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# DDC-16 DOUBLE DENSITY MINI-FLOPPY DISK INTERFACE FOR SS-30 BUS

The DDC-16 board provides the ability to access up to four mini-floppy diskette drives on one SS-30 slot. It is directly compatible with OS-9 (t.m. Microware) and FLEX 2 and FLEX 9 (t.m. Technical Systems Consultants). With minor modifications, it mar be made to work with GIMIX FLEX 9 systems. It uses the Western Digital 1795 Floppy Disk Formatter/Controller.

The board has the following features:

- It may be used on 6800 or 6809 systems with 4, 8, or 16 addresses per I/O slot, by proper selection of shorting plugs.
- It is configured for straight-thru 34-line-cable operation when used with most mini-floppy diskette drives.
- The mini-floppy diskette drives may be single or double sided, single or double density, single or double track, with 35/70 or 40/80 tracks per side, assuming that the software supports such features.
- Drive-ready indication may be generated on-board or by the selected drive, with selection by shorting plugs.
- If the software supports interrupt-driven disk operations, this board will provide FIRQ or IRQ interrupts optionally thru shorting plugs.
- It provides additional digital filtering which makes it possible to use certain mini-floppy drives in double density mode which would not otherwise be possible.
- It provides optional write pre-compensation for certain drives to enable the use of certain drives, especially double-track units.
- It does not provide power for the disk drives; drive power must be supplied by the user.

Constructing the DDC-16 from the bare board is a major task which should be undertaken only by someone experienced in electronic kit building; others should purchase the assembled-and-tested unit.

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## NOTES ON THE USE OF THIS BOARD

Late versions of FLEX 2 should work properly with this board; however, double sided, double density, and double track features of mini-floppy disks are not supported. Because of problems with the mini-floppy drivers, versions of SWTPC FLEX 9 older than 2.8:1 should not be used. TSC FLEX 9 does not support double density and double track features.

In any case, you must ensure that the software does not attempt to step the head of the mini-floppy disk drives at too fast a rate. The corrections to the software to slow it down to the proper speed vary so greatly among the disk operating systems that no attempt will be made here to do so. If you suspect that you have such a problem with your system, check with your software supplier.

The mini-floppy disk drives must be configured properly to interface with the DDC-16 board. The technique varies with the model of drive but is generally very simple. Each drive must be given a unique address, called a drive number, starting with zero. This is usually done by straightening pins on a jumper block or by throwing switches on a dip-switch block. No drive may have more than one address. The drive must be configured to load the head when the drive is selected. Also, the pullup resistor packs on all drives except the last on the daisy chain must be removed or disabled.

The cable which connects the drives and controller board must be installed correctly, or damage to the drives and controller board may result. All connectors should be mounted to the same side of the cable, and line 1 of the cable should be aligned with line 1 on all drive and controller board connectors. A table providing the interface configuration appears later.

Diskettes must be oriented properly in the drives for correct operation. Check the drive manual for the proper orientation of the diskette. When testing the drives with good diskettes, cover the write protect notches on the edge of the diskettes to prevent accidental corruption of the data on the diskette.

When the drives are correctly configured, the LED indicators on the front of the drives are drive-select lights and are activated only when the DDC-16 selects the drives. They do not indicate that the motor is on or that the drive is powered up. The board will turn the motors on for all connected drives but will select only one drive. After the requested disk operation, the drive will be deselected, but the motors may remain on for ten to sixty seconds.

Diskettes should not be left in the drives when the computer or drives are powered up or down. Diskettes should also be protected from dust, heat, cold, moisture, fingerprints, magnetic fields, spindling, folding, mutilating, etc. to maintain the data intact. Better quality diskettes are required as more data is placed onto the diskettes.

## CONSTRUCTION AND CHECKOUT INFORMATION

Check the board for any breaks or irregularities in the lands, hairline etch flaws, etc. If any are found, repair them or return the board for replacement before proceeding. Orient the board so that the silk-screen writing is toward you. All components are mounted from the front of the board and soldered on the back.

Mount the Molex connectors. Make sure they are firmly placed against the board before soldering. Insert the index pin into the Molex connectors at bus position 24. Mount the regulators. The 7805 must be mounted with a heat-sink. The 78L12 flat side must be turned toward the top of the board. Mount the capacitors (with very short leads), observing polarity on the 47 mf and Tantalum units. Plug the board into the SS-30 bus, checking to make sure the Molex index pin is in the correct position. Power the system up and check at least the following voltages:

U1-20 @ +5 volts, U10-40 @ +12 volts.

Power the system down.

Install jumpers J2 thru J6 if write pre-compensation is not to be used and J1 if it is to be used. If GIMIX FLEX 9 is to be used, trace the lands from U16-2,6,13,15,17 to jumpers J7 thru J11; cut the grounding traces but do not cut the lands from the pins to the jumpers: install jumpers J7 thru J11.

Mount the sockets for the integrated circuits. Mount the resistors. Mount the crystal and ground its case. Mount the Amphenol 34-pin connector. Mount the programming pins and test points: they are described later. Plug the board (temporarily) into the SS-30 bus, power the computer system up, check voltages, and power it down.

If the system uses .four addresses per slot, it will also be necessary to short SS-30 bus positions 1 and 30 on port 5 with a piece of insulated wire on the back of the mother board.

Mount the integrated circuits with pin 1 toward the left of the board. Double check that all pins are making contact and are not folded under and that all packages are in the correct positions. Program the programming pins to provide the options described later.

Plug the board into the SS-30 bus and power the system up. Check the voltages at the points described above. Follow the procedures given below under the heading "DATA SEPARATOR AND WRITE PRE-COMPENSATION ADJUSTMENTS". Power the system down and remove the board.

Plug the board into the proper slot. This will usually be port 1 for 16 addresses per slot and port 6 for 4 addresses per slot. Plug the cable to the diskette drives into the Amphenol connector with the lines toward the back of the board. Power the system up.

If the board does not work, recheck all voltages, jumpers and shorting pins, IC package locations, capacitor polarity, resistor values, etc. If all else fails, return the board for repair.

# PARTSLIST - DDC-16

## Integrated Circuits

| | | | |
|---|---|---|---|
| Ul | 74LS244 | U11 | 14049 |
| U2 | 74LS240 | U12 | 74LS139 |
| U3 | 14541 | U13 | 74LS32 |
| U4 | 74LS123 | U14 | 74LS08 |
| U5 | 74LS124 | U15 | 74LS273 |
| U6 | 74LS02 (Optional) | U16 | 74LS244 |
| U7 | WD2143 (Optional) | U17 | 74LS373 |
| U8 | WD1691 | U18 | 74LS245 |
| U9 | 74LS132 | U19 | 74LS640 |
| U10 | WD1795 | U20 | 14041 |
| | | U21 | 74121 |

## Resistors

| | | |
|---|---|---|
| R1 | 330 Ohm 1/4 Watt | |
| R2 | 330 Ohm 1/4 Watt | |
| R3 | 330 Ohm 1/4 Watt | |
| R4 | 330 Ohm 1/4 Watt | |
| R5 * | 56K Ohm 1/4 Watt | |
| R6 | 100K Ohm 1/4. Watt | |
| R7 | 5.6K Ohm 1/4 Watt | |
| R8 | 150K Ohm 1/4 Watt | |
| R9 | 75K Ohm 1/4 Watt | |
| R10 | 10K Ohm 1/4 Watt | |
| R11 | 10K Ohm 1/4 Watt | |
| R12 | 1M Ohm 1/4 Watt | |
| R13 | 10K Ohm 1/4 Watt | |
| R14 | 10K Ohm 1/4 Watt | |
| R15 | 47K Ohm, l/4 Watt | |
| R16 | 47K Ohm 1/4 Watt | |
| R17 | 33 Ohm 1/4 Watt | |
| R18 | 100K Potentiometer | |
| R19 | 50K Potentiometer | |
| R20 | 5K Potentiometer (Opt) | |
| R21 | 2.2K Ohm 1/4 Watt (Opt) | |
| R22 | 1K Ohm 1/4 Watt | |
| R23 | 10K Ohm 1/4 Watt | |
| R24 | 4.7K Ohm 1/4 Watt | |

*Value may be reduced to 10K to reduce motor-on time.

## Capacitors

| | |
|---|---|
| Cl | 47 mfd. 25 vdc. |
| C2 | 47 mfd. 25 vdc. |
| C3 | 0.1 mfd. |
| C4 | (unused) |
| C5 | 4.7 mfd. Tantalum |
| C6 | 0.1 mfd. |
| C7 | 0.33 mfd. Tantalum |
| C8 | 0.1 mfd. (Opt) |
| C9 | 0.1 mfd. |
| C10 | 100 pfd. |
| C11 | 33 pfd. |
| C12 | 4.7 mfd. Tantalum |
| C13 | 0.1 mfd. |
| C14 | 0.1 mfd. |
| C15 | 20 pfd. |
| C16 | 0.01 mfd. |
| C17 | 0.1 mfd. |
| C18 | 0.1 mfd. |
| C19 | 0.1 mfd. |
| C20 | 0.1 mfd. |
| C21 | 0.01 mfd. |
| C22 | 220 pfd. |

## Miscellaneous

| | |
|---|---|
| (1) | 1.0000 MHZ Crystal |
| (3) | 10 Pin Molex 90-Degree Socket |
| (11) | Programming Pins and Plugs |
| (3) | Test Point Pins |
| (1) | 40 Pin Low-Profile IC Socket |
| (8) | 20 Pin Low-Profile IC Socket |
| (1) | 18 Pin Low-Profile IC Socket |
| (4) | 16 Pin Low-Profile IC Socket |
| (7) | 14 Pin Low-Profile IC Sockets |
| (1) | Amphenol 34-pin Male 90-Degree Plug |

## Regulators

| | |
|---|---|
| VR1 | 7805 +5V (Requires Heat Sink) |
| VR2 | 78L12 +12V (Alternate 7812) |

## OPTION SELECTIONS

In order to make this board as flexible as possible, several programming pins and shorting plugs are used. The table below provides the definitions of the selections available. The default selections are indicated by asterisks.

E1 (Drive Ready):
- * A-B(up)=Drive Ready on Pin 6
- B-C(down)=Drive Ready on Pin 34

E2 (Drive Ready):
- * 09(up)=Drive Ready from Pin 8 (Index Pulse)
- 00(Down)=Drive Ready from I/O Select
- (right)=Drive Ready from El

E3 (Drive Select 3):
- * A(up)=Drive Select 3 on Pin 4
- B(left)-Drive Select 3 on Pin 34
- C(down)=Drive Select 3 on Pin 6

E4 (Track Greater Than 43):
- A-B(down)=TG43 from WD1795-29 to WD1691-15
- * B-C(up)=TG43 grounded to WD1691-15,

E5 (Side Select):
- A-B(left)=Side Select from WD1795-25
- * B-C(right)=Side Select From U15-19

E6 (Double Density):
- * A-B(left)=Double Density from WD1795-25
- B-C(right)=Double Density from U15-15

E7 (Write Protect):
- A-B(left)=Write Protect from Pin 28 (Write Protect)
- * B-C(right)=Write Protect from U15-6 and Pin 28

E8 (4/16 Addresses per I/O Port):
- 4(down)=four addresses per I/O port
- * 16(up)=sixteen addresses per I/O port

E9 (4/16 Addresses per I/O Port):
- 4(left)=four addresses per I/O port
- * 16(right)=sixteen addresses per I/O port

E10 (IRQ Interrupt):
- IRQ(left)=generate IRQ
- * N(right)=do not generate IRQ

Ell (FIRQ Interrupt):
- FIRQ(down)=generate FIRQ
- * N(up)=do not generate FIRQ

## DATA SEPARATOR AND WRITE PRE-COMPENSATION ADJUSTMENTS

Adjustments on the DDC-16 disk controller board require a high-impedance DC voltmeter and frequency counter or calibrated oscilloscope.

## INITIAL FREQUENCY CHECK

Connect a frequency counter or calibrated oscilloscope to TP3 on the controller board. The frequency present there should be 1.0000 MHZ. If it is not, check the 1.0000 MHZ crystal, U11, R12, C15, and U9. The board will not function at all until it has a stable 1.0000 MHZ frequency on TP3.

## DATA SEPARATOR ADJUSTMENTS

1. Connect a high-impedance DC voltmeter or calibrated oscilloscope to TP1 on the controller board. The ground lead should be connected to the ground leg of the 7805.

2. Adjust R18 to obtain a 1.4 volt DC level.

3. Connect a frequency counter or calibrated, oscilloscope to TP2 on the controller board.

4. Adjust R19 to obtain a frequency of 2.0000 MHZ.

5. After controller board adjustments are verified, secure each of the potentiometers with a drop of liquid silicone rubber or fingernail polish. Do not use epoxy or cyanoacrylate type glues or the potentiometers may be destroyed.

## WRITE PRE-COMPENSATION ADJUSTMENTS

Procedures for adjusting the write pre-compensation circuitry on the disk controller board vary greatly among the disk drives which require it. Unless you know that your drives require write pre-compensation, do not attempt to use it. In any case, the adjustments as described by the disk drive manufacturer should be followed and will involve the adjustment of R20 and possibly replacement of C8 with another value.

## DISK INTERFACE DEFINITION

The table below represents a typical configuration of the mini-floppy disk interface. Only the even-numbered lines are-shown, since all the odd-numbered lines are common DC ground. Direction of *information* flow is indicated by designating the source of the signal.

| Line | | Description | Source |
|---|---|---|---|
| 02 | | Spare | |
| 04 | | Drive Select 3 | DDC-16 |
| | or | In Use | Drive |
| | or | Spare | |
| 06 | | Drive Ready | Drive |
| | or | Drive Select 3 | DDC-16 |
| | or | Spare | |
| 08 | | Index/Sector Pulse | Drive |
| 10 | | Drive Select 0 | DDC-16 |
| 12 | | Drive Select 1 | DDC-16 |
| 14 | | Drive Select 2 | DDC-16 |
| 16 | | Motor On | DDC-16 |
| 18 | | Step Direction | DDC-16 |
| 20 | | Step Pulse | DDC-16 |
| 22 | | Write Data | DDC-16 |
| 24 | | Write Gate | DDC-16 |
| 26 | | Track 00 Detected | Drive |
| 28 | | Write Protect | Drive |
| 30 | | Read Data | Drive |
| | or | Separate Clock * | Drive |
| 32 | | Side Select | DDC-16 |
| 34 | | Drive Select 3 | DDC-16 |
| | or | Drive Ready | Drive |
| | or | Separate Data * | Drive |
| | or | Spare | |

* If the drive presents separate clock and data on lines 30 and 34, the drive will require modification to present read data on line 30.

# ASSEMBLY INSTRUCTIONS FOR DDC-16

The DDC-16 is available either as a bare board or as a kit. These assembly instructions are for both. WARNING: If you purchase the DDC-16 as a bare board be certain that you use ONLY the exact parts specified in the enclosed parts list. Most values are critical. Any substitution can prevent the board from working properly. Every effort has been made to use standard off-the-shelf parts so that no substitutions would be necessary. If you believe that you will not be able to locate the correct parts in your area we suggest that you order the parts kit. Throughout these assembly instructions there are numerous helpful hints on kit construction. These are provided to aid the newcomer to kit assembly and to provide clarification as to our-instructions for the experienced kit assembler. Please read the ASSEMBLY INSTRUCTIONS completely and thoroughly before attempting assembly. This is essential because your type of system (GIMIX, SWTP, etc.) will-determine the sequence of assembly steps.

TOOLS REQUIRED: 1 pair wire cutters, 1 pair needle nose pliers, 1 roll of rosin core solder (approx. .020 - .035 diameter), one 25 watt pencil type soldering iron (or equivalent). Integrated circuits, transistors, diodes and to a lesser extent capacitors, and resistors can be damaged by heat when soldering. A clean solder tip will allow you to make the joint quickly without excessive heat build up. A heat sink on the lead or pin between the part and the joint will ensure that the part will not be damaged. Grip the lead with a heat sink tool or a pair of needle nose pliers or if nothing else is available pack a wet tissue around the lead. (Many problems with kits can be traced to poor solder joints. Frequent cleaning of your soldering iron tip on a sponge dampened with water will allow you to make good solder joints quickly. This greatly lessens the chances of a poor correction or a part being damaged by too much heat.) For adjusting the DDC-16 you will need the use of a D.C. voltmeter and a frequency counter or calibrated oscilloscope.

ORIENTATION: The board has two sides. The side with the printing on it will be called the front and the side without printing will be the back. Looking at the front of the board the words "Southeastern Micro Systems" are printed at the bottom of the board. The top of the board has a position for the 34 pin connector for the disk drives. The very bottom of the board has holes for connecting three 10 pin Molex connectors. To the left of the holes is the number 30. This is the left side of the board. On the other side of the holes is the number 1. This is the right side of the board. The numbers 1 and 30 are the first and last pin numbers of the SS-30 bus. On the lower left side of the board is VR1 (voltage regulator 1). On the lower right side of the board is VR2 (voltage regulator 2). VR2 will go into the three holes below C2 (capacitor 2).

GENERAL INFORMATION: Now look for U1 on the board. The U represents an integrated circuit or "chip" or "IC". The 1 represents the IC's number on this board. Next to the marking U1 are two rows of holes. These are for the pins of the IC socket. A line at either end of rows connects the last two holes. You will notice that the line on the left side has

a notch in it. This signifies that the hole BELOW the notch and CLOSEST to it is pin 1 for that IC. Examine one of the IC sockets. It also should have a notch in one end. This notch has to be on top of the notch mark (on the board) before the socket is soldered to the board. Examine the IC's. On one CORNER there is a little round circle (NOT the circle in the MIDDLE of the end) or there is a notch in one end. Either one or both of the marks may be present. The little circle in the CORNER is nearest pin 1. If the IC has a notch, turn it so that the notch is on the left, then pin 1 will be in the lower left hand corner. If the IC is installed backwards it will be destroyed when power is applied to the board. Looking at the parts list we see that IC U1 has a number such as 74LS244. Look through the IC's until you find this number and you will have found U1. Sometimes a chip will have several letters in front of the number such as SN, DM or MC, simply ignore these letters. A word of caution, many IC's can be damaged by static electricity. The special mat material that the IC's are stuck into prevents static damage. Do not remove the IC's from the mat until the board is completely finished (except for the IC's) AND you are ready to install it in the computer. If it is ever necessary to store the board out of the computer with the IC's installed, wrap it completely in aluminum foil. When installing the IC's into their sockets be very careful that all the pins line up. The best method is to use an IC installation tool. The second best method is to barely put one row of the IC's pins into its row on the socket, then using a straight edge (like a single edge razor or straight piece of metal) push the other row of pins toward the middle of the IC while very gently pushing down on the IC. When the pins line up with the socket holes and the IC starts into the socket double check to make sure that each pin is going into its holes and is not going under the IC or outside its holes.

INSPECTION: CAREFULLY examine both sides of the board. Every effort has been made to ensure that you receive a perfect board. Ten or fifteen minutes of careful inspection can save numerous hours of trouble shooting when the board is covered with parts. Look for cracks or damage to the board. Look for any breaks in the etching lines or any line which is not clearly separated from any other line. A bright light and a magnifying glass will greatly help the inspection. If the problem is a broken line the gap can be bridged by soldering. If the board has defects return it for repair or replacement. If you ordered the kit use the parts list to check that all parts were delivered. If you are buying your own parts make certain that all parts are EXACTLY as specified. All parts marked "opt" are optional and NOT included in the parts kit. (See OPTIONAL ASSEMBLY instructions)

DDC-16 INSTALLED IN GIMIX FLEX 9: This section is only for GIMIX FLEX 9 users. ALL OTHERS go directly to the BOARD ASSEMBLY section. THESE DIRECTIONS MUST BE FOLLOWED CAREFULLY! The ground foil traces on jumpers J7 - J11 will be cut. All of these foil traces are WIDE (no narrow foil traces are to be cut). These traces should be cut with an XACTO type knife or single edge razor blade so that a small section of foil can be removed. The object is to break the connections cleanly so that no traces of foil or copper are left to cause a short across the section of the trace that was removed.

( ) Locate J9 on the front of the board. The upper pin hole on J9 has a wide foil trace which connects it with a long vertical wide foil trace.

( ) Cut the wide trace BETWEEN the upper pin hole and the long vertical wide trace. (DO NOT CUT the long vertical wide trace.)

( ) Locate J10 on the front of the board. The lower pin hole has a wide trace running to it.

( ) Cut the wide trace below the pin hole.

( ) Locate J11 on the front of the board. The upper pin hole has a wide trace running it.

( ) Cut the wide trace above the pin hole.

( ) Locate J7 and J8 on the front of the board. Using a piece of string as a marker insert one end into the upper pin hole of J7 and the other end into the lower hole. (This will identify the holes when the board is turned over.) Using another piece of string do the same to J8.

( ) Turn the board. over so that you are looking at the back. The bottom of the board must still be on the bottom. The two pieces of string should be sticking out of the four pin holes on the board. J8 is on the left and J7 is on the right.

( ) Locate J7 (on the right). The lower pin hole has a wide foil trace running to it.

( ) Cut the wide foil trace to the right of the pin hole.

( ) Locate J8 (on the left). The lower pin hole has a narrow trace which runs to the right to another pin hole. Approximately 1/2 inch to the right of J8 along this narrow trace is a wide foil trace.

( ) Cut the WIDE foil trace. (DO NOT cut or damage the narrow foil trace.) Remove the string markers.

( ) Turn the board over so that you are looking at the front of the board. Bend jumper wires for J8 - J11.

( ) Solder jumper with J8 - J11. Note the jumper for J7 will be installed after the 1C sockets are installed.

( ) Go to the BOARD ASSEMBLY section to continue (return to next line after completing IC socket installation).

( ) Looking at the front of the board insert a string marker into each of the J7 pin holes.

( ) Bend and cut the jumper with short leads so that it will not touch either IC socket on the front of the board.

( ) Remove the string marker.

( ) Mount the jumper in J7 on the BACK SIDE of the board.

( ) Solder J7 on the BACK SIDE of the board. (CAUTION: Do not apply too much solder as it can run under the IC sockets. Be careful that pin 3 of U15 does not short to the upper pin hole of J7.)

( ) Return and complete the BOARD ASSEMBLY section.

BOARD ASSEMBLY: (Use Parts List and Schematic Diagram for reference.)

( ) Mount and solder IC sockets. (Make sure the sockets are the correct size for the slot on the board. Make sure that the sockets are firmly against the front of the board. Mount all parts on the front of the board and solder from the back unless directed otherwise. After soldering cut all excess leads off flush with the board.) If the DDC-16 is to be installed in a GIMIX FLEX 9 system return and complete the DDC-16 INSTALLED IN GIMIX FLEX 9 section; otherwise continue this section.

( ) Mount and solder the three ten pin Molex connectors on the bottom of the board.

( ) Insert the plastic index pin into the Molex connector at pin position no. 7. (Looking at the front of the board pin no. 30 is on the left and pin no. 1 is on the right.)

( ) Mount and solder the Amphenol 34-pin Male 90-Degree Plug on the top of the board.

( ) Mounting and soldering capacitors C1 through C22. C8 is optional and not included. It is critical that capacitors C1, C2, C5, C7,and C12 be installed with the correct polarity. Near the location for each of these capacitors on the board there is a "+" sign. The plus lead on the capacitor must go into the capacitor hole on the board closest to the "+".

After soldering each capacitor, clip and save the excess wire leads sticking through the board. These can be used as jumper wires later in the assembly.

( ) Capacitors C1 and C2 either have both a "+" and a "-" on their sides or only a "-". If it has only a "-" then the lead farthest from the "-" is the "+" or positive. Mount and solder C.1 and C2.

( ) Mount and solder C3. C4 not used.

( ) C5 is a Tanatalum capacitor. Determine the "+" lead (the parts kit contains a drawing showing the "+" lead). This lead goes in the "+" hole of C5. Mount and solder C5.

( ) Mount and solder C6.

( ) C7 is a Tanatalum capacitor. Determine the "+" lead (the parts kit contains a drawing showing the "+" lead). This lead goes into the hole marked "+". Mount and solder C7.

( ) C8 is optional and not included.

( ) Mount and solder C9.

( ) C10 is a 100 pfd (picofarad) capacitor. It will be labeled lO1J. Mount and solder C10.

( ) C11 is a 33 pfd. It is labeled 330J. Mount and solder C11.

( ) C12 is a Tanatalum capacitor. Follow the instructions for C5. Mount and solder C12.

( ) Mount and solder C13.

( ) Mount and solder C14.

( ) C15 is a 20 pfd capacitor. It is labeled 20. Mount and solder C15.

( ) C16 is a .O1 mfd capacitor. Do not confuse it with a .1 mfd. Mount and solder C16.

( ) Mount and solder C17, C18, C19 and C20.

( ) C21 is a .O1 mfd capacitor. Do not confuse it with the .1 mfd. Mount and solder C21.

( ) C22 is a 220 pfd capacitor. It is labeled 221J.

RESISTORS: All fixed resistor holes are spaced 1/2 inch apart.

( ) Mount and solder R1.

( ) Mount and solder R2.

( ) Mount and solder R3.

( ) Mount and solder R4.

( ) Mount and solder R5.

( ) Mount and solder R6.

( ) Mount and solder R7.

( ) Mount and solder R8.

( ) Mount and solder R9.

( ) Mount and solder R10.

( ) Mount and solder R11.

( ) Mount and solder R12.

( ) Mount and solder R13.

( ) Mount and solder R14.

( ) Mount and solder R15.

( ) Mount and solder R16.

( ) Mount and solder R17. R18 and R19 are potentiometers (TRIMPOT). Too much heat can melt the case.

( ) Mount and solder R18 and R19. R20 and R21 – see Optional Section.

( ) Mount and solder R22.

( ) Mount and solder R23.

( ) Mount and solder R24.

JUMPERS: If your drive requires write pre-compensation skip the next step and go to OPTIONAL ASSEMBLY SECTION. Using wires saved from resistors and capacitors bend wires to go into J2 through J6.

( ) Mount and solder J2 through J6. (DO NOT jumper J1.)

( ) PROGRAMMING PINS AND TEST POINTS: A strip of pins are enclosed which are used as programming pins and test points. The programming pins are

labeled E1 through E11. The test points are labeled TP1 through TP3. All test points are 1 pin. All programming pins are 3 pins except E2 and E3 which have an additional single pin. The programming of E1 through E11 is covered in the documentation.

( ) Mount and solder TP1.

( ) Mount and solder TP2.

( ) Mount and solder TP3.

( ) Mount and solder E1.

( ) Mount and solder E2.

( ) Mount and solder E3.

( ) Mount and solder E4.

( ) Mount and solder E5.

( ) Mount and solder E6.

( ) Mount and solder E7.

( ) Mount and solder E8.

( ) Mount and solder E9.

( ) Mount and solder E10.

( ) Mount and solder E11.

CRYSTAL AND REGULATORS:

( ) Mount the crystal in its pin holes. Ground the crystal by soldering a piece of wire to the case through the hold down holes.

( ) Solder the crystal and case.

( ) Mount VR2 (781,12) below C2. The flat side of VR2 faces capacitor C2. Solder VR2.

( ) VR1 (7805) is mounted on the board with two heat sinks. Due to the extremely high density of parts on this SS-30 card the lower heat sink must be timed to avoid any danger of sorts and to allow for IC installation. The lower heat sink has a full back while the upper heat sink has a cut out in it. Orientate the lower heat sink on the flat surface of the board so that the hold lines up with the hole on the board. The three horizontal fins on the right side must be cut off with wire cutters. Three vertical fins on the right side will remain. The upper right vertical fin must be cut off flush with the part that touches the board. Cut the three horizontal fins off of the lower heat sink.

( ) Cut the upper right vertical fin off of the lower heat sink. When mounting VR1 and the lower heat sink refer to the enclosed sheet labeled "Mounting Instructions For: VR1 on DDC-16". DO NOT MOUNT the UPPER heat sink at this time. It will be mounted after the IC installation.

( ) Bend legs of VR1 so that VR1 will lay flat on the board and the hole in VR1 lines up with the hole in the board.

( ) Mount VR1 and the lower heat sink to the board. Solder VR1.

BOARD TESTING:

( ) Plug the board into a SS-30 bus position and power up system.

( ) Check the following voltages:

( ) IC U1 at pin 20 is +5 volts.

( ) IC U10 at pin 40 is +12 volts.

( ) Power down the system.

( ) If voltages were correct proceed to next step. If voltages were not correct double check that all parts are installed correctly. Check all solder joints. Make sure that no solder joint or loose particle has caused any shorts on the board.

IC INSTALLATION: Install IC's 1 through 21. Use either an IC installation tool or a straight edge as previously described to install the IC's. Be certain that all the IC pins are in their proper socket holes before pushing it into its socket. Make certain that no pins are bent under the IC after it is inserted.

PIN PROGRAMMING: The programming pins enable this board to be as flexible as possible. The enclosed OPTION SELECTIONS page shows in summary each pin option and its default. This section will provide a more detailed explanation of the purpose of each pin. The pins are numbered E1 through E11. The pins are programmed with shunts or by wire wrap. E1 and E2 selects which pin of the 34 pin Amphenol connector the DDC-16 will read the Drive Ready signal from the drive. The documentation that came with your drive twill tell you on which pin the drive sends the Drive Ready signal. The DDC-16 must be programmed to read this signal on the correct pin. E2 is used in almost all cases. The 09 (up) is used for almost all 6809 systems and uses pin 8. The 00 (down) is used for almost all 6800 systems and uses no pin. Selecting the (right) position of E2 allows El to select the Drive Ready. If it is not selected then El does not have to be programmed. If this position is selected then E1 must be programmed. E1 will then put the Drive Ready on Pin 6 (up) or Pin 34 (down).

( ) Shunt E2.

( ) Shunt E1 if required. If the system has four drives E3 will select the pin on which the fourth drive (Drive 3) will be selected. Most use Pin 4. Check your drive documentation.. No programming is required if a fourth drive is not connected.

( ) Shunt E3 if required. E4, E5, E6 and E7 are all provided to allow use of certain features of Western Digital 1795 controller. At the present time none of the operating systems on the market have been written to utilize these features. Therefore all four of these pins MUST BE programmed to the default position which disables these features.

( ) Shunt E4: B-C (up).

( ) Shunt E5: B-C (right). Shunt E6: A-B (left).

( ) Shunt E7: B-C (right). E8 and E9 configure the DDC-16 for the type of 1/0 addressing used by your motherboard. 4 is used for older motherboards which only have four addresses per 1/0 slot such as the SWTP-B2. 16 is used for the newer motherboards which have sixteen addresses per 1/0 slot such as SWTP-B3. Determine from your computer documentation which type you have. Note: If the motherboard for the system is a SWTP MP-B or MP-B2 a jumper MUST be installed on the motherboard at I/0 slot 5. Instructions are in the INSTALLATION section.

( ) Shunt E8.

( ) Shunt E9. E10 and E11 are Interrupt programming pins and are only used in special custom software applications. NO programming is required for the default position. The normal default position is no interrupt.

FINAL ASSEMBLY:

( ) Remove the screw and nut holding URI to the board.

( ) Mount the upper heat sink as shown in the enclosed drawing.

( ) Install and tighten the screw and bolt. (Do not overtighten as damage to the board may result.)

INSTALLATION: Check your mainframe documentation as to the correct slot on the SS-30 bus into which the DDC-16 should be installed.

( ) If the motherboard is a MP-B3 or MP-MB insert the DDC-16 into slot 1. (This is the second slot from the left. Slot 0 is the first slot.) If your motherboard is a different type continue below:

( ) If the motherboard is a SWTP MP-B or MP-B2 a minor modification to the motherboard is necessary. At slot 5 a jumper must be installed between pins 1 and 30. If you do not want the modification to be permanent AND you are not going to use slot 5 the jumper can be a wire wrap between pins 1 and 30. If the fix is to be permanent or you are going to use slot 5 then remove the motherboard and solder an insulated piece of jumper wire on the bottom of the board from pin 1 to pin 30. Re-install the motherboard. Plug DDC-16 into slot 6.

( ) Go to the DATA SEPARATOR AND WRITE PRE-COMPENSATION ADJUSTMENTS.

( ) Install the 34 pins ribbon cable connector from the disks into its connector on top of the DDC-16. When the connector is plugged into the DDC-16 the ribbon side of the connector should be on the same side as slot 0.

OPTIONAL ASSEMBLY: Write pre-compensation is used almost exclusively on double track drives. It is optional because, at this time, very few manufacturers have a marketable double track drive. If you acquired drives which require write pre-compensation simply remove jumpers J2 through J6 and then install J1. Install the parts marked "optional" on the parts list. Then adjust R20 according to the WRITE PRE-COMPENSATION ADJUSTMENTS.

## DATA SEPARATOR AND WRITE PRE-COMPENSATION ADJUSTMENTS

Adjustments on the DDC-16 disk controller board require a DC voltmeter and frequency counter or calibrated oscilloscope.

### INITIAL FREQUENCY CHECK

Connect a frequency counter or calibrated oscilloscope to TP3 on the controller board. The frequency present there. should be 1.000 MHZ. If it is not, check the 1.000 MHZ crystal, U11, R12, C15, and U9. The board will not function at all until it has a stable 1.000 MHZ frequency on TP3.

### DATA SEPARATOR ADJUSTMENTS

( ) Connect a DC voltmeter or calibrated oscilloscope to TP1 on the controller board. The ground lead should be connected to the ground leg (center leg) of URI.

( ) Adjust R18 to obtain a 1.4 volt DC level.

( ) Connect a frequency counter or calibrated oscilloscope to TP2 on the controller board.

( ) Adjust R19 to obtain a frequency of 2.000 MHZ.

( ) After controller board adjustments are verified, secure each of the potentiometers with a drop of liquid silicone rubber or fingernail polish. Do not use epoxy or dyanoacrylate type glues or the potentiometers may be destroyed.

### WRITE PRE-COMPENSATION ADJUSTMENTS

Procedures for adjusting the write pre-compensation circuitry on the disk controller board vary greatly among the disk drives which require it. Unless you know that your drives require write pre-compensation, do not attempt to use it. In any case, the adjustments as described by the disk drive manufacturer should be followed and will involve the adjustment of R20 and possibly replacement of C8 with another value.

( ) Return and complete the INSTALLATION section.

Note: The flat side of VR2 should be facing the top of the board