Summary of Differences

This manual presents technical documentation for three different Amiga models, comparing them to the original Amiga, referred to as model A1000. Technical information included in this manual is relevant for the following Commodore Amiga models:

- the Amiga 500 (A500), a low-cost version of the original Amiga computer, software-compatible with the A1000. Unlike the A1000, the A500 has an integrated keyboard, provision for internal memory expansion up to 1 megabyte, new-style hardware connectors, and Kickstart code in ROM.

Two versions of the Amiga 2000:

- the A2000 is software-compatible with the A1000 and has internal slots, real time clock/calendar and new-style hardware connectors.

- the B2000, the cost-reduced version of the Amiga 2000, features some different custom chips, but is otherwise similar to the A2000.

The B2000 is still under development, and the information presented in this document is subject to change. The information included on the B2000 is intended to aid developers in designing software and peripherals that are applicable for both the current and upcoming version of the Amiga 2000.

Unless differences are specifically noted, information presented for the A2000 also holds true for the B2000. The differences between the two Amiga 2000 models are mainly hardware differences which will affect peripheral design, but not the way the computers function with software. Section 2 contains system block diagrams for all three new Amiga models.

KICKSTART IN ROM

Both the Amiga 2000 and the Amiga 500 feature version 1.2 of Kickstart built into ROM. Kickstart 1.2 (currently version 33.180) boots automatically when the Amiga is turned on.

EXTRA KEYS ON THE KEYBOARD

Both the Amiga 2000 and 500 feature 94-key keyboards, as compared to the A1000's 89-key keyboard. (The European versions of the keyboards have 96 keys.) The new keys are all located on the numeric keypad, and include:

KEY		SCAN CODE
Left parentheses	(	$5A
Right parentheses	)	$5B
Slash	/	$5C
Asterisk	*	$5D
Plus	+	$5E

In PC mode on the Amiga 2000 (using a Bridgeboard), these keys assume typical PC functions, including Number lock (left parenthesis), Print screen (asterisk) and Scroll lock (right parenthesis).

On some keyboards, the left Amiga key has been replaced by the Commodore key. This key performs identically in either case.

RAW KEY CODES ON THE KEYBOARD

Keyboard Layout Showing Raw Key Codes

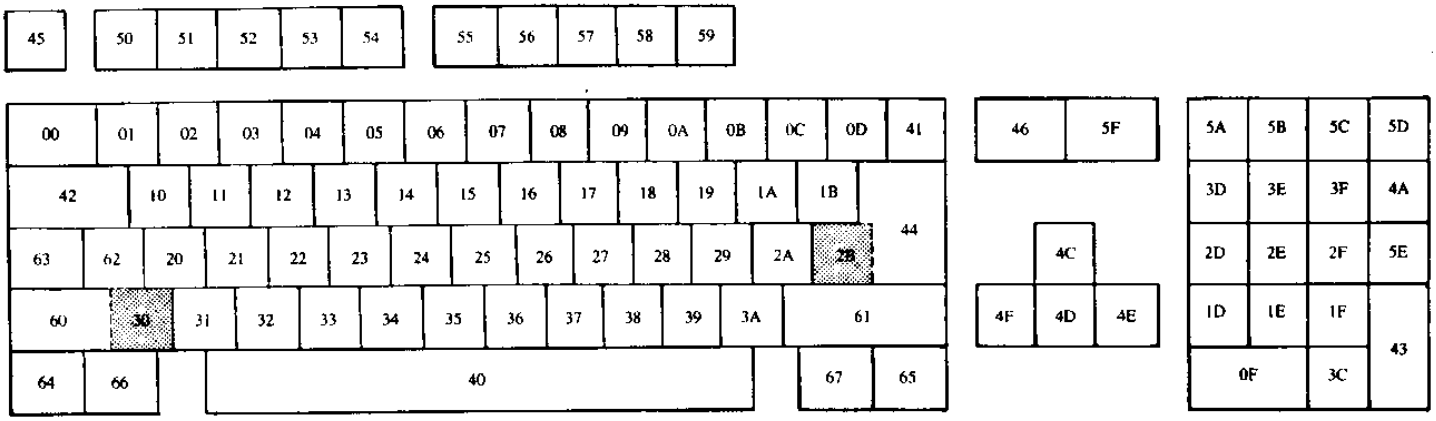


Figure 1.1 Key Codes

Note: On the U.S. keyboard, the keys with codes 44 and 60 are extended to include the European keys with codes 2B and 30, respectively. Also note that England uses the U.S. rather than the European keyboard, but not the U.S. keymap.

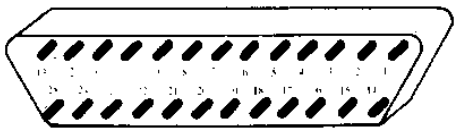
See Table 1-1 at the end of this section for a table of the raw key codes.

EXTERNAL SYSTEM I/O

This section describes each I/O interface in detail, and some of the tradeoffs made with respect to A1000 compatibility.

The Amiga 2000 and Amiga 500 have differences in the serial and parallel ports from the Amiga 1000, the main difference being changes in the sex of each port (changing the serial to female and the parallel to male), which allows the new Amigas to use standard interface cables.

RS232 and MIDI Port



The RS232 connector on the A500 and A2000 is form fit and function identical to a Commodore PC-10/20 with a few exceptions. **This is the OPPOSITE sex connector from the A1000.** The connector is a shielded male DB25P connector. The A1000 supplies various non-standard RS232 signals on the DB25 connector. These non-standard signals were removed wherever possible. The RS232 connector is NOT physically compatible with some MIDI interfaces but is compatible with the Amiga Modem/1200 RS (model 1680). Below is a comparison chart between the RS232 standard, a Hayes Smartmodem standard, the A1000 RS232, and the new Amiga 500/2000 RS232 connector.

PIN	RS232	A1000	A500/ A2000	PC10	HAYES®	DESCRIPTION
1	GND	GND	GND	GND	GND	Frame ground
2	T×D	T×D	T×D	T×D	T×D	Transmit Data
3	R×D	R×D	R×D	R×D	R×D	Receive Data
4	RTS	RTS	RTS	RTS	—	Request to send
5	CTS	CTS	CTS	CTS	CTS	Clear to send
6	DSR	DSR	DSR	DSR	DSR	Data set ready
7	GND	GND	GND	GND	GND	Signal ground
8	DCD	DCD	DCD	DCD	DCD	Carrier detect
9	—	—	+12v	+12v	—	+12 volt power
10	—	—	−12v	−12v	—	−12 volt power
11	—	—	AUDO	—	—	Audio output
12	S.SD	—	—	—	SI	Speed Indicate
13	S.CTS	—	—	—	—	
14	S.T×D	−5Vdc	—	—	—	−5 volt power
15	T×C	AUDO	—	—	—	Audio output
16	S.R×D	AUDI	—	—	—	Audio input
17	R×C	EB	—	—	—	Port clock 716KHz
18	—	INT2*	AUDI	—	—	Interrupt line/Audio input
19	S.RTS	—	—	—	—	
20	DTR	DTR	DTR	DTR	DTR	Data terminal ready
21	SQD	+5Vdc	—	—	—	+5 volt power
22	RI	—	RI	RI	RI	Ring indicator
23	SS	+12Vdc	—	—	—	+12 volt power
24	T×C1	C2*	—	—	—	3.58MHz clock
25	—	RESB*	—	—	—	Buffered system reset

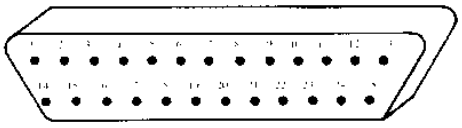
As you will notice, the A500 and 2000 deletes clocks and interrupt lines from the A1000. The +/−5Vdc and reset lines are also deleted. The +/−12Vdc lines are identical to a PC10/20.

The following signals (formerly on the RS232 connector) can be found on other connectors:

ResB = parallel connector
C2 = video connector

Centronics Port

The Centronics port also has some non-standard signals. Below is a table comparing the A1000 Centronics port with the A500/A2000 Centronics port. Again, this is the opposite sex from the A1000 and the same sex connector as an IBM®-PC (i.e., a female DB25 connector).



PIN	A1000	A500/A2000	PC10
1	DRDY*	STROBE*	STROBE*
2	Data 0	Data 0	Data 0
3	Data 1	Data 1	Data 1
4	Data 2	Data 2	Data 2
5	Data 3	Data 3	Data 3
6	Data 4	Data 4	Data 4
7	Data 5	Data 5	Data 5
8	Data 6	Data 6	Data 6
9	Data 7	Data 7	Data 7
10	ACK*	ACK*	ACK*
11	BUSY(data)	BUSY	BUSY
12	POUT(clk)	POUT	POUT
13	SEL	SEL	SEL
14	GND	+5v pullup	AUTOFDXT*
15	GND	NC	ERROR*
16	GND	RESET*	INIT*
17	GND	GND	SLCT IN*
18-22	GND	GND	GND
23	+5v	GND	GND
24	NC	GND	GND
25	Reset*	GND	GND

Video Output

The A500 and A2000, like the A1000, use a DB23 video connector.

This 23 pin connector contains all the signals necessary to work with a Genlock, but the current Genlock will need to be redesigned in order to meet the physical requirements of the A500 and A2000, in-

stead of the A1000. An A500 genlock will also have to supply its own power. Power will not be provided for the Genlock. All signals on the 23 pin connector are the same except for the power.

In addition to the 23 pin video connector, the A500/B2000 provides a monochrome composite video output, unlike the A1000. This provides the capability of using a low-cost, high persistence monochrome monitor with the A500 for viewing 640 × 400 interlaced video without as much flickering.

Power is provided for the A520 modulator and composite video adapter.

Mouse and Joystick Ports

The mouse and joystick ports of the A500 and A2000 are identical to the A1000, except that the current limiting protection circuitry has been eliminated. The A500 and A2000 use a different mouse than the one the A1000 uses. A diagram and information on this mouse is included in Appendix A of this manual.

A500 Expansion Port

The expansion port is electrically compatible with the A1000, but because of its physical location, it cannot accept any A1000 expansion peripherals without some further adapter. Power is supplied to this connector, but only enough for a ROM cartridge. The exact pinout of this 86 pin edge connector appears later in this document, in the section of Amiga expansion. The A500 diagram in Appendix A shows the new positioning of this port (relative to A1000) and the pin numbers.

A500 RAM Expansion

Associated with the built-in 512KB of RAM is a header socket to allow an additional 512KB of RAM and a battery backed-up real time clock board to be added. This small PCB (the A501 RAM Expansion Cartridge) can easily be installed by the user. The clock in this unit functions the same as that built into the A2000, which is reviewed in Section 7-I.

A500 Power Supply Connector

The A500 power supply connector is similar to that of the C128. The pinout of the square 5 pin DIN connector is as follows:

PIN	SIGNAL
1	+5Vdc @ 4.3A
2	Shield Ground
3	+12Vdc @ 1.0A
4	Signal Ground
5	−12Vdc @ .1A

External Disk Interface Connector

The 23 pin D-type connector with sockets (DB23S) at the rear of the Amiga is nominally used to interface to MFM devices.

The second disk drive port is similar to the A1000, and is therefore compatible with the 1010 or the 1020 disk drive. The CPU will power one external 1010 disk drive.

External Disk Connector Pin Assignment

Pin	Name	Dir	Notes
1	RDY*	I/O	If motor on, indicates disk installed and up to speed. If motor not on, Identification mode. See below.
2	DKRD*	I	MFM input data to Amiga.
3	GND		
4	GND		
5	GND		
6	GND		
7	GND		
8	MTRXD*	OC	Motor on data, clocked into drive's motor on flip flops by the active transistion of SELxB*. Guaranteed setup time is 1.4 µsec. Guaranteed hold time is 1.4 µsec.
9	SEL2B*/SEL3B*	OC	A500:Select drive 2/A2000: Select drive 3.
10	DRESB*	OC	Amiga system reset. Drives should reset their motor on flip flops and set their write protect flip flops.
11	CHNG*	I/O	Note: Nominally used as an open collector input. Drive's change flop is set at power-up or when no disk is installed. Flop is reset when drive is selected and the head stepped, but only if a disk is installed.
12	+5V		270 ma maximum; 410 ma surge. When below 3.75V, drives are required to reset their motor on flops, and set their write protect on flops.
13	SIDEB*	O	Side 1 if active, side 0 if inactive.
14	WPRO*	I/O	Asserted by selected, write protected disk.

15	TKO*	I/O	Asserted by selected drive when read/write head is positioned over track 0.
16	DKWEB*	OC	Write gate (enable) to drive.
17	DKWDB*	OC	MFM output data from Amiga.
18	STEPB*	OC	Selected drive steps one cylinder in the direction indicated by DIRB.
19	DIRB	OC	Direction to step the head. Inactive to step towards center of disk (higher numbered tracks).
20	SEL3B*/ Not Used	OC	A500: Select drive 3/A2000: Not used.
21	SEL1B/SEL2B	OC	A500: Select drive 1/A2000: Select drive 2.
22	INDEX*	I/O	Index is pulse generated once per disk revolution, between the end and beginning of cylinders. The 8520 can be programmed to conditionally generate a level 6 interrupt to the 68000 whenever the INDEX* input goes active.
23	+12V		160 ma maximum; 540 ma surge.

Note: * in signal name denotes active low signal.

External Disk Connector Identification Mode

An identification mode is provided for reading a 32 bit serial identification data stream from an external device. To initialize this mode, the motor must be turned on then off. See pin 8, MTRXD* for a discussion of how to turn the motor on and off. The transition from motor on to motor off reinitializes the serial shift register.

After initialization, the SELxB* signal should be left in the inactive state.

Now enter a loop where SELxB* is driven active, read serial input data on RDY* (pin 1), and drive SELxB* inactive. Repeat this loop a total of 32 times to read in 32 bits of data. The most significant bit is received first.

External Disk Connector Defined Identifications

$0000 0000 – no drive present
$FFFF FFFF – Amiga standard 3.25 diskette
$5555 5555 – 48 TPI double density double sided

As with other peripheral ID's, users should contact Commodore Technical Support for ID Assignment.

The serial input data is active low and must therefore be inverted to be consistent with the above table.

External Disk Connector Limitations

1. The total cable length including daisy chaining must not exceed 1 meter.
2. A maximum of 3 external devices may reside on this interface (2 for the A2000).
3. Each device must provide a 1000 Ohm pullup resistor on every open collector input.

Full Bus Termination

Unlike the A1000 and the A500, both versions of the Amiga 2000 have an internal expansion bus, as a function of having an internal card cage.

Internal RAM Expansion on the A500

On the A500, memory at $C00000 is "slow" RAM (the processor is locked out by the custom chips) rather than fast RAM as suggested by A1000 external expansion. Thus, when ExecBase is transferred to $C00000 to free up chip RAM, there is no speed advantage. However, you would still be making real chip RAM available for other purposes. The B2000 functions as the A500 does in this regard.

EIA Ring Indicate Support

The A500, A2000 and B2000 support the RS232 RI lead to allow operation with modem standards. When the RI signal is asserted, the parallel port SEL line will be driven low. If this function is not desired, the RI lead should be disconnected in the modem cable.

Time of Day Clock

In the A500, the Time of Day clock is tied to the VSYNC signal rather than the power line. This results in the theoretical error of several minutes a day. For more precise timing, use the optional real-time clock.

In genlock mode, the genlock peripheral provides a 30 Hz V/Z signal, which results in the clock running half speed.

Light Pen

The light pen input on the A500 and B2000 has been moved to the second mouse port to allow use without a pass-thru mouse adapter. On a B2000, the light pen can be jumpered to port 0.

Monochrome Composite Video

The A500 and B2000 provide a full-bandwidth 16-level grey-scale composite video output. Color composite is available with an optional A520 composite color/rf video adapter.

Audio Filter Cut-out

The A500 and B2000 can cut out the anti-aliasing filter by programmatically turning off the "power on" LED. External bandwidth limiting to below 15 KHz will be required for most applications. This permits wider frequency response by using faster sampling rates.

A500 Reset

The A500 implements a "hard-wired" Control/Commodore/Amiga key reset rather than the "soft" A1000/A2000 keyboard reset. "Shut down" keyboard messages are not transmitted.

A2000 Expansion Bus IPL Lines

The A2000 does not run the processor IPL lines beyond the 86 pin MMU connector. Instead, additional interrupt request lines are allocated for future expansion devices. These lines are **not** supported by the current software.

Table 1-1 RAW KEY CODES

Raw Key Number	Keycap Legend	Unshifted Default Value	Shifted Default Value
00	` ~	` (Accent grave)	~ (tilde)
01	1 !	1	!
02	2 @	2	@
03	3 #	3	#
04	4 $	4	$
05	5 %	5	%
06	6 ^	6	^
07	7 &	7	&
08	8 *	8	*
09	9 (	9	(
0A	0)	0	)
0B	- _	- (Hyphen)	_ (Underscore)
0C	= +	=	+
0D	\ |	\	|
0E		(undefined)	
0F	0	0	0 (Numeric pad)
10	Q	q	Q
11	W	w	W
12	E	e	E
13	R	r	R
14	T	t	T
15	Y	y	Y
16	U	u	U
17	I	i	I
18	O	o	O
19	P	p	P
1A	[{	[	{
1B	] }	]	}
1C		(undefined)	
1D	1	1	1 (Numeric pad)
1E	2	2	2 (Numeric pad)
1F	3	3	3 (Numeric pad)
20	A	a	A
21	S	s	S
22	D	d	D
23	F	f	F
24	G	g	G
25	H	h	H
26	J	j	J
27	K	k	K
28	L	l	L
29	; :	;	:
2A	' "	' (single quote)	"
2B		(RESERVED)	(RESERVED)
2C		(undefined)	
2D	4	4	4 (Numeric pad)
2E	5	5	5 (Numeric pad)
2F	6	6	6 (Numeric pad)
30		(RESERVED)	(RESERVED)
31	Z	z	Z
32	X	x	X
33	C	c	C
34	V	v	V
35	B	b	B
36	N	n	N
37	M	m	M
38	, <	, (comma)	<
39	. >	. (period)	>
3A	/ ?	/	?
3B		(undefined)	
3C	.	.	. (Numeric pad)
3D	7	7	7 (Numeric pad)
3E	8	8	8 (Numeric pad)
3F	9	9	9 (Numeric pad)
40	(Space bar)	20	20
41	BACK SPACE	08	08
42	TAB	09	09
43	ENTER	0D	0D (Numeric pad)
44	RETURN	0D	0D
45	ESC	1B	1B
46	DEL	7F	7F
47		(undefined)	
48		(undefined)	
49		(undefined)	
4A	-	-	- (Numeric Pad)
4B		(undefined)	
4C	Up Arrow	<CSI>A	<CSI>T
4D	Down Arrow	<CSI>B	<CSI>S
4E	Forward Arrow	<CSI>C	<CSI> A[1]
4F	Backward Arrow	<CSI>D	<CSI> @
50	F1	<CSI>0~	<CSI>10~
51	F2	<CSI>1~	<CSI>11~
52	F3	<CSI>2~	<CSI>12~
53	F4	<CSI>3~	<CSI>13~
54	F5	<CSI>4~	<CSI>14~
55	F6	<CSI>5~	<CSI>15~
56	F7	<CSI>6~	<CSI>16~
57	F8	<CSI>7~	<CSI>17~
58	F9	<CSI>8~	<CSI>18~
59	F10	<CSI>9~	<CSI>19~
5A	(	(	(
5B	)	)	)
5C	/	/	/
5D	*	*	*
5E	+	+	+
5F	HELP	<CSI>?~	<CSI>?~

[1] In shifted Forward Arrow and Backward Arrow, note blank space after <CSI>. <CSI> stands for Command Sequence Initiator.