INTRQ - The 1791/8866 controller sets this line to a one whenever it has completed a command and is no longer busy. This line is reset by a reference to the command register or the status register of the 1791/8866 controller.

Register 3 - Not currently used
Location 343:373 (E3FB hex) standard Disk Jockey

Register 4 - 1791/8866 controller status register
Location 343:374 (E3FC hex) standard Disk Jockey

This is the status register of the 1791/8866 controller. The meaning of the bit patterns of this register varies depending upon the command that the controller is executing or has executed. See the 1791/8866 data document for a detailed discussion of this register.

WRITE ONLY REGISTERS

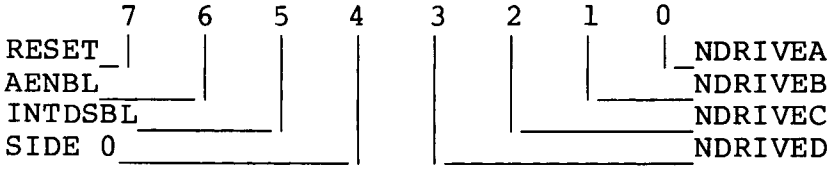
Register 0 - The inverted UART data input register
location 343:370 (E3F8 hex) standard Disk Jockey

Inverted data is stored is this register by the CPU for serial output by the UART. The UART transfers the data from this register to an internal parallel load serial output register where the start bit optional parity bit and the stop bits are appended to the data. Whenever the UART empties register 0, the TBRE status bit is raised to inform the CPU that it is possible to output more data to the UART.

Register 1 - Disk Jockey drive control register
location 343:371 (E3F9 hex) standard Disk Jockey

This is an eight bit register that is used to select one of four possible drives that can be connected to the controller, select side one or side two for double headed drives, enable or disable the interrupt control capabilities of the controller, enable or disable the stall logic of the controller during data accesses to the 1791/8866's data register, and set or clear the master reset pin of the 1791/8866 controller and the VCO oscillator. During power-up and system bus resets, is register is initialized so that it is as if ones had been written in all eight bits. The specific nature and use of the bits in this register is presented below:

DRIVE CONTROL REGISTER



RESET - When a one is stored in this bit, the master reset pin of the 1791/8866 is active and the controller chip is in a reset condition and will not accept any commands. The Voltage Controlled Oscillator of the Phase Lock Loop is also disabled and the Phase Lock Loop will not process any data to produce data windows for the 1791/8866. This bit is used to reinitialize the 1791/8866 in the event that the micro-program in the controller chip becomes confused and gets lost trying to read bad data. When a zero is stored in this bit (after a one value) the VCO of the Phase Lock Loop will properly start and the 1791/8866 will execute a home command and place itsef in a state to accept commands.

AENBL - When the CPU references the 1791/8866's data register during a data transfor, the PREADY line (S-100 bus line 72) is brought low which puts the processor in a wait state. The CPU remains in this state until the 1791/8866 raises its DATA REQUEST line. This mode of operation dispenses with the usual status test during data transfers and makes it possible for the Disk Jockey to run at double density speeds without having to use a DMA channel. However, there are times when the CPU needs access to the data register even though the DATA REQUEST LINE is low and will stay low (just before a seek command is issued, for example). When the AENBL bit is a one, the stall logic that usually governs accesses to the 1791/8866's data register is disabled. This allows the CPU to have access to this register as if it were a normal memory location. However, before the Disk Jockey can move data to or from the floppy disk drive, this bit must be a zero so that the CPU can synchronize its data transfers to the 1791/8866 controller.

INTDSBL - When this bit is a zero, the interrupt request line of the 1791/8866 controller is enabled to request interrupts on the S-100 system bus. When this bit is a one, no interrupts can be generated by the controller. The user should consult the 1791/8866 data sheet for a thorough understanding of the chip's interrupt request line.

SIDE 0 - When a double headed drive is connected to the Disk Jockey, a zero in this bit will enable head 1 whenever the drive is selected. A zero will enable head 0. If a single headed drive is selected, this bit has no effect on the drive.

NDRIVED - When this bit is a zero and the head isloaded, the fourth or last drive is selected. A one written in this bit will deselect the last drive.

NDRIVEC - This is the drive select bit for the third drive connected to the Disk Jockey. A zero selects the third drive when the head is loaded while a one deselects the third drive.

NDRIVEB - The drive select bit for the second drive connected to the Disk Jockey. When the head is loaded, a zero in this bit will select the second drive while a one will deselect it.

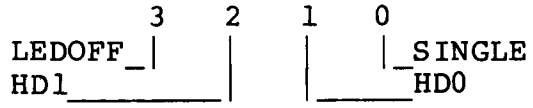
NDRIVEA - The drive select bit for the first drive connected to the Disk Jockey. A zero in this bit will select the first drive when the head is loaded and a one will deselect it.

Only one of the four low order bits of this register should ever be a zero. If more than one of these bits are zero, loading the head will select more than one drive and cause data errors during reads and possible head position errors on seeks.

Register 2 - The Disk Jockey function register
Location 343:372 (E3FA hex) standard Disk Jockey

Only the low order four bits of this register have any significance. Two bits load and unload the read/write head of the drive, one determines the density mode that the 1791/8866 controller operates at, and the last is used to turn on and off the LED at the top of the PC board. During power-up and system bus reset, this register is initialized so that it is as iff ones had been written in all four bits. The specific function of the various bits in this register is detailed below:

DISK JOCKEY FUNCTION REGISTER



LEDOFF - When a one is stored in this bit, the LED at the top of the circuit board is turned off. A zero will turn the LED on.

SINGLE - When this bit is a one, the DJ board will read and write data to and from the disk in single density. When this bit is a zero, reads and writes are performed in double density.

HD0,HD1 - These two bits control the loading of the read/write head. Their functional character is detailed in the table below.

HD1	HD0	Read/write head function
0	0	head is loaded
0	1	not allowed
1	0	1791/8866 may unload head
1	1	head is unloaded

Register 3 - Not currently used
Location 343:373 (E3FB hex) standard Disk Jockey

Register 4 - 1791/8866 controller command register
Location 343:374 (E3FC hex) standard Disk Jockey

This is the command register of the 1791/8866 controller. There are four different classes of commands and within each class there are a number of separate commands that the controller can execute. See the 1791/8866 data document for a detailed discussion of this register and its use.

READ-WRITE REGISTERS

Register 5 - 1791/8866 track register
Location 343:375 (E3FD hex) standard Disk Jockey

The 1791/8866 controller uses this register as a reference to where the read/write head of the disk drive is positioned. Extreme care should be exercised when writing in this register. If care is not exercised, seek errors may likely occur. See the 1791/8866 data document for a more detailed discussion.

Register 6 - 1791/8866 sector register
Location 343:376 (E3FE hex) standard Disk Jockey

This is the sector register of the 1791/8866 controller. Only one of the commands will cause the 1791/8866 to write in this register. Generally the 1791/8866 uses this register to determine which sector is to be read or written. See the 1791/8866 data document for a more detailed discussion.

Register 7 - 1791/8866 data register
Location 343:377 (E3FF hex) standard Disk Jockey

This is the data register of the 1791/8866 controller. Data is written into this register when the controller is writing to the disk. Data is read from this register when the controller is reading from the disk. The desired track number is also written in this register when seek commands are issued to the controller. As before the 1791/8866 data document should be referred to for a more complete discussion

FINAL NOTE

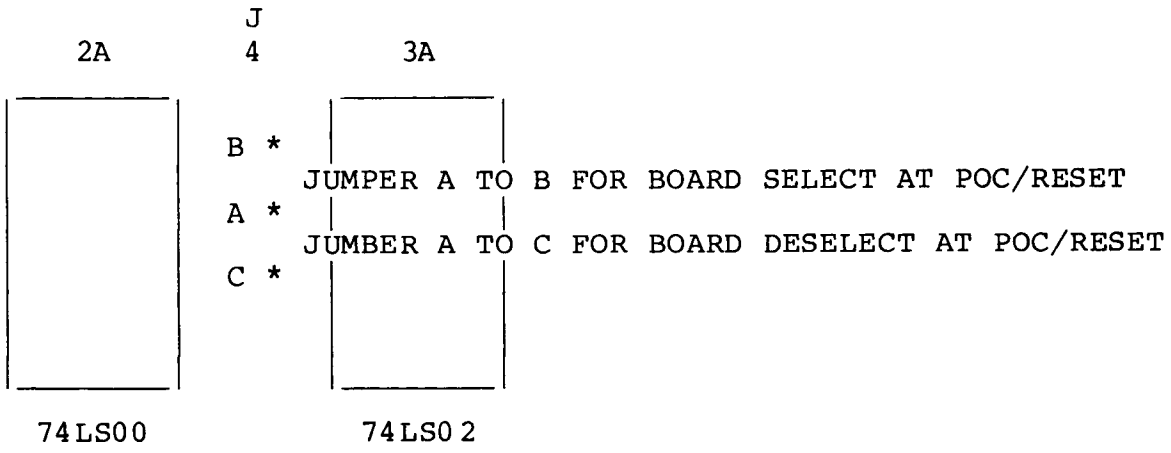
The Disk Jockey firmware contains numerous examples illustrating the use of the hardware registers listed above. A comprehensive study of the two Western Digital data documents along with a careful examination of the Disk Jockey firmware will equip the interested user with enough knowledge to control the disk drive at the hardware level.

BOARD SELECT BY I/O ADDRESS -- BANK SELECTION

The purpose of "Bank Selection" is to allow more memory in a system than the CPU can normally address. This is accomplished by assigning a board not only a memory address somewhere within the 64K range of addressable memory, but also a bit position within a special dedicated I/O port - port 40H (100Q). Port 40H is called the "Bank Select Port" and is used by a wide variety of S-100 hardware manufacturers exclusively for this purpose. With this scheme, it is possible to have as much as 524,288 bytes of memory on the S-100 bus without addressing conflicts.

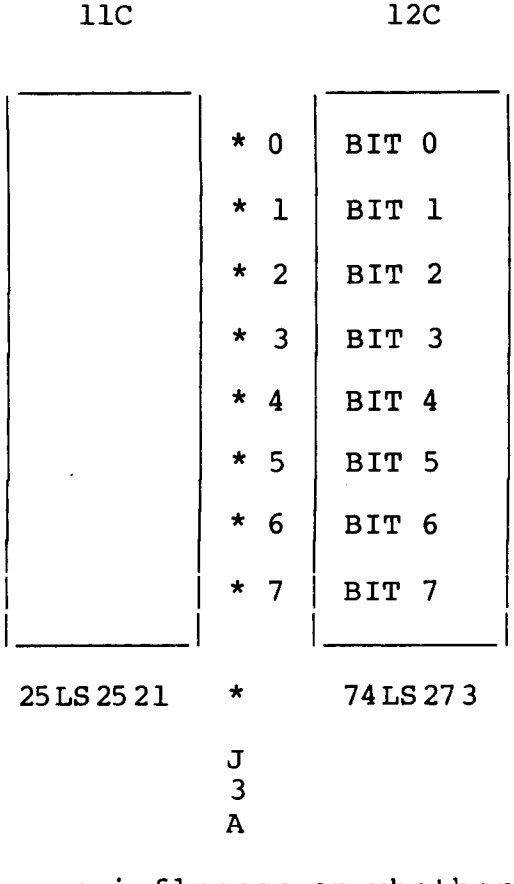
System software and user programs are growing larger each day and it is clear that memory mapped devices such as the Disk Jockey must exercise care in the way that they use S-100 bus memory space. To make way for the increased need for memory space, the Disk Jockey now implements the bank select port, port 40H, so that the 2K of memory space that the board uses can be assigned to any of eight banks within the extended address space on the bus. Another feature of the board is its ability to select or de-select itself during power-on clear or bus resets.

To implement the bank select logic on the board, the user must decide which bit within port 40H will be used to select and de-select the board. This bit is selected by installing a jumper on the board. A decision must also be made as to whether the board should select or de-select itself when POC* (bus line 99) or PRESET* (bus line 75) is active. This decision is made by the installation of another jumper. The details of these two jumper options are presented below:



Factory assembled boards will be shipped with a jumper installed between A and B so that the board will select itself during POC* or PRESET*. If for some reason this choice is not acceptable to the user, it is easy to remove the jumper and install it between A and C. It is necessary that one of the two jumpers always be installed, even if the board is not to be used in a bank select environment. If the bank select logic is not to be used, the jumper should be between A and B. A final note - both jumpers should never be installed simultaneously.

Bank Select Logic - Bit Selection



The bank select scheme will provide for eight banks of memory each having 64K bytes. These banks are numbered 0 through 7 which correspond to the bit positions in the illustration at the right. The pad just above J3A below should be jumpered to exactly one of the pads to the right. The bit number to the right of the pad will determine the memory bank that the Disk Jockey will reside in. Once this choice is made, the Disk Jockey will be enabled or disabled when the CPU executes an OUT 40H instruction. The pattern in the A register will determine whether the board is selected or not. Suppose, for example, that J3A is connected to bit 7. Then the Disk Jockey will be enabled when the CPU executes an OUT 40H instruction and the A register has a pattern such that bit 7 is a one. The values of the other bits have no influence on whether the board will be selected or not. If bit 7 is a zero, the board will be deselected. Again, the values of the other bits have no influence. However, for the bank select scheme to work properly, when an OUT 40H instruction is executed, usually only one of the bits in the A register should be a one. In this way, only one bank of memory will be selected at one time.

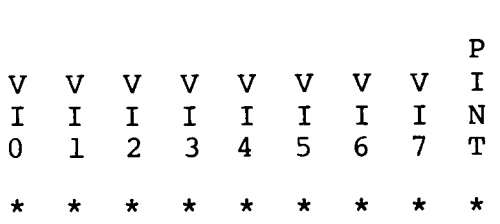
The bank select logic on the Disk Jockey board can be disabled by removing the 25LS2521 IC from position 11C.

INTERRUPT LOGIC

Whenever the 1791/8866 disk controller chip finishes an operation such as read sector, seek to a track, seek to track 0, etc., it raises an internal interrupt request flag which is brought to the outside world on pin 39 of the device. This flag can be used to inform external hardware that the chip is ready to execute new tasks. The present version of the Disk Jockey controller buffers this signal and makes provision for the user to connect it to any of the nine different interrupt lines available on the S-100 bus.

Presently there is not a great deal of interrupt driven software available for microcomputer systems. However, this will probably change as the user demand for increased system speed and performance begins to be felt by software vendors. It is also fair to say that interrupt driven operating systems are somewhat more complex and require a great deal more thought to implement than operating systems which are not interrupt driven. Operating systems such as UNIX have been designed with interrupts in mind while operating systems such as CP/M were designed before people seriously considered using classic interrupt techniques in a microcomputing environment.

The Disk Jockey interrupt logic is implemented by installing a jumper at the lower left hand area of the circuit board. The jumper should originate at the open pad just to the left of J1A and should connect to ONLY ONE of the pads below the symbols VI0, VI1, VI2, VI3, VI4, VI5, VI6, VI7, or PINT. Unless there is a vectored interrupt controller on the bus or on the system's CPU board, the jumper connection should be made to PINT. After the interrupt jumper is installed, interrupts from the 1791/8866 can be enabled or disabled by writing a 0 or 1 in bit 5 of the Disk Jockey drive control register (write only register #1). For the details please refer to the section on Hardware Level Registers. The jumper pad layout for installing interrupts on the DJ board are shown below:



BOOT LED

Just to the left of P1, the right angle header connector for the disk drive, is the boot LED. This LED (light emitting diode) will slowly flash on and off if the DBOOT routine cannot load the bootstrap from the diskette. Since the boot routine does not use any of the terminal I/O logic, this LED is helpful in determining whether a go/no-go attempt at bringing up an operating system is due to faulty I/O hardware and/or drivers or due to some other cause-- memory, diskette media, controller, CPU, etc.

BOOTING WITHOUT A DISKETTE

If no diskette has been placed in Drive A and a boot is attempted (as is often the case during a power-on-jump when the system is first powered up), the red activity light at the front of the Drive A will flash on briefly about once every second and the boot LED will turn on without flashing. It is possible to execute a bootstrap load in this mode. Insert a system diskette into Drive A. Do not lower the door, but push the diskette into the drive far enough so that it locks into place (the higher the drive door, the easier for the diskette to lock into place). Wait for the activity light at the front of the drive to flash on and off and, when it goes off, close the drive door. The system will boot the next time the drive activity light goes on.

POWER STABILIZATION

Whenever the bootstrap load DBOOT routine is called, the head on Drive A will not load (as evidenced by the drive activity LED at the front of the drive) for a second or two. There is a built in delay in DBOOT to make sure that all components of the system are stable and have finished any reset processes that may occur when the system encounters an active POC* (negative logic power-on-clear) or PRESET* (negative logic bus reset) signal. This delay precaution is especially important when power is first applied to a system which does a power-on-jump to the controller.

PHANTOM LOGIC

The DJ will respond to the PHANTOM* line (S-100 pin 67) if paddle 6 of switch 1 is placed in the 'on' position. This paddle is the third from the top of the LEFT switch which is at position 5D on the circuit board. The Disk Jockey controller will become de-selected when the PHANTOM* is active (logic zero) if this paddle is on. If this paddle is placed in the 'off' position, the DJ controller will ignore the PHANTOM* line. In order for the Power-on Jump feature of the controller to work on a SOL computer, the PHANTOM* switch must be on.

The DJ can also generate PHANTOM* whenever the prom or ram on the DJ is accessed. This feature can be used to disable other memory boards in the system which may conflict with the memory address of the DJ. To enable this feature install the jumper J2 on the circuit board. With jumper J2 installed the DJ will drive the PHANTOM* line low (active state) whenever the address on the S-100 bus matches the addresses occupied by the DJ. Note that if jumper J2 is installed AND the PHANTOM* enable switch is on the DJ will never become selected. Only one of the PHANTOM* options of the DJ can be used at a time.

4 MHz OPERATION

The Disk Jockey controller has been designed to work at all three of the most common S-100 bus speeds: 2 MHz, 4 MHZ, and 5 MHz. However, at bus speeds in excess of 2 MHz, the 2708 EPROM on the board may not function properly unless a wait state is inserted during fetches to this part. The DJ has been designed to automatically insert ONE wait state in bus cycles which read data or instructions from the 2708 EPROM if paddle 7 of switch 1 is in the 'on' position. If this paddle is in the 'off' position no wait states will be generated during fetches from the 2708 EPROM.

Whenever the Disk Jockey is operating in a system that has a CPU clock speed faster than 2 MHz, paddle 7 of switch 1 MUST be in the 'on' position. If the Disk Jockey is operating with a CPU that is running a 2MHz or slower, paddle 7 of switch 1 MUST be in the 'off' position. This paddle is the second from the top of the LEFT switch at location 5D on the circuit board.

The Disk Jockey controller has the ability to generate addresses on the system S-100 bus when power is first applied or when a system reset is active. This address generating ability will force the CPU to branch to the DBOOT routine on the DJ board so that the system will boot an operating system into memory. There are six paddles on switch 1 at board position 5D which control the power-on jump logic of the controller. Paddle 8, at the top of the switch enables or disables the power-on jump circuitry. The logic is enabled if the paddle is in the 'on' position and disabled if the paddle is in the 'off' position. If the logic is disabled, the settings of the other five paddles are not important. If the logic is enabled, the settings of the rest of the paddles informs the CPU of the starting address of the Disk Jockey controller within a 64K reigon of memory. Since the controller uses 2K of address space which starts on a 2K boundary, it is necessary to specify the 5 high order address bits to affect a branch to the controller. The remaining 5 paddles on switch 1 program these 5 high order address bits. These switches are arranged in ascending order:

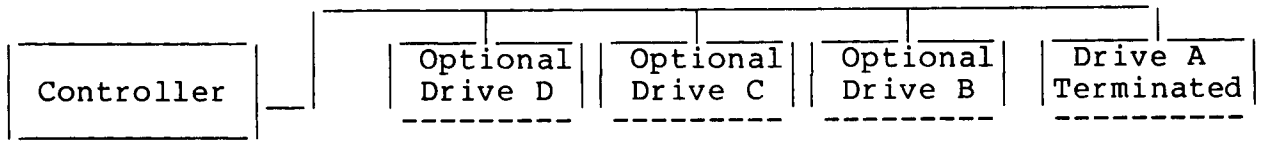
Paddle 5 programs address bit 11 - on for low, off for high
Paddle 4 programs address bit 12 - on for low, off for high
Paddle 3 programs address bit 13 - on for low, off for high
Paddle 2 programs address bit 14 - on for low, off for high
Paddle 1 programs address bit 15 - on for low, off for high

These paddles occupy the lowest five positions on switch 1 at board position 5D. For a standard DJ board located at E000H (340:000Q), paddles 1, 2, and 3 should be off while paddles 4 and 5 should be on. Below a complete table of switch settings is detailed.

POWER-ON JUMP TABLE

JUMP ADDRESS		SWITCH SETTING				
Octal	Hex	SW1-1 (A15)	SW1-2 (A14)	SW1-3 (A13)	SW1-4 (A12)	SW1-5 (A11)
000:000	0000	on	on	on	on	on
010:000	0800	on	on	on	on	off
020:000	1000	on	on	on	off	on
030:000	1800	on	on	on	off	off
040:000	2000	on	on	off	on	on
050:000	2800	on	on	off	on	off
060:000	3000	on	on	off	off	on
070:000	3800	on	on	off	off	off
100:000	4000	on	off	on	on	on
110:000	4800	on	off	on	on	off
120:000	5000	on	off	on	off	on
130:000	5800	on	off	on	off	off
140:000	6000	on	off	off	on	on
150:000	6800	on	off	off	on	off
160:000	7000	on	off	off	off	on
170:000	7800	on	off	off	off	off
200:000	8000	off	on	on	on	on
210:000	8800	off	on	on	on	off
220:000	9000	off	on	on	off	on
230:000	9800	off	on	on	off	off
240:000	A000	off	on	off	on	on
250:000	A800	off	on	off	on	off
260:000	B000	off	on	off	off	on
270:000	B800	off	on	off	off	off
300:000	C000	off	off	on	on	on
310:000	C800	off	off	on	on	off
320:000	D000	off	off	on	off	on
330:000	D800	off	off	on	off	off
340:000	E000	off	off	off	on	on
350:000	E800	off	off	off	on	off
360:000	F000	off	off	off	off	on
370:000	F800	off	off	off	off	off

Drives on Discus systems are connected in daisy chain fashion to the controller board, as illustrated below.



As can be seen from the above figure, Drive A is located at one end of the cable and is the only terminated drive on the cable. The location of any additional drives on the cable is not important as long as they are not at the end of the cable. Again, extra drives are not terminated.

Aside from termination, the only physical difference between an "A" and a "B" drive, or between any two differently addressed drives,is the jumper strapping on the PC board of the drives. Strapping a drive for termination and drive selection is documented in the manual which accompanies the drive.

Four different daisy chain cables are available for one, two, three or four drive systems. A daisy chain cable is simply a parallel cable. Not all available connectors on a multiple drive cable need be filled for the system to function. Also, a dual system with drives addressed, say, as "A" and "C" would work fine as long as the operator remembered to refer to the second drive as "C" rather than "B". In other words, the absence of a "B" drive in no way "locks out" the "C" and "D" drives.

The following rule applies to all cable configurations supplied by Morrow Designs:

> The 50 pin flat ribbon cable provided with the Discus system should be connected to the Disk Jockey controller board so that the cable extends out over the solder side of the PC board-- not the component side.
>
> Whichever end of the 50 pin flat ribbon cable is chosen to plug into the controller board, that side of the cable which is on the LEFT (closer to the heat sink) as it connects to the controller should be UP as it connects to each and every drive on the system. Thus, P1 pin 50 on the DJ controller board should come in to each disk drive via the top part of the male 50 pin connector attached to the cabinet of each drive. If the LED on the front of the drive comes on upon power up, the cable is on backwards and should be reversed. The LED on the front of the drive should light up only when a command has been issued to load the head.
>
> Any visual "key" such as an arrow or triangle on a connector should be used solely as an aid in implementing the connection scheme described above.

BAUD RATE SELECTION

Paddles 1 to 4 of Switch 2 at the right side of the DJ control the baud rate for the 1602 UART. Sixteen separate baud rates, ranging from 50 to 19,200, are available. The following table lists all possible switch settings for baud rate selection.

BAUD RATE SWITCH SETTINGS

SW2-1	SW2-2	SW2-3	SW2-4	BAUD RATE
on	on	on	on	50
on	on	on	off	75
on	on	off	on	110
on	on	off	off	134.5
on	off	on	on	150
on	off	on	off	300
on	off	off	on	600
on	off	off	off	1200
off	on	on	on	1800
off	on	on	off	2000
off	on	off	on	2400
off	on	off	off	3600
off	off	on	on	4800
off	off	on	off	7200
off	off	off	on	9600
off	off	off	off	19200

WORD LENGTH

Paddle 5 of Switch 2 controls data word length selection for the 1602 UART. Placing paddle 5 in the "on" position sets the word length to 7 bits, while "off" fixes the word length to 8 bits. The table below gives the word length selection settings for the DJ.

WORD LENGTH SELECTION

SW2-5	WORD LENGTH
"on"	7 BITS
"off"	8 BITS

STOP BIT COUNT

SW2-6 controls the number of stop bits, either one or two, which the UART sends after each data word. The "off" position will set the device to two stop bits, and the "on" position to one.

Most devices are extremely tolerant concerning stop bit setting. As a general rule, if a device fails to communicate with the Disk Jockey, it is not because the stop bit setting is incorrect.

STOP BIT COUNT SELECTION

SW2-6	STOP BIT COUNT
"on"	1 STOP BIT
"off"	2 STOP BITS

PARITY

If paddle 8 of switch 2 is in the "off" position, the UART will not generate any parity bits at the end of the serial data word. If the paddle is in the "on" position, refer to the table below for the proper parity setting via paddle 7.

PARITY SWITCH SETTING

SW2-7	PARITY
"on"	ODD PARITY
"off"	EVEN PARITY

FAST REFERENCE FOR DJ2D DIP SWITCHES

Power-on-jump Switch

on	off	SW1
	8	-"on" enables POJ
	7	-"on" for 4 MHz
	6	-"on" for PHANTOM
	5	-ADDR 11
	4	-ADDR 12
	3	-ADDR13
	2	-ADDR 14
	1	-ADDR 15

"on" for 0 address bits

"off" for 1 address bits

5D

UART Switch

on	off	SW2
	8	-"on"= parity/"off"=no
	7	-"on"= odd/"off"=even
	6	-"on"= 1 stop bits
	5	-"on"= 7 bits/"off"=8
	4	-A
	3	-B
	2	-C
	1	-D

low order bit

Baud Rate Selection "on" = 0 bit

high order bit

13C

[ ]	1	5" x 10" printed circuit board w/solder mask & legend	
[ ]	1	180 Ohm 1/4 watt 5% resistor	brown-grey-brown
[ ]	2	240 Ohm 1/4 watt 5% resistor	red-yellow-brown
[ ]	1	330 Ohm 1/4 watt 5% resistor	orange-orange-brown
[ ]	2	470 Ohm 1/4 watt 5% resistors	yellow-purple-brown
[ ]	2	560 Ohm 1/4 watt 5% resistors	green-blue-brown
[ ]	1	750 Ohm 1/2 watt 5% resistor	purple-green-brown
[ ]	8	1k Ohm 1/4 watt 5% resistors NOTE: On early versions of the silk screened legend on the circuit board, a 3.3k Ohm resistor is shown just to the right of IC 6300 at board position 8C. This is an error. This should be a 1k Ohm resistor.	brown-black-red
[ ]	1	1.5k Ohm 1/4 watt 5% resistor	brown-green-red
[ ]	5	3.3k Ohm 1/4 watt 5% resistors	orange-orange-red
[ ]	3	4.7k Ohm 1/4 watt 5% resistors	yellow-purple-red
[ ]	2	6.19k Ohm 1/8 watt 1% resistors	blue-brown white-brown
[ ]	2	10k Ohm 1/4 watt 5% resistors	brown-black-orange
[ ]	1	18.2k Ohm 1/8 watt 1% resistor	brown-grey-red-red
[ ]	1	20.5k Ohm 1/8 watt 1% resistors	red-black-green-red
[ ]	2	27k Ohm 1/4 watt 5% resistors	red-purple-orange
[ ]	1	47k Ohm 1/4 watt 5% resistor	yellow-purple-orange
[]	1	54.9k Ohm 1/8 watt 1% resistor	green-yellow-white-red
[ ]	1	86.6k Ohm 1/8 watt 1% resistor	white-blue-blue-red
[ ]	4	1M Ohm 1/4 watt 5% resistors	brown-black-green
[ ]	1	180 Ohm 1/8 watt 5% 9 resistor SIP array	SIP3
[ ]	1	1k Ohm 1/8 wattt 5% 9 resistor SIP array	SIP1
[ ]	2	3.3k Ohm 1/8 watt 5% 9 resistor SIP array	SIP2,SIP4
[ ]	3	33 picofarad 5% silver mica capicators	

[ ]	2	47 picofarad 2% silver mica capicator	
[ ]	2	112 picofarad 2% silver mica capicator	
[ ]	1	470 picofarad 5% silver mica capicator	
[ ]	1	.001 microfarad ceramic disk capicator	
[ ]	1	.01 microfarad mylar capicator	
[ ]	3	1.0 - 2.0 microfarad dipped tantalum capicator	
[ ]	6	1.0 - 4.7 microfarad axial lead tantalum capicators	
[ ]	2	39 microfarad axial lead tantalum capicators	
[ ]	16	ceramic disk capicators - may vary in value from .01 to .1 microfarads depending on current supplies	
[ ]	1	Dual-in-line 50 conductor right angle header	P1
[ ]	1	Single-in-line 7 conductor right angle header	P2
[ ]	1	3-pin header	
[ ]	1	2-pin header	
[ ]	1	Heat sink for the 7805 regulator at bottom of board	
[ ]	4	6-32 5/16 pan head machine screws	
[ ]	4	6-32 1/4" hex machine nuts	
[ ]	1	5.0688 MHz HU/18 Crystal	
[ ]	1	10.0000 MHz HU/18 Crystal	
[ ]	2	8 position DIP switch arrays	5D,13C
[ ]	1	1N751A 5.1 volt Zener diode	
[ ]	8	1N914/4820-0201 signal diodes NOTE: The silk screened legend on the circuit board shows a group of four diodes just above the 1791/8866 controller at position 14C on the circuit board. These parts are not to be installed and are not furnished with the kit. These parts go with a version of the 1791 controller that Western Digital is not presently making.	
[ ]	1	RL209 light emitting diode	
[ ]	2	2N3904 transistor	

[ ]	2	2N3906 transistor	
[ ]	1	8 pin low-profile socket	
[ ]	15	14 pin low-profile sockets	
[ ]	13	16 pin low-profile sockets	
[ ]	3	18 pin low-profile sockets	
[ ]	7	20 pin low-profile sockets	
[ ]	1	24 pin low-profile socket	
[ ]	2	40 pin low-profile sockets	
[ ]	2	74LS00 quad 2-input NAND gate	2A,3B
[ ]	1	74LS02 quad 2-input NOR gate	3A
[ ]	1	74LS04/LS14 hex inverter	5C
[ ]	1	7404 hex inverter	2C
[ ]	1	74LS08 quad 2-input AND gate	7B
[ ]	1	74LS10 triple 3-input NAND gate	7A
[ ]	1	74LS30 8-inpur NAND gate	7C
[ ]	1	74LS32 quad 2-input OR gate	4C
[ ]	1	7438/LS38 quad 2-input NAND buffer	8B
[ ]	5	74LS74 dual D type flip-flop	4A,5A,6A,8A,2B
[ ]	1	74LS155 dual 1 of 4 decoder	6B
[ ]	1	74160/LS160/74161/LS161 4 bit counter	6C
[ ]	1	74175/LS175 4 bit dual rail register	9B
[ ]	1	74LS221 dual monostable	2D
[ ]	1	74LS240 octal tri-state inverting buffer	10D
[ ]	2	74LS244 octal tri-state buffer	6D,8D
[ ]	1	74273/LS273 octal latch	12C
[ ]	1	74367/LS367 hex tri-state buffer	13B
[ ]	4	74368/LS368 tri-state inverting buffer	10B,11B,4D,12B

[ ]	1	74LS373 octal tri-state buffer/latch	7D
[ ]	1	74390/LS390 dual decade counter	3C
[ ]	1	81LS96/LS98 octal tri-state inverting buffer	9D
[ ]	1	25LS2521 octal comparator	11C
[ ]	1	96LS02 dual monostable	4B
[ ]	1	MMI6300/6301/82S129/74S287 4 x 256 PROM	8C
[ ]	1	MMI6331/82S123/74S288 8 x 32 PROM	3D
[ ]	1	2708 8 x 1k EPROM	11D
[ ]	2	2114-3L 4 x 1k low power 300NS static RAM	9C,10C
[ ]	1	BR1941/2941/COM5016 dual baud rate generator	13D
[ ]	1	TR1602/TR1868/MB8866 Uart	14D
[ ]	1	FD1791/8866 dual density floppy disk controller	14B
[ ]	1	1448/4558 dual operational amplifier	1C
[ ]	1	7812/78M12 monolithic 12 volt .5 amp regulator	
[ ]	1	79L05 monolithic -5 volt 100 ma regulator	
[ ]	1	7912/79M12 monolithic -12 volt regulator	

WARNING! IMPROPER ASSEMBLY OF THIS KIT WILL VOID THE WARRANTY. READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO CONSTRUCT THIS KIT

INVENTORY

Make sure that all parts listed in the Parts List have been included. Notify Morrow Designs immediately if any are missing. Also, quickly return all extra parts.

USE BENDING BOARD

With the exception of the axial tantalum capacitors, the 1N751A zener diode, one of the 1/4 watt 240 Ohm resisters, and the 1/2 watt 750 Ohm resistors, all the resistor and diode leads should be bent to .4 inches. The leads of the 750 Ohm resistors should have a spacing of .55 inches. The axial lead tantalum capacitors should be bent to .7 inches. Use of a bending block will give your finished kit a more professional look.

USE SOCKETS

Sockets are provided for every IC on the Disk Jockey.

NO REPAIR WORK WILL BE ATTEMPTED ON ANY RETURNED BOARD WITH ANY IC SOLDERED DIRECTLY TO THE CARD

ORIENTATION

When this manual refers to the bottom of the circuit board it means the side with the gold S-100 edge connectors. Right and left assume a view from the component side of the board which has the silk screen legend.

All IC sockets will either have their pins numbered, have a 45 degree angle across the corner of pin one, or have a deep groove at the top of the socket. On the Disk Jockey, all sockets and all IC's have pin 1 closest to the top left corner of the board.

The tantalum capacitors are polarized. The dipped tantalum cap has a red dot at its positive lead. This lead should be inserted at the side of the oval legend where the "+" sign is located. The 1.0 microfarad capacitor's positive lead is identified by a circular "tit" where it enters the body of the housing. The positive end of the 39 microfarad capacitors is identified by a red band. The silk screen identifies the positive lead of these axial parts with a "+" sign. The by-pass caps, identified on the silk screened legend by an asterisk "*" enclosed by a box, are not polarized. The .01 mylar cap and the

The two DIP switch arrays are to be positioned so that switch paddle number 1 is toward the bottom of the board.

The SIP resistor packs, historically prone to being inserted backwards, should have their white dot nearest the white dot on their respective legends. For SIP2 and SIP4 this means that the white dot should point toward the top of the board. For SIP1, the white dot should point to the left and for SIP3, the dot will point to the right.

The crystals included in this kit have a piece of foam pad attached to their PC board side. When these parts are installed, the protective paper on the back of the pad should be peeled off just before the leads are inserted through the circuit board at the position indicated on the parts legend. The foam pad has an adhesive on it which will hold the crystal to the circuit board. The pad and the adhesive are insulators so that no short circuit can occur when the crystal is installed.

The orientation of the transistors is indicated on the silk screen legend of the circuit board, as is their type number. A very common cause of smoke on power-up is a 2N3906 correctly oriented in the place of a 2N3904 and vice versa.

The black band at one end of the diodes marks the cathode and should correspond to the white arrow point on the legend of the circuit board.

Placing the 50 pin flat cable connector, P1, upside down is a disaster. The angled pins should go through the circuit board. Only the longer straight pins are long enough to accept the ribbon cable to the disk drive. The I/O connector, P2, should be positioned so that the longer angled pins point toward the top of the board while the shorter straight pins go through the circuit board.

EXAMINE THE BOARD

Visually examine the circuit board for any trace opens or shorts. A concentrated five minute scrutiny will uncover most trace defects. Several hours of scattered, unconcentrated scrutiny generally won't reveal anything. Take special care that no shorts or opens exist on those areas of the circuit board that will be covered by IC sockets. Ohm out any suspicious looking traces for either shorts or discontinuity as appropriate. Return immediately any bare board found to be flawed. Such boards will be replaced under warranty.

SOLDERING AND SOLDER IRONS

The most desirable soldering tool for complex electronic kits is a constant temperature iron with an element regulated at 650 degrees F. The tip should be fine so that it can be brought into close contact with the pads of the circuit board. Such irons are available from Weller and Unger and should be part of any electronics shop.

There are three important soldering requirements for building this kit:

1. Do not use an iron that is too cold (less than 600 degrees F) or too hot (more than 750 degrees F).
2. Do not hold the iron against a pad for more than about six seconds.
3. Do not apply excessive amounts of solder.

The recommended procedure for soldering components to the circuit board is as follows:

1. Bring the iron in contact with BOTH the component lead AND the pad.
2. Apply a SMALL amount of solder at the point where the iron, component lead, and pad ALL make contact.
3. After the initial application of solder has been accomplished with the solder flowing to the pad and component lead, the heat of the iron will have transferred to BOTH the pad AND lead. Apply a small amount of additional solder to cover the joint between the pad and the lead.

DO NOT PILE SOLDER ON THE JOINT! EXCESSIVE HEAT AND SOLDER CAUSE PADS AND LEADS TO LIFT FROM THE CIRCUIT BOARD. EXCESSIVE SOLDER IS THE PRIMARY CAUSE FOR BOARD SHORTS AND BRIDGED CONNECTIONS.

[ ] Install and solder the eight signal diodes (1N914 or equivalent) and clip the excess leads from the parts. Be sure that the black bands of the diodes are positioned to match the arrow points of the white legend of the circuit board.

[ ] Install, solder, and trim the 1N751A zener diode.

PROTECT YOUR EYES WHEN YOU CLIP COMPONENT LEADS AFTER SOLDERING

[ ] Install and solder all the 1/4 watt resistors in place. Do this in sections so that the leads can be conveniently clipped.

[ ] Install, solder, and trim the leads of the 1% precision resistors.

[ ] Next, install, solder and trim the leads of the 750 Ohm 1/2 watt resistor.

[ ] Install and solder the 40 pin sockets first, then the 24, 20, 18, 16, and 14 pin sockets in that order. Finally install and solder the 8 pin socket. By installing the sockets in this order, a smaller sized socket will never be placed in a larger sized position.

[ ] Install and solder the SIP resistor pack arrays. The top pack at the left should have its dot to the left. The top pack at the right should have its dot to the right. The two packs at the center and at the bottom of the board should have their dots pointing toward the top of the board.

[ ] Install and solder the 6 axial lead 1.0 microfarad capicators. The top two have their "+" leads to the left. The next pair have their "+" leads to the right and the final two will have their "+" leads pointing to the left again. Clip the excess leads from the parts.

[ ] Install, solder, and clip the leads of the two 39 microfarad caps. The red band of these parts must point to the left.

[ ] Bend the leads of the 7812, 7912, and one of the 7805 regulators. Set the other 7805 aside for now. Install the top three regulators at the left hand side of the board by placing a nut on top of the regulator, insert a screw from the bottom of the circuit board through the hole of the board and through the hole of the regulator. Hand tighten the nut. Solder the leads. Tighten the screws firmly.

[ ] After bending the leads 90 degrees, install and solder the two crystals in place. Clip the excess leads. Fix them to the circuit board by peeling the protective paper off their foam pad and pressing the pad against the board. Be sure to solder the crystals into place so that their padded side will fall into the area outlined on the silk screened legend.

[ ] Install and solder the two connectors P1 and P2. Be sure to reread the orientation section before installing these parts.

[ ] Install and solder the light emitting diode at the top of the board just to the left of P1. One of the leads of this diode is longer than the other. The longer lead is the anode and must be to the left when the part is inserted. Clip the excess leads after soldering.

[ ] Install, solder and clip the leads of the 1.5 dipped tantalum capicators. A total of three are to be installed. One is just to the right of the 7805 regulator in upper left corner of the board. The red dot of this device is to point to the left. The rest have their dots pointing toward the top of the board. There is one to the right of the 1791/8866 IC at position 14B, and another to the left of the 1602 IC at position 14D.

[ ] Install, solder and clip the 33 picofarad silver mica cap just to the right of the 10 Meg crystal in the left side of the board.

[ ] Install, solder and clip the leads of the 47 and 112 picofarad silver mica caps just to the left of the 74LS123 IC at location 2D.

[ ] Install, solder and clip the two 33 picofarad silver mica caps-- one between the 74LS10 IC at 7A and the 74LS74 IC at 8A and the other between the 6631 IC at 3D and the 74LS367 IC at 4D.

[ ] Install, solder and clip the 470 picofarad mica cap at the upper left of the 7404 IC at location 2C.

[ ] Install, solder and clip the .001 microfarad disk cap to the left of the 10 MHz crystal.

[ ] Install, solder and clip the .01 microfarad mylar cap to the left of the .001 disk cap just installed.

[ ] Install, solder and clip the leads of the three transistors just to the right of the regulator area carefully observing the placement and orientation information silk screened on the circuit board.

[ ] Install and solder the two DIP switch arrays. Switch 1 of each DIP should be positioned toward the bottom of the board.

[ ] Install, solder, and clip the leads of the 16 by-pass capacitors whose positions are identified by rectangular boxs each with asterisk "*" in the middle.

[ ] Bend the leads of the remaining 7805 regulator and insert it in the circuit board. Place a separate, finned heat sink between the regulator and the board, work a screw from the back of the board through the board, heat sink, and regulator and hand tighten into the nut on top of the regulator. Solder the leads and adjust the wings of the separate heat sink and, finally, tighten the screw.

CLEAN AND EXAMINE THE BOARD

Use flux cleaner to remove solder rosin residue. Examine the circuit board carefully for shorts, solder bridges, or missed pins.

HOW TO FIND WHERE TO PLACE PARTS

For parts placement, please see the silk screened legend on the printed circuit board.

IC's may vary from those marked on the silk screened legend if they are listed as alternate IC's (following a slash) in the Parts List.

DO NOT INSERT ANY IC'S IN THEIR SOCKETS AT THIS TIME

INITIAL CHECK-OUT AND POWER-UP

Before inserting any IC's in their sockets perform the following check-out procedure:

1. Re-check the back of the board for solder shorts and bridged connections and for pins of IC sockets that have not been soldered. These unsoldered pins can cause aggravating intermittant probems during check-out.

2. Re-check components for orientation and make sure all components to be soldered have been soldered.

3. With an ohm meter, check for shorts between all regulated voltages (+5V,-5V,+12V,-12V) and ground and between any two regulator outputs (all regulator output pins are on the right side of the regulator, towards the bottom of the circuit board in this case). Check for shorts between S-100 supply voltages (+8V,+16V, -16V) and ground. S-100 pins 1 and 51 hold 8 volts, pin 2 holds +16 volts, and pin 52 -16 volts. Ground is on S-100 pins 50 and 100. Check these voltages for shorts amoung each other.