Model F100

Mirage Floppy Subsystem

Technical Manual

Document Number: 600-280-00
Revision: A
Date: 3/4/86
Serial No.:

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REVISION HISTORY

ECO No.	Date	Description	Pages
0328	6/28/84	New ZETACO Cover	
0523	3/4/86	New Cover	

Customer Service

Our warranty attests the quality of materials and workmanship in our products. If malfunction does occur, our service personnel will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions and technical advise is required, please phone Custom Systems giving the serial number, board name, model number, and problem description. You will be placed in contact with the appropriate technical assistance.

Product Return

Pre-return Checkout.

If a subsystem malfunction is suspected, the use of test software is needed to determine if the subsystem is the problem and what in particular is wrong with the subsystem. The tests applicable to this subsystem are listed on the next page of the manual. Please run the test sequence before considering product return.

Returned Material Authorization.

Before returning a product to Custom Systems for repair, please ask our service department for a "Returned Material Authorization" number. Each product returned requires a separate RMA number. Use of this number in correspondence and tag attached to the product will ensure proper handling and avoid unnecessary delays.

Returned Material Information.

Information concerning the problem description, system configuration, revision level, and results, i.e., error program counter number should be included with the returning material. A form is provided for this information on the next page of the manual.

Packaging.

To safegaurd your materials during shipment, please use packaging that is adequate to protect it from damage. Mark the box "Delicate Instrument" and indicate the RMA number(s) on the shipping label.

(Include with returning material)

MATERIAL RETURN INFORMATION

All possible effort to test a suspected malfunctioning subsystem should be made before returning the subsystem to Custom Systems, Inc. for repair. This will: 1) Determine if in fact the product is defective (many products returned for repair are not defective, causing the user unnecessary system down-time, paper work, and handling while proper testing would indicate the subsystem is working properly). 2) Increase the speed and accuracy of a product's repair which is often dependent upon a complete understanding of the user checkout test results, problem characteristics, and the user system configuration. Checkout results for the Stand-Alone Floppy Subsystem should be obtained by performing the following tests. (Include error program counter #'s where applicable)

TEST	RESULTS
1) Selftest	
2) FDCD	
3) System testing	

Other tests performed:

Please allow our service department to do the best job possible by answering the following questions thoroughly and returning this sheet with the malfunctioning board.

1. Does the problem appear to intermittent or heat sensitive? (If yes, explain).

_____

3. Describe the system configuration (i.e.,baud rate, character format,ect.)

_____

4. Has the subsystem been returned before?____Same problem?_____

To be filled out by the CUSTOMER:

Model #:_____
Serial #:_____
RMA #:_____
Returned by:_____
(company name)

Table of Contents

Chapter 1: Introduction

1.1 Product Overview

The Stand Alone Floppy was designed to enable any host computer to interface to a floppy drive with minimal control hardware needed by the host. This was achieved by inserting a controller between the host computer and the floppy disk drive to convert the data . Now, providing the host computer has an auxiliary RS232 port, no added control hardware is needed. Baud rates are selectable from 50 to 50k baud to aid in applications to given environments.(Obviously a faster baud rate would mean better overall performance.) Also all parity selections are supported.

*Note: From this point forward we will refer to the Floppy Disk Controller as the FDC.

Chapter 2: Installation

2.1 Unpacking

Carefully open the package you received and check for the following items:

1. Floppy Enclosure (drive, power supply, FDC)
2. 200-067-00 cable
3. Power cord
4. Reference Manual
5. Diagnostic Software

If any of the previous items were found missing or damaged please notify Custom Systems,Inc. of the problem and return for repair if necessary.

2.2 Inspection

Inspection of the hardware received is important and helps to ensure the installation of this device . Please do the following inspection to insure that there were no problems during shipment:

1) Look at the metal enclosure and make sure that no physical damage has occurred.

2) Check the two cables for any physical damage (check for cuts,gouges,ect...).

(Inspection cont.)

3) Verify that the serial numbers on the items you received match with the serial numbers on the invoice and packing slip.

Report shipping damages to the transportation company and Custom Systems,Inc. Please let Custom Systems ,Inc. know if any of the items received are different from the items ordered.

2.3 Site Preparation

There is no special site preparation necessary.The only requirement is that there is adequate clearance in the front for the insertion of diskettes and clearance in back for ventilation.

2.4 Setting the Switches

Inside the enclosure on the FDC there are two sets of switches . One set selects the baud rate and the other set selects the type of drive being used and type of diagnostic mode desired. Although we will cover all the switch settings, it would be advisable that the switches for selecting drive type and diagnostic mode are not tampered with. (They are factory set before the unit is shipped!)

The best way to gain access to the switches is to remove the top panel from the enclosure. This will expose the FDC and the switches.

The switch in location A4 is for setting the baud rate and a master reset.Refer to FIGURE 2.1 and FIGURE 2.2 for setting.

FIGURE 2.1

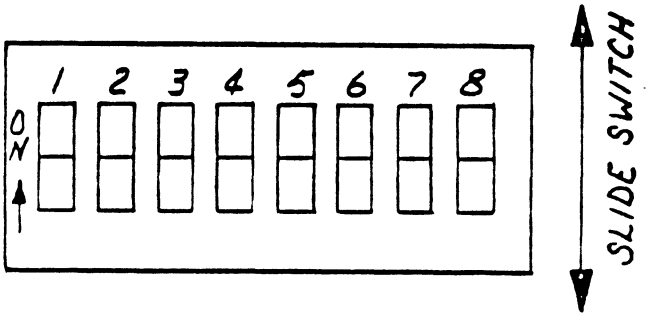

FIGURE 2.2

Baud Rate Selection Table (Loc. A4)

Freq.KHZ	Baud rate	SW2	SW3	SW4	SW5	SW6	SW7
.80	50	on	on	on	on	on	on
1.20	75	on	on	on	on	on	off
1.76	110	on	on	on	on	on	off
2.15	134.5	on	on	on	on	off	off
2.40	150	on	on	on	off	on	on
4.80	300	on	on	on	off	on	off
9.60	600	on	on	on	off	off	on
19.20	1200	on	on	on	off	off	off
28.80	1800	on	on	off	on	on	on
32.00	2000	on	on	off	on	on	off
38.40	2400	on	on	off	on	off	on
57.60	3600	on	on	off	on	off	off
76.80	4800	on	on	off	off	on	on
115.20	7200	on	on	off	off	on	off
153.60	9600	on	on	off	off	off	on
307.20	19.2K	on	on	off	off	off	off
614.40	38.4K	on	off	on	on	on	on
800.00	50.0K	off	off	on	on	on	on

SW8 = Master Reset >>>>> on = reset off = not

Normally this switch is not needed but it does provide means to reset the FDC without powering down.

(Setting the Switches Cont.)

The switch in location A6 is used for setting FDC parameters,uart parameters,loop on self-test error and an optional jump to an on-board debug tool. For the meaning of each given switch refer to FIGURE 2.1 , 2.3, 2.4 and the comments below.

FIGURE 2.3
Uart Parameters (Loc. A6)

Data bits	stop bits	parity	SW2	SW3	SW4
7	2	even	on	on	on
7	2	odd	on	on	off
7	1	even	on	off	on
7	1	odd	on	off	off
8	2	none	off	on	on
8	1	none	off	on	off
8	1	even	off	off	on
8	1	odd	off	off	off

FIGURE 2.4
FDC Parameters (Loc. A6)

	OFF	ON
SW6	Single sided	Double sided
SW7	FM	MFM
SW8	Standard 8"	Mini 5 1/4"

(Switch A6 setting Cont.)

SW1 >>>>> ON = Report error code

This setting puts the FDC in the mode, should a hardware error exist, to blink an error code on the on-board display.

OFF = Loop on self-test

This condition will cause the board to loop on a given error.

SW5 >>>>> ON = Normal operation

OFF = Jump to the on-board debug tool.

2.5 Cabling

There are only two cables to be concerned with.The first is the power cable , which plugs into the rear of the floppy enclosure , and the second the actual 200-067-00 cable. One end of the 200-067-00 cable mates with the connector on the back of the enclosure and the other end goes to the auxiliary port that the floppy is to be controlled from. FIGURES 2.5 and 2.6 show the physical connection and the wiring diagram.

FIGURE 2.5
(Drawing of enclosure and cabling)

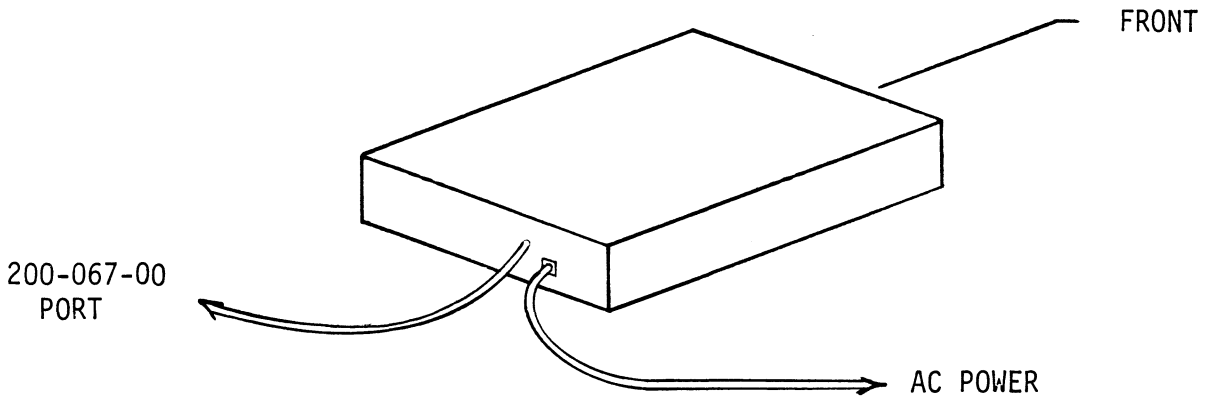

FIGURE 2.6
200-067-00 Cable

Floppy End		Auxiliary Port End
send data	PIN #1 ----------	received data
rec. data	PIN #2 ----------	send data
ground	PIN #3 ----------	ground

2.6 Powering Up

When power is applied to the unit the FDC automatically executes an on board self-test. This is done each time the unit is powered up to ensure that the hardware is functioning properly.

Powering up the device requires plugging the unit into a 110V power source and positioning the ON/OFF switch at the back of the enclosure to the "ON" position. You are now ready to use the Stand Alone Floppy.

Chapter 3: Programming

3.1 Protocal

The command and handshake protocal is straight forward and simple. When the host would like to 'talk' to the FDC it would issue a given block code to initiate the sequence. The following data would then depend on the sequence we are trying to execute. When the final transfer of the sequence is received by the FDC or the host ,the host has to only wait for the done block as an indicator that the FDC is done.(There are only a few exceptions to this rule.) The following will explain in more detail how each specific case will be handled.

****
**** Command Block ****
****

There will be four types of block codes.The first type is the Command block.This block will be sent by the host computer and will contain the following data:

byte	function
1	Start of the command block (0F1H)
2	Head+Unit+Command (MSB H,U,U,C,C,C,C,C LSB)
3	Track Address (0 - 4C)
4	Sector Address (1 - 1A)
5	Check Sum

*Note: All check sums are the total of the '0' bits in each byte of the block.After being calculated use the lower byte of the two byte sum

This will always be the first block to be sent to the FDC and depending on the code sent the host will then be waiting for one of the following blocks to be sent back:

****
**** Data Block ****
****

This is Data Block. The data block is sent to the host on a read operation and sent to the FDC on a write operation. In the case of a write ,the host will send the write command block and wait for a done block (to be discussed later),to signifiy that it is ready for the data block to be sent.Then, at the end of the write command ,a second done block will be sent to the host indicating that the operation is complete. Conversely,with a read command ,the command block is sent and the host simply waits for the data block to be returned.At the end of the read data block , there will be no done block to follow ,but the second to the last byte of the data block received will signify a good or bad read. The read command is the exception to the rule as far as the done block is concerned.The Data Block is as follows:

byte	function
1	data block code (0F2H)
2	size of data block in bytes (hex)
3	data block
4	check sum (described earlier)

*Note: During the read command, set the data block size to one more byte than the actual record size.This second to the last byte will then be the indicator as to whether it was a good or bad read.

00H returned = good read
01H returned = bad read

****
**** Done Block ****
****

The next block to be discussed is the done block. The done block is used to signal to the host that a given sequence of operations is completed and is ready for the next given block sequence. It is , in a sense, the handshake between the host and the FDC.This code is always sent by the FDC and never the host. Its definition is as follows:

byte	function
1	done code (0F4H)
2	completion status (0 = good) (1 = bad)
	(if the status command was sent this byte would be the real status)
3	check sum

****
**** Error Block ****
****

The only other block code is the error block.This block should be used if something goes wrong and the protocal no longer makes any sense. When this block code is used the sender must always wait for the receiver to get done with whatever he is doing. Examples of this are:

1) Illegal block code received
2) checksums do not compare
3) block sent was too long or short

The error code sequence is as follows:

byte	function
1	error code (0F3H)
2	check sum

3.2 Commands Supported

The commands that are supported by the FDC are the following:

command	code
1) write a sector	01 hex
2) read a sector	06 hex
3) seek a track	0C hex
4) recalibrate	0D hex
5) format a track	0B hex
6) sense drive status	0A hex

In the following the data exchanges are discussed for each given command. Any deviation from the standard 'handshake' will be explained. Also ,the arrows drawn will indicate which way the data flow is at that particular time.

host	activity	FDC
	**********	
	**** write ****	
	**********	
write block----->		
	(none)	
		<-----done and status
data block or error-->		
	(disk write)	
		<-----done and status

host	activity	FDC
	**********	
	**** read ****	
	**********	
read block------>		
	(disk read)	
		<--data block with status
	**********	
	**** seek ****	
	**********	
seek block------>		
	(seek the track)	
		<--done and status
	**********	
	**** recalibrate ****	
	**********	
recal block----->		

(recal to track zero)

<--done and status

****
**** format a track ****
****

format block---->

(format the track)

<--done and status

Note: In the format command block only the FDC has the ability to specify the header data.The host specifies the fill data in the sector address of the command block.

host	activity	FDC

****
**** sense drive status ****
****

status block---->

(get the real drive status)

<--done and actual drive status

There are times when the command sent to FDC was understood but was unable to successfully complete the operation on the drive. Examples of this are:

1) A command was attempted but the unit was not ready.

2) Write command was issued but the unit is write protected.

3) A read or write was issued to the FDC but the actual command was unable to be completed because of a flaw in the media or the diskette was not formatted properly.

Chapter 4: Diagnostic Provisions

4.1 Self-Test

If a problem should exist with the Stand-Alone Floppy subsystem there are two provisions made to aid in determining where the problem exits.The first is the on-board self-test.

The self-test is run each time the subsystem is powered up.It performs a number of initial checks and tests to provide some indication as to whether the hardware seems to be functioning normally. The way to tell if self-test has run successfully is to look at the LED display found on the FDC board at location B7. When the test has completed the middle segment of the display will display a"dash".This indicates the FDC is idle and is waiting for a command. If an error condition is present the LED display will blink the test number that is failing. If this happens ,please notify Custom Systems of the problem and before returning the board call CSI's Engineering Secretary for return authorization procedures.

During normal operation the display can also be used as an activity indicator.When it is not idle the display will show a number indicating the decoded command that it is trying to execute.

4.2 Diagnostic Utility

The diagnostic that is shipped with the floppy subsystem should always be run when first receiving the unit from shipment. It is a tool used in determining whether or not communications are established with the auxiliary port,(baud rate,character type,ect...),and that all hardware concerned is in working condition. The FDC diagnostic also contains an automatic floppy diskette formatter and a command string builder using the protocal we talked about previously.(Caution:this diagnostic is only compatible with a Mirage^ based system.)

To run the diagnostic ,providing it has been loaded onto your current working disk, simply type "FDCD" (CR) and a menu will be displayed offering the user a choice of options to run. Type one of the given letters offered and the program will run that given test automatically or if more parameters are needed it will ask you for them.To terminate the diagnostic program and return to your system ,type a "Q" and control will be returned to the system.

Apendix

A.1 Installation for Mirage

The installation of the Stand-Alone Floppy in the Mirage environment consists of the following steps and are detailed in the pages that follow:

1) Character format configuration
2) Baud Rate Selection
3) Cabling
4) Running of the CP/M level diagnostics

Character Format Configuration

The Stand-Alone Floppy subsystem is factory set for a character format of eight bits, one stop bit and no parity. For the Mirage proccessor to function with this, the auxiliary port that you choose to use must also be configured with this character format.

Baud Rate Selection

The baud rate of the floppy subsystem is also factory set at a baud rate value of 19.2K baud. This is a baud rate compatible with the Mirage proccessor's auxiliary port.

Cabling

The cabling of the floppy subsystem is much like cabling a terminal with only one difference. Pin 25 of the D-type connector is tied to ground to signal to the Mirage board that the floppy is connected and not some other peripheral.

Floppy		Mirage
PIN 1 - Send Data	>>>>>>>>>>>>>>>>>>>	PIN 3 - Received data
PIN 2 - Received data	<<<<<<<<<<<<<<<<	PIN 2 - Send data
PIN 3 - Ground	<<<<<<<<<<<<>>>>>>>>>>>	PIN 7 - Ground
		PIN 25 - Ground Floppy cable monitor

Running of CP/M Level Diagnostics

The diagnostics shipped to you on your chosen media is in dump format and is called "FDIAG.VF".It is like any other virtual floppy and can be mounted or dismounted using your Mirage board. Once the diagnostic virtual floppy has been mounted , go to the disk in which you have "FDIAG.VF" mounted. In that virtual floppy you will find a program called "FDCD.COM". Type "FDCD" (CR) to run that program. When the program is run this menu will appear:

CUSTOM SYSTEM'S DEBUG CHOICES

M = EXAMINE MEMORY/MODIFY
D = DISPLAY MEMORY
F = FILL MEMORY
B = BLOCK MEMORY MOVE
X = EXAMINE/MODIFY REGISTERS
G = GO TO
I = I/O PORT INPUT
O = I/O PORT OUTPUT
S = SET DISK COMMAND
E = SEEK EXERCISER
Z = FORMAT AND VERIFY A FLOPPY
R = RUN DIAGNOSTICS
Q = QUIT

When this is displayed insert a blank,but formatted floppy, diskette in the subsystem. If a formatted floppy is not available then acquire and insert a new soft sectored diskette and type a "Z" to format and verify one. Now that a properly formatted floppy is in the subsystem type an "R" to run the diagnostics and answer the question of how many passes to run follwed by a carriage return. If an error is found , the problem will be displayed on the terminal, steps should be taken to rectify the situation. When successful completion of the test has occurred a "TOTAL PASSES: NN" will be seen where NN is the number of passes completed.

*NOTE: If for some reason an error exists and it is not due to bad media , cabling or character format configuration problems please notify Custom Systems Inc. If nessessary to return for repair ,acquire instructions on how to do so from C.S.I's Engineering Secretary.

ZETA

Please give us your comments.

Please use this form to send us your comments regarding this Technical Manual. Your input is greatly appreciated! Problems will be promptly addressed and action taken as necessary. If you wish a written reply, please furnish your name and mailing address. Thank you.

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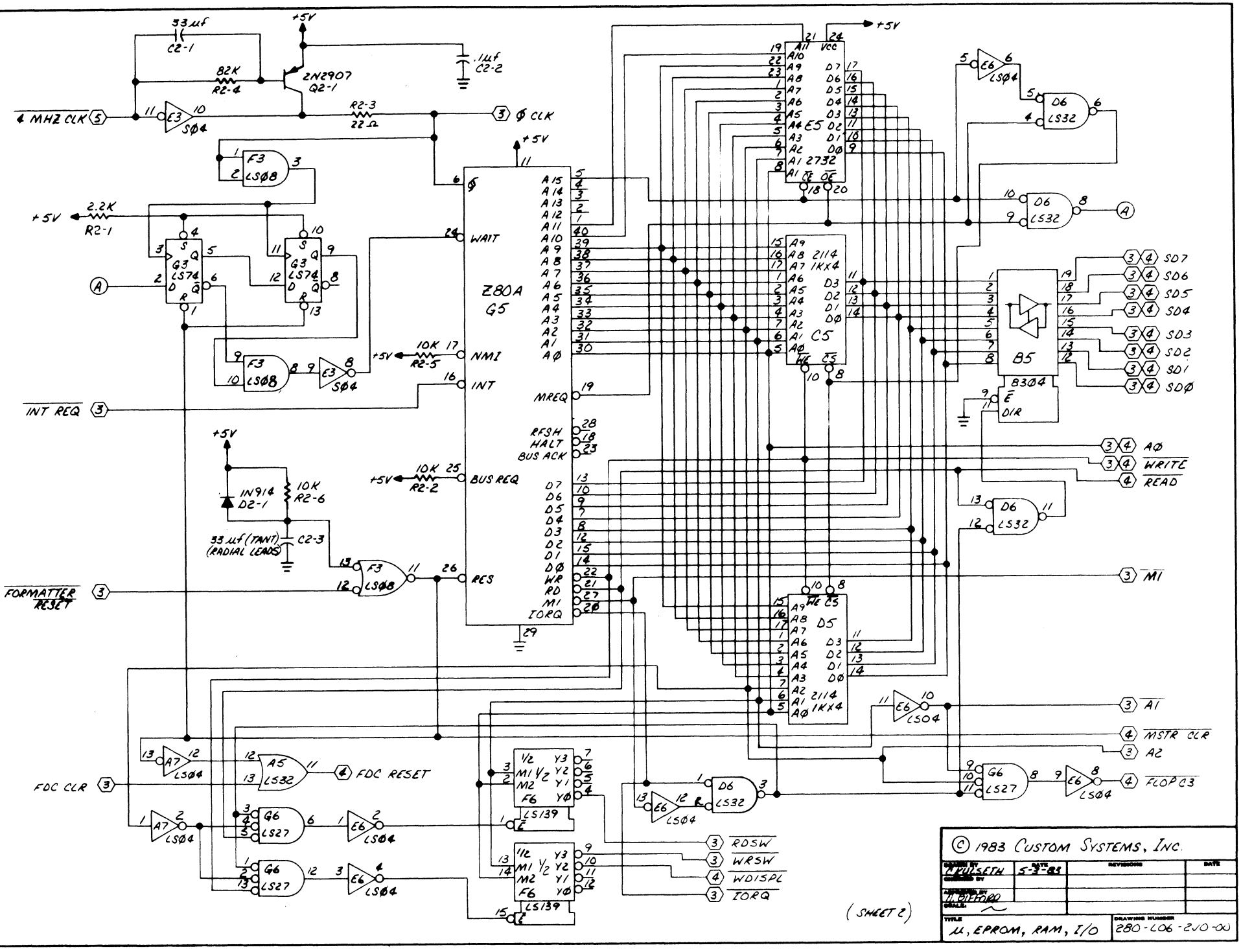
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C2-1
+5V
2N2907
Q2-1
.1µf
C2-2
82K
R2-4
4 MHZ CLK
R2-3
22Ω
Ø CLK
2.2K
R2-1
WAIT
NMI
INT
INT REQ
MREQ
RFSH
HALT
BUS ACK
BUS REQ
10K
R2-5
R2-2
IN914
D2-1
10K
R2-6
33 µf (TANT)
(RADIAL LEADS)
C2-3
FORMATTER RESET
RES
WR
RD
M1
IORQ
Z80A
G5
2114
1KX4
C5
D5
B5
B304
FDC CLR
FDC RESET
RDSW
WRSW
WDISPL
IORQ
SD7
SD6
SD5
SD4
SD3
SD2
SD1
SDØ
AØ
WRITE
READ
M1
A1
MSTR CLR
A2
FLOP C3
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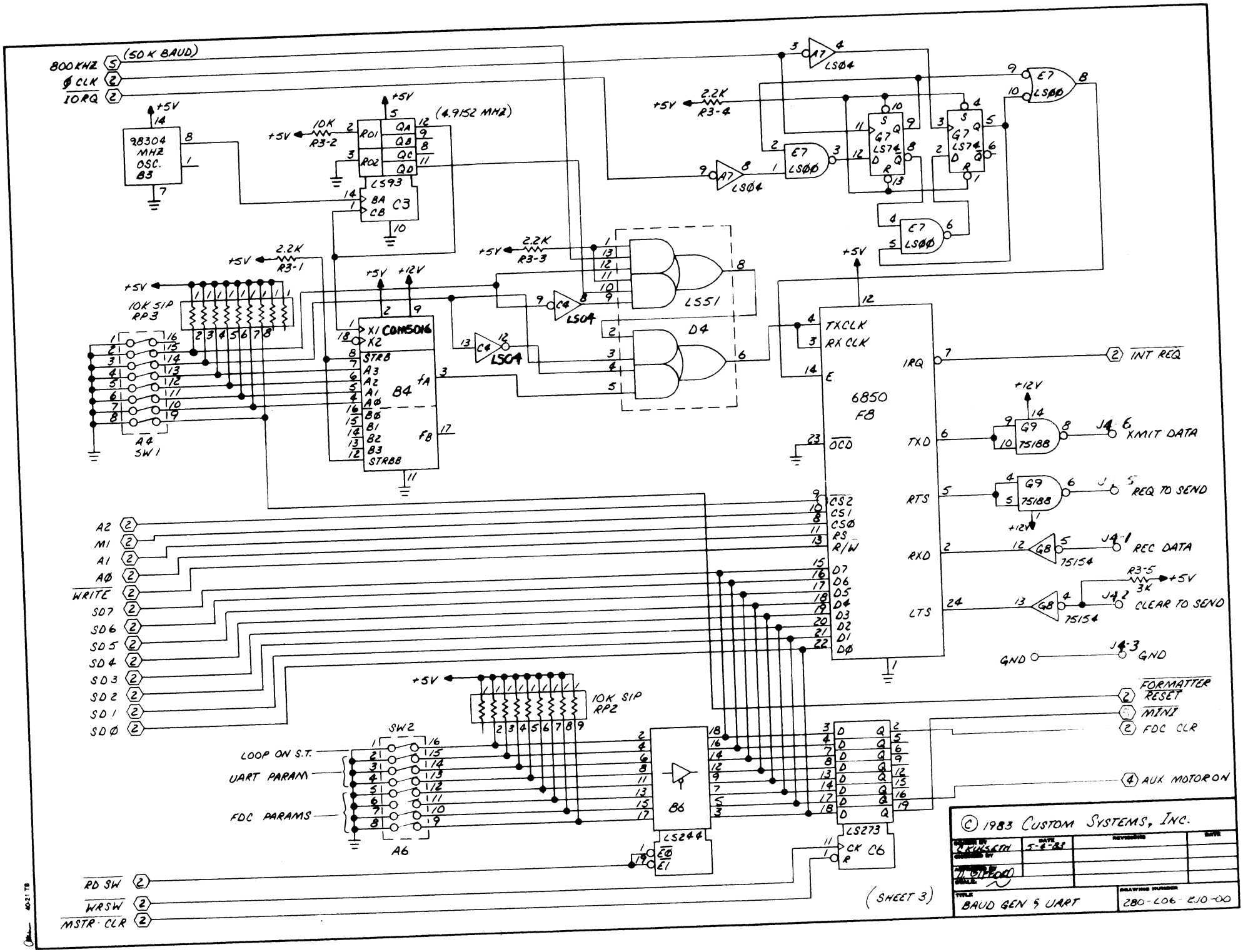
800 KHZ (50 K BAUD)
Ø CLK
IORQ
98304 MHZ OSC. B3
(4.9152 MHZ)
10K R3-2
2.2K R3-1
2.2K R3-3
2.2K R3-4
10K SIP RP3
A4 SW1
COM5016
B4
LS551
D4
6850 F8
TXCLK
RX CLK
IRQ
INT REQ
TXD
XMIT DATA
RTS
REQ TO SEND
RXD
REC DATA
CTS
CLEAR TO SEND
GND
A2
A1
A0
WRITE
SD7
SD6
SD5
SD4
SD3
SD2
SD1
SD0
10K SIP RP2
SW2
LOOP ON S.T.
UART PARAM
FDC PARAMS
A6
B6
LS244
LS273 C6
FORMATTER RESET
MINI
FDC CLR
AUX MOTORON
RD SW
WRSW
MSTR-CLR
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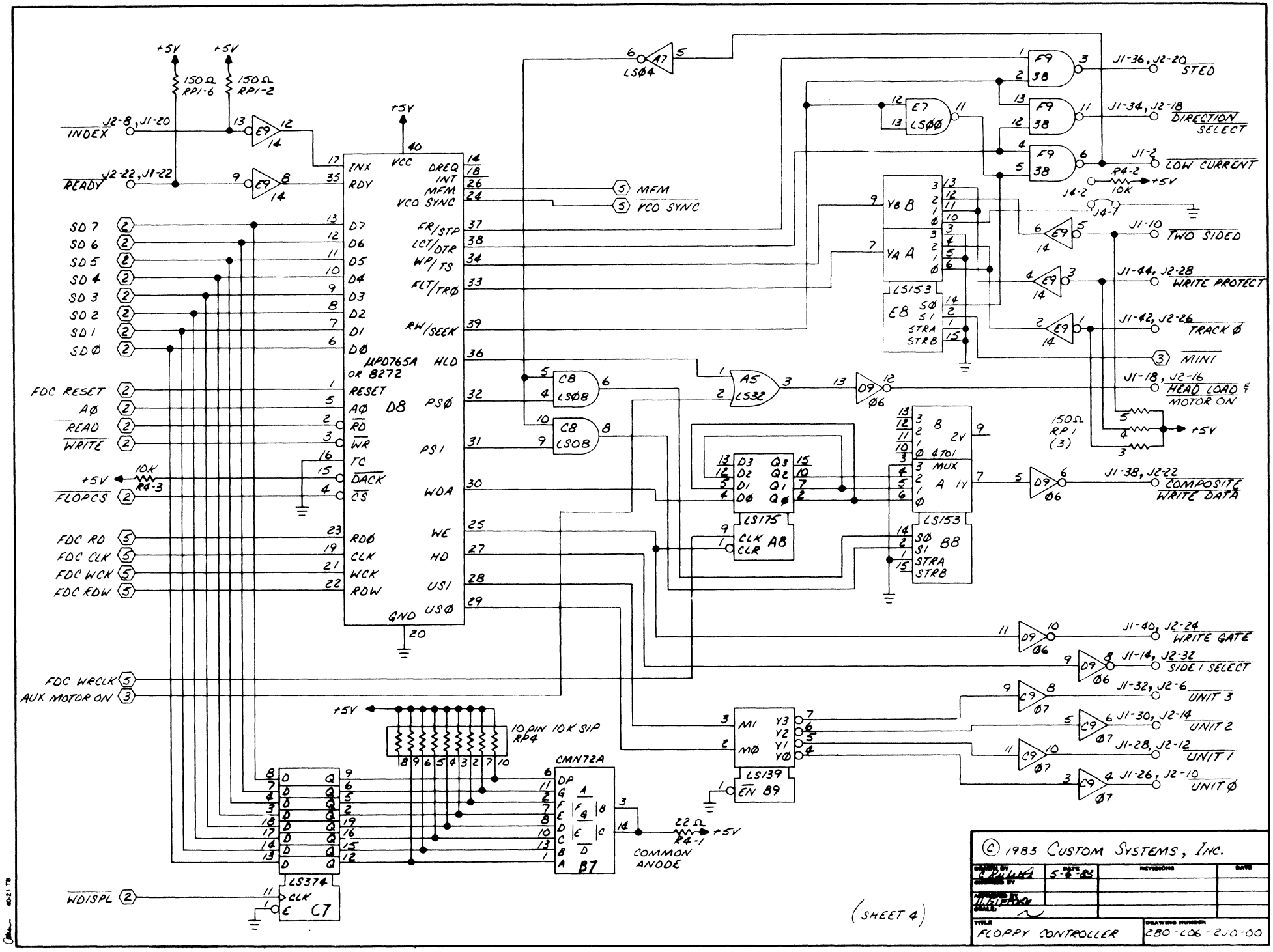
+5V
150Ω RP1-6
150Ω RP1-2
J2-8, J1-20 INDEX
J2-22, J1-22 READY
LS04 A7
F9 38
E7 LS00
E9 14
C9 14
J1-36, J2-20 STED
J1-34, J2-18 DIRECTION SELECT
J1-2 LOW CURRENT
R4-2 10K
J4-2
J4-7
J1-10 TWO SIDED
J1-44, J2-28 WRITE PROTECT
J1-42, J2-26 TRACK Ø
3 MINI
J1-18, J2-16 HEAD LOAD & MOTOR ON
150Ω RP1 (3)
J1-38, J2-22 COMPOSITE WRITE DATA
LS153 E8
LS153 B8
LS175 A8
LS32 A5
C8 LS08
D9 Ø6
μPD765A OR 8272
INX
RDY
VCC
DREQ
INT
MFM
VCO SYNC
FR/STP
LCT/DTR
WP/TS
FLT/TRØ
RW/SEEK
HLD
PSØ
PS1
WDA
WE
HD
US1
USØ
RESET
AØ
RD
WR
TC
DACK
CS
RDØ
CLK
WCK
RDW
GND
D7
D6
D5
D4
D3
D2
D1
DØ
SD 7
SD 6
SD 5
SD 4
SD 3
SD 2
SD 1
SD Ø
FDC RESET
AØ
READ
WRITE
+5V
10K R4-3
FLOPCS
FDC RD
FDC CLK
FDC WCK
FDC RDW
FDC WRCLK
AUX MOTOR ON
MFM
VCO SYNC
10 PIN 10K SIP RP4
CMN72A
LS139 EN B9
LS374 C7
22Ω R4-1
COMMON ANODE
WD1SPL
J1-40, J2-24 WRITE GATE
J1-14, J2-32 SIDE 1 SELECT
J1-32, J2-6 UNIT 3
J1-30, J2-14 UNIT 2
J1-28, J2-12 UNIT 1
J1-26, J2-10 UNIT Ø
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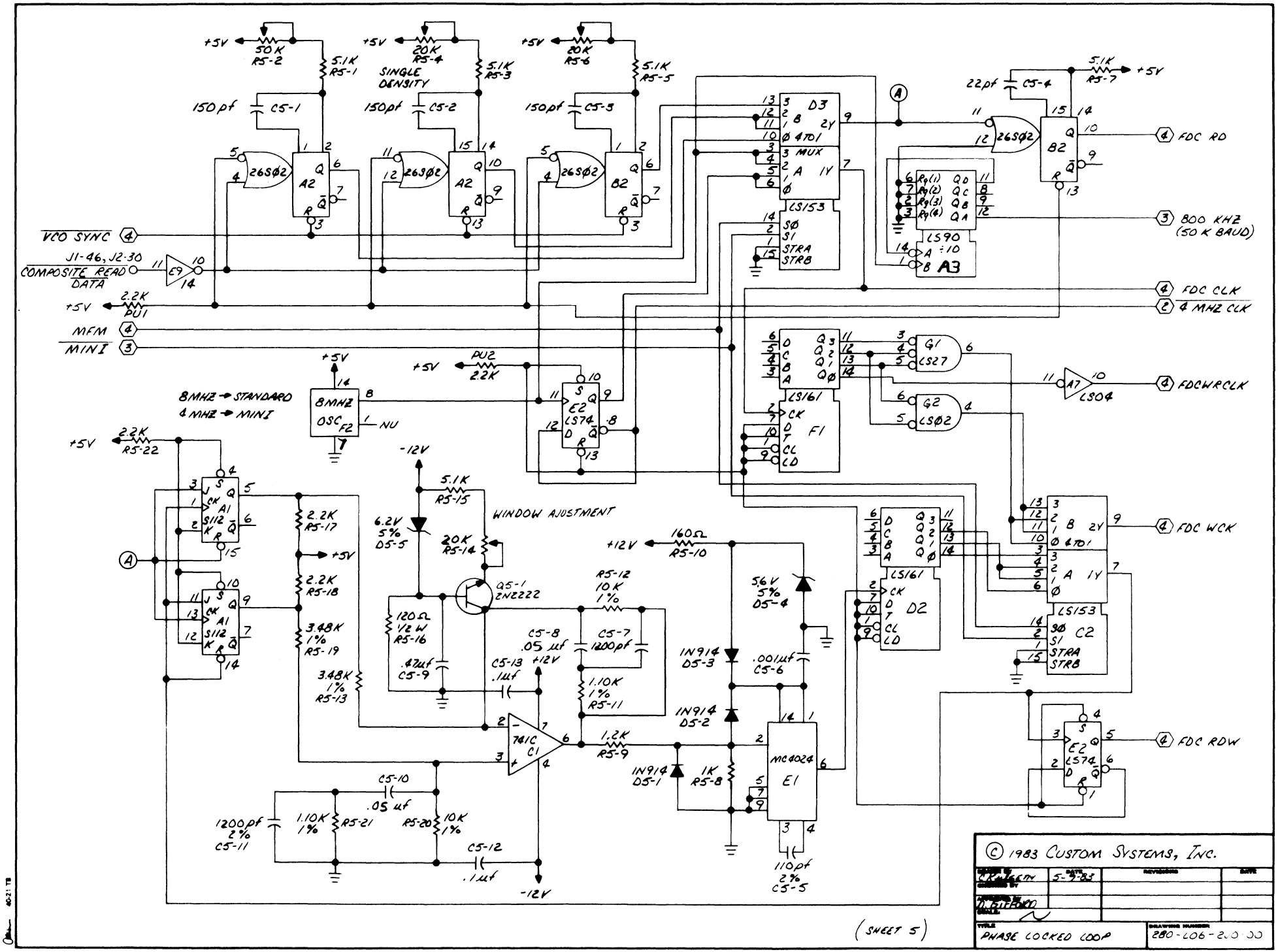
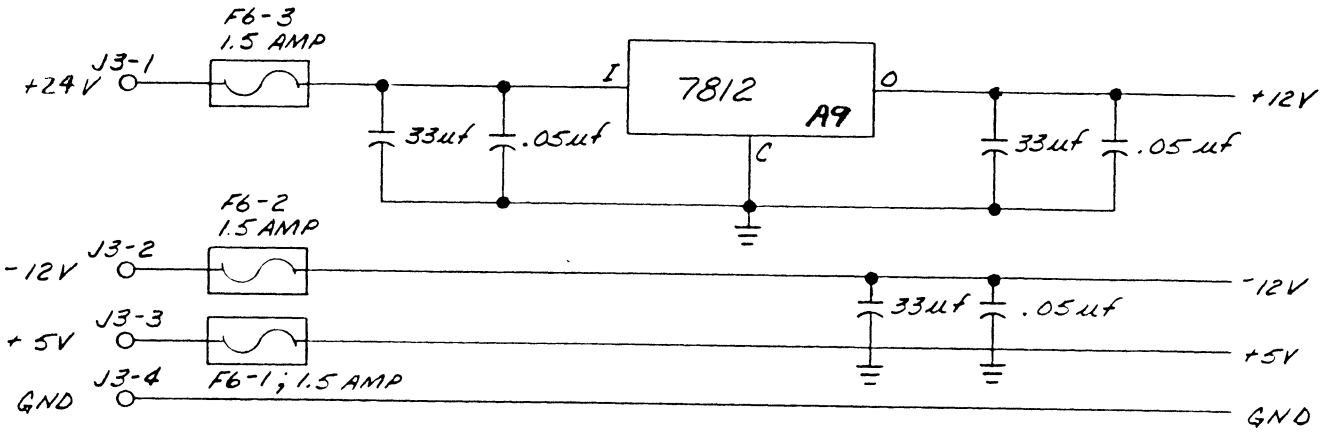
FLOPPY CONTROLLER
DRAWING NUMBER
280-006-200-00


+5V
50K RS-2
5.1K RS-1
150pf C5-1
SINGLE DENSITY
20K RS-4
5.1K RS-3
150pf C5-2
20K RS-6
5.1K RS-5
150pf C5-3
22pf C5-4
5.1K RS-7
VCO SYNC
J1-46, J2-30 COMPOSITE READ DATA
2.2K RU1
MFM
MINI
8MHZ → STANDARD
4 MHZ → MINI
8MHZ OSC
PU2 2.2K
2.2K RS-22
5.1K RS-15
6.2V 5% DS-5
20K RS-14
WINDOW AJUSTMENT
Q5-1 2N2222
120Ω 1/2 W RS-16
.47uf C5-9
C5-8 .05 uf
C5-13 .1uf
2.2K RS-17
2.2K RS-18
3.48K 1% RS-19
3.48K 1% RS-13
-12V
+12V
160Ω RS-10
RS-12 10K 1%
C5-7 1200pf
1.10K 1% RS-11
1.2K RS-9
5.6V 5% DS-4
.001uf C5-6
IN914 DS-3
IN914 DS-2
IN914 DS-1
1K RS-8
110pf 2% C5-5
C5-10 .05 uf
1200pf 2% C5-11
1.10K 1% RS-21
10K 1% RS-20
C5-12 .1uf
FDC RD
800 KHZ (50 K BAUD)
FDC CLK
4 MHZ CLK
FDCWRCLK
FDC WCK
FDC RDW
(SHEET 5)
© 1983 CUSTOM SYSTEMS, INC.
5-9-83
PHASE LOCKED LOOP
280-106-200 00



(SHEET 6)

DRAWN BY	DATE	REVISIONS	DATE
C RUGGETH	8-2-83		
CHECKED BY			
APPROVED BY			
SCALE: ~			

TITLE: MIRAGE FLOPPY

DRAWING NUMBER: 280-106-200-00