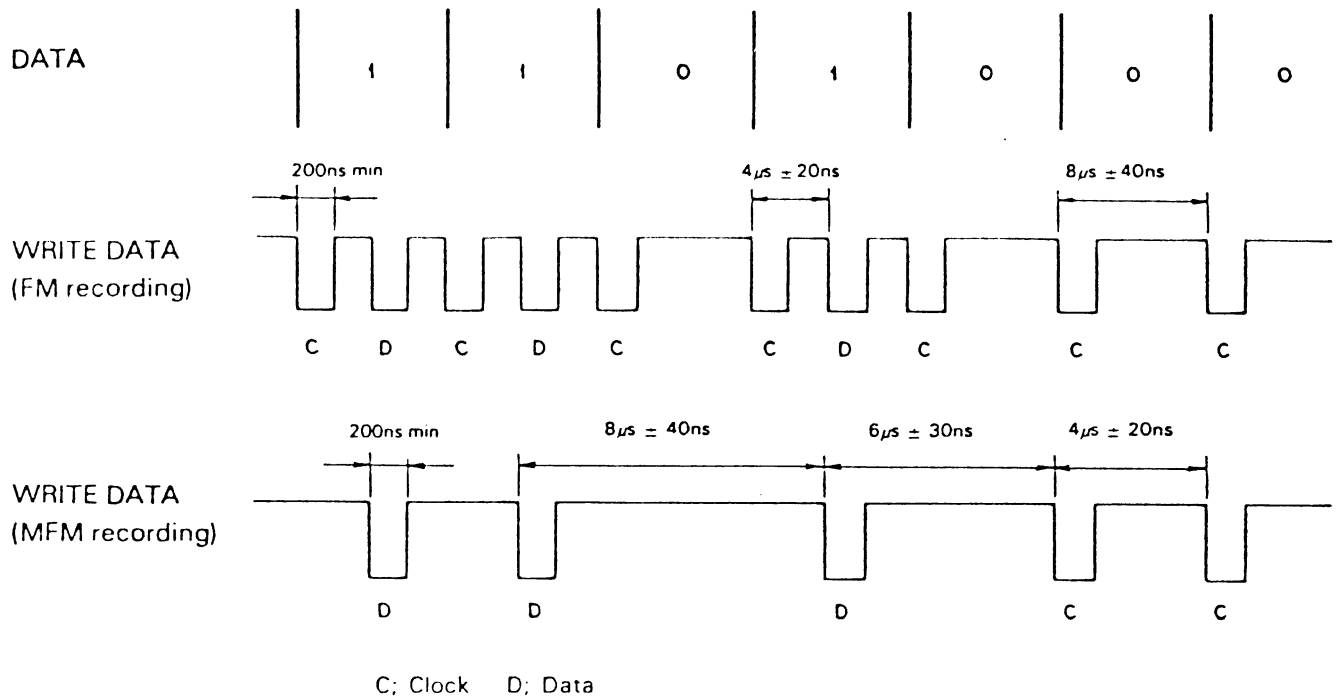
(4) READ DATA timing



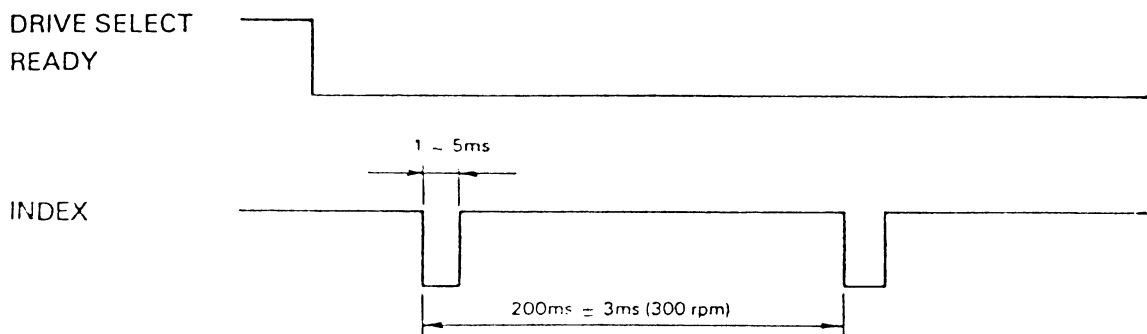
(5) Write timing



(6) WRITE DATA timing



(7) INDEX timing



POWER SUPPLY INTERFACE

Power Supply Specifications

The DC power (+12V, +5V) shown in Specification (2) of Section 3-2 is required by the power supply. There are four power lines (+12V, +5V, and the two return lines).

Frame Ground

The frame ground and signal ground are connected through a capacitor and a resistor. The values are as follows:

$R = 100\text{ k}\Omega$ $C = 0.01\text{ }\mu\text{F}$

Connect the frame ground where the AC ground and DC ground are one point connected in the host system.

Power Supply Sequence

- (1) The power ON sequence is not specified. However, the time in which the supplied power voltage rises up to 90% of the specified value, should be set to 100 ms or less.
- (2) If the drive is in a status other than write operation, and the DC power is disconnected, the disk and the data stored on the disk are not destroyed. However, its contents will be destroyed if the WRITE GATE is not set to high level.

INTERFACE CONNECTOR AND PIN ARRANGEMENT

Interface Connector

- (1) DC power connector

	Drive side	Host side
Connector/housing	AMP 172349-1 or equivalent	AMP 1-480424-0 or equivalent
Pin	—	AMP 60619-1 or equivalent

- (2) Interface signal connector

	Drive side
Connector	Card Edge Connector (Fig. 8-2)

Pin Arrangement

The arrangement of each pin is shown Fig. 7-1. This diagram shows the back of the drive.

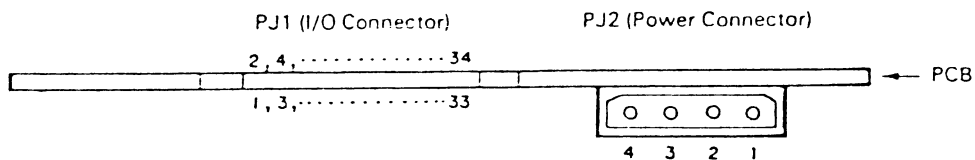


Fig. 7-1 Pin Arrangement

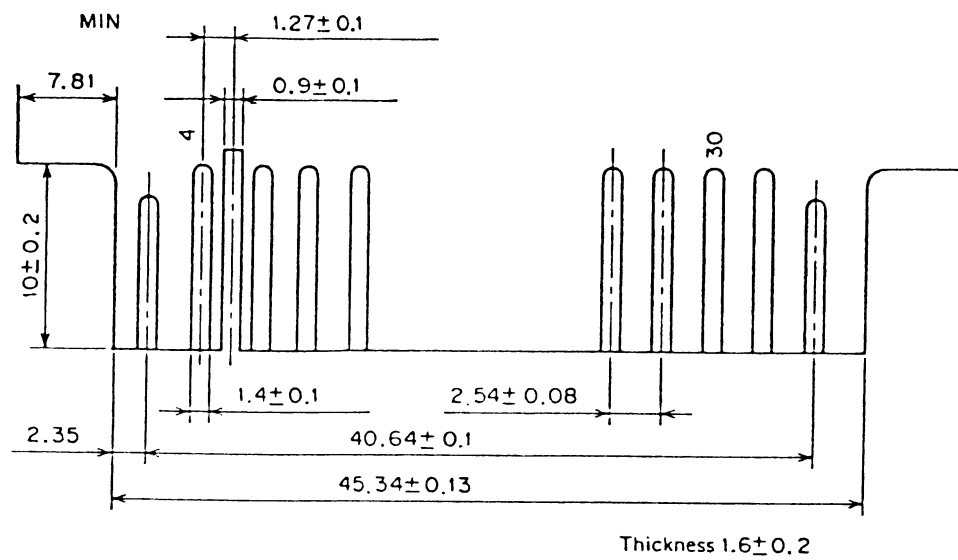


Fig. 7-2 Card Edge Connector

(1) DC Power connector

Pin number	Signal
1	+12V DC
2	+12V RETURN
3	+5V RETURN
4	+5V DC

(2) Interface signal connector

Pin number	Signal	Pin number	Signal
2	OPEN	1	GND
4	IN USE	3	GND
6	DRIVE SELECT 3	5	GND
8	INDEX	7	GND
10	DRIVE SELECT 0	9	GND
12	DRIVE SELECT 1	11	GND
14	DRIVE SELECT 2	13	GND
16	OPEN	15	GND
18	DIRECTION SELECT	17	GND
20	STEP	19	GND
22	WRITE DATA	21	GND
24	WRITE GATE	23	GND
26	TRACK 00	25	GND
28	WRITE PROTECT	27	GND
30	READ DATA	29	GND
32	SIDE SELECT	31	GND
34	READY	33	GND

GND: SIGNAL GROUND

SHORT PLUG AND FRONT LED

Short Plug

The arrangement of each pin is shown Fig.

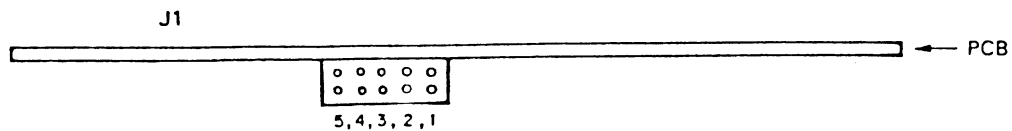


Fig. 8-1 Short Plug

This diagram shows the side of the drive.

Note: Position 1 through 5 of the "J1" are designated as follows.

- POS. 1: Connect the termination resistors when closed
- POS. 2: Configure the drive as "DRIVE 0" when closed
- POS. 3: Configure the drive as "DRIVE 1" when closed
- POS. 4: Configure the drive as "DRIVE 2" when closed
- POS. 5: Configure the drive as "DRIVE 3" when closed

Front LED

The front LED lights when the DRIVE SELECT signal selected by the short plug is set to low level.

Functions of Test Points

The following ten test points (with two GND) are provided on the control board, each of which is used in observing the waveform for FDD adjustment or check.

(1) TP1, TP2 (pre-amp output) and TP3 (analog GND)

These are the test points of the read amp output.

The signal from the head, after being amplified in level about 200 times by the pre-amp, and then filtered out by an LPF, after which it can be observed at test points TP1 and TP2. TP1 and TP2 are in 180° anti-phase to each other.

For accurate waveform observation, it is necessary to add the signals of both channels together (the signal of the one channel is inverted in phase) to observe these signals as one waveform using an oscilloscope with two channels. TP3 is used in grounding the oscilloscope.

TP1 and TP2 are used in checking the read/write head for its different characteristics or in checking and adjusting the tracking alignment, the index burst timing.

(2) TP4 (read data signal)

This is the test point of the read data pulse. The inverted READ DATA signal appears here.

In FM mode, a data signal with 2F or 1F period is observed, while in MFM mode, a data signal with 2F, 1.5F or 1F period is observed. (See Table 106.)

This test point is used in check and adjustment of asymmetry.

(3) TP5 (Digital GND)

(4) TP6 (index sensor)

This is the test point of the index sensor photo-transistor output after it passes through the Schmitt inverter. Thus the inverted output signal appears at this test point.

TP6 is used in the following checks and adjustments.

1. Check and adjust disk rotating speed
2. Check and adjust index burst timing
3. For external trigger check and adjust tracking alignment

(5) TP7 (index sensor)

This is the test point of the index sensor photo-transistor output. A waveform with soft leading and trailing edges appears here, since the sensor output signal is taken out before flowing across the Schmitt inverter. Here it is necessary to check that the output voltage of the index sensor is normal (with no waveform split).

Note: Use TP6 in check and adjustment of index burst timing since the index burst timing may deviate according to its relevant manner of triggering.

(6) TP8 (write protect sensor)

This is the test point of the write protect sensor photo-transistor output. The inverted WRITE PROTECT output signal appears here. With a disk in which a measure for write protection is taken (its notches are masked), it becomes high level.

The voltage at this test point should be more than 3 V in the write protect state and less than 0.5 V in the write enable state (the notches are open).

This test point is used in check and adjustment of the write protect sensor.

(7) TP9 (Disk-in sensor)

This is the test point of the disk-in sensor photo-transistor output.

This signal becomes high level when a disk is inserted into the FDD.

(8) TP10 (track 00 sensor)

This is the test point of the track 00 sensor photo-transistor output. The voltage at this test point should be within the range shown in Fig. 107.

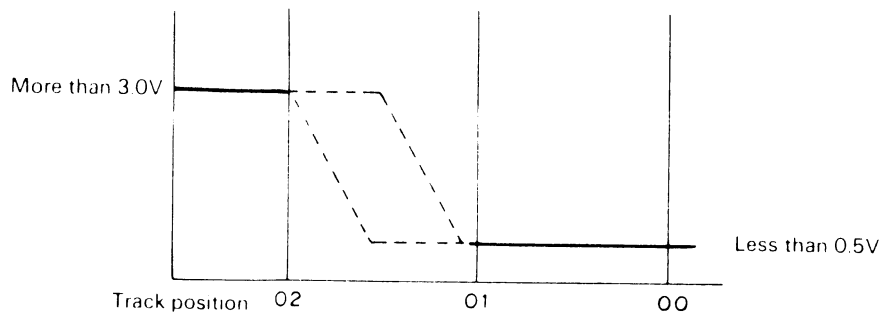


Fig. 107

Adjust so that the level of the sensor output changes between track 01 (Low level) and track 02 (High level).

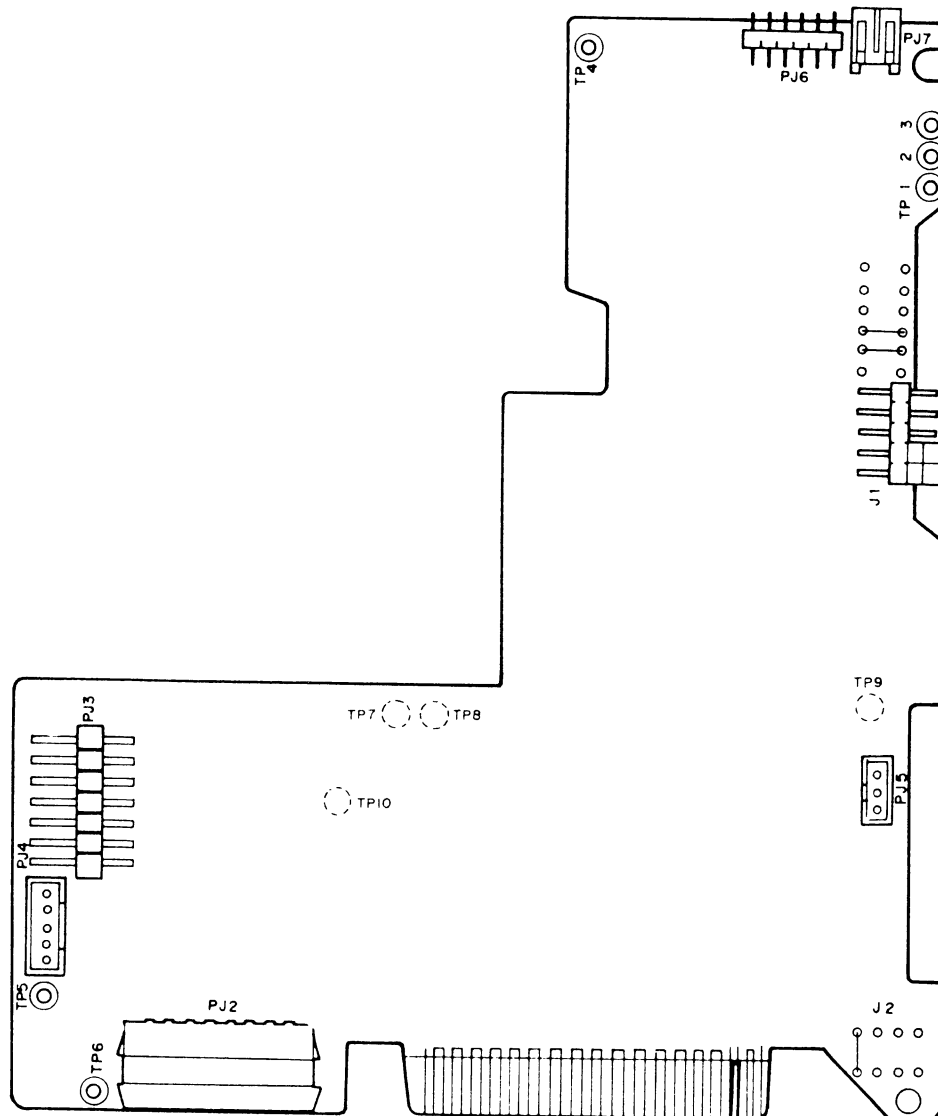


Fig. 108 Test points and connectors on the control PC board ass'y

Check and Adjustment

Adjustment of Veil Position (For F-502II)

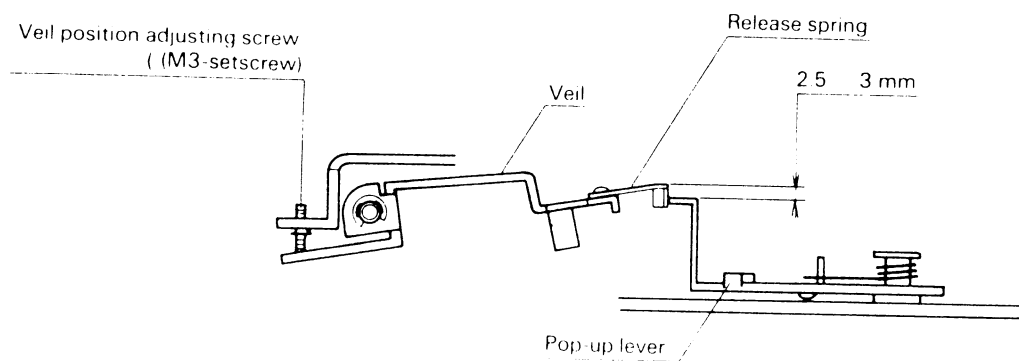
When the clamp base plate ass'y is replaced or when the machine is repaired, adjust the position of the veil as follows:

(1) Tools

- ① Hex. wrench for M1.5
- ① Screw lock adhesive

(2) Check and adjustment procedure

1. Lift the door lever (Fig. 408) to release the lock.
(The door lever should be kept opened.)
2. Load the work disk (do not close the door lever).
3. Turn the veil adjusting screw so that the distance between the release spring and pop up lever when they start moving is 2.5 ~ 3 mm (Fig. 301).
4. If the value specified in item 3 cannot be obtained, adjust the veil adjusting screw.
5. Apply screw lock to the veil adjusting screw.
6. For setscrew mounting, refer to item 1-2-1.



Adjustment of Clamp Support Plate Position

When the following parts are replaced or when the machine is serviced, adjust the position of the clamp support as follows:

- Clamp base plate ass'y
- Clamper ass'y
- DD motor ass'y

(1) Tools

- ① Phillips screwdriver for M2.5
- ② Screw lock adhesive

(2) Adjustment (This adjustment is not needed on F-502LII Rev.B.)

1. Push down the door lever (Fig. 408) to lock. In case of F-502LII, set the pop-up lever to the disk insertion position (Fig. 409) and set the front lever as shown in the right figure to lock.
2. Loosen two clamp support mounting screws.
3. Adjust the position of the clamp support and align the holes in the clamper guide and clamper shaft.
4. Tighten the screws to the specified torque and apply a small amount of screw lock adhesive. See Fig. 302.

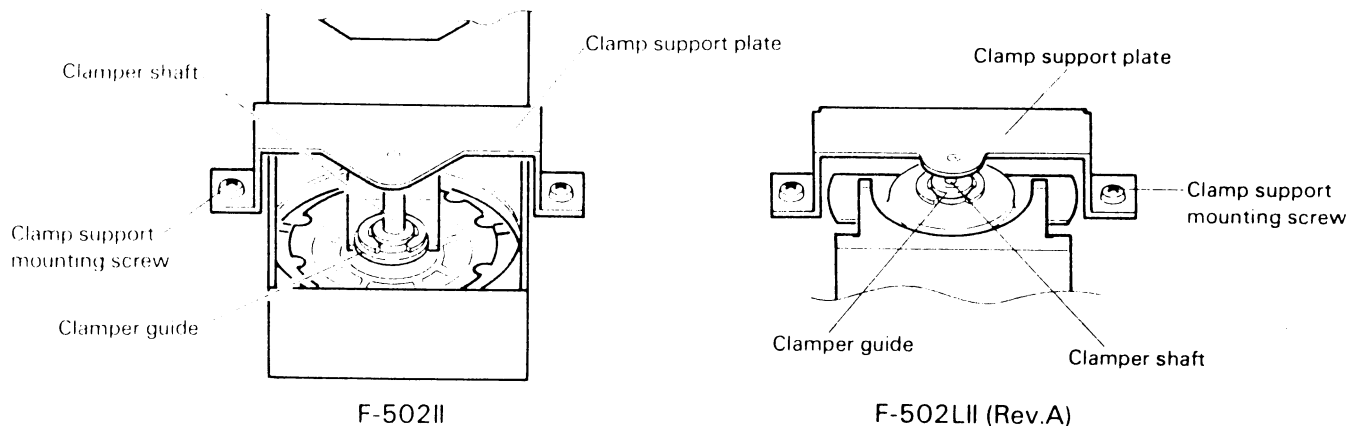


Fig. 302

Check of Write Protect Sensor

When replacing the following assemblies, be sure to check the write protect sensor.

- DD motor ass'y
- Write protect sensor ass'y

(1) Measuring instruments and jigs

- ① Max. media jig
- ② Digital voltmeter or oscilloscope
- ③ FDD tester

(2) Check procedure

1. Connect the digital voltmeter or oscilloscope to test point TP8 on the control PC board.
Setting of oscilloscope: DC 1 V/div.
2. Insert the max. media jig at the position where notch A is on the path of the light from the write protect sensor.

3. Supply power to the FDD, then check that the voltage at TP8 is within the following range:
Voltage at TP8 when notch A is on the light path: Less than 0.5V
4. Shift the max. media jig to the position where notch B is on the path of the light.
5. Supply power to the FDD, then check that the voltage at TP8 is within the following range:
Voltage at TP8 when notch B is on the light path: More than 3.0V
6. When it is not within the specified range, check whether or not there is foreign matter on the light path. If so, remove it. If not, replace the write protect sensor ass'y in accordance with item 4-11.

Check of Disk-in Sensor

When replacing the disk-in sensor ass'y, be sure to check the disk-in sensor.

(1) Measuring instruments

- ① Work disk
- ② Digital voltmeter or oscilloscope
- ③ FDD tester

(2) Check procedure

1. Connect the digital voltmeter or oscilloscope to test point TP9 on the control PC board ass'y.
Setting of oscilloscope: DC 1V/div.
2. Supply power to FDD, then check that the voltage at TP9 is within the following range:
Voltage at TP9: Less than 0.5V
3. Insert the work disk and supply power to FDD, then check that the voltage at TP9 is within the following range:
Voltage at TP9 when inserted work disk: More than 3V
4. When it is not within the specified range, check whether or not there is foreign matter on the light path. If so, remove it. If not, replace the disk-in sensor ass'y in accordance with item 4-14.

Check and Adjustment of Disk Rotating Speed

The rotating speed of the DD motor has been adjusted before the DD motor ass'y is built in. When replacing or repairing this ass'y check and adjust the disk rotating speed according to the following procedure:

(1) Measuring instruments, and tools

- ① Small screwdriver
- ② Frequency counter
- ③ Work disk
- ④ FDD tester

(2) Check and adjustment procedure

1. Connect the frequency counter to TP6 and TP5.
2. Load the work disk and rotate the DD motor.
3. Set the head to track 00.
4. Check that separation between pulses at TP6 is within the following range:
Pulse separation at TP6: 200 ± 3 ms
5. When the pulse separation is not within the specified range, adjust the variable resistor (see Fig. 412) on the servo PC board of the DD motor ass'y so that it is set to around the center value of the specified range.

Check and Adjustment of Head for Touching with Disk

When replacing or repairing the following parts or assemblies, check and adjust the head for touching with the disk according to the following procedure:

○ Head carriage ass'y

(1) Measuring instruments and tools

- ① Oscilloscope
- ② FDD tester
- ③ Work disk

(2) Check and adjustment procedure

1. Connect the oscilloscope to TP1 or TP2 (pre-amp output).
Setting of oscilloscope: AC 0.2 V/div., 20 msec/div.
 2. Load the work disk and rotate the DD motor.
 3. Move the head to track 39.
 4. Select the side 0.
 5. Write one cycle of a 2F signal, then set the FDD in reproduction mode.
 6. Measure the average read level for the above one cycle.
 7. Pressing the upper section of the head arm very lightly (10 ~ 20 gram), execute step 5 and measure the read level as in step 6.
 8. Check that the average read level at step 6 is more than 80% of the read level at step 7.
 9. Select the side 1 and repeat items 5 ~ 8.
 10. Move the head to track 00, then execute steps 4 ~ 9.
 11. If the value specified in item 6 cannot be obtained, loosen the veil adjusting screw (Fig. 408) (by about 90°) and check again. After re-adjustment, be sure to check and adjust the veil position referring to item 3-1. (For F-502II)
 12. When the requirement in step 6 is not met even by executing step 11, the following causes can be assumed.
 - a. Disk defective:
When the disk or jacket is deformed or damaged, replace the work disk.
 - b. Head carriage ass'y defective:
Replace it in accordance with item 4-9.
- Note:** When pressing the head arm, be careful not to lower the rotating speed of the DD motor by pressing it with excessive force.

Check and Adjustment of Asymmetry

When replacing the following assemblies, check and adjust the asymmetry according to the following procedure:

○ Head carriage ass'y

○ Control PC board ass'y

(1) Measuring instruments and tools

- ① Oscilloscope
- ② Alignment disk
- ③ FDD tester
- ④ Small screwdriver
- ⑤ Work disk

(2) Check and adjustment procedure

1. Connect the oscilloscope to TP4 on the control PC board.
Setting of oscilloscope: DC 1 V/div.
2. Load the alignment disk and rotate the DD motor.

3. Move the head to track 39.
4. Select the side 0.
5. Check that the asymmetry meets the following value:
Asymmetry (with alignment disk): Less than $0.6 \mu\text{sec}$.
Arrange so that three read data pulses can be observed on the oscilloscope screen. Then, check so that the split (asymmetry) width of the second read data pulse waveform from the trigger pulse.
6. Remove the alignment disk and load the work disk.
7. Write a 1F signal on track 39 and measure the split (asymmetry) width of the waveform as shown in Fig. 303.
8. Check that the asymmetry meets the following value:
Asymmetry of 1F signal on track 39: Less than $0.6 \mu\text{sec}$
9. Select the side 1 and repeat items 5 ~ 8.
10. When the asymmetry does not meet the specified value, the following causes can be assumed.
 - a. Disk defective:
Replace the work disk.
 - b. With high density of leak
magnetic flux around FDD:
When magnetic flux sources such as magnet, transformer, CRT, magnetized iron, etc. are near the FDD, place them far away, then carry out the asymmetry check and adjustment once again.
 - c. Head defective:
Replace the head carriage ass'y in accordance with item 4-9.
 - d. Read amp defective:
Replace the control PC board ass'y in accordance with item 4-3.

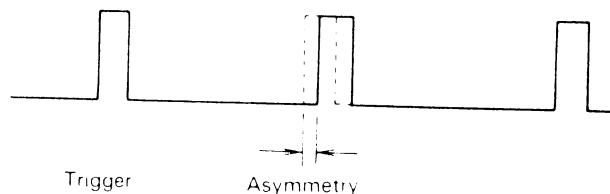


Fig. 303

Check of Read Level and Resolution

When replacing the following assemblies, check the read level and resolution.

- Head carriage ass'y
- Control PC board ass'y
- (1) Measuring instruments
 - ① Oscilloscope
 - ② FDD tester
 - ③ Reference disk

(2) Check procedure

1. Connect the two channel oscilloscope to TP1 and TP2 (each for pre-amp output) on the control PC board.

Setting of oscilloscope: AC 0.1 V/div, 2 ~ 5 μ s/div.

Set channels CH1 and CH2 both to the above range, invert the signal of either channel and add the signal of both channels together.

2. Load the reference disk and rotate the DD motor.
3. Move the head to track 39.
4. Select the side 0.
5. Write one cycle of a 2F signal and measure the average read level. (See Fig. 304)

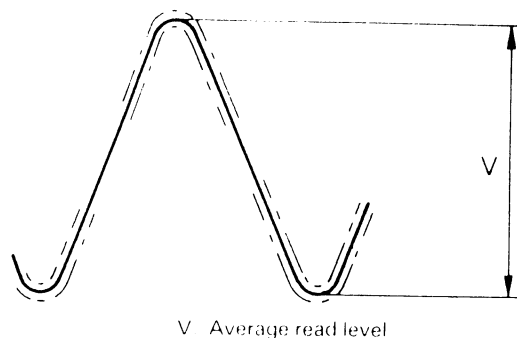


Fig. 304

6. Put the read level in step 5 and the calibration value of the reference disk in the following equation, then calculate the true value of the read level.

(True value of read level = average read level + calibration value)

7. Check that the true value of the read level meets the following value:

Read level of 2F signal on track 39: More than 400 mVp-p

8. Write one cycle of a 1F signal with the above condition maintained, measure the average read level and find the true value of the read level in accordance with step 6.

9. Put the read levels of 1F and 2F signals in the following equation, and resolve.

$$\text{Resolution (true value)} = \frac{\text{read level of 2F signal (true value)}}{\text{read level of 1F signal (true value)}} \times 100\%$$

10. Check that the resolution meets the following value:

Resolution on track 39: More than 60%

11. Select the side 1 and repeat items 5 ~ 10.

12. When the true value of the read level in step 7 and/or the result in step 10 does not meet the specified values, the following causes can be assumed.

- a. Reference disk defective:

When the disk or the jacket is deformed or damaged, replace the reference disk.

- b. Improper rotation of disk:

Check and adjust the rotating speed of the disk in accordance with item 3-5.

- c. Improper touching of head with disk:

Check and adjust the head for touching with the disk in accordance with item 3-6.

- d. Head defective:

Replace the head carriage ass'y in accordance with item 4-9.

- e. Control PC board read/write amp defective:

Replace the control PC board in accordance with item 4-3.

13. Remove the reference disk.

Check and Adjustment of Tracking Alignment

When replacing the following assemblies or part, be sure to check and adjust the tracking alignment.

- Head carriage ass'y
- Stepping motor ass'y
- Steel belt
- DD motor ass'y
- Clamper ass'y

(1) Measuring instruments and tools

- ① Two channel oscilloscope
- ② Alignment disk
- ③ FDD tester
- ④ Phillips screwdriver for M3
- ⑤ Screw lock adhesive
- ⑥ Thermometer and hygrometer

(2) Check procedure

Check and adjust the tracking alignment at normal room temperature (about 23°C) and humidity (about 50%). Avoid check and adjustment under extreme environmental condition even when temperature and humidity are within the permissible ranges specified for the FDD and disk, because tracking adjustment may not be done exactly under such conditions. In addition, when the FDD and the alignment disk (CE disk) are left for more than two hours, until their temperatures are balanced with the normal environmental temperature, higher accuracy can be obtained. It is recommended that adjustment be made with the FDD in the same position as when housed in the system.

Similarly, it is advisable to use an alignment disk which has been checked for calibration (provided with correction data) with the standard drive. In addition, note that use of an alignment disk which has exceeded its life may cause inaccurate adjustment.

1. Connect the two channel oscilloscope to TP1 and TP2. Connect the external trigger input to TP6 (index sensor output).

Setting of oscilloscope:

CH1: AC 0.5 V/div., 20 msec/div.

CH2: AC 0.5 V/div., 20 msec/div., inverted

Others: Both outputs added together and external trigger used on the (+) trigger setting.

2. Rotate the DD motor and load the alignment disk.
3. Select the side 0
4. Move the head to alignment check track 16.
5. Check that the burst signal wave form in Fig. 305 is observed. If the burst signal wave form is not observed, the tracking is out of alignment.
Adjust the tracking alignment.

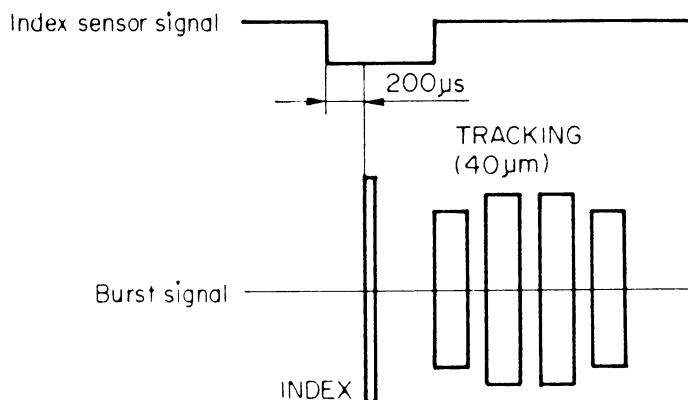


Fig. 305

6. After stepping in the head by one or several tracks from the original track position, step it out by the same number of steps to return it to the set track position, then measure values B1 to B4. Calculate the off-track amount as follows. (See Fig. 306)

$$\text{Off-track amount } (\mu\text{m}) = 2K \cdot (B2 - B3) / (B2 + B3 - B1 - B4)$$

$$K = 40 \mu\text{m}$$

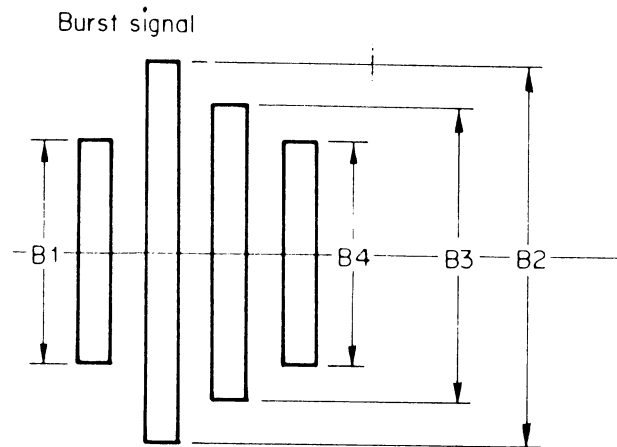


Fig. 306

7. After stepping out the head by one or several tracks from the original track position, step it in by the same number of steps to return it to the set track position, then measure values B1 to B4. Calculate the off-track amount in the same manner as item 6.
8. Select the side 1 and repeat items 4 ~ 7.
9. Check that the respective off-track amounts in items 6 and 7 are within the following range. when they are not within the specified range, adjust the tracking according to the adjustment procedure.

$$\text{Off-track amount } (\mu\text{m}) = \pm 40 \mu\text{m}$$

(3) Adjustment procedure

1. Loosen the stepping motor setscrews A and B. (Fig. 412)
2. Move the head to track 16.
3. Manually rotate the stepping motor body and monitor the burst signal waveform. (Fig. 305) When the burst signal waveform cannot be received, check with track 14 or 18.
Note: To align with the excited phase of the stepping motor, be sure to move the head to an odd number track.
4. When the burst signal waveform is located, rotate the stepping motor body so that the right and left peak points of B2 and B3 become the same as the calibrated value. Then, secure the motor.
5. Step the head in and out repeatedly, and fine adjust the installation of the stepping motor so that the alignment error (difference between B2 and B3) of the burst signal waveform is minimized when the head is returned to the alignment check track inward and outward. When hystereses occur in inwards and outwards trackings, adjust so that both hystereses are equal.
6. Perform the same procedures on sides 0 and 1 so that the alignment error of the sides 0 and 1 becomes minimum.
7. Tighten the stepping motor retaining screws A and B in this order to a specified torque and repeat adjustment so that the alignment error is within $\pm 40 \mu\text{m}$.
8. Apply screw lock to the stepping motor retaining screws.
9. Remove the alignment disk.
10. Adjust the track 00 sensor, referring to item 3-10.
11. Adjust the track 00 stopper, referring to item 3-11.

Check and Adjustment of Track 00 Sensor

When adjusting or replacing the following assemblies or part, check and adjust the track 00 sensor.

- Head carriage ass'y
- Stepping motor ass'y
- Steel belt
- Track 00 sensor ass'y

(1) Measuring instruments and tools

- ① Oscilloscope
- ② Digital voltmeter
- ③ Alignment disk
- ④ FDD tester
- ⑤ Phillips screwdriver for M3
- ⑥ Screw lock adhesive

(2) Check procedure

1. Set up the oscilloscope referring to the steps in 3-9 "Check of tracking alignment", step 1.
2. Move the head to alignment check track 16 and check that a burst signal is received as shown in Fig. 305.
3. If the correct burst signal cannot be received, adjust as shown in "Adjustment".
4. Remove the alignment disk.
5. Connect the digital voltmeter or oscilloscope to TP10.
Setting of oscilloscope: DC 1 V/div.
6. Start the DD motor and load the work media.
7. Check that the voltage at TP10 is as shown in the table when the head is moved to the specified position.

Track 00 ~ 01	Less than 0.5 V
Track 02 or subsequent tracks	More than 3.0 V

Table 307

If the voltage at TP10 is not as specified in Table 307, adjust referring to "Adjustment".

8. Check that the voltage waveform at TP10 is not very much disturbed at HIGH-LOW switching when the head is repeatedly moved between tracks 00 and 04.

(3) Adjustment procedure

1. Connect the FDD tester with the tester connected, turn its power off once.
2. Connect the oscilloscope, referring to 3-9 "Check of tracking alignment", step 1.
3. Loosen the track 00 sensor mounting screw (Fig. 412) and fully move the track 00 sensor to the DD motor side.
4. Turn the FDD tester on, start the DD motor and load the alignment disk.
5. Repeat step in operation until burst signal waveform is observed (Fig. 305).
6. Fully move the track 00 sensor outward.
7. Step the head out by 15 tracks outward (track 01 position).
8. Measure the voltage at TP10 with digital voltmeter or oscilloscope.
9. Position the track 00 sensor so that the voltage at TP10 is "Low" level (less than 0.5 V).
10. Step the head in by 1 track (track 02 position).
11. Check that the voltage at TP10 is "High" level (more than 3 V).
12. If the correct voltage cannot be obtained, fine adjust the position of the track 00 sensor so that the voltage indicated in step 9 and 11 is obtained.
13. Tighten the mounting screw to the specified torque.

Check and Adjustment of Track 00 Stopper

When adjusting the tracking alignment or the track 00 sensor, be sure to check and adjust the track 00 stopper according to the following procedure:

(1) Measuring instruments and tools

- ① Pencil light (or flash light)
- ② FDD tester
- ③ Phillips screwdriver

(2) Check procedure

1. Remove the three mounting screws and the one collar of the control PC board ass'y.
2. Disconnect the two head connectors (PJ6), the front LED connector (PJ7) and the disk-in sensor connector (PJ5) from the control PC board ass'y and reverse the control PC board ass'y around 14-pin connector (PJ3). (See Fig.108)
3. Move the head to track 00. In this condition, check that there is a very small clearance between the stepping motor pulley pin and the track 00 stopper (for F-502II/F-502LII Rev.A) or between the carriage ass'y and the track 00 stopper screw (for F-502LII Rev.B). (See Figs. 408 ~ 410)
4. While directing the light of the pencil light (or flash light) onto the light receiver section (lower side) of the track 00 sensor, move the head outwards by one step (to track -01).
5. Check that the stepping motor pulley pin or the head carriage (F-502LII Rev.B) touches the track 00 stopper with a sound after which it remains in contact with the stopper.
6. As instructed in step 4, further move the head outwards by one steps (to track -02). At this time, check that the head carriage returns to its original position of track 00 with a very small clearance between the stepping motor pulley pin or the head carriage (for F-502LII Rev.B) and the track 00 stopper.
7. Move the head inwards and outwards repeatedly between track 00 and the track located several tracks inside. At this time, check that no striking sound occurs between the stepping motor pulley pin or the head carriage (for F-502LII Rev.B) and track 00 stopper.
8. Check by seeking track 39 that the pulley pin does not hit the track 00 stopper.
(only F-502II/F-502LII Rev.A)
9. When the requirements in step 3 ~ 8 are not met, adjust the track 00 stopper position according to the procedure in "Adjustment".

(3) Adjustment procedure

1. Set the head to track 00.
2. Loosen the mounting screw of the track 00 stopper. (only F-502II/F-502LII Rev.A)
3. Adjust the stopper or stopper screw (F-502LII Rev.B) to the position at which there is a very small clearance between the pulley pin or the head carriage and stopper. Then, tighten the mounting screw of the stopper to the specified torque.
4. Execute steps 3 ~ 8 in "Check".
5. Attach the control PC board in the reverse procedure to that when detached.

Check and Adjustment of Index Burst Timing

When adjusting or replacing the following assemblies, be sure to check and adjust the index burst timing.

- Head carriage ass'y
- DD motor ass'y
- Index sensor ass'y
- Control PC board ass'y
- Clamp base plate ass'y
- Clamper ass'y

(1) Measuring instruments and tools

- ① Two channel oscilloscope
- ② Alignment disk
- ③ FDD tester
- ④ Phillips screwdriver for M2.5
- ⑤ Screw lock adhesive

(2) Check procedure

1. Connect the CH1 and CH2 terminals of the two channel oscilloscope to TP6 (index sensor output) and TP1 or TP2 (pre-amp output) on the control PC board respectively.

Setting of oscilloscope:

CH1: DC 2 V/div., 50 μ sec/div.

CH2: AC 0.1 V/div., 50 μ sec/div.

Trigger: CH1 at (+) trigger setting

2. Rotate the DD motor and load the alignment disk. It is assumed that the tracking alignment has been adjusted correctly in item 3-9.
3. Set the head to track 16.
4. Measure "t" as shown in Fig. 308.

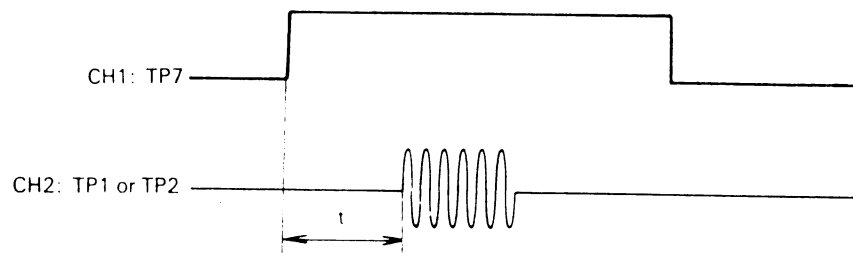


Fig. 308

5. Check that value of the index burst timing "t" is within the range shown below. If outside the range, adjust in accordance with the adjustment procedure.

Index burst timing "t" = 200 μ sec \pm 200 μ sec

(3) Adjustment procedure

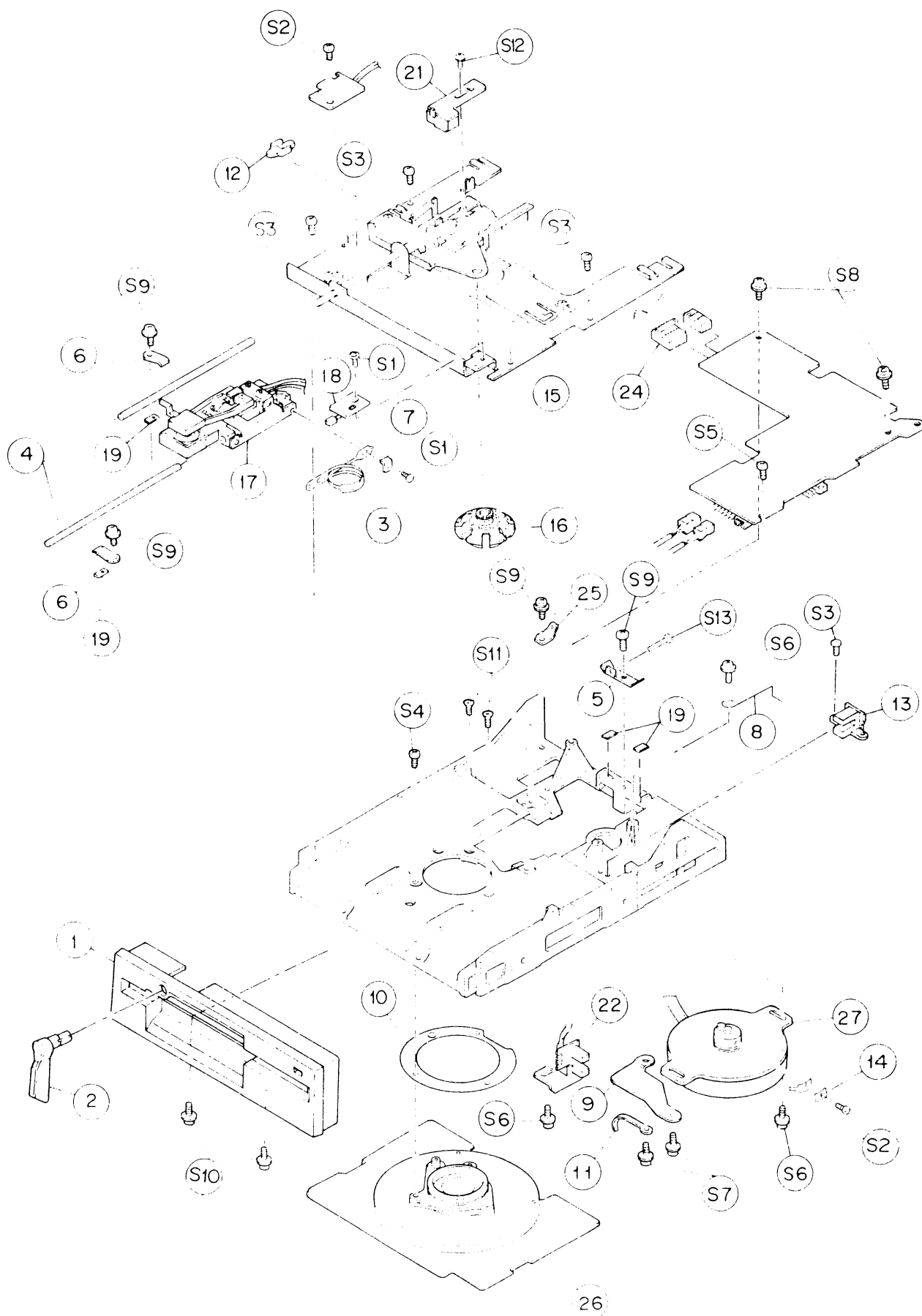
1. Loosen the mounting screw of the index sensor, then adjust the position of the index sensor so that the value of the index burst timing is within the specified range in step 5 in "Check". See Figs. 408 ~ 410.
2. Tighten the mounting screw to the specified torque, and execute steps 3 ~ 5 in "Check".
3. Apply a small amount of screw lock adhesive to the head of the mounting screw.
4. Check by TP7 that the output voltage of the index sensor is normal. (No waveform split should occur at "High" level of more than 3.0 V or at "Low" level of less than 0.5 V.)
5. Remove the alignment disk.

Note: In this check and adjustment, take care not to allow strong external light to strike the index sensor.

Mechanism Parts List and Exploded View of F-502LII

NO.	PARTS NO.	DESCRIPTION	QTY	REMARKS
1	077F1JC-1001A	FRONT PANEL (BLACK)	1	
1	080F3JC-1001A	FRONT PANEL (BEIGE)	1	
2	078F7JC-1007A	FRONT LEVER (BLACK)	1	
2	078F8JC-1007A	FRONT LEVER (BEIGE)	1	
3	051F1JC-1053A	STEEL BELT	1	
4	051F1JC-1057A	RAIL	2	
5	078F7JC-1015A	RAIL RETAINER A	1	
6	078F7JC-1016A	RAIL RETAINER B	2	
7	078F7JC-1013A	STEEL BELT RETAINER	1	
8	078F7JC-1013A	SHIELD WIRE HOLDER	1	
9	051F1JC-1069A	SHIELD PLATE D	1	
10	051F1JC-1072A	P-ADJUSTMENT PLATE	1	ADJ. PARTS
11	051F1JC-1076A	WIRE HOLDER	1	
12	056F1JC-1079A	WP SOCKET	1	
13	078F7JCSEP02A	DISK-IN SENSOR ASS'Y	1	
14	051F1JC-1084A	PULLEY WASHER	1	
15	078F7JCS1008A	CLAMP BASE PLATE ASS'Y	1	
16	078F7JCU1014A	CLAMPER ASS'Y	1	
17	078F7JCS1051A	HEAD CARRIAGE ASS'Y	1	
18	078F7JCSEP03A	FRONT LED ASS'Y	1	
19	056F1JC-1104A	P-WASHER	4	ADJ. PARTS
20	077F1JCSEP02A	W/P SENSOR ASS'Y	1	
21	077F1JCSEP01A	INDEX SENSOR ASS'Y	1	
22	051F1JCSEP04B	TRACK 00 SENSOR ASS'Y	1	
23	078F1JCSEP01A	CONTROL PCB ASS'Y	1	
24	051F1JCSW02A	8 PIN CONNECTOR HOUSING	1	
25	EJ0008-01MS	FASTEN TERMINAL	1	
26	078F5JC-EM01A	DD MOTOR ASS'Y	1	
27	078F5JC-EM02A	STEPPING MOTOR ASS'Y	1	
S-1	112-30714	SCREW 2 × 3	2	
S-2	SPNZ25-03042	SCREW 2.5 × 3	2	
S-3	SPNZ25-05042	SCREW 2.5 × 5	4	
S-4	SPNZ30-05042	SCREW 3 × 5	1	
S-5	SPNZ30-06042	SCREW 3 × 6	1	
S-6	SENB30-06042-3	SCREW 3 × 6 × 8 WS	3	
S-7	SENB30-08042-3	SCREW 3 × 8 × 8 WS	2	
S-8	SENB30-06042	SCREW 3 × 6 S	2	
S-9	SENA30-06042	SCREW 3 × 6 S	4	
S-10	SENF30-08042-3	SCREW 3 × 8 × 8 S	2	
S-11	SPSZ30-06042	SCREW 3 × 6	2	
S-12	SENF20-08042	SCREW 2 × 8 × 5 S	1	
S-13	SP3Z20-07042	SCREW 2 × 7	1	

Mechanism Exploded View of F-502LII



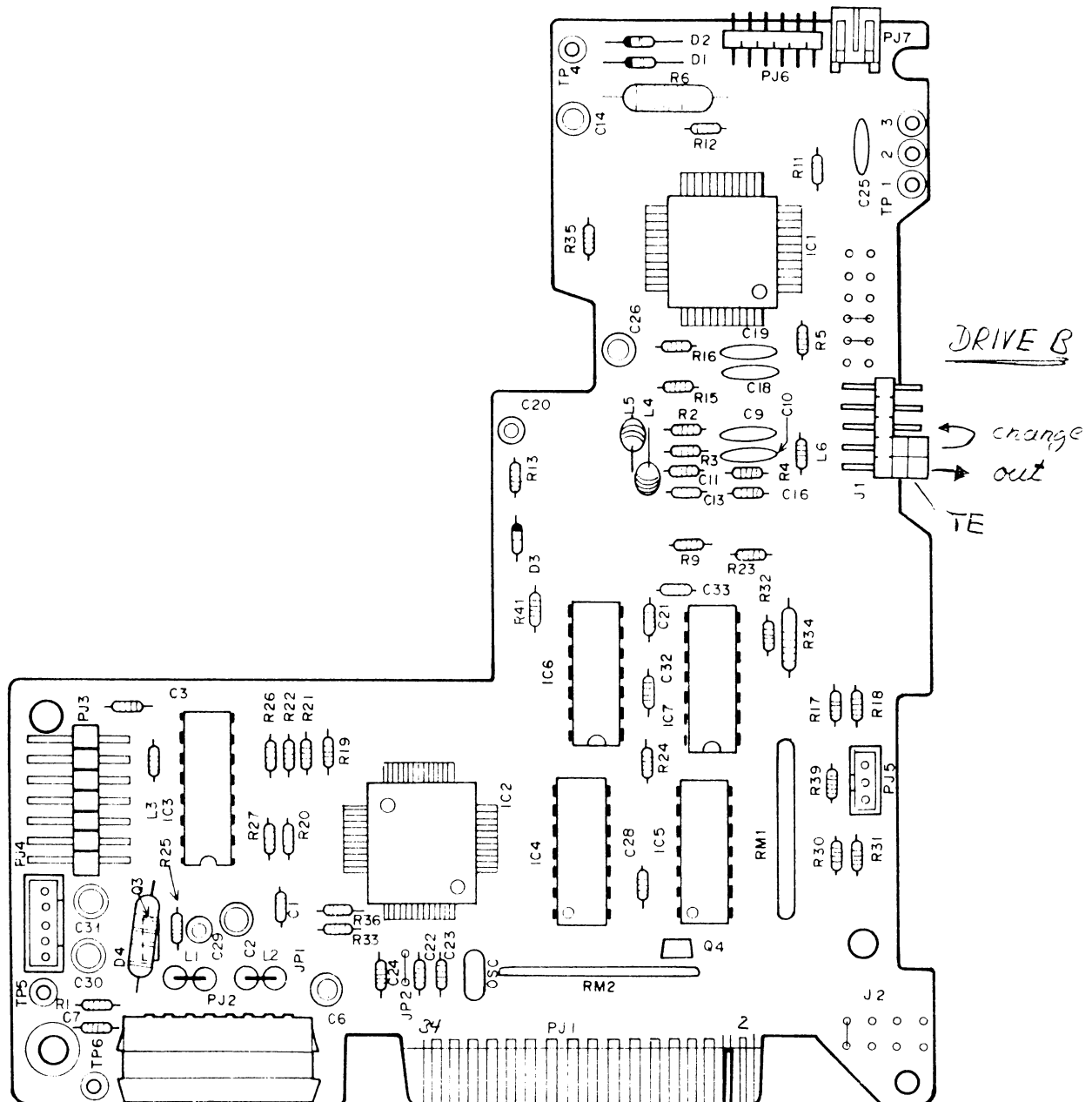
Electronical Parts List of Control PC Board Ass'y

The components of the control PC board ass'y are listed below.

PARTS NO.	DESCRIPTION	QTY	REMARKS
QCX20185	R/W IC. CX20185	1	IC1
QTC8600SF	IC. TC8600SF	1	IC2
QTD62003P	IC. TD62003P	1	IC3
EI74T38	IC. 7438	2	IC4, 5
Q74LS04	IC. 74LS04	2	IC6, 7
Q2SA950-X	TR. 2SA950	1	Q3
QRN1201-X	TR. RN1201	1	Q4
Q1S1588-X	DIODE 1S1588	2	D1, 2
Q1SS176-X	DIODE 1SS176	1	D3
QS5566B	DIODE S5566B	1	D4
O51F1JC-EZ04A	F-INDUCTOR BL02RN2-R62	2	L1, 2
O51F5JC-EL01A	INDUCTOR 100 μ H	1	L3
O80F1JC-EL02A	INDUCTOR 470 μ H	2	L4, 5
O68F1JC-EL01A	INDUCTOR 47 μ H	1	L6
CCK50B561KYJ-X	CAPACITOR 560PF/50V	1	C13
CCK50S300J-X	CAPACITOR 30PF/50V	2	C22, 23
CCXK25G223ZYJ-X	CAPACITOR 0.022 μ F/25V	5	C1, 3, 24, 28, 33
CCK50S101K-X	CAPACITOR 100PF/50V	1	C11
CCK16Y472MYJ-X	CAPACITOR 4700PF/16V	1	C21
O65F1JC-EZ10A	CERAMIC RESONATOR 4MHZ	1	OSC
CCK12S104MY-X	CAPACITOR 0.1 μ F/25V	1	C25
CCK16S473MY-X	CAPACITOR 0.047 μ F/16V	4	C9, 10, 18, 19
CCK16C103NYJ-X	CAPACITOR 0.01 μ F/16V	2	C7, 32
CCK16Y222MYJ-X	CAPACITOR 2200PF/16V	1	C16
CEX16C220M-X	CAPACITOR 22 μ F/16V	2	C2, 14
ECE0011C330-X	CAPACITOR 33 μ F/10V	2	C6, 26
ECE0011H3R3-X	CAPACITOR 3.3 μ F/50V	2	C20, 29
CEX25A100M-X	CAPACITOR 10 μ /25V	2	C30, 31
RDNT181J-X	RESISTOR 1/6W 180 Ω	2	R5, 35
RDNT221J-X	RESISTOR 1/6W 220 Ω	2	R17, 20
RDNT391J-X	RESISTOR 1/6W 390 Ω	3	R2, 3, 24

PARTS NO.	DESCRIPTION	QTY	REMARKS
RDNT471J-X	RESISTOR 1/6W 470 Ω	1	R23
RDNT102J-X	RESISTOR 1/6W 1K Ω	5	R25, 26, 27, 32, 33
RDNT122J-X	RESISTOR 1/6W 1.2K Ω	1	R21
RDNT222J-X	RESISTOR 1/6W 2.2K Ω	2	R4, 41
RDNT392J-X	RESISTOR 1/6W 3.9K Ω	2	R9, 11
RDNT472J-X	RESISTOR 1/6W 4.7K Ω	1	R12
RDNT103J-X	RESISTOR 1/6W 10K Ω	6	R16, 19, 30, 31, 36, 39
RDNT303J-X	RESISTOR 1/6W 30K Ω	1	R15
RDNT473J-X	RESISTOR 1/6W 47K Ω	2	R18, 22
RDNT104J-X	RESISTOR 1/6W 100K Ω	2	R1, 13
RSEE131J	RESISTOR 1W 130 Ω	1	R6
RDCT151J-X	RESISTOR 1/4W 150 Ω	1	R34
056F1JC-EZ01A	R-PACK 150 Ω X 8 1/8W	1	RM1
065F1JC-EZ09A	R-PACK 1K Ω X 5 1/8W	1	RM2
068F1JC-EJ08A	SHORT PLUG	2	J1
078F5JC-EJ01A	SHORT PIN 10PIN	1	J1
XF06C025	JUMPER WIRE	3	J1, J2
XF06C050	JUMPER WIRE	1	JP2
EJ0012A04MR	POWER CONNECTOR 4PIN	1	PJ2
EJ0020A	BAND	1	PJ2
068F1JC-EJ01A	2PIN CONNECTOR MALE (LED)	1	PJ7
078F5JC-EJ01A	4PIN CONNECTOR (DD MOTOR)	1	PJ4
068F1JC-EJ06A	3PIN CONNECTOR (DISK-IN)	1	PJ5
068F1JC-EJ02A	12PIN CONNECTOR (HEAD)	1	PJ6
068F1JC-EJ03A	14PIN CONNECTOR (SENSOR)	1	PJ3

Location of Electronical Parts



W-D Controller

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WESTERN DIGITAL SUPER BIOS USER'S GUIDE

Section 1.0: General

This document defines features and use of the Western Digital Super BIOS. The Super BIOS part number is 62-000094-031. The Super BIOS will operate on the following boards.

WD1002S-WX2	ST506/412 (MFM) to XT Bus. 8" Thru-hole card. 5 MHz.
WD1002S-WX2A	ST506/412 (MFM) to XT Bus. 8" Thru-hole card. 5 MHz.
WD1002A-WX1	ST506/412 (MFM) to XT Bus. Half-slot, surface-mount card. 5 MHz.
WD1002-27X	ST506/412 (RLL) to XT Bus. Half-slot, surface-mount card. 7.5 MHz.

Section 2.0: Features

- * MFM Drive Tables

- * RLL Drive Tables

- * Auto-configuration

The user can enter and reset drive configuration parameters at format time. The parameters are written to cylinder 0, head 0, sector 1. No information is written to cylinder 0, head 0, sector 1 when static drive tables are used to format the drive.

- * Virtual Drive Formatting and Operation

The user should never run the IBM Advanced Diagnostics Format Drive option on the first virtual drive. Doing so will destroy the data on the second virtual drive when the format drive command is issued. For this mode of operation only one hard drive should be attached to the controller.

* Dual Controller Operation

The first controller must be set for BIOS address C800H and I/O address 320H. The second controller must be set for BIOS address CA00H and I/O address 324H. Only one hard drive should be attached to each controller if using DOS. Furthermore the virtual drive option should not be used.

* Bad Track Formatting

* Compatible with both XT and AT systems

The AT must have system BIOS #6181028 and #6181029 (1981-1984) for use with DOS 2.1 and system BIOS #6480090 and #6480091 (1985) for use with DOS 3.0, 3.1, and 3.2. Drives operating on the XT controller are not setup in the configuration memory of the AT.

The XT controller must be set for the first controller if it is the only Winchester controller in the AT. Also, the setup must be run to tell the AT there are 0 drives.

If the XT controller is to operate with an AT Winchester controller, then it must be set for second controller. The drive attached to the AT controller must be setup in configuration memory.

If there is no hard drive attached to the AT Winchester controller, then the XT controller is setup for first controller.

If two XT controllers are to operate in the AT than one is set for first and the other for second. Also, setup must be run to tell the AT there are 0 drives.

Section 3.0: MFM Drive Tables

Table 3	Table 2	Table 1	Table 0
615 Cylinders	615 Cylinders	306 Cylinders	612 Cylinders
4 Heads	2 Heads	4 Heads	4 Heads
450 RWC	450 RWC	153 RWC	450 RWC
450 WPC	450 WPC	0 WPC	450 WPC
11 EBL	11 EBL	11 EBL	11 EBL
5 CCB	5 CCB	5 CCB	5 CCB

RWC = Reduced write current.

WPC = Write precompensation.

EBL = Maximum correctable Error Burst Length.

CCB = Command Control Block option byte.

Section 3.1: BIOS address of MFM Drive Tables

Segment address = C800: (First controller) or,
CA00: (Second controller).

Offset address						
Table 3	Table 2	Table 1	Table 0	Definition		
:0073 67h	:0063 67h	:0053 32h	:0043 64h	Split cyl. (LSB)		
:0074 02h	:0064 02h	:0054 01h	:0044 02h	Split cyl. (MSB)		
:0075 04h	:0065 02h	:0055 04h	:0045 04h	Physical heads		
:0076 C2h	:0066 C2h	:0056 99h	:0046 C2h	RWC cyl. (LSB)		
:0077 01h	:0067 01h	:0057 00h	:0047 01h	RWC cyl. (MSB)		
:0078 C2h	:0068 C2h	:0058 00h	:0048 C2h	WPC cyl. (LSB)		
:0079 01h	:0069 01h	:0059 00h	:0049 01h	WPC cyl. (MSB)		
:007A 0Bh	:006A 0Bh	:005A 0Bh	:004A 0Bh	Error Burst Length		
:007B 05h	:006B 05h	:005B 05h	:004B 05h	CCB Option Byte		
:007C 67h	:006C 67h	:005C 32h	:004C 64h	Physical cyl. (LSB)		
:007D 02h	:006D 02h	:005D 01h	:004D 02h	Physical cyl. (MSB)		
:007E 00h	:006E 00h	:005E 00h	:004E 00h	Reserved		
:007F 00h	:006F 00h	:005F 00h	:004F 00h	Reserved		
:0080 00h	:0070 00h	:0060 00h	:0050 00h	Reserved		
:0081 00h	:0071 00h	:0061 00h	:0051 00h	Reserved		
:0082 00h	:0072 00h	:0062 00h	:0052 00h	Reserved		

Section 4.0: RLL Drive Tables

Table 3	Table 2	Table 1	Table 0
615 Cylinders	612 Cylinders	987 Cylinders	981 Cylinders
4 Heads	4 Heads	7 Heads	5 Heads
616 RWC	613 RWC	988 RWC	982 RWC
616 WPC	613 WPC	988 WPC	982 WPC
11 EBL	11 EBL	11 EBL	11 EBL
7 CCB	7 CCB	0 CCB	7 CCB

RWC = Reduced write current.

WPC = Write precompensation.

EBL = Maximum correctable error burst rate.

CCB = Command control block option byte.

Section 4.1: BIOS address of RLL Drive Tables

Segment address = C800: (First controller) or,
CA00: (Second controller).

Offset address						
Table 3	Table 2	Table 1	Table 0	Definition		
:00B5 67h	:00A5 64h	:0095 DBh	:0085 D5h	Split cyl. (LSB)		
:00B6 02h	:00A6 02h	:0096 03h	:0086 03h	Split cyl. (MSB)		
:00B7 04h	:00A7 04h	:0097 07h	:0087 05h	Physical heads		
:00B8 68h	:00A8 65h	:0098 DCh	:0088 D6h	RWC cyl. (LSB)		
:00B9 02h	:00A9 02h	:0099 03h	:0089 03h	RWC cyl. (MSB)		
:00BA 68h	:00AA 65h	:009A DCh	:008A D6h	WPC cyl. (LSB)		
:00BB 02h	:00AB 02h	:009B 03h	:008B 03h	WPC cyl. (MSB)		
:00BC 0Bh	:00AC 0Bh	:009C 0Bh	:008C 0Bh	Error Burst Length		
:00BD 07h	:00AD 07h	:009D 00h	:008D 07h	CCB Option Byte		
:00BE 67h	:00AE 64h	:009E DBh	:008E D5h	Physical cyl. (LSB)		
:00BF 02h	:00AF 02h	:009F 03h	:008F 03h	Physical cyl. (MSB)		
:00C0 00h	:00B0 00h	:00A0 00h	:0090 00h	Reserved		
:00C1 00h	:00B1 00h	:00A1 00h	:0091 00h	Reserved		
:00C2 00h	:00B2 00h	:00A2 00h	:0092 00h	Reserved		
:00C3 00h	:00B3 00h	:00A3 00h	:0093 00h	Reserved		
:00C4 00h	:00B4 00h	:00A4 00h	:0094 00h	Reserved		

Section 5.0: Step Rate Tables

The CCB option byte in conjunction with the onboard microprocessor selects the desired step rate.

CCB Option Byte	Microprocessor Version	Step Rate
	1015-14	
0		3 msec. per step
1		3 msec. per step
2		3 msec. per step
3		3 msec. per step
4		200 usec. per step
5		70 usec. per step
6		3 msec. per step
7		3 msec. per step
	1015-24, 1015A-24	
0		3 msec. per step
1		45 usec. per step
2		60 usec. per step
3		18 usec. per step
4		210 usec. per step
5		75 usec. per step
6		30 usec. per step
7		18 usec. per step
	1015A-25	
0		3.1 msec. per step
1		46.5 usec. per step
2		22.5 usec. per step
3		10.5 usec. per step
4		202.5 usec. per step
5		70.5 usec. per step
6		38.5 usec. per step
7		10.5 usec. per step
	1015E-08	
0		3.3 msec. per step
1		24 usec. per step
2		24 usec. per step
3		11 usec. per step
4		24 usec. per step
5		24 usec. per step
6		24 usec. per step
7		11 usec. per step

Section 6.0: Configuration Switch (SW)

SW refers to either location SW1 or location S1 on the controller card.

Jumper Installed = ON, Jumper Not Installed = OFF

SW-1 LSB Drive 0 table select.
SW-2 MSB Drive 0 table select.
SW-3 LSB Drive 1 table select.
SW-4 MSB Drive 1 table select.
SW-5 LSB Options select.
SW-6 MSB Options select.
SW-7 IRQ select. OFF=IRQ5, ON=IRQ2 (e.g. Tandy 1000)
SW-8 AT select. OFF=XT, ON=AT

Section 6.1: Drive 0 Decode (SW-1 and SW-2)

SW-2	SW-1	Definition
ON	ON	Drive 0 will use table 0.
ON	OFF	Drive 0 will use table 1.
OFF	ON	Drive 0 will use table 2.
OFF	OFF	Drive 0 will use table 3.

Section 6.2: Drive 1 Decode (SW-3 and SW-4)

SW-4	SW-3	Definition
ON	ON	Drive 1 will use table 0.
ON	OFF	Drive 1 will use table 1.
OFF	ON	Drive 1 will use table 2.
OFF	OFF	Drive 1 will use table 3.

Section 6.3.0: Options Decode (SW-5 and SW-6) for MFM

SW-6	SW-5	Tables	SPT
OFF	OFF	MFM	17
OFF	ON	UNDEFINED	
ON	OFF	UNDEFINED	
ON	ON	UNDEFINED	

Section 6.3.1: Options Decode (SW-5 and SW-6) for RLL

SW-6	SW-5	27X W-9 Must be	Tables	SPT	BIOS XLATE	DYNAMIC CONFIG.	EQUIVALENT RLL STANDARD BIOS
OFF	OFF				UNDEFINED		
OFF	ON	OFF	RLL	17	YES	NO	1
ON	OFF	OFF	RLL	26	NO	YES	2
ON	ON	ON	RLL	17	NO	YES	0

Section 7.0: Format Example

1. Boot the machine from drive A:
2. Load DOS debug utility by typing:
A>debug <Return>
3. At the debug prompt (-) type:
-g=c800:5 <Return>
4. The screen should display the following:
WX2 Format Revision 1.0S (C) Copyright Western Digital Corp. 198
Current Drive is C:, Select new Drive or RETURN for current.
5. Press Return for drive C: or type D: <Return> for drive D:
6. The screen should display the following:
Current Interleave is 3, Select new interleave or RETURN for current.
7. Press Return or type new interleave value <Return>.
8. The screen should display the following:
Are you dynamically configuring the drive - answer Y/N
9. If no, type n <Return> and go to step 16 . You are using drive tables.
If yes, type y <Return> and continue. You are not using drive tables and will enter the parameters via the keyboard.

10. The screen should display the following:

Key in disk characteristics as follows:ccc h rrr ppp ee o
where

ccc = total number of cylinders (1-4 digits)

h = number of heads (1-2 digits)

rrr = starting reduced write current cylinder (1-4 digits)

ppp = write precomp cylinder (1-4 digits)

ee = max correctable error burst length (1-2 digits)

range = 5 to 11 bits, default = 11 bits

o = CCB option byte, step rate select (1 hex digit)

range = 0 to 7, default = 5

refer to controller and drive specification for step rates

11. For example, type the following:

615 4 616 616 11 5 <Return>

12. The screen should display the following:

Are you virtually configuring the drive - answer Y/N

13. If no, type n <Return> and go to step 16.

If yes, type y <Return> and continue. There can only be one physical drive.

14. The screen should display the following:

Key in cylinder number for virtual drive split as vvvv ...
where vvvv = number of cylinders for drive C: (1-4 digits)

15. For example, type the following:

300 <Return>

Note: Drive D: will use the remaining cylinders. For example,
615-300=315.

16. The screen should display the following:

Press "y" to begin formatting drive (C or D) with interleave
(03 or value entered above)

17. Press y <Return> to begin the Low Level Format. Any other key will exit with nothing done.

18. The screen should display the following:

Formatting . . .

Do you want to format bad tracks - answer Y/N

19. If no, type n <Return> and go to step 25.
If yes, type y <Return> and continue.

20. The screen should display the following:

Key in bad track list as follows: ccc h ...
where
ccc = bad track cylinder no (1-4 digits)
h = bad track head number (1-2 digits)

21. For example, type the following:

100 0 100 3 245 1 300 2 <Return>

22. The screen should display the following:

More ? Y/N

23. If you have more bad tracks to enter type y <Return> and go to step 20.
If not, type n <return> and continue.

24. The screen should display the following:

BAD TRACK MAP	
TRACK ADDR	PROBLEM
ccc h	USER-SUPPLIED

25. The screen should display the following:

Format Successful

System will now restart

Insert DOS diskette in drive A:
Press any key when ready.

26. If the drive was virtually configured, this Low Level Format IS NOT run on drive D:, however, if a second physical drive is to be formatted, repeat this procedure.
27. Load and execute DOS FDISK utility for both drive C: and D: regardless of virtual or physical.

FDISK read parameters should indicate the proper split of cylinders for drive C: and D:.

28. Load and execute DOS Format utility for both drive C: and D: regardless of virtual or physical.

File-Card

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