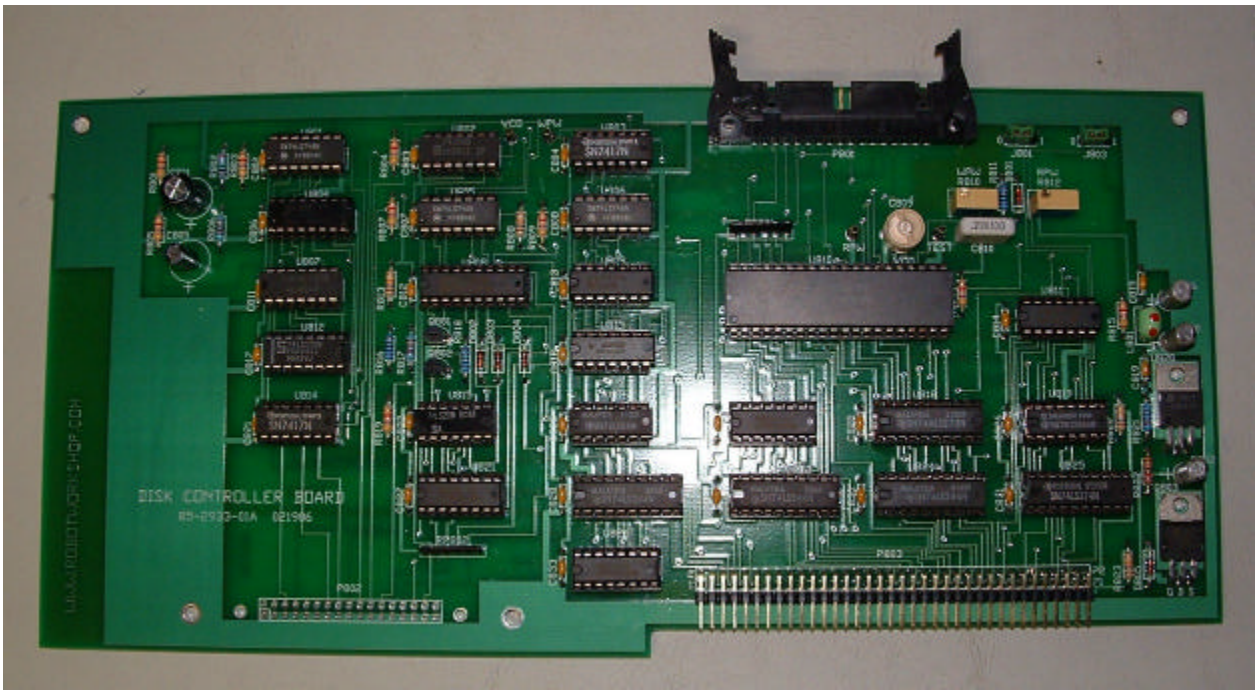
ET-19 ROBOT

DISK CONTROLLER BOARD (H2KDCB)

HERO 2000 ROBOT

Floppy Disk Controller Board

(H2KDCB)



By Robert L. Doerr

http://www.robotworkshop.com

Manual Revision 1.2

NOTE: This optional enhancement board has been tested in several HERO 2000 robots using different configurations with excellent results. Although every effort has been made to ensure the compatibility with the widest range of devices (and the accuracy of the documentation) there are no guarantees expressed or implied that it will work under any or all circumstances.

Table of contents

INTRODUCTION

This option for the HERO 2000 robot allows the robot to use a standard 360K or 720K floppy drive with the robot. The disk controller acts as the interface between the computer bus in your Robot and the Disk Drive. It is supported by the original HERO 2000 version of MS-DOS and may be supported by future operating systems as well. It is a faithful reproduction of the original Heathkit floppy controller for the robot. Unlike the Heathkit version this option is available in kit form for those that enjoy building kits.

NOTE: Although the current board is setup to use standard double-sided double density disks (40 or 80 track) it may be possible to use Hi-Density drives with some custom software/drivers and perhaps a small modification to the board. There is also a second connection available for an external floppy and that is also another option for future expansion.

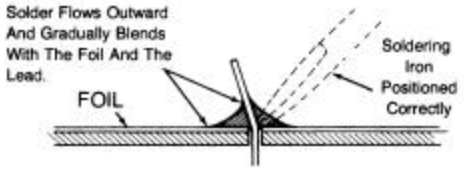
If the Disk Controller board is already assembled, please proceed to the Installation section.

CIRCUIT ASSEMBLY (Kit version only)

This kit should be built using standard construction methods. The following items are required to build the kit: diagonal cutter, needle nose pliers, soldering iron (pencil type) with fine tip, 60/40 Rosin core solder, and some patience. Follow the instructions carefully and read the entire step before performing each operation. To successfully assemble this kit you must have good soldering skills. A good solder connection will form the electrical connection between two parts, such as a component lead and a circuit board foil. Care also needs to be taken to ensure that there are no solder bridges causing shorts. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

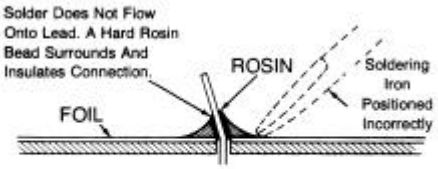
During assembly make sure you keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When the solder tends to “ball” or does not stick to the tip, the tip needs to be cleaned and retinned.

A GOOD SOLDER CONNECTION

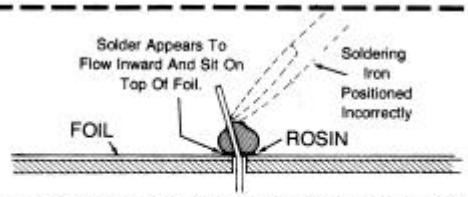


When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.



When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

The component side of the board says “DISK CONTROLLER BOARD” on the bottom left. All of the components will be mounted on the component side of the board. During construction the top of the board with the internal floppy connector (P801) should be up. After installing each component at the specified location solder it in place before proceeding to the next. When installing DIP sockets it works best if each of the two opposing corners is soldered first. Then gently press on the center of the socket while warming the solder on those corner pins with the soldering iron to make sure the socket is properly seated. Finally solder the rest of the leads on the socket. This method gives the board a much cleaner look than if the leads on the sockets have been folded over to hold it in place before soldering.

NOTE: A small axial capacitor will be soldered just to the left of all of the chips on the board with the exception of U810. The spacing is slightly wider between the pads for the capacitor and the pads for the chips. This was done to prevent the chip sockets from being accidentally installed into the spot for the capacitors. Make sure that the notch in each socket is located toward the left and that pin one goes into the pad with the square foil.

- ❑ Install the twenty-six .1µf (104) axial caps at locations: **C802**, **C806**, **C811**, **C817**, **C821**, **C803**, **C807**, **C812**, **C822**, **C827**, **C804**, **C808**, **C813**, **C818**, **C823**, **C828**, **C833**, **C824**, **C829**, **C825**, **C830**, **C814**, **C826**, **C831**, **C815**, and **C819**. These can be inserted in either direction since polarity does not matter.

- ❑ Install the four 10K Ω (BRN-BLK-BLK-RED or BRN-BLK-ORG) resistors, one *between U805 & U806* at location **R808**, *between U807 & U808* at location **R813**, *just to the left of U820* at location **R820**, and *just to the left of Q803* at location **R823**.

- ❑ Install the 1M Ω (BRN-BLK-BLK-YEL or BRN-BLK-GRN) resistor *just to the left of U801* at location **R802**.

- ❑ Install the 237 Ω (RED-ORG-VIO-BLK) resistor *just to the left of U820* at location **R821**.

- ❑ Install the 715 Ω (VIO-BRN-GRN-BLK) resistor *just to the left of Q803* at location **R822**. This is a substitute part for the original 720 ? value used and is the closest match available.

- ❑ Install the three 1K Ω (BRN-BLK-BLK-BRN) resistors, one *just under J801 near the top right of the board* at location **R811**, *just to the left of U812* at location **R816**, and *under U808* at location **R818**.

- ❑ Install the two 120K Ω (BRN-ORG-BLK-RED) resistors, one *just to the left of U804* at location **R806** and *just to the left of Q801* at location **R817**.

- ❑ Install the nine 4.7K Ω (YEL-VIO-RED) resistors, three *near the top left corner* at locations **R801**, **R803**, and **R805**, one *just to the left of U802* at location **R804**, *just to the left of U805* at location **R807**, *between U805 & U806* at location **R809**, *just to the right of U810* at location **R814**, *just to the right of U811* at location **R815**, and *just to the left of U815* at location **R819**.

- ❑ Install the 1N4149 diode *just to the left of R812 near the top of the board* at location **D801**. Place the band down according to the legend on the board.

- ❑ Install the three 1N4148 diodes at locations **D802**, **D803**, and **D804**. Place the band up according to the legend on the board.

- ❑ Install the 1N5249 diode *just to the left of Q803 near the bottom of the board* at location **D805**. Place the band up according to the legend on the board.

- ❑ Install the two 150 Ω (151) resistor packs at locations **RP801** and **RP803**. There is a dot or band on one end of these parts that should line up with the square pad on the board. The end with this designation is the common bus of the resistor network.

- ❑ Install the LM317T Voltage regulator at location **U820**. Optionally attach it with a ¼" 4-40 screw, lockwasher, and nut to the board.

- ❑ Install the BUZ71A FET at location **Q803**. Optionally attach it with a ¼" 4-40 screw, lockwasher, and nut to the board.

- ❑ Install the 40-pin socket at location **U810**. The notch should point toward the left of the board.

- ❑ Install the six 20-pin sockets at locations **U808**, **U818**, **U822**, **U823**, **U824**, and **U825**. The notch should point toward the left of the board.

- ❑ Install the six 16-pin sockets at locations **U804**, **U812**, **U817**, **U819**, **U821**, and **U826**. The notch should point toward the left of the board.

- ❑ Install the twelve 14-pin sockets at locations **U801**, **U802**, **U803**, **U805**, **U806**, **U807**, **U809**, **U811**, **U813**, **U814**, **U815**, and **U816**. The notch should point toward the left of the board.

- ❑ Install the two MPS2369 transistors at locations **Q801** and **Q802**. The flat side should point toward the bottom of the board.

- ❑ Install the 72-pin connector at location **P803**. The side of the connector with the bent leads is inserted into the board from the component side. Make sure the connector is level with the board. Proper alignment is critical since the card will not seat properly if this is not installed correctly.

- ❑ Install the 34-pin (2x17) connector at location **P801**.

- ❑ Install the .22µf (.22K100) capacitor (plastic rectangular box) at location **C810**. Polarity does not matter and this part can be installed in either direction.

- ❑ Install the 47µf electrolytic capacitor *near the left side of the board* at location **C801**. Observe the polarity as you do this. The striped side (-) should face up, away from the (+) sign on the board.

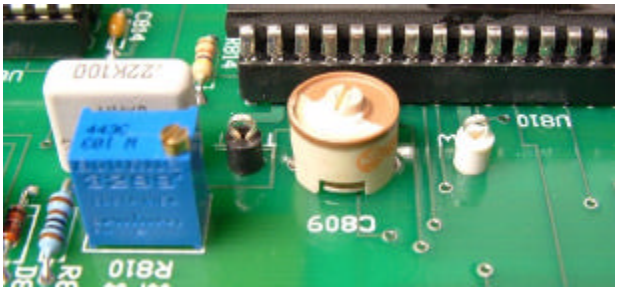
- ❑ Install the 1.0µf electrolytic capacitor *near the left side of the board* at location **C805**. Observe the polarity as you do this. The striped side (-) should face up, away from the (+) sign on the board.

- ❑ Install the two 10µf electrolytic capacitors *near the right side of the board* at locations **C816** and **C832**. Observe the polarity as you do this. The striped side (-) should face right, away from the (+) sign on the board.

- ❑ Install the 22µf electrolytic capacitor *just above U820 near the right of the board* at location **C820**. Observe the polarity as you do this. The striped side (-) should face right, away from the (+) sign on the board.

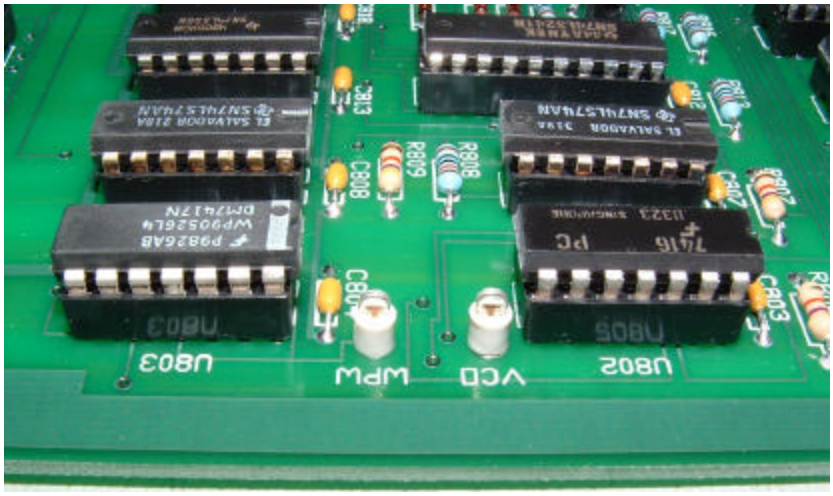
- ❑ Install the 35µh inductor at location **L801**. Polarity does not matter and this part can be installed in either direction. The one supplied may be a dipped component with marking dots and looks similar to a capacitor. Since the rest of the capacitors (with the exception of the variable cap) it should be obvious which part this is.

- ❑ Install the 15-60pf variable capacitor *just above the socket for U810* at location **C809** (VCO). The pads for this part are between RPW and /TEST. (This part may be substituted with a part that allows for a larger range of adjustment)



- ❑ Install the two 10K Ω trim resistors at locations **R810** (WPW) and **R812** (RPW). These set the adjustment for the Write-Precomp and Read-Precomp signals.

- ❑ Install the three white test points at locations **VCO**, **WPW**, and **RPW**. They provide a point to clip on the scope leads for calibrating the board.



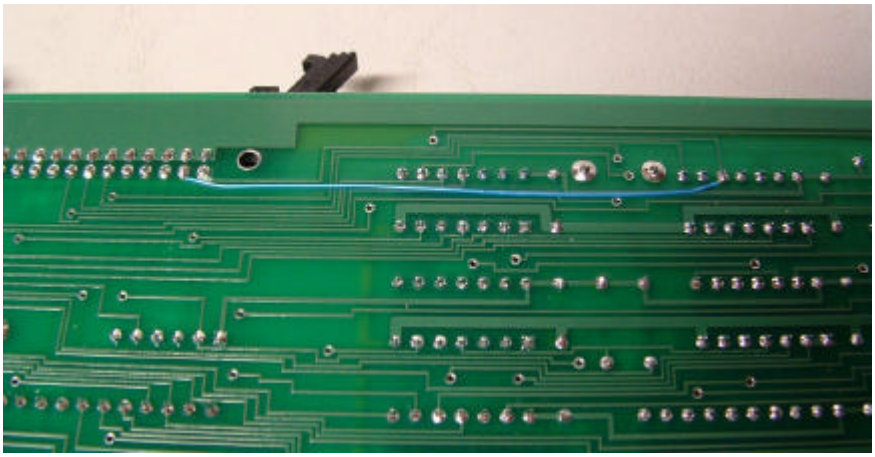
- ❑ Install the black test point at location **/TEST**. This provides the point that needs to be shorted to ground after the card is powered up in order to calibrate the board.

NOTE: When installing the headers insert the shorter leads into the PCB. The longer lead is where the configuration jumpers will go.

- ❑ Install the two 3-pin (1x3) headers *near the top right of the board* at locations **J801** and **J803**.

NOTE: The pin numbering on the two 34-pin connectors P801 and P802 match the numbering on the schematic and that of the floppy drive itself. The original Heathkit boards had a mistake on the silkscreen legend for these connectors and the numbering was reversed. This board has the correct pin numbering which allows a cable to have the stripe match pin 1 on the board and pin 1 on the floppy drive. An original floppy cable will work since only the numbering on the legend has been updated and the physical pin locations are still the same.

- ❑ ***On 85-2933-01A boards only!*** Install a small wire on the back (solder) side of the board from pin 10 on U802, to pin 32 on P801 as pictured below:



- ❑ *OPTIONAL:* Fill in the via's with solder. These are the left over holes that connect top traces to traces on the other side of the board. Over time and from expansion/contraction of the board material (Not to mention flexing of the board) small cracks can develop in the via's. In order to prevent this from happening it is best to fill them in with solder. It might be necessary to heat both sides of the via in order to get a clean connection.

- ❑ *OPTIONAL:* De-flux and clean the board. This step is not required but when properly cleaned the board's appearance is better and it is easier to spot cold solder joints and solder bridges. Depending upon the type of flux used, this can be done economically using common rubbing alcohol and an old toothbrush.

- ❑ Install the three 74LS244 chips in sockets **U822**, **U823**, and **U824**. The notch should point toward the left.

- ❑ Install the 74LS241 chip in socket **U808**. The notch should point toward the left.

- ❑ Install the 74LS374 chip in socket **U825**. The notch should point toward the left.

- ❑ Install the 74LS273 chip in socket **U818**. The notch should point toward the left.

- ❑ Install the three 74LS74 chips in sockets **U801**, **U805**, and **U806**. The notch should point toward the left.

- ❑ Install the three 74LS138 chips in sockets **U817**, **U821**, and **U826**. The notch should point toward the left.

- ❑ Install the 74LS32 chip in socket **U811**. The notch should point toward the left.

- ❑ Install the two 7417 chips in the sockets **U803** and **U814**. The notch should point toward the left.

- ❑ Install the 7416 chip in the socket at **U802**. The notch should point toward the left.

- ❑ Install the 96LS02 chip in the socket at **U804**. The notch should point toward the left.

- ❑ Install the 74LS27 chip in the socket at **U807**. The notch should point toward the left.

- ❑ Install the 74LS00 chip in the socket at **U809**. The notch should point toward the left.
- ❑ Install the 74LS175 chip in the socket at **U812**. The notch should point toward the left.
- ❑ Install the 74LS02 chip in the socket at **U813**. The notch should point toward the left.
- ❑ Install the 74LS20 chip in the socket at **U815**. The notch should point toward the left.
- ❑ Install the 74LS04 chip in the socket at **U816**. The notch should point toward the left.
- ❑ Install the 74LS365 chip in the socket at **U819**. The notch should point toward the left.
- ❑ Install the WD2797A chip in the socket at **U810**. The notch should point toward the left.
- ❑ Install the two jumper blocks (position 0) at locations **J801** and **J803**.

This concludes the Assembly procedures for the HERO 2000 Disk Controller Board. Congratulations! Before proceeding, look over the board and verify the correct location and orientation of all parts. Also check to make sure there are no solder bridges or poor solder joints. Some of the traces are very close together and it is easy to accidentally create a solder bridge across a trace or two.

INSTALLATION

The base 24K of memory on the CPU board is not large enough to load the Disk operating system so a memory expansion board is required. The robot needs one (or more) ET-19-15 memory expansion board with at least 128K of RAM. A better option is to use the H2KIDE expansion board which can provide all the extra memory on a single board and also provides an IDE interface for a Hard Drive.

This card will work in any free expansion slot. It is normally installed in one of the slots just to the left of the I/O card so that the floppy cable can come through the RF shield assembly. When the RF shield is not used then any available slot can be used. In the event that an optional connector is installed at location P802 then the board must be installed near the I/O board so the connector can come through one of the openings in the back of the robot.

Please refer to the ET-19-6 option manual for instructions regarding the installation of the Floppy drive and associated cables. If this is going to be installed with the optional H2KIDE board and IDE Hard drive then a “Y” power adapter will be required to supply power to both drives.

NOTE: The pin numbering of connector P801 on the original Heathkit floppy controller is reversed and has caused confusion when connecting to floppy drives. This controller has kept the same connector and pin locations but the square pad designating pin 1 has been relocated to the opposite side to line up with that of the floppy drive itself.

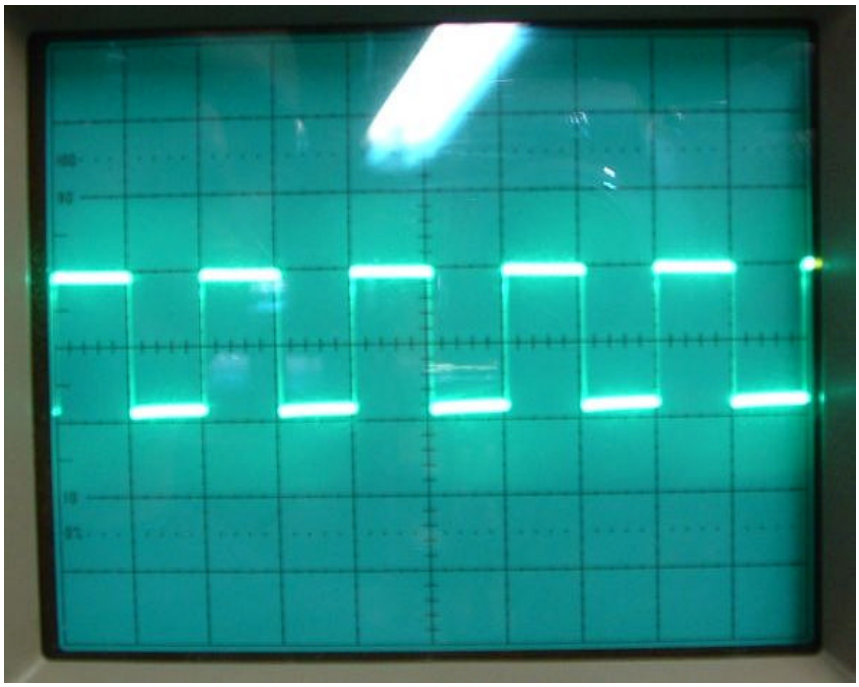
CALIBRATION

To calibrate the Disk Controller Board you should have access to a 100Mhz (or better) Oscilloscope. Depending upon the model and brand of the scope used, you may not have the exact division settings as those used in the procedure below. Just select the next closest range and factor in the difference for the waveform displayed.

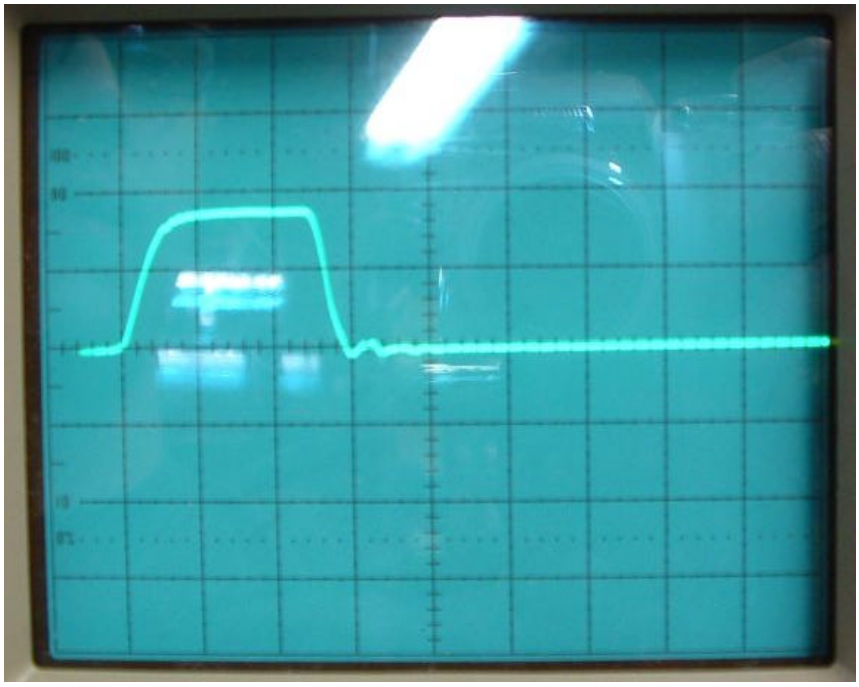
It is easier to calibrate the board if it is plugged into an extender board which allows the board to be powered up in the robot while it is exposed. If you do not have access to an extender card you can install it in the left most slot during calibration while still allowing access to the adjustments. There are three adjustments that need to be set. The first is the frequency setting for VCO. Once that is set you can adjust the WPW (Write Pre-comp) and RPW (Read Pre-comp) settings for the appropriate pulse width. For VCO the frequency is important while the settings for WPW and RPW focus more on the width of the pulse itself.

After powering up the robot attach a ground lead (from the plated hole used to pull out the card) to the /TEST connection on the disk controller card. This will put the card in a test mode so that the signals can be properly adjusted. NOTE: If this /TEST pin is grounded BEFORE powering on and resetting the robot some of the signals will not be present and you will not be able to calibrate the card.

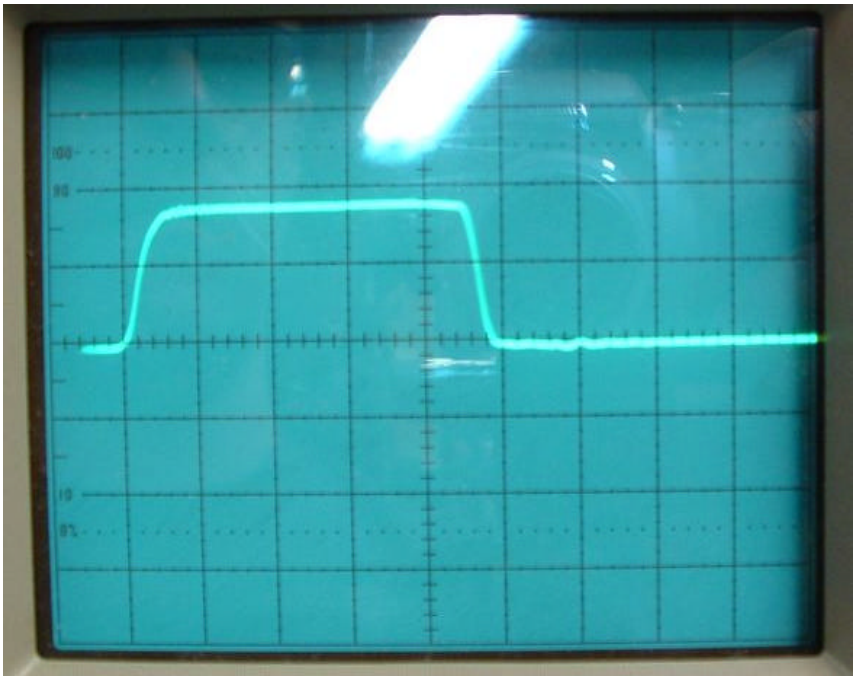
First, set the scope to 2µs per division. Attach the probe lead to the VCO test point on the board. Adjust the variable capacitor for a 250KHz square wave. This is a critical adjustment. You should see a nice clean square wave pattern on the scope like the one shown below:



Next, change the scope setting to 50ns and move the scope probe to the WPW test point on the Disk controller board. Adjust R810 (WPW) until the pulse is around 150ns in duration. It should appear similar to the picture below:



Finally, move the scope probe to the RPW test point on the Disk controller board. Adjust R812 (RPW) until the pulse is around 250ns in duration. It should appear similar to the picture below:



That's it. Power down the robot and move the Disk Controller Board to the appropriate slot.

OPERATION

The robot will automatically support this card as long as is has the latest Main ROM set (V2.0.3) and can boot the original custom version of MS-DOS directly from this board. It may also be supported by third party Disk operating systems as well.

SPECIFICATIONS

Disk Controller: WD2797
Drives Supported: Up to two, single/double-sided, 48/96 tracks per inch, single/double density
Data Separator: Phase-locked Loop
Precompensation: Variable
Data Transfer: Programmed, using wait states
Disk controller board I/O address: B0 through B5

JUMPER SETTINGS

J801: 0 **(default)** or 1
J803: 0 **(default)** or 1

I/O PORT ASSIGNMENTS

The Disk Controller Board is an I/O based device. It is controlled and access through six contiguous I/O addresses listed below:

Offset	Read access	Write access	Access
B0	Disk controller Status register	Disk controller Command register	R/W
B1	Error register	Feature register	R/W
B2	Sector count register	Sector count register	R/W
B3	Sector number	Sector number	R/W
B4	n/a	Disk controller board Control Latch	W only
B5	Disk controller board Status port	n/a	R only

IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE
Robot Does not power up after board is installed.	1. Check for solder bridges and cold solder joints. 2. Check for bent/folded pins on all logic IC's. 3. Check orientation of resistor packs
Floppy drive activity light always lit	1. Check for reversed ribbon cable.
Can't access Floppy device	2. Check drive power. 3. Verify settings on drive and termination. 4. Check calibration of controller board. 5. Clean drive heads. 6. Check for 2Mhz clock on bus, 1Mhz clock at WD2797 7. Jumpers J801 or J803 not set correctly.

HERO 2000 BUS DEFINITION

The following table shows the HERO 2000 bus signals. The Termination column tells how and where the signal is terminated on the bus. "T" means the signal is terminated on the backplane. "C" means the signal is terminated on the CPU board. "O" means the signal is also terminated on the CPU board but must be driven with open-collector circuits to prevent damage. An asterisk after the Mnemonic name means that the line is active low.

Pin #	Mnemonic	Definition	Termination
1	GND		
2	GND		
3	GND		
4	+16v	Unregulated +16 VDC (up to +24 VDC)	T
5	A0	Address bit 0	T
6	A1	Address bit 1	T
7	A2	Address bit 2	T
8	A3	Address bit 3	T
9	A4	Address bit 4	T
10	A5	Address bit 5	T
11	A6	Address bit 6	T
12	A7	Address bit 7	T
13	A8	Address bit 8	T
14	A9	Address bit 9	T
15	A10	Address bit 10	T
16	A11	Address bit 11	T
17	A12	Address bit 12	T
18	A13	Address bit 13	T
19	A14	Address bit 14	T
20	A15	Address bit 15	T
21	A16	Address bit 16	T
22	A17	Address bit 17	T
23	A18	Address bit 18	T
24	A19	Address bit 19	T
25	VI0*	Vectored Interrupt 0	O
26	VI1*	Vectored Interrupt 1	O
27	VI2*	Vectored Interrupt 2	O
28	VI3*	Vectored Interrupt 3	O
29	VI4*	Vectored Interrupt 4	O
30	VI5*	Vectored Interrupt 5	O
31	VI6*	Vectored Interrupt 6	O
32	VI7*	Vectored Interrupt 7	O
33	NMI*	Nonmaskable Interrupt	O
34	RESET	System Reset	T
35	HLD*	Processor Hold (DMA)	O
36	HLDA	Hold Acknowledge (DMA)	T

Continued on next page.

Pin #	Mnemonic	Definition	Termination
37	PHI	5 MHz system clock	T
38	CLK	2 MHz system clock	T
39	MLDIS*	Main Latch Disable (DMA)	O
40	SLEEP	Sleep signal for system	O
41	OUT	Output cycle status	T
42	INP	Input cycle status	T
43	MEMR	Memory Read cycle status	T
44	WO*	Write Output cycle status	T
45	SYNC	Signal retimed from ALE	T
46	WR*	Write strobe	T
47	STVAL*	Status Valid	T
48	DBIN	Data bus In (read strobe)	T
49	RDY	Ready; adds wait states	O
50	MWRT	Memory Write cycle	T
51	DI0	Data Input bit 0	C
52	DI1	Data Input bit 1	C
53	DI2	Data Input bit 2	C
54	DI3	Data Input bit 3	C
55	DI4	Data Input bit 4	C
56	DI5	Data Input bit 5	C
57	DI6	Data Input bit 6	C
58	DI7	Data Input bit 7	C
59	DO0	Data Output bit 0	T
60	DO1	Data Output bit 1	T
61	DO2	Data Output bit 2	T
62	DO3	Data Output bit 3	T
63	DO4	Data Output bit 4	T
64	DO5	Data Output bit 5	T
65	DO6	Data Output bit 6	T
66	DO7	Data Output bit 7	T
67	+5S	Supplies +5 VDC when sleeping	
68	+5S	Supplies +5 VDC when sleeping	
69	+12	Supplies +12 VDC	
70	+12	Supplies +12 VDC	
71	+5	Supplies +5 VDC	
72	+5	Supplies +5 VDC	

INTERRUPT DEFINITIONS

Listed in order of importance. The lower the number the higher the priority.

Level	Description
0	Originally reserved for parity error interrupt when using dynamic RAM. Since the ET-19 uses static RAM this interrupt vector may be redefined in the future.
1	REMOTE LINK: Active when the ET-19-2 Remote is communicating with the Robot.
2	TIMER: Processes the 10ms timer interrupt
3	Reserved for floppy disk controller option
4	EPCIAINT: Serial port A interrupt
5	EPCIBINT: Serial port B interrupt
6	Originally reserved for a video board upgrade. May be redefined in the future.
7	Originally reserved for a printer port upgrade. May be redefined in the future.

REPLACEMENT PARTS LIST

Integrated Circuits

Quantity	Description	Location
1	74LS00 – Quad NAND gates	U809
1	74LS02 – Quad NOR gates	U813
1	74LS04 – Hex Inverter	U816
1	7416 – Hex Inverter Buffer/Driver (Open Collector outputs)	U802
2	7417 – Hex Buffer/Driver (Open Collector outputs)	U803 and U814
1	74LS20 – Dual 4-Input NAND gates	U815
1	74LS27 – Triple 3-Input NOR gates	U807
1	74LS32 – Quad OR gates	U811
3	74LS74 – Dual D positive edge-triggered Flip-Flop	U801, U805, and U806
3	74LS138 – 3 to 8 line decoder	U817, U821, and U826
1	74LS175 – Quad D-type Flip-Flop	U812
1	74LS241 – Octal Buffer/Line driver Tri-State outputs	U808
3	74LS244 – Octal Buffer/Line driver Tri-State outputs	U822, U823, and U824
1	74LS273 – Octal D-type Flip-Flop w/clear	U818
1	74LS365 – Hex Tri-State Buffers	U819
1	74LS374 – Octal D-type Flip-Flop Tri-State outputs	U825
1	96LS02 – Retriggerable Resettable Monostable Multivibrator	U804
1	WD2979 – Western Digital Floppy controller	U810
1	LM317T – Variable Voltage regulator 1.5A	U820
2	MPS2369 – NPN high speed switching transistor	Q801 and Q802
1	BUZ71A – N-Channel Power MOSFET 13A, 50V, .120?	Q803
1	1N4149 signal diode	D801
3	1N4148 signal diode	D802, D803, and D804
1	1N5249 zener diode (19v)	D805

Capacitors and Inductors

Quantity	Description	Location
26	.1µf 104 (25v or higher) monolithic axial or dip capacitors	C802, C806, C811, C817, C821, C803, C807, C812, C822, C827, C804, C808, C813, C818, C823, C828, C833, C824, C829, C825, C830, C814, C826, C831, C815, and C819
1	1.0µf electrolytic capacitor – Radial Lead	C805
2	10µf electrolytic capacitors – Radial Lead	C816 and C832
1	22µf electrolytic capacitor – Radial Lead	C820
1	47µf electrolytic capacitor – Radial Lead	C801
1	.22µf 22K100 capacitor	C810
1	15-60pf two-lead variable capacitor (part may have wider range)	C809 (VCO)
1	35µh inductor – Radial lead	L801

Resistors

Quantity	Description	Location
2	6-pin 150 ? SIP resistor pack (common lead)	RP801 and RP802
4	10K Ω 1/4W resistors	R808, R813, R820, and R823
1	1M Ω 1/4W resistor	R802
1	237 Ω 1/4W resistor	R821
1	715 Ω 1/4W resistor (substitute for 720 ? 1/4W resistor)	R822
3	1K Ω 1/4W resistors	R811, R816, and R818
9	4.7K Ω 1/4W resistors	R801, R803, R804, R805, R807, R809, R814, R815, and R819
2	120K Ω 1/4W resistors	R806 and R817
2	10K Ω multi-turn trim pot .100” spacing	R810 and R812

Other components

Quantity	Description	Location
12	14-pin DIP sockets	U801, U802, U803, U805, U806, U807, U809, U811, U813, U814, U815, and U816
6	16-pin DIP sockets	U804, U812, U817, U819, U821, and U826
6	20-pin DIP sockets	U808, U818, U822, U823, U824, and U825
1	40-pin DIP socket	U810
1	72-pin (2x36) right angle header (Bus connector)	P803
1	34-pin (2x17) right angle connector (floppy connector)	P801 (P802 optional)
2	3-pin (1x3) header (Gold plated)	J801 and J803
3	White test points	VCO, WPW, and RPW
1	Black test point	/TEST
2	.100” jumpers	J801 and J803
1	Printed Circuit Board (through hole plated) 85-2933-01A or later	

Revision History

85-2933-01 – Original Heathkit Disk Controller board.

85-2933-01A - First reproduction version of Disk Controller board. One trace on connector P801 is off by one pad and requires that the trace be cut and a jumper wire added.

85-2933-01B – Future version of Disk Controller board PCB with corrected trace on P801.

SPECIAL THANKS

A note of thanks to the following people who helped with feedback on the initial version of the kits:

George Warner, Larry Correa, Jack Wilker, and Dennis DeDonatis

And all the HERO community who have responded with their feedback and support!