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Rev. B

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## APPLICATION NOTE

### INTERFACING THE FINCH<sup>TM</sup> DEVICE INTERFACE (FDI) FAMILY WITH THE INTEL iSBC-215 CONTROLLER

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APPLICATION NOTE  
INTERFACING THE FINCH™ DEVICE INTERFACE (FDI) FAMILY WITH  
THE INTEL iSBC-215 CONTROLLER

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### 1.0 INTRODUCTION

The INTEL iSBC-215 ® Controller allows Winchester disk drives to be interfaced with any INTEL Multibus ® interface compatible computer system. It's design is based on the INTEL 8089 I/O processor, which allows Direct Memory Access (DMA) transfers, error detection and correction, and data management.

The iSBC-215 Controller also provides two INTEL iSBX ® bus connectors which allow other storage devices such as flexible disk drives or magnetic tape cartridge drives to be interfaced with the Multibus.

The purpose of this application note is to point out the necessary modifications to accomplish interface compatibility between the iSBC-215 Board and the FDI Family. It is assumed that the user is already familiar with the Multibus host protocol.

The adapter board mentioned in this application note is not a product and will not be supported as a product.

### 2.0 REFERENCE DOCUMENTS

In addition to this application note, reference to the following documents may be required:

77711078	Product Specification for WREN Disk Drive 9415-3
77653332	Product Specification for FINCH Disk Drive 9410-FDI
144780-001	iSBC-215 Winchester Disk Controller Hardware Reference Manual

### 3.0 GENERAL DESCRIPTION

The iSBC-215 Controller is designed with the Multibus interface to the host and a general purpose drive interface. The drive interface is selectable through switch settings and jumper options. There are two versions of the iSBC-215 Board which will operate the FDI Family; the older iSBC-215A Controller and the current iSBC-215G Controller.

Those wishing to use the iSBC-215 Board with the FDI Family should order the iSBC-215G product.

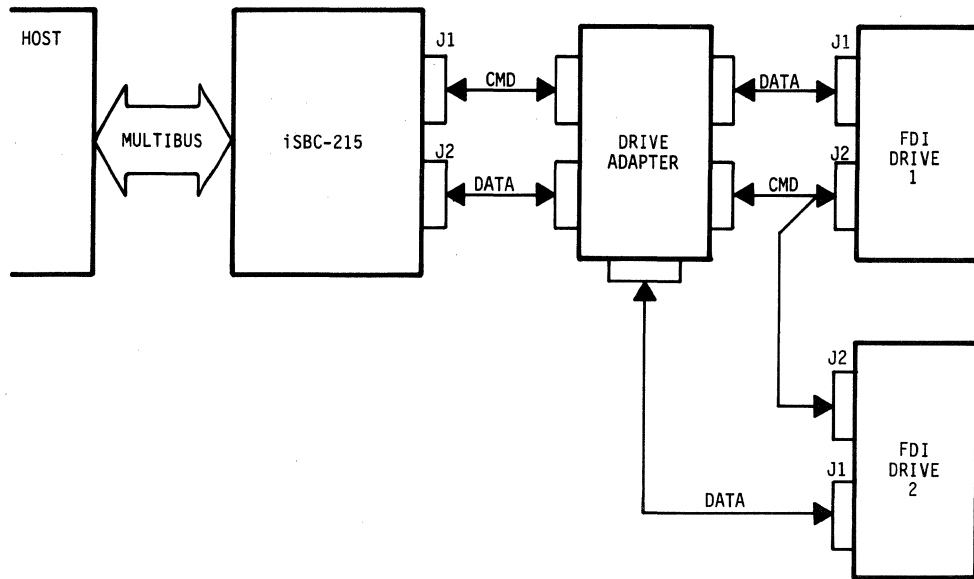
Figure 1 is a block diagram of the hardware configuration. The drive adapter is used to convert the general purpose controller interface to the Finch Device Interface (FDI) used on the 9410-FDI FINCH or the 9415-3 WREN. The details of the FINCH adapter will be described in Appendix A and the WREN adapter will be described in Appendix B.

#### 3.1 iSBC-215 CONFIGURATION

Due to the variations required for the operation of different drives, there are a number of jumpers which require verification for FDI compatibility. Table 1 and Table 2 identifies the proper setting.

The drive adapters, described in Appendix A and B, provide all necessary interface modifications to gain compatibility for two FDI Drives. These adapters are not a product from CDC; however, all information and documentation for these boards can be provided to help the user with the integration of FDI Family drives.







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FIGURE 1. HARDWARE CONFIGURATION BLOCK DIAGRAM



TABLE 1. ISBC-215A AND ISBC-215G JUMPER SETTINGS


JUMPER	LOCATION	DESCRIPTION
W1	1-3	OPEN/CLOSED HEAD POSITIONING
W2	1-2	VENDOR SELECT
W3		SBX BOARD CONTROL
W4		SBX BOARD CONTROL
W5	1-2	RD-
W6	1-2	RD+
W7	1-2	RDCL+
W8	1-2	RDCL-
W9	NO JUMPER	TRI-STATE SELECT
W10	NO JUMPER	RADIAL SELECT
W11		SBX BOARD CONTROL
W12		SBX BOARD CONTROL
W13	1-3	HARD/SOFT SECTORING
W14	1-3	AM CONTROL
W15	1-2	GAP CONTROL
W16	1-3	HARD/SOFT SECTORING
W17	1-2	INDEX SELECT
W18		ARBITRATION SELECT
W19		INTERRUPT LEVEL SELECT
W20	NO JUMPER	-5 V SELECT
W21	NO JUMPER	-5 V REGULATOR SELECT
W22	1-2	RD CLOCK SELECT
W23	1-2	COMMON BUS REQUEST

} LEVEL SELECT

Use Table 1 jumper settings plus the following jumper settings.

TABLE 2. ISBC-215G JUMPER SETTINGS

W24	NO JUMPER	DMA REQ
W26	1-2	VEND 1
W27	NO JUMPER	VEND 2
W28	1-2	BPRO1
W29		--
W30		--
W32	NO JUMPER	LOCK
W33	1-2	SECTOR 0
W34	NO JUMPER	ANSI SELECT
W35	NO JUMPER	ANSI SELECT
W36	NO JUMPER	PAGE 0-F
W37	1-2	VEND 3
W38	1-2	VEND 4

 SEE THE ISBC-215 HARDWARE MANUAL.



## APPENDIX A

### 9410-FDI FINCH DRIVE ADAPTER DESCRIPTION

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#### A.1 9410-FDI FINCH DRIVE ADAPTER

The purpose of the drive adapter (Figure A-1) is to perform three functions:

1. Scramble I/O pins.
2. Convert the Byte Clocks from the FINCH into Sector pulses for the iSBC-215 Board.
3. Convert the 40 pin iSBC-215 Board data cable to two 20-pin data cables and translate the differential read drivers.

##### A.1.1 Scramble I/O Pins

Since the drive interface of the iSBC-215 Board is general purpose it is necessary to convert the I/O pin designation of the 50-pin command cable as shown in Figure A-2 (iSBC-215A) and Figure A-3 (iSBC-215G).

##### A.1.2 Byte Clock Counter

The FDI interface uses Byte Clocks to support user variations in data field; however, the iSBC-215 Board is a hard sectored device which uses a Sector pulse. The drive adapter will convert Byte Clocks to Sector as shown in Figure A-4 (iSBC-215A) and Figure A-5 (iSBC-215G). This counter is switch selectable. The switches are set for the "binary weight minus two for each byte the user wants to count:

Example: 256 byte data field

The user can get 42 sectors at 320 bytes/sector.

The user enters 320 Minus 2 or 318 binary on the switches.

Table A-1 summarizes the Byte Clock counter switch settings.

##### A.1.3 Data Cable Conversion

The 40-pin data cable of the iSBC-215 Board is converted to two 20-pin data cables, as shown in Figure A-6 (iSBC-215A) and Figure A-7 (iSBC-215G).

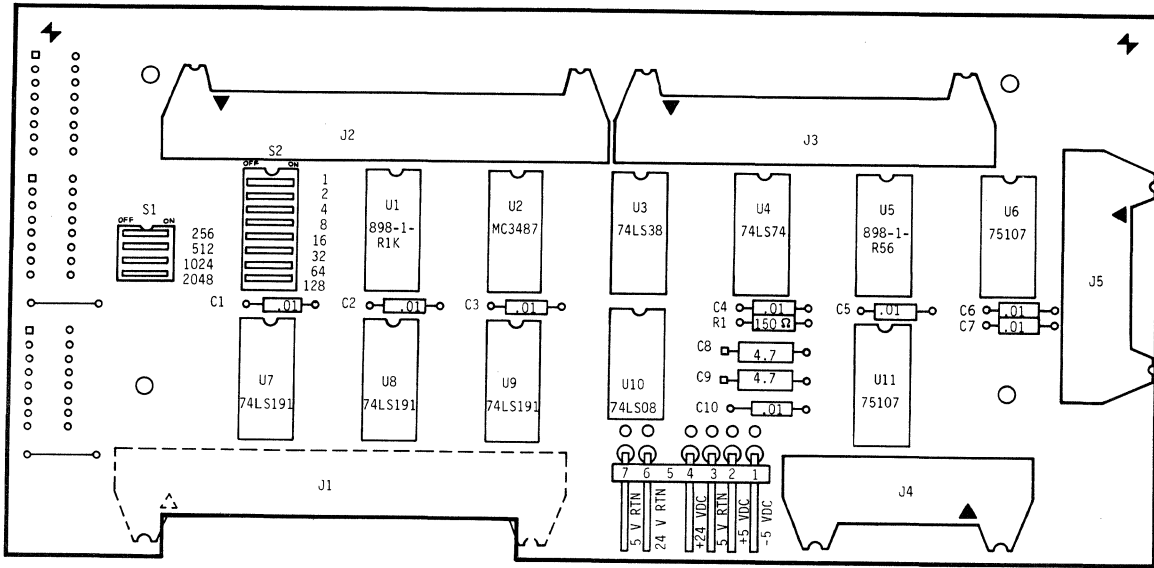
#### A.2 DRIVE ADAPTER MOUNTING

The drive adapter can be mounted on the back of the FINCH or mounted to the wall of a cabinet by four standoffs. Figure A-8 identifies the mounting requirements for mounting on the back of the FINCH. Figure A-9 is a recommended right angle bracket for mounting the drive adapter to the FINCH.

#### A.3 DRIVE ADAPTER POWER

The drive adapter requires  $\pm 5$  V DC power supply. This power may be supplied separately to the drive adapter by pigtailling off the power supply leads. (This method would only be necessary when mounting is separate.) The user may also provide a pigtail from the drive adapter to the FINCH DC power connect thus requiring one power connection (from power supply) on the drive adapter for both the FINCH and drive adapter.

The mating power connector part number is shown in Figure A-10.



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DESCRIPTION	PL NO.		CAP	DESCRIPTION
1K RES PACK	11	U1	C1	.01
MC3487	5	U2	C2	.01
7438	6	U3	C3	.01
7474	8	U4	C4	.01
56 OHM RES PACK	12	U5	C5	.01
75107	9	U6	C6	.01
74191	10	U7	C7	.01
74191	10	U8	C8	4.7, 10V, 20%
74191	10	U9	C9	4.7, 10V, 20%
7408	7	U10	C10	.01
75107	9	U11		

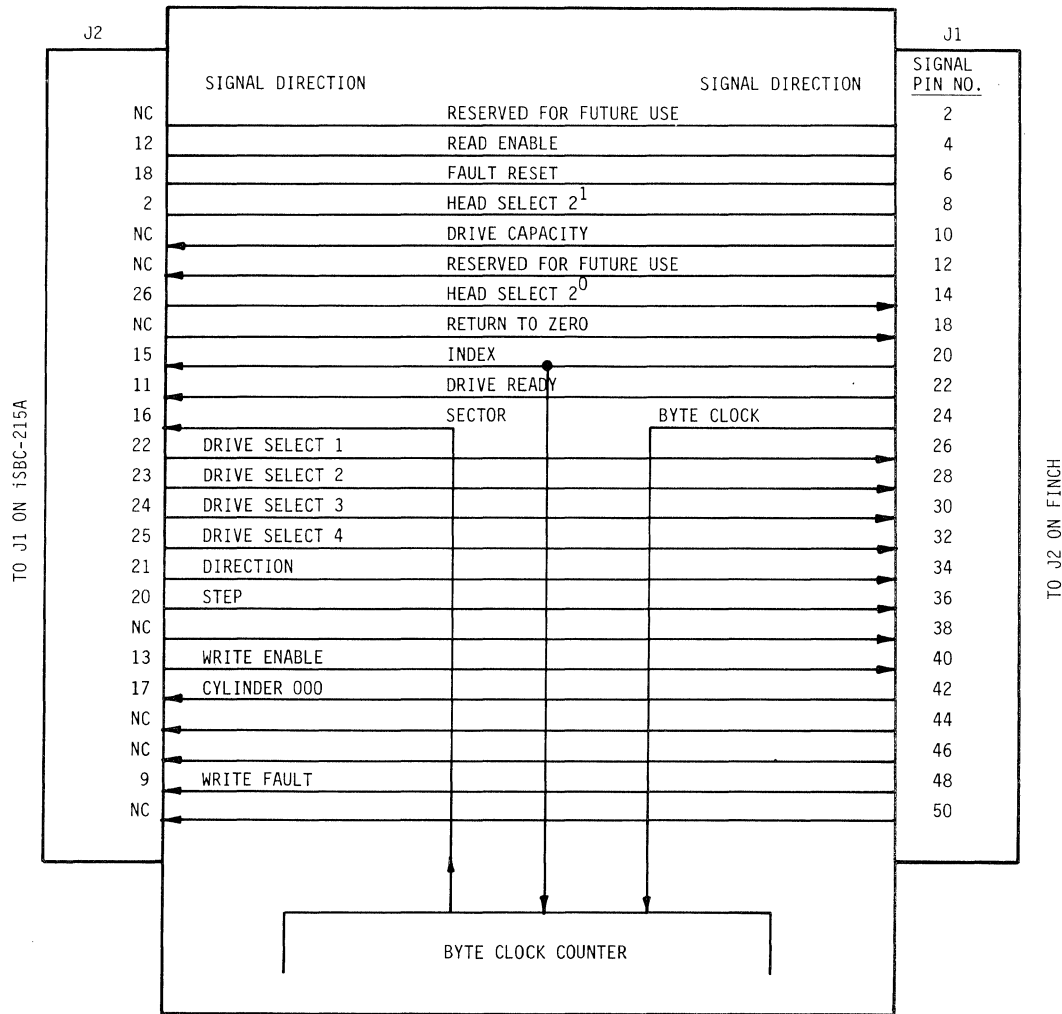
CONN.	DESCRIPTION
J1	50 PIN
J2	50 PIN
J3	40 PIN
J4	20 PIN
J5	20 PIN
J6	7 PIN POWER
J7	

R1	1/4W, 5%, 150
S1	4-POSITION
S2	8-POSITION

FF156b

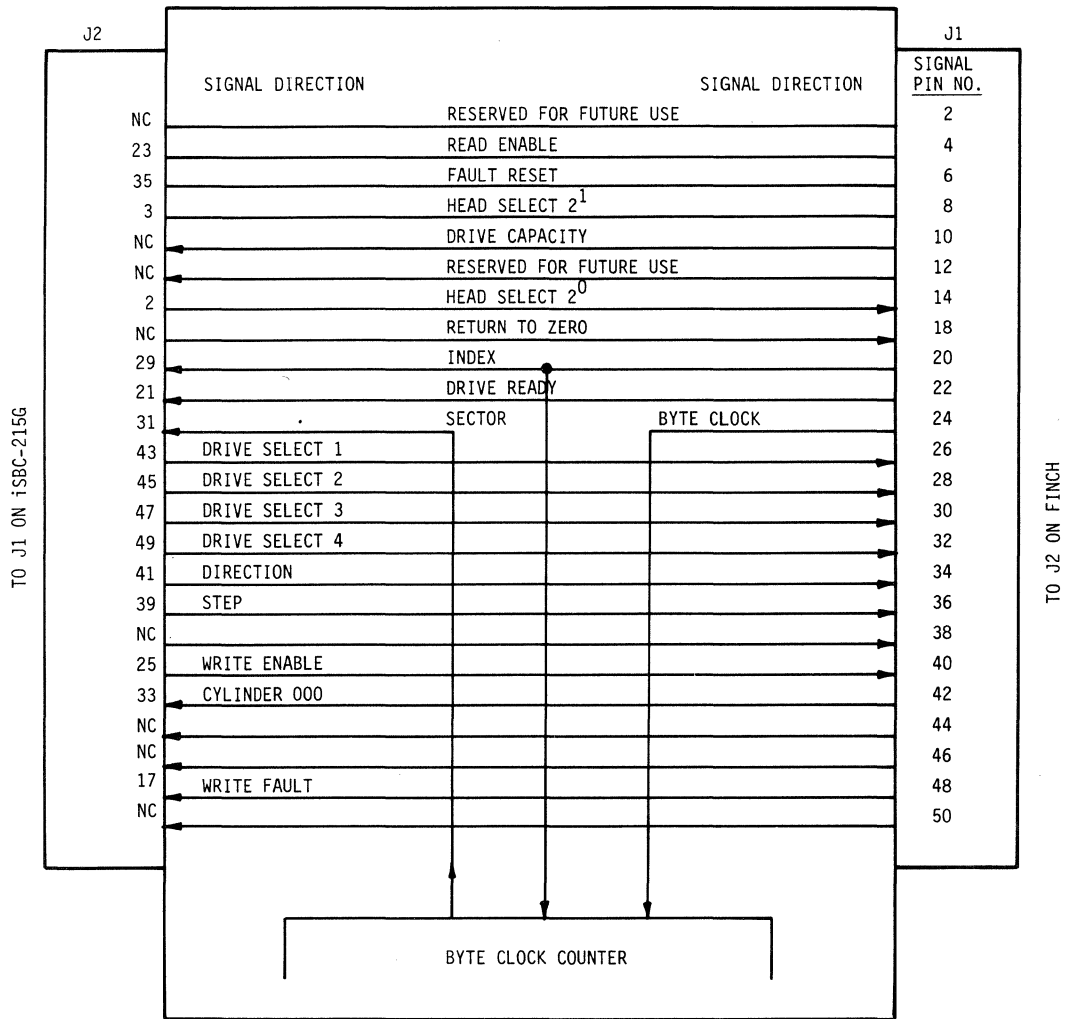
FIGURE A-1. 9410-FDI FINCH DRIVE ADAPTER





FF160a

FIGURE A-2. ISBC-215A COMMAND CABLE PIN SCRAMBLING



FF246b

FIGURE A-3. ISBC-215G COMMAND CABLE PIN SCRAMBLING

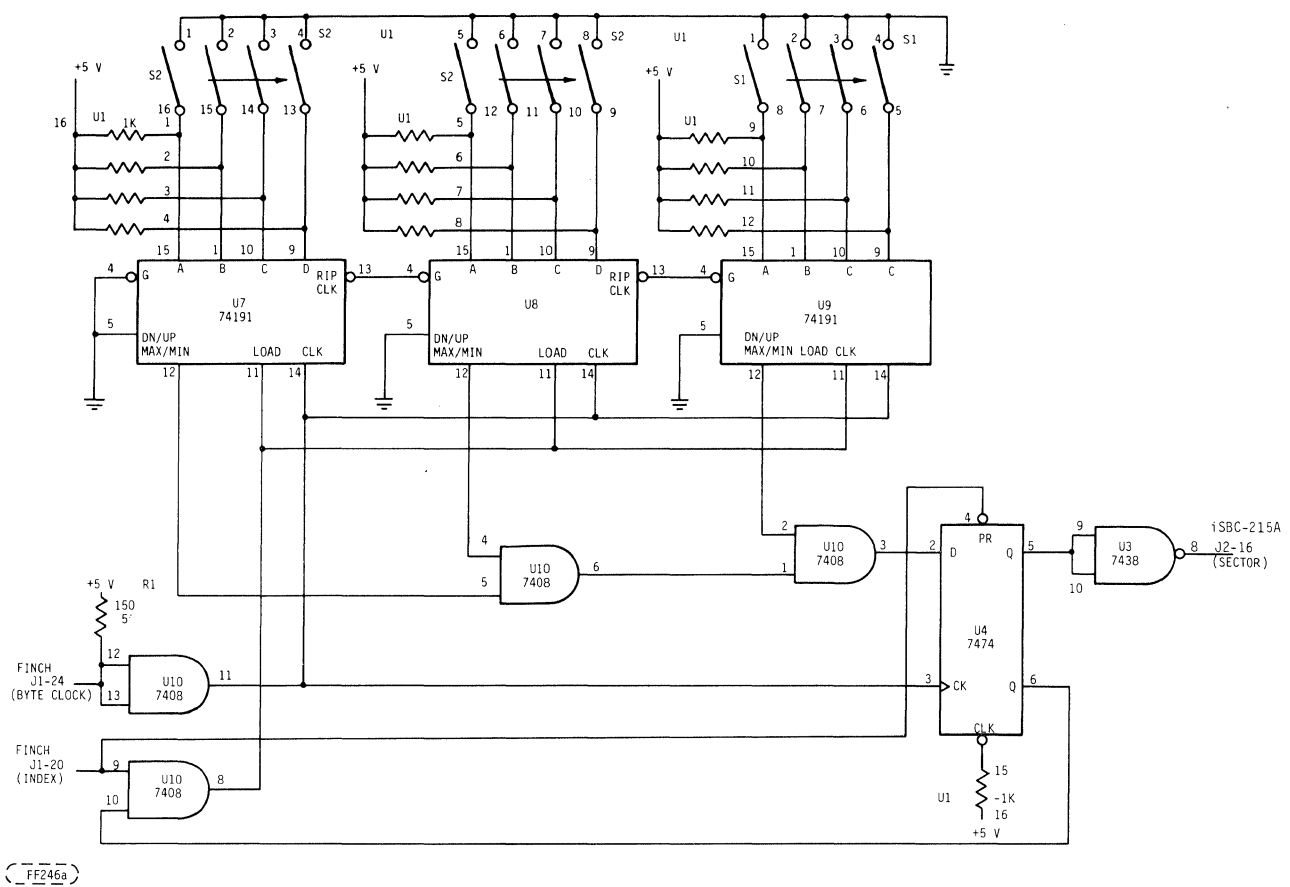


FIGURE A-4. iSBC-215A BYTE CLOCK COUNTER

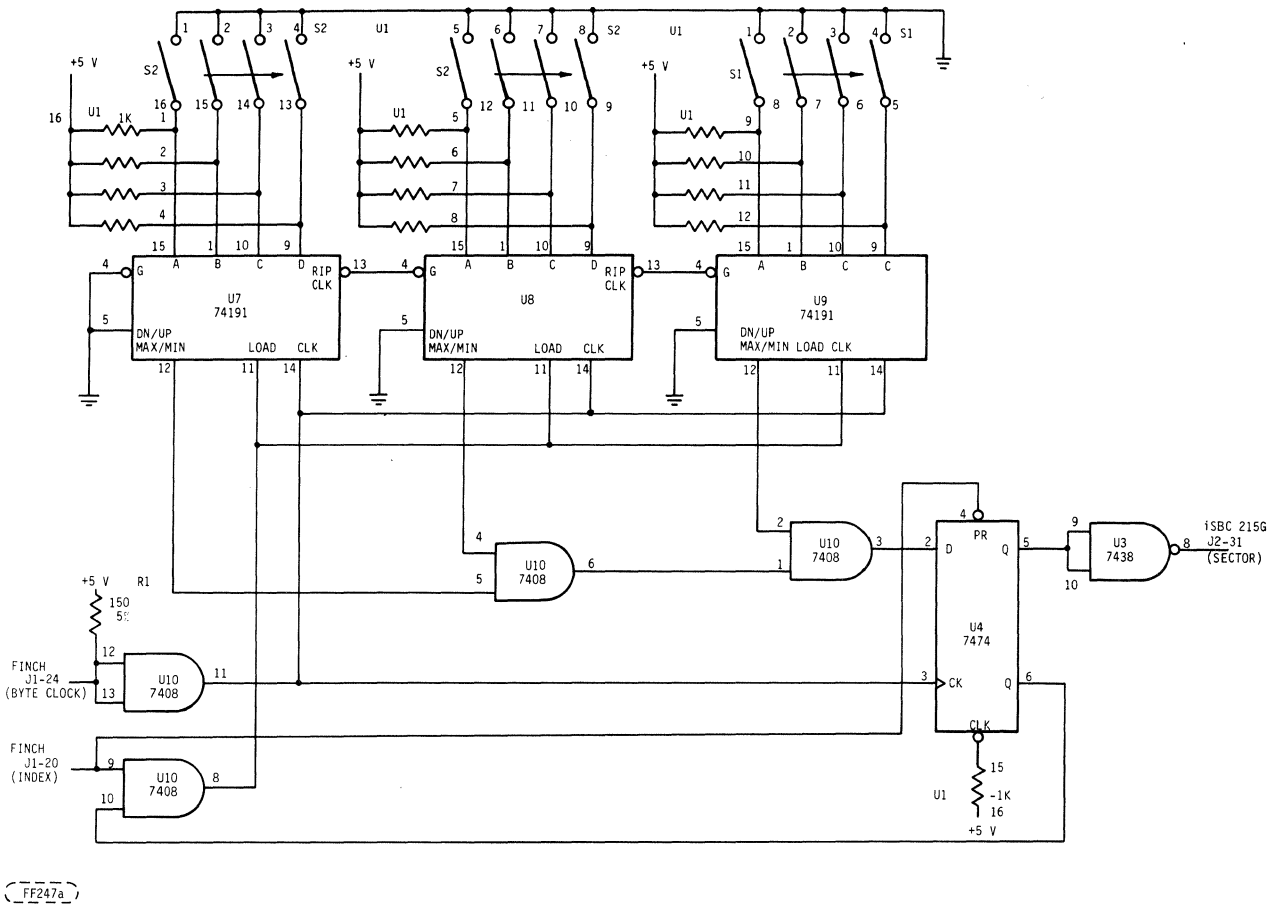


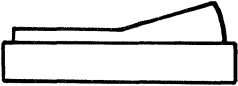
FIGURE A-5. ISBC-215G BYTE CLOCK COUNTER

TABLE A-1. BYTE CLOCK COUNTER SWITCH SETTINGS

SECTOR SIZE	SECTOR NUMBER	DIP SWITCH SETTING											
		LSB				S2				S1			MSB
		1	2	3	4	5	6	7	8	1	2	3	4
128	70	0	1	1	1	1	1	0	1	0	0	0	0
256	42	0	1	1	1	1	1	0	0	1	0	0	0
512	23	1	1	1	0	0	0	1	0	0	1	0	0
1024	12	0	1	1	1	1	0	1	0	0	0	1	0

ON

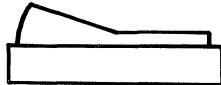


OFF

ON = 1

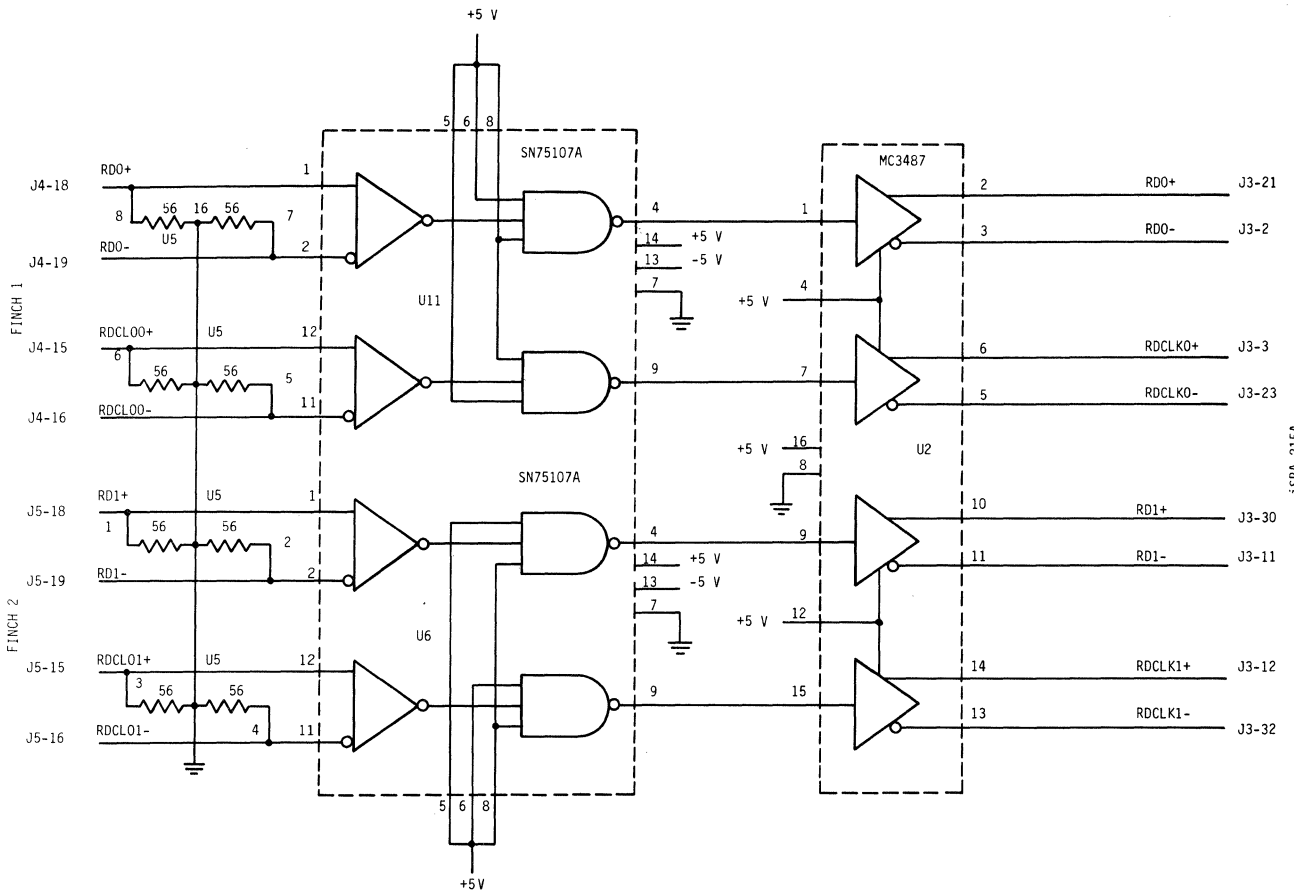
  

ON



OFF

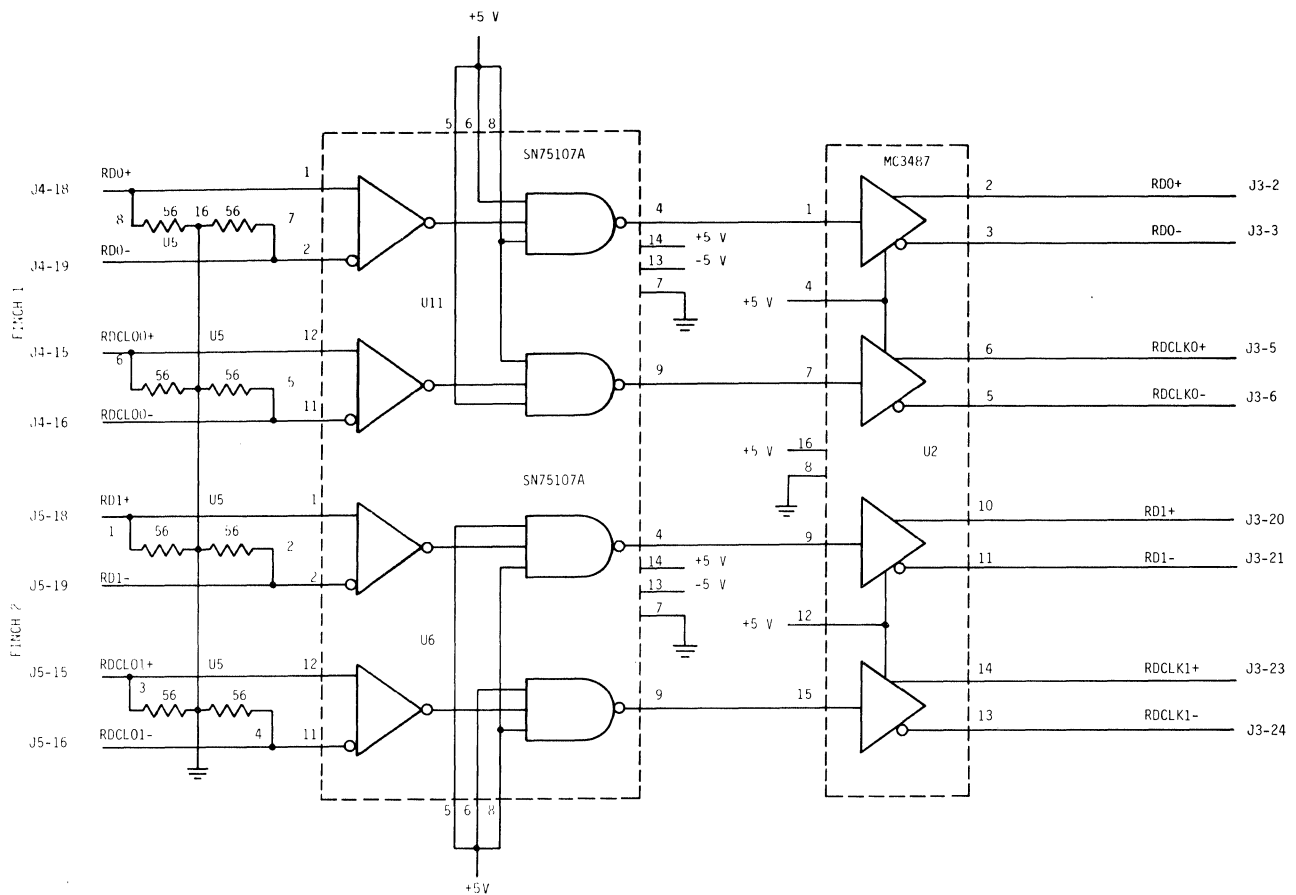
OFF = 0



J4-7	SEEK COMPLETE 0	J3-29
J4-9	-WRITE DATA 0	J3-5
J4-10	+WRITE DATA 0	J3-24
J4-12	-WRITE CLOCK 0	J3-26
J4-13	+WRITE CLOCK 0	J3-6
J5-7	SEEK COMPLETE 1	J3-38
J5-9	-WRITE DATA 1	J3-33
J5-10	+WRITE DATA 1	J3-14
J5-12	-WRITE CLOCK 1	J3-35
J5-13	+WRITE CLOCK 1	J3-15

FF157

FIGURE A-6. ISBC-215A DATA CABLE CONVERSION

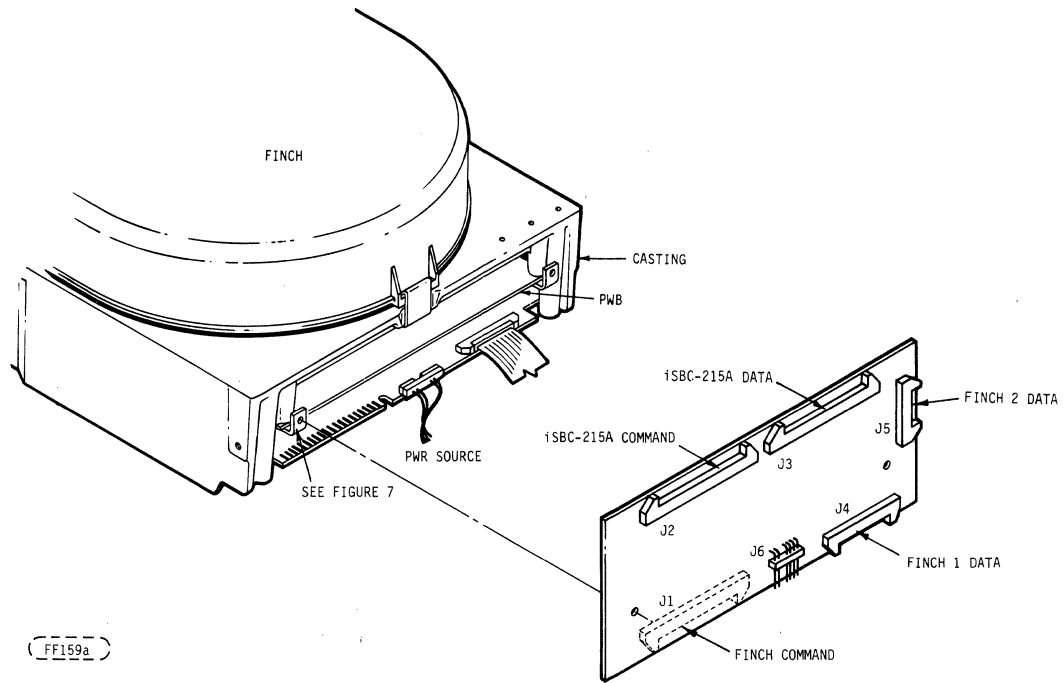


ISBA-215A

J4-7	SEEK COMPLETE 0	J3-18
J4-9	-WRITE DATA 0	J3-9
J4-10	+WRITE DATA 0	J3-8
J4-12	-WRITE CLOCK 0	J3-12
J4-13	+WRITE CLOCK 0	J3-11
J5-7	SEEK COMPLETE 1	J3-36
J5-9	-WRITE DATA 1	J3-27
J5-10	+WRITE DATA 1	J3-26
J5-12	-WRITE CLOCK 1	J3-30
J5-13	+WRITE CLOCK 1	J3-29

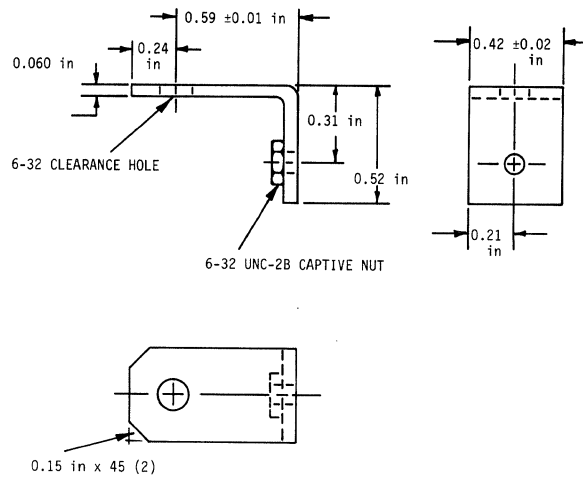
FF245a

FIGURE A-7. ISBC-215G DATA CABLE CONVERSION



FF159a

FIGURE A-8. DRIVE ADAPTER MOUNTING



FF159b

FIGURE A-9. DRIVE ADAPTER MOUNTING BRACKET



#### A.4 Cabling Requirements

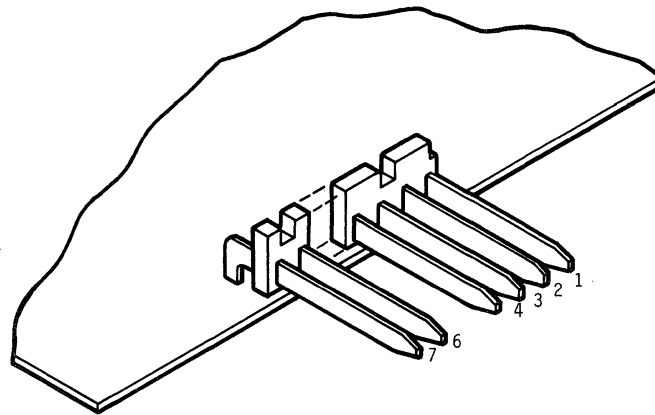
The drive adapter uses 3M flat cable connectors for board interconnect. The Finch cabling requirements are shown in Figure A-11.

#### CONNECTOR

#### AMP PART NO.

##### 7-Position Plug-in:

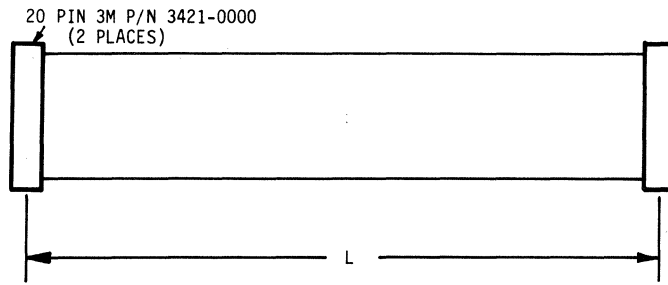
With Locking Clip Housing	1-87270-1
Locking Clip Contacts	87278-2
Crimping Tool for Locking Clips	90308
Without Locking Clip Housing	3-87025-3
High Pressure Contacts	87024-3
Nylon Keying Post	87116-1
Mate-n-Lok Kit	77664325



PIN	FUNCTION
1	-5.2 V
2	5.0 V
3	±5 V Common
4	+24 V
6	+24 V Common
7	±5 V Common

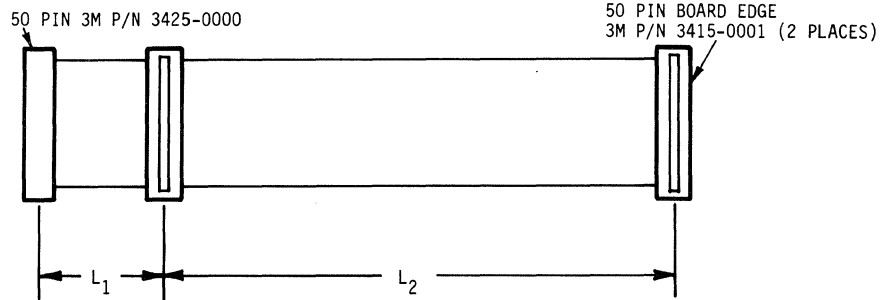
(G040b)

FIGURE A-10. DC POWER CONNECTOR



L MIN = 1 INCH (25.4 mm) FOR FINCH 1  
L MAX = 10 FEET (3.05 m) FOR FINCH 2

FINCH DATA CABLE



L<sub>1</sub> = 1 INCH (25.4 mm) FOR FINCH 1  
L<sub>2</sub> = 10 FEET (3.05 m) FOR FINCH 2

EF155a

FINCH COMMAND CABLE

FIGURE A-11. FINCH CABLE REQUIREMENTS

APPENDIX B  
9415-3 WREN DRIVE ADAPTER DESCRIPTION

---

## B.1 9415-3 WREN DRIVE ADAPTER

The purpose of the drive adapter (Figure B-1) is to perform three functions:

1. Scramble I/O pins.
2. Convert the Byte Clocks from the WREN into Sector Pulses for the iSBC-215 Board.
3. Generate a Track 00 signal from Drive Ready.

### B.1.1 Scramble I/O Pins

Since the drive interface of the iSBC-215 Board is general purpose it is necessary to convert the I/O pin designation of the 50-pin command cable as shown in Figure B-2 (iSBC-215A) and Figure B-3 (iSBC-215G).

The 40-pin data cable of the iSBC-215A is converted to two 20-pin data cables, as shown in Figure B-2 (iSBC-215A) and Figure B-3 (iSBC-215G).

### B.1.2 Byte Clock Counter

The FDI interface uses Byte Clocks to support user variations in data field; however, the iSBC-215 Board is a hard sectored device which uses a Sector pulse. The drive adapter will convert Byte Clocks to Sector as shown in Figure B-4 (iSBC-215A) and Figure B-5 (iSBC-215G). This counter is switch selectable. The switches are set for the "binary weight minus two" for each byte the user wants to count:

Example: 256 byte data field

The user can get 32 sectors at 315 bytes/sector.

The user enters 315 Minus 2 or 313 binary on the switches.

Table B-2 summarizes the Byte Clock counter switch settings.

### B.1.3 Generation of Track 00

Due to the limitations of the 34 pin command cable, the 9415-3 WREN does not provide Track 00. However, a time delay on the Drive Ready line was added when it reaches Track 00. This time delay can be detected by the circuit shown in Figure B-6 (iSBC-215A) and Figure B-7 (iSBC-215G) to generate Track 00.

## B.2 DRIVE ADAPTER MOUNTING

The drive adapter can be mounted on the back of the WREN. Figure B-8 identifies the mounting requirements for mounting on the back of the WREN. Figure B-9 is a recommended right angle bracket for mounting the drive adapter to the WREN.

## B.3 DRIVE ADAPTER POWER

The drive adapter requires +5 V DC power supply. This power may be supplied separately to the drive adapter by pigtail off the power supply leads. (This method would only be necessary when mounting is separate.) The user may also provide a pigtail from the drive adapter to the WREN DC power connect thus requiring one power connection (from power supply) on the drive adapter for both the WREN and drive adapter.

The mating power connector part number is shown in Figure B-10.

## B.4 CABLING REQUIREMENTS

The drive adapter uses 3M flat cable connectors for board interconnect. The WREN cabling requirements are shown in Figure B-11.

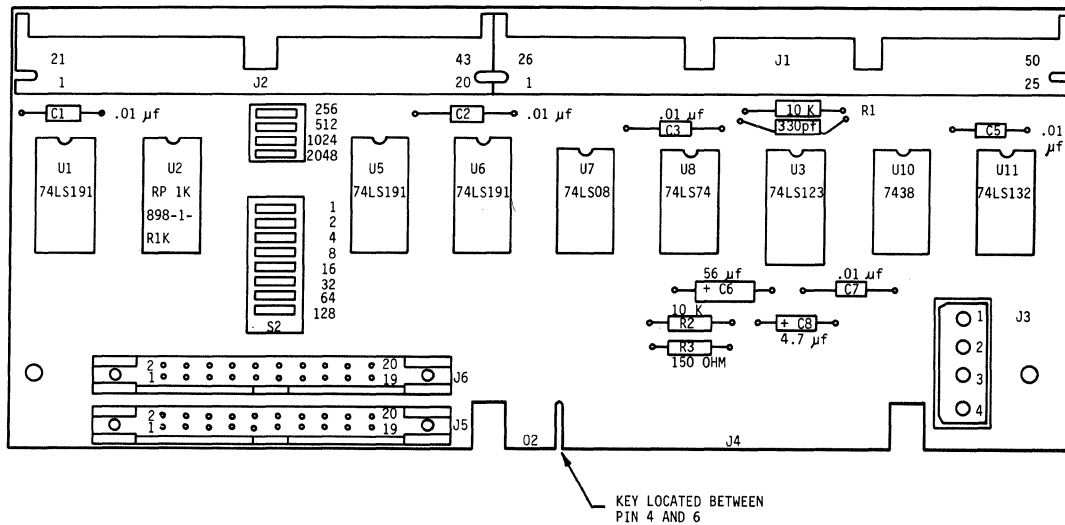
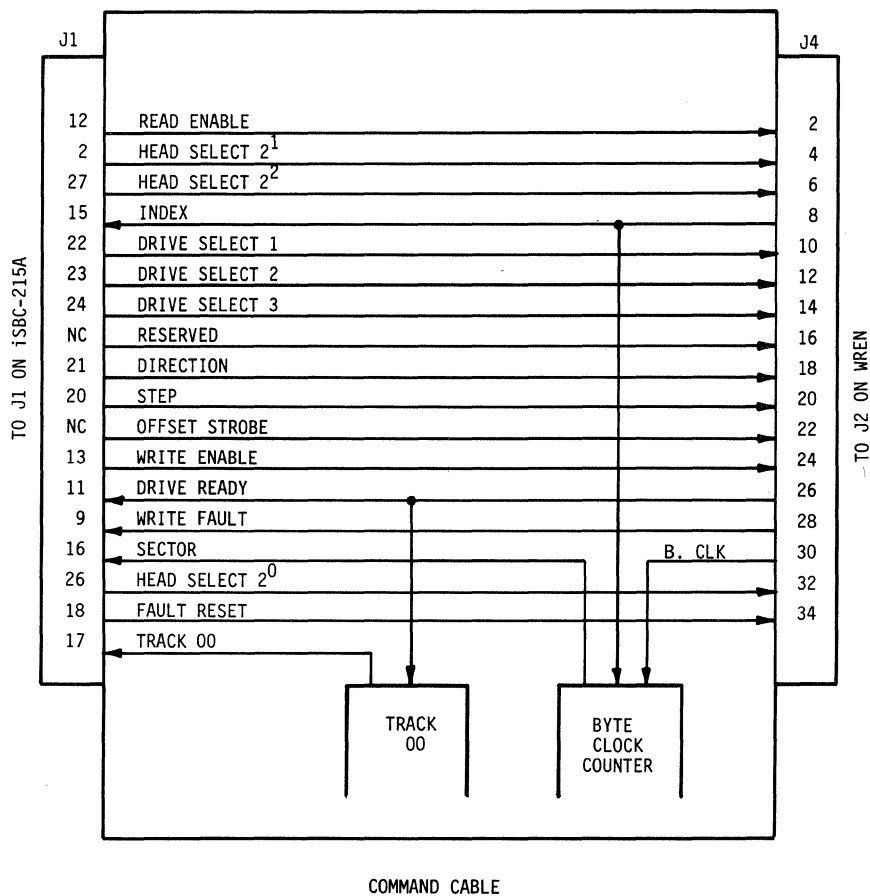
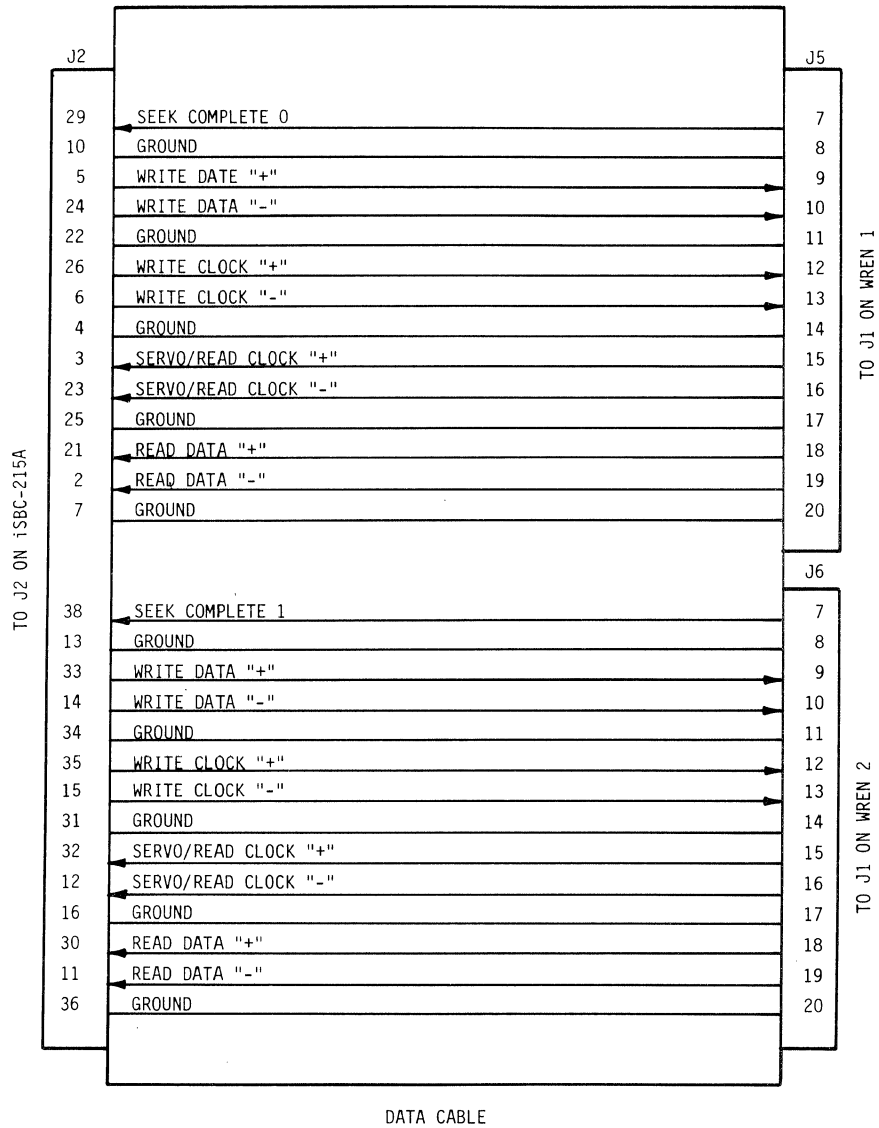


FIGURE B-1. 9415-3 WREN DRIVE ADAPTER



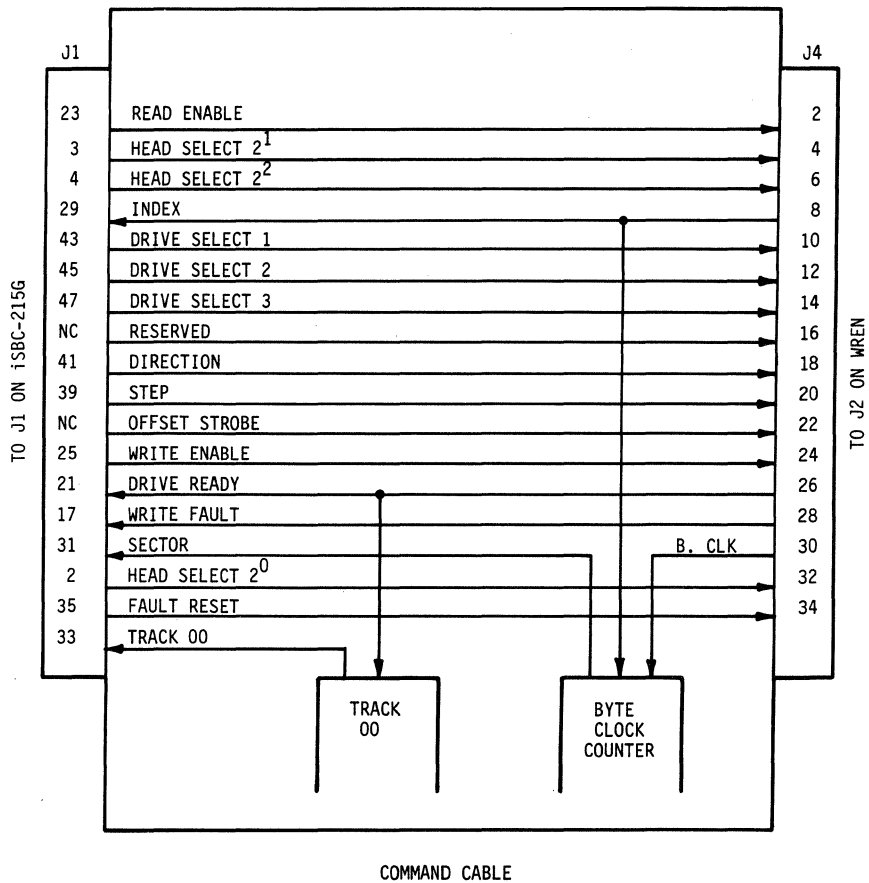
FF211b

FIGURE B-2. ISBC-215A I/O PIN SCRAMBLING (CONTD.)



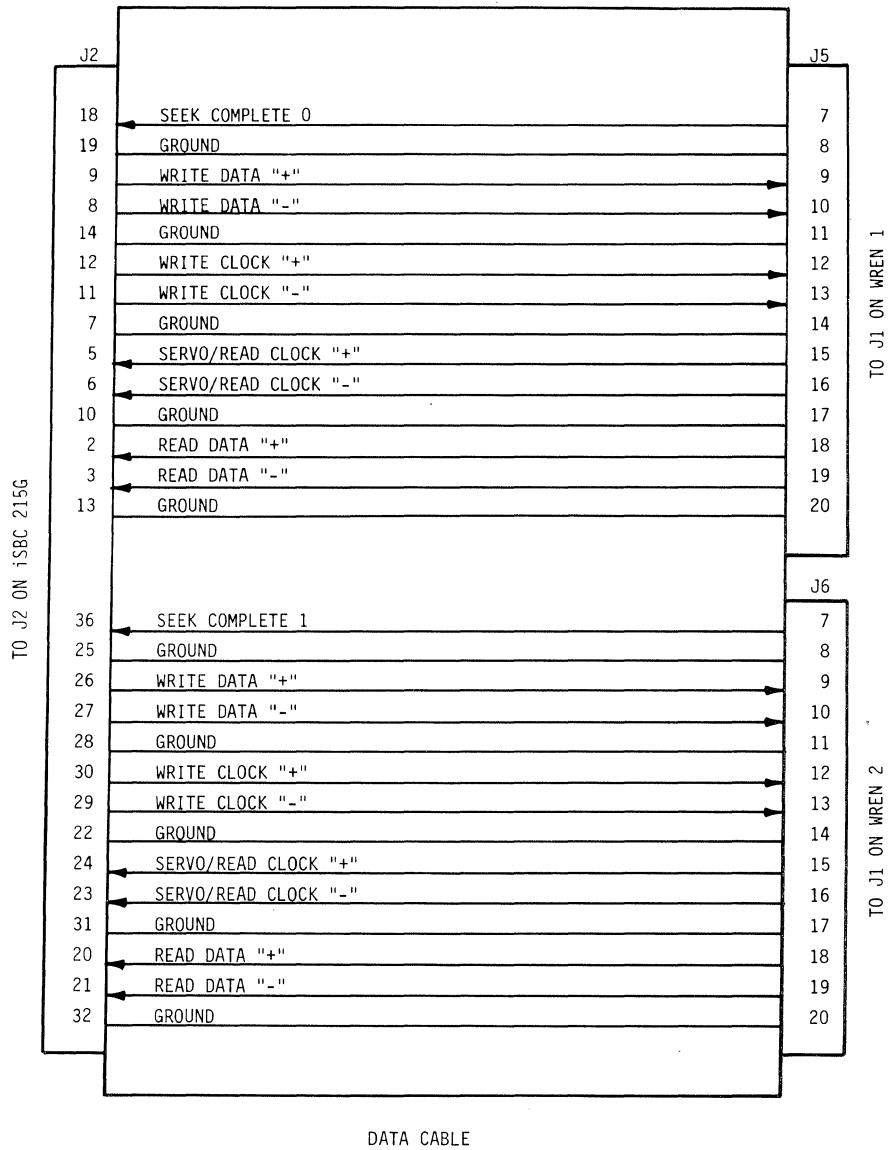
FF210a

FIGURE B-2. ISBC-215A I/O PIN SCRAMBLING (CONTD.)



FF210b

FIGURE B-3. ISBC-215G I/O PIN SCRAMBLING (CONTD.)



FF209a

FIGURE B-3. ISBC-215G I/O PIN SCRAMBLING (CONTD.)

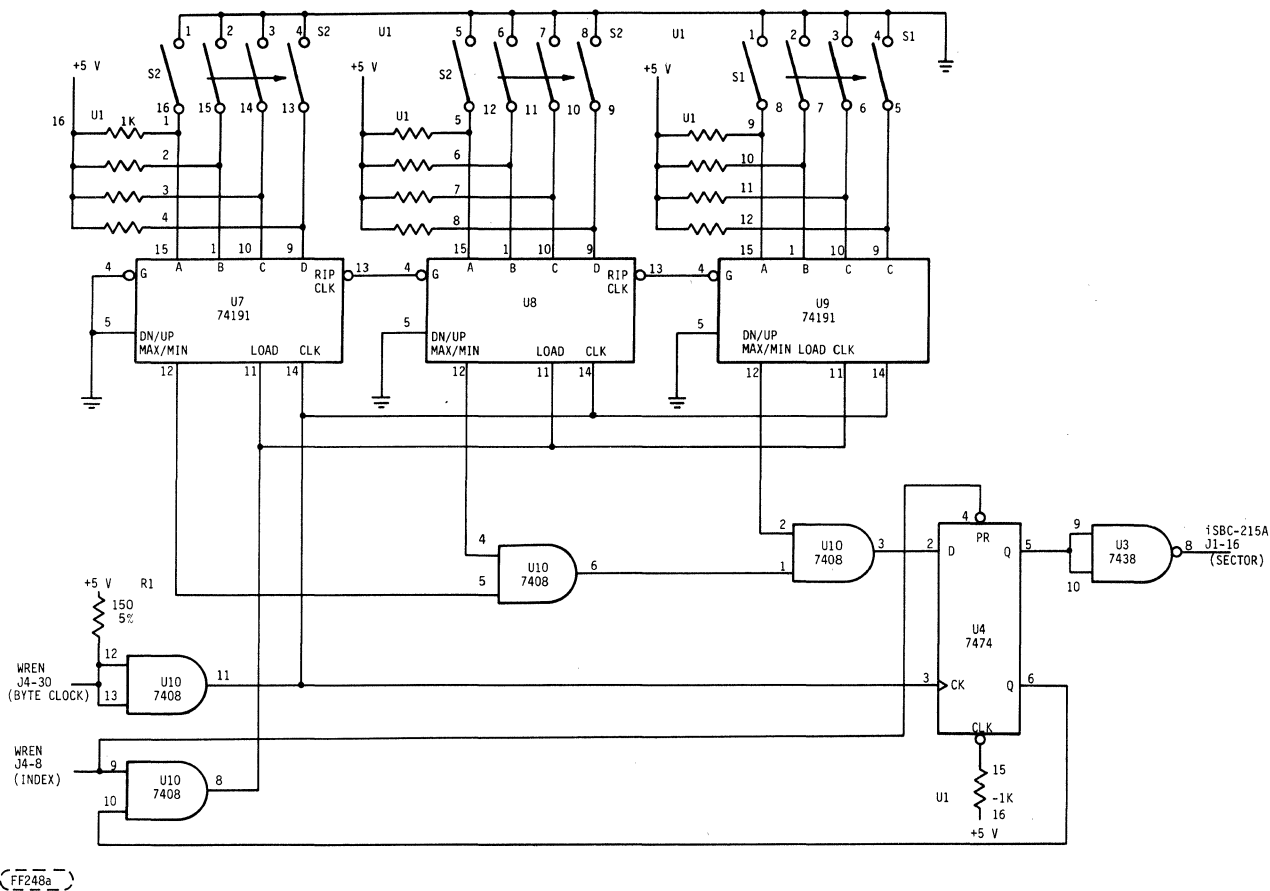


FIGURE B-4. ISBC-215A BYTE CLOCK COUNTER



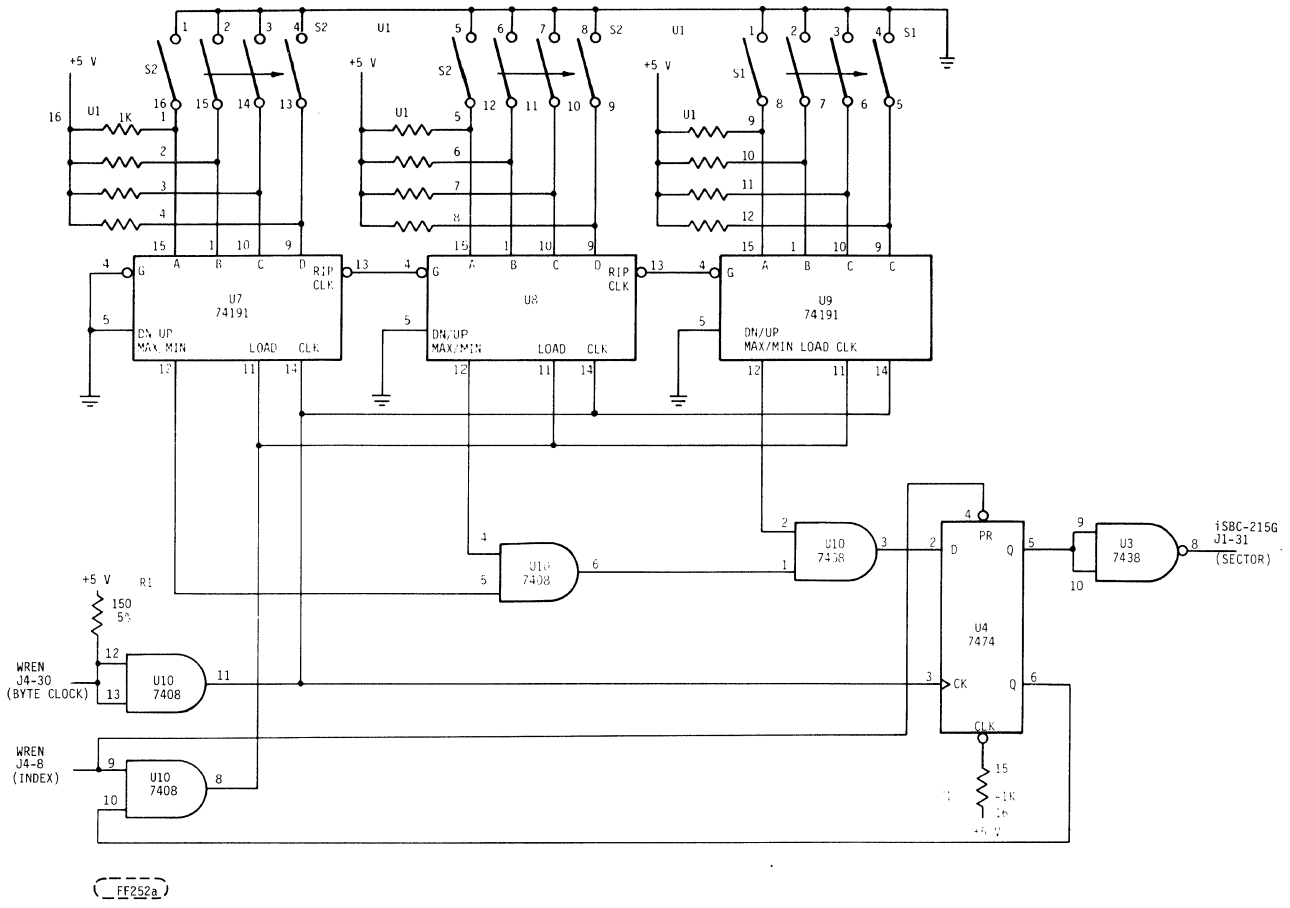


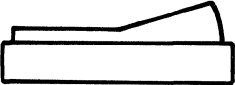
FIGURE B-5. iSBC-215G BYTE CLOCK COUNTER

TABLE B-1. BYTE CLOCK COUNTER SWITCH SETTINGS

SECTOR SIZE	SECTOR NUMBER	DIP SWITCH SETTING											
		LSB				S2				S1			MSB
		1	2	3	4	5	6	7	8	1	2	3	4
128	52	0	0	0	0	0	0	1	1	0	0	0	0
256	32	1	0	0	1	1	1	0	0	1	0	0	0
512	17	1	1	1	1	0	0	1	0	0	1	0	0
1024	9	0	1	1	1	1	0	1	0	0	0	1	0

ON

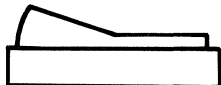


OFF

ON = 1

ON



OFF

OFF = 0

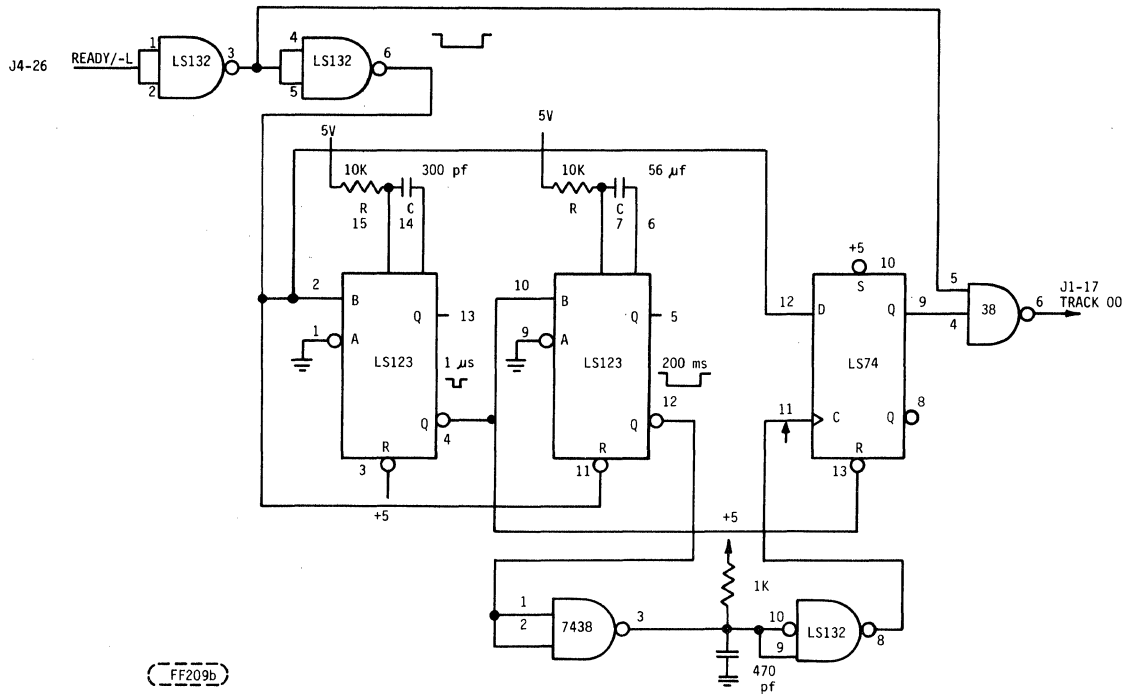


FIGURE B-6. ISBC-215A TRACK 00 GENERATION

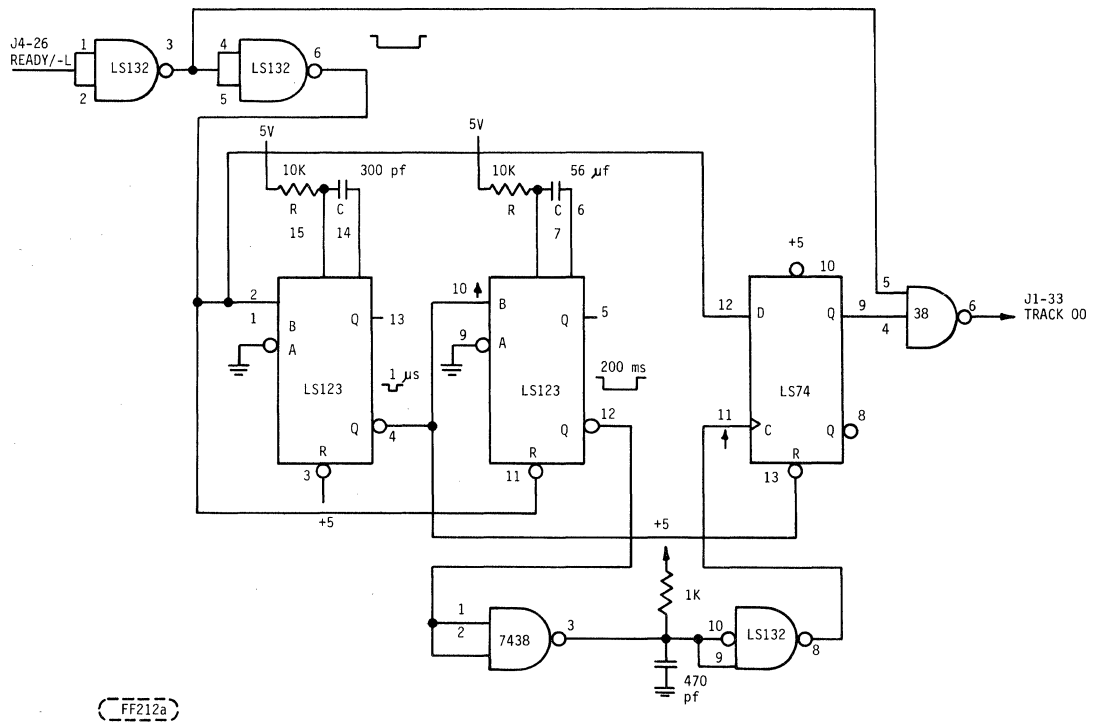
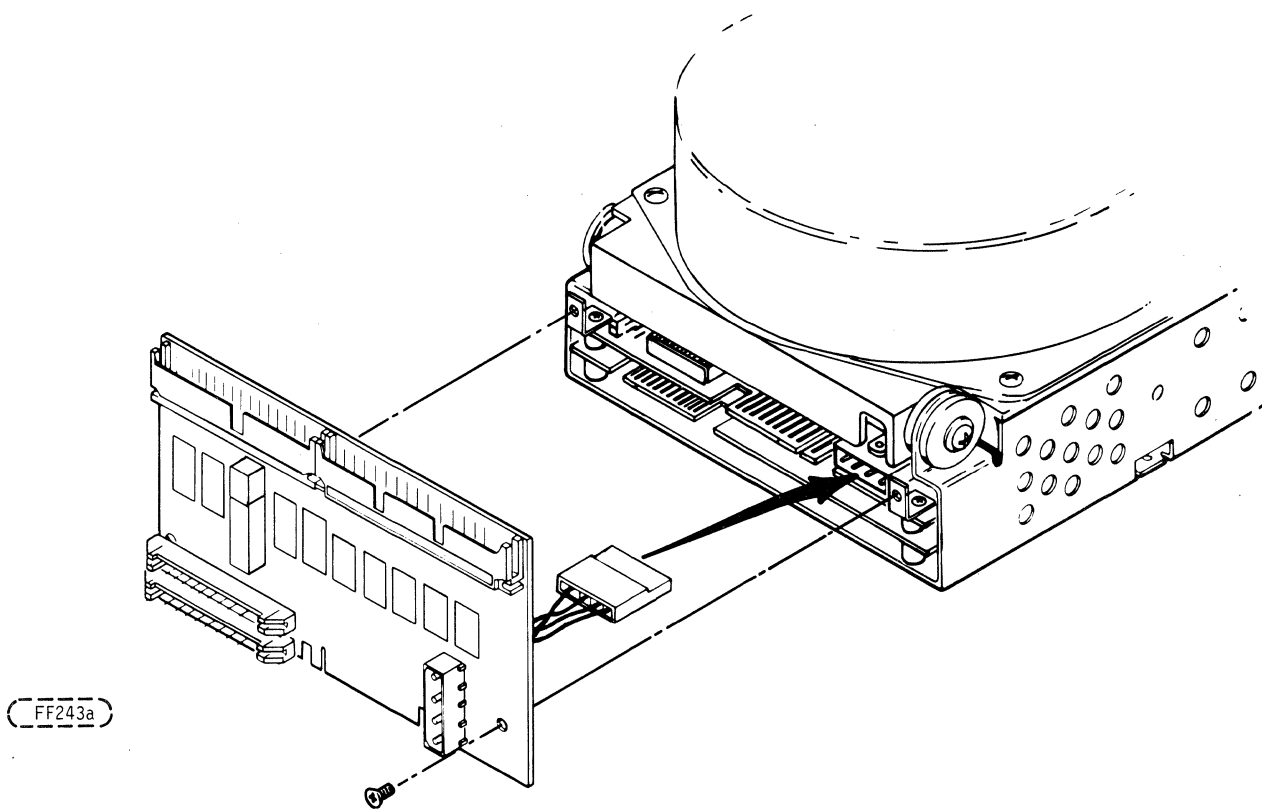
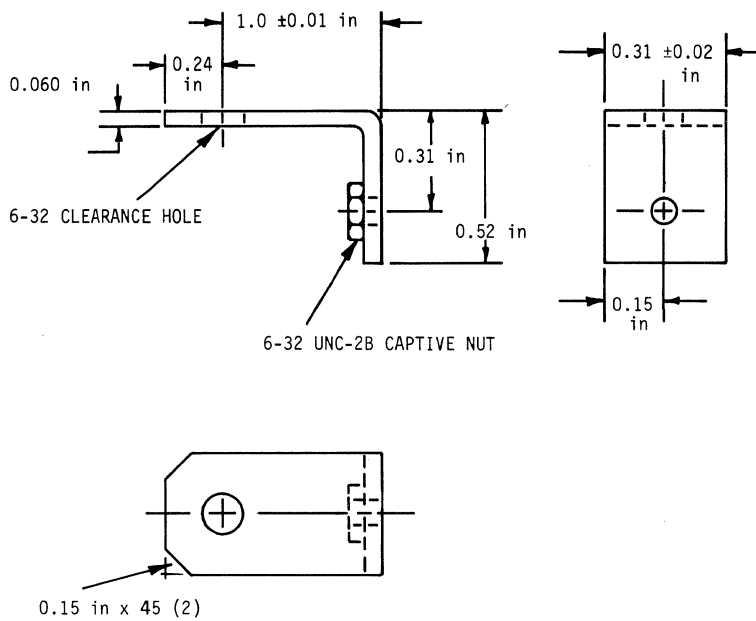


FIGURE B-7. ISBC-215G TRACK 00 GENERATION



FF243a

FIGURE B-8. DRIVE ADAPTER MOUNTING



FF238b

FIGURE B-9. DRIVE ADAPTER MOUNTING BRACKET

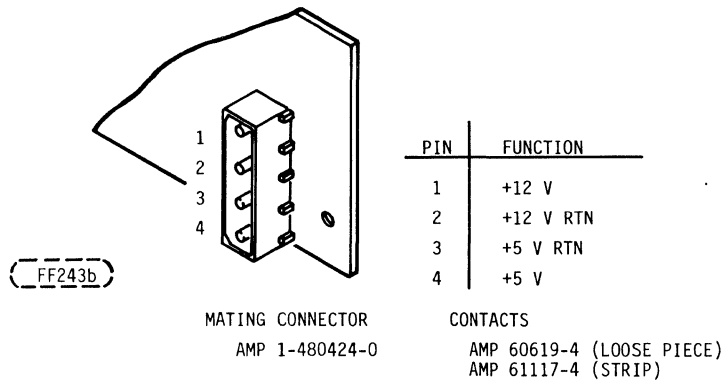
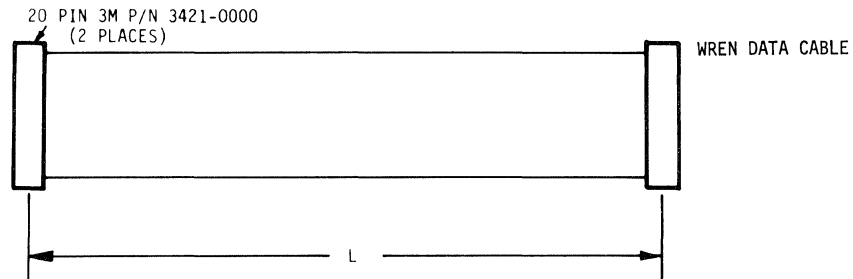
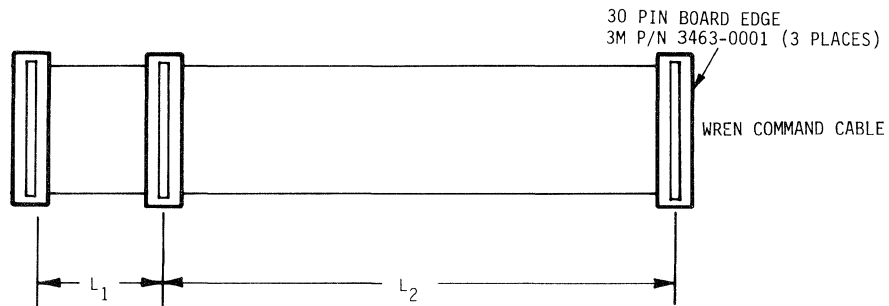


FIGURE 5-10. DC POWER CONNECTOR



L MIN = 1 INCH (25.4 mm) FOR WREN 1  
L MAX = 10 FEET (3.05 m) FOR WREN 2



FF211a

L<sub>1</sub> = 2 INCH (50.8 mm) FOR WREN 1  
L<sub>2</sub> = 10 FEET (3.05 m) FOR WREN 2

FIGURE B-11. WREN CABLE REQUIREMENTS





STAPLE

STAPLE

FOLD

FOLD

**BUSINESS REPLY MAIL**  
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY

**CONTROL DATA CORPORATION**

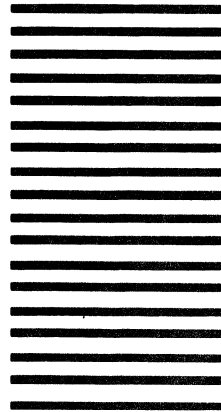
10321 West Reno Avenue  
Oklahoma City, Oklahoma 73130

ATTN: APPLICATIONS ENGINEERING OKM154

FOLD

FOLD

**FIRST CLASS**  
Permit Number 1332  
OKLAHOMA CITY,  
OKLAHOMA



CUT ALONG LINE





CORPORATE HEADQUARTERS, P.O. BOX 0, MINNEAPOLIS, MINNESOTA 55440  
SALES OFFICES AND SERVICE CENTERS IN MAJOR CITIES THROUGHOUT THE WORLD



CONTROL DATA CORPORATION