ORG=R01-WENDY GILLESPIE      LOC=HVNT      BLDG=1510      DEPT=0426      REQUESTOR=              PROC NO=000001652162-A05

PROCESS RETRIEVAL        - CHANGE IDENTIFICATION-

| ITEM-ID | RTG ALT | D/P IND | PRIME PROC | PROC COMP | CHANGE-NO | CHG EF-DATE | CST | CH | PC ANA | RESP-ENG | SO | SPEC SUPP | LEAD TIME | VAR LT DAY/100 | YIELD FACTOR |
|---------|---------|---------|------------|-----------|-----------|-------------|-----|----|--------|----------|----|-----------|-----------|----------------|--------------|
| 00 1652162 | A05 | MFG | YES | YES | INSR 10 745961 | 01DEC78 | E | J 036 | M69 | G MCCORMACK | F | 902 | | | 100 |

| BASIC NAME GROUP | DESCRIPTION BM | LAB-CTL 954 | PROC 10 | B/M LVL 745961 | DISP | SHIP-MODE | CERT DATE | U/M 01 | MAX-QTY | MIN-QTY | OPTM QTY | OUT-SEQ NO |
|------------------|----------------|-------------|---------|----------------|------|-----------|-----------|--------|---------|---------|----------|------------|

| BILL LEVEL 10 745961 | DRAWING LVL NONE | INSTR LVL NONE | SPEC LVL NONE | DIAGNOST LVL NONE | ITEM HDR LVL 10 745961 | MDF LVL NONE |
|----------------------|------------------|----------------|---------------|-------------------|------------------------|--------------|

| OPER NO | CONTENT NO | CMP SEQ | BASIC NAME | CONT QTY | SP QY | U/M | QTY MDR | ENG PLN | CH | MFG PLN | ALT CH | DESCRIPTION | SO | SPEC SUPP | PC ANA | DSB CD | FALL OUT | CMP USE | TIC | REFERENCE ITEM-ID |
|---------|------------|---------|------------|----------|-------|-----|---------|---------|----|---------|--------|-------------|----|-----------|--------|--------|----------|---------|-----|-------------------|
| AAAA | | | | | | | | | | | | | | | | | | | | |
| 00 | 2222222 | 1 | FORM | 1 | | 01 | U | R | S | | | GA23-0001-0 | A | 992 | 007 | | | 99 | | |
| 00 | 2222222 | 2 | FORM | 1 | | 01 | U | R | S | | | GA23-0002-0 | A | 992 | 007 | | | 99 | | |
| 00 | 2222222 | 3 | FORM | 1 | | 01 | U | R | S | | | GX27-0010-0 | A | 992 | 007 | | | 99 | | |

SHPG   DEPT=0176

| OPER NO | CONTENT NO | CMP SEQ | BASIC NAME | CONT QTY | SP QY | U/M | QTY MDR | ENG PLN | CH | MFG PLN | ALT CH | DESCRIPTION | SO | SPEC SUPP | PC ANA | DSB CD | FALL OUT | CMP USE | TIC | REFERENCE ITEM-ID |
|---------|------------|---------|------------|----------|-------|-----|---------|---------|----|---------|--------|-------------|----|-----------|--------|--------|----------|---------|-----|-------------------|
| 0080 | DEPT=0744 | | | | | | | | | | | | | | | | | | | |
| 00 | 1652157 | 1 | 3601ENG SP | 1 | | 01 | U | R | R | | | | R | 902 | 036 | | | 99 | | |
| 00 | 1652160 | 3 | PRD SHEET | 1 | | 01 | U | R | S | | | EC 745961 | R | 902 | 036 | | | 99 | | |
| 00 | 2222222 | 2 | FORM | 1 | | 01 | U | R | S | | | SX27-2957 | A | 992 | 007 | | | 99 | | |
| 00 | 2222222 | 4 | FORM | 1 | | 01 | U | R | S | | | GX27-0002-0 | A | 992 | 007 | | | 99 | | |
| 00 | 2222222 | 7 | FORM | 1 | | 01 | U | R | S | | | GA27-2898-0 | A | 992 | 007 | | | 99 | | |

***LAST PAGE***

ORG=A78-MIKE FREE            LOC=HVNT      BLDG=1512      DEPT=0607      REQUESTOR=SALLY                    PROC NO=000001747487-K05

                              PROCESS RETRIEVAL        - CHANGE IDENTIFICATION- 10000745949


| ITEM-ID | RTG ALT | D/P IND | PRIME PROC | PROC COMP | CHANGE-NO | IEC TYP | CHG EF-DATE | CST | CH | PC ANA | RESP-ENG | | SPEC SO | LEAD SUPP | VAR LT TIME | YIELD DAY/100 FACTOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00  1747487 | K05 | MFG | YES | YES INSR 10 | 745949 | | 22SEP78 | E | J | | M72 | | F | 902 | | 100 |

| BASIC NAME PUB GRP | DESCRIPTION BM | LAB-CTL | PROC 954 | B/M LVL 10 | DISP 745949 | SHIP-MODE | CERT DATE | U/M 01 | MAX-QTY | MIN-QTY | OPTM QTY | OUT-SEQ NO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|


| BILL LEVEL | DRAWING LVL | INSTR LVL | SPEC LVL | DIAGNOST LVL | ITEM HDR LVL | MDF LVL |
|---|---|---|---|---|---|---|
| 10  745949 | NONE | NONE | NONE | NONE | 10  745948 | NONE |

      3631-PROCESS IS A FINAL


| OPER NO | CONTENT NO | CMP SEQ | BASIC NAME | CONT QTY | QTY U/M | ENG MDR PLN CH | MFG ALT PLN CH | DESCRIPTION | SPEC SO | PC SUPP | DSB ANA | FALL CD | CMP OUT USE | REFERENCE TIC ITEM-ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ****** ****************************************************************************************************************************************** |
| AAAA |
| ****** ****************************************************************************************************************************************** |
| 0080 | DEPT=0744 | | | | | | | | | | | | | |
| 00 | 222837 | 1 | BINDER | 1 | 01 U | | D | | A | Z90 | 32 | | 99 | 1652141 |
| 00 | 1652141 | 1 | INSTR | 1 | 01 U | R | R | | R | 902 | PCA | | 99 | |
| 00 | 1747488 | 1 | PRD SHEET | 1 | 01 U | R | S | EC 745949 | R | 902 | | | 99 | |
| 00 | 1747489 | 1 | TAB | 1 | 01 U | | D | | A | Z93 | PCA | | 99 00 | 1652141 |
| 00 | 2222222 | 1 | FORM | 1 | 01 U | R | S | SY27-2519-0 | A | 992 | 007 | | 99 | |
| 00 | 2222222 | 2 | FORM | 1 | 01 U | R | S | S126-013-2 | A | 992 | 007 | | 99 | |
| 00 | 2222222 | 3 | FORM | 1 | 01 U | R | S | SN31-0864 | A | 992 | 007 | | 99 | |
| ****************************************************************************************************************************************** |


                              ***LAST PAGE***

                        ***IBM INTERNAL USE ONLY***

------------------------------------------------------------------------
------------------------------------------------------------------------

MACHINE TYPE-NONE

------------------------------------------------------------------------
------------------------------------------------------------------------

***SECTION NO 000***

TITLE- INDUSTRY SYSTEMS      INSTALLATION REPORT
------------------------------------------------------------------------

MAINTENANCE REFERENCE MATERIAL

NONE
------------------------------------------------------------------------

PARTS AND ASSEMBLIES

| CHECK | PART NUMBER | QUANTITY | U/M | NAME | DESCRIPTION | REFERENCE/EC |
|-------|-------------|----------|-----|------|-------------|--------------|
|  | 5116787 | 1 | 1 | BAG | 10X14 | |
|  | 5117493 | 1 | 1 | LETTER | CE INSTN. | |
|  | 5117494 | 1 | 1 | INREP | INST.REPORT | |
|  | 5117495 | 1 | 1 | ENVELOPE | ENVELOPE(0024) | |

COMMENTS-    NONE
                        *** LAST PAGE ***

```
MACH LIST FOR-3601 MOD-  A SER-57054041 PLT-57  COL 26 SHIP 28          20JUN79

CTRY-724  CUST-W000001-          SER BR-    SYS #- IQ564-    -         TYP-

FCT ORDER-IV1870  SALES MODEL-    PLT SEQ #-

TYPE OF PRODUCTION -      LOCATION CODE - F

SHIPPED-06JUL79  SHP SEQ-      FCT SEQ-0002  WD-   MODE-    MACH STA-FACTORY

SEQ #         EC #      STATUS       MASTER COMMENT       PICK-UP EC    DATE


B0002 FCT 000743984    FACT LVL


Y0001 OPT 000393674    INSTALED                                        08JUN79
Y0002 OPT 000335233    INSTALED                                        08JUN79


FEATURE BM  QTY  FEATURE  NAME    MES # K M DEV  STAT  DATE   ACC  SHP-LVL-FCT


0001563243  0001 MODEM CABLE           5500 INT  08JUN79              0001
*****                         COMMENTS


E0001 FCT 000739341    FACT LVL

 ***** THE FOLLOWING IS AN RPQ FEATURE  *****


0001651191  0001 ADD ATT RPQ SUPT      9492 INT  08JUN79              0003
*****                         COMMENTS
D0006       000742978    PRES LVL


E0003 FCT 000742972    FACT LVL

 ***** THE FOLLOWING IS AN RPQ FEATURE  *****


0001651369  0001 * RPQ SUPP DISC       9589 INT  08JUN79              0001
*****                         COMMENTS
D0005       000742979    PRES LVL


E0001 FCT 000742956    FACT LVL


0001739382  0001 PUBS GROUP                 INT  08JUN79              0007
*****                         COMMENTS


E0007 FCT 000745961    FACT LVL


0001831755  0001 COVER GROUP                INT  08JUN79              0003
*****                         COMMENTS


E0003 FCT 000745183    FACT LVL


0004406037  0001 1200 BPS 2 WIRE       5500 INT  08JUN79              0001
*****                         COMMENTS


E0001 FCT 000747313    FACT LVL
E0002 FCT 000748506    INQUIRY


0004406053  0001 SHP GP A2/A3/C00       0000 INT  08JUN79             0001
*****                         COMMENTS
D0001       000745949    PRES LVL


E0001 FCT 000747313    FACT LVL
E0002 FCT 000748506    INQUIRY


0004406072  0001 220V 50HZ             2813 INT  08JUN79              0001
*****                         COMMENTS
```

| SEQ # | EC # | STATUS | MASTER COMMENT | PICK-UP EC | DATE |
|-------|------|--------|----------------|------------|------|

E0001 FCT 000746738    FACT LVL

 ***** THE FOLLOWING IS AN RPQ FEATURE  *****

0004940972  0001 GERM.LAN MOD A02                2929 INT  08JUN79          0001
*****                           COMMENTS

E0001 FCT 000111111    FACT LVL

0004941012  0001 33FD 50HZ HI VLT                 INT  08JUN79          0002
*****                           COMMENTS

E0002 FCT 000745228    FACT LVL

R0001 REA 0005709061   INSTALED                               000111111

Y0001 OPT 000746202    INQUIRY

0004946036  0001 LOGIC GRP                        INT  08JUN79          0004
*****                           COMMENTS
D0001        000748503    INQUIRY
D0002        000355419    INQUIRY

E0004 FCT 000747306    FACT LVL

Y0001 OPT 000747545    INSTALED                                         08JUN79

0004946045  0001 CCA W.CLK                       6301 INT  08JUN79          0002
*****                           COMMENTS

E0002 FCT 000389181    FACT LVL

0004946047  0001 USER STORAGE N01               9592 INT  08JUN79          0002
*****                           COMMENTS

E0002 FCT 000748080    FACT LVL
E0003 FCT 000748490    INQUIRY

0004946048  0001 USER STORAGE N02               9592 INT  08JUN79          0002
*****                           COMMENTS

E0002 FCT 000748080    FACT LVL
E0003 FCT 000748490    INQUIRY

0004946051  0001 LOOP ADAPT 1                    4735 INT  08JUN79          0002
*****                           COMMENTS

E0002 FCT 000748080    FACT LVL

0004946052  0001 LOOP ADAPT 2                    4735 INT  08JUN79          0002
*****                           COMMENTS

E0002 FCT 000748080    FACT LVL

0004946080  0001 FRAME ASM                        INT  08JUN79          0005
*****                           COMMENTS

E0005 FCT 000748132    FACT LVL
E0006 FCT 000748362    INQUIRY

MACH LIST FOR-3601 MOD- A SER-57054041 PLT-57 COL 26 SHIP 28          20JUN79

CTRY-724 CUST-W000001-          SER BR-    SYS #- IQ564-    -          TYP-

FCT ORDER-IV1870 SALES MODEL-    PLT SEQ #-

TYPE OF PRODUCTION -    LOCATION CODE - F

SHIPPED-06JUL79 SHP SEQ-    FCT SEQ-0002 WD-    MODE-    MACH STA-FACTORY

<div align="center">FEATURE SUMMARY LIST          PAGE 01</div>

| FEATURE BM | SOP | QTY | STAT | FEATURE NAME | MES | DEV | DATE | CCL RPQ |
|---|---|---|---|---|---|---|---|---|
| 0001563243 | | 0001 | INT | MODEM CABLE | | 5500 | 08JUN79 | |
| 0001651191 | | 0001 | INT | ADD ATT RPQ SUPT | | 9492 | 08JUN79 | £ |
| 0001651369 | | 0001 | INT | * RPQ SUPP DISC | | 9589 | 08JUN79 | £ |
| 0001739382 | | 0001 | INT | PUBS GROUP | | | 08JUN79 | |
| 0001831755 | | 0001 | INT | COVER GROUP | | | 08JUN79 | |
| 0004406037 | | 0001 | INT | 1200 BPS 2 WIRE | | 5500 | 08JUN79 | |
| 0004406053 | | 0001 | INT | SHP GP A2/A3/C00 | | 0000 | 08JUN79 | |
| 0004406072 | | 0001 | INT | 220V 50HZ | | 2813 | 08JUN79 | |
| 0004940972 | | 0001 | INT | GERM.LAN MOD A02 | | 2929 | 08JUN79 | £ |
| 0004941012 | | 0001 | INT | 33FD 50HZ HI VLT | | | 08JUN79 | |
| 0004946036 | | 0001 | INT | LOGIC GRP | | | 08JUN79 | |
| 0004946045 | | 0001 | INT | CCA W.CLK | | 6301 | 08JUN79 | |
| 0004946047 | | 0001 | INT | USER STORAGE N01 | | 9592 | 08JUN79 | |
| 0004946048 | | 0001 | INT | USER STORAGE N02 | | 9592 | 08JUN79 | |
| 0004946051 | | 0001 | INT | LOOP ADAPT 1 | | 4735 | 08JUN79 | |
| 0004946052 | | 0001 | INT | LOOP ADAPT 2 | | 4735 | 08JUN79 | |
| 0004946080 | | 0001 | INT | FRAME ASM | | | 08JUN79 | |
| 0005240403 | | 0001 | INT | RFI FILTER | | 2759 | 08JUN79 | |
| 0007373861 | | 0001 | INT | PACKING BM - HVT | | | 08JUN79 | |

# TABLE OF CONTENTS

VOL  BD M/T 3601   A SERIAL 57054041        COL 26 SHIP 28

LOGIC      NUMBER  DESCRIPTION                PART NUMBER EC NUMBER   FEATURE BM
SLT BOARDS
         01AA1    CUSTMZ BD MODS 2A2B3A3B STGE 2     0006813046 000747306   0004946036

# TABLE OF CONTENTS

VOL  RS M/T 3601  A SERIAL 57054041          COL 26 SHIP 28

| LOGIC      NUMBER  DESCRIPTION | PART NUMBER | EC NUMBER | FEATURE BM |
|---|---|---|---|
| REFERENCE DATA | | | |
| 128    SHIP GRP BM (M.I.MANUAL) | 0001747487 | 000745949 | 0004406053 |
| 140    SHIP GRP BM (OPS.GUIDE) | 0001652162 | 000745961 | 0001739382 |
| 300    INSTALLATION REPORT BM | 0005117491 | 000111111 | |
| 305    CE INSTR FORM IN FIVE LANGUAGES | 0005117493 | 000111111 | |
| 310    INSTALLATION REPORT SHEET | 0005117494 | 000111111 | |
| 315    WINDOW ENVELOPE | 0005117495 | 000111111 | |
| 320    POLYTHENE BAG | 0005116787 | 000111111 | |

# TABLE OF CONTENTS

LOGIC      NUMBER  DESCRIPTION              PART NUMBER EC NUMBER   FEATURE BM
REFERENCE DATA
        PRD 01    OPS GUIDE                 0001652160 000745961  0001739382
        PRD 02    M I MANUAL                0001747488 000745949  0004406053

                                                  PAGE NO. 0003

MACH LIST FOR-3601 MOD- A SER-57054041 PLT-57  COL 26 SHIP 28          20JUN79

| SEQ # | EC # | STATUS | MASTER COMMENT | PICK-UP EC | DATE |
|---|---|---|---|---|---|
| E0007 FCT 000748379 | | INSTALED | | | 08JUN79 |
| E0008 FCT 000749176 | | INSTALED | | | 08JUN79 |

0005240403  0001 RFI FILTER                    2759 INT  08JUN79              0002
*****                              COMMENTS

| E0002 FCT 000745183 | | FACT LVL | | | |
| E0003 FCT 000748756 | | INQUIRY | | | |
| E0004 FCT 000749176 | | INSTALED | | | 08JUN79 |

0007373861  0001 PACKING BM - HVT                   INT  08JUN79              0001
*****                              COMMENTS

E0001 FCT 000960248   FACT LVL

END

# TABLE OF CONTENTS

LOGIC       NUMBER   DESCRIPTION                  PART NUMBER EC NUMBER   FEATURE BM
MINNOW PROGRAM
        01       2 3619 SUPPORT DISKETTE            0001651369 000742979  0001651369

# IBM

**3601** Models 2A, 2B, 3A, 3B, and
Models C and D

**3602** Models 1A and 1B
Finance Communication Controllers
Maintenance Information

# Preface

This manual contains maintenance information necessary to service the IBM 3601 Models, 2A, 2B, 3A, 3B, and Models C and D Finance Communication Controller and the 3602 Models 1A and 1B Finance Communication Controller. It contains the following chapters and appendixes:

- Chapter 1 (Left)    Maintenance Analysis Procedures (MAPs)
- Chapter 1 (Right)   Maintenance Procedures
- Chapter 2           Maintenance Approach, Aids, and Special Tools
- Chapter 3           Reference Data
- Chapter 4           Component Locations
- Chapter 5           Parts Catalog
- Chapter 6           Installation Instructions
- Appendix A          List of Abbreviations
- Appendix B          Glossary
- Appendix C          Index
- Appendix D          List of Pages

Each chapter has its own Contents table where feasible.

## Use of the MAPs

The starting point for each call is the error indication index, MAP 1. This index directs the Customer Engineer (CE) to MAPs which will isolate the trouble indicated by the error indication. Each MAP contains step by step procedures to locate the failing part. Where necessary, the MAPs refer to operating procedures and maintenance procedures (check, adjustment, removal, and replacement) located in Chapter 1, right half.

When the CE gets to a point in the MAPs that indicates "call for aid", the error indications should be checked again before calling for aid. If other error indications are present, the MAPs pointed to by MAP 1 should be used. If no other error indications are present, MAP 2 should be used. This MAP provides a systematic approach to finding error indications. Additionally, MAP 2 leads to use of the starter diskette in the attempt to identify the problem. (Refer to 3.3.3 for details on starter diskette operation.) A more detailed description of the maintenance approach is contained in Chapter 2.

## Safety Notices

The following DANGER notices are also located in the applicable procedures:

**DANGER**
**Motor case can get hot.**

**DANGER**
**When replacing a 60-Hz drive motor, position two large holes in motor frame ( 4 on 1.26) to top and under bracket.**

**DANGER**
**As the first step in removing and replacing the power supply, disconnect the 3601 power cord from the ac outlet.**

### CE Safety Practices

All Customer Engineers are expected to take every safety precaution possible and observe the following safety practices while maintaining IBM equipment:

1. You should not work alone under hazardous conditions or around equipment with dangerous voltage. Always advise your manager if you MUST work alone.
2. Remove all power AC and DC when removing or assembling major components, working in immediate area of power supplies, performing mechanical inspection of power supplies and installing changes in machine circuitry.
3. Wall box power switch when turned off should be locked or tagged in off position. "Do not Operate" tags, form 229-1266, affixed when applicable. Pull power supply cord whenever possible.
4. When it is absolutely necessary to work on equipment having exposed operating mechanical parts or exposed live electrical circuitry anywhere in the machine, the following precautions must be followed:
   a. Another person familiar with power off controls must be in immediate vicinity.
   b. Rings, wrist watches, chains, bracelets, metal cuff links, shall not be worn.
   c. Only insulated pliers and screwdrivers shall be used.
   d. Keep one hand in pocket.
   e. When using test instruments be certain controls are set correctly and proper capacity, insulated probes are used.
   f. Avoid contacting ground potential (metal floor strips, machine frames, etc. – use suitable rubber mats purchased locally if necessary).
5. Safety Glasses must be worn when:
   a. Using a hammer to drive pins, riveting, staking, etc.
   b. Power hand drilling, reaming, grinding, etc.
   c. Using spring hooks, attaching springs.
   d. Soldering, wire cutting, removing steel bands.
   e. Parts cleaning, using solvents, sprays, cleaners, chemicals, etc.
   f. All other conditions that may be hazardous to your eyes. REMEMBER, THEY ARE YOUR EYES.
6. Special safety instructions such as handling Cathode Ray Tubes and extreme high voltages, must be followed as outlined in CEM's and Safety Section of the Maintenance Manuals.
7. Do not use solvents, chemicals, greases or oils that have not been approved by IBM.
8. Avoid using tools or test equipment that have not been approved by IBM.
9. Replace worn or broken tools and test equipment.
10. The maximum load to be lifted is that which in the opinion of you and management does not jeopardize your own health or well-being or that of other employees.
11. All safety devices such as guards, shields, signs, ground wires, etc. shall be restored after maintenance.
12. Each Customer Engineer is responsible to be certain that no action on his part renders product unsafe or exposes hazards to customer personnel.
13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.
14. All machine covers must be in place before machine is returned to customer.
15. Always place CE tool kit away from walk areas where no one can trip over it (i.e., under desk or table).
16. Avoid touching mechanical moving parts (i.e., when lubricating, checking for play, etc.).
17. When using stroboscope – do not touch ANYTHING – it may be moving.
18. Avoid wearing loose clothing that may be caught in machinery. Shirt sleeves must be left buttoned or rolled above the elbow.
19. Ties must be tucked in shirt or have a tie clasp (preferably nonconductive) approximately 3 inches from end. Tie chains are not recommended.
20. Before starting equipment, make certain fellow CE's and customer personnel are not in a hazardous position.
21. Maintain good housekeeping in area of machines while performing and after completing maintenance.

### Artificial Respiration

General Considerations
1. Start Immediately, Seconds Count
   Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing, warm the victim or apply stimulants.
2. Check Mouth for Obstructions
   Remove foreign objects – Pull tongue forward.
3. Loosen Clothing – Keep Warm
   Take care of these items after victim is breathing by himself or when help is available.
4. Remain in Position
   After victim revives, be ready to resume respiration if necessary.
5. Call a Doctor
   Have someone summon medical aid.
6. Don't Give Up
   Continue without interruption until victim is breathing without help or is certainly dead.

Rescue Breathing for Adults
Victim on His Back Immediately
1. Clear throat of water, food, or foreign matter.
2. Tilt head back to open air passage.
3. Lift jaw up to keep tongue out of air passage.
4. Pinch nostrils to prevent air leakage when you blow.
5. Blow until you see chest rise.
6. Remove your lips and allow lungs to empty.
7. Listen for snoring and gurglings, signs of throat obstruction.
8. Repeat mouth to mouth breathings 10-20 times a minute.

Continue rescue breathing until he breathes for himself.

Thumb and finger positions

Final mouth to mouth position

Reprint Courtesy Mine Safety Appliances Co.

EC 745948

1747488

B

# PUBLICATIONS REFERENCE DRAWING

MACHINE TYPE / MODEL NO. 3601 MODELS A02, A03, B02, B03, C, D

MACHINE NAME  CONTROLLER

| FORM NO. | E C NO. | DESCRIPTION / COMMENTS | QUANTITY | B/M NO. |
|---|---|---|---|---|
| SY27-2519-0 | 745948 | MAINT. INFO., BASE MANUAL (NOTE 1) | 1 | 1747487 |
| SN31-0864 | 745949 | TNL TO SY27-2519-0 | 1 | 1747487 |
| S126-0013-2 | 745948 | PARTS CATALOG (NOTE 2) | 1 | 1747487 |

NOTES,

1  ASSEMBLE MAINTENANCE INFORMATION MANUAL WITH BINDER AND SPINE TAB PER ASSEMBLY INSTRUCTIONS P/N 1652141

2  INSERT PARTS CATALOG AFTER MAINTENANCE MANUAL, CHAPTER 4

| IBM | | | DATE | CHANGE NO | | DATE | CHANGE NO |
|---|---|---|---|---|---|---|---|
| NAME | PUB REF DWG (PRD) | REL | MAR 76 | 742712 | | NOV 77 | 745948 |
| 3601 CONTROLLER | | | SEP76 | 743984 | | AUG 78 | 745949 |
| DESIGN | LR  MAR76 | SHT 1 OF 1 | APR77 | 745946 | | | |
| DETAIL | C2  11/5/4 | | JUN 77 | 745947 | | | |
| CHECK | | CLASSIFICATION | MUST CONFORM TO ENG SPEC | DEVELOPMENT NO | | LOGIC PG NO | |
| APPRO | JLM  MAR76 | | | | | 3601BB | B |

1747488

# Chapter 1. Maintenance Procedures

## Contents

## Contents (Cont)

# Contents (Cont)

BLANK PAGE

Note: *The MAPs and the procedures refer to the following 3604 keyboard display terminals: the 3604 at address 1 on loop 1; the control operator's 3604; and the 3604 at which the CE is logged on. With an operating diskette, the 3604 at address 1 on loop 1 may or may not be physically the same 3604 as the control operator's 3604. With a starter diskette, the 3604 at address 1 on loop 1 is also the control operator's 3604.*

## 1.1 STARTUP (RESET)

The following text (1.1.1, 1.1.2 and 1.1.3) applies to the operating diskette and the starter diskette.

### 1.1.1 Startup (Reset) Sequence

The startup sequence is as follows:

1. The CE activates the power switch or the reset switch on the controller.
2. The 3604 at address 1 on loop 1 displays a series of messages in the upper left corner of the gas panel to indicate the progress of the startup diagnostic tests. (This 3604 may require a power off/on reset.) The first message of this series is IDL (initial diagnostic load) and the final message is DTC (diagnostic test complete). Each message is displayed for a number of seconds and then is replaced by the succeeding one.
3. The control operator's 3604 displays a message on the top two lines of the gas panel. (This message indicates that the configuration image and the application programs have been successfully loaded from the diskette.) The top line contains seven groups of characters. From left to right, the groups give the following information:

   a. The control code supplemental version ID.
   b. Diskette identification (Volume ID).
   c. Configuration identification.
   d. The EC level of the controller data.
   e. Control unit (controller) address (CUA). The CUA is used by the host to address this controller.
   f. Relocate count (a count of the diskette records moved to the error track because of diskette surface defects).
   g. Session identification. As used here, a session is one or more periods of time that the customer thinks of as one continuous period of time for record keeping.

   The second line of the gas panel contains a five-digit message, 00001. This message requests the CE to key and enter one digit to specify the type of start wanted.

The type of start specified by each valid digit is as follows:

   0 XX = Load utility, where 70 = diskette format.*
   1 = Cold start.
   2 = Warm start.
   3 = Diagnostic loop.
   4 = Prompt mode.
   5 = Prompt mode for optional operations.
   6 X = Describe the 3604 model number, where
       X = model number.
   7 XX = Load link module, where
       01 = CCA TAM
       02 = HPCA TAM
       03 = CCA CREDIT LYONNAIS
       04 = HPCA CREDIT LYONNAIS
       05 = BSC
   8 = Cold start with no start link issued.
   9 = Warm start with no start link issued.

*Starter diskette only.

Note: *Use the Universal Translate Table keyboard locations when entering the required digit. See keyboard chart in 1.2.*

Special Note: *When using an operating diskette, never specify a cold start (digit 1 or digit 8) unless the customer allows you to do so.*

4. The CE keys and enters the correct digit. If 1, 2, 8, or 9 are entered, go to step 5 in this sequence. If 4 is entered, go to step 6. If 5 is entered, go to step 7. If 3 is entered, the controller will loop on the startup diagnostic sequence (IDL to DTC).
5. After entering 1, 2, 8 or 9, the gas panel goes blank and the customer's application program takes control.
6. If the CE requests a prompt mode start by keying and entering 4, the control operator's 3604 displays a sequence of five-digit messages (00002 through 00004) in the position where 00001 was displayed. After each message is displayed, the CE enters a response as shown in the chart on the next page, and the next message then appears. After the response to message 00004 has been completed, the screen again displays 00001. The CE now enters a 1, 2, 3, 4, 5, 8, or 9 to specify the startup, as in step 4.

7.  If the CE requests a prompt mode start by keying and entering 5, the control operator's 3604 displays the message 00005 in place of 00001. The CE keys and enters responses to this message as shown in the chart below. After the responses to 00005 have been completed, the screen again displays 00001. The CE now enters 1, 2, 3, 4, 5, 8, or 9 to specify the startup, as in step 4.

8.  The CE may describe the 3604 by entering 6 X where X is the 3604 model number.

**Prompt Mode Message Sequence***

| Displayed Message | CE Response |
|---|---|
| 00002 | Enter a one- or two-character control unit address (CUA) in hex. This CUA replaces the one on the diskette.** |
| 00003 | Enter a 1 to request dump option. Enter a 0 to request no dump option.**<br><br>Note: *The dump is taken only after a system failure. See 82060.* |
| 00004 | Enter a 1- to 16-character control operator identification code, supplied by the customer. Valid characters are 0–9, A–F, X, and blank.**<br><br>If 90000 is displayed after entering a new identification (ID) code, the earlier ID code must be entered. If it is not entered correctly, 00004 will again display; if it is entered correctly, the ID code will be changed and 00001 will display. |
| 00005 | Enter the ID codes for as many as 16 optional modules of controller data. (Press enter after each ID code of one or two hex characters.) The 00005 message will remain after each entry unless the CE has responded by entering 00 or FF, or by pressing the EM (enter) key or the RE (reset) key. If 00 is entered, no optional modules will be loaded. If FF is entered, all optional modules will be loaded. For optional module ID codes on starter diskette, see 3.3.3.** |
| 00006 | Enter a 5-character XID.** |

*Refer to the IBM 3600 system FE MIM, SY27-2520.
**If only the EM (enter) key is pressed, this input is bypassed and the operation continues. If the RE (reset) key is pressed twice, the prompt mode sequence is terminated.

## 1.1.2 Startup (Reset) Errors

1.  If the startup diagnostics detect an error, the startup terminates with no message displayed or with one of the following messages displayed on the 3604 at address 1 on loop 1. (See MAP 1, Error Indication Index.)

| | | |
|---|---|---|
| IDL | MV0 XXX | MV3 0 |
| HSH | ROS | MV1 XXX |
| LDI | PCK | MV2 XXX |
| IRT | LSW | MV3 XXX |
| HSH | HSH | ESA |
| LDC | LEC | INV |
| INS | MV2 0 | DTC |

MV2 and MV3 messages will only appear with the expanded memory. HSH will only appear if there is a diskette read error.

2.  If the controller detects an error during the remainder of the startup:

a.  82XXX error messages* are displayed on the 3604 at address 1 on loop 1.

b.  9XXXX error messages* are displayed at the control operator's 3604.

## 1.1.3 Error-Free Startup (Reset)

If the startup was error-free, the startup message sequence will reach DTC, blank the display, then display a startup message ending with 00001 on the second line of the gas panel, and accept the startup request.

## 1.2 LOGON/LOGOFF PROCEDURES FOR CE

### 1.2.1 Operating Diskette

The following procedure assumes that there has been a good startup (1.1.1):

1.    At an idle 3604, press the RE (reset) key three times. If reset is not marked, ask the customer to identify the reset key.
2.    Message 90000 should be displayed. When 90000 is displayed, the layout of the keyboard keys is as assigned by the Universal Translate Table (UTT). The keyboard layout for the different 3604 keyboards is shown on the next page.

      **Note:** *If 90000 is not displayed and the CHECK indicator lights, another 3604 is already logged on.*

3.    Obtain the control operator identification (ID) code from the customer and enter this code at the 3604, using the 3604 UTT keyboard layout.

      **Note:** *The control operator ID is not displayed.*

4.    Message 91111 should be displayed, indicating a successful logon. If 91111 is not displayed, go to step 1.
      **Note:** *After 91111 is displayed, the CE is able to give the keyboard commands, described in the IBM 3600 System FE MIM, SY27-2520.*

5.    Logoff Procedure: To log off, key in 000 and then press the enter (EM) key.

### 1.2.2 Starter Diskette

As soon as the CE completes the startup by responding to the 00001 message, the gas panel on the control operator's 3604 (address 1 on loop 1) goes blank and the message 92222 appears. This message indicates that the CE is automatically logged on that 3604 and may run exerciser tests by using its keyboard. The CE can log off that 3604 and can then manually log on and log off at another 3604 in the same way as with an operating diskette (1.2.1). Note, however, that the control operator ID code for the starter diskette is 12345.

A. 30-Key Keyboard

**Legend:**

| | | |
|---|---|---|
| BS | = | backspace |
| RE | = | reset |
| EM | = | end of message |
| NK | = | return to normal keyboard = 045 |
| SP | = | space |
| AV | = | advance/clear* |
| FR | = | free* |

\* Used only for large disk storage utilities and error code diagnostic.

= motor bar available

B. 45-Key Keyboard

C. 74-Key Keyboard

D. 77-Key Keyboard

E. 92-Key Keyboard

F. 94-Key Keyboard

G. 99-Key Keyboard

**Universal Translate Table Keyboard Layout**

EC 745948

## 1.3 ASSIGNING THE COMPONENT TO BE TESTED

### 1.3.1 Operating Diskette

1. Log on at any idle 3604 (1.2.1).
2. Key in: 007 LSSD X

where:

L⃰ = Loop number.
SS = Terminal address (01 through 16).
D = Component address, as follows:

    1 = Keyboard
    2 = Display
    3 = Encoder
    4 = 3610, 3612 document printer or 3618 printer
    5 = 3611 or 3612 Passbook Printer
    6 = 3606/3608 keyboard/display
    7 = 3608 printer
    8 = 3614 Consumer Transaction Facility
X = 1 for side B.
X = 0 for side A.

    If X is not entered, the default is the A side. If only 007 is entered, the component is reassigned to its work station.

### 1.3.2 Starter Diskette

Refer to starter diskette configuration information (3.3.3) to determine how to prepare for use of the starter diskette and also see command code 973. (Refer to the IBM 3600 System FE MIM, SY27-2520.)

**Test Component on Loop 1**

1. Set address switches of the terminal that contains the component to be tested (3.3.3).
2. Log on (1.2.2).
3. Key and enter: 007 LSSD X
   The letters LSSD X have the same meaning as with the operating diskette.

**Test Component on Loop 2**

1. Set address switches of the terminal that contains the component to be tested (3.3.3).
2. Log on (1.2.2).

3. With the starter diskette, loop 2 is named as having a wrappable modem. If loop 2 actually has a wrappable modem (1200 bps), go now to step 4. If loop 2 has no modem or has a modem that is not wrappable (600 bps), then key and enter:

    040 0 02 00 02
    040 0

4. Key and enter: 007 LSSD X
   The letters LSSD X have the same meanings as with the operating diskette.

**Test Component on Loop Other Than 1 or 2**

1. Set address switches of the terminal that contains the component to be tested (3.3.3).
2. Log on (1.2.2).
3. Determine whether the loop has a wrappable modem (1200 bps), a modem that is not wrappable, or no modem (local loop).
4. Key and enter:

    040 0 0X00 0Y
    040 0

where:

    X is set to 2 if there is no wrappable modem on the loop (local loop or World Trade 600 bps remote loop).
    X is set to 3 if there is a wrappable modem (1200 bps remote loop).
    Y is set to the loop number of the loop to be tested.

    The first of the above commands stops all loops except loop 1, and specifies the loop to be tested. The 040 0 command starts the loop to be tested.

5. Key and enter : 007 LSSD X
   The letters LSSD X have the same meanings as with the operating diskette.

## 1.4 ASSIGNING A COMPONENT TO BE THE OUTPUT PRINTER

### 1.4.1 Operating Diskette

1. Log on at any idle 3604 (1.2.1).
2. Key in: 006 LSSD X

   where:

   · L = Loop number.
   SS = Terminal address (01 through 16).
   D = Component address, as follows:

      1 = Keyboard
     *2 = Display
      3 = Encoder
     *4 = 3610, 3612 document printer, or 3618 printer
      5 = 3611 or 3612 passbook printer
      6 = 3606/3608 keyboard/display
      7 = 3608 printer
      8 = 3614 Consumer Transaction Facility
   X = 1 for side B
   X = 0 for side A

   *Only components that can be assigned as an output printer (continuous form printers only).

### 1.4.2 Starter Diskette

Refer to starter diskette configuration information (3.3.3) to determine how to prepare for use of the starter diskette and also see command code 973. (Refer to the IBM 3600 System FE MIM, SY27-2520.)

**Output Printer on Loop 1**

1. Set the address switches of the terminal that contains the component that is to be the output printer (3.3.3).
2. Log on (1.2.2).
3. Key and enter 006 LSSD X
   The letters LSSD X have the same meanings as with the operating diskette.

**Output Printer on Loop 2**

1. Set the address switches of the terminal that contains the component that is to be the output printer (3.3.3).

2. Log on (1.2.2).
3. With the starter diskette, loop 2 is named as having a wrappable modem. If loop 2 actually has a wrappable modem (1200 bps), go now to step 4. If loop 2 has no modem or has a modem that is not wrappable (600 bps), then key and enter:

      040 0 02 00 02
      040 0

4. Key and enter 006 LSSD X
   The letters LSSD X have the same meanings as with the operating diskette.

**Output Printer on Loop Other Than 1 or 2**

1. Set the address switches of the terminal that contains the component that is to be the output printer.
2. Log on (1.2.2).
3. Determine whether the loop has a wrappable modem (1200 bps), a modem that is not wrappable (600 bps), or no modem (local loop).
4. Key and enter:

      040 0 0X 00 0Y
      040 0

   where:

   X is set to 2 if there is no wrappable modem on the loop (local loop or World Trade 600 bps remote loop).
   X is set to 3 if there is a wrappable modem (1200 bps remote loop).
   Y is set to the number of the loop to be tested.

   The first of the above commands stops all loops except loop 1, and specifies the loop to be tested. The 040 0 command starts the loop to be tested.

5. Key and enter 006 LSSD X
   The letters LSSD X have the same meanings as with the operating diskette.

## 1.5 DISPLAY/PRINT STATISTIC COUNTERS

**Note:** *Statistic counts are located in functional storage and are lost each time there is a reset (warm start or cold start). In contrast, the log is located on the diskette. Thus, the log is lost only on a cold start.*

### 1.5.1 Operating Diskette

After logging on at a 3604 (1.2), the CE can key in either of two commands to obtain statistic counters:

1.  010 LSSD is keyed to display the statistic counters of a specified component,

    where:

    L = Loop number.
    SS = Terminal address (01 through 16)
    D = Component address, as follows:

    >   1 = Keyboard
    >   2 = Display
    >   3 = Encoder
    >   4 = 3610, 3612 document printer, or 3618 printer
    >   5 = 3611 or 3612 passbook printer
    >   6 = 3606/3608 keyboard/display
    >   7 = 3608 printer
    >   8 = 3614 Consumer Transaction Facility

    LSSD = 9001 for host link
    LSSD = 9002 for diskette
    LSSD = 903X for ALA line
    LSSD = X000 for loop control, where X is the number of the loop.

2.  012 X is keyed to print statistic counters for all components on the assigned output printer. X is the number of loops attached to the controller.

    The output format is:

    LSDM TT SS XXX XXX XXX... ... ...
    L = Loop number.
    S = Terminal address in hexadecimal
    D = Component address, same as input above
    M = Modulus value for a terminal component, or speed of a loop (see below)

TT = Component type (see below)
SS = Work station identification
XXX = error count in decimal
LSDM = 9010 = Host link
LSDM = 9020 = Diskette
LSDM = 93X0 = ALA line
LSDM = X000 for loop control where X is the number of the loop.

If M = loop speed, values are as follows:

>   01 = 4800 bps
>   02 = 2400 bps
>   04 = 1200 bps
>   08 = 600 bps
>   8X = clocking loop

Component types (TT) are as follows:

| | | | |
|---|---|---|---|
| 80 = Loops | | 01 = Host link | |
| 81 = Keyboard | | 02 = Diskette | |
| 82 = Display | | 03 = ALA line | |
| 83 = 3610, 3611 or 3612 printer | | | |
| 85 = 3618 printer | | | |
| 86 = Magnetic Stripe Encoder | | | |
| 87 = 3614 Consumer Transaction Facility | | | |
| 88 = 3606/3608 keyboard/display | | | |
| 89 = 3608 printer | | | |

### 1.5.2 Starter Diskette

1.  Refer to starter diskette configuration information (3.3.3) to determine how to prepare for using the starter diskette by:

    a.  Setting the address switches of some terminals or by simply turning off power on other terminals.

    b.  For loops other than loop 1, using the 040 command to set up the loop that is to be the working loop.

2.  Obtain statistic counters in the same way as with an operating diskette (1.5.1).

## 1.6 DISPLAY/PRINT CONTROLLER LOG

**Note:** *Refer to 3.3.5 for more information on the controller log.*

1. Log on (1.2).
2. Key in one of the following commands:

| *Command* | *Function* |
|---|---|
| 001 | Display the first part of each of the last five messages in the log. Each display line will contain a four-digit message number and as many as 36 characters of the message. After the first time you press the enter key, you can go back five additional messages each time you press the enter key again. |
| 002 XXXX | Display full text of log message XXXX (maximum 240 characters). |
| 002 9999 | Display the last X1-XXX type message in the log. (Display full text of the message; maximum of 240 characters.) |
| 046 XXXX YYYY | Print log messages numbered XXXX through YYYY on the printer assigned to be the output printer by command code 006. |
| 046 0001 9999 | Print all log messages on the assigned output printer. |

## 1.7 LOOP ERROR LOG MESSAGE

The loop error message is:

　　11 005 Loop X Error, Code = Y - Z

Where:

　　X = Loop Number
　　Y = Loop Status
　　　　0 - Loop Failed (Wrap Good)
　　　　1 - Modem Check
　　　　2 - Loop Check
　　　　4 - Machine Check
　　　　8 - User Requested Stop Loop
　　Z = Data Set (Modem) Status
　　　　0 - Transmit and Receive Not Ready
　　　　1 - Receive Ready (Carrier Detect)
　　　　2 - Transmit Ready (Clear to Send)
　　　　3 - Combination of 1 and 2

## 1.8—1.19　　NOT USED

## 1.20 3601 DISKETTE DRIVE ASSEMBLY REMOVAL AND REPLACEMENT

1. Turn off power.
2. Remove the smaller front end cover by raising it from its pivot pins.
3. Remove the side cover by raising up and tilting the top outwards.
4. Remove the diskette drive control card access cover by removing one holding screw.
5. Unplug the diskette drive motor connector.
6. Unplug the cable from the diskette drive control card and remove the ground wire. (The other end of this cable plugs into 01A1Z3.)
7. Remove the holding screw from the diskette drive assembly base plate. The base plate is exposed by the front end cover removal (step 2).
8. Loosen the Zeus* fastener on the inside top of the diskette drive assembly.
9. Remove the diskette drive assembly by sliding it out from the front end of the controller.

　　Replace the diskette drive assembly by reversing the above procedure.**

---

*Titan Tool Supply Co., Inc.

**Jumper assembly PN 4409828 for low voltage (100 — 123.5) or PN 4409829 for high voltage (200 — 240) may be required in order to use the latest style diskette drive motor.

## 1.21 LATCH ASSEMBLY REMOVAL AND REPLACEMENT

1. Open diskette drive assembly cover **3** .
2. Remove the two latch mounting screws **1** .
3. Pull latch **11** away from cover.
4. To replace, reverse above procedure.

## 1.22 COVER ASSEMBLY REMOVAL AND REPLACEMENT

CAUTION: Do not allow pressure pad arm **40** to snap against head.

1. Remove diskette drive assembly (1.20).
2. Remove two screws **8** while holding cover.
3. Remove cover carefully to avoid damage to wires.
4. Remove wires from LED **2** and pressure pad actuator **9** .
5. Remove wires from clip on cover.
6. To replace cover, reverse above procedure.

## 1.23 COLLET REMOVAL AND REPLACEMENT

1. Remove diskette drive assembly (1.20).
2. Remove cover (1.22).
3. Remove mounting screw **10** .
4. Remove collet assembly **5** and spring and washer **4** .
5. Remove collet **7** by removing clip **6** .
6. To replace collet, reverse above procedure.

CAUTION: Before replacing cover screws, position actuator **39** bail under pressure pad arm. **40**
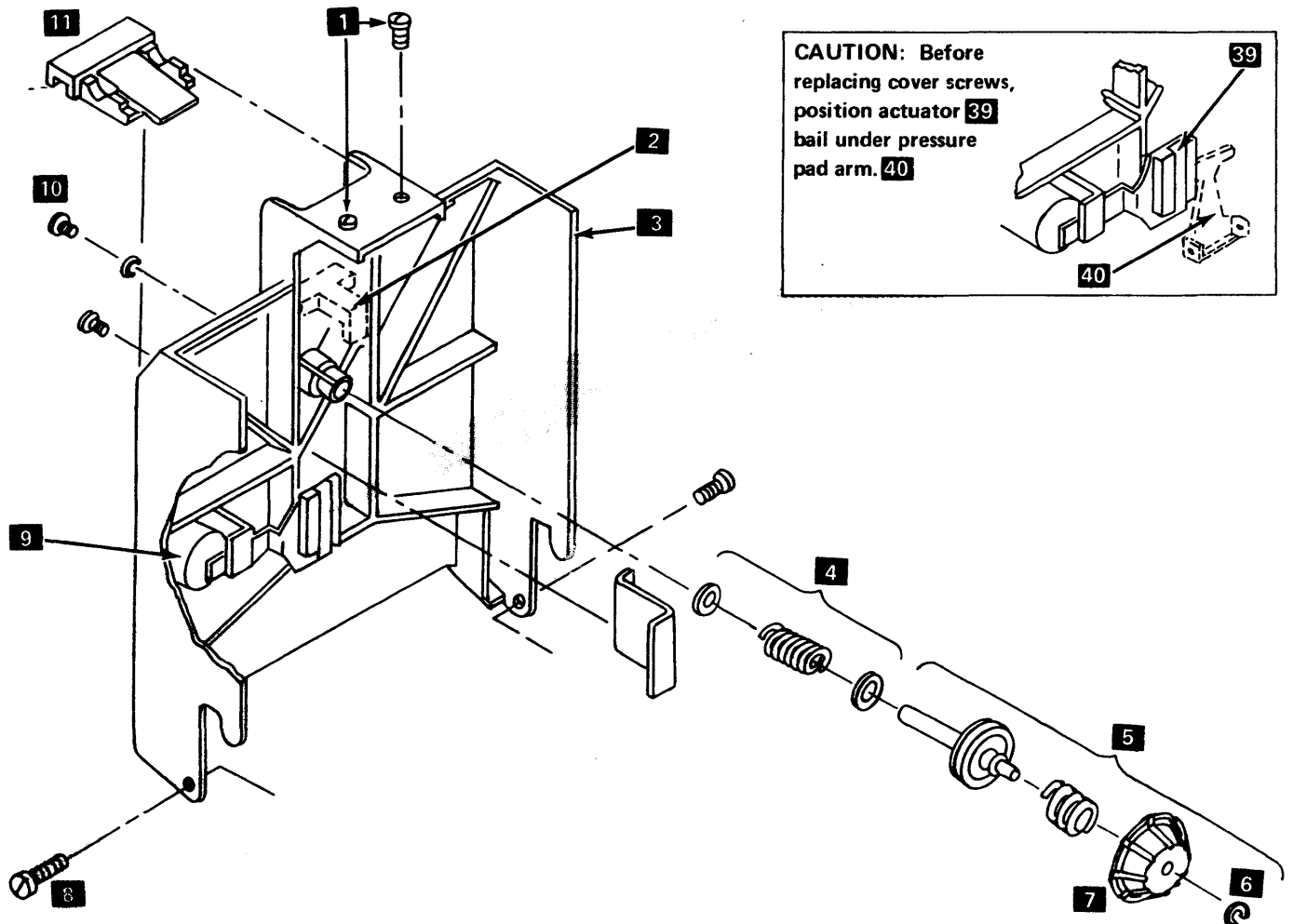
## 1.24 TRACK INDICATOR ADJUSTMENT

1. Log on (1.2).
2. Key in 034 0001 0001 and press the enter (EM) key. This causes the read/write head assembly to seek and ˙read record 1 on track 0 continuously.
3. Loosen two screws.
4. Adjust track indicator so that zero line is centered on pressure pad arm pointer.
5. Tighten screws.
6. Press reset (RE) key twice.
7. Check for gap between pressure pad arm and track indicator bracket at all tracks by keying:

   034 0001 7501

8. Press reset (RE) key twice to end the test.

**Front View**

EC 745948
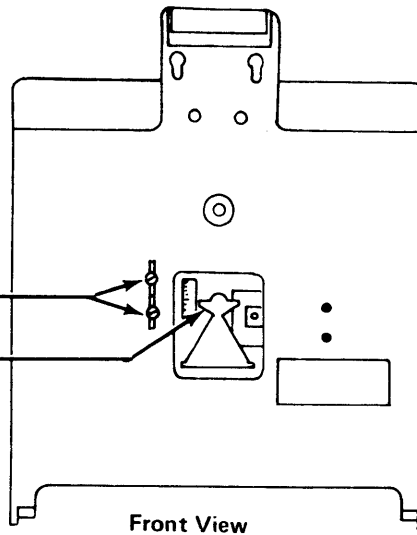
## 1.25 DRIVE MOTOR REMOVAL

**DANGER**
**Motor case can get hot.**

1. Remove diskette drive assembly (1.20).
2. Remove drive belt.
3. Loosen two motor mounting clamps and remove drive motor **3** .
4. Loosen setscrew **2** and remove drive pulley **1** .

## 1.26 DRIVE MOTOR REPLACEMENT

1. Replace drive pulley **1** . (Align setscrew **2** with flat surface on shaft.)

**DANGER:**
**When replacing a 60-HZ drive motor, position two large holes **4** in motor frame to top and under bracket.**

2. Clamp motor to mounting bracket.
3. Replace belt.
4. Inspect belt tracking and adjust if necessary (1.27).
5. Replace diskette drive assembly (1.20).

## 1.27 BELT TRACKING ADJUSTMENT

Belt must ride in center of drive pulley **1** and hub pulley **12** when drive pulley is rotated counterclockwise viewed from the pulley side.

**CAUTION: Drive pulley setscrew must be aligned with flat surface on motor shaft.**

1. Remove diskette drive assembly (1.20).
2. Adjust drive pulley **1** and idler position so that belt rides on center of drive pulley and hub pulley. To adjust drive pulley, loosen setscrew **2** . To adjust idler position, loosen screw **6** and slide idler in or out.
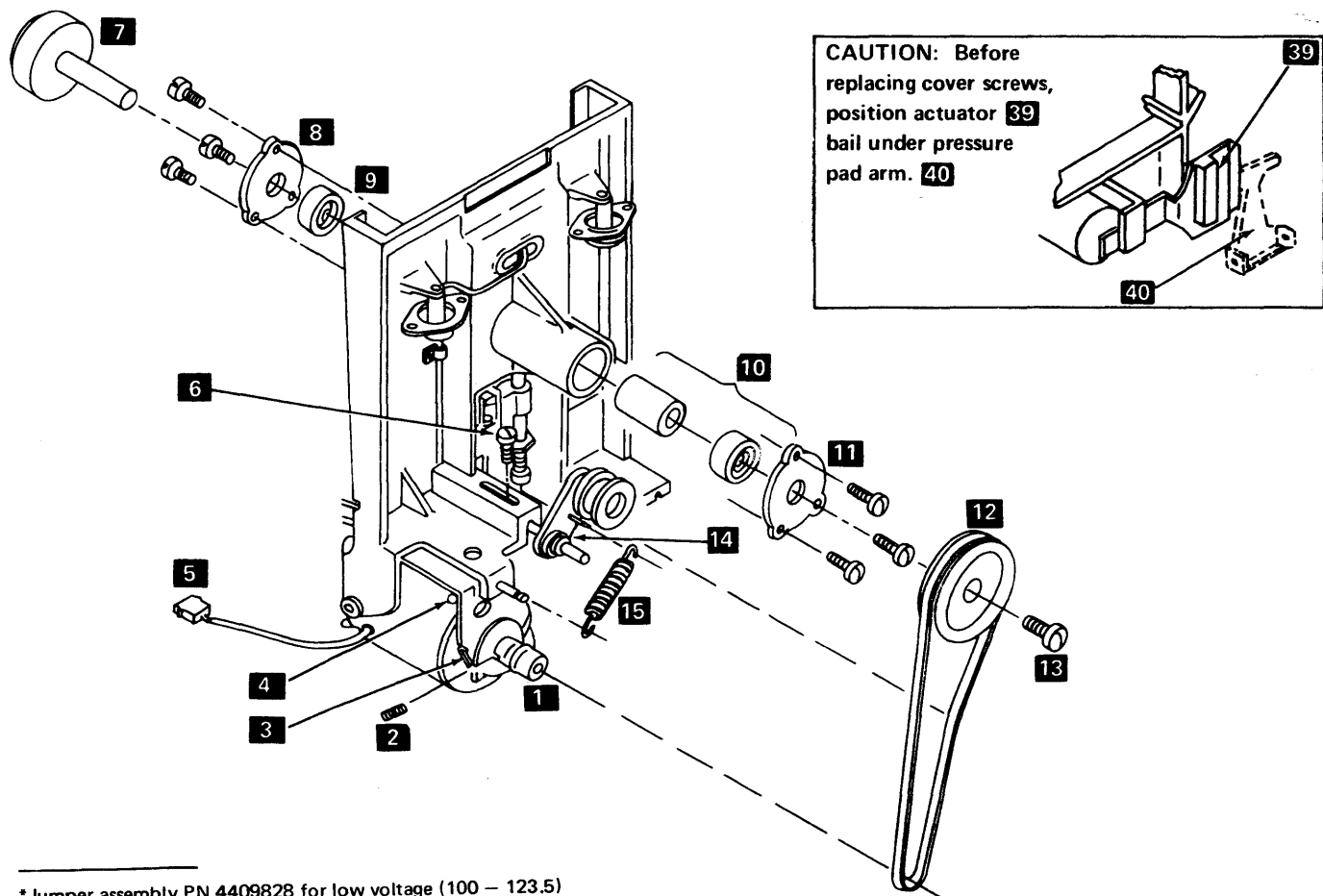
CAUTION: Before replacing cover screws, position actuator **39** bail under pressure pad arm. **40**



*Jumper assembly PN 4409828 for low voltage (100 – 123.5) or PN 4409829 for high voltage (200 – 240) may be required in order to use the latest style diskette drive motor.

## 1.28 IDLER ASSEMBLY REMOVAL AND REPLACEMENT

1. Remove diskette drive assembly (1.20).
2. Remove belt and spring **15**.
3. Remove screw **6** and remove idler assembly.
4. To replace idler, reverse above procedure and inspect belt tracking (1.27).

## 1.29 HUB ASSEMBLY REMOVAL AND REPLACEMENT

1. Remove diskette drive assembly (1.20).
2. Remove cover from diskette drive assembly (1.22).
3. Remove drive belt.
4. Remove screw **13** and remove hub pulley **12**.
5. Remove hub **7**.
6. Remove bearing retaining screws, retaining plate **8**, and bearing **9**.
7. Remove bearing retaining screws, retaining plate **11**, bearing, and spacers **10**.

8. To replace, reverse above procedure. Inspect belt tracking and adjust if necessary (1.27).

CAUTION: The front bearing **9** must be flush with front surface of baseplate. To do this, tighten front bearing retaining screws first. Seal on bearings should face outside.

## 1.30 DRIVE PULLEY REMOVAL

1. Remove diskette drive assembly (1.20).
2. Remove belt.
3. Loosen setscrew **2** and remove drive pulley **1**.

## 1.31 DRIVE PULLEY REPLACEMENT

1. Position drive pulley **1** on shaft.
2. Align setscrew **2** with flat surface of shaft, and tighten.
3. Replace belt.
4. Inspect belt tracking and adjust if necessary (1.27).
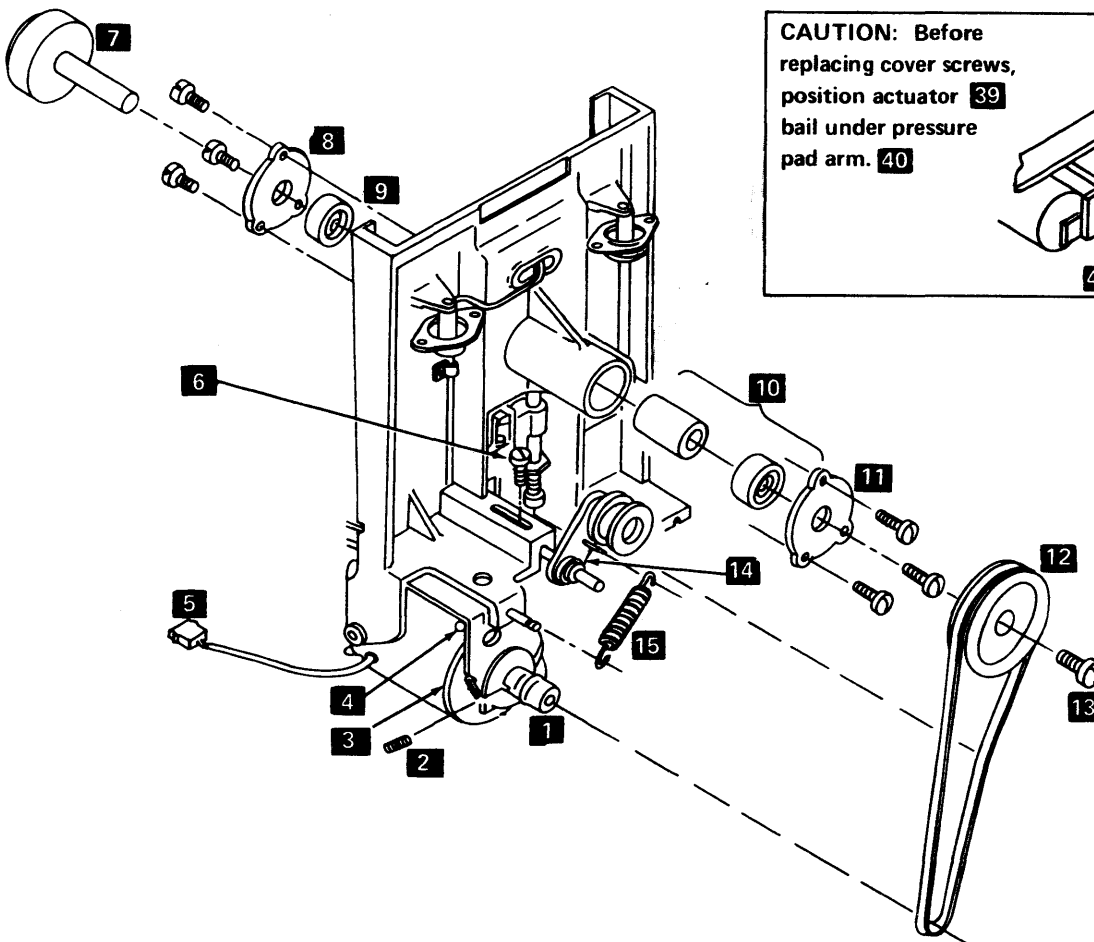
CAUTION: Before replacing cover screws, position actuator **39** bail under pressure pad arm. **40**
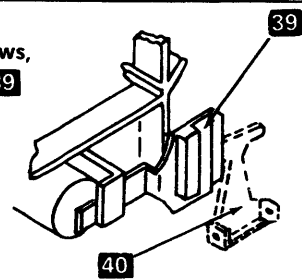
## 1.32 PRESSURE PAD ACTUATOR REMOVAL AND REPLACEMENT

1. Remove diskette drive assembly (1.20).
2. Remove cover from diskette drive assembly (1.22).
3. Remove two screws **2**.
4. Remove leads and remove pressure pad actuator **1** .
5. To replace, reverse above procedure and adjust (1.33).
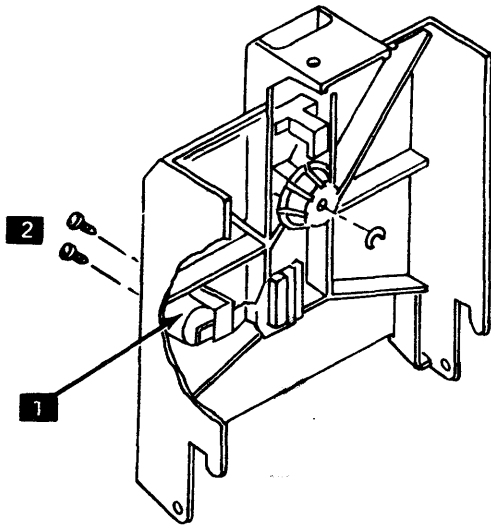
## 1.33 PRESSURE PAD ACTUATOR ADJUSTMENT

1. Load diskette into the diskette drive assembly.
2. Energize the coil by installing a jumper between the "—Head Load" and "Ground" test points on the diskette drive control card (1.51).
3. Adjust screw **3** until the pressure pad arm **40** and bail **39** just touch.
4. Rotate adjusting screw **3** clockwise 1/2 to 3/4 turn and check for gap between arm and bail at all tracks. If condition cannot be met within 1/2 to 3/4 turn, look for mechanical defect.
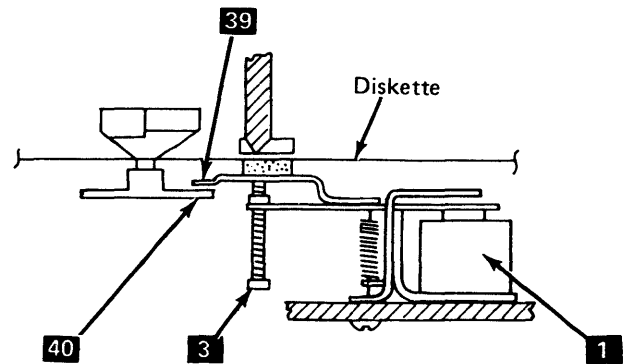
Diskette

CAUTION: Before replacing cover screws, position actuator **39** bail under pressure pad arm. **40**
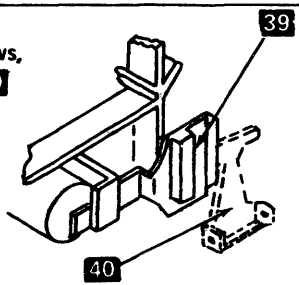
## 1.34 LEADSCREW AND HEAD CARRIAGE ASSEMBLY REMOVAL

1. Remove diskette drive assembly (1.20).
2. Note routing of head cable.
3. Remove wires from connector by pushing down with small screwdriver, as shown.



Green
Red
Blank
Black
White
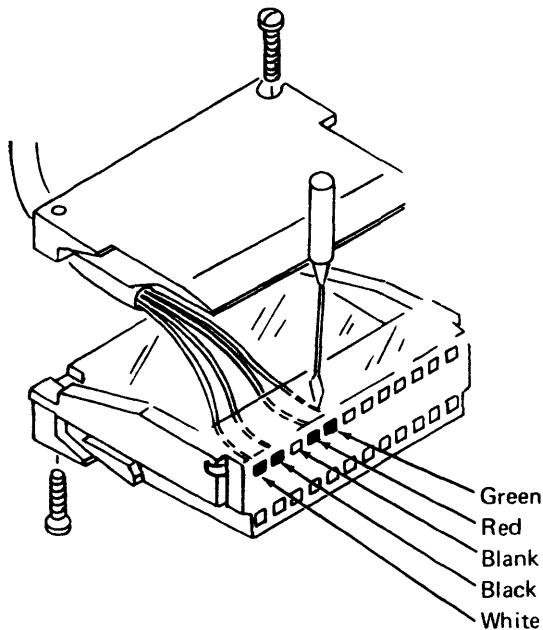
4. Center carriage on leadscrew by turning stepper motor wheel.
5. Remove stepper motor **3** per procedure 1.42, and remove leadscrew wheel **2**.
6. Remove diskette drive assembly cover (1.22).
7. Loosen clamping screws on upper and lower stops **5** **6**.
8. Remove bottom bearing **4**.

   **CAUTION: Watch for preload spring **1** when removing shaft.**

9. Slide leadscrew assembly down until top clears baseplate, then slide assembly out.

   **CAUTION: Do not allow pressure pad arm to snap against head.**

10. Remove top bearing, preload spring, and both stops from leadscrew.

## 1.35 LEADSCREW AND HEAD CARRIAGE ASSEMBLY REPLACEMENT

**Note:** *If the leadscrew and carriage are disassembled, reassemble by threading the leadscrew into the bottom portion of the carriage assembly and into the carriage nut and spring. At **7** there should be a movement of approximately 0.202 inch (0.51 mm) against spring tension.*

1. Center carriage assembly on leadscrew and install upper and lower limit stops.
2. Replace top bearing and preload spring **1** (depression side up).
3. Replace assembly into baseplate, bottom end first.
4. Replace bottom bearing and check for about 0.030-inch (0.76 mm) up and down movement of leadscrew against preload spring.
5. Replace leadscrew wheel, leadscrew wheel clamp, and stepper motor.

   **Note:** *Reroute head cable as noted under step 2 of the removal procedure (1.34).*

6. Connect wires (see 1.34 for wire locations).

   **Note:** *Make sure that the locking tabs on the terminals engage in the connector slot to prevent the leads from pushing out when plugged in.*
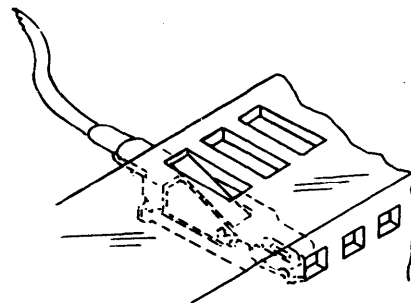


7. Adjust stepper motor (1.43) and read/write head (1.36).
8. Replace diskette drive assembly cover (1.22).

**EC 745948**
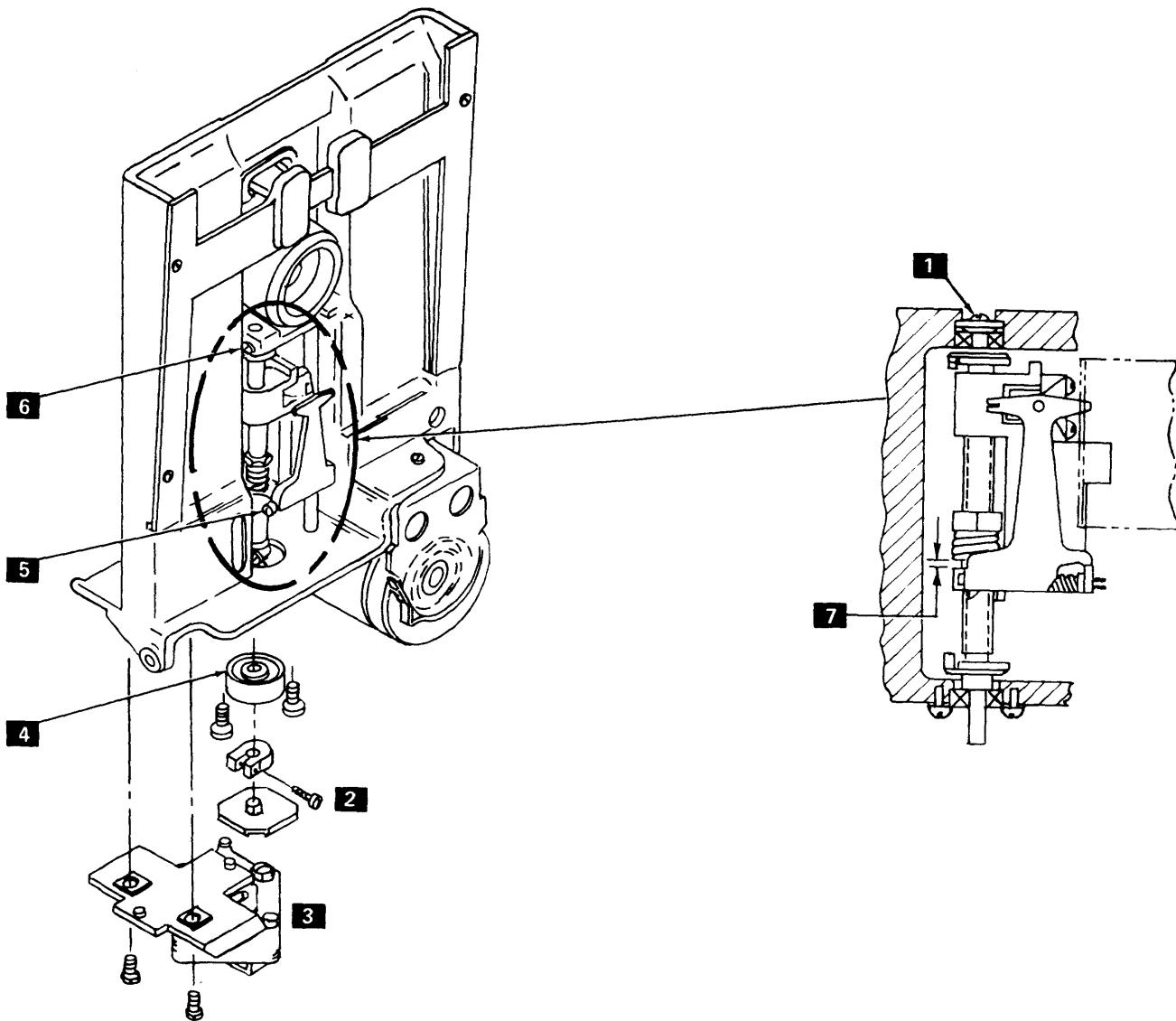
## 1.36 READ/WRITE HEAD ADJUSTMENT

To properly make the head adjustment, you must obtain three simultaneous conditions:

- Correct head-to-CE tool clearance.

- Correct relationship between the stepper motor and leadscrew wheels.

- Correct clearance between the stepper motor and leadscrew wheels.

1. Remove diskette drive assembly (1.20).
2. Access head to track 0. Leadscrew wheel **12** and stepper motor wheel **13** should line up as in view **S** .
3. Remove diskette drive assembly cover (1.22).
4. Loosen mounting screw and move phototransistor assembly **1** to the left.

   Note: *If phototransistor assembly is not moved, the accuracy of the head adjustment may be affected.*

5. Loosen clamping screws on lower limit stop **8** and leadscrew wheel **9** .

   Note: *Steps 6 and 7 provide maximum stepper motor-to-leadscrew wheel pin penetration with no binds.*

6. Determine type of stepper assembly, below:



  **X**   White     **12** / **13**   .025±.005

  **Y**   Black / Steel pin / White    **12** / **13**   .020±.005
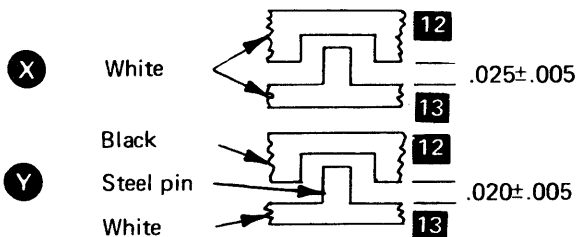
7. With stepper motor wheel **13** and leadscrew wheel **12** positioned as in view **S** , insert feeler gauge between these wheels. (see **11** in view **S** .) The feeler gauge should correspond to the gap setting for **X** or **Y** in step 6. Gauge may be left in place.
8. Locate the white dot label or other mark on the outer circumference of diskette drive hub. If hub has both, always use white dot. Rotate hub so that this mark is in the up position.

   Note: *Step 8 makes sure that any hub eccentricity is located in the same spot and that all head adjustments use the same reference point.*

   CAUTION: **Avoid any contact of CE tool with highly polished face of head.**

9. Install CE tool **2** on hub. Clamp into place with thumbscrew.

10. Rotate CE tool so that it contacts surface **4** .
11. Rotate leadscrew by gripping upper limit stop **3** and adjust for gap **5** . This gap is a number found on the front of the read head assembly **6** . This number represents thousandths. Example: 3 equals 0.003" (0.076 mm). Adjust for a very light drag on a 0.003" (0.076 mm) gauge. A 0.002" gauge (0.051 mm) must be free.

    Note: *When doing step 12, be sure that stepper motor wheel and leadscrew wheel remain positioned as in view* **S** .

12. Tighten leadscrew wheel clamping screw **9** . The top of the clamping collar should be nearly even with the top of the metal clamping surface of leadscrew wheel.

    Note: *If clamping collar is not fastened tightly, machine operation can cause head to go out of adjustment.*

13. Adjust phototransistor **1** so that raised edge is in contact with CE tool, and tighten mounting screw.
14. Remove CE tool and adjust lower limit stop (1.40).
15. Recheck gap setting **5** .
16. Rotate stepper motor at least one full revolution and check for binds.
17. Adjust upper limit stop (1.41).
18. If leadscrew wheel is type **Y** in step 6, the slot should be 25—40 percent full with IBM #23 grease.
19. Replace cover (1.22) and adjust track indicator (1.24).

## 1.37 HEAD AND PRESSURE PAD CLEANING

1. Open the smaller front cover of the controller and remove it by raising it from its pivot pins.
2. Turn off power.
3. Open the cover of the disk drive assembly, and manually rotate the stepper motor wheel until the carriage assembly is at the upper limit stop.

   CAUTION: **Do not allow pressure pad arm to snap against head. Also, use only the materials mentioned in steps 4 and 5 to clean head and pressure pad.**

4. Pivot pressure pad arm **7** away from head and check pad for contamination. If contaminated, use dry brush (PN 2200106) to remove caked deposits and to fluff pad.

   CAUTION: **Fluid treated cloth should not contact pressure pad.**

5. While holding pressure pad arm out, clean polished head surface with isoproply alcohol (PN 2200200) applied to a clean cloth (PN 2108930).

## 1.38 LEADSCREW WHEEL REMOVAL AND REPLACEMENT

1. Remove diskette drive assembly (1.20).
2. Remove stepper motor (1.42).
3. Loosen clamping screw **9** and remove leadscrew wheel **12** .
4. Replace leadscrew wheel. (Don't tighten clamping screw **9** in this step. This screw is tightened during the read/write head adjustment.)
5. Replace stepper motor (1.42).
6. Adjust stepper motor (1.43).
7. Adjust read/write head (1.36).

## 1.39 NOT USED

CAUTION: Before replacing cover screws, position actuator **39** bail under pressure pad arm.**40**
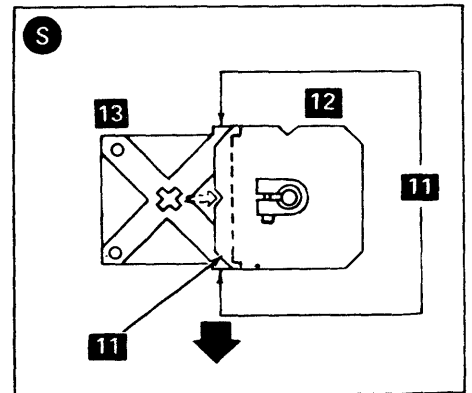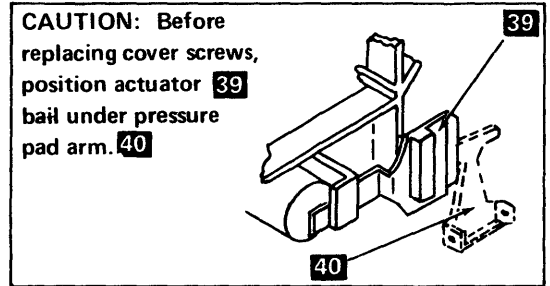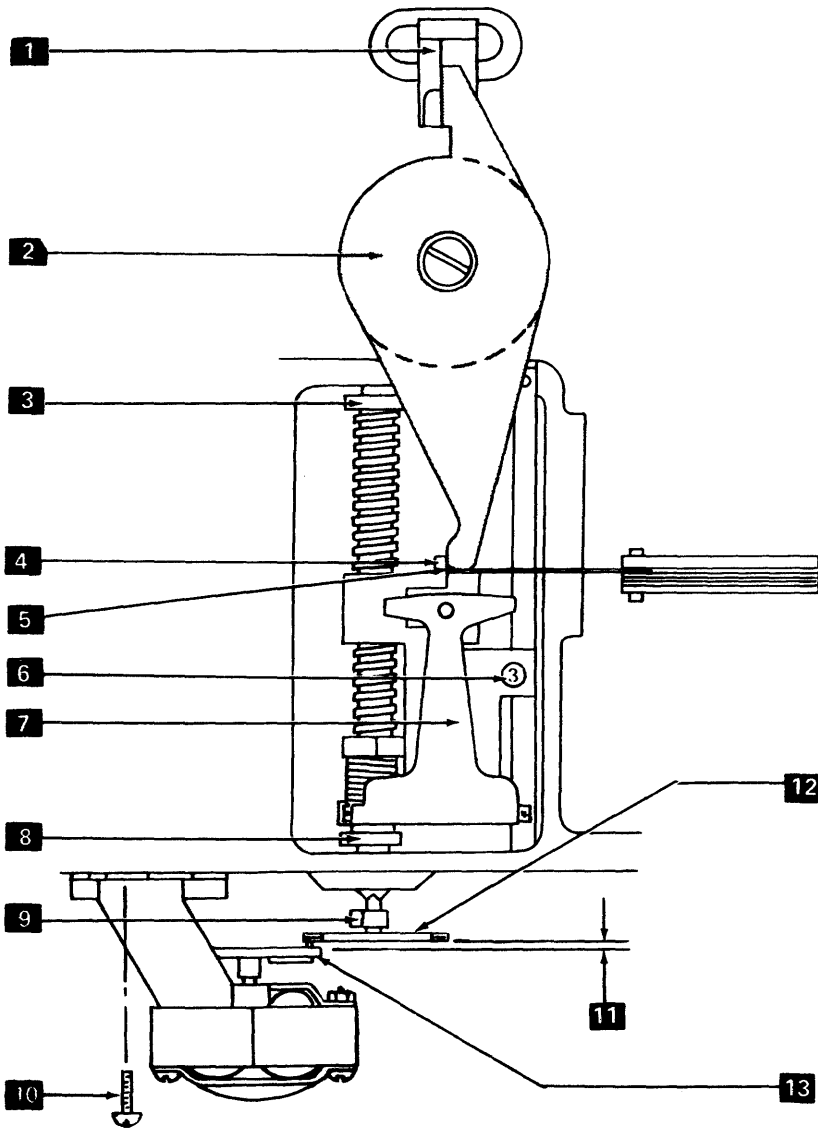
Machine Front (Cover Side)

**Note:** *The lower and upper limit stops are adjusted (1.40, 1.41) to make sure that the carriage can always be accessed to tracks 0 and 76 and will not overtravel, damaging this mechanism.*

## 1.40 LOWER LIMIT STOP ADJUSTMENT

1. Remove diskette drive assembly (1.20).
2. Loosen clampscrew **1** . Make sure that leadscrew is 45° ± 15° beyond track 0 in downward direction. Leadscrew wheel **6** and stepper motor wheel **7** must be in position shown in Detail A.
3. Position limit stop **5** so that projection on limit stop is in front of and against the projection on carriage.
4. Adjust distance **4** between top of projection on limit stop and bottom of carriage for 0.012 to 0.018 inch (0.31 to 0.46 mm).

## 1.41 UPPER LIMIT STOP ADJUSTMENT

1. Remove diskette drive assembly (1.20).
2. Loosen clamp screw **3** and slide stop up as far as possible.
3. Starting at track 0, rotate stepper motor wheel to move carriage assembly up to track 76.
4. Adjust stop so that distance **2** is 0.025 to 0.035 inch (0.64 to 0.89 mm).
5. Tighten clamp screw **3** .

**CAUTION: Do not overtighten clampscrew.**

Back View

Detail A

Top View

Front of Machine (Cover Side)
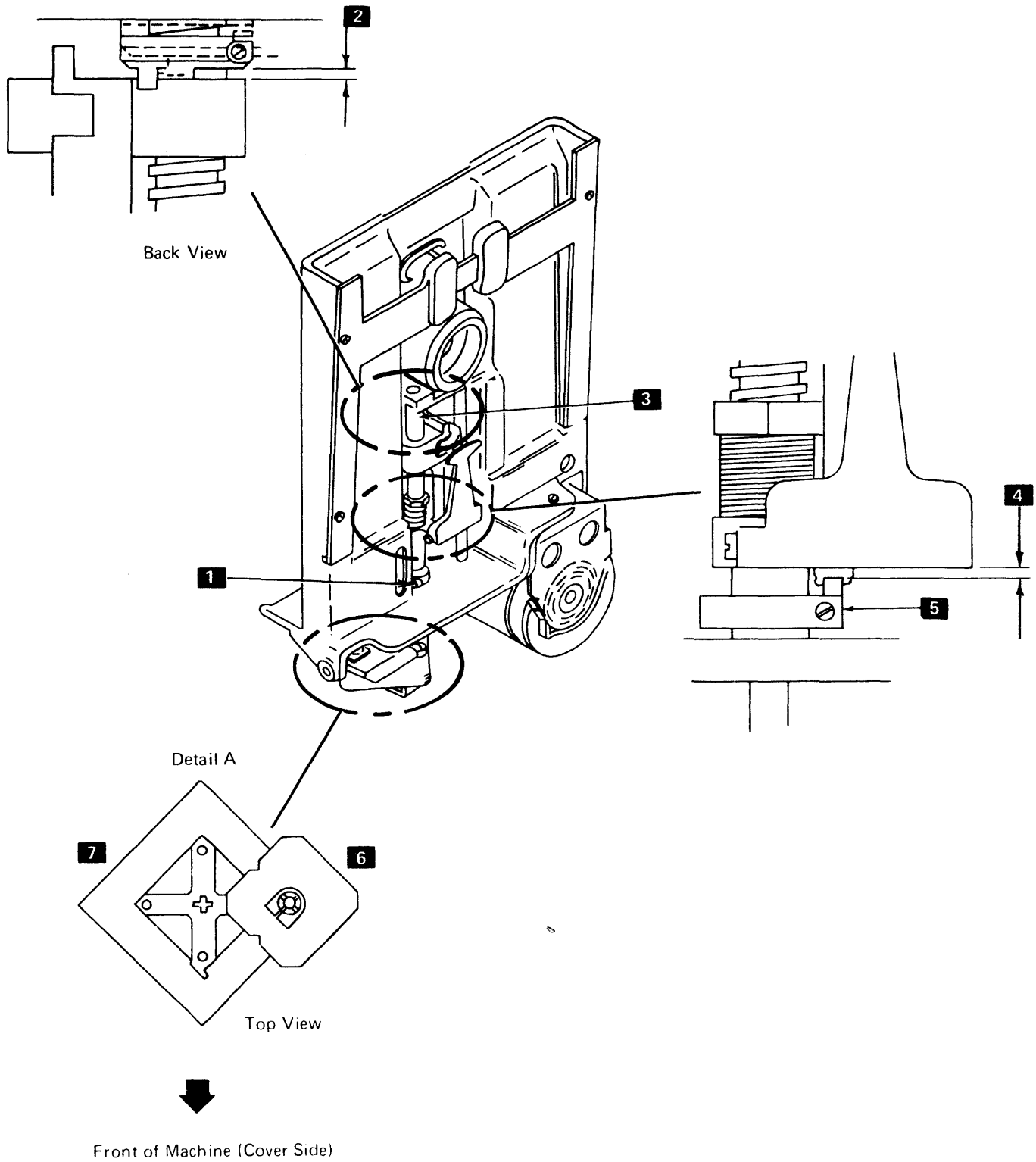
## 1.42 STEPPER MOTOR REMOVAL AND REPLACEMENT

1.   Remove diskette drive assembly (1.20).
2.   Remove five leads from the connector (black, white, yellow, red, and blue).



- Black
- White
- Yellow
- Red
- Blue
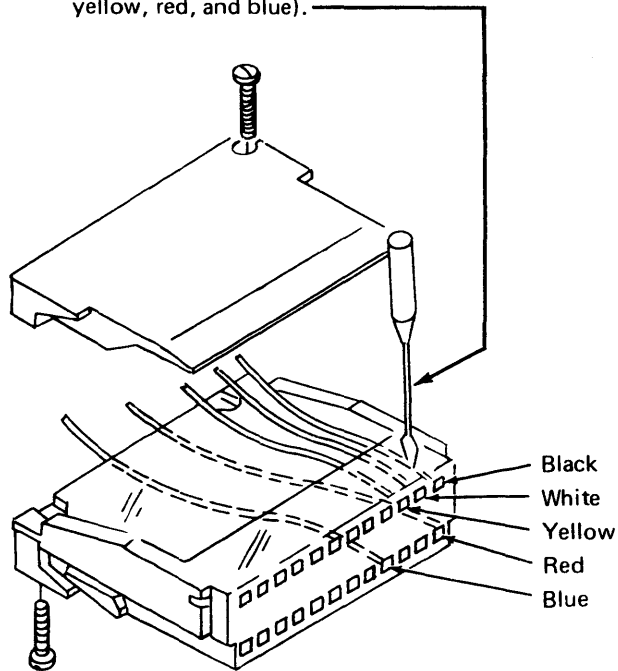
3.   Remove two screws **1** and remove motor.
4.   To replace stepper motor, reverse the above procedure and then adjust the stepper motor (1.43).

**CAUTION:  To avoid breaking parts when replacing the stepper motor, make sure that pins 5 of stepper motor wheel 4 are in slots of leadscrew wheel 3.**

**Make sure that the locking tabs on the terminals engage in the connector slot to prevent the leads from pushing out when plugged in.**
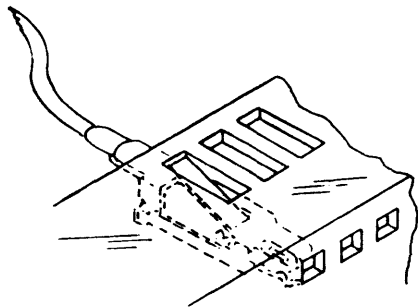


## 1.43 STEPPER MOTOR ADJUSTMENT

1.   Remove diskette drive assembly (1.20).
2.   Loosen two screws **1** .
3.   Move stepper motor away from leadscrew.
4.   Loosen clamping screw **2** and move leadscrew wheel **3** up so that it rotates freely.
5.   Position leadscrew wheel as shown in Detail A.
6.   Pull leadscrew wheel **3** down until pins **5** on stepper motor drive wheel **4** fit into notches on lead-screw wheel.  See Detail A.
7.   Slide stepper motor toward leadscrew until pins contact notches.  No clearance is allowable.  Do not force stepper motor into leadscrew wheel.
8.   Tighten two stepper motor mounting screws **1** .
9.   Move leadscrew wheel up until it rotates freely.
10.  Rotate leadscrew wheel and slide down on drive pins in the position shown in Detail B.
11.  Adjust head (1.36).

**EC 745948**

CAUTION: Before
replacing cover screws,
position actuator **39**
bail under pressure
pad arm. **40**

**39**

**40**

Detail A

**5**

**3**

**4**
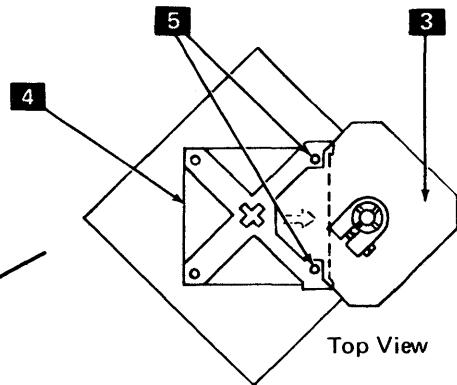
Top View

Front of Machine (Cover Side)

Detail B

Note location of
notches and tabs

**4**

**3**

Top View

Front of Machine (Cover Side)

**2**

**3**

**1**
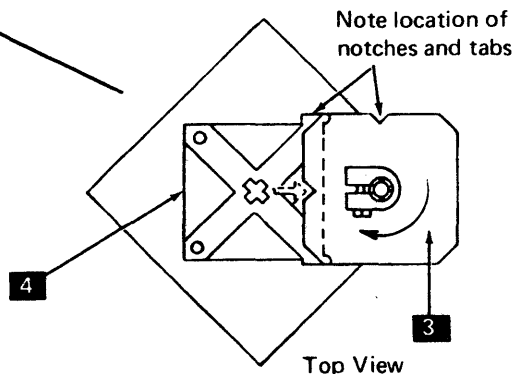
## 1.44 PHOTOTRANSISTOR SERVICE CHECK

**Note:** *Always perform the following procedure with the diskette loaded; otherwise ambient light will be present, causing a faulty reading on the VOM.*

1. Unplug motor connector.
2. Attach positive probe of VOM (15V dc scale) to +5V dc test point on diskette drive control card (1.51).
3. Attach negative probe to "Phototransistor Current" test point on diskette drive control card (1.51).
4. Insert diskette and close cover.
5. With head unloaded, rotate hub until index hole causes phototransistor to switch on or off. (Rotating the hub back and forth causes a continuous switching in the transistor.)
6. A shift in excess of 3.5V dc should be noted on VOM under normal circumstances.
7. If scope is available, plug motor connector in and test for index pulse width of 1.7 to 8.0 ms.





500 usec/cm
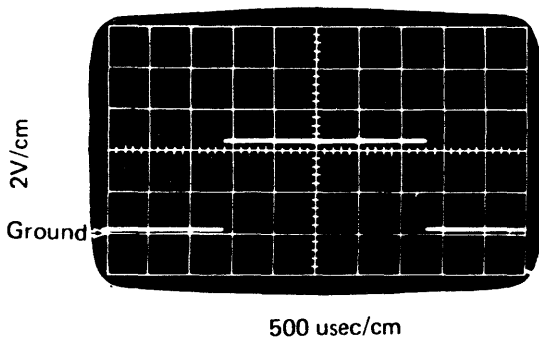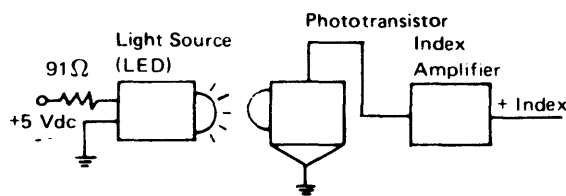
## 1.45 PHOTOTRANSISTOR ADJUSTMENT

1. Access to track 0.
2. Remove diskette drive assembly (1.20).
3. Remove diskette drive assembly cover (1.22).
4. Loosen mounting screw **3**, and move phototransistor **2** to left.
5. Install CE tool **1** as shown below.



Install CE tool by screwing thumbscrew into drive hub.

Rotate CE tool so it contacts this surface.
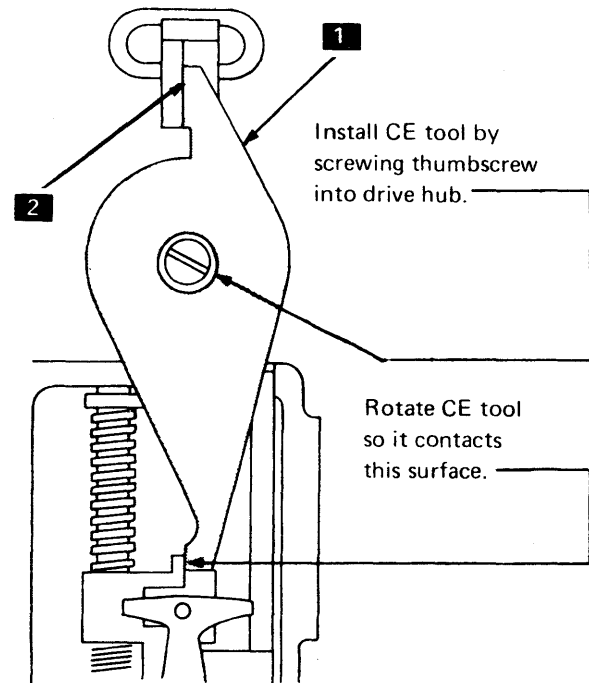
6. Adjust phototransistor **2** so that raised edge is in contact with tool.
7. Tighten mounting screw **3**.
8. Remove CE tool.
9. Replace diskette drive assembly cover (1.22).

## 1.46 PHOTOTRANSISTOR REMOVAL AND REPLACEMENT

1. Access to track 0.
2. Remove diskette drive assembly (1.20).
3. If necessary, remove diskette drive assembly cover (1.22).
4. Remove mounting screw **3** and washer.
5. Remove leads from phototransistor assembly.
6. Connect leads to the replacement phototransistor. (Yellow wire goes to terminal marked Y.)
7. Adjust starting at step 5 of 1.45.

CAUTION: Before
replacing cover screws,
position actuator **39**
bail under pressure
pad arm. **40**
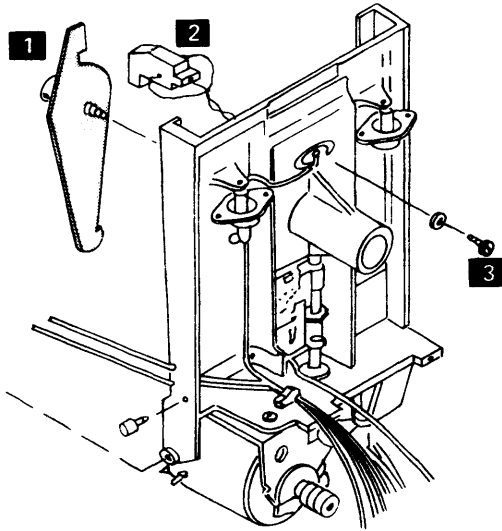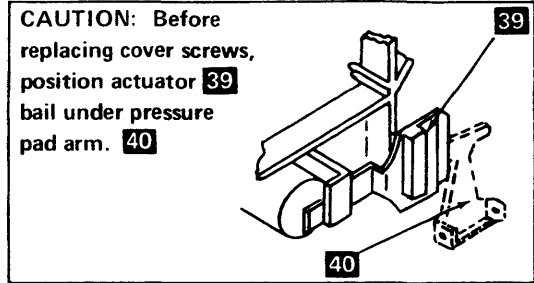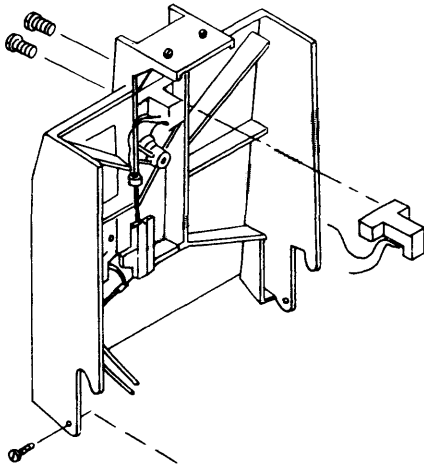
## 1.47  LIGHT EMITTING DIODE (LED) SERVICE CHECK

1.   Attach positive probe of VOM to "LED Current" test point on diskette drive control card (1.51) and attach negative lead to ground test point.
2.   Voltage should be +1.0V dc to +1.6V dc.

## 1.48  LED REMOVAL AND REPLACEMENT

1.   Remove diskette drive assembly (1.20).
2.   Remove diskette drive assembly cover (1.22).
3.   Remove two mounting screws **1** .
4.   Remove leads from LED assembly **2** .
5.   To replace, reverse the above procedure. (Yellow wire goes to terminal marked Y.)
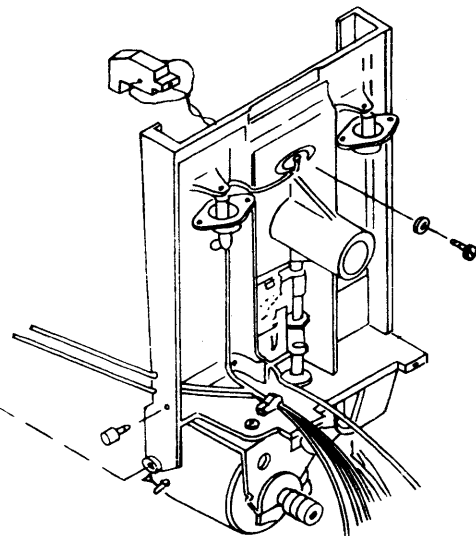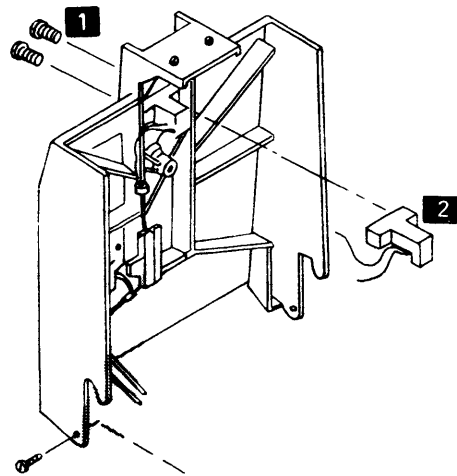


CAUTION: Before replacing cover screws, position actuator **39** bail under pressure pad arm. **40**
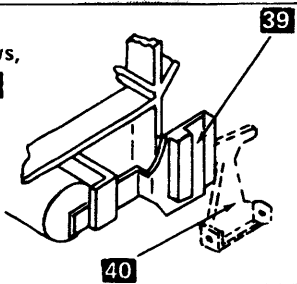
## 1.49 DISKETTE DRIVE CONTROL CARD PIN ASSIGNMENT

| Name | Color | FC Card | FC Cable End |
|---|---|---|---|
| Stepper Motor MC-0 (Phase 0) | White | B03 | D03 |
| Stepper Motor MC-1 (Phase 1) | Red | D02 | B02 |
| Stepper Motor MC-2 (Phase 2) | Yellow | B04 | D04 |
| Stepper Motor MC-3 (Phase 3) | Black | B02 | D02 |
| Stepper Common +24V dc | Blue | D05 | B05 |
| Head Magnet +24V dc | Yellow | D04 | B04 |
| – Head Load | Black | B05 | D05 |
| LED Return | Black | D06 | B06 |
| LED Current | Yellow | D07 | B07 |
| Phototransistor Return | Black | D09 | B09 |
| Phototransistor Current | Yellow | B08 | D08 |
| Head Input | Black | B12 | D12 |
| Head Input | White | B13 | D13 |
| Erase Current | Red | B10 | D10 |
| Head Ground and Shield | Green | B09 | D09 |
| Preamp TP1 | | D12 | B12 |
| Preamp TP2 | | D13 | B13 |
| Ground | Black | D08 | B08 |

Diskette Drive Cable

Cable to basic control board. See Figure 3-3.

Diskette Drive Control Card/Cable Socket, Card Side
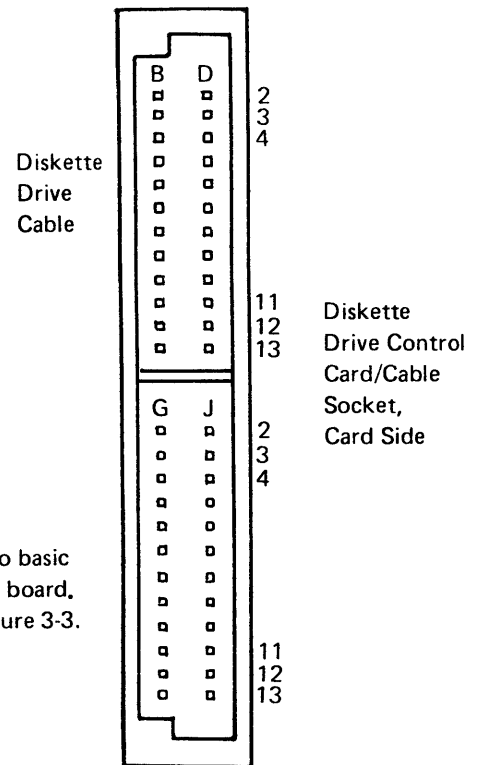
| Name | | FC Card | FC Cable End | 01A1Z Cable End | 3601-2/3 Basic Ctrl Bd | 3601-C Basic Ctrl Bd | 01A1 TB1 |
|---|---|---|---|---|---|---|---|
| +Access 0 | | G02 | D02 | D02 | H6A04 | D6E04 | |
| +Access 1 | | G03 | D03 | D03 | H6B04 | E6A04 | |
| +Access 2 | | G04 | D04 | D04 | H6C04 | E6B04 | |
| +Access 3 | | G05 | D05 | D05 | H6D04 | E6C04 | |
| +Diskette Data | | G07 | D07 | D07 | J6A04 | E6E04 | |
| +Head Engage | | G10 | D10 | D10 | J6D04 | F6C04 | |
| +Write Data | | J02 | B02 | B02 | H6A02 | D6E02 | |
| +Erase Gate | | J04 | B04 | B04 | H6C02 | E6B02 | |
| +Write Gate | | J05 | B05 | B05 | H6D02 | E6C02 | |
| +Low Current | | J06 | B06 | B06 | H6E02 | E6D02 | |
| +Index | | G13 | D13 | D13 | K6B04 | K6B04 | |
| +24V dc | | J10 | B10 | B10 | J6D02 | G6A04 | |
| +5V dc* | | J03 | B03 | | | | TB1-1 |
| –5V dc* | | J11 | B11 | | | | TB1-4 |
| Ground | | J08 | B08 | B08 | J6B02 | F6C02 | TB1-10 |

*Note: This cable wire is not point to point.

## 1.50 DISKETTE DRIVE CONTROL CARD REMOVAL AND REPLACEMENT

The diskette drive control card is positioned with the components and test pins facing out. The card does not have to be moved for servicing.

1.   Turn off power.
2.   Loosen screw and turn bracket 90°.
     Tighten screw.
3.   Remove card.
4.   To replace, reverse above procedure. Be sure card is properly seated in socket and retaining bracket.
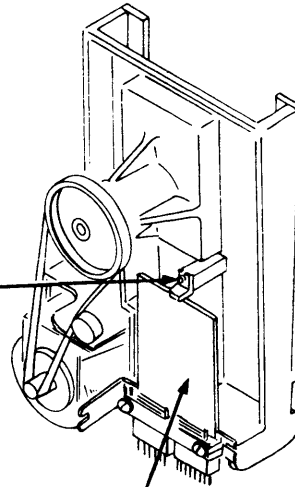
## 1.51 DISKETTE DRIVE CONTROL CARD TEST POINTS

### 2 X 3 Card Test Points

**Note:** *2 X 2 card test points are on the following page.*

(Only the major components are shown as an aid in locating pins.)

Diskette Drive
Control Card

PN 8524194

- Head Load
+24V dc
Preamp TP2
+ Write Gate
+ Low Current
+ Head Engage
+ Write Data
+ Index
Phototransistor Current (Yellow)
+ Access 1
+ Access 3
Preamp TP1
-5V dc
+ Access 2
+ Diskette Data

Erase Current

+5V dc

MC-1
MC-2
MC-3
MC-0

Ground
LED Current
+ Access 0

Cable to Basic Controller Board

Diskette Drive Cable

EC 745948
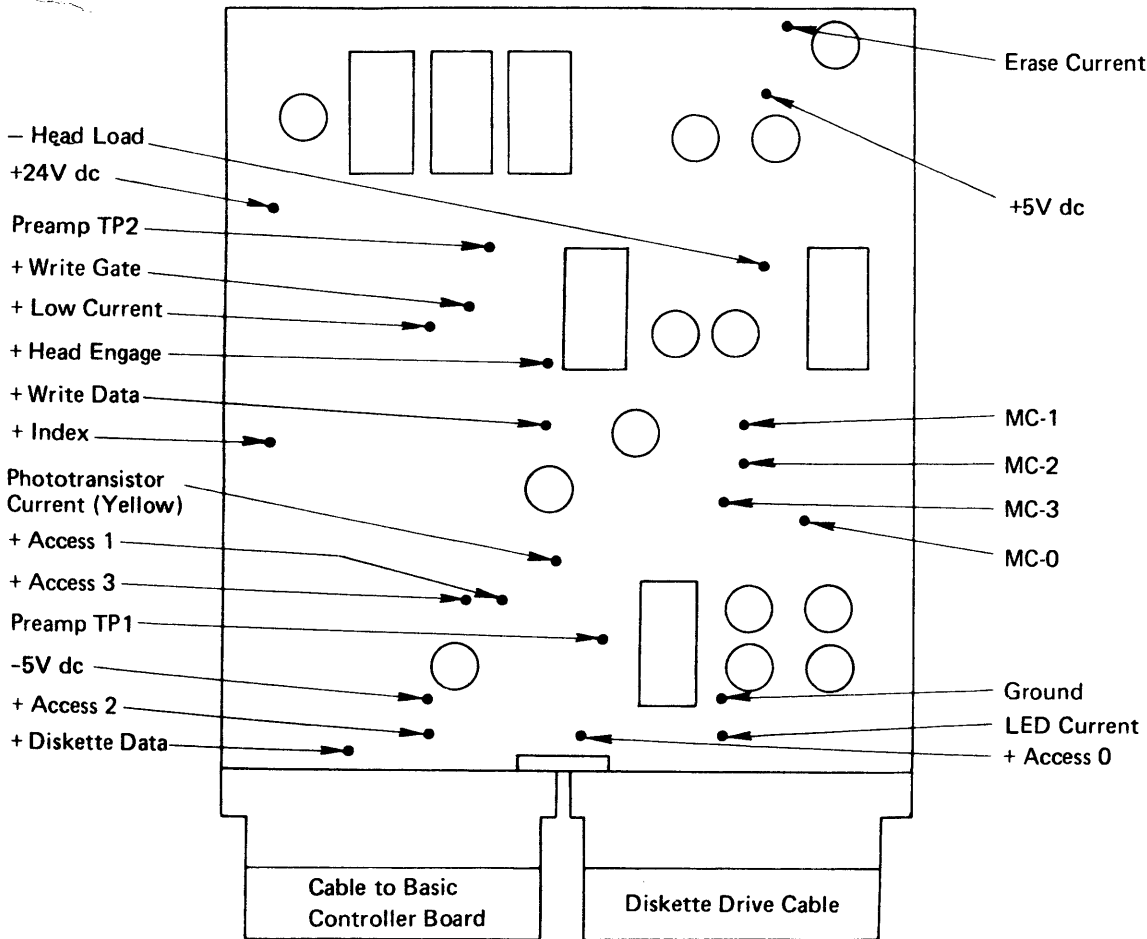
## 1.51 (Cont)

### 2 X 2 Card Test Points

**Note:** *If you experience the problem of no index pulse or multiple index pulses because of shine-through, raise the threshold level of the index amplifier by moving the jumper to position 1. You can raise the threshold level again by moving the jumper to position 2. With the jumper in the high threshold position, more LED light is required to switch the PTX amplifier than when the jumper is in the medium or low threshold positions. Do not increase the threshold level more than necessary to ensure proper operation.*

### 1.52—1.59  NOT USED



Cable to Basic Control Board

File Cable

+ Index
-5V dc
+Head Engage
+24V dc
Ground
+File Data
+Low Current
+Access 3
+Write Gate
+Access 2
+Erase Gate
+Access 1
+Access 0
+Write Data
+5V dc
Preamp TP2
+18V dc
Preamp TP1
Phototransistor Current
Ground
LED Current
-Head Load
MC-2
MC-0
MC-3
MC-1

Position 1 (medium threshold)

Position 2 (high threshold)

Normal Position (low threshold)

PN 8528202

## 1.60 DISKETTE DRIVE ASSEMBLY REMOVAL AND REPLACEMENT

**3601**

1.  Turn off power.
2.  Remove the smaller front end cover by raising it from its pivot pins.
3.  Remove the side cover by raising up and tilting the top outwards.
4.  Remove the diskette drive control card access cover by removing one holding screw.
5.  Unplug the diskette drive motor connector.
6.  Unplug the cable from the diskette drive control card and remove the ground wire.
7.  Remove the holding screw from the diskette drive assembly base plate. The base plate is exposed by the front end cover removal (step 2).
8.  Loosen the Zeus* fastener on the inside top of the diskette drive assembly.
9.  Remove the diskette drive assembly by sliding it out from the front end of the controller.

Replace the diskette drive assembly by reversing the above procedure.**

**3602**

1.  Turn off power.
2.  Swing open the right front cover.
3.  Remove the right end cover by pulling out on the bottom and lifting off.
4.  Remove the holding screw from the front of the diskette drive bottom base plate.
5.  Loosen the two holding screws on the frame to the top rear of the assembly.
6.  Lift the assembly up and off the screws loosened in step 5.
7.  Tilt the assembly out the front.
8.  Disconnect the cables if required.

Replace the diskette drive assembly by reversing the above procedure.**

---

*Titan Tool Supply Co., Inc.

**Jumper assembly PN 4409828 for low voltage (100—123.5) or PN 4409829 for high voltage (200—240) may be required in order to use the latest style diskette drive motor.

## 1.61 LATCH ASSEMBLY REMOVAL AND REPLACEMENT

1. Open diskette drive cover **3** .
2. Remove the two latch mounting screws **2** .
3. Pull latch **1** away from cover.
4. To replace, reverse above procedure.

## 1.62 COVER ASSEMBLY REMOVAL AND REPLACEMENT

1. Turn off power.
2. Open diskette drive cover **3** .
3. Remove both pivot screws **11** while holding cover.
4. Remove cover.
5. To replace cover, reverse above procedure.

**Note:** *When replacing the cover be sure the two timing pins* **12** *have been returned to the special holder.*

**CAUTION: Allow power to remain off if removing the cover to start a diskette drive maintenance procedure. Do not turn on power unless a procedure instructs you to do so or is completed.**

## 1.63 COLLET REMOVAL AND REPLACEMENT

1. Remove diskette drive cover (1.62).
2. Remove mounting screw **13** .
3. Remove collet assembly **6** , spring **4** , two washers **10** and shim **9** .
4. Remove collet **8** by removing clip **7** .
5. To replace collet, reverse above procedure.
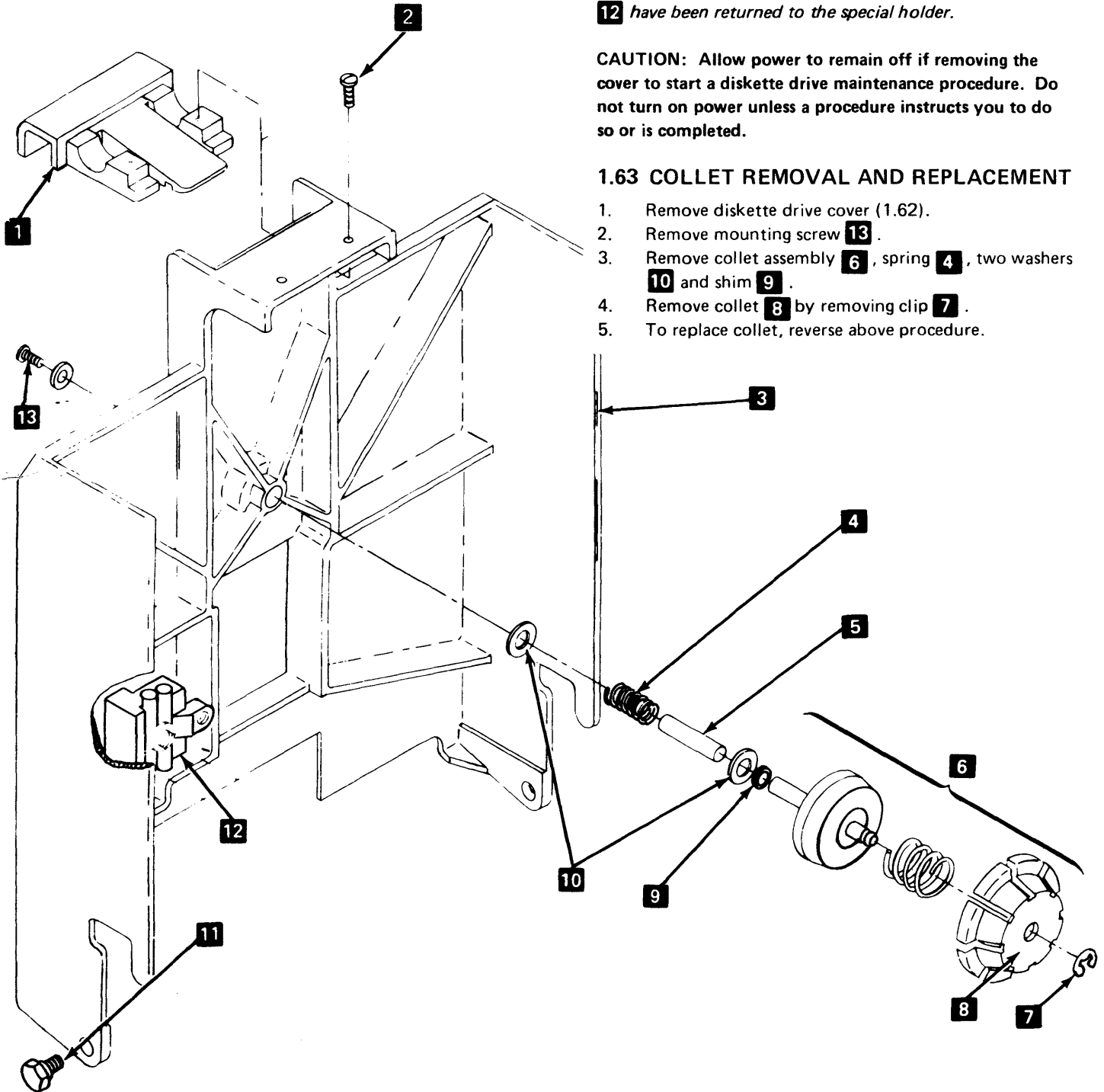
## 1.64 HEAD/CARRIAGE POSITION SERVICE CHECK AND ADJUSTMENT

CAUTION: The head/carriage assembly is a factory-adjusted and tested assembly. Do not try to adjust or repair this internal component. Do not, for any reason, clean the read/write heads. To do so would cause severe damage to the head surfaces or head spring supports.

**Service Check**

1. Remove diskette drive cover (1.62).
2. Remove cover/wiper assembly **4** .

CAUTION: The read/write heads must not be allowed to come together without a piece of clean paper inserted between the head surfaces.

3. Insert a piece of clean paper between the head surfaces.
4. Rotate stepper motor pulley by hand to track 40 and insert timing pin **6** (located inside cover assembly) through pulley **5** and into timing slot **7** in casting.
5. Turn on power.
6. Electrically detent stepper motor to phase 0 by installing a jumper between the "-Align Access" and "Ground" test points on diskette drive control card (1.94).

Note: *The timing pin should now pass freely through the stepper motor pulley and the timing slot in the casting. If it does not, remove the timing pin and jumper, power off, and adjust the head/carriage position, starting at step 4.*

7. Remove the timing pin and return it to its storage location inside cover assembly.
8. Remove jumper installed in step 6.
9. Rotate stepper motor pulley clockwise, by hand, one detent position.

Note: *This moves the head/carriage assembly approximately 0.020 in (0.508 mm). Verify by looking for no gap between timing pointer* **1** *on carriage and timing block* **2** *on casting.*

10. Replace jumper between the "-Align Access" and "Ground" test points on diskette drive control card (1.94).
11. Verify 0.020-in. (0.508 mm) gap **3** between timing pointer **1** on carriage and timing block **2** on casting by looking for no motion of head/carriage assembly when a 0.0195-in. (0.495 mm) feeler gauge is inserted. Check for motion of head/carriage assembly when inserting a 0.021-in. (0.533 mm) feeler gauge.

Note: *If there is motion with a 0.0195-in. (0.495 mm) gauge inserted, or no motion with a 0.021-in. (0.533 mm) gauge inserted, the head/carriage assembly requires adjustment. Adjust head/carriage position starting at step 10*

12. If for some reason verification in step 11 is not positive, repeat steps 8 through 11. (Accuracy of this verification requires that the stepper motor be electrically detented from a point at least one detent away from track 40.)
13. If verification in step 11 is good, remove jumper installed in step 10.
14. Remove paper from between head surfaces.
15. Replace cover/wiper assembly.
16. Replace diskette drive cover (1.62).

Factory
adjustment
only

Head/Carriage Assembly
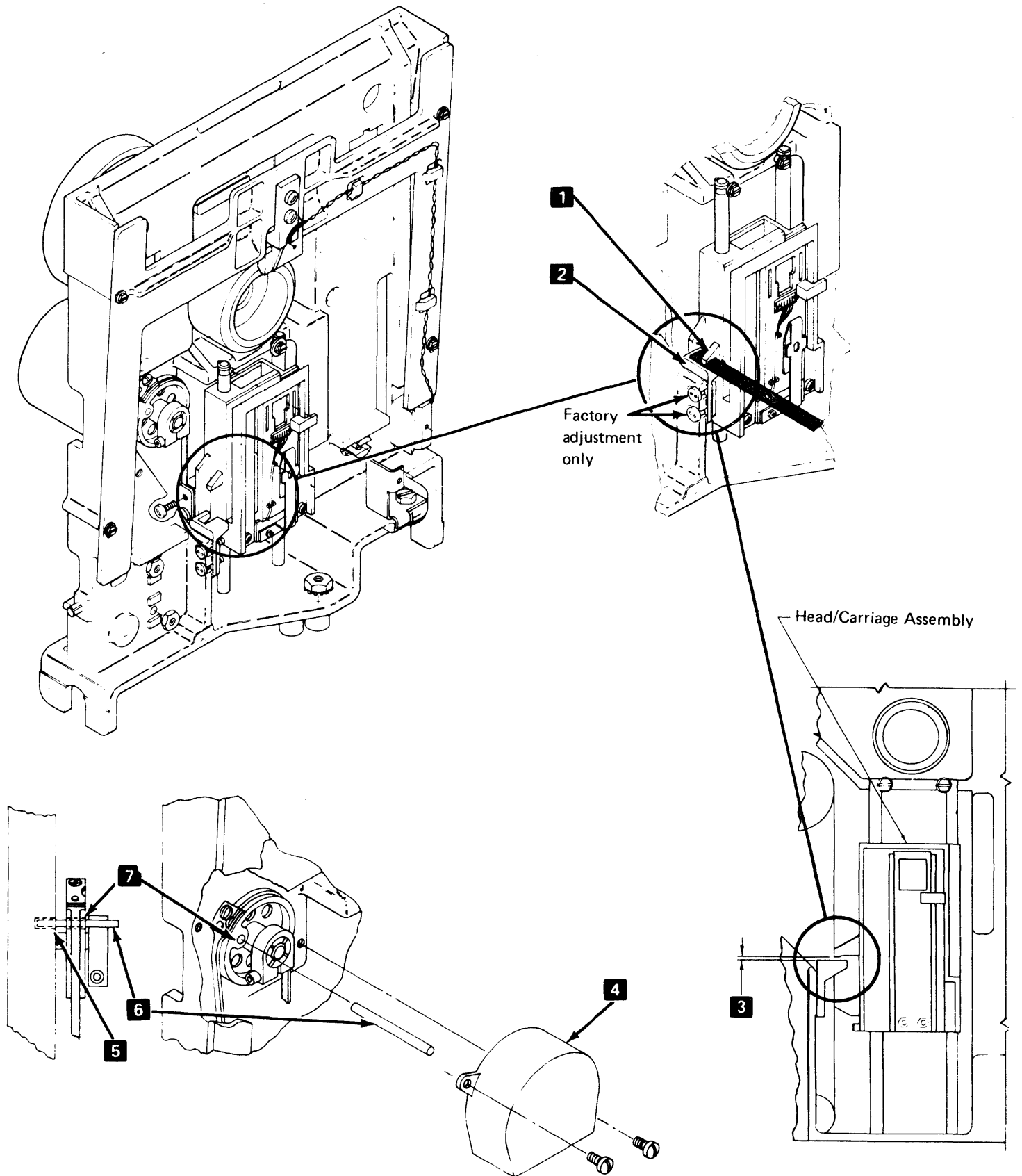
## 1.64 HEAD/CARRIAGE POSITION SERVICE CHECK AND ADJUSTMENT (Cont)

CAUTION: The head/carriage assembly is a factory-adjusted and tested assembly. Do not try to adjust or repair this internal component. Do not, for any reason, clean the read/write heads. To do so would cause severe damage to the head surfaces or head spring supports.

**Adjustment**

1. Remove diskette drive cover (1.62).
2. Remove cover/wiper assembly **4** .

CAUTION: The read/write heads must not be allowed to come together without a piece of paper inserted between the head surfaces.

3. Insert a piece of clean paper between head surfaces.
4. Measure and record gap between stepper motor pulley and casting **10** .

```
Gap is:
```

5. Loosen clamp screw **7** .

Note: *The stepper motor shaft should be free to rotate inside the stepper motor pulley.*

6. Rotate stepper motor pulley by hand to track 40 and insert timing pin **6** (located inside cover assembly) through pulley **9** and into timing slot **5** in casting.
7. Turn on power.
8. Electrically detent stepper motor to phase 0 by installing a jumper between the "-Align Access" and "Ground" test points on diskette drive control card (1.94).

CAUTION: Do not push clamp **8** against pulley **9** when tightening clamp screw **7** . Clamp must be positioned near the end of the pulley flanges for effective clamping.

9. Make the gap **10** recorded in step 4 and tighten pulley clamp screw **7** .

Note: *The timing pin should now pass freely through the stepper motor pulley and the timing slot in the casting.*

10. Remove the timing pin and return it to its storage location inside the cover assembly.
11. Loosen two band clamping screws **1** on head/carriage assembly.
12. Remove jumper installed in step 8.
13. Rotate stepper motor pulley clockwise, by hand, one detent position.

Note: *This moves the head/carriage assembly approximately 0.020 in. (0.508 mm); verify by visually checking for no gap between timing pointer **2** and carriage and timing block **3** on casting.*

14. Replace jumper between the "-Align Access" and "Ground" test points on diskette drive control card (1.94).

Note: *Verify that head/carriage assembly moved to track 40 by visually checking that timing hole in pulley lines up with timing slot in casting (do not use timing pin).*

15. Insert 0.020-in. (0.508 mm) feeler gauge between timing pointer **2** on carriage and timing block **3** on casting.

Note: *Apply light pressure to top of carriage to hold gauge in place.*

16. With light pressure still applied to top of carriage, tighten band clamping screws **1** .
17. Remove jumper installed in step 14.
18. Rotate stepper motor pulley clockwise, by hand, one detent position.
19. Replace jumper between the "-Align Access" and "Ground" test points on diskette drive control card (1.94) and verify alignment of timing holes at track 40.
20. Verify 0.020-in. (0.508 mm) gap between timing pointer and timing block by visually checking for no motion of head/carriage assembly when a 0.0195-in. (0.495 mm) feeler gauge in inserted. Check for motion of head/carriage assembly when inserting a 0.021-in. (0.533 mm) feeler gauge.

Note: *If there is notion with a 0.0195-in. (0.495 mm) gauge inserted, or no motion with a 0.021-in. (0.533 mm) gauge inserted, repeat steps 11 through 20.*

21. If adjustment is good, remove jumper installed in step 19.
22. Remove paper from between head surfaces.
23. Replace cover/wiper assembly **4** .
24. Replace diskette drive cover (1.62).



EC 745948

Factory
adjustment
only
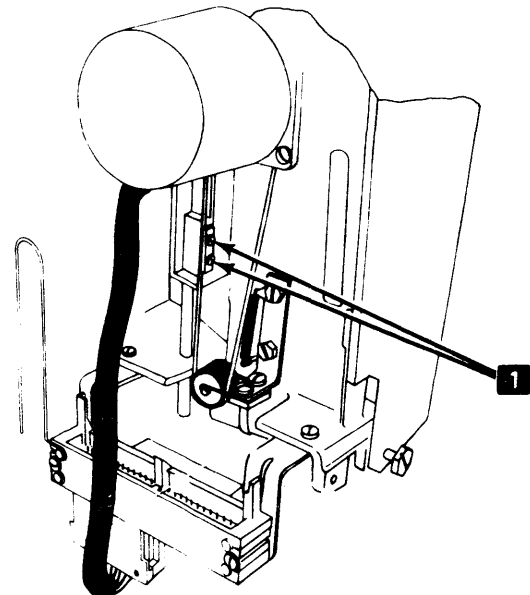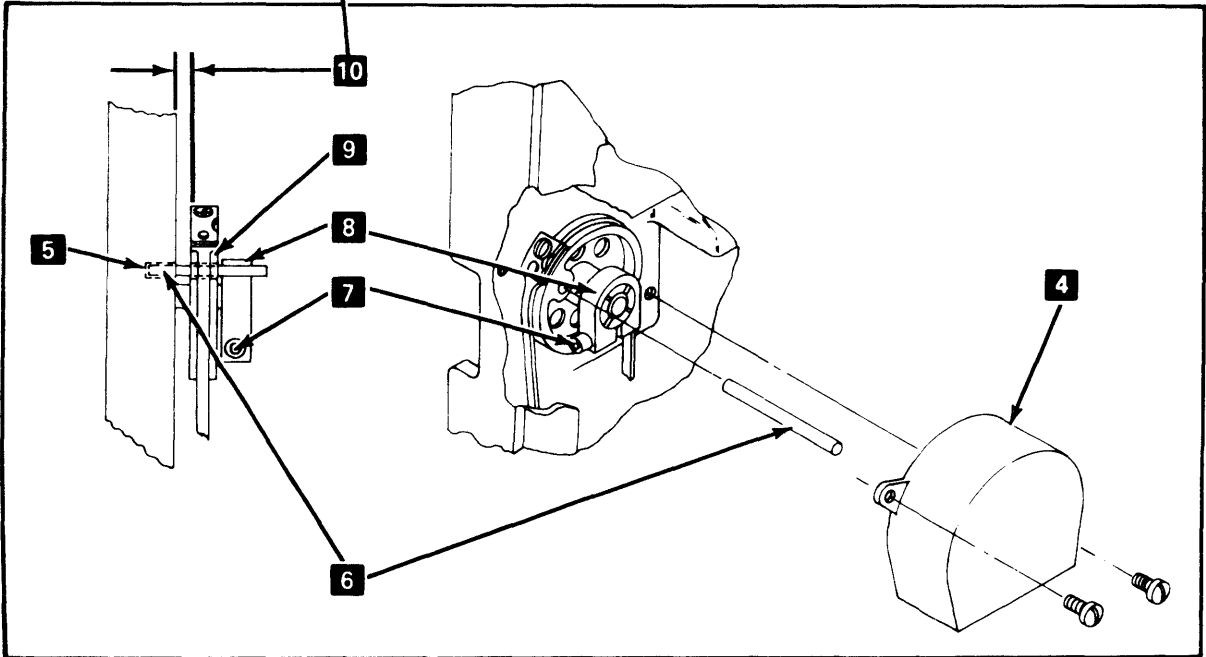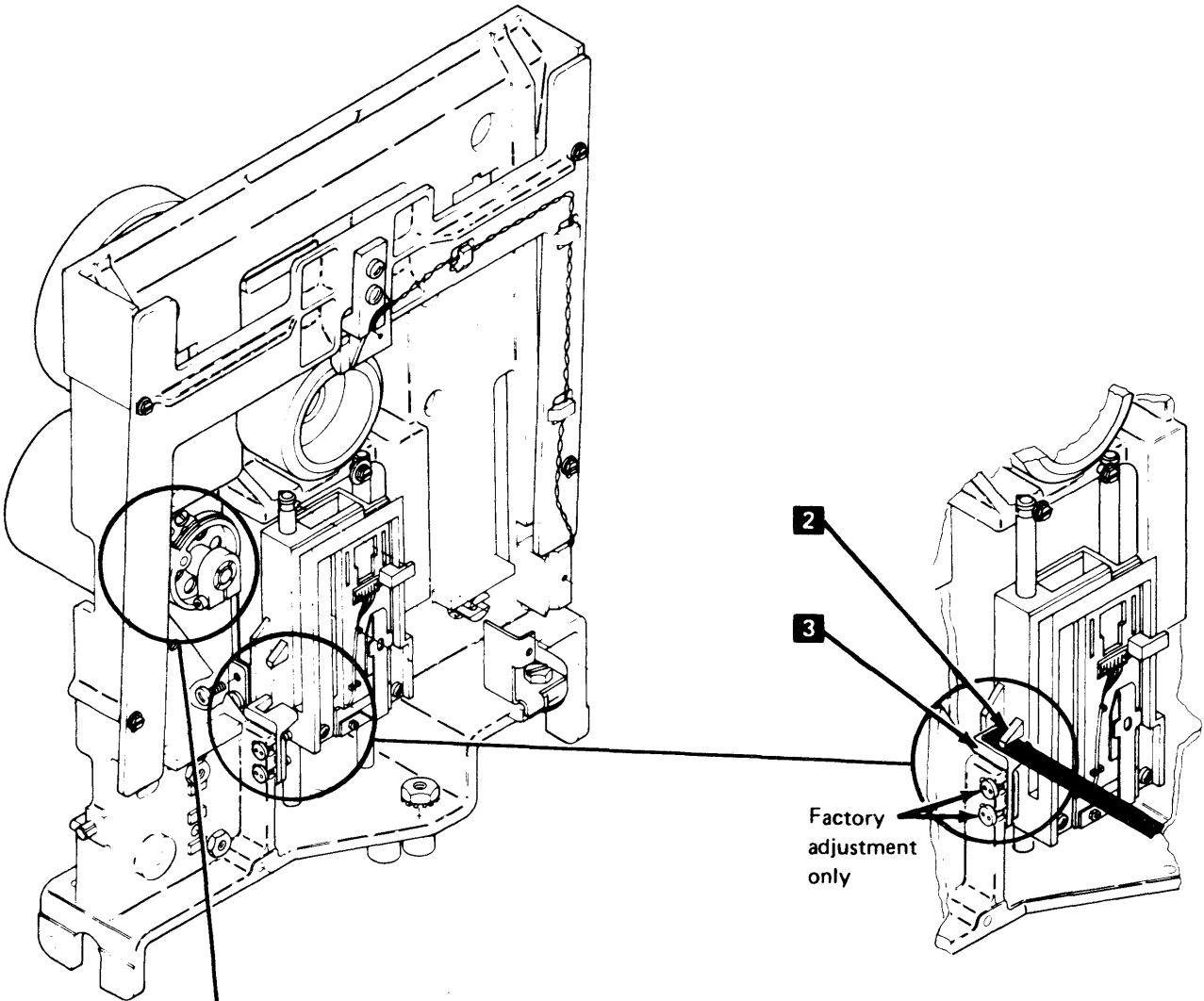
## 1.65 HEAD/CARRIAGE ASSEMBLY REMOVAL

1. Remove diskette drive cover (1.62).
2. With power off, remove cover/wiper assembly **7** .
3. Remove head cable from diskette drive control card.

CAUTION: The read/write heads must not be allowed to come together without a piece of clean paper inserted between the head surfaces.

Note: *When removing cable assemblies, observe the original routing for replacement purposes.*

4. Remove card retainer and diskette drive control card.
5. Position head/carriage assembly to approximately track 40.
6. Remove two band clamping screws **2** and clamp **1** . Carefully place head/carriage assembly at its lower limit (track 0).
7. Remove screw **12** , nylon washer **14** , and guide rod **13** .
8. Carefully lift and pivot head/carriage assembly to remove it from guide rod **4** .
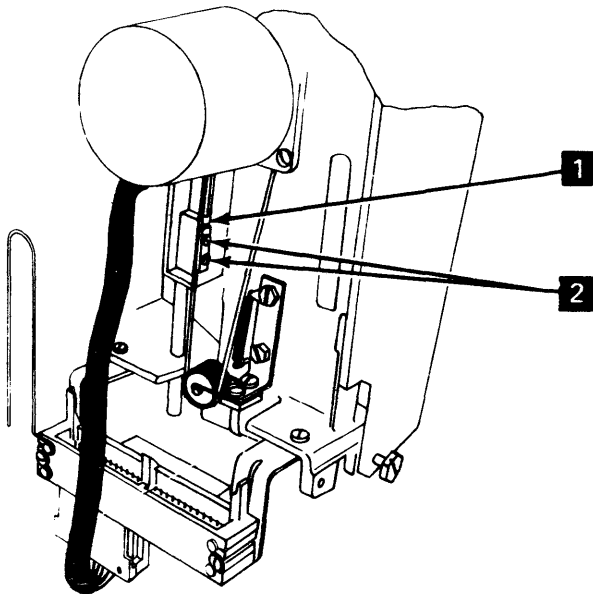


## 1.66 HEAD/CARRIAGE ASSEMBLY REPLACEMENT

CAUTION: When installing the head/carriage assembly, make sure bail assembly **5** is under tab **6** of the carriage arm with bail return spring **11** properly installed.

CAUTION: The read/write heads must not be allowed to come together without a piece of clean paper inserted between the head surfaces.

1. Insert a piece of clean paper between the head surfaces.
2. Carefully install head/carriage assembly on guide rod **4** and place it at its lower limit.
3. Replace guide rod **13** , nylon washer **14** , and screw **12** .

Note: *Ensure guide rod notch **15** is aligned with screw **12** and is properly seated in groove **3** .*

4. Position head/carriage assembly to approximately track 40.
5. Replace clamp **1** and two band clamping screws **2** , but do not tighten.
6. Replace diskette drive control card and card retainer.
7. Following original routing, carefully replace head cable onto diskette drive control card.
8. Rotate stepper motor pulley by hand to track 40 and insert timing pin **9** (located inside cover assembly) through pulley **10** and into timing slot **8** in casting.
9. Turn on power.
10. Electrically detent stepper motor to phase 0 by installing a jumper between the "−Align Access" and "Ground" test points on diskette drive control card (1.94).
11. The timing pin should pass freely through the stepper motor pulley and the timing slot in the casting. If it does, adjust the head/carriage position (1.64), starting at step 11. If it does not, remove the timing pin and adjust the head/carriage position (1.64), starting at step 4.
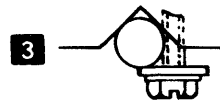


Properly Seated　　　　　Improperly Seated
Guide Rod　　　　　　　　Guide Rod

EC 745948

Solenoid

Diskette

Solenoid
Locking Screw

R/W Heads

Carriage Assembly

Front Cover

Bail Assembly

Backstop Screw
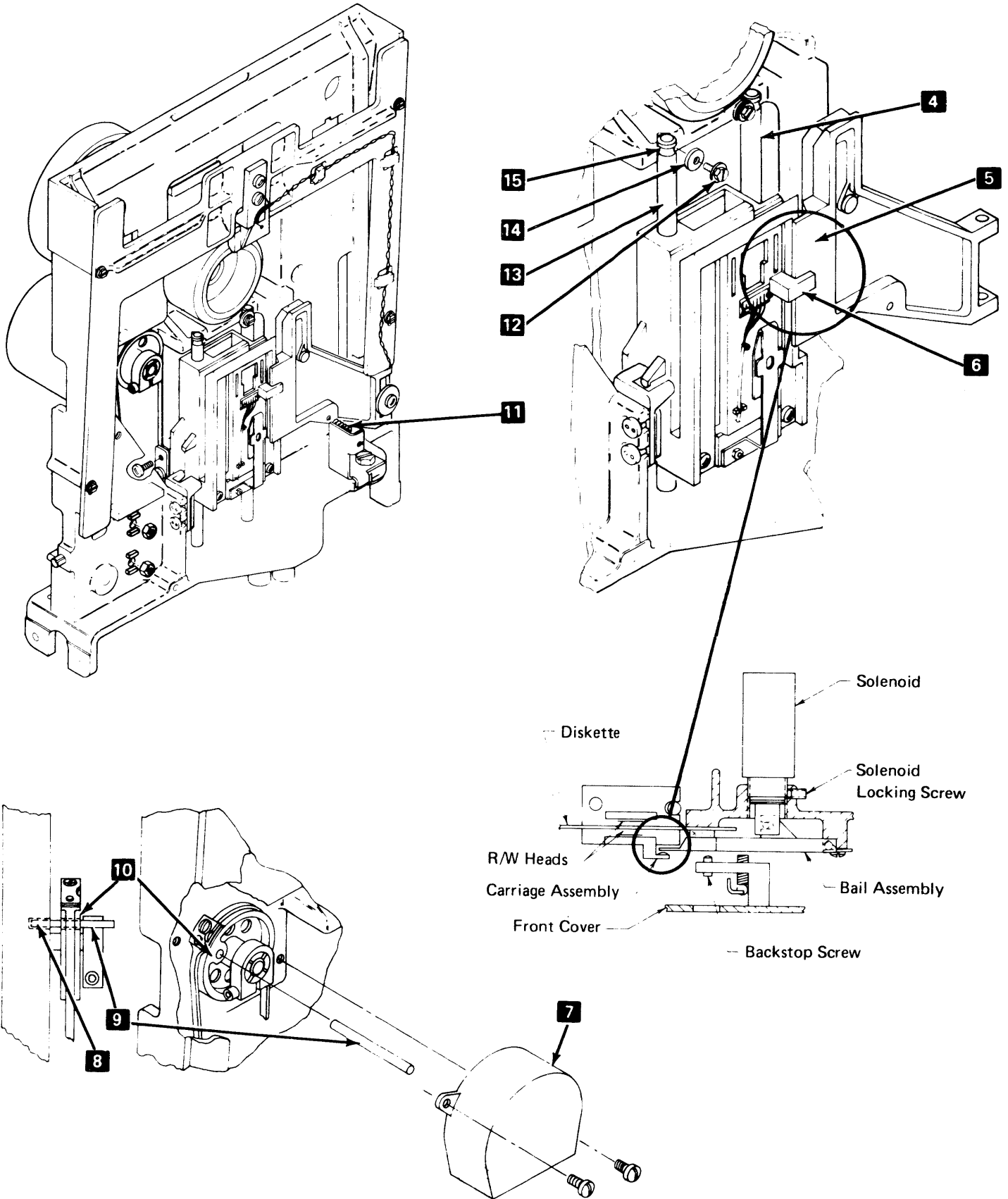
## 1.67  HEAD LOAD SOLENOID/BAIL ASSEMBLY
SERVICE CHECK AND ADJUSTMENT

**Service Check**

1.   Turn off power.
2.   Disconnect drive motor power cable from socket **3**.
3.   Remove diskette drive cover (1.62).

**DANGER:**
**Voltage is still present at socket with the drive motor**
**power cable disconnected and power on.**

4.   Turn on power.

**CAUTION:  The read/write heads must not be allowed to**
**come together without a piece of clean paper inserted**
**between the head surfaces.**

5.   Insert a piece of clean paper between the head sur-
     faces.
6.   Energize the head load solenoid by installing a jum-
     per between the "—Head Load" and "Ground" test
     points on diskette drive control card (1.94).
7.   Verify gap **5** of 0.015 ± 0.005 in. (0.381 ± 0.127mm)
     between bail **1** and carriage arm **2** throughout
     carriage travel.
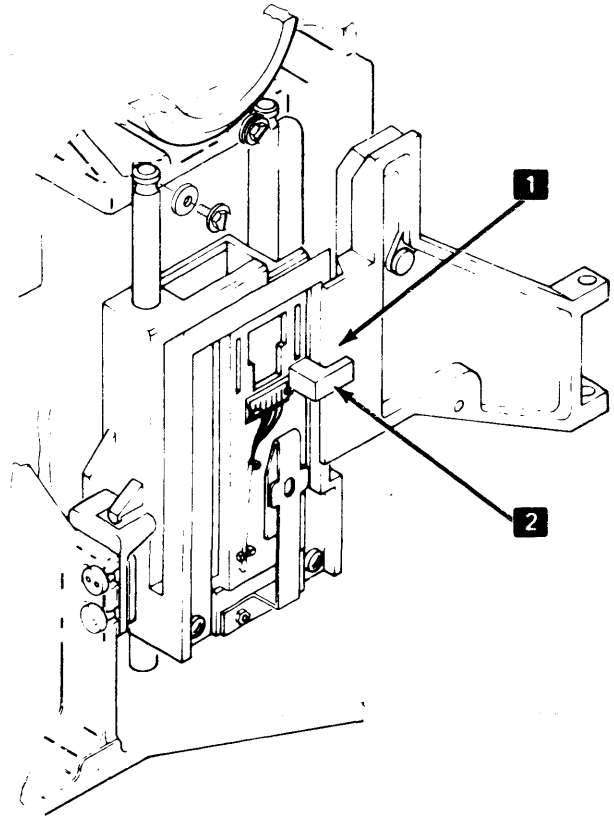
**Note:** *If the gap is not within tolerance, adjust solenoid/bail*
*assembly, starting at step 7.*

8.   Remove jumper installed in step 6.
9.   Remove paper from between head surfaces.
10.  Replace diskette drive cover (1.62).
11.  With head load solenoid deenergized and cover closed,
     look for gap **4** of 0.93 to 0.108 in. (2.3 to 2.7 mm)
     between head surfaces.

**Note:** *This gap cannot be measured and must be estimated.*

12.  If the gap checked for in step 11 is not within toler-
     ance, adjust the head load solenoid (1.67), starting at
     step 14.
13.  Turn off power.
14.  Connect the drive motor power cable to socket **3**.
15.  Turn on power.

Solenoid

Carriage Assembly

Piece of clean paper

Plunger

Solenoid

R/W Heads

Bail Assembly

Carriage Tab

**5** 0.4 ± 0.13 mm

Carriage Assembly

**4**

R/W Heads

Plunger

Carriage Tab

Bail Assembly

Backstop Screw
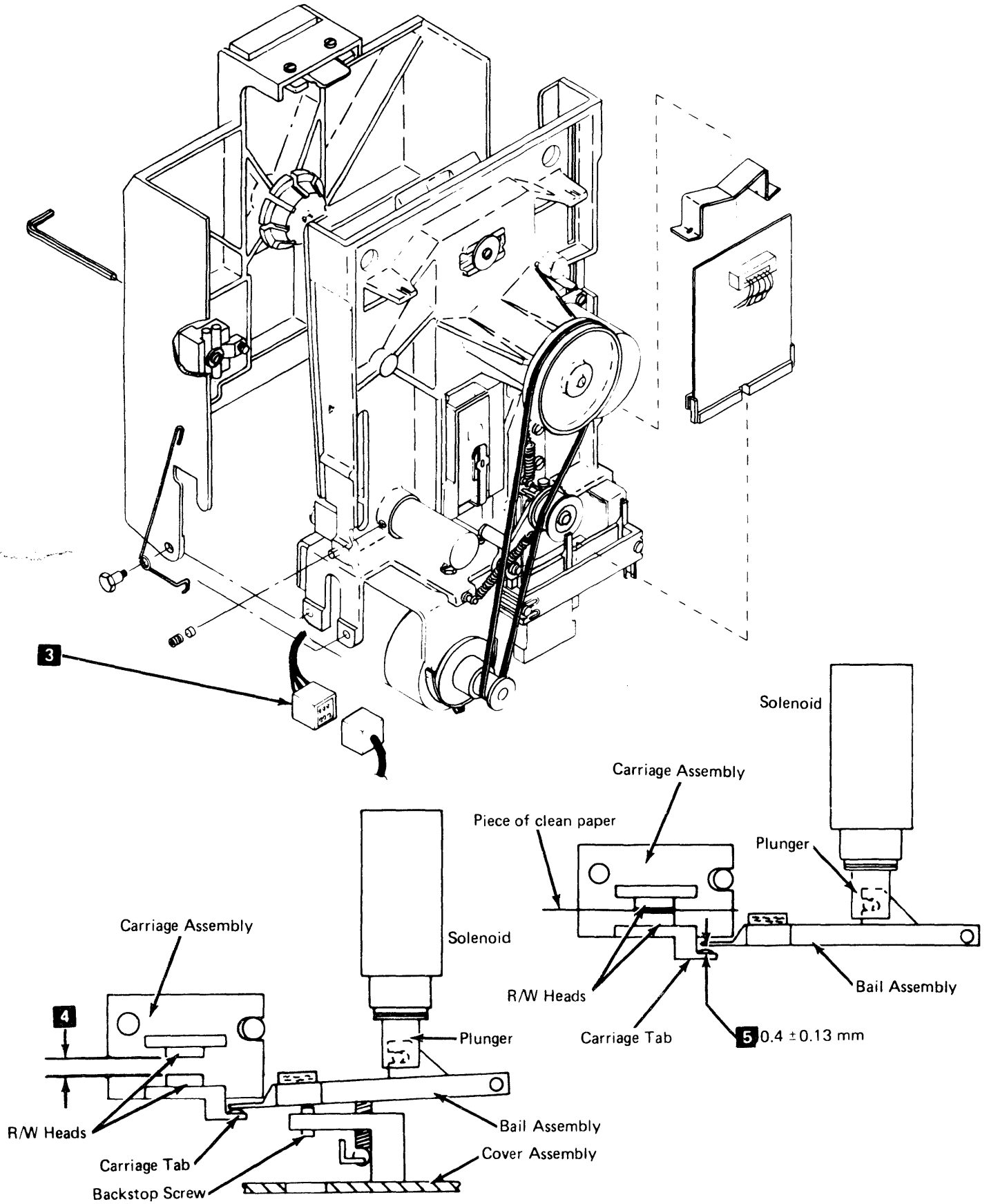
Cover Assembly

## 1.67 HEAD LOAD SOLENOID/BAIL ASSEMBLY SERVICE CHECK AND ADJUSTMENT (Cont)

**Adjustment**

1. Turn off power.
2. Disconnect the drive motor power cable from socket **7**.
3. .Remove diskette drive cover (1.62).

> **DANGER**
> **Voltage is still present at socket with the drive motor power cable disconnected and power on.**

4. Turn on power.

**CAUTION: The read/write heads must not be allowed to come together without a piece of clean paper inserted between the head surfaces.**

5. Insert a piece of clean paper between the head surfaces.
6. Energize the head load solenoid by installing a jumper between the "—Head Load" and "Ground" test points on diskette drive control card (1.94).

> **DANGER**
> **Solenoid case can get hot.**

7. Remove the holding screw from the disk drive assembly base plate.
8. Loosen the Zeus fastener on the inside top of the diskette drive assembly.
9. Slide out the diskette drive assembly so that the solenoid locking screw is accessible **6**.
10. Loosen solenoid locking screw **6**.
11. Rotate solenoid **4** in casting for gap **9** of 0.015 ± 0.005 in. (0.381 ± 0.127mm) between bail **1** and carriage arm. **2**.

**Note:** *A clockwise rotation of the solenoid decreases the bail-to-carriage arm gap.*

12. Verify this gap throughout carriage travel.
13. With pellet **5** still in place, tighten solenoid locking screw **6**.
14. Replace the holding screw removed in step 7.
15. Tighten the Zeus fastener.
16. Remove jumper installed in step 6.
17. Remove paper from between head surfaces.
18. Replace diskette drive cover (1.62).

19. With head load solenoid deenergized and cover closed, look for gap **8** of 0.093 to 0.108 in. (2.3 to 2.7 mm) between head surfaces.

**Note:** *This gap cannot be measured and must be estimated. To obtain this gap, turn the backstop screw **3** clockwise until the heads just touch, then back open the heads by turning the backstop screw one turn counterclockwise.*

20. Turn off power.
21. Connect the drive motor power cable to socket **7**.
22. Turn on power.

**3**

**4**

**5**

**6**

**7**

Solenoid

Carriage Assembly

Plunger

Bail Assembly

Piece of clean paper

R/W Heads

Carriage Tab

**9**

Carriage Assembly

**8**

Solenoid

Plunger

R/W Heads

Carriage Tab

Backstop Screw

Bail Assembly
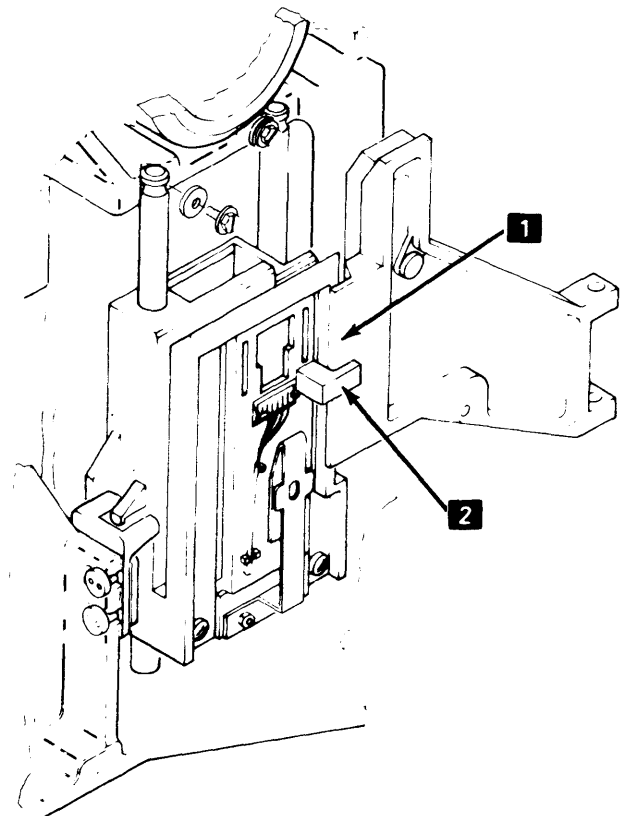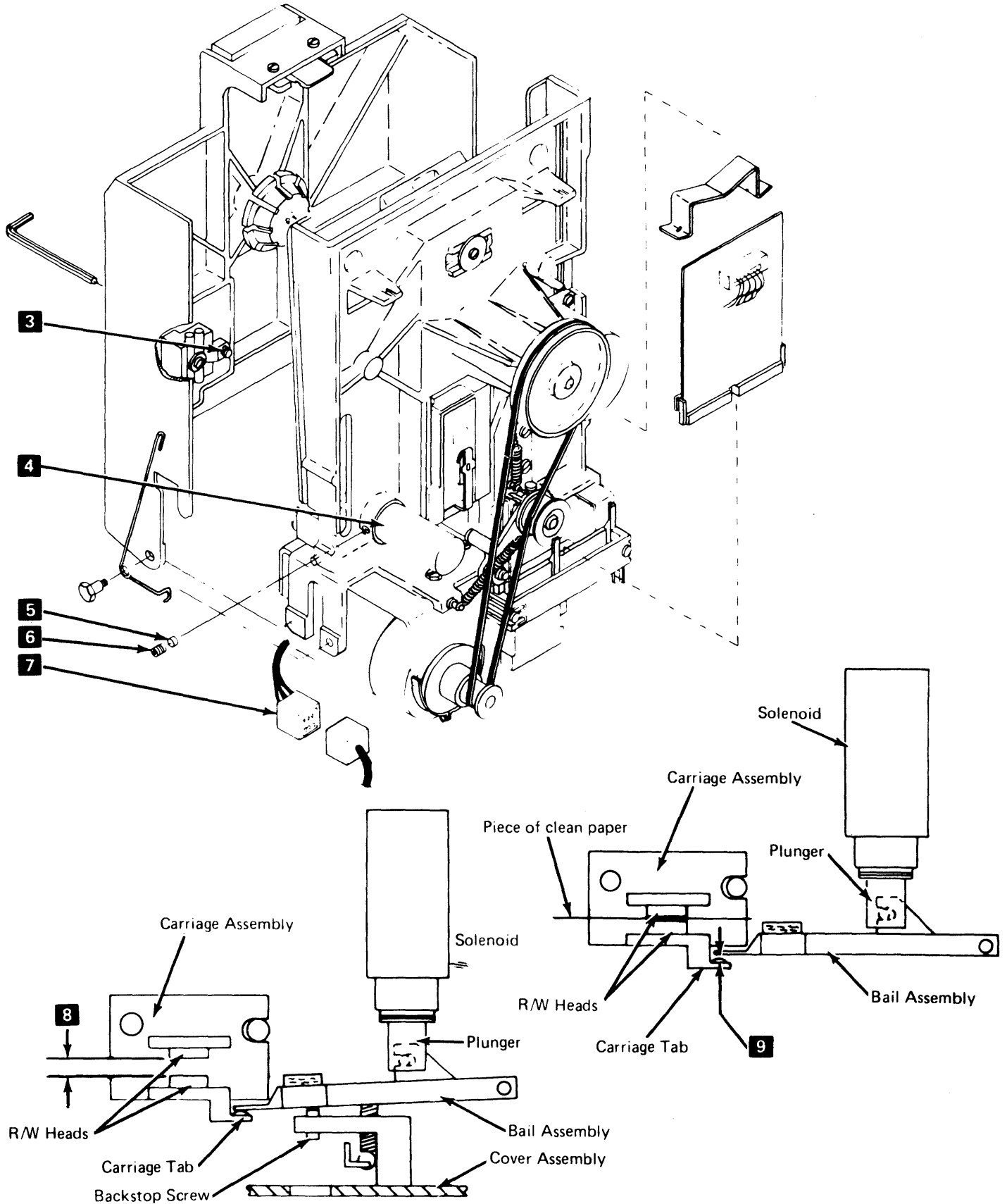
Cover Assembly

## 1.68 HEAD LOAD SOLENOID/BAIL ASSEMBLY REMOVAL AND REPLACEMENT

### Removal

1.  Turn off power.
2.  Disconnect drive motor power cable from socket **9**.
3.  Remove diskette drive cover (1.62).

**CAUTION: The read/write heads must not be allowed to come together without a piece of clean paper inserted between the head surfaces.**

4.  Insert a piece of clean paper between the head surfaces.
5.  Remove the solenoid leads **11** from taper pin terminal block **10**.

**Note:** *When removing cable assemblies, observe the original routing for replacement purposes.*

6.  Remove bail return spring **4**.
7.  Remove mounting screw **3** and bail **2**, pulling solenoid plunger **5** out of solenoid **6**.
8.  Remove plunger from bail.
9.  Loosen solenoid locking screw **8**.

**Note:** *Be careful not to lose pellet **7**.*

10. Remove head load solenoid by turning it counterclockwise.

### Replacement

**Note:** *When replacing the head load solenoid, replace both the solenoid **6** and plunger **5**.*

1.  Install solenoid approximately four turns into casting.
2.  Install plunger to bail **2**.

**CAUTION: When installing plunger into solenoid, be careful not to damage solenoid surface material.**

3.  While inserting plunger into solenoid, replace bail and mounting screw **3**.

**Note:** *Be sure bail is under tab **1** of carriage arm.*

4.  Replace bail return spring **4**.
5.  Replace solenoid leads **11** to taper pin terminal block **10**.

**DANGER:**
**Voltage is still present at socket **9** with the drive motor power cable disconnected and power on.**

6.  Turn on power.
7.  Adjust solenoid/bail assembly (1.67), starting at step 6.



EC 745948

**5**

**6**

**7**

**8**

**9**

**10**

+24 Vdc > — H — Solenoid

+ A 160 Ω F

28 Ω

D

Capacitor +

28 Ω

White

Solenoid **11**

White

160 Ω

Black     Yellow
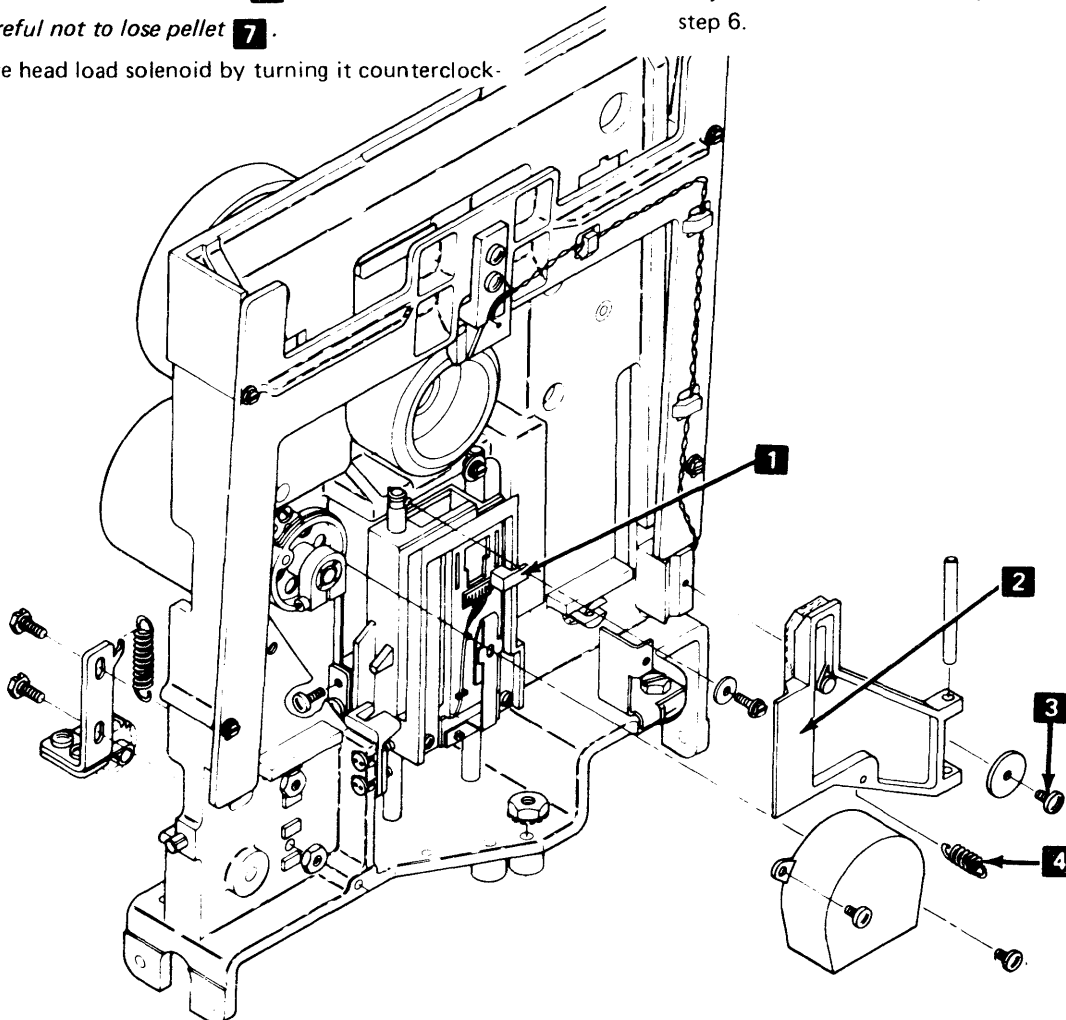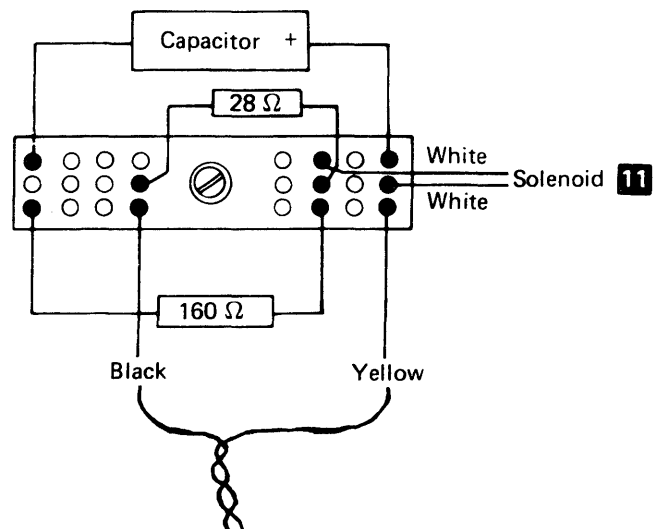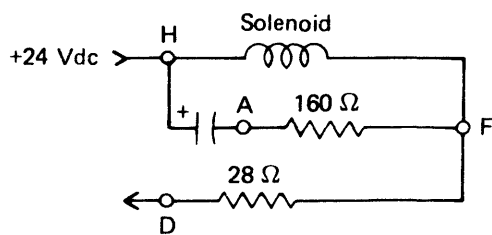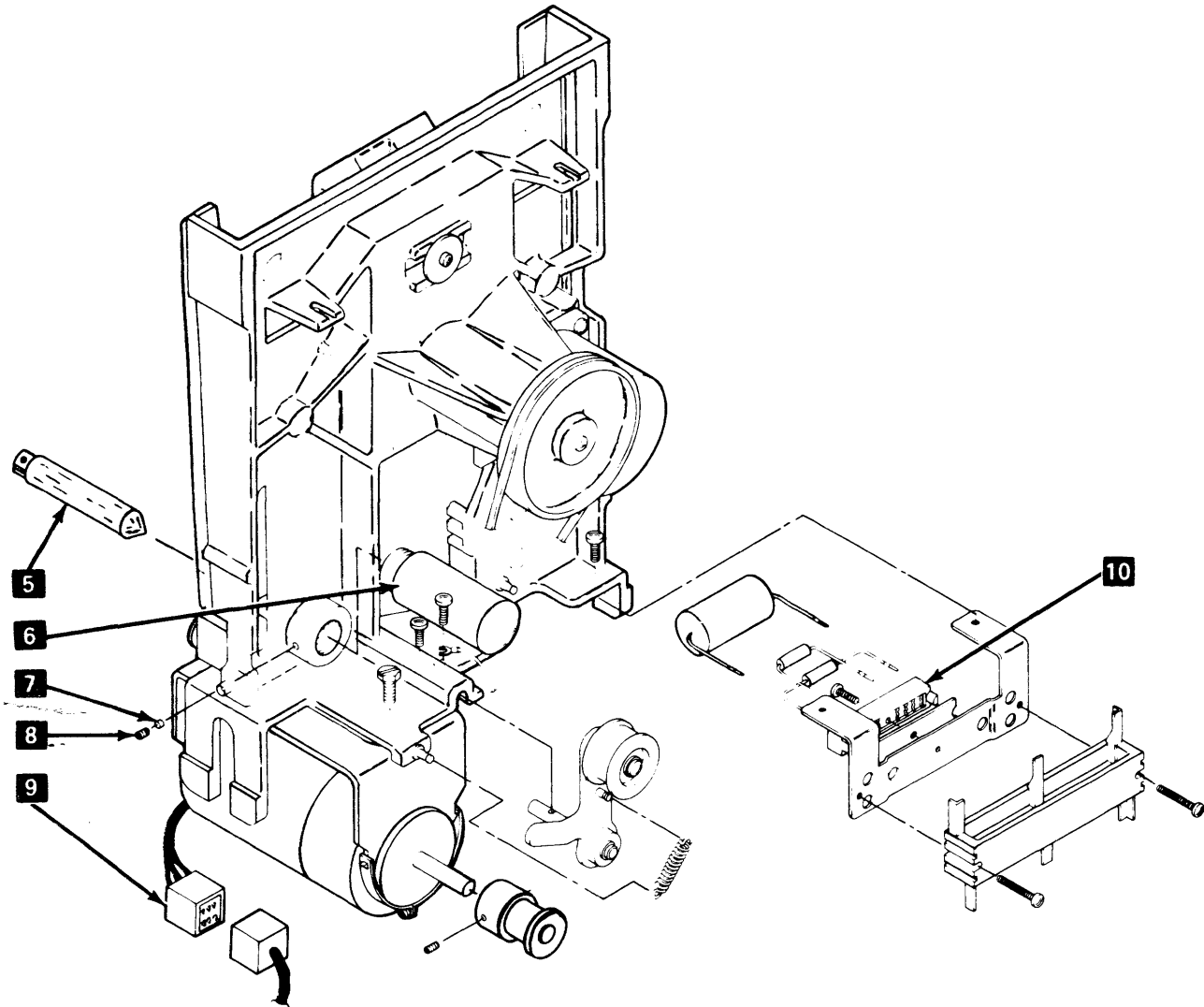
## 1.69 DRIVE BELT SERVICE CHECK AND ADJUSTMENT

**Service Check**

1. With power on, check that belt **2** is riding on center of hub pulley **1** and drive pulley **6** .
2. If belt is not centered, adjust drive belt.

**Adjustment**

1. Turn off power.
2. Loosen idler locking screw **3** and drive pulley setscrew **7** .
3. Slide idler assembly **4** and drive pulley **6** in or out so belt is centered on hub pulley **1** and drive pulley when drive pulley is rotated counterclockwise.
4. Align drive pulley setscrew with flat surface **8** of the drive shaft and tighten.
5. Turn on power and do drive belt service check.

## 1.70 DRIVE MOTOR REMOVAL

**DANGER:**
**Motor case can get hot.**

1. Remove diskette drive cover (1.62).
2. With power off, disconnect drive motor power cable from socket **10** .
3. Remove drive belt.
4. Remove two motor bracket mounting screws **12** and remove drive motor and bracket as an assembly **11** .
5. Loosen setscrew **7** and remove drive pulley **6** .

## 1.71 DRIVE MOTOR REPLACEMENT

1. Install drive pulley **6** on new motor. (Align setscrew with flat surface of the drive shaft **8** and tighten.)

**DANGER:**
**When replacing a 60-Hz drive motor, position two large holes in motor frame to top and under bracket.**

2. Replace motor and bracket assembly **11** and two screws **12** .
3. Replace diskette drive cover (1.62).
4. Connect drive motor power cable to socket **10** . *
5. Turn on power and do drive belt service check (1.69).

## 1.72 DRIVE PULLEY REMOVAL

1. Turn off power.
2. Remove drive belt.
3. Loosen setscrew **7** and remove drive pulley **6** .

## 1.73 DRIVE PULLEY REPLACEMENT

1. Install pulley **6** on motor shaft aligning setscrew **7** with the flat surface **8** of the shaft.
2. Replace drive belt.
3. Turn on power and do drive belt service check (1.69).

## 1.74 IDLER ASSEMBLY REMOVAL AND REPLACEMENT

**Removal**

1. Turn off power.
2. Remove drive belt.
3. Remove idler spring **5** .
4. Remove idler assembly locking screw **3** .
5. Remove idler assembly **4** .

**Replacement**

1. Reverse above procedure and adjust drive belt (1.69).

---

*Jumper assembly PN 4409828 for low voltage (100—123.5) or PN 4409829 for high voltage (200—240) may be required in order to use the latest style diskette drive motor.

Factory
Installation
Only
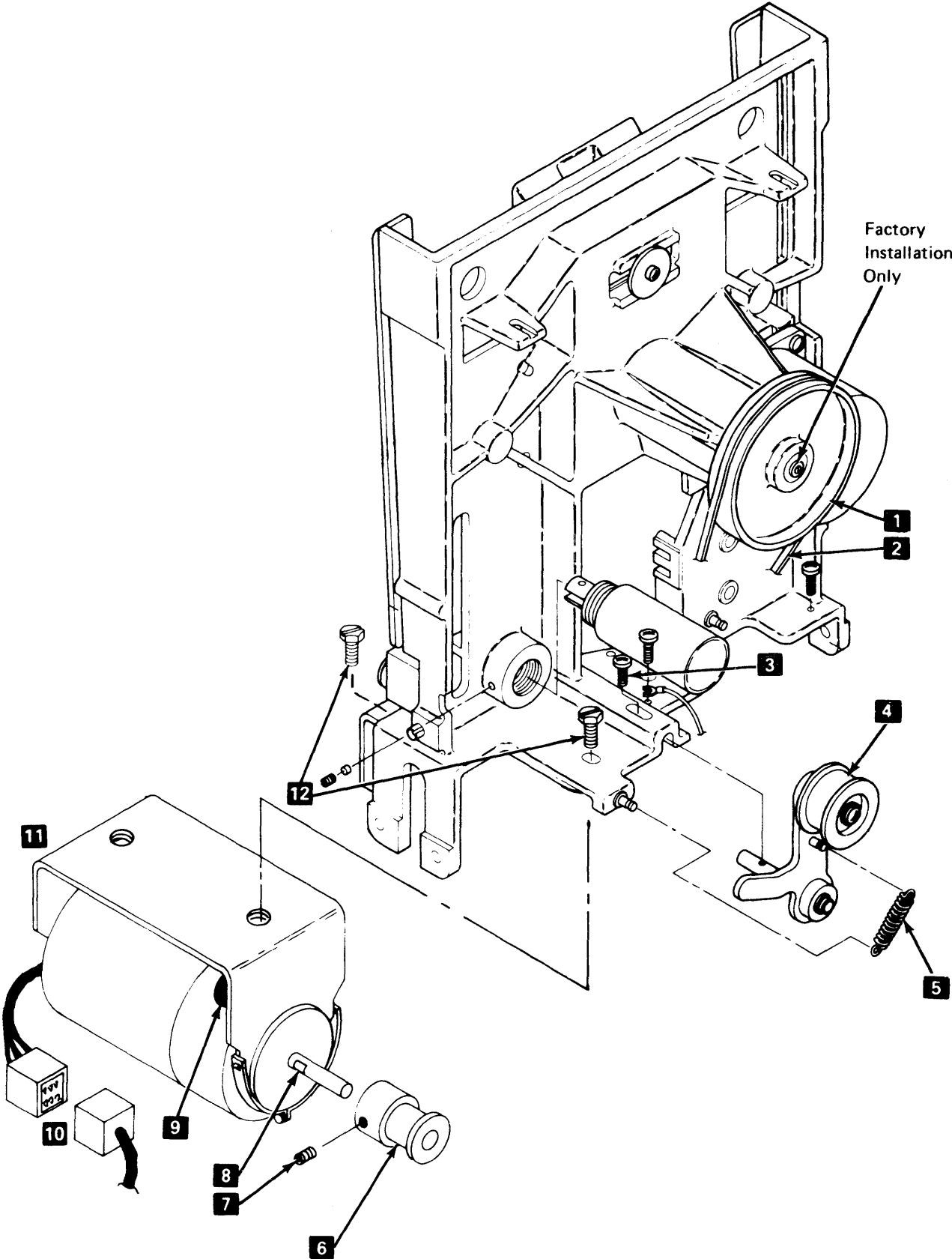
## 1.75 STEPPER MOTOR REMOVAL

1. Remove diskette drive cover (1.62).
2. With power off, remove head cable from diskette drive control card.
3. Remove card retainer and diskette drive control card.
4. Disconnect cable from position A2 **19** and remove two screws **1** and cover **2** .
5. Remove stepper motor leads **3** from cable connector by pushing down on terminal tabs with small screwdriver.



Blue D02
Orange D03
Yellow D04
Red B02
Black B05 **3**
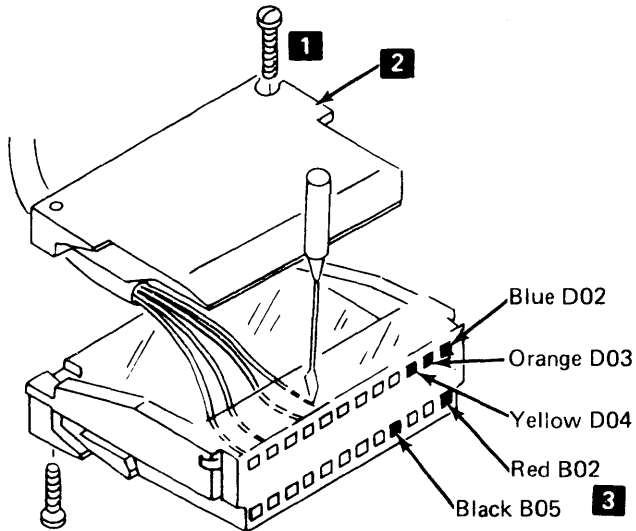
6. Remove cover/wiper assembly **8** .
7. Loosen two mounting screws **5** . Push idler assembly **7** against spring tension and tighten screws.
8. Remove clamp screw **17** on pulley **13** .
9. Remove clamp **16** .

CAUTION: During the following steps be careful not to damage the drive band **14** .

10. Carefully remove drive band ends from pulley pin **15** .
11. Measure and record gap between stepper motor pulley and casting **18** .

> Gap is:

12. Loosen clamp screw **11** and remove stepper motor pulley.
13. Remove three stepper motor mounting screws **4** and remove motor.

## 1.76 STEPPER MOTOR REPLACEMENT

1. Install stepper motor into its mounting position and route motor cable toward diskette drive control card.
2. Replace and tighten three screws **4** .
3. Insert stepper motor leads **3** into cable connector.

Note: *Make sure that the locking tabs on the terminals engage in the connector slot to prevent the leads from pushing out when plugged in.*

4. Replace connector cover and two screws.
5. Connect cable to position A2 **19** .
6. Replace stepper motor pulley **13** , clamp **12** , and screw **11** (do not tighten screw).

Note: *With the stepper motor pulley clamp screw loose, the motor shaft is free to rotate inside the pulley.*

7. Replace drive band ends on pulley pin **15** with notches facing away from stepper motor. Install clamp **16** and screw **17** , but do not tighten screw.
8. Loosen two mounting screws **5** and allow spring tension to position idler **7** . Tighten mounting screws and center drive band on idler pulley as shown **6** .
9. Replace diskette drive control card and card retainer.
10. Replace head cable on diskette drive control card.
11. Position stepper motor pulley by hand to track 40 and insert timing pin **10** (located inside cover assembly) through pulley and into timing slot **9** in casting.
12. Turn on power.
13. Electrically detent stepper motor to phase 0 by installing a jumper between the "—Align Access" and "Ground" test points on diskette drive control card (1.94).
14. Make the gap between pulley and casting **18** equal the value recorded during stepper motor removal, step 11 (1.75).

CAUTION: Do not push clamp against pulley when tightening clamp screw. Clamp must be positioned near the end of the pulley flanges for effective clamping.

15. Tighten clamp screw **11** .
16. Tighten band clamp screw **17** .
17. Remove timing pin and return it to its storage location inside the cover assembly.
18. Remove jumper installed in step 13.
19. Do drive band service check (1.80).
20. Do head/carriage position service check (1.64).
21. Replace cover/wiper assembly **8** .
22. Replace diskette drive cover (1.62).

Center drive band
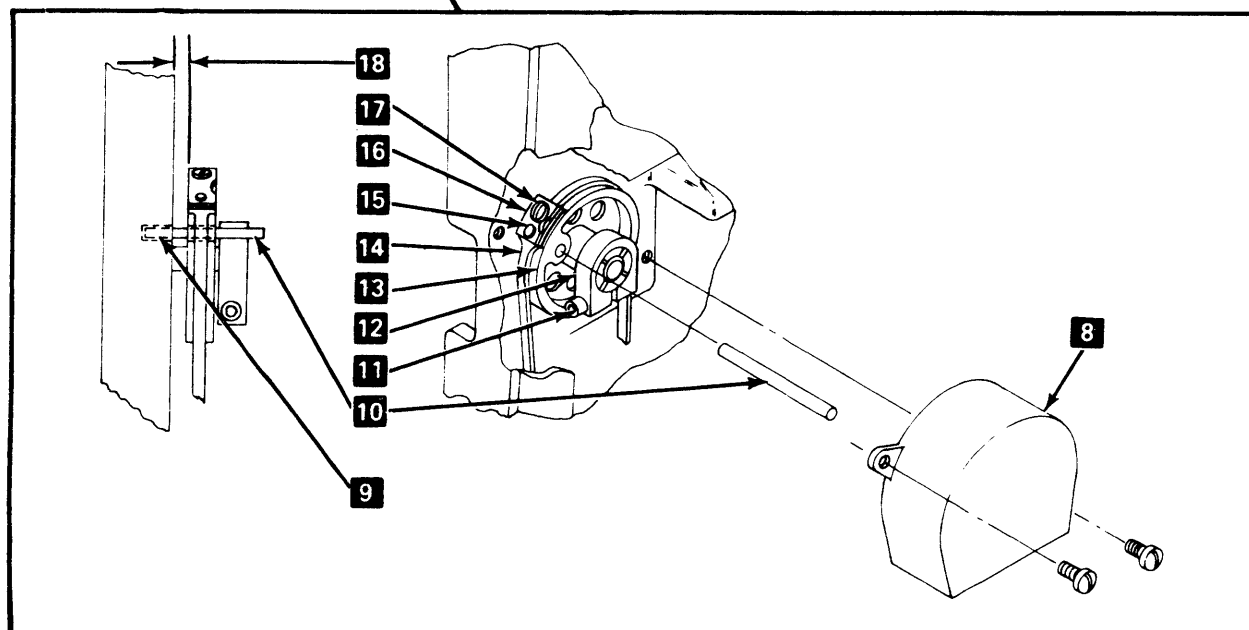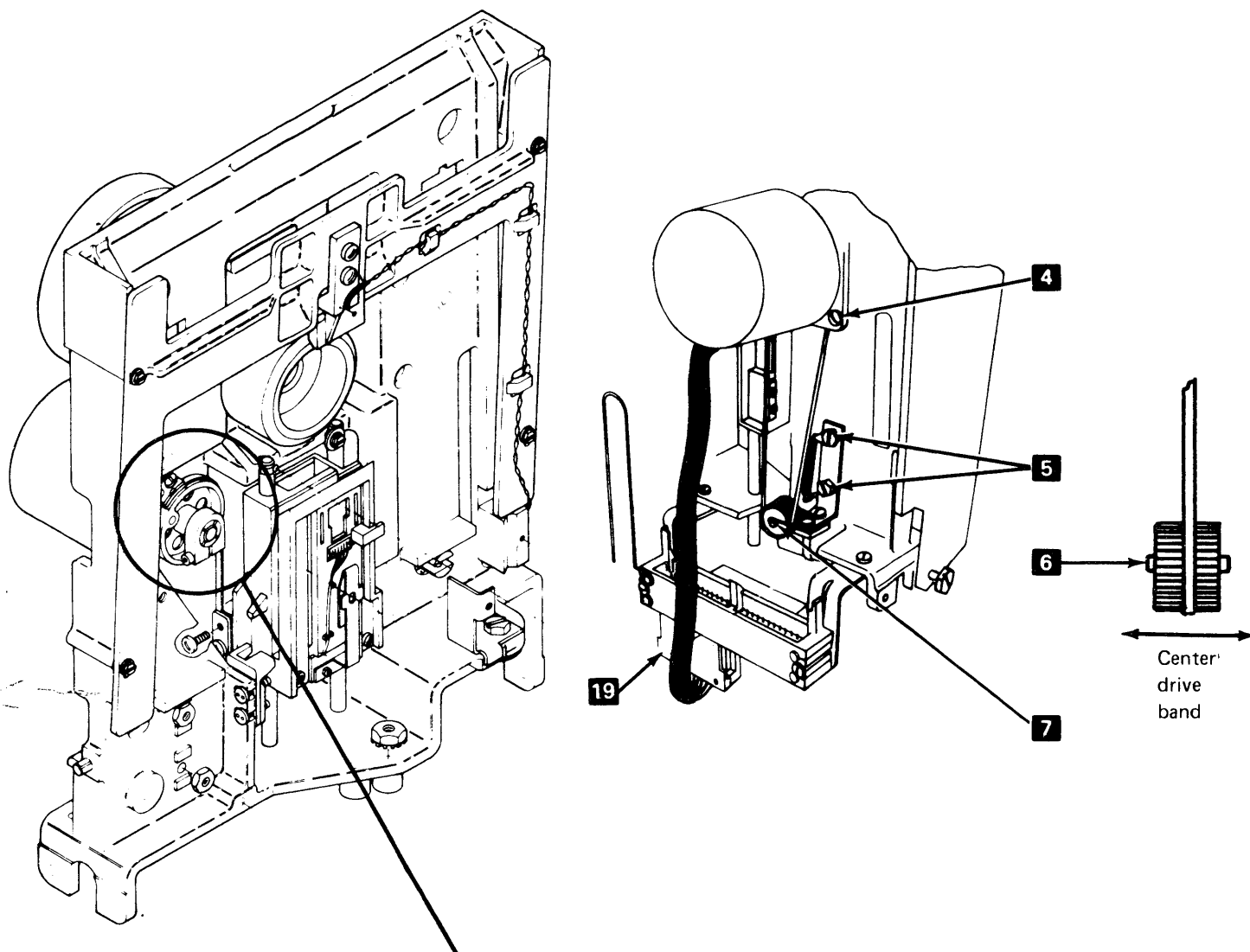
## 1.77 PULLEY/CLAMP REMOVAL

1. Remove diskette drive cover (1.62).
2. With power off, remove cover/wiper assembly **4**.
3. Disconnect head cable from diskette drive control card.
4. Remove card retainer and diskette drive control card.
5. Loosen two mounting screws **1**. Push idler assembly **3** against spring tension and tighten screws.

**CAUTION: During the following steps be careful not to damage the drive band.**

6. Remove clamp screw **14** and clamp **13** from pulley **10**.
7. Carefully remove drive band ends from pulley pin **12**.
8. Measure and record gap between stepper motor pulley and casting **15**.

> Gap is:

9. Loosen clamp screw **8** and remove pulley **10** and clamp **9**.

## 1.78 PULLEY/CLAMP REPLACEMENT

1. Replace pulley **10**, clamp **9**, and clamp screw **8**. (Do not tighten screw.)

**Note:** *With the stepper motor clamp screw loose, the motor shaft is free to rotate inside the pulley.*

2. Replace drive band ends on pulley pin **12** and install clamp **13** and screw **14**. Do not tighten screw.
3. Loosen two mounting screws **1** and allow spring tension to position idler **3**. Tighten mounting screws and center drive band on idler pulley as shown **2**.
4. Replace diskette drive control card and card retainer.
5. Replace head cable on diskette drive control card.
6. Position stepper motor pulley by hand to track 40 and insert timing pin **7** (located inside cover assembly) through pulley and into timing slot **6** in casting.
7. Turn on power.
8. Electrically detent stepper motor to phase 0 by installing a jumper between the "–Align Access" and "Ground" test points on diskette drive control card (1.94).

9. Make the gap between pulley and casting equal the value recorded during pulley/clamp removal, step 8 (1.77).

**CAUTION: Do not push clamp against pulley when tightening clamp screw. Clamp must be positioned near the end of the pulley flanges for effective clamping.**

10. Tighten clamp screw **8**.
11. Tighten band clamp screw **14**.
12. Remove timing pin and return it to its storage location inside cover assembly.
13. Remove jumper installed in step 8.
14. Do drive band service check (1.80).
15. Do head/carriage position service check (1.64).
16. Replace cover/wiper **4**.
17. Replace diskette drive cover (1.62).

## 1.79 WIPER REPLACEMENT

1. Remove diskette drive cover (1.62).
2. Remove cover/wiper assembly **4**.
3. Exchange wiper **5**.
4. Replace cover/wiper assembly.
5. Replace diskette drive cover (1.62).

EC 745948



Center
Drive
Band

1.77—1.79 SY27-2519-0 (4/78) 1-51R
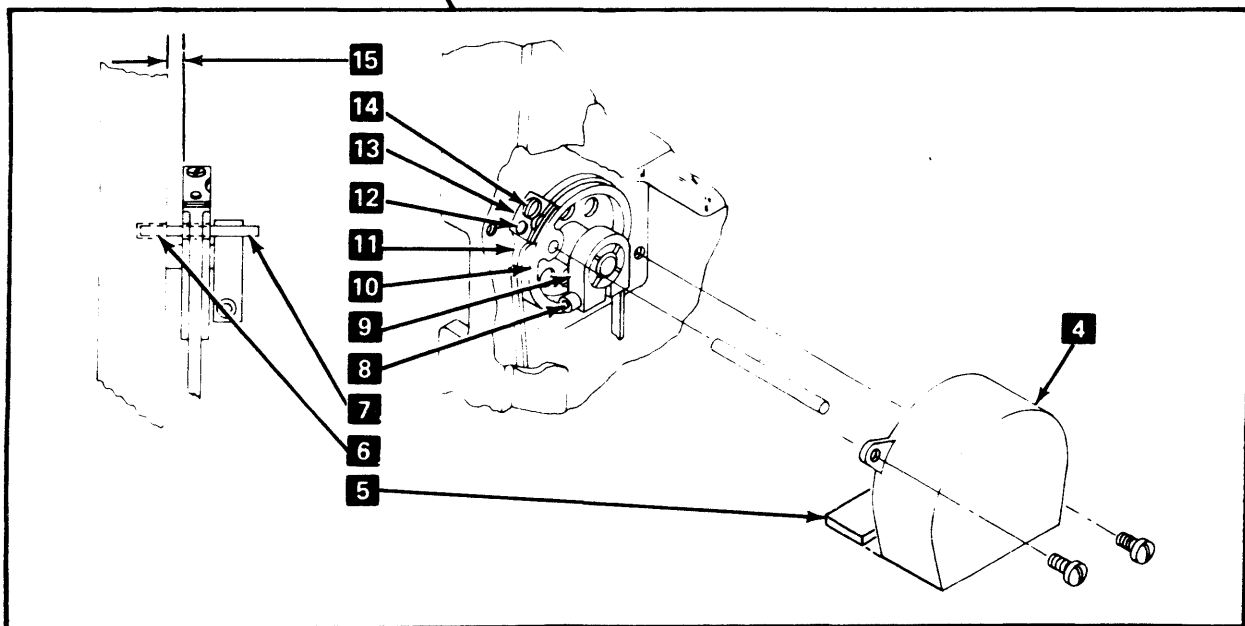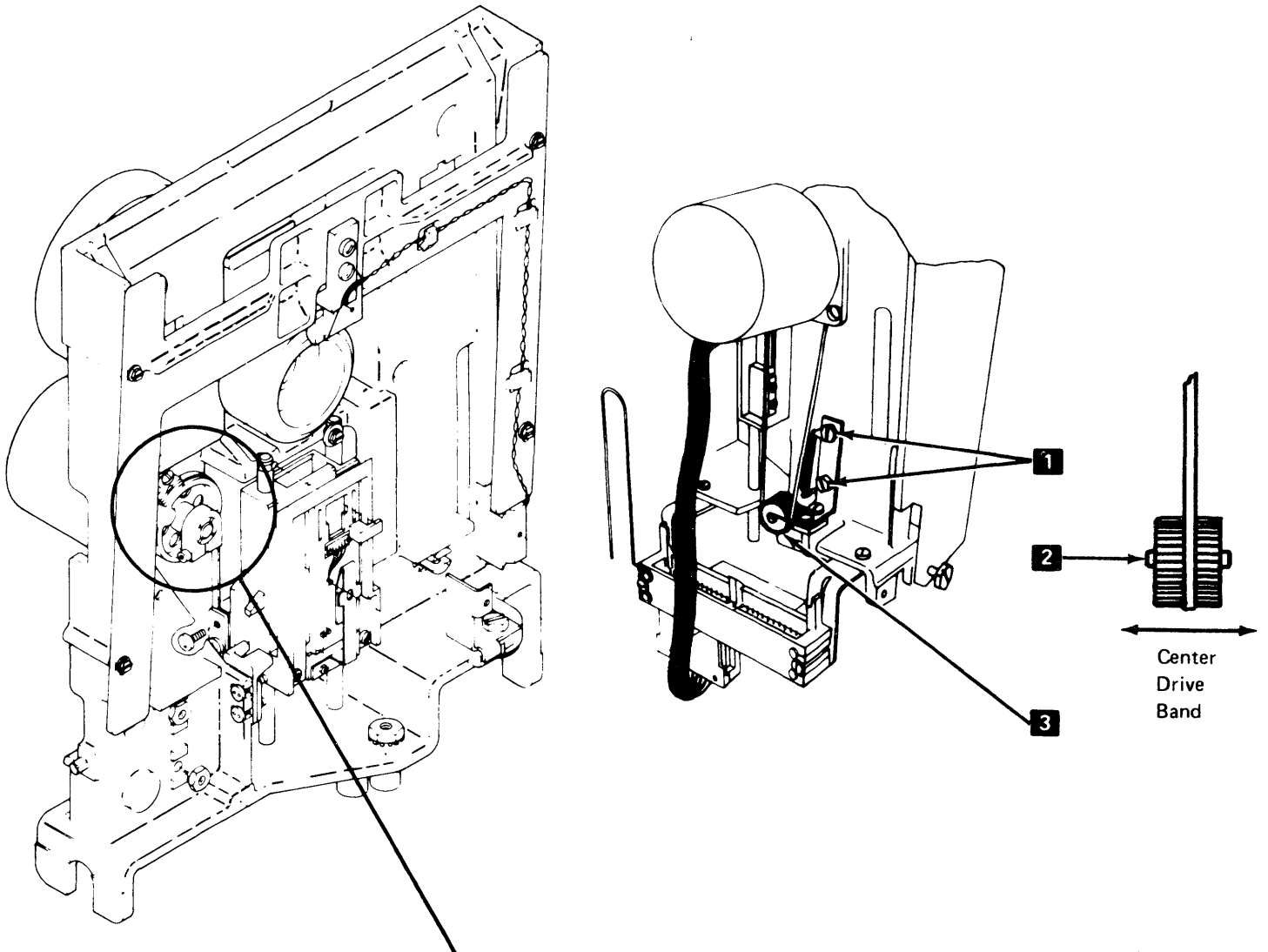
## 1.80 DRIVE BAND SERVICE CHECK AND ADJUSTMENT

### Service Check

1. Remove diskette drive cover (1.62).
2. With power off, disconnect head cable from diskette drive control card.
3. Remove card retainer and diskette drive control card.
4. - Loosen two mounting screws **3** and allow spring tension to position idler **5**. Tighten mounting screws.
5. Remove cover/wiper assembly **7**.
6. Rotate stepper motor pulley and check that drive band is centered **4** on idler pulley **5** throughout travel of head/carriage assembly.
7. If above check is not good, adjust drive band, starting at step 5.
8. Replace diskette drive control card and card retainer.
9. Connect head cable to diskette drive control card.
10. Replace cover/wiper assembly **7**.
11. Replace diskette drive cover (1.62).

### Adjustment

1. Remove diskette drive cover (1.62).
2. With power off, remove cover/wiper assembly **7**.
3. Disconnect head cable from diskette drive control card.
4. Remove card retainer and diskette drive control card.
5. Position head/carriage assembly to approximately track 40.
6. Remove two band clamping screws **2** and clamp **1**.
7. Loosen two mounting screws **3** and allow spring tension to position idler **5**. Tighten mounting screws.
8. Rotate stepper motor pulley by hand a few turns to allow drive band to find its center **4** on idler pulley.
9. Position head/carriage by hand to approximately track 40 and check that band mounting slots **6** are centered (left to right) over mounting holes on carriage pad.
10. Repeat step 9 for approximately track 76. If both positions are centered, skip step 11.
11. Loosen clamp screw **10** and adjust stepper motor pulley **12** to position needed for steps 9 and 10.
12. Measure and record gap between stepper motor pulley and casting **15**.

    | Gap is: |
    | --- |

13. Position head/carriage assembly to approximately track 40.

14. Replace clamp **1** and two clamp screws **2**, but do not tighten.
15. Position stepper motor pulley by hand to track 40 and insert timing pin **9** (located inside cover assembly) through pulley and into timing slot **8** in casting.
16. Loosen clamp screw **10**.
17. Replace diskette drive control card and card retainer.
18. Connect head cable to diskette drive control card.
19. Turn on power.

**Note:** *With clamp screw **10** loose, stepper motor shaft is free to turn inside pulley.*

20. Electrically detent stepper motor to phase 0 by installing a jumper between the "−Align Access" and "Ground" test points on diskette drive control card (1.94).
21. Make the gap between pulley and casting **15** equal the value recorded during step 12.

**CAUTION: Do not push clamp **11** against pulley **12** when tightening clamp screw **10**. Clamp must be positioned near the end of the pulley flanges for effective clamping.**

22. Tighten clamp screw **10**.

**Note:** *The timing pin should pass freely through the stepper motor pulley and the timing slot in the casting.*

23. Remove timing pin and return it to its storage location inside cover assembly.
24. Remove jumper installed in step 20.
25. Adjust head/carriage position (1.64), starting at step 13.

**EC 745948**
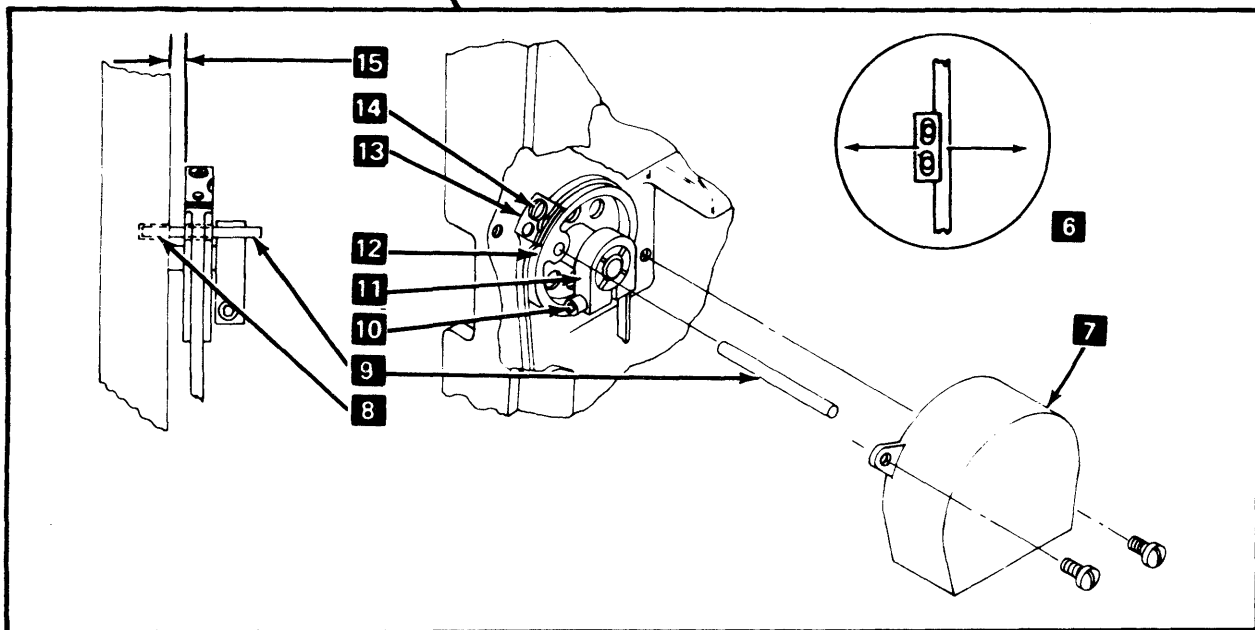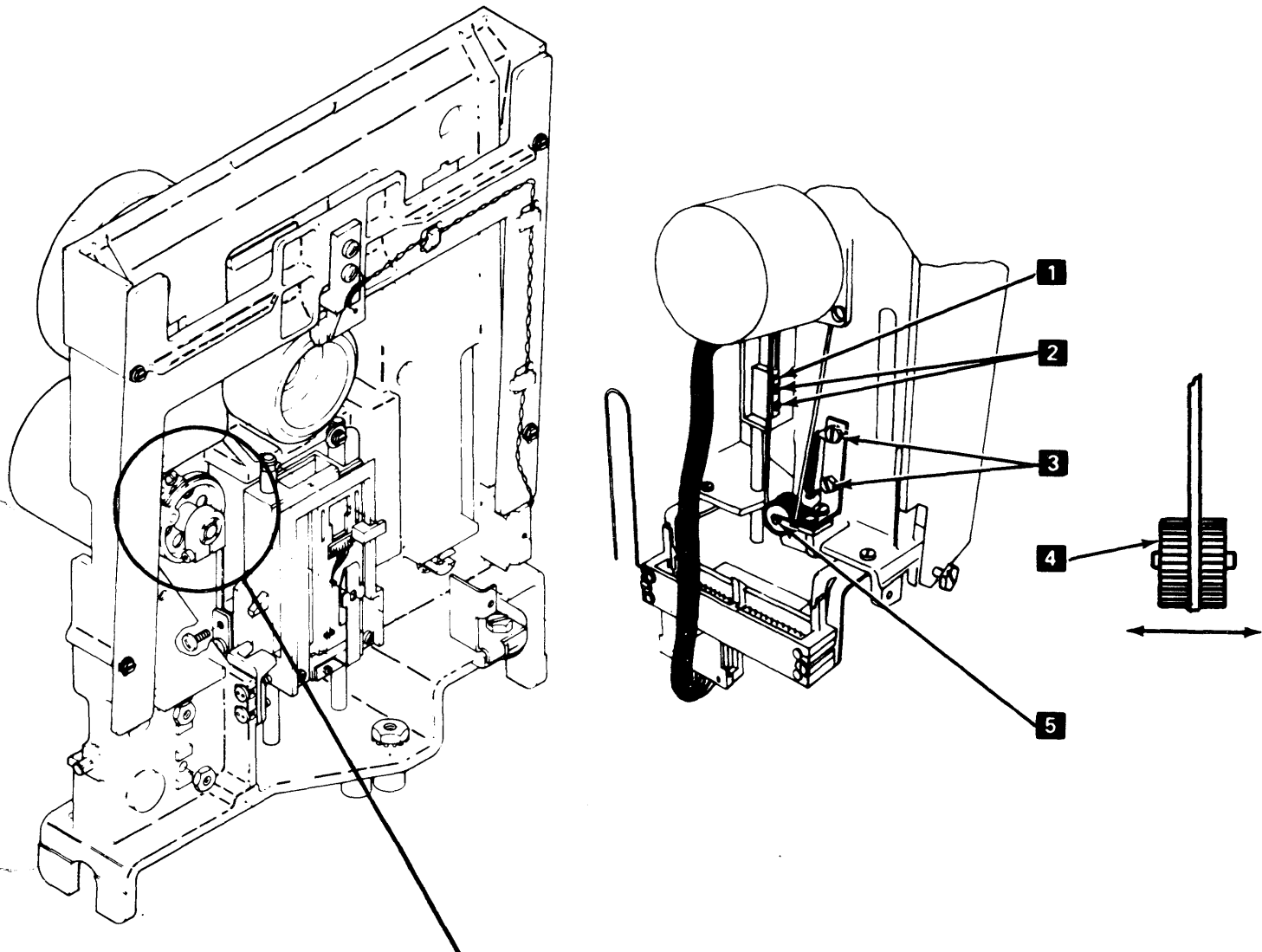
## 1.81 DRIVE BAND REMOVAL

1.   Remove diskette drive cover (1.62).
2.   With power off, remove cover/wiper assembly **5** .
3.   Disconnect head cable from diskette drive control card.
4.   Remove card retainer and diskette drive control card.
5.   Loosen two mounting screws **3** . Push idler assembly **4** against spring tension and tighten mounting screws.
6.   Position head/carriage assembly to approximately track 40.
7.   Remove two band clamping screws **2** and clamp **1** . Carefully lower head/carriage assembly to rest on casting.
8.   Remove clamp screw **6** and clamp **7** .
9.   Remove drive band ends from pulley pin **8** .
10.  Remove drive band.

## 1.82 DRIVE BAND REPLACEMENT

1.   Place drive band around idler assembly **4** .
2.   Install drive band ends on pulley pin **8** with notches facing away from stepper motor.
3.   Replace clamp **7** and clamp screw **6** , but do not tighten.
4.   - -Adjust drive band (1.80), starting at step 9.

Center
drive
band
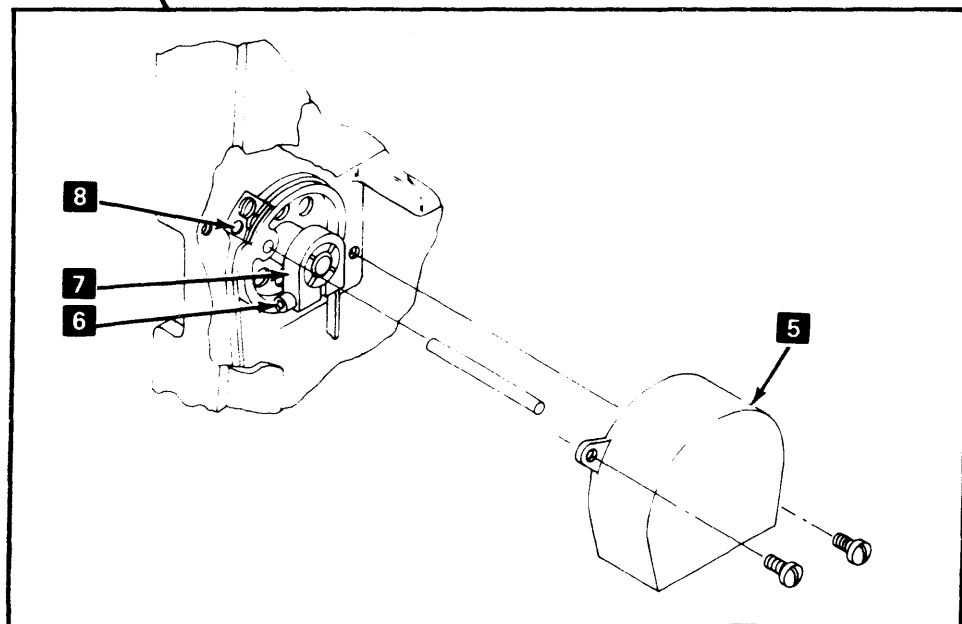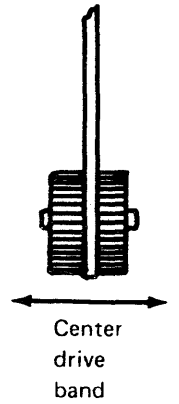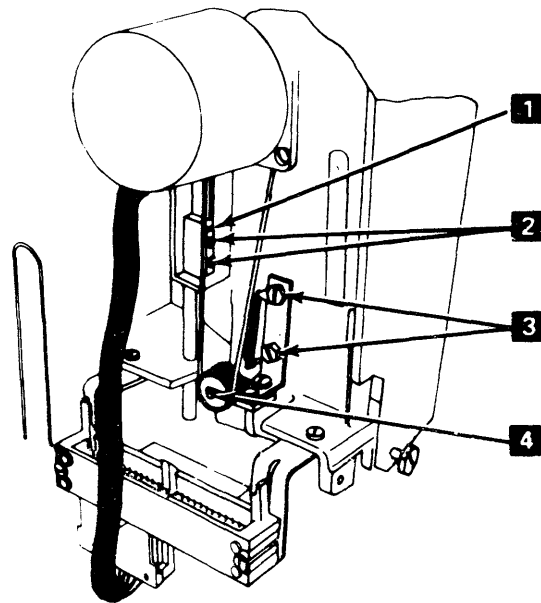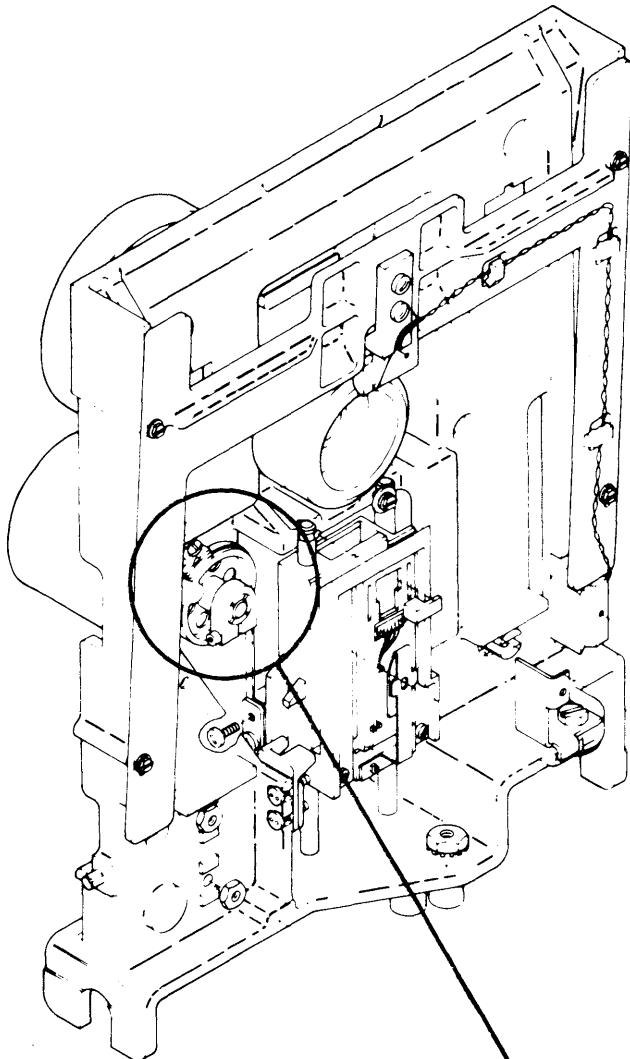
## 1.83 STEPPER DRIVE IDLER ASSEMBLY REMOVAL

1.   Remove drive band (1.81).
2.   Loosen two mounting screws **2** .
3.   Remove spring **1** .
4.   Remove mounting screws and idler assembly **3** .

## 1.84 STEPPER DRIVE IDLER ASSEMBLY REPLACEMENT

1.   Replace idler assembly **3** and two mounting screws **2** .
2.   Replace spring **1** .
3.   Push idler assembly against spring tension and tighten mounting screws.
4.   Replace drive band (1.82).
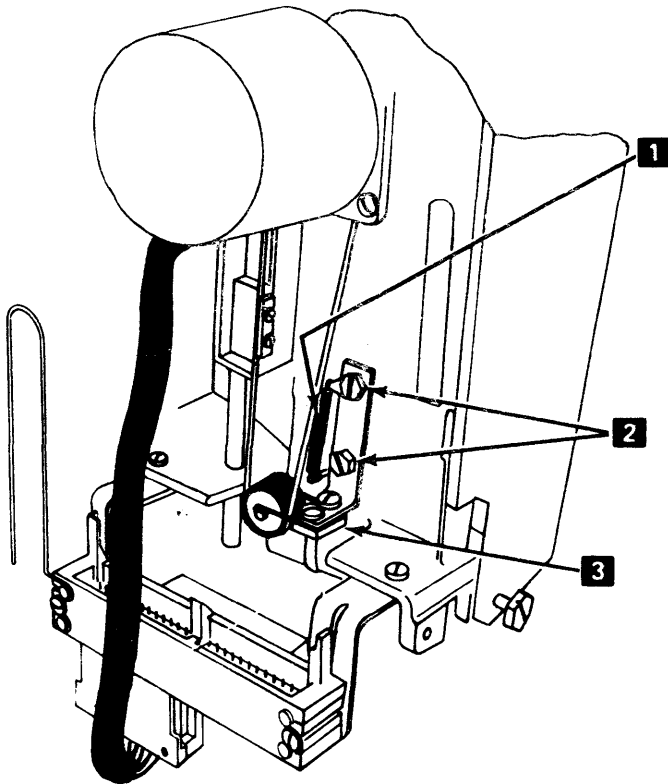
## 1.85 LED/PTX ALIGNMENT

1. Remove diskette drive cover (1.62).
2. Loosen PTX mounting screw **2**.
3. Position PTX assembly **3** against casting stop **1** (away from leads) and tighten mounting screw.
4. Loosen two LED mounting screws **4**.
5. Insert two timing pins **7** (located inside cover assembly) through LED and into PTX assembly and tighten LED mounting screws.
6. Remove timing pins and return to storage location inside cover assembly.
7. Replace diskette drive cover (1.62).
8. Turn on power.

## 1.86 LED SERVICE CHECK

1. Turn on power.
2. Connect negative probe of volt/ohmmeter (VOM) to "Ground" test point on diskette drive control card (1.94).
3. Connect positive probe of VOM (5V dc scale) to "43FD LED Voltage" test point (1.94).
4. Check VOM for reading of 1V dc to 2V dc.
5. Move positive probe to "33FD LED Voltage" test point (1.94).
6. Check VOM for reading of 1V dc to 2V dc.
7. If either voltage level is not within limits, replace LED assembly **5**.
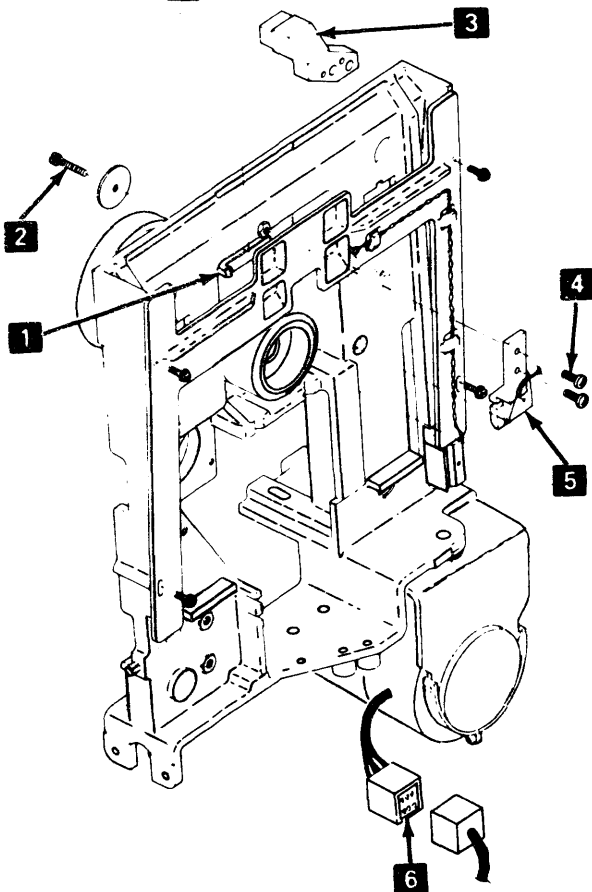
## 1.87 PTX/AMPLIFIER SERVICE CHECK

**CAUTION: Perform this service check with a diskette inserted backward (with the label facing the hub pulley), or LED light will be present causing a wrong VOM reading.**

1. Turn off power.
2. Insert a diskette backward and close cover.
3. Disconnect drive motor power cable from socket **6**

**DANGER:**
**Voltage is still present at socket with the drive motor power cable disconnected and power on.**

4. Turn on power.
5. Connect positive probe of VOM (15V dc scale) to "+Index" test point on diskette drive control card (1.94).
6. Connect negative probe of VOM to "Ground" test point (1.94).
7. Check VOM for reading of less than 1V dc.
8. Install one end of a jumper to "43FD PTX" test point (1.94).
9. While observing VOM, touch other end of jumper to diskette drive casting three times. VOM should read 2.5V dc or more for at least last two groundings.
10. Repeat steps 8 and 9 with jumper on "33FD PTX" test point (1.94).
11. If either condition fails to generate at least 2.5V dc output, replace diskette drive control card.
12. Remove diskette.
13. Insert the starter diskette normally.
14. Rotate the hub until the index hole causes the phototransistor to switch on and off. There should be a shift of approximately 2.5V.
15. Repeat the process with a 2-sided diskette. This tests the other LED and phototransistor.





Guide — Base Casting — PTX Assembly — LED Assembly — Timing Pins (2) — **7**
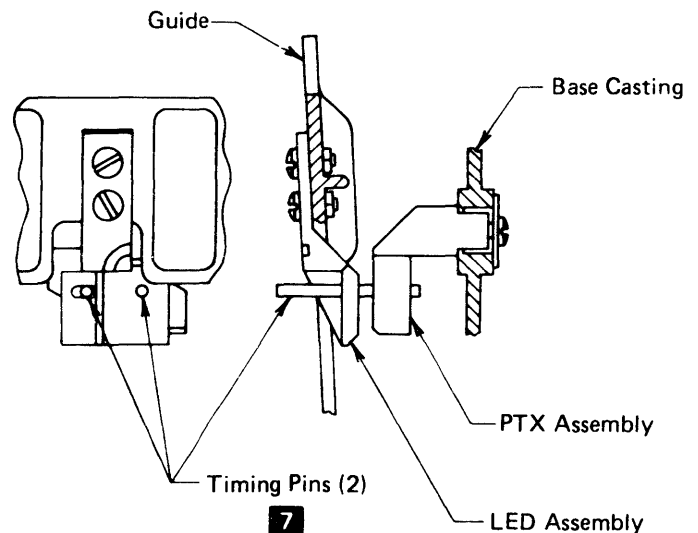
## 1.88 LED REMOVAL

1. Remove diskette drive cover (1.62).
2. Disconnect drive control cable from position A2 on the file control card.
3. Remove cable connector cover **1** and remove four LED leads **2** by pushing down on tabs with a small screwdriver.
4. Remove LED cable from retainers **11**.

**Note:** *When removing cable assemblies, note the original routing for replacement purposes.*

5. Remove four screws **10** and guide **9**.
6. Remove two LED mounting screws **13** and nuts **14** and remove LED assembly.

## 1.89 LED REPLACEMENT

1. Install LED assembly **12**, two mounting screws **13**, and nuts **14** into guide **9**.
2. Replace guide and four screws **10**.
3. Following original routing through three retainers **11**, insert the four LED leads **2** (33FD pair identified with tubing) into diskette drive control cable conector.
4. Replace the cable connector cover **1**.
5. Connect cable to position A2 on diskette drive control card socket.
6. Align LED/PTX (1.85), starting at step 2.
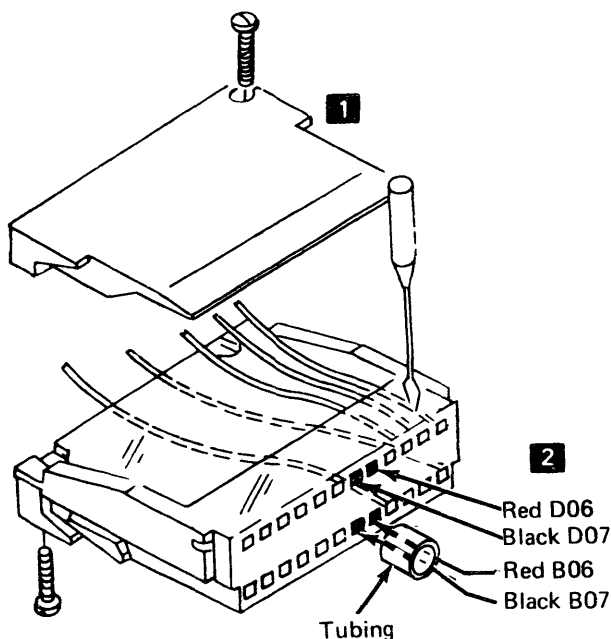
## 1.90 PTX REMOVAL

1. Remove diskette drive cover (1.62).
2. With power off, remove four screws **10** and guide **9**.

**Note:** *Be careful not to damage the LED leads.*

3. Disconnect the diskette drive control cable from position A2 on the file control card.
4. Remove connector cover **3** and remove four PTX leads **4** by pushing down on tabs with small screwdriver.
5. Remove PTX mounting screw **7** and washer **6**.
6. Remove PTX assembly **8**.

**Note:** *When removing cable assemblies, note original routing for replacement purposes.*

## 1.91 PTX REPLACEMENT

1. Install PTX assembly **8** against casting stop **5** (away from leads) and replace screw **7** and washer **6**.
2. Following original routing, insert four PTX leads **4** (33FD pair identified by tubing) into diskette drive control cable connector.
3. Replace connector cover **3** and plug connector into position A2 of diskette drive control card socket.
4. Replace guide **9** and four screws **10**.
5. Adjust LED/PTX (1.85), starting at step 4.



Red D06
Black D07
Red B06
Black B07
Tubing

Tubing
Black D08
Yellow B09
Black D10
Yellow D11

EC 745948

(4 screws)
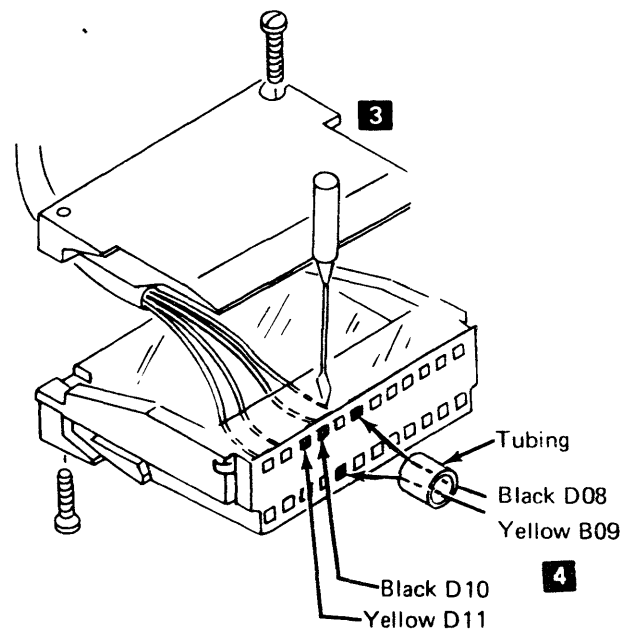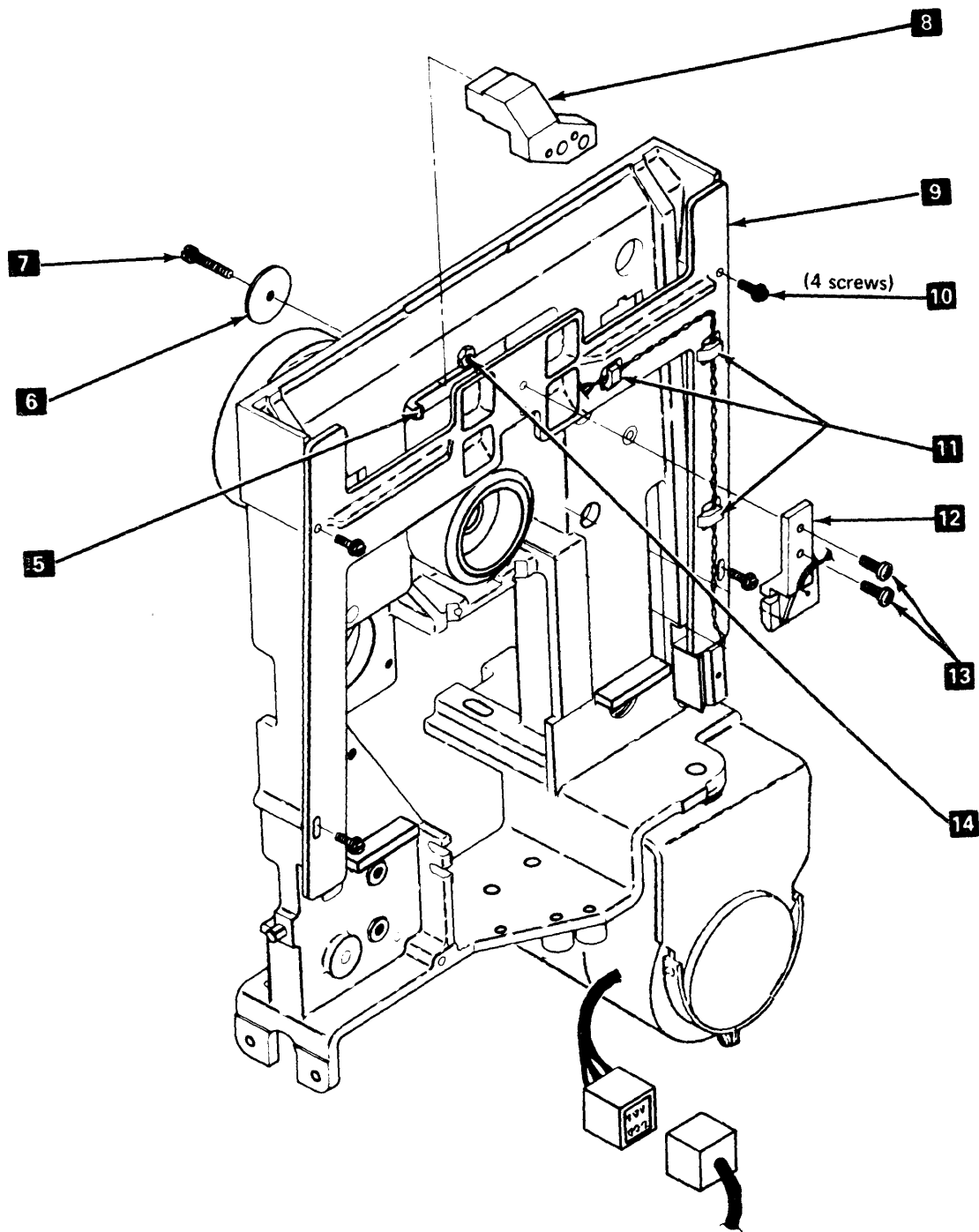
## 1.92  DISKETTE DRIVE CONTROL CARD PIN ASSIGNMENTS

| Name | Color | Control Card | Cable, Drive End |
|------|-------|--------------|------------------|
| Stepper Motor MC-0 (Phase 0) | Orange | G03 | D03 |
| Stepper Motor MC-1 (Phase 1) | Red | J02 | B02 |
| Stepper Motor MC-2 (Phase 2) | Yellow | G04 | D04 |
| Stepper Motor MC-3 (Phase 3) | Blue | G02 | D02 |
| Stepper Common +24V dc | Black | J05 | B05 |
| Head Magnet +24V dc | Yellow | J04 | B04 |
| – Head Load | Black | G05 | D05 |
| LED Return (Diskette 1) | Red | J06* | B06 |
| LED Current (Diskette 1) | Black | J07* | B07 |
| PTX Return (Diskette 1) | Yellow | J09* | B09 |
| PTX Current (Diskette 1) | Black | G08* | D08 |
| LED Return (Diskette 2) | Red | G06 | D06 |
| LED Current (Diskette 2) | Black | G07 | D07 |
| PTX Return (Diskette 2) | Yellow | G11 | D11 |
| PTX Current (Diskette 2) | Black | G10 | D10 |
| Preamp TP1 | | J12 | B12 |
| Preamp TP2 | | J13 | B13 |
| Ground | Black | J08 | B08 |

Cable to Basic Control Board. See Figure 3-3.

Diskette Drive Cable

Diskette Drive Control Card/Cable Socket Card Side
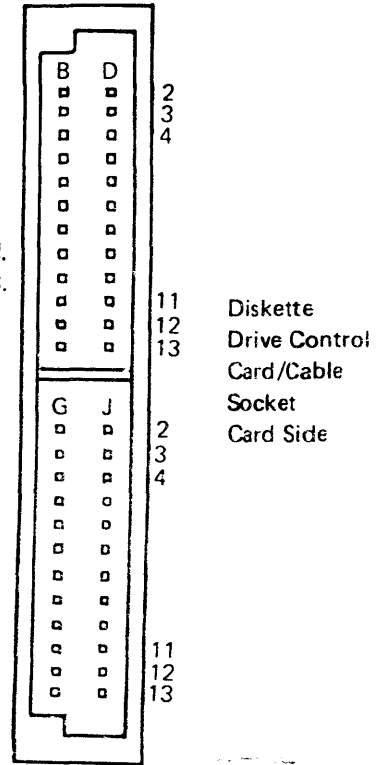
| Name | Control Card | Cable, Drive End | Cable End | 3601-2/3 3602 Basic Ctrl Bd | 3601-D Basic Ctrl Bd | 3601 TB1 | 3602 TB1 |
|------|------|------|------|------|------|------|------|
| + Access 0 | B02 | D02 | D02 | H6A04 | D6E04 | | |
| + Access 1 | B03 | D03 | D03 | H6B04 | E6A04 | | |
| + Access 2 | B04 | D04 | D04 | H6C04 | E6B04 | | |
| + Access 3 | B05 | D05 | D05 | H6D04 | E6C04 | | |
| + Diskette Data | B07 | D07 | D07 | J6A04 | E6E04 | | |
| + Head Engage | B10 | D10 | D10 | J6D04 | F6C04 | | |
| + Write Data | D02 | B02 | B02 | H6A02 | D6E02 | | |
| + Erase Gate | D04 | B04 | B04 | H6C02 | E6B02 | | |
| + Write Gate | D05 | B05 | B05 | H6D02 | E6C02 | | |
| + Inner Tracks | D06 | B06 | B06 | H6E02 | E6D02 | | |
| + Index | B13 | D13 | D13 | K6B04 | G6A04 | | |
| + Erase Current Sense | D09 | B09 | B09 | J6C02 | F6B02 | | |
| + Select Head 1 | D07 | B07 | B07 | J6A02 | E6E02 | | |
| + Two-sided Diskette Sense | B08 | D08 | D08 | J6B04 | F6A04 | | |
| – Two-sided Drive Sense | B09 | D09 | D09 | J6C04 | F6B04 | | |
| + 24V dc | D10 | B10 | B10 | J6D02 | F6C02 | | |
| + 5V dc** | D03 | B03 | | | | TB1-1 | TB1-6 |
| – 5V dc** | D11 | B11 | | | | TB1-4 | TB1-10 |
| Ground | D08 | B08 | B08 | J6B02 | F6A02 | TB1-10 | TB1-3 |

*Tubing.

**This cable wire is not point to point.

## 1.93 DISKETTE DRIVE CONTROL CARD REMOVAL AND REPLACEMENT

1. Turn off power.
2. Disconnect head cable **2** from diskette drive control card **3** .
3. Remove card retainer **1** and card.
4. To replace, reverse above procedure.

## 1.94 DISKETTE DRIVE CONTROL CARD TEST POINTS

PN 8527157

+diskette loaded
+predrive MC-3
+predrive MC-2
+predrive MC-1
+predrive MC-0
+43FD index
+33FD index
Diff read A
Diff read B
—high gain
—align access
—high current
Preamp testpoint 1
Preamp testpoint 2
—high gain A
—high gain B
Locator pin

+access 0
+access 1
+access 2
+access 3
+file data
+diskette sense
+head engage

+write data
+erase gate
+write gate
+inner tracks
+head select 1
Ground
+erase current sense
+24 volts
—5 volts

+index
MC-3
MC-0
MC-2
—head load
43FD LED voltage
+5 volts
—data protect

43FD PTX
(emitter)

MC-1
MC-CUM
33FD LED voltage
Ground
33FD PTX (emitter)

Head 0 ct
Head 1 ct
+14 volts

## 1.94 DISKETTE DRIVE CONTROL CARD TEST POINTS (Cont)

**A**

R/W Read/Write — White
Center Top Read/Write - Blue
Head 1    R/W Read/Write — Black
Erase — Red
Erase — Yellow
Cable Shield Gnd — Black
Head 0    Cable Shield Gnd — Black
Erase — Yellow
Erase — Red
(B/W) Read Write — Black
Center Top Read/Write Blue
(R/W) Read/Write White

PN 8527124

Head 0 CT

Head Cable **A**

Ground O

Head 1 CT O

+24V O

- High Gain A
TP3H
TP4H
Regulator Test Point
-Align Access
+Pre-Drive MC-3
+Pre-Drive MC-1
+Pre-Drive MC-0
+Pre-Drive MC-2
+43FD Index
+33FD Index
+Pre-Drive Head Load
Diff Read B
Diff Read A

Preamp TP2 O

-Head Load O

+Erase Gate O   O
Write Data

+5V O    O +Head Engage

+Write Gate O

33FD PTX O    O 43FD PTX

Preamp TP1 O

O +Select Head 1

O +Access 3

43FD LED Current O    O +Inner Tracks

O MC-0

+Access 0 O

O +Index   +Diskette Sense O

O 33FD LED Current    +Access 1 O

O +Access 2

+File Data O

+Erase Current Sense O

O MC-2     MC-3 O   O MC-1   O -5V

A2        A1

EC 745948

## 1.95 INDEX TEST POINT

Check for index pulses every 166.6 ms at the "+Index" test
point on the diskette drive control card (1.51 or 1.94).
Pulse width should be 1.7 to 8.0 ms.

20 ms/Division
Index Pulses Every 166 ms
Pulse Width in Example: Approximately 5 ms
Sync: + Internal

1 ms/Division
Index Pulse of Approximately 5 ms
Sync: + Internal
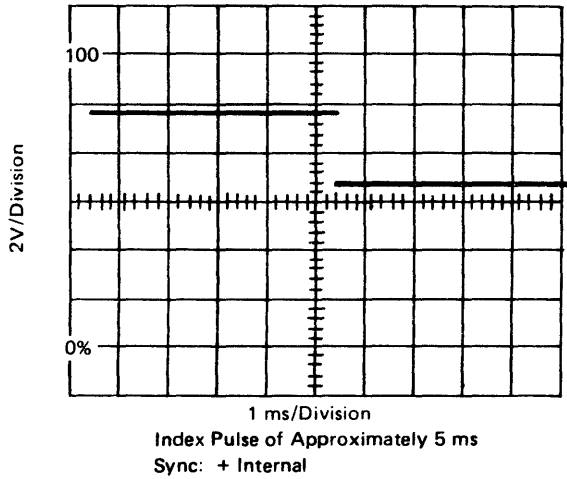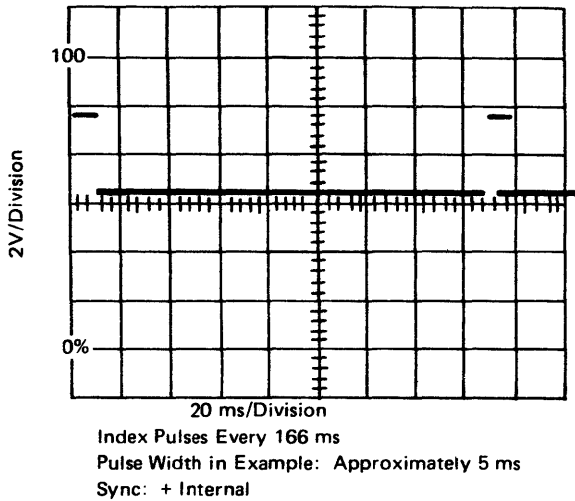
## 1.96–1.99 Not Used

## 1.100 DISK ENCLOSURE (DE) REMOVAL

The following may eliminate the need for DE replacement; it clears as much of the customer data as possible for his security.

You should advise the customer that some information that was on the disk has been destroyed. You should ask the customer whether he wishes to attempt to salvage the remaining data using the utility programs or his own methods. If the customer does not or can not salvage data, the CE should run utility program routines 1 and 4 as follows:

● Load the diagnostic/utility diskette in the diskette drive and press reset on the controller.
● When the control program has been loaded, BCB0 may display; respond with the model number of the 3604 that you are using, followed by enter (EM). BC80 should then display on this 3604.
● When BC80 is displayed, respond with 000001 EM (enter key); when 0012 is displayed, respond with F and EM (enter key).
● When 0014 is displayed, respond with C and EM (enter key).
● When the routine is complete, 0000 is displayed. Then respond with 000004 EM (enter key) to run routine 4.
● When 0045 is displayed, respond with C6 EM (enter key). This should write all sector IDs and zero all data fields. If a message of 0041,DDD is displayed, you have a permanent, unrecoverable disk defect, and the DE must be replaced.
● When the routine is complete (nearly 1 hour), there should be a normal completion message of 0044,DDD, where DDD is the decimal count of the sectors with alternates assigned (recoverable surface defects). Respond with C EM (enter key) to terminate.

Running these utilities clears and restores the DE IDs. All the data is now zeros.

**Note:** *See your branch office for correct methods of returning a used DE to ensure security of customer data. Inform the customer of methods available.*

**CAUTION:** Do not turn the motor spindle unless instructed to, and then in a clockwise direction only. See the direction arrow on the duct cover at the rear of the DE.

**CAUTION: The DE weighs approximately 37 lb. (12.25 kg.); locate a space for it before removal.**

1.   Disconnect the controller from the ac power source.
2.   Turn on the actuator lock **1** .
3.   Remove the DE card socket cover.
4.   Release the cable straps located at the side of the DE card sockets.
5.   Remove the cards and cable ends from the DE card sockets.
6.   Remove the drive belt guard **7** by loosening the two holding screws and lifting it off.
7.   Lock the spindle by loosening the two screws holding the spindle lock/anti-static brush, and by engaging the spindle locking pin on the spindle pulley **9** . Tighten the two holding screws.
8.   Remove the drive belt **5** after removing belt tension by pivoting the drive motor **6** upward.
9.   Disconnect the speed-sensing transducer **3** wires from TB1 **2** terminals 7 (black wire) and 8 (white wire). Unfasten these wires from the holder **4** .
10.  If present, disconnect the two wires from TB2 **11** terminals 1 (yellow wire) and 2 (black wire).
11.  Disconnect DE ground wire from TB1 **2** terminal 4.
12.  Disconnect DE ground strap **8** at the controller end.
13.  Ensure that the DE holding clip at the top of the disk storage subframe is engaged. See Detail A.
14.  Remove the three mounting nuts and washers **10** . See Detail B.

**CAUTION: When lifting away the DE, use care to prevent loose wires from being damaged.**

15.  Release the DE holding clip, and lift away the DE. Always support the DE on its three mounting screws **10** .

Holding Clip

Two-Coiled
Washer
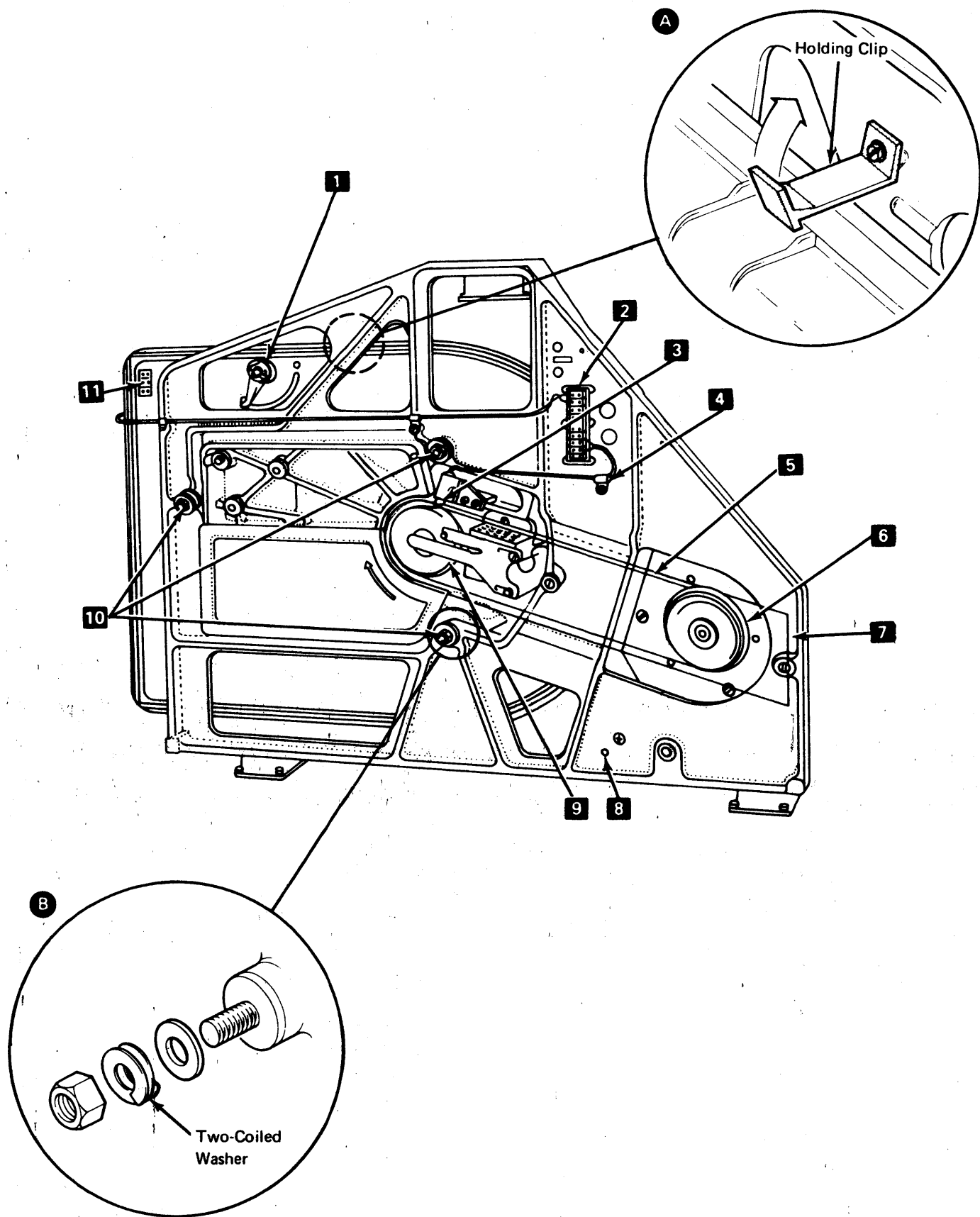
## 1.101 DISK ENCLOSURE (DE) REPLACEMENT

**Note:** *Instructions for packing and unpacking are supplied with each DE; one copy fastened outside the case, another inside the case. If both copies are missing, order PN 7373765.*

**CAUTION:** Do not turn the motor spindle unless instructed to, and then in a clockwise direction only. See the direction arrow on the duct cover at the rear of the DE.

**CAUTION:** When installing the DE, use care to prevent loose wires from being damaged.

1. Lift the DE onto the disk storage subframe. Push the three mounting screws **10** firmly into the rubber mounts, and ensure that the holding clip, at the top of the disk storage subframe, is engaged. See Detail B.

**Note:** *Alignment marks are provided on the disk storage subframe for positioning the top of the DE.*

2. Install the three sets of DE mounting nuts and washers (see Detail C) on the mounting screws **10**. Tighten each nut until its two-coiled washer is depressed.

3. Connect the DE ground strap **8** at the controller end.

4. Connect the DE ground wire to TB1 **2** terminal 4.

5. Connect the speed-sensing transducer wires to TB1 **2** terminals 7 (black wire) and 8 (white wire). Fasten these wires in the holder **4**.

6. Measure the space between the speed-sensing transducer **3** and the spindle pulley **9** for 0.006 ± 0.002-in. (0.1524 ± 0.0508 mm) gap. See Detail A. Adjust, if needed, by loosening the clamping screw.

7. If a yellow wire and a black wire are present near TB2 **11**, connect to terminals 1 (yellow wire) and 2 (black wire).

8. Install the drive belt **5**, smooth side against pulleys, after pivoting the drive motor **6** upward.

**CAUTION:** Ensure that the drive belt cannot touch the speed-sensing transducer.

9. Unlock the spindle by loosening the two screws holding the spindle lock/anti-static brush, and by disengaging the spindle locking pin on the spindle pulley **9**. Center the anti-static brush on the center pin of the spindle, and tighten the two holding screws.

10. Ensure that the anti-static brush has a pressure of approximately 60 grams on the center pin of the spindle. Adjust, if needed, by forming the brush.

11. Install the drive belt guard **7**.

12. Install the cards and cable ends in the DE card sockets. See DE cables (1.112).

13. Fasten the cable straps located at the side of the DE card sockets.

14. Install the DE card socket cover.

15. Turn off the actuator lock **1**.

16. Do the motor brake service check (1.104).

**CAUTION:** Before turning on power, allow 30 minutes for the DE to reach room temperature.

17. Run utility program routines 1 and 4 as follows to prepare the DE for 3602 use:

- Load the diagnostic/utility diskette in the diskette drive and press reset on the controller.
- When the control program has been loaded, BCB0 may display; respond with the model number of the 3604 that you are using, followed by enter (EM). BCB0 should then display on this 3604.
- When BC80 is displayed, respond with 000001 EM (enter key); when 0012 is displayed, respond with F and EM (enter key).
- When 0014 is displayed, respond with C and EM (enter key).
- When the routine is complete, 0000 is displayed. Then respond with 000004 EM (enter key) to run routine.
- When 0045 is displayed, respond with C6 EM (enter key). This should write all sector IDs and zero all data fields. If a message of 0041,DDD is displayed, you have a permanent, unrecoverable disk defect, and the DE must be replaced.
- When the routine is complete (nearly 1 hour), there should be a normal completion message of 0044,DDD, where DDD is the decimal count of the sectors with alternates assigned (recoverable surface defects). Respond with C EM (enter key) to terminate.

Running these utilities clears and restores the DE IDs. All the data is now zeros.

EC 745949

Two-Coiled
Washer
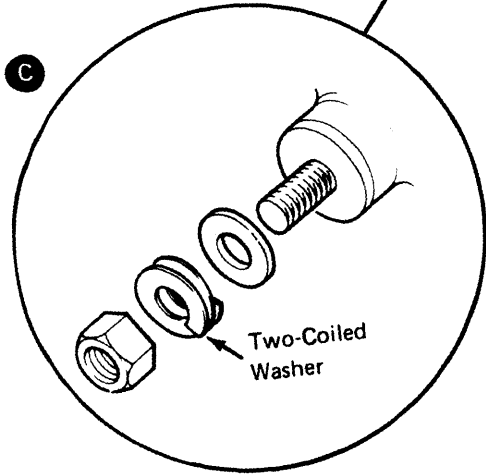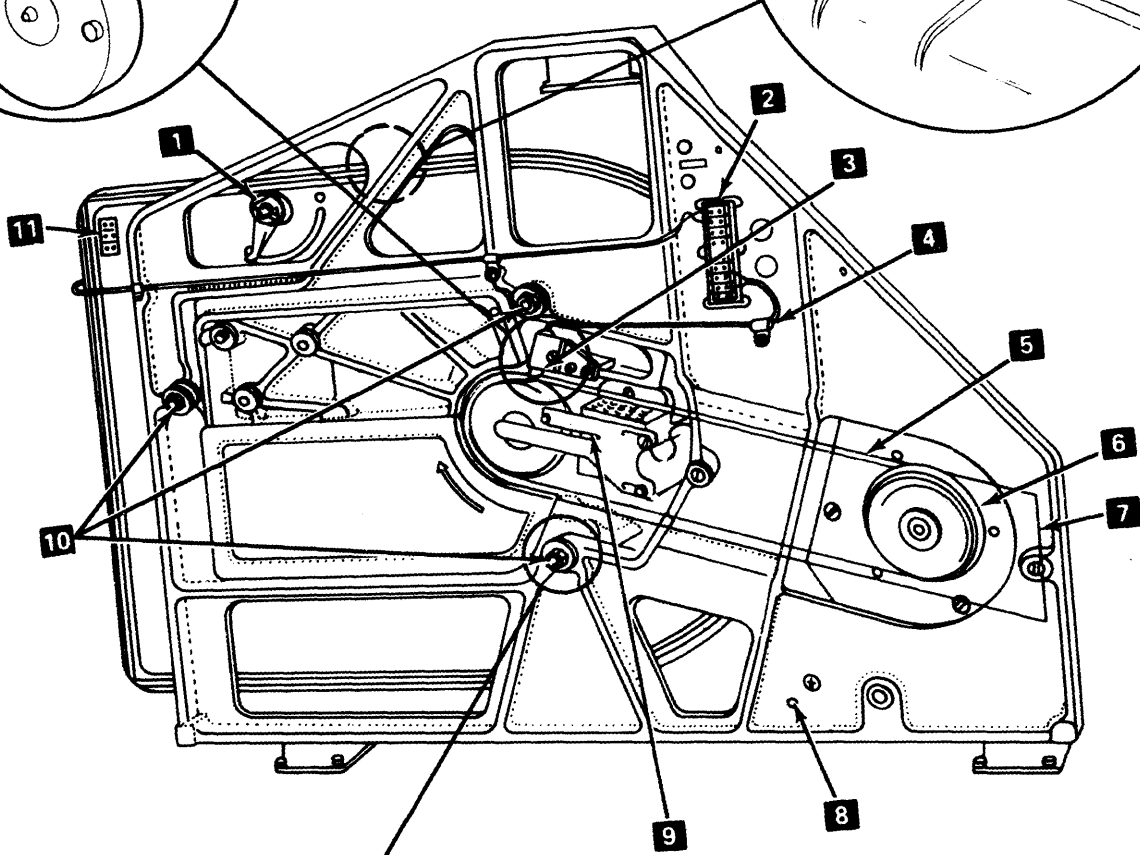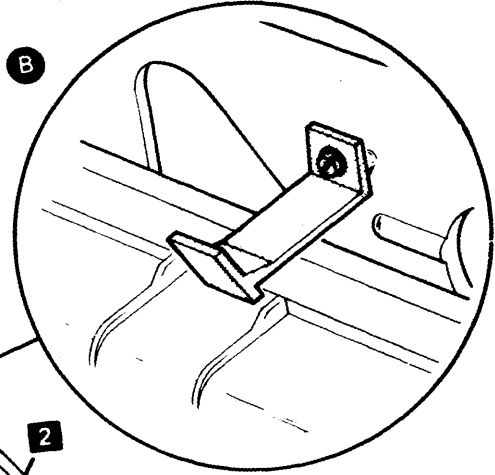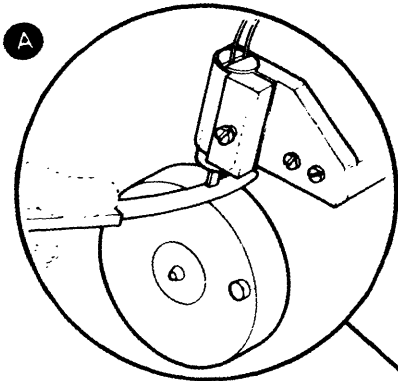
## 1.102  DISK MOTOR REMOVAL

CAUTION: Do not turn the motor spindle unless instructed to, and then in a clockwise direction only. See the direction arrow on the duct cover at the rear of the DE.

1. Disconnect the controller from the ac power source.
2. Turn on the actuator lock **1**.
3. Remove the drive belt guard **5** by loosening the two holding screws and lifting it off.
4. Lock the spindle by loosening the two screws holding the spindle lock/anti-static brush, and by engaging the spindle locking pin on the spindle pulley **6**. Tighten the two holding screws.
5. Remove the drive belt **3** after removing belt tension by pivoting the drive motor **4** upward.
6. Disconnect the motor wires from TB1 **2**, terminal 1, terminal 2, and terminal 3.
7. Disconnect the motor-brake wires from TB1 **2**, terminals 5 and 6.
8. Remove the three reusable cable straps that hold these wires (disconnected in steps 6 and 7) to the disk storage subframe.
9. Insert the blade of a large screwdriver through the center of the motor tension spring, and lift the spring from the motor mounting bracket. See Detail A.
10. Remove the locking clip and holding ring from the motor pivot pin.
11. Slide the motor assembly away from the disk storage subframe, and lift upward to clear the pivot pin.
12. Remove the motor from the mounting bracket by removing the three screws at the front of the bracket.
13. If required, remove the brake assembly (1.106).

## 1.103  DISK MOTOR REPLACEMENT

CAUTION: Do not turn the motor spindle unless instructed to, and then in a clockwise direction only. See the direction arrow on the duct cover at the rear of the DE.

1. Install the motor on its mounting bracket, ensuring that the motor vents face upward and the motor cable exits at the bottom left. Fasten the motor, using the three mounting screws.
2. Replace the brake assembly if it was removed (1.107).
3. Put a small amount of grease on the pivot points of the motor assembly.
4. Lift the motor assembly into position, and insert the pin on the motor mount into the hole in the disk storage subframe.
5. Lift the brake end of the motor assembly onto the pivot pin.
6. Install the holding ring on the pivot pin. Then install the holding clip on the pivot pin, pushing it into the slot with a screwdriver.
7. Lift the tension spring into its position on the motor mounting bracket. See Detail A.
8. Pivot the drive motor upward to ensure correct seating of the tension spring.
9. Connect the motor wires to TB1 **2**, terminal 1, terminal 2, and terminal 3.
10. Connect the motor-brake wires to TB1 **2**, terminals 5 and 6, as indicated by wire labels.
11. Install the three reusable cable straps that hold these wires (connected in steps 8 and 9) to the disk storage subframe.
12. Install the drive belt **3**, smooth side against pulleys, after pivoting the drive motor **4** upward.

CAUTION: Ensure that the drive belt cannot touch the speed-sensing transducer.

13. Unlock the spindle by loosening the two screws holding the spindle lock/anti-static brush, and by disengaging the spindle locking pin on the spindle pulley **6**. Center the anti-static brush on the center pin of the spindle, and tighten the two holding screws.
14. Ensure that the spindle anti-static brush has a pressure of approximately 60 grams on the center pin of the spindle. Adjust, if needed, by forming the brush.
15. Install the drive belt guard **5**.
16. Turn off the actuator lock **1**.

Tension
Spring

Mounting
Screw
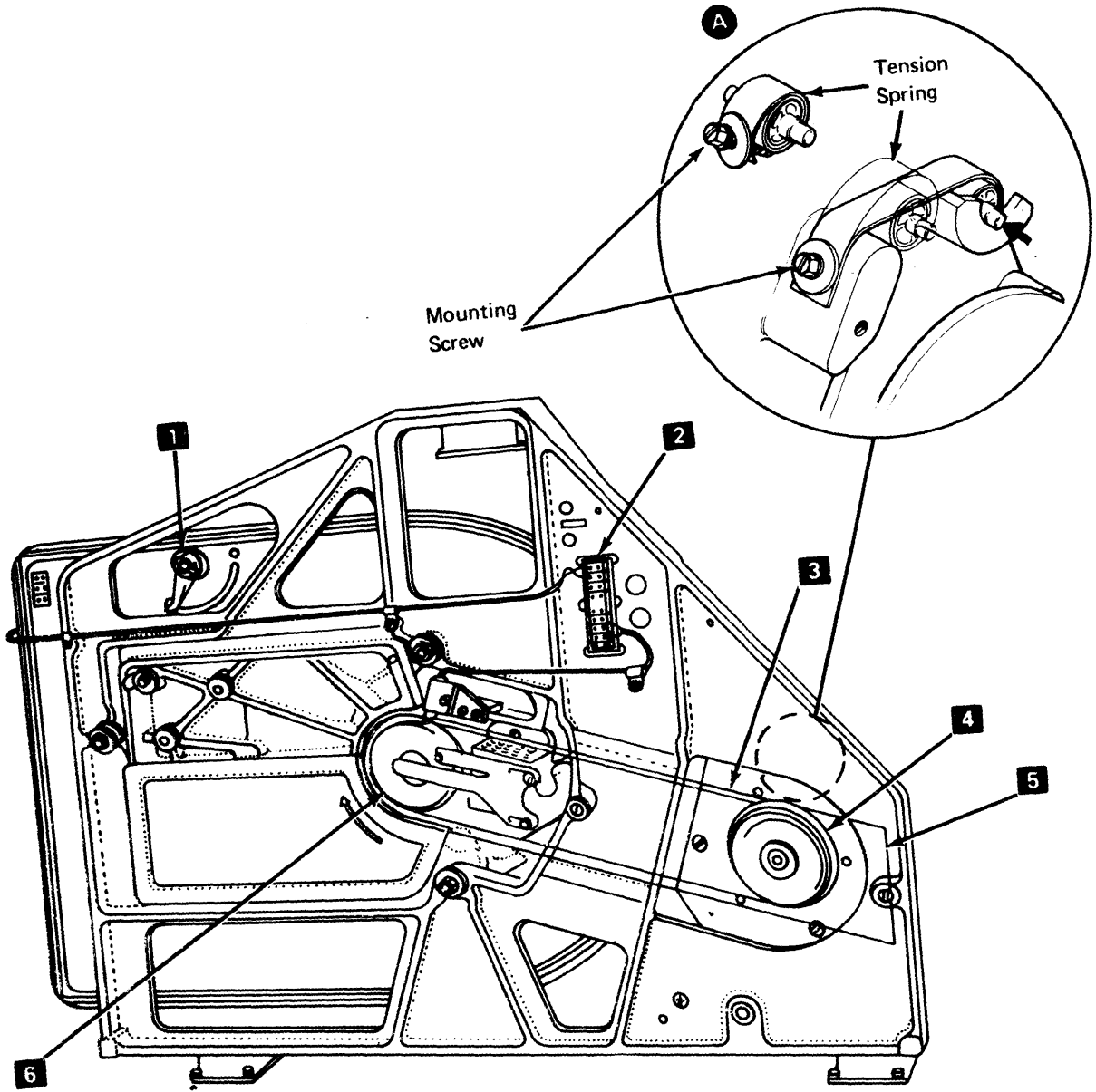
## 1.104 MOTOR BRAKE SERVICE CHECK

1. Disconnect the controller from the ac power source.
2. Disconnect the disk motor power plug at the ac power box.
3. Connect the controller to ac power, and turn on power.
4. The brake is now energized, and the gap **1** between the brake pad **2** and the brake plate **3** should be 0.005 to 0.010-in. (0.127 to 0.254 mm) at all three openings in the brake mount.
5. Turn off power.
6. Disconnect the controller from the ac power source.
7. The brake is now de-energized, and the gap **8** between the brake pad **7** and the brake coil **6** should be 0.005 to 0.010-in. (0.127 to 0.254 mm) at all three openings in the brake mount.
8. Connect disk motor power plug removed in step 2.
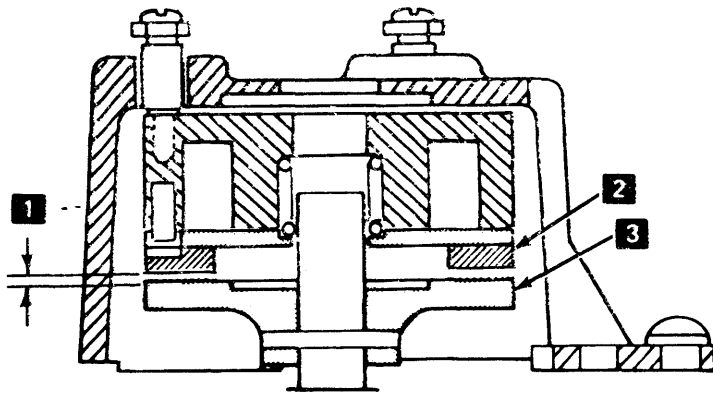
## 1.105 MOTOR BRAKE ADJUSTMENT

1. Disconnect the controller from the ac power source.
2. Loosen the three brake adjustment locking screws **4** .
3. Turn the three adjusting screws **5** slowly for 0.008-in. (0.203 mm) gap as measured in service check step 7.
4. Tighten the locking screws **4** , and do service check.
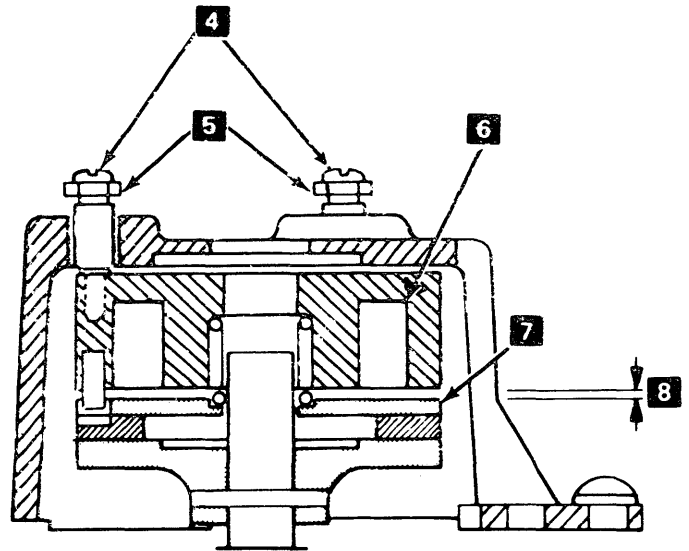
BLANK PAGE

## 1.106  MOTOR BRAKE ASSEMBLY REMOVAL

1.  Disconnect the controller from the ac power source.
2.  Cut open the cable strap **6** holding the motor and brake cables together, and also the strap **5** holding the brake cable to the brake mount.
3.  Remove the brake anti-static brush **3** by removing the screw holding it to the brake mount.
4.  Remove the ground wire **2** by removing the brake adjustment locking screw **1**. Replace the locking screw.
5.  Remove the three mounting screws **7** holding the brake assembly to the motor; also, remove ground wire **4**.
6.  Remove the brake assembly, including the brake pad **13** and spring **12**.

## 1.107  MOTOR BRAKE ASSEMBLY REPLACEMENT

1.  Loosen the three brake locking screws **8**.
2.  Turn the brake adjusting studs out until the brake coil **11** touches the brake mount **10**.
3.  Mount the brake assembly onto the rear of the motor. Ensure that the three slots in the brake pad **13** are aligned with the three pins on the brake coil **11**. When viewed from the rear of the motor, the hazard label should be on top and the cables from the motor and brake should run together at the bottom left.

4.  Install the three screws **7** holding the brake assembly to the motor, connecting the ground wire **4** under one of the screws.

CAUTION: Ensure that the brake mount **10** touches the motor end on each of the three mounting surfaces. The surfaces must not be pressed together by the screws **7**, as this would damage the brake assembly. If the surfaces do not touch using hand pressure, ensure that earlier assembly has been done correctly.

5.  Install the anti-static brush **3** and its ground cables **2** and **4**. Ensure that the brush has a pressure of approximately 60 grams on the center of the brake. Adjust, if needed, by forming the brush arm.
6.  Install the remaining ground wire **2** under one of the brake adjustment screws **1**.
7.  Tie the motor and brake cables with cable straps **5** and **6**.
8.  Do the motor brake service check (1.104).

EC 745948

Access to
Brake Pulley

Motor Assembly

**1**

**2**

**3**

**4**

**6**

**5**

**7**

**8**

**9**

**10**

**11**

**12**

**13**

Brake Assembly
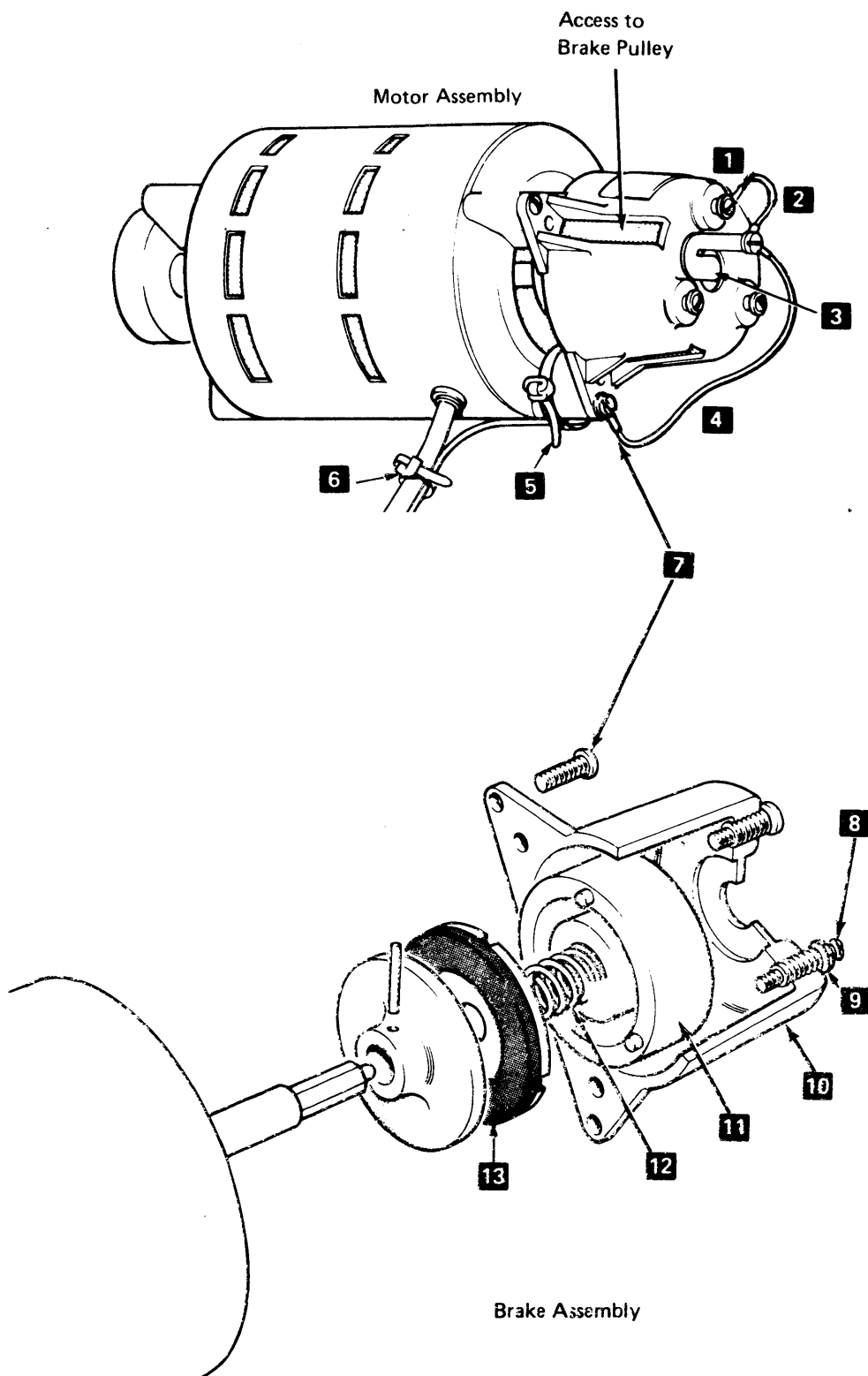
## 1.108  SPEED-SENSING TRANSDUCER SERVICE CHECK

1. Turn off power.
2. Measure for approximately 300 ohms resistance between points 01A1A5D10 and 01A1A5D11. If measurement is incorrect, replace the transducer **2** and do the adjustment (1.109).
3. Connect a CE Probe to the transducer signal, as follows:

| Switch | Position |
|---|---|
| TECHNOLOGY | MULTI |
| LATCH | NONE |
| GATE | OFF |

Connect probe signal lead to 01A1A5D11, and probe reference lead to 01A1A5D10.

Power leads

+ (red) to any card socket D03 pin (+5V).
- (black) to any card socket D08 pin (Ground).

4. Turn on power.
5. With the disk turning, both probe lights should be on. If not, do the adjustment(1.109). If adjustment was correct, replace transducer.

## 1.109  SPEED-SENSING TRANSDUCER ADJUSTMENT

CAUTION: Do not turn the spindle **4** during the following procedure.

1. Disconnect the controller from the ac power source.
2. Turn on the actuator lock **1** .
3. Remove the drive belt guard **3** .
4. Measure the space between the transducer **2** and the spindle pulley **4** for 0.006 ± 0.002-in. (0.1524 ± 0.0508 mm); see Detail A. Adjust, if needed, by loosening the transducer clamping screw.
5. Install the drive belt guard **3** .
6. Turn off the actuator lock **1** .

## 1.110  ANTI-STATIC BRUSH SERVICE CHECK

1. Disconnect the controller from ac power.
2. Remove the drive belt guard **3** .
3. Ensure that the anti-static brush for the spindle **4** , has a pressure of approximately 60 grams on the center of the spindle. Adjust, if needed, by forming the brush arm.
4. Ensure that the anti-static brush for the brake has a pressure of approximately 60 grams on the center of the brake. Adjust, if needed, by forming the brush arm.
5. Install the drive belt guard **3** .

A

Clamping
Screw

Transducer

Transducer
Bracket

1

2

3

4

01A1A5D11 — TB1-7 — Black

Speed-Sensing
Transducer

01A1A5D10 — TB1-8 — White

SY27-2519-0

1.108—1.110
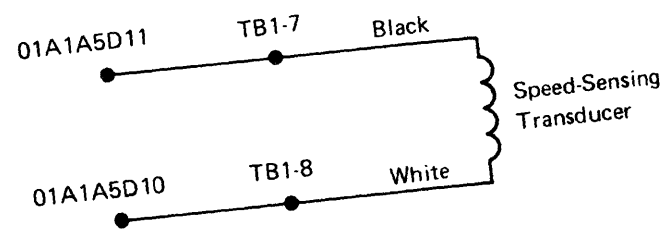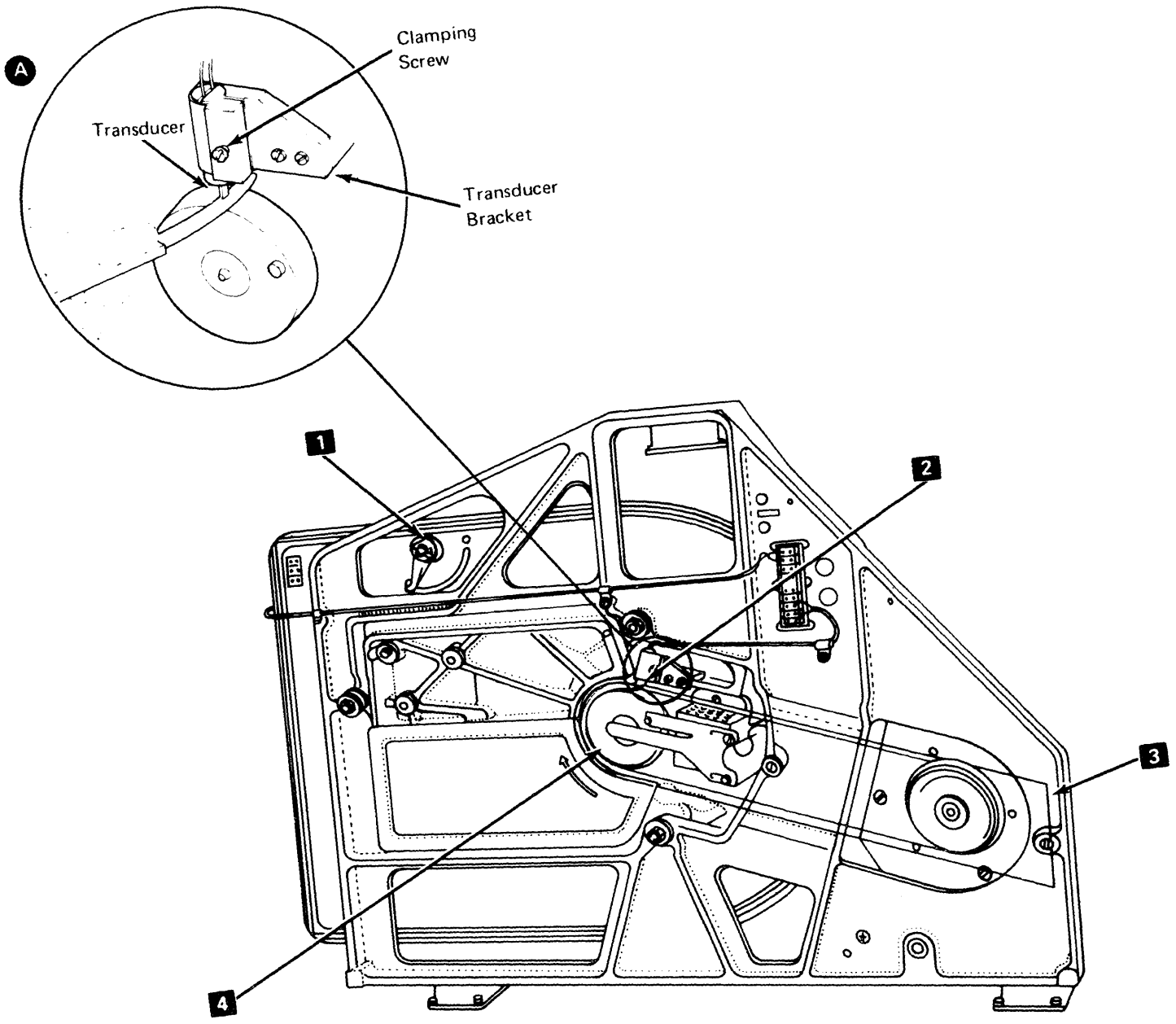
## 1.111   DISK STORAGE CARD JUMPERS
### (PN 1794401)

01A1G2

```
┌─────────────────────────────────────┐
│              Disk Size               │
│                                      │
│                                      │
│                                      │
│                                      │
│              ⌒  Model 1B Only        │
│              ⌒  Model 1A Only        │
│                                      │
└─┘ └─┘     └─┘      └─┘   └─┘ └─┘
```
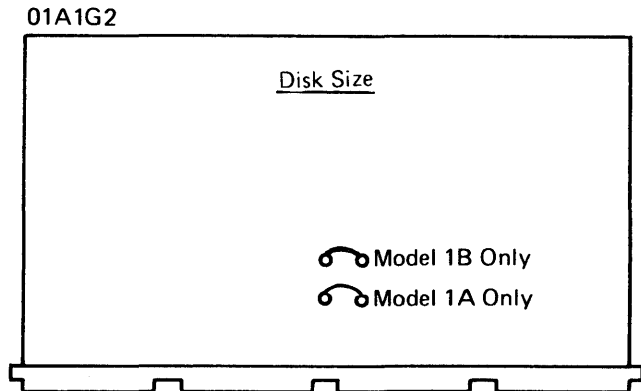
**Notes:** *01-B1 board requires back panel connection from H2B09 to F6C04. 01-A1 board requires back panel connections defining installed disk storage size:*

**Model 1A (5.2 Meg.)**

| W/O Fixed Heads | D3D09 to C4B10<br>J3D11 to J3D10<br>A3D02 to A3D10 |
|---|---|
| With Fixed Heads | D3D09 to C4B10<br>J3D11 to J3D10<br>M5D13 to M5D08 |

**Model 1B (9.3 Meg.)**

| W/O Fixed Heads | B5D09 to D2D09<br>B5D10 to D4D07<br>J3D10 to J3D08<br>D4D05 to K3D10<br>D4D06 to K3B13<br>M5D11 to M5D08<br>A3D02 to A3D10 |
|---|---|
| With Fixed Heads | B5D09 to D2D09<br>B5D10 to D4D07<br>J3D10 to J3D08<br>D4D05 to K3D10<br>D4D06 to K3B13<br>M5D11 to M5D08<br>M5D13 to M5D08 |

See Caution → 01A1J2

Top Card Connectors

```
┌─────────────────────────────────────┐
│     o  o Lvl 2                       │
│     o  o Lvl 3        Interrupt Level│
│     o  o Lvl 1                       │
│     ⌒    Model 1A Only               │
│    ⌒  Lvl 4  Models 1A and 1B        │
│     o  o Lvl 5                       │
│     o  o Lvl 7                       │
│     o  o Lvl 6                       │
│       ▭              ▭               │
└─────────────────────────────────────┘
```

Capacitors

See Caution → 01A1K2

Top Card Connectors

```
┌─────────────────────────────────────┐
│          Addressing                  │
│   Bit 0  o   o                       │
│   Bit 1  o   o   o   o Bit 5         │
│   Bit 2  o   o   o   o Bit 6         │
│   Bit 3  ⌒   o   o Bit 7             │
│              o Bit 4  o              │
│   Models 1A and 1B                   │
│       ▭              ▭               │
└─────────────────────────────────────┘
```
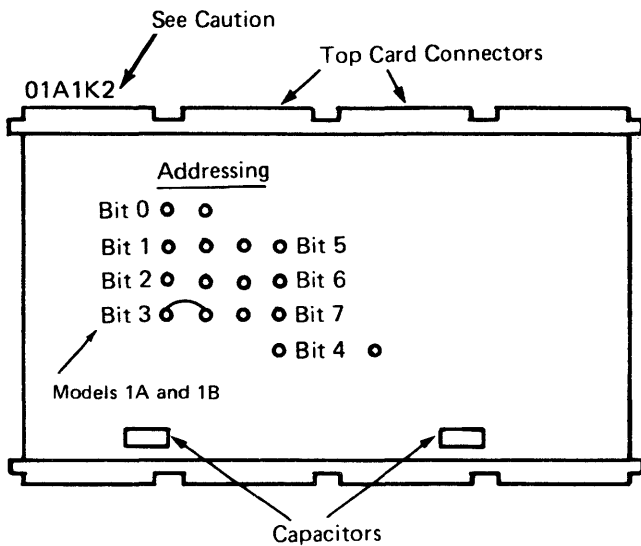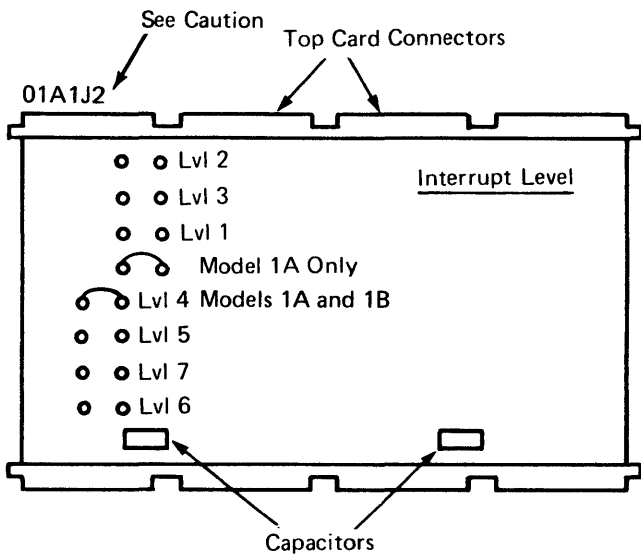
Capacitors

**CAUTION:** To avoid plugging card in backwards, note the location of the capacitors and plug in the card with the capacitors towards the socket.

EC 745948

## 1.112 DE CABLES



Cable 1 → To TB1 Terminals 1, 2, and 3
A2 Fixed Head
Cable 2 → 01A1A5 Transducer, Brake, Drive
Cable 3 → 01A1A2 Servo Preamp
Cable 6 → 01A1A3 Fixed Heads
B3 Preamplifier and Write Select Card
Cable 4 → 01A1A4 Read/Write Logic
A5 Data, AGC Detector Card
Cable 5 → 01A1Y1 (Card Side) Read/Write Data
AB
W1 Board
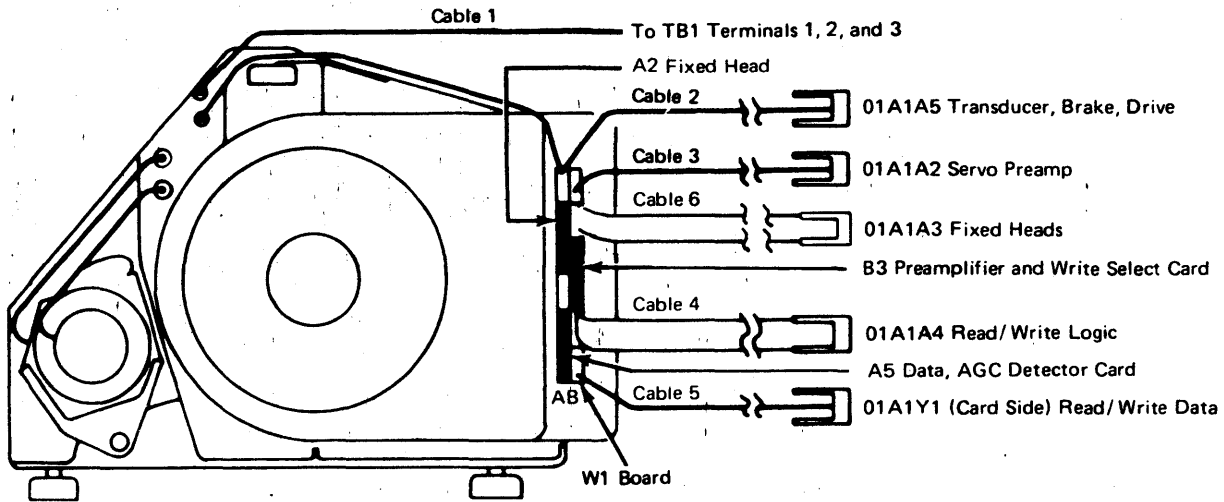
### Cable 1 (Disk Drive Motor)

| | Disk TB1 | Wire Number | 208, 230, 220, 235V ac | 115V ac |
|---|---|---|---|---|
| Disk Drive Motor | 1 | 1 | Line | Neutral |
| | 2 | 2 | Ground | Ground |
| | 3 | 3 | Line | Line |
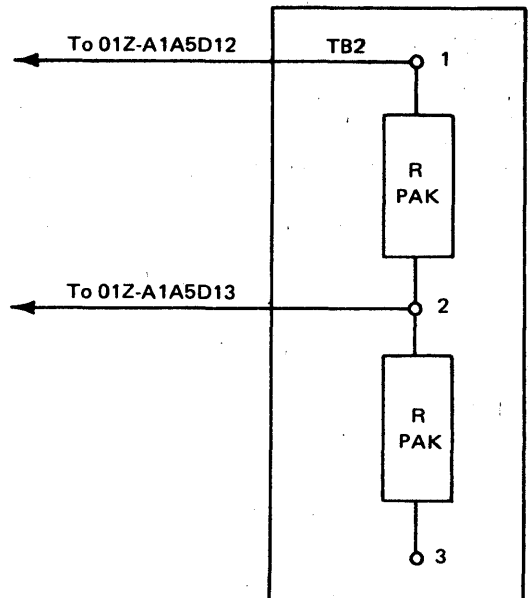
### Cable 2 01X-W1A1 to 01A1A5

| | Disk TB1 | W1 Logic Board Plugging Position and Pin Number | 01A1A5 Cable Connector Contact Number |
|---|---|---|---|
| Motor | 5 | | B07 |
| Brake | 6 | | B05 |
| Speed | 7 | | D11 |
| Transducer | 8 | | D10 |
| | | A1B02 | B02 |
| | | A1B03 | B03 |
| | | A1B04 | B04 |
| | | A1B07 | B08 |
| | | A1D02 | D02 |
| | | A1D07 | D07 |
| | | A1D09 | D08 |
| | Disk TB2 | | |
| 1B Only | 1 | | D12 |
| | 2 | | D13 |

**Disk TB2**
**(Not present on Mod 1A)**

To 01Z-A1A5D12 → TB2 1
R PAK
To 01Z-A1A5D13 → 2
R PAK
3

### Cable 3 01X-W1B1 to 01A1A2 (Servo Amp)

| W1 Board Plugging Position and Pin Number | 01A1 Board Plugging Position and Pin Number |
|---|---|
| B1D04 | A2D04 |
| B1D05 | A2D05 |

## 1.112 DE CABLES (Cont)

Cable Connector
Contact Numbers

| D02 | □ □ | B02 |
| D03 | □ □ | B03 |
| D04 | □ □ | B04 |
| D05 | □ □ | B05 |
| D06 | □ □ | B06 |
| D07 | □ □ | B07 |
| D08 | □ □ | B08 |
| D09 | □ □ | B09 |
| D10 | □ □ | B10 |
| D11 | □ □ | B11 |
| D12 | □ □ | B12 |
| D13 | □ □ | B13 |

### Cable 4 01X-W1B5 to 01A1A4

| Cable Connection | | |
|---|---|---|
| 01X-W1B5B11 | to | 01A1A4B11 |
| B06 | to | B06 |
| B13 | to | B13 |
| B09 | to | B09 |
| B08 | to | B08 |
| B12 | to | B12 |
| D06 | to | D06 |
| D05 | to | D05 |
| D09 | to | D09 |
| B04 | to | B04 |
| B03 | to | B03 |
| 01X-W1B5D12 | to | 01A1A4D12 |
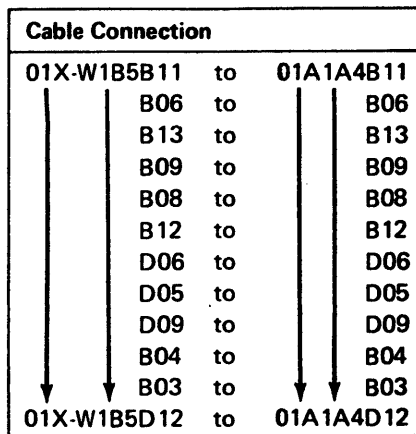
### Cable 5 01X-W1B6 to 01A1Y1

| Cable Connection |
|---|
| 01X-W1B6D11 to 01A1C1C11 |
| 01X-W1B6D13 to 01A1C1E11 |

### Cable 6 01X-W1B2 to 01A1A3

| Cable Connection | | |
|---|---|---|
| 01X-W1B2B03 | to | 01A1A3B03 |
| B04 | to | B04 |
| B05 | to | B05 |
| B07 | to | B07 |
| B08 | to | B08 |
| B09 | to | B09 |
| B10 | to | B10 |
| B12 | to | B12 |
| D02 | to | D02 |
| D03 | to | D03 |
| D04 | to | D04 |
| D05 | to | D05 |
| D06 | to | D06 |
| D07 | to | D07 |
| D09 | to | D09 |
| D10 | to | D10 |
| D11 | to | D11 |
| 01X-W1B2D13 | to | 01A1A3D13 |

EC 745948
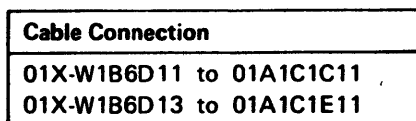
## 1.113   DE BRAKE CIRCUIT
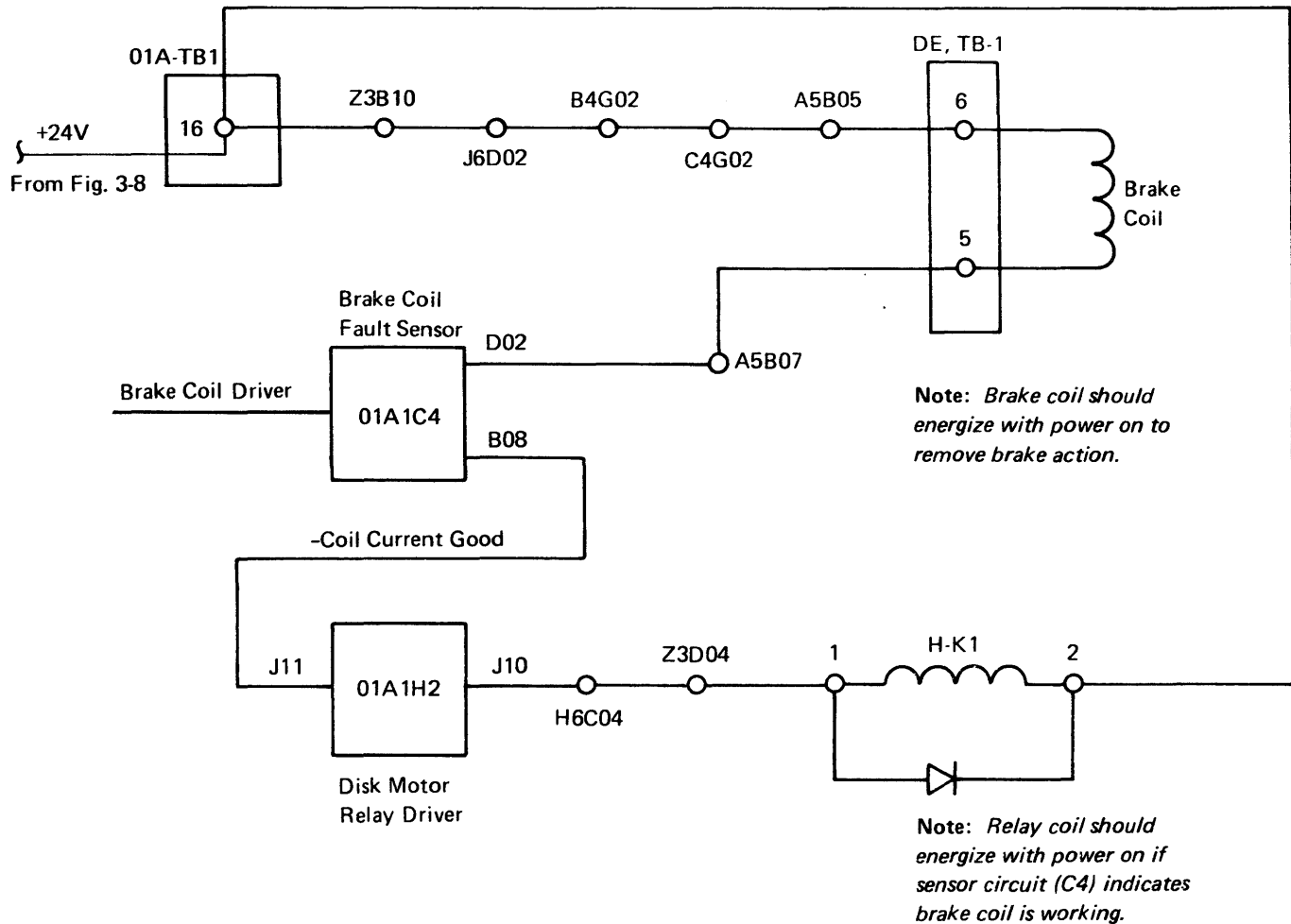


- Measure 24V at 01ATB1-16

- To test continuity, turn off power and remove cards A1C4 and A1H2.

- Measure between TB1-16 and 01A1C4D02 for approximately 100 ohms.

- Between TB1-16 and 01A1H2J10, an ohmmeter should read approximately 25 ohms in one direction and 250 ohms in the other.

- Ensure that cabling is not shorted to anything else.

- Correct any problem found or, if continuity is good, replace the two cards.

## 1.114  DISK STORAGE DIAGNOSTIC RUN

Note: *The results of this diagnostic are valid only if the complete procedure is followed from power on or reset. The diagnostic expects to start from a reset condition.*

1.  Power off all terminals other than the 3604 at address 1 on loop 1, to prevent interference.
2.  Insert the diagnostic diskette and activate the controller power-on or reset switch.
3.  When the control program has been loaded, BCB0 may display; respond with the model number of the 3604 that you are using, followed by enter (EM). BC80 should then display on this 3604.
4.  Key in 1010 and press enter (EM). This command selects and runs all disk storage tests that do not require manual intervention.*
5.  Messages will be displayed defining machine status:

|          |     |                                                                                                                                                          |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000     | =   | Tests completed successfully.                                                                                                                             |
| 1080     | =   | Temporarily unable to do input/ output. This is normal for short periods of time during the tests. A stop (1 minute or more) at this point indicates a controller problem; see MAP2. |
| 10EE X-X | =   | Machine failure where X-X is error code data. The first two digits are the number of the failing routine. See the Disk Diagnostic Error Codes. |
| 10F0     | =   | Test is running.                                                                                                                                          |
| BCXX     | =   | Procedure error; see Chapter 3, section 3.12.4.                                                                                                           |

Note: *The diagnostic run can be ended at any time by pressing the free (FR) key on the 3604 (refer to 1.2 for keyboard locations).*

CAUTION: **Do not use reset to end. This could terminate an incomplete write operation. Use the free (FR) key.**

---

*For more information on command codes and test routines, see Chapter 3, section 3.12.

## 1.115  DISK DIAGNOSTIC ERROR CODES

The following error codes are displayed following error message 10EE. These codes direct you to replace the FRUs in the most likely sequence to solve the failure. Return each FRU that does not solve the problem.

CAUTION: **Turn power off when changing cards.**

The first two digits of the error code are the number of the failing routine. Generally, error code stops on routines that read can be caused by the disk data having been destroyed. Refer to the routine description in 3.12.3 to determine if a routine or utility program should be run to try to correct or eliminate this as a cause of the error code stop. Refer to the example on the following page.

Try to find a completely matching code. Ignore the "X" character if it appears in the list. The "X" has the following meaning per the jumpering in 1.111:

0 = 5 Meg, no fixed heads.
1 = 10 Meg, no fixed heads.
4 = 5 Meg, fixed heads.
5 = 10 Meg, fixed heads.

If you cannot find a complete match, try to match only the first 4 characters to the codes in the list with the "*". All cards are located on 01A1 board, except B3, A2 and A5, which are located on the DE. Any other exceptions will be noted. If the error code stop changes when you replace a card, consider the following:

1. Any change in the error code stop may mean that the replacement card was defective or there is more than one problem on the machine.
2. A higher error code stop probably indicates that the replacement card was good, but that there is a second problem. The second problem may be another card or the contents of the disk may have been destroyed by the first defective card. You can try to correct the disk data by running a write routine or one of the utility programs as described in Chapter 3.
3. A lower error code stop probably indicates that the replacement card was defective. If you could not find a match, or if card replacement did not correct the problem, return to the MAP step that you came from.

Note: *Be sure to check jumpers on cards 01A1G2, J2, and K2 (1.111).*

**Example:**

An example of the sequence of steps that may be required to resolve a customer problem is as follows:

Customer reports problem — probably by an 11 007 error log message.

CE runs diagnostic — error stop 421A 0083 1001 X013 0268 9700

1. The CE determines that the first two digits are 42, which is the failing routine. By referring to 3.12.3, the CE determines that routine 42 is a write-then-read sector ID on the CE cylinder; therefore, the problem is not because of bad data on the disk. Error code list 1.115 directs the CE to replace cards. When the diagnostic is run the second time, there is a 4191 message. By looking at 3.12.3, the CE determines that routine 41 reads the IDs on the CE cylinder; therefore, this error stop can be caused by bad data on the disk.

2. The CE should run only routine 42 as he is trying to correct the original error stop by changing the FRUs listed. In this case the third card corrects the problem.

3. The CE then runs the whole diagnostic again. This time he gets a 4993 error message. Again, by looking at 3.12.3, he could determine that this is a read of the fixed head IDs.

4. The CE should then run routine 50 to write the fixed head IDs.

5. The CE should then run the whole diagnostic again. This time it runs error free.

6. The CE then returns the system to the customer.

7. The customer may then get another 11 007 message indicating disk data is still bad per MAP 11-2.

8. The CE should then advise the customer that some information that was on the disk has been destroyed.

9. The CE should ask if the customer wishes to attempt to salvage the remaining data using the utility programs or his own methods.

10. If the customer does not or can not salvage data, the CE should run utility program routines 1 and 4 as follows:
    Load the diagnostic/utility diskette in the diskette drive and press reset on the controller. When the control program has been loaded, BCB0 may display; respond with the model number of the 3604 that you are using, followed by enter (EM). When BC80 is displayed, respond with 000001 EM (enter key); when 0012 is displayed, respond with F and EM (enter key). When 0014 is displayed, respond with C and EM (enter key). When the routine is complete, 0000 will display. Then respond with 000004 EM (enter key) to run routine 4. When 0045 is displayed, respond with C6 EM (enter key). This should write all sector IDs and zero all data fields. If a message of 0041,DDD is displayed, you have a permanent, unrecoverable disk defect, and the DE must be replaced. When the routine is complete (nearly 1 hour), there should be a normal completion message of 0044,DDD where DDD is the decimal count of the sectors with alternates assigned (recoverable surface defects). Respond with C EM (enter key) to terminate.

11. Running these utilities clears and restores the DE IDs. All the data is now zeros.

## 1.115  DISK DIAGNOSTIC ERROR CODES (Cont)

(These codes follow the "10EE" message.)

| Code | | | FRUs | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| * 0000 | | | F2 | L2 | | | | | |
| * 0168 | | | F2 | G2 | H2 | J2 | | | |

For Error Code 0181, check that 01A1 has power (Fig. 3-8) and that it is cabled to 01A2 (1.112).

| Code | | | FRUs | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| * 0181 | | | * | F2 | 01A2M2 | | | | |
| * 0183 | | | F2 | K2 | J2 | | | | |
| 0183 | 525C | | F2 | J2 | | | | | |
| * 0185 | | | C2 | K2 | H2 | F2 | D2 | B3 | G2 | L2 |
| 0185 | 0210 | | G2 | K2 | | | | | |
| 0185 | 0410 | | G2 | K2 | | | | | |
| 0185 | 0411 | | G2 | | | | | | |
| 0185 | 0810 | | H2 | K2 | | | | | |
| 0185 | 1010 | | D2 | K2 | C2 | F2 | G2 | B3 | |
| 0185 | 2010 | | G2 | K2 | | | | | |
| 0185 | 4010 | | F2 | K2 | | | | | |
| 0185 | 8010 | | F2 | K2 | L2 | | | | |
| * 0187 | | | G2 | | | | | | |
| * 0189 | | | F2 | G2 | H2 | J2 | K2 | L2 | |
| 0189 | 0011 | | H2 | F2 | G2 | J2 | | | |
| 0189 | 0012 | | F2 | J2 | | | | | |
| 0189 | 0014 | | F2 | J2 | | | | | |
| 0189 | 0017 | | F2 | J2 | L2 | | | | |
| 0189 | 0018 | | F2 | J2 | | | | | |
| 0189 | 0020 | | J2 | H2 | | | | | |
| 0189 | 0030 | | J2 | F2 | G2 | H2 | | | |
| 0189 | 0050 | | G2 | H2 | J2 | | | | |
| 0189 | 0051 | | L2 | G2 | H2 | | | | |
| 0189 | 0080 | | F2 | H2 | | | | | |
| 0189 | 0090 | | K2 | J2 | H2 | | | | |
| * 0191 | | | G2 | F2 | J2 | L2 | | | |
| 0191 | 0010 | 0010 | F2 | G2 | L2 | | | | |
| 0191 | 8014 | 0010 | J2 | G2 | | | | | |
| * 0193 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0195 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0197 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0199 | | | F2 | J2 | H2 | G2 | K2 | | |
| * 019B | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 019D | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 019F | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 01A0 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 01A1 | | | F2 | G2 | | | | | |
| * 01A2 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | FRUs | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| * 0283 | | | J2 | K2 | L2 | F2 | | | |
| * 0285 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0287 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0289 | | | K2 | F2 | J2 | | | | |
| * 028B | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 028D | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 028F | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0291 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0293 | | | M2 | J2 | F2 | K2 | L2 | | |
| 0293 | 0010 | 0000 | F2 | M2 | K2 | J2 | L2 | | |
| 0293 | 0010 | 0070 | F2 | | | | | | |
| 0293 | 0010 | 0080 | F2 | | | | | | |
| 0293 | 0010 | 00C3 | K2 | | | | | | |
| 0293 | 0010 | 00D1 | J2 | | | | | | |
| * 0295 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0297 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0299 | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 029B | | | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 029D | | | M2 | J2 | F2 | D2 | | | |
| 029D | 0010 | 0002 | M2 | J2 | D2 | | | | |
| 029D | 0010 | 00FF | J2 | K2 | | | | | |
| 029D | 0010 | F270 | M2 | F2 | | | | | |

For error codes beginning with 03XX, perform the transducer service checks first (1.108).

| Code | | | FRUs | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| * 0391 | | | * | C4 | B4 | D2 | H2 | M2 | |
| * 0393 | | | * | C4 | F2 | L2 | M2 | | |
| * 0395 | | | * | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0397 | | | * | F2 | J2 | K2 | L2 | M2 | H2 | G2 |
| * 0399 | | | * | C4 | H2 | B2 | D2 | M2 | |
| * 039B | | | * | F2 | J2 | K2 | L2 | M2 | H2 | G2 |

For error codes beginning with 04XX, ensure that the actuator lock is off. Run routine 56 first. If it does not isolate the failure, return to this list.

| Code | | | | | | FRUs | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| * 0471 | | | | | | * | L2 | M2 | G2 | | | | | | |
| * 0475 | | | | | | * | L2 | | | | | | | | |
| * 0491 | | | | | | * | D2 | G2 | | | | | | | |
| 0491 | 1010 | 1005 | X000 | 0450 | | * | G2 | | | | | | | | |
| 0491 | 1010 | 1005 | X000 | 0650 | | * | G2 | | | | | | | | |
| * 0493 | | | | | | * | D2 | C4 | M2 | | | | | | |
| * 0495 | | | | | | * | D2 | B2 | B4 | C4 | C2 | F2 | G2 | H2 | M2 | J2 |
| 0495 | 0000 | 1001 | X000 | 0278 | 0400 | * | D2 | M2 | | | | | | | |
| 0495 | 0000 | 1001 | X000 | 02E8 | 0400 | * | C4 | D2 | | | | | | | |
| 0495 | 0000 | 1001 | X000 | 03D8 | 0400 | * | D2 | M2 | G2 | | | | | | |
| 0495 | 0000 | 1001 | X000 | 0648 | 0400 | * | C4 | D2 | M2 | | | | | | |
| 0495 | 0000 | 1001 | X000 | 0668 | 0400 | * | D2 | C4 | | | | | | | |
| 0495 | 0010 | 1000 | X000 | B050 | 0410 | * | D2 | C2 | | | | | | | |
| 0495 | 0010 | 1000 | X000 | B070 | 0410 | * | D2 | B4 | | | | | | | |
| 0495 | 0010 | 1000 | X000 | F270 | 0410 | * | F2 | G2 | H2 | J2 | L2 | | | | |
| 0495 | 0010 | 1001 | X000 | 0050 | 0410 | * | C4 | D2 | | | | | | | |
| 0495 | 0010 | 1001 | X000 | 0250 | 0410 | * | C4 | B4 | | | | | | | |
| 0495 | 0010 | 1001 | X000 | 0258 | 0410 | * | C4 | D2 | | | | | | | |
| 0495 | 0010 | 1001 | X000 | 0278 | 0410 | * | B4 | D2 | B2 | C4 | M2 | | | | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | | FRUs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0495 | 0010 | 1001 | X000 | 0450 | 0410 | * | D2 | B4 | B2 | | |
| 0495 | 0010 | 1001 | X000 | 0650 | 0410 | * | B4 | D2 | | | |
| 0495 | 0010 | 1001 | X000 | 1258 | 0410 | * | D2 | M2 | | | |
| 0495 | 0010 | 1001 | X000 | 2A40 | 0410 | * | D2 | C4 | | | |
| 0495 | 0010 | 1001 | X000 | 2C50 | 0410 | * | C4 | B2 | B4 | D2 | M2 |
| 0495 | 0010 | 1001 | X000 | 2E50 | 0410 | * | C4 | D2 | C2 | M2 | |
| 0495 | 0010 | 1001 | X000 | 3050 | 0410 | * | G2 | D2 | C4 | B4 | |
| 0495 | 0010 | 1001 | X000 | 3250 | 0410 | * | D2 | M2 | | | |
| 0495 | 0010 | 1001 | X000 | 3270 | 0410 | * | B4 | B2 | C4 | | |
| 0495 | 0010 | 1001 | X000 | 8A50 | 0410 | * | D2 | B4 | G2 | M2 | |
| 0495 | 0010 | 1001 | X000 | A270 | 0410 | * | D2 | C4 | M2 | B4 | |
| 0495 | 0010 | 1001 | X000 | AA40 | 0410 | * | D2 | G2 | J2 | M2 | |
| 0495 | 0010 | 1001 | X000 | AA50 | 0410 | * | D2 | G2 | C4 | | |
| 0495 | 0010 | 1001 | X000 | AC50 | 0410 | * | D2 | C4 | B4 | B2 | M2 |
| 0495 | 0010 | 1001 | X000 | AE50 | 0410 | * | C4 | D2 | M2 | | |
| 0495 | 0010 | 1001 | X000 | AE70 | 0410 | * | D2 | C4 | M2 | B4 | |
| 0495 | 0010 | 1001 | X000 | B050 | 0410 | * | D2 | B4 | B2 | C4 | |
| 0495 | 0010 | 1001 | X000 | B250 | 0410 | * | B4 | D2 | J2 | M2 | |
| 0495 | 0010 | 1001 | X000 | B270 | 0410 | * | D2 | B4 | | | |
| 0495 | 0010 | 1001 | X000 | B450 | 0410 | * | B2 | B4 | C4 | D2 | |
| 0495 | 0010 | 1001 | X000 | EE50 | 0410 | * | B4 | C4 | | | |
| 0495 | 0010 | 1001 | X000 | EE70 | 0410 | * | B4 | B2 | C4 | | |
| 0495 | 0010 | 1001 | X000 | F250 | 0410 | * | B2 | B4 | D2 | | |
| 0495 | 0010 | 1001 | X000 | F270 | 0410 | * | B2 | D2 | B4 | C4 | K2 | F2 |
| 0495 | 0010 | 1401 | X000 | 2C50 | 0410 | * | G2 | | | | |
| 0495 | 0010 | 1401 | X000 | 3250 | 0410 | * | G2 | | | | |
| * 0497 | | | | | | * | M2 | | | | |
| * 0499 | | | | | | * | M2 | F2 | D2 | G2 | J2 |
| 0499 | 0000 | 1001 | X000 | 02F0 | 0400 | * | D2 | | | | |
| 0499 | 0020 | 9141 | X001 | 02F8 | 0420 | * | F2 | | | | |
| * 049B | | | | | | * | D2 | C4 | F2 | G2 | J2 |
| * 1075 | | | | | | F2 | L2 | J2 | K2 | | |
| 1075 | 0000 | 1001 | X004 | 02E8 | 0380 | L2 | F2 | | | | |
| 1075 | 0049 | 1001 | X071 | 02E8 | 0140 | J2 | K2 | | | | |
| * 1078 | | | | | | F2 | J2 | K2 | G2 | H2 | L2 |
| 1078 | 0000 | 0000 | X000 | 02E8 | | F2 | K2 | J2 | | | |
| 1078 | 0000 | 1001 | X000 | 02E8 | | F2 | J2 | G2 | H2 | L2 | |
| * 107A | | | | | | G2 | | | | | |
| * 107B | | | | | | L2 | G2 | K2 | H2 | F2 | |
| 107B | 0020 | 1041 | X008 | 02E8 | | L2 | | | | | |
| 107B | 0020 | 1141 | X000 | 02E8 | | G2 | H2 | K2 | | | |
| 107B | 0020 | 1141 | X008 | 02E8 | | L2 | F2 | G2 | | | |
| 107B | 0020 | 9141 | X000 | 02E8 | | F2 | K2 | L2 | | | |
| * 107C | | | | | | F2 | H2 | | | | |
| * 107F | | | | | | F2 | J2 | K2 | G2 | H2 | L2 |
| * 1081 | | | | | | F2 | G2 | H2 | J2 | L2 | |
| 1081 | 0000 | 0000 | | | | F2 | J2 | G2 | H2 | | |
| 1081 | 0801 | 0000 | | | | G2 | F2 | H2 | L2 | | |
| * 1083 | | | | | | L2 | F2 | M2 | G2 | H2 | K2 |
| 1083 | X000 | 0000 | | | | F2 | L2 | M2 | K2 | | |
| 1083 | X008 | 0000 | | | | L2 | F2 | G2 | H2 | | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | FRUs | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| * 1084 | | | G2 | J2 | F2 | D2 | H2 | K2 | M2 |
| 1084 | 0011 | 0000 | K2 | | | | | | |
| 1084 | 00F9 | 0000 | F2 | | | | | | |
| 1084 | 1111 | 0000 | K2 | | | | | | |
| 1084 | 8011 | 0000 | F2 | G2 | H2 | | | | |
| * 1086 | | | H2 | M2 | F2 | K2 | L2 | G2 | |
| 1086 | X089 | | M2 | | | | | | |
| 1086 | X08C | | L2 | M2 | | | | | |
| 1086 | X0A8 | | L2 | F2 | G2 | H2 | K2 | M2 | |
| 1086 | X0C8 | | M2 | | | | | | |
| 1086 | X0C9 | | H2 | K2 | | | | | |
| * 1087 | | | J2 | H2 | K2 | G2 | | | |
| 1087 | 9113 | 0000 | K2 | J2 | | | | | |
| 1087 | 9115 | 0000 | K2 | J2 | G2 | H2 | | | |
| 1087 | 9119 | 0000 | H2 | J2 | | | | | |
| 1087 | 9151 | 0000 | H2 | J2 | | | | | |
| 1087 | 9191 | 0000 | H2 | J2 | | | | | |
| * 1088 | | | H2 | J2 | C2 | | | | |
| * 1091 | | | H2 | J2 | K2 | M2 | G2 | F2 | L2 |
| 1091 | X040 | 0003 | H2 | G2 | J2 | K2 | | | |
| 1091 | X088 | 0003 | M2 | F2 | L2 | | | | |
| 1091 | X089 | 0003 | M2 | K2 | | | | | |
| * 1093 | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 1094 | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 1096 | | | H2 | G2 | F2 | K2 | L2 | J2 | |
| 1096 | 9110 | 0005 | H2 | K2 | | | | | |
| 1096 | 9111 | 0005 | H2 | G2 | F2 | L2 | J2 | | |
| * 1097 | | | L2 | H2 | M2 | G2 | K2 | | |
| 1097 | XFFF | 0005 | L2 | M2 | | | | | |
| * 1098 | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 1099 | | | H2 | J2 | | G2 | | | |
| 1099 | 9111 | 000A | H2 | G2 | J2 | | | | |
| 1099 | 9151 | 000A | J2 | H2 | | | | | |
| * 109B | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 109D | | | J2 | K2 | H2 | F2 | | | |
| 109D | 8191 | 000E | J2 | H2 | | | | | |
| 109D | 9110 | 000E | H2 | J2 | | | | | |
| * 109E | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10A0 | | | K2 | J2 | H2 | G2 | F2 | C2 | L2 |
| 10A0 | 1011 | 0015 | K2 | J2 | G2 | | | | |
| * 10A2 | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10A4 | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10A6 | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10A7 | | | H2 | F2 | | | | | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (cont)

| Code | | | | FRUs | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| * 10B0 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10B2 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10B3 | | | | H2 | L2 | | | | | | | |
| 10B3 | X008 | 0000 | | L2 | | | | | | | | |
| * 10B4 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10B6 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10B8 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10BA | | | | H2 | K2 | G2 | F2 | | | | | |
| * 10BC | | | | L2 | M2 | H2 | F2 | G2 | C2 | | | |
| * 10BE | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10BF | | | | H2 | K2 | | | | | | | |
| * 10C0 | | | | H2 | G2 | | | | | | | |
| * 10C2 | | | | L2 | H2 | M2 | F2 | G2 | | | | |
| 10C2 | X044 | | | L2 | F2 | | | | | | | |
| 10C2 | X060 | | | L2 | M2 | F2 | | | | | | |
| 10C2 | X040 | 0129 | | L2 | G2 | M2 | | | | | | |
| 10C2 | X0CA | 0129 | | H2 | F2 | | | | | | | |
| * 10C3 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10C4 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10C6 | | | | H2 | G2 | K2 | | | | | | |
| 10C6 | 5011 | 0129 | | K2 | H2 | | | | | | | |
| * 10C7 | | | | L2 | F2 | | | | | | | |
| * 10C8 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10C9 | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10CA | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 | | |
| * 10CB | | | | G2 | J2 | H2 | | | | | | |
| * 10D0 | | | | M2 | K2 | J2 | L2 | H2 | F2 | G2 | B3 | D2 |
| 10D0 | 0000 | 0001 | 0007 | J2 | K2 | | | | | | | |
| 10D0 | 0000 | 0010 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0000 | 0030 | 0007 | M2 | F2 | | | | | | | |
| 10D0 | 0000 | 0080 | 0007 | L2 | M2 | | | | | | | |
| 10D0 | 0000 | 0200 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0000 | 0400 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0000 | 0800 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0000 | 1000 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0000 | 2000 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0000 | 4000 | 0007 | K2 | M2 | | | | | | | |
| 10D0 | 0001 | 0000 | 0011 | K2 | | | | | | | | |
| 10D0 | C2C3 | 0000 | 0072 | L2 | | | | | | | | |
| 10D0 | FFFF | 0000 | 0001 | L2 | M2 | K2 | F2 | | | | | |
| 10D0 | FFFF | 0000 | 0005 | L2 | M2 | | | | | | | |
| 10D0 | FFFF | 0000 | 000F | M2 | L2 | | | | | | | |
| 10D0 | FFFF | 0001 | 0001 | L2 | M2 | | | | | | | |
| 10D0 | FFFF | 000F | 0001 | L2 | M2 | | | | | | | |
| 10D0 | FFFF | 00FF | 0001 | M2 | J2 | K2 | | | | | | |
| 10D0 | FFFF | 1FFF | 0001 | K2 | | | | | | | | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | FRUs | | | | | | |
|------|------|------|------|------|----|----|----|----|----|----|----|
| 10D0 | FFFF | 2101 | 0001 | | L2 | M2 | | | | | |
| 10D0 | FFFF | 3183 | 0001 | | L2 | | | | | | |
| 10D0 | FFFF | 7FFF | 0001 | | K2 | M2 | | | | | |
| 10D0 | FFFF | 8CEB | 0001 | | L2 | M2 | | | | | |
| 10D0 | FFFF | BFFF | 0001 | | K2 | M2 | | | | | |
| 10D0 | FFFF | DEDF | 0001 | | L2 | | | | | | |
| 10D0 | FFFF | EFFF | 0001 | | K2 | M2 | | | | | |
| 10D0 | FFFF | F0FF | 0001 | | J2 | K2 | | | | | |
| 10D0 | FFFF | F1FF | 0001 | | D2 | B3 | | | | | |
| 10D0 | FFFF | F7FF | 0001 | | K2 | M2 | | | | | |
| 10D0 | FFFF | FAFB | 0001 | | L2 | F2 | H2 | | | | |
| 10D0 | FFFF | FBFF | 0001 | | K2 | M2 | G2 | | | | |
| 10D0 | FFFF | FDFF | 0001 | | K2 | M2 | G2 | | | | |
| 10D0 | FFFF | FEFF | 0001 | | K2 | M2 | | | | | |
| 10D0 | FFFF | FFFE | 0001 | | M2 | L2 | H2 | | | | |
| * 10D2 | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10D5 | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10D6 | | | | | L2 | | | | | | |
| * 10D8 | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10DA | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 10DC | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 117B | | | | | G2 | F2 | | | | | |
| 117B | 0041 | 1001 | X055 | 02E8 | F2 | | | | | | |
| * 11A0 | | | | | B3 | | | | | | |
| * 11C3 | | | | | J2 | K2 | H2 | | | | |
| * 127B | | | | | G2 | | | | | | |
| * 1281 | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 1282 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 1283 | | | | | L2 | F2 | G2 | H2 | | | |
| 1283 | X008 | 0000 | | | F2 | G2 | L2 | H2 | | | |
| * 1284 | | | | | L2 | M2 | H2 | J2 | K2 | F2 | G2 |
| * 1286 | | | | | K2 | F2 | | | | | |
| * 128A | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 128D | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 128E | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 1290 | | | | | H2 | | | | | | |
| * 1292 | | | | | M2 | L2 | | | | | |
| * 1294 | | | | | L2 | J2 | H2 | | | | |
| 1294 | X060 | 0003 | | | H2 | | | | | | |
| * 1296 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 1299 | | | | | L2 | | | | | | |
| * 129A | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 129B | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 129C | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| * 129D | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |
| 129D | 9115 | 0001 | | | H2 | | | | | | |
| * 129E | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | FRUs | | | | | | | |
|------|---|---|---|---|------|----|----|----|----|----|----|----|
| * 12A0 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12A1 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12A2 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12A4 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12A6 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12A8 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12A9 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12AA | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12AB | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12AC | | | | | K2 | G2 | | | | | | |
| * 12AD | | | | | G2 | H2 | F2 | K2 | J2 | | | |
| 12AD | 9111 | X0F8 | 02E8 | 0016 | G2 | K2 | H2 | J2 | | | | |
| 12AD | 9150 | X0F8 | 02E8 | 0016 | H2 | F2 | | | | | | |
| * 12AE | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12AF | | | | | H2 | F2 | | | | | | |
| * 12D0 | | | | | H2 | | | | | | | |
| * 12D2 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 12D4 | | | | | L2 | F2 | | | | | | |
| 12D4 | 00C9 | 1011 | X022 | 02E8 | F2 | | | | | | | |
| * 12D5 | | | | | K2 | J2 | C2 | | | | | |
| 12D5 | 0001 | 1011 | X022 | 02E8 | K2 | C2 | | | | | | |
| * 137E | | | | | J2 | K2 | | | | | | |
| * 1383 | | | | | G2 | K2 | D2 | | | | | |
| * 1385 | | | | | D2 | G2 | C4 | M2 | | | | |
| * 1387 | | | | | G2 | D2 | | | | | | |
| * 1389 | | | | | F2 | J2 | K2 | G2 | | | | |
| * 138B | | | | | G2 | K2 | F2 | D2 | | | | |
| 138B | 8211 | | | | K2 | G2 | F2 | D2 | | | | |
| 138B | 9111 | | | | F2 | G2 | | | | | | |
| * 138D | | | | | J2 | G2 | F2 | K2 | | | | |
| * 1391 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 1393 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 1395 | | | | | G2 | J2 | | | | | | |
| 1395 | 1011 | 0005 | | | J2 | G2 | | | | | | |
| * 1397 | | | | | K2 | G2 | | | | | | |
| * 1399 | | See Note at end of list. | | | G2 | J2 | F2 | H2 | | | | |
| 1399 | 9611 | 0003 | See Note at end of list. | | J2 | H2 | F2 | | | | | |
| * 139B | | | | | G2 | J2 | F2 | | | | | |
| 139B | 9011 | 0002 | | | J2 | G2 | | | | | | |
| 139B | 9011 | 0003 | | | J2 | G2 | F2 | | | | | |
| 139B | 9411 | 0004 | | | J2 | | | | | | | |
| * 139D | | | | | G2 | J2 | K2 | H2 | | | | |
| * 139E | | | | | G2 | J2 | K2 | H2 | | | | |
| * 139F | | | | | G2 | J2 | K2 | | | | | |
| 139F | 9611 | 0007 | | | G2 | K2 | | | | | | |
| * 13A1 | | | | | G2 | H2 | F2 | J2 | K2 | | | |
| 13A1 | 9011 | 0009 | | | G2 | F2 | H2 | K2 | | | | |
| 13A1 | 9611 | 0009 | | | J2 | G2 | | | | | | |
| * 13A3 | | | | | L2 | J2 | K2 | F2 | G2 | H2 | M2 | |
| * 13A5 | | | | | G2 | K2 | J2 | D2 | F2 | H2 | L2 | M2 |
| * 13A7 | | | | | G2 | K2 | J2 | D2 | F2 | H2 | L2 | M2 |
| * 13A9 | | | | | G2 | K2 | J2 | D2 | F2 | H2 | L2 | M2 |
| * 14C7 | | | | | L2 | | | | | | | |
| * 14D5 | | | | | L2 | | | | | | | |
| * 14E1 | | | | | G2 | K2 | J2 | D2 | F2 | H2 | L2 | M2 |
| * 14E2 | | | | | L2 | M2 | F2 | G2 | | | | |

EC 745948

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | | | FRUs | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 14E2 | 0008 | X008 | | | | | L2 | F2 | G2 | | | | | | | |
| 14E2 | 0041 | X020 | | | | | M2 | L2 | | | | | | | | |
| * 14E3 | | | | | | | L2 | G2 | H2 | | | | | | | |
| * 14E4 | | | | | | | F2 | G2 | L2 | | | | | | | |
| * 1503 | | | | | | | F2 | K2 | | | | | | | | |
| * 1582 | | | | | | | D2 | G2 | C4 | F2 | J2 | M2 | | | | |
| 1582 | 0003 | | | | | | F2 | J2 | | | | | | | | |
| 1582 | 002A | | | | | | F2 | G2 | | | | | | | | |
| * 1606 | | | | | | | F2 | | | | | | | | | |
| * 1801 | | | | | | | J2 | F2 | K2 | L2 | M2 | | | | | |
| * 2003 | | | | | | | G2 | | | | | | | | | |
| * 200F | | | | | | | D2 | G2 | J2 | M2 | L2 | | | | | |
| 200F | 0008 | 0001 | 0079 | 02E8 | 0000 | | M2 | L2 | | | | | | | | |
| 200F | 000B | 0001 | 0077 | 02E8 | 0000 | | M2 | L2 | | | | | | | | |
| * 2101 | | | | | | | C4 | D2 | B4 | | | | | | | |
| 2101 | 000A | 8001 | 0008 | 3660 | | | B4 | C4 | | | | | | | | |
| * 2103 | | | | | | | G2 | | | | | | | | | |
| * 2105 | | | | | | | C4 | D2 | | | | | | | | |
| * 2180 | | | | | | | L2 | | | | | | | | | |
| * 2181 | | | | | | | F2 | J2 | K2 | L2 | H2 | | | | | |
| * 220F | | | | | | | G2 | H2 | L2 | J2 | M2 | C2 | F2 | | | |
| 220F | 000A | 8141 | X0C9 | | | | H2 | | | | | | | | | |
| 220F | 000A | 8181 | X0C9 | | | | C2 | H2 | J2 | | | | | | | |
| 220F | 000B | 0001 | X007 | | | | L2 | | | | | | | | | |
| 220F | 000B | 0001 | X057 | | | | L2 | | | | | | | | | |
| 220F | 000B | 0001 | X063 | 0000 | | | L2 | M2 | | | | | | | | |
| 220F | 002A | 8141 | X0CB | 0000 | | | F2 | G2 | H2 | L2 | | | | | | |
| 220F | 004B | 0001 | X061 | 0000 | | | L2 | | | | | | | | | |
| * 2211 | | | | | | | L2 | F2 | H2 | G2 | J2 | K2 | C2 | | | |
| 2211 | 0023 | 0001 | X057 | 02E0 | 0000 | 0000 | K2 | | | | | | | | | |
| 2211 | 0023 | 0001 | X057 | 02E0 | 0000 | 1FC0 | C2 | H2 | | | | | | | | |
| 2211 | 0023 | 0001 | X057 | 02E8 | 0000 | | H2 | | | | | | | | | |
| 2211 | 0043 | 0001 | X057 | 02E0 | 0000 | 0000 | J2 | G2 | H2 | | | | | | | |
| 2211 | 0043 | 0001 | X057 | 02E8 | 0000 | | J2 | H2 | G2 | | | | | | | |
| * 2213 | | | | | | | K2 | J2 | L2 | F2 | M2 | | | | | |
| 2213 | 0003 | 0001 | X057 | 02E8 | 0000 | 0040 | K2 | J2 | F2 | M2 | | | | | | |
| 2213 | 0003 | 0001 | X057 | 02E8 | 0000 | FFC0 | L2 | | | | | | | | | |
| * 2281 | | | | | | | K2 | L2 | C2 | M2 | B3 | A5 | F2 | J2 | H2 | D2 |
| 2281 | 0003 | 488C | 4886 | | | | F2 | H2 | L2 | | | | | | | |
| 2281 | 0003 | E0E1 | 4888 | | | | M2 | L2 | | | | | | | | |
| 2281 | 0003 | E0E1 | 83FA | | | | F2 | L2 | M2 | H2 | D2 | | | | | |
| 2281 | 0003 | E0E1 | 8400 | | | | H2 | F2 | | | | | | | | |
| 2281 | 0003 | E0E1 | 8404 | | | | L2 | | | | | | | | | |
| 2281 | 0803 | 866A | 4886 | | | | B3 | C2 | J2 | B2 | K2 | D2 | | | | |
| 2281 | 0803 | E0E1 | 83F8 | | | | C2 | B3 | A5 | J2 | K2 | | | | | |
| 2281 | 0803 | E0E1 | 8400 | | | | K2 | J2 | H2 | | | | | | | |
| * 230F | | | | | | | F2 | G2 | | | | | | | | |
| * 2311 | | | | | | | B3 | K2 | C2 | H2 | | | | | | |
| 2311 | 0023 | 0001 | X016 | 02E8 | 0040 | 0000 | K2 | | | | | | | | | |
| 2311 | 0023 | 0001 | X016 | 02E8 | 0040 | 0040 | B3 | | | | | | | | | |
| 2311 | 0023 | 0001 | X057 | 02E8 | 0040 | | C2 | H2 | | | | | | | | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | | | FRUs | | | | | | | |
|------|---|---|---|---|---|---|------|----|----|----|----|----|----|----|
| * 2313 | | | | | | | K2 | F2 | B3 | H2 | | | | |
| 2313 | 0003 | 0001 | X016 | 02E8 | 0040 | 0000 | K2 | F2 | H2 | | | | | |
| 2313 | 0803 | 0001 | X016 | 02E8 | 0040 | 0000 | B3 | K2 | | | | | | |
| * 2381 | | | | | | | G2 | K2 | J2 | D2 | F2 | H2 | L2 | M2 |
| * 2481 | | | | | | | F2 | G2 | H2 | D2 | C2 | L2 | M2 | J2 |
| * 2482 | | | | | | | F2 | G2 | H2 | D2 | M2 | | | |
| 2482 | 0803 | | | | | | H2 | G2 | D2 | M2 | | | | |
| * 2483 | | | | | | | L2 | F2 | C2 | H2 | J2 | | | |
| 2483 | 0023 | | | | | | C2 | | | | | | | |
| 2483 | 0043 | | | | | | H2 | J2 | | | | | | |
| * 2484 | | | | | | | F2 | G2 | H2 | D2 | C2 | L2 | M2 | J2 |
| * 2485 | | | | | | | D2 | G2 | F2 | J2 | M2 | | | |
| * 2487 | | | | | | | F2 | G2 | H2 | D2 | C2 | L2 | M2 | J2 |
| * 2489 | | | | | | | D2 | | | | | | | |
| * 2520 | | | | | | | J2 | K2 | D2 | | | | | |
| * 2522 | | | | | | | J2 | G2 | | | | | | |
| * 2524 | | | | | | | J2 | F2 | D2 | K2 | | | | |
| 2524 | 0003 | 0001 | X016 | 02E8 | 0001 | 0000 | J2 | D2 | F2 | | | | | |
| 2524 | 0003 | 0001 | X016 | 02E8 | 0005 | 0105 | J2 | K2 | | | | | | |
| 2524 | 0003 | 0001 | X016 | 02E8 | 0032 | 1032 | J2 | K2 | | | | | | |
| * 2622 | | | | | | | J2 | | | | | | | |
| * 3207 | | | | | | | D2 | G2 | | | | | | |
| * 3209 | | | | | | | G2 | D2 | K2 | C4 | J2 | M2 | | |
| 3209 | 2003 | 0001 | X000 | 02F8 | C001 | | D2 | G2 | K2 | | | | | |
| 3209 | 2003 | 1001 | X000 | 0040 | 00A8 | | D2 | | | | | | | |
| 3209 | 2003 | 1001 | X000 | 0640 | 0002 | | G2 | F2 | | | | | | |
| 3209 | 2003 | 1001 | X000 | 066C | C001 | | K2 | | | | | | | |
| 3209 | 2003 | 1001 | X000 | 2E60 | 0002 | | C4 | D2 | | | | | | |
| 3209 | 2003 | 1001 | X000 | 3260 | 0002 | | D2 | G2 | M2 | | | | | |
| 3209 | 2003 | 1001 | X000 | 3260 | 00A8 | | J2 | | | | | | | |
| * 3213 | | | | | | | G2 | J2 | K2 | D2 | | | | |
| 3213 | 0003 | 1001 | X016 | 0268 | 5400 | 1400 | J2 | | | | | | | |
| 3213 | 0003 | 1801 | X016 | 0268 | 0080 | 0180 | G2 | K2 | D2 | | | | | |
| * 3219 | 0423 | 1001 | X013 | 0269 | 5400 | | J2 | H2 | K2 | | | | | |
| * 328F | | | | | | | D2 | M2 | | | | | | |
| * 3290 | | | | | | | M2 | D2 | C4 | G2 | | | | |
| 3290 | 0268 | | | | | | G2 | D2 | | | | | | |
| 3290 | 1060 | | | | | | M2 | C4 | | | | | | |
| 3290 | 1660 | | | | | | M2 | C4 | | | | | | |
| 3290 | 5260 | | | | | | D2 | M2 | | | | | | |
| * 3292 | | | | | | | M2 | D2 | | | | | | |
| * 3293 | | | | | | | L2 | M2 | | | | | | |
| * 3294 | | | | | | | M2 | D2 | L2 | C4 | K2 | J2 | H2 | C2 |
| * 3295 | | | | | | | K2 | H2 | C2 | J2 | | | | |
| * 3296 | | | | | | | M2 | D2 | L2 | C4 | K2 | J2 | H2 | C2 |
| * 32A0 | | | | | | | M2 | D2 | L2 | C4 | K2 | J2 | H2 | C2 |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | FRUs | | | | | | | | | |
|------|---|------|----|----|----|----|----|----|----|----|----|
| * 3301 | | G2 | | | | | | | | | |
| * 3309 | | G2 | D2 | | | | | | | | |
| * 3383 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3384 | | G2 | K2 | | | | | | | | |
| * 3385 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3387 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3389 | | M2 | | | | | | | | | |
| * 338B | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3393 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3395 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3397 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3399 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 339B | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3413 | | C4 | D2 | B4 | C2 | B2 | | | | | |
| * 3490 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3492 | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3494 | | G2 | J2 | | | | | | | | |
| * 3496 | See Note at end of list. | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3498 | See Note at end of list. | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 349A | | G2 | D2 | K2 | M2 | C4 | J2 | F2 | L2 | | |
| * 3509 | | D2 | C4 | | | | | | | | |
| * 3513 | | D2 | | | | | | | | | |
| * 3607 | | D2 | C4 | | | | | | | | |
| * 3609 | | D2 | | | | | | | | | |
| * 360F | | H2 | J2 | K2 | F2 | L2 | M2 | G2 | | | |
| * 4127 | | H2 | J2 | K2 | | | | | | | |

For error code 4191, run routine 51 first. The CE Track Data may have been destroyed. If it does not isolate the failure, return to this list.

| Code | | | | | | FRUs | | | | | | | | |
|------|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| * 4191 | | | | | | * | K2 | J2 | H2 | F2 | G2 | | | |
| * 4193 | | | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 | |
| * 4214 | | | | | | B2 | F2 | G2 | C2 | | | | | |
| * 4217 | | | | | | H2 | L2 | F2 | J2 | | | | | |
| * 4219 | | | | | | D2 | K2 | J2 | H2 | B3 | A5 | C2 | G2 | F2 |
| 4219 | 0403 | 1001 | X013 | 0269 | 5400 | K2 | G2 | | | | | | | |
| 4219 | 0423 | 1001 | X013 | 0268 | 5400 | G2 | F2 | H2 | | | | | | |
| 4219 | 0803 | 1001 | X011 | 0269 | 5400 | H2 | | | | | | | | |
| 4219 | 0803 | 1001 | X013 | 0269 | 5400 | K2 | J2 | | | | | | | |
| 4219 | 1013 | 1001 | X011 | 0268 | 5400 | D2 | B3 | | | | | | | |
| 4219 | 1013 | 1001 | X011 | 0269 | 5400 | D2 | B3 | A5 | C2 | | | | | |
| 4219 | 1013 | 1001 | X011 | 0269 | 9700 | B2 | A5 | D2 | | | | | | |
| * 421A | | | | | | K2 | H2 | J2 | B3 | F2 | G2 | C2 | | |
| 421A | 0083 | 1001 | X013 | 0268 | 9700 | D2 | F2 | G2 | | | | | | |
| 421A | 0083 | 1001 | X013 | 0269 | 9700 | K2 | H2 | C2 | J2 | | | | | |
| * 4225 | | | | | | H2 | | | | | | | | |
| * 4293 | | | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | FRUs | | | | | | | |
|------|------|------|------|------|----|----|----|----|----|----|----|
| * 433D | | | | H2 | | | | | | | |
| * 4392 | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| 4392 | 0003 | 9702 | | H2 | G2 | | | | | | |
| * 4393 | | | | G2 | H2 | F2 | K2 | | | | |
| * 4395 | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 4397 | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 439A | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 439E | | | | G2 | | | | | | | |
| * 439F | | | | G2 | F2 | | | | | | |
| * 43A0 | | | | H2 | | | | | | | |
| * 43A6 | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 43A9 | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 43AA | | | | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 43AB | | | | H2 | F2 | | | | | | |

For error code 4446, run Routine 51 first. The CE Track Data may have been destroyed. If it does not isolate the failure, return to this list.

| Code | | | | | | FRUs | | | | | | | |
|------|------|------|------|------|------|------|----|----|----|----|----|----|----|
| * 4446 | | | | | | K2 | H2 | J2 | L2 | B3 | F2 | G2 | C2 |
| * 4601 | | | | | | F2 | H2 | G2 | J2 | K2 | L2 | M2 | |
| * 4628 | | | | | | H2 | F2 | G2 | K2 | L2 | | | |
| 4628 | 002A | X008 | 0268 | 5440 | | F2 | G2 | H2 | K2 | L2 | | | |
| * 4630 | | | | | | G2 | F2 | H2 | | | | | |
| 4630 | 000A | 9100 | X088 | 0268 | 5440 | H2 | G2 | | | | | | |
| 4630 | 000A | 9101 | X008 | 0268 | 5440 | G2 | H2 | | | | | | |
| 4630 | 002A | 9141 | X008 | 0268 | 5440 | F2 | G2 | | | | | | |
| * 4633 | | | | | | H2 | F2 | G2 | L2 | | | | |
| * 464B | | | | | | F2 | H2 | | | | | | |
| * 4689 | | | | | | J2 | K2 | G2 | H2 | | | | |
| * 4783 | | | | | | F2 | | | | | | | |
| * 4784 | | | | | | F2 | | | | | | | |
| * 4785 | | | | | | F2 | K2 | | | | | | |
| * 4787 | | | | | | F2 | K2 | H2 | L2 | | | | |
| * 4788 | | | | | | K2 | H2 | L2 | F2 | | | | |
| * 4789 | | | | | | G2 | | | | | | | |
| * 478A | | | | | | K2 | | | | | | | |
| * 478B | | | | | | M2 | | | | | | | |
| * 483B | | | | | | G2 | B4 | H2 | F2 | J2 | K2 | L2 | M2 |

For error code 4891, run Routine 51 first. The CE Track Data may have been destroyed. If it does not isolate the failure, return to this list.

| Code | | FRUs | | | | | | | |
|------|----|------|----|----|----|----|----|----|----|
| * 4891 | * | K2 | J2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 4892 | | F2 | G2 | B3 | C2 | L2 | | | |

## 1.115 DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | | FRUs | | | | | | | | |
|------|------|------|------|------|------|------|----|----|----|----|----|----|----|----|
| * 4989 | | | | | | K2 | J2 | A2 | H2 | F2 | G2 | B3 | C2 | L2 |
| * 4990 | | | | | | B2 | A5 | A2 | | | | | | |
| * 4991 | See Note at end of list. | | | | | F2 | D2 | A2 | G2 | B4 | L2 | M2 | C4 | |
| * 4992 | See Note at end of list. | | | | | F2 | D2 | A2 | G2 | B4 | L2 | M2 | C4 | |
| * 4993 | | | | | | F2 | D2 | A2 | G2 | B4 | L2 | M2 | C4 | |
| * 5090 | | | | | | A2 | B3 | D2 | G2 | | | | | |
| * 5092 | | | | | | A2 | B3 | D2 | G2 | | | | | |
| * 5093 | | | | | | A2 | B3 | D2 | G2 | | | | | |
| * 5094 | | | | | | A2 | B3 | D2 | G2 | | | | | |
| * 5222 | | | | | | J2 | K2 | | | | | | | |
| * 5381 | | | | | | F2 | D2 | | G2 | B4 | L2 | M2 | C4 | |
| * 5383 | | | | | | F2 | D2 | | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5668 | | | | | | F2 | L2 | | M2 | | | | | |
| * 5681 | | | | | | F2 | D2 | | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5682 | | | | | | F2 | D2 | | G2 | B4 | L2 | | | |
| 5682 | 0000 | 0001 | X000 | 02E8 | | F2 | B4 | | G2 | | | | | |
| 5682 | 0010 | 0010 | X000 | 0000 | | F2 | L2 | | | | | | | |
| 5682 | 0010 | 1010 | X000 | 8450 | | D2 | | | | | | | | |
| 5682 | 0010 | 1011 | X000 | AC70 | | D2 | | | | | | | | |
| 5682 | 0010 | 1011 | X000 | B250 | | D2 | | | | | | | | |
| 5682 | 0010 | 1011 | X000 | B270 | | D2 | M2 | | | | | | | |
| * 5691 | | | | | | D2 | C4 | | G2 | J2 | M2 | | | |
| 5691 | 0010 | 1011 | X000 | 42E8 | | C4 | D2 | | M2 | | | | | |
| * 5693 | | | | | | F2 | D2 | | G2 | J2 | K2 | | | |
| 5693 | 0000 | 0011 | X000 | F270 | | F2 | K2 | | | | | | | |
| 5693 | 0000 | 1011 | X000 | F270 | | D2 | F2 | | G2 | J2 | K2 | | | |
| * 5695 | | | | | | F2 | D2 | | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5697 | | | | | | D2 | C4 | | M2 | | | | | |
| * 5699 | | | | | | D2 | C4 | | B4 | B2 | G2 | F2 | M2 | J2 |
| 5699 | 0000 | 1001 | X000 | 0278 | 0100 | D2 | M2 | | | | | | | |
| 5699 | 0000 | 1001 | X000 | 02D8 | 0100 | D2 | C4 | | C2 | M2 | G2 | | | |
| 5699 | 0010 | 1000 | X000 | AC50 | 1C00 | D2 | C2 | | | | | | | |
| 5699 | 0010 | 1000 | X000 | B070 | 1C00 | D2 | C2 | | | | | | | |
| 5699 | 0010 | 1001 | X000 | 0250 | AB00 | C4 | D2 | | M2 | | | | | |
| 5699 | 0010 | 1001 | X000 | 0258 | 0100 | C4 | | | | | | | | |
| 5699 | 0010 | 1001 | X000 | 0270 | 0100 | C4 | D2 | | | | | | | |
| 5699 | 0010 | 1001 | X000 | 0278 | 0100 | B4 | B2 | | D2 | C4 | | | | |
| 5699 | 0010 | 1001 | X000 | 0450 | BF00 | D2 | B4 | | | | | | | |
| 5699 | 0010 | 1001 | X000 | 0450 | B700 | D2 | B4 | | M2 | | | | | |
| 5699 | 0010 | 1001 | X000 | 1258 | 0100 | D2 | B4 | | M2 | | | | | |
| 5699 | 0010 | 1001 | X000 | 2C50 | 1D00 | C4 | B2 | | M2 | | | | | |
| 5699 | 0010 | 1001 | X000 | 3050 | 1D00 | B2 | C4 | | B4 | D2 | | | | |
| 5699 | 0010 | 1001 | X000 | 3270 | 0100 | D2 | B4 | | C4 | M2 | G2 | | | |
| 5699 | 0010 | 1001 | X000 | 3070 | 0100 | C4 | D2 | | M2 | | | | | |
| 5699 | 0010 | 1001 | X000 | 3250 | 1D00 | C4 | | | | | | | | |
| 5699 | 0010 | 1001 | X000 | 3270 | 1D00 | B2 | B4 | | C4 | | | | | |
| 5699 | 0010 | 1001 | X000 | 7270 | 0100 | D2 | B2 | | | | | | | |
| 5699 | 0010 | 1001 | X000 | 8A50 | 0000 | D2 | B4 | | M2 | | | | | |

## 1.115   DISK DIAGNOSTIC ERROR CODES (Cont)

| Code | | | | | | FRUs | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 5699 | 0010 | 1001 | X000 | A270 | 0000 | D2 | C4 | B4 | M2 | | | | |
| 5699 | 0010 | 1001 | X000 | A850 | 1C00 | B2 | B4 | C4 | | | | | |
| 5699 | 0010 | 1001 | X000 | AA50 | 0000 | D2 | G2 | C4 | B4 | | | | |
| 5699 | 0010 | 1001 | X000 | AC70 | 1C00 | D2 | B4 | | | | | | |
| 5699 | 0010 | 1001 | X000 | AE50 | 0000 | C4 | D2 | M2 | | | | | |
| 5699 | 0010 | 1001 | X000 | B074 | 1C00 | D2 | B4 | | | | | | |
| 5699 | 0010 | 1001 | X000 | B250 | 0000 | B4 | D2 | | | | | | |
| 5699 | 0010 | 1001 | X000 | B270 | 0000 | D2 | B4 | | | | | | |
| 5699 | 0010 | 1001 | X000 | B270 | 0100 | D2 | C4 | J2 | M2 | | | | |
| 5699 | 0010 | 1001 | X000 | EA70 | 0000 | B2 | B4 | | | | | | |
| 5699 | 0010 | 1001 | X000 | EE50 | 0000 | B4 | | | | | | | |
| 5699 | 0010 | 1001 | X000 | F250 | 0000 | D2 | B2 | | | | | | |
| 5699 | 0010 | 1001 | X000 | F270 | 0000 | B2 | D2 | B4 | F2 | | | | |
| 5699 | 0010 | 1001 | X000 | F650 | 0000 | B4 | | | | | | | |
| 5699 | 0010 | 1001 | X000 | F670 | 0000 | B2 | B4 | C4 | | | | | |
| 5699 | 0010 | 1011 | X000 | 4668 | 0100 | C4 | C2 | | | | | | |
| 5699 | 0010 | 1401 | X000 | 2C50 | 1F00 | G2 | | | | | | | |
| 5699 | 0010 | 1401 | X000 | 3050 | 1F00 | G2 | | | | | | | |
| * 569B | | | | | | F2 | D2 | G2 | H2 | B4 | L2 | M2 | C4 |
| * 569D | | | | | | D2 | C4 | F2 | G2 | J2 | | | |
| * 5781 | | | | | | F2 | D2 | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5791 | | | | | | F2 | D2 | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5792 | | | | | | F2 | L2 | J2 | K2 | M2 | | | |
| 5792 | 0010 | | | | | M2 | | | | | | | |
| * 5793 | | | | | | F2 | D2 | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5794 | | | | | | L2 | F2 | | | | | | |
| * 5795 | | | | | | F2 | D2 | G2 | H2 | B4 | L2 | M2 | C4 |
| * 5796 | | | | | | M2 | L2 | C4 | F2 | D2 | | | |
| 5796 | 7270 | | | | | M2 | C4 | | | | | | |
| 5796 | D270 | | | | | M2 | D2 | | | | | | |
| 5796 | F250 | | | | | F2 | | | | | | | |
| 5796 | F274 | | | | | L2 | | | | | | | |

**Note:** *These error codes may be caused by configuration errors on the diagnostic diskette. Check the continuity of the configuration jumpers on 1.111 and ensure that they correctly match the hardware you have. Then start utility routine 5 by entering 000005 when BC80 is displayed. This should dynamically configure your diskette. When it displays 0055 terminate it by depressing the Free Key, and rerun the diagnostic. This time, follow the FRU replacement listed for these error codes.*

## 1.116 — 1.119 Not Used

## 1.120 SUPPLY VOLTAGE TEST POINTS

| Logic Board | Card and Pin* | Limits |
|---|---|---|
| Basic | H2U03 | +4.5 to +5.5 |
| Controller | H2S11 | +7.7 to +9.3 |
| and Adapter | H2S06 | -4.5 to -5.5 |

*Ground = any D08, J08, P08, or U08

Note: *If the axe circuit forces all supply voltages to 0 volt, all voltages should be looked upon as failing.*

## 1.121 EXTERNAL MODEM WRAP CARD

| | PN 8523344 | | PN 1747496 | |
|---|---|---|---|---|
| Line Name | Modem | Jumper* | Modem | Jumper |
| Request | 600 | A to B | | |
| | 1200 | A to B | All | A to B |
| to Send | GND 4800 | Open | | |
| Data | 600 | D to E | | |
| Signal | 1200 | C to D | | |
| Rate | GND 4800 | Open | 1200 | D to E |
| Selector | | | 2400 | C to D |

*Use jumper, PN 816645.

```
PN 8523344
A B    C D
o o    o  o
           o
           E
```

```
PN 1747496**
o E    E
o D
o C
o B
o A
```

```
Jumper D
PN 816645
              B
            o  o
          o o  o o o
            D E    A
 o o
 A      C
       o o
      o o o
      G F

 o o        o o
 A           A

PN 5864363   (A)
   5864660
```
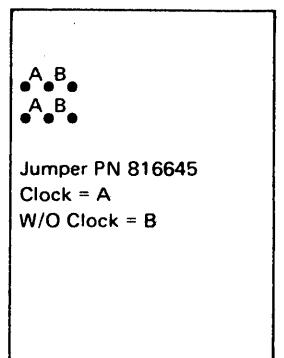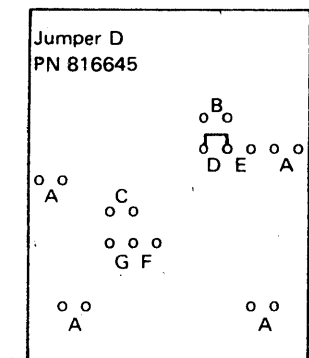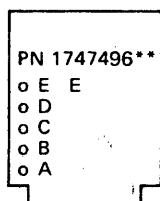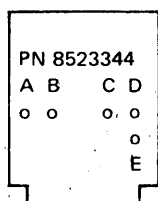
```
          A B
         • • •
          A B
         • • •   •

Jumper PN 816645
Clock = A
W/O Clock = B

PN 4409769   (B)
```

Note: *See the chart on the end of the logic gate for card locations.*

---

**Optional EC747541, added capacitor assembly PN 4405002 from B09 and D09 to ground D08 to eliminate noise on Xmit data and Xmit clock.

## 1.122 EXTERNAL MODEM SIGNAL CABLE

```
   6    5    4          3    2
  o o o o|o|o|o|o o o   o o o o|o o o|o o o
        1 2 3 4
        5 6 7 8
  o o o o|o|o|o|o o o   o o o o|o o o|o o o
Adapter Board Y1       Basic Controller Board Y2

  o o o o|o o o|o o o
          7    8
  o o o o|o o o|o o o
Adapter Board Y6
```
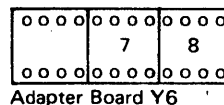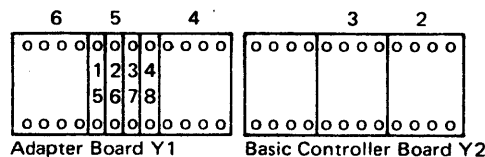
PN 4944498 * (Used with card PN 8523344)

| Signal | Y Pin | Connector |
|---|---|---|
| Received Data | 1 | 3 |
| Ground | 2 | 7 |
| Tranmitted Data | 3 | 2 |
| Spare | 4 | Tied back |
| Clear to Send | 5 | 5 |
| Carrier Detect | 6 | 8 |
| Request to Send | 7 | 4 |
| Data Signal Rate Sel | 8 | 23 |

PN 4944499 (Used with card PN 1747496) * *

| Signal | Y Pin | Connector |
|---|---|---|
| Received Data | 1 | 3 |
| Ground | 2 | 7 |
| Transmitted Data | 3 | 2 |
| Spare | 4 | Tied back |
| Transmit Clock | 5 | 24* |
| Data Term. Ready | 6 | 20 |
| Request to Send | 7 | 4 |
| Data Signal Rate Sel | 8 | 23 |

*15 for some WT modems.

PN 4409768 (Used with card A or B)

| Signal | Card Pin | Connector |
|---|---|---|
| Received Data | G04 | 3 |
| Ground | J08 | 7 |
| Transmitted Data | G07 | 2 |
| Spare | | Tied back |
| Transmit Clock | G12 | 24* |
| Data Term. Ready | J02 | 20 |
| Request to Send | G03 | 4 |
| Data Signal Rate Sel | J06 | 23 |

*15 for some WT modems.

```
        Top
      □    ⊠—G02
      □    □
      □    □
      □    □
      □    □
      □    □
      □    □      Plug on G/J Pins
      □    □
      □    □
      □    □
      □    □
 J13—⊠    □
```
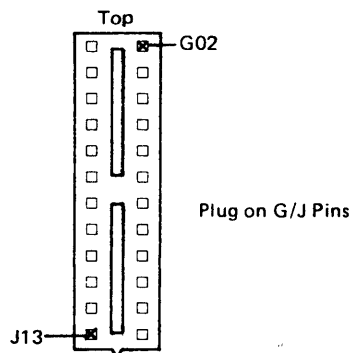
## 1.123 TRANSMIT LEVEL ADJUSTMENT

### 38LS Modems

The US Domestic version is not adjustable. It is factory set and sealed at 0 db. The World Trade version is adjusted by setting the switches as shown.

```
┌─────────────────────────────────────┐
│ Rocker Switch                        │
│ Identification                       │
│                        ┌────┬────┐   │
│                        │ R  │ H  │   │
│                        ├────┼────┤   │
│                        │ P  │ G  │   │
│                        ├────┼────┤   │
│                        │ N  │ F  │   │
│                        ├────┼────┤   │
│                        │ M  │ E  │   │
│                  *     ├────┼────┤   │
│                ┌────┐  │ L  │ D  │   │
│                │ DD │  ├────┼────┤   │
│                ├────┤  │ K  │ C  │   │
│                │ CC │  ├────┼────┤   │
│                ├────┤  │ J  │ B  │   │
│                │ BB │  ├────┼────┤   │
│                ├────┤  │ I  │ A  │   │
│                │ AA │  └────┴────┘   │
│                └────┘                │
│ Component Side                       │
└─────────────────────────────────────┘
```

*WT only; switches AA-DD are for line equalization (3.9.4).

I=On

| Switch DBM | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 0 | I | | | | | | | |
| -1 | | I | | | | | | |
| -2 | | | I | | | | | |
| -3 | | | | I | | | | |
| -4 | | | | | I | | | |
| -5 | | | | | | I | | |
| -6 | I | | | | | | I | |
| -7 | | I | | | | | I | |
| -8 | | | I | | | | I | |
| -9 | | | | I | | | I | |
| -10 | | | | | I | | I | |
| -11 | | | | | | I | I | |
| -12 | I | | | | | | | I |
| -13 | | I | | | | | | I |
| -14 | | | I | | | | | I |
| -15 | | | | I | | | | I |
| -16 | | | | | I | | | I |
| -17 | | | | | | I | | I |
| -18 | I | | | | | | | I |

### 1200-BPS Integrated Modem

#### Setting Transmit Level Without a DB Meter (Remote Loop)

Turn the transmit level potentiometer counterclockwise at least 15 turns (for PN 5864365, counterclockwise 15 turns, then clockwise 8 turns) to set the level to approximately -2db to 0db. This potentiometer is the topmost on the card when the card is plugged in. (No jumpers on card).

#### Setting Transmit Level Without a DB Meter (Host Link)

Turn the transmit level potentiometer clockwise at least 15 turns. With the jumper on the transmit card, the level will be approximately 0db to +2db; without the jumper, approximately -2db to 0db. This potentiometer is topmost on the card when the card is plugged in.

#### Transmit Level Adjustment With a DB Meter

This procedure requires DB meter PN453545:

1. Set the 2W-4W TRANS/REC switch to TRANS.
2. Set the WRAP switch to the down position (not in wrap).
3. Connect the DB meter in one of the following ways:
   a. Connect the plug end of the communications cable to the TRANS/REC jack on the cover of the DB meter. Jumper the cover LINE terminals to the DB meter LINE terminals. Set the BRDG/600/324 switch to 600. See Wiring A.
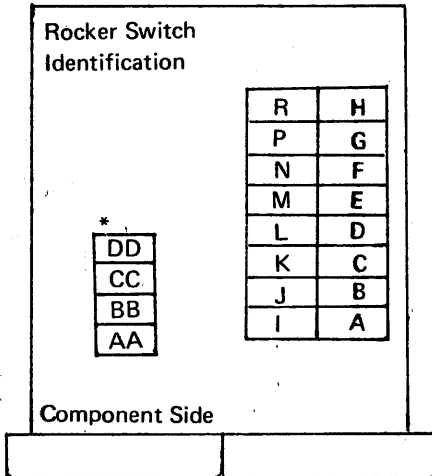   b. Jumper the transmit lines (B02 and D05 of the modem transmit card) to the LINE terminals of the DB meter. Set the BRDG/600/324 switch to 600 and disconnect the cable to the communication channel. See Wiring B.
   c. 4-wire only:
      Jumper the transmit lines (B02 and D05 of the modem transmit card) to the LINE terminals of the DB meter. Set the BRDG/600/324 switch to BRDG. See Wiring C.
4. Set the RANGE switch (0 to -45) to the value to be added to the meter reading.
5. Set the POWER switch to on.
6. Press the BATT TEST switch. The meter should read in the GOOD range if the batteries are good. Release the BATT TEST switch.
7. Adjust the transmit level potentiometer (at the top of the transmit card when the card is plugged in) until the meter value plus the RANGE switch value equals the required DB level. (You may have to jumper J07 to ground to force the modem to transmit.) You may have to install the transmit level jumper on the card to reach 0db level.

EC 745948

## 1.124 TRANSMIT LEVEL ADJUSTMENT FOR 600-BPS INTEGRATED MODEM

This procedure requires DB meter PN 453545:

1.  Set the 2W-4W TRANS/REC switch to TRANS.
2.  Set the WRAP switch to the down position (not in wrap).
3.  Connect the DB meter as stated in (a) below if the communication cable of the controller is terminated by a plug, or as stated in (b) below if terminated by other than a plug.
    a.  Connect the plug end of the communications cable to the TRANS/REC jack on the cover of the DB meter. Jumper the cover LINE terminals to the DB meter Line terminals. Set the BRDG/600/324 switch to 600. See Wiring A.
    b.  Jumper the transmit lines (B02 and D05 of the modem transmit card) to the LINE terminals of the DB meter. Set the BRDG/600/324 switch to 600 and disconnect the cable to the communication channel. See Wiring B.
4.  Set the RANGE switch (0 to –45) to the value to be added to the meter reading.
5.  Set the POWER switch to on.
6.  Press the BATT TEST switch. The meter should read in the GOOD range if the batteries are good. Release the BATT TEST switch.
7.  Read the meter and add it to the value of the RANGE switch.

    **CAUTION: Turn off power before removing or inserting a card.**

8.  If transmit level adjustment is required, refer to the adjacent sketch. Two straps are required, one on each side of the dashed line between the two 0 DB pairs of pins. Add the values assigned to the two strapped pairs of pins.



600-bps Transmit Card
(Component Side)

Wiring A

Communications
Cable

Wiring B

EC 745948

COVER

METER

DB 15 10 7 5 3 1 2 0 .1 .2 .3

Batt Test

Good

ON  BATT TEST

TRANS

2W 4W
TRANS

WRAP

REC

REC

LINE

Wiring C

20  25
15      30
10      35
600
5      40
324
0  45

BRDG

MIN  MAX

ATTENUATOR

LINE

MONITOR

B02

D05
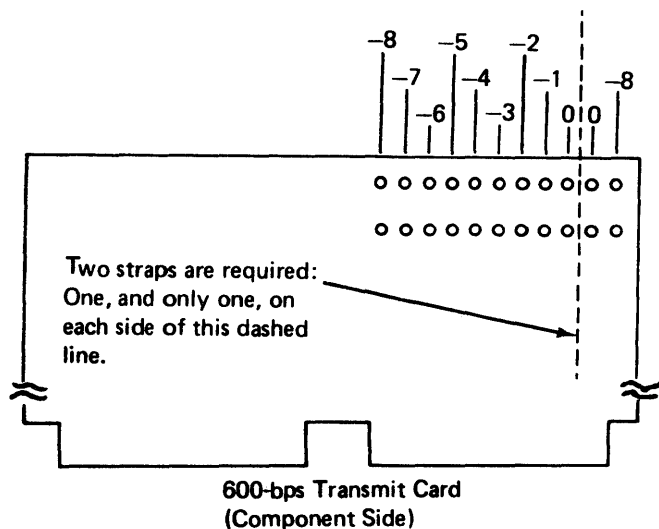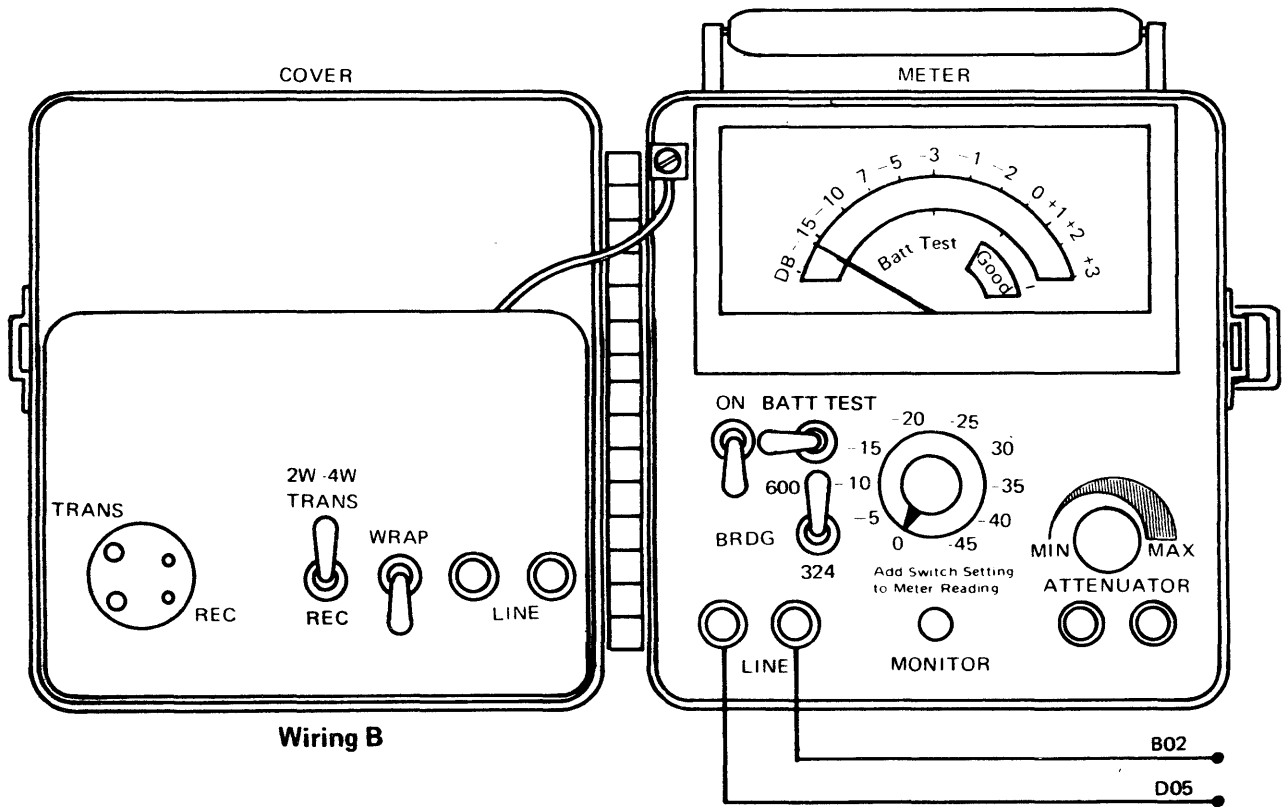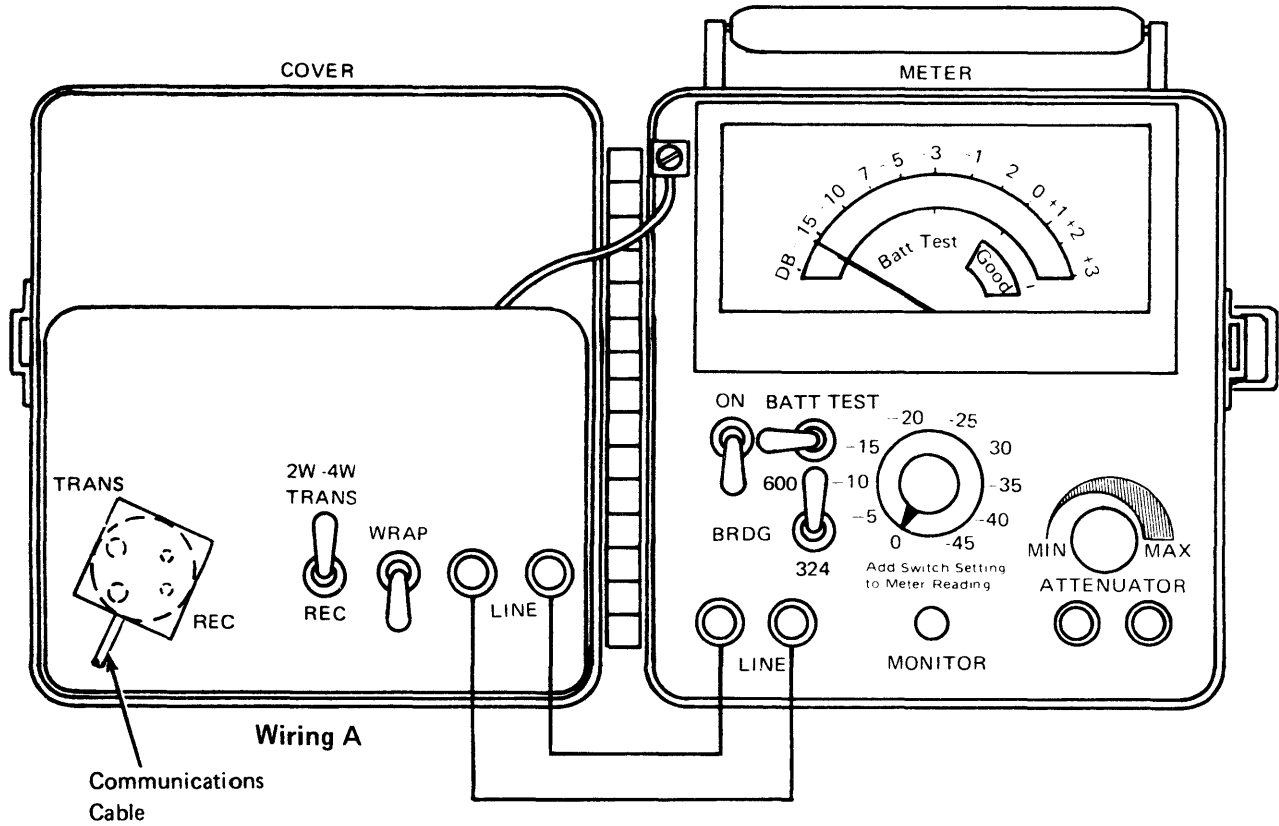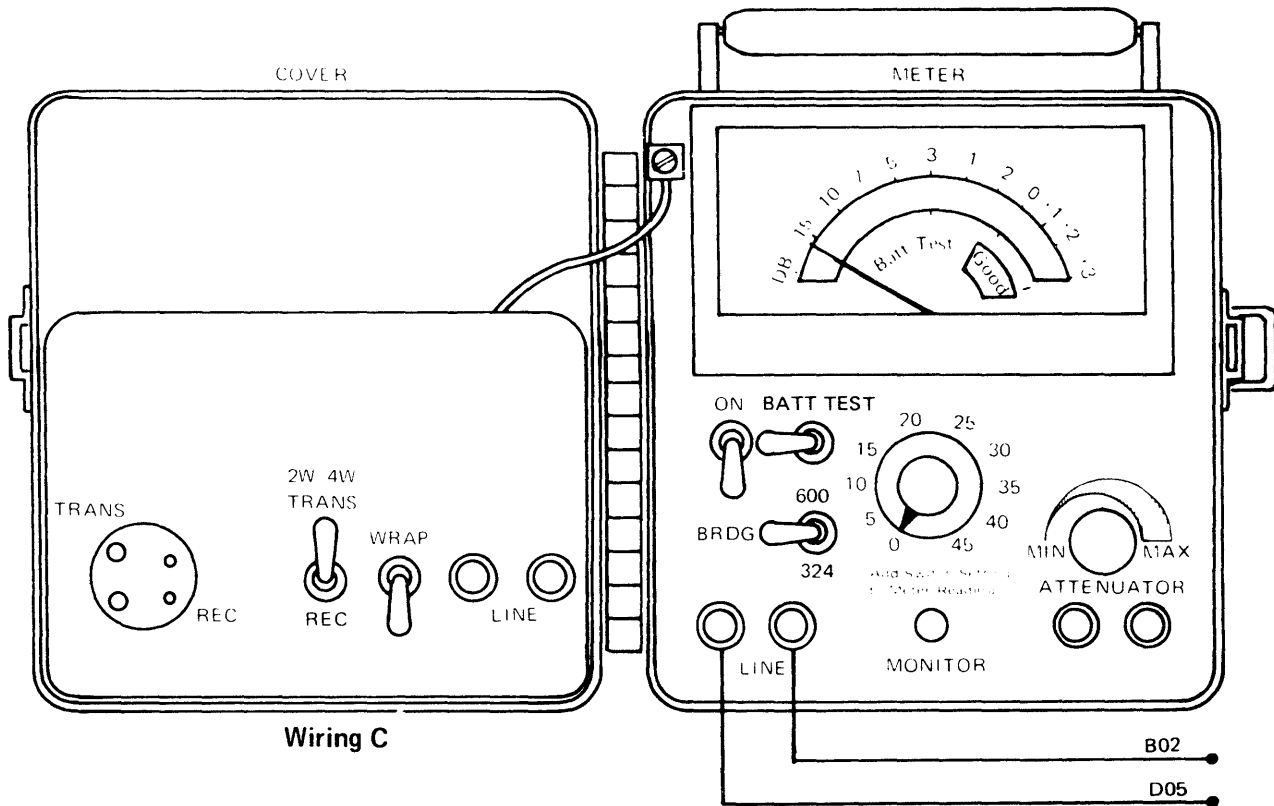
(Procedure 1.123)

## 1.125 RECEIVE-LEVEL CHECK FOR 1200-BPS AND 600-BPS INTEGRATED MODEMS

To verify that an adequate signal level is being received, you may monitor the receive signal at the controller with the DB meter, as follows:

1. **CAUTION: Turn off power.**
2. Remove the transmit and receive card, cards.
3. Turn on power.
4. Connect the DB meter LINE terminals as explained in Note 1.
5. Set the BRDG/600/324 switch to 600.
6. Set the power switch to on.
7. Press the BATT test switch. The meter should read in the good range if the batteries are good. Release the BATT test switch.

8. Set the range switch to obtain a meter reading and add its value to the meter reading. (Two-wire 1200 bps operation requires that the other end be forced to transmit by jumpering J07 of its transmit card to ground.)

9. In countries that permit transmission at 0 db, the received signal should be about −16 db. In these countries, the signal-to-noise ratio at the receiver should allow normal operation between extreme limits of 0 and −27 db. Usually, lower transmit limits allow the receiver to operate to a lower extreme. The carrier detect threshold can be lowered from −33 db to −43 db by jumpering D11 to D12 on the receive card (2-card modem).
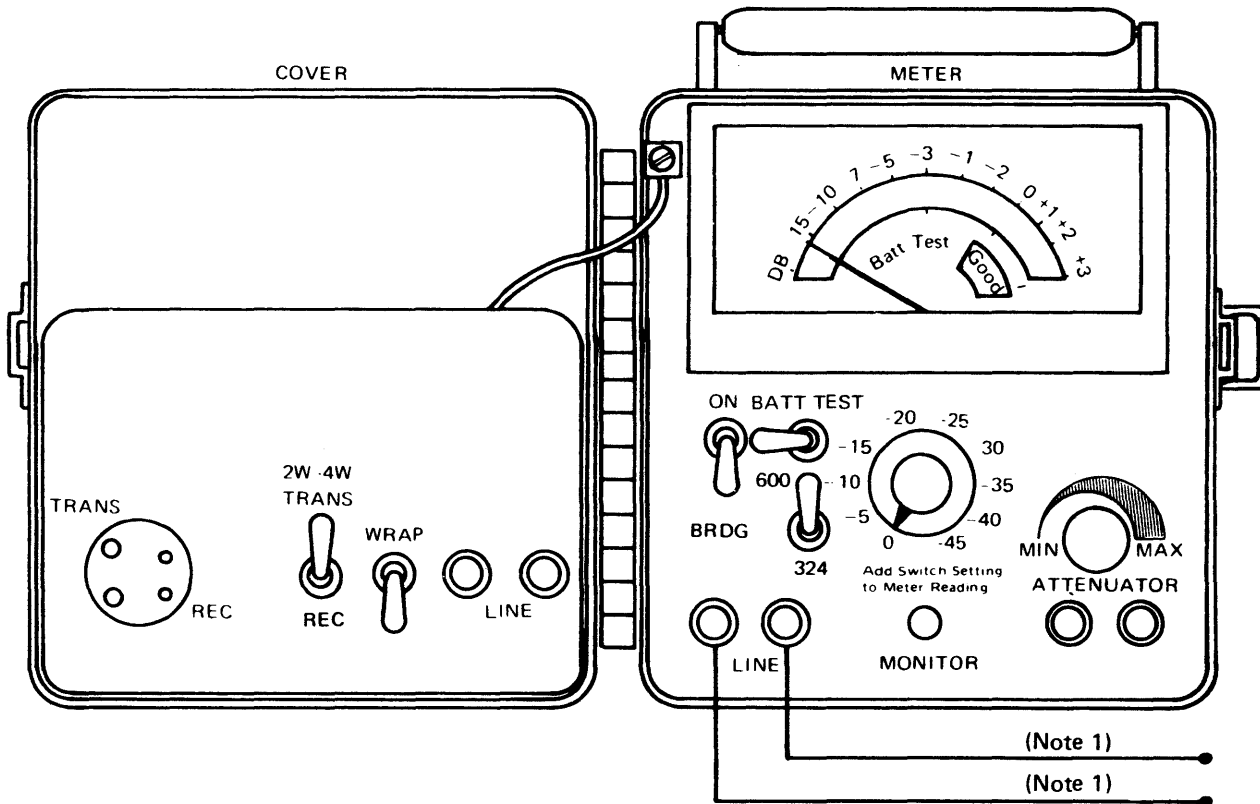


Note 1:

1200 bps:     Connect LINE terminals to G09 and J11 of receiver card.

600 bps:      Connect LINE terminals to B02 and D05 of the transmit card.

38LS M/D:     Connect LINE terminals to B02 and D05.

## 1.126 POWER SUPPLY REMOVAL AND REPLACEMENT

**DANGER**
**Be sure to disconnect the controller power cord from the ac outlet.**

1. Unplug power input cable from the power supply assembly.
2. Unplug the slip-on connectors from the output of the power supply. Note wire number sequence. Refer to Power Distribution Wiring Diagram, Figure 3-10.
3. Loosen two bottom holding screws.
4. Remove two top holding screws.
5. Lift power supply mounting plate off two lower holding screws.
6. Remove screws holding power supply to mounting plate.

To replace the power supply, reverse the above procedure.

**DANGER**
**Be sure to disconnect controller power cord from ac outlet.**

1. Remove diskette access cover.
2. Remove front cover (two screws).
3. Remove side cover and open gate.
4. Remove top cover (four nuts, one in each corner).
5. Remove fan air duct.
6. Loosen bottom 2 screws on power supply mounting plate.
7. Remove top two screws.
8. Lift power supply mounting plate from bottom two screws. Turn power supply 90° to expose cabling through top of machine.

To replace the power supply, reverse the above procedure.

## 1.127 LOGIC BOARD REMOVAL AND REPLACEMENT

**CAUTION: Turn off power.**

1. Unplug all cards from board.
2. Unplug all cables from board. Note the location of cables and jumpers.
3. Remove four screws that hold the logic board to the gate.
4. Remove the logic board.

To replace the logic board, reverse the above procedure. Use 1.131 for card locations. Be sure to connect jumpers on board, as on the original board. For jumper information, refer to 3.9, 3.11, and 1.111.

## 1.128 CARD NAMES – BOARDS WHERE USED (ALL CONTROLLERS)

Note: *For disk storage cards, see 1.129.*

| Term | Name | Use | Board Name | Part Number |
|------|------|-----|------------|-------------|
| ALA | Alternative line attachment (to down line equipment from the controller) | ALA | Basic controller, adapter | |
| CA | Communication Adapter; see CCA and HPCA. | | | |
| CCA | Common communication adapter (with clock) | ALA Host | Basic controller, adapter | 8526485 |
| | Common communication adapter (without clock) | ALA Host | Basic controller, adapter | 8523016 |
| CTRL | Control | | | |
| CTLR 1 | Controller card 1 | Basic | Basic controller | 2411872 |
| CTLR 2 | Controller card 2 | Basic | Basic controller | 2411851 |
| CTLR 3 | Controller card 3 | Basic | Basic controller | 2411869 2411893* |
| Diskette Adapter | Diskette adapter | Basic | Basic controller | 1590652 1590648* 5619736* |
| EIA | Electronic Industries Association (converter for external modem) | Host | Basic controller | 8523023 |
| EIA/ PTT | Electronic Industries Association (converter for external modem)/ public telephone, telegraph (with clock) | Remote loop | Basic controller, adapter | 1747496 4409769** |
| | Electronic Industries Association (converter for external modem)/ public telephone, telegraph (without clock) | Remote loop | Basic controller, adapter | 8523344 4409769** |
| ESA 1 | Extended storage address (card 1) | Basic | Basic controller | 2411855 1588028* 1588030* 1588096* 1588098* |
| | | Expanded memory | Basic controller | 1588075 1588090* |
| ESA 2 | Extended storage address (card 2) Heavy lands identify D and J connector pins to board. | Basic | Basic controller | 8514516 |
| | | Expanded memory | Basic controller | 2411890 |

*Indicates this PN has a later EC level than the PN listed above it. To ensure card is available, order the part number on the card being replaced. It is possible that later level cards have been used since the publication of this document. If a card with a part number that is not listed is found in the machine, consult your support structure for more information.

** See 1.121 and 1.122.

EC 745949

**1.128 (cont)**

| Term | Name | Use | Board Name | Part Number |
|---|---|---|---|---|
| FSU Type A | Functional storage unit; first and second 8K blocks of Volume 0 | Basic | Basic controller | 1744832 4941120* 6815146* |
| FSU Type B | Functional storage unit; first, second, third, and fourth 8K blocks of Volume 0 | Basic | Basic controller | 4406044 6815147* |
| FSU Type C | Functional storage unit; first and second 8K blocks of Volume 1 | Basic | Basic controller | 8527159 |
| FSU Type D | Functional storage unit; first, second, third, and fourth 8K blocks of Volume 1 | Basic | Basic controller | 1588051 |
| FSU Type E | Functional storage unit; first, second, third, and fourth 8K blocks of Volume 1 | Basic | Basic controller | 1588052 |
| FSU Type F | Functional storage unit; two 8K blocks | Basic | Basic controller | 8527158 |
| HOST | Line attachment to up-line equipment from the controller | | | |
| HPCA | High performance communication adapter (with clock) | Host | Basic controller | 8526519 |
| | | ALA | Basic controller, Adapter | |
| | High performance communication adapter (without clock) | Host | Basic controller | 8526518 |
| | | ALA | Adapter | |
| LOOP CTRL | Loop control | Loop | Basic controller, Adapter | 1744811 1741520* 4404468* |
| M/D RCVR | Modulator/demodulator (modem) receiver | Host | Basic controller | 5864331 |
| | | ALA | Basic controller, Adapter | |
| M/D XMIT | Modulator/demodulator (modem) transmitter | Host | Basic controller | 5864353 5864374* |
| | | ALA | Adapter | |
| M/D WRAP | Modulator/demodulator (modem) wrap (test card) | Host | Basic controller | 5862864 |
| | | ALA | Adapter | |
| M/D RCVR/ XMIT | Modulator/demodulator (modem) receiver transmitter (single card remote loop modem) | Remote loop | Adapter | 5864365 5864376* |

*Indicates this PN has a later EC level than the PN listed above it. To ensure card is available, order the part number on the card being replaced. It is possible that later level cards have been used since the publication of this document. If a card with a part number that is not listed is found in the machine, consult your support structure for more information.

**1.128  (cont)**

| Term | Name | Use | Board Name | Part Number |
|---|---|---|---|---|
| RE-DRIVE | Redrive card. Amplifies and redrives signals on the input/output bus to disk storage, loop 7, 8 and ALA ports 81, 82, and 83 | Disk loop ALA | Adapter | 8525771 |
| RESET | Reset | Basic | Basic controller | 8524554 |
| 38LS M/D | 38-low speed (up to 1200 bps) Modulator/Demodulator | Host | Basic controller | 1644769 |
| | | ALA | Basic controller, Adapter | 1756005* 8564510* |
| | | Remote loop | Adapter | 1755945  World 1756011*  Trade 8564481* |
| 38LS EIA | 38 low-speed (up to 1200 bps) Compatible Electronic Industries Association (converter for external modem) | Host | Basic controller | 5864363 5864660* |
| | | ALA | Basic controller Adapter | |

\* Indicates this PN has a later EC level than the PN listed above it.
To ensure card is available, order the part number on the card
being replaced. It is possible that later level cards have been used
since the publication of this document. If a card with a part
number that is not listed is found in the machine, consult
your support structure for more information.

EC 745949

## 1.129 CARD NAMES — BOARDS WHERE USED
(3602 Disk Storage Only)

| Term | Name | Use | Board Name | Part Number |
|------|------|-----|-----------|-------------|
| Buffer | Disk storage adapter buffer | Disk storage | Disk storage | 1745550<br>6815150* |
| Bus Byte 0 | Disk storage adapter bus, byte 0 | Disk storage | Disk storage | 8524620 |
| Bus Byte 1 | Disk storage adapter bus, byte 1 | Disk storage | Disk storage | 8524652 |
| Byte Ctrl | Disk storage adapter byte control | Disk storage | Disk storage | 8526006 |
| Coil Drivers | Disk storage control coil drivers, 5.2 meg | Disk storage | Disk storage | 5861346<br>5861352* |
| | Disk storage control coil drivers, 9.3 meg | Disk storage | Disk storage | 5861350 |
| Ctrl Disk | Disk storage adapter control | Disk storage | Disk storage | 8525774<br>8526618*<br>8526620** |
| Data Separator | Disk storage adapter data separator | Disk storage | Disk storage | 8219247<br>8219259* |
| Data AGC | Disk enclosure data and automatic gain control | Disk storage | DE | 5850850<br>8250197*<br>8219258*†<br>8219260*†<br>8219264*† |
| Decode | Disk storage adapter decode | Disk storage | Disk storage | 8524609 |
| Fixed Head | Disk enclosure fixed head | Disk storage | DE | 5861336<br>8250195*† |
| Interface | Disk storage adapter interface, 5.2 meg | Disk storage | Disk storage | 8522402<br>8522701*<br>8522693* |
| | Disk storage adapter interface, 9.3 meg | Disk storage | Disk storage | 8522616<br>8522694*<br>8522702* |

Note: *For footnotes, refer to the following page.*

**1.129 (cont)**

| Term | Name | Use | Board Name | Part Number |
|------|------|-----|-----------|-------------|
| Position Detect | Disk storage access arm position detector, 5.2 meg | Disk storage | Disk storage | 5850867<br>8219249*<br>8219265* |
| | Disk storage access arm position detector, 9.3 meg | Disk storage | Disk storage | 5850973<br>8219251*<br>8219266* |
| Preamp | Disk storage data preamplifier | Disk storage | DE | 8230292<br>8219253*<br>8219255*† |
| Seek Ctrl | Disk storage seek control | Disk storage | Disk storage | 8526496<br>8528055* |
| Velocity Ctrl | Disk storage access arm velocity control 5.2 meg | Disk storage | Disk storage | 5850875<br>8219257* |
| | Disk storage access arm velocity control 9.3 meg | Disk storage | Disk storage | 5850968 |

*Indicates this PN has a later EC level than the PN listed above it. To ensure card is available, order the part number on the card being replaced. It is possible that later level cards have been used since the publication of this document. If a card with a part number that is not listed is found in the machine, consult your support structure for more information.

† ● Fixed head card PN 8250195 must be used with a choice of Data AGC cards PNs 8219258 or 8219260 or 8219264 and preamplifier card 8N 8219255.
  ● Data AGC cards PNs 8219258 or 8219260 or 8219264 must use preamplifier card PN 8219255.
  ● Preamplifier card PN 8219255 can only be used with Data AGC cards PNs 8219258 or 8219260 or 8219264.

**Buffer card PN 6815150 and the following wires are prerequisite for this card:
  K4D08 to L4D13
  G4B05 to L5B11
  M4B09 to L4B02
  L4B13 to G3D02
  J3B06 to L3B06
  J3B09 to L4B05
  L2B06 to J5D04
  H3D09 to L3B11
  L4B11 to H2D02
  L4D05 to D5B10
  K3B02 to L3D10

## 1.130 BOARD LOCATIONS

PN 4404290

Expanded Storage

PN 4944490
4404286

Basic Controller

PN 4944496

TSR 3

Adapter
(3 Only)

**3601 Models 2A, 2B, 3A, 3B**
**Prior to Mid 1978**

PN 4404290

Expanded Storage

PN 6813046

Basic Controller

TSR 2 Mod 3A, 3B only

PN 4404288

TSR 2

Adapter
(3 Only)

**3601 Models 2A, 2B, 3A, 3B**
**After Mid 1978**

PN 6813048

Basic Controller

TSR 2

**3601 Models C, D**

PN 1744816

Disk Storage

PN 4944490
4404286
6813046

Basic Controller

PN 4944496
4404288

Adapter

PN 4404296

Expanded Storage

**3602 Models 1A, 1B**

## 1.131  CARD LOCATIONS

**Note:** *Compare Board Locations (1.130) with your controller to determine your board PN.*

|  | Y1 | | | Y2 | | | | Y3 | | | Y4 | | | Y5 | | | Y6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R/W to DE | | | | | | | | | | | | | | | | | | |
|  | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | U | V |
| 2 | DE Servo | Position Detect | Data Separator | Interface |  | Decode | Seek Ctrl | Byte Ctrl | Bus Byte 1 | Bus Byte 0 | Ctrl, Disk | Buffer | | | | | | | | |
| 3 | DE Fixed Head | | | | | | | | | | | | | | | | | | | |
| 4 | DE R/W | Coil Drivers | Velocity Ctrl | | | | | | | | | | | | | | | | | |
| 5 | DE Ctrl | | | | | | | | | | | | | | | | | | | |

| 6 | | Z1 | | Z2 | Special Voltages Z3 | Data to Adapter Z4 | Ctrl to Adapter Z5 | Z6 |

**Disk Storage  Card Side PN 1744816**

|  | Y1 | | | Y2 | | | | Y3 | | | Y4 | | | Y5 | | | Y6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Host EIA/Modem | | | Loop PTT  2 \| 3 | | | | Local Loops  1\|2\|3 | | | Special Voltages | | | | | | | | | |
|  | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | U | V |
| 2 | M/D Wrap (Host)(15) | M/D Xmit (Host 15) | CCA or HPCA (Host 15) | Loop Ctrl (1) | Loop Ctrl (2) | Loop Ctrl (3) | Diskette Adapter | Ctlr 3 | Ctlr 2 | Ctlr 1 | ESA 1 | ESA-2 / Reset | Type A / FSU 1, 2 Vol 0 | Type F / FSU 3, 4 Vol 0 | Type F / FSU 5, 6 Vol 0 | Type F / FSU 7, 8 Vol 0 | Type F / FSU 7, 8 Vol 1 | Type F / FSU 5, 6 Vol 1 | Type F / FSU 3, 4 Vol 1 | Type C / FSU 1, 2 Vol 1 (Or cables to expanded storage) |
| 3 | EIA (Host)(15) | | | | | | | | | | | | | | | | | | | |
| 4 | EIA PTT (Loop) (2) | M/D Rcvr (Host 15) | | | | | | | | | | | | | | | | | | |
| 5 | EIA PTT (Loop) (3) | | | | | | | | | | | | | | | | | | | |

| 6 | Data to Adapter Z1 | Control to Adapter Z2 | Diskette Ctrl Z3 | To M/D Loops 2,3 Z4 | Operator Panel Z5 | Z6 |

**Basic Controller  Card Side PN 4404286**                                          EC 745948

## Adapter Card Side PN 4404288

| Position | | |
|---|---|---|
| A | | |
| B | 38LS M/D (Loop) EIA/PTT ④ | 38LS M/D (Loop) EIA/PTT ② |
| C | 38LS M/D (Loop) EIA/PTT ⑤ | 38LS M/D (Loop) EIA/PTT ③ |
| D | 38LS M/D (Loop) EIA/PTT ⑥ | |
| E | | 38LS M/D or 38LS EIA (ALA 81) |
| F | | |
| G | Loop Ctrl ④ | |
| H | Loop Ctrl ⑤ | |
| J | Loop Ctrl ⑥ | |
| K | Redrive | |
| L | | |
| M | | |
| N | CCA (ALA 81) | |
| P | CCA (ALA 82) | |
| Q | CCA (ALA 83) | |
| R | Loop Ctrl ⑧ | |
| S | Loop Ctrl ⑦ | |
| T | 38LS M/D or 38LS EIA (ALA 83) | 38LS M/D or 38LS EIA (ALA 82) |
| U | 38LS M/D (Loop) EIA/PTT ⑧ | 38LS M/D (Loop) EIA/PTT ⑦ |
| V | Control To Disk Storage | Data To Disk Storage |

Columns: 1 (Y1), 2 (Y2 — M/D for Loops 2, 3), 3 (Y3), 4 (Y4 — Basic Controller), 5 (Y5 — Basic Controller), 6 (Y6)

Left side connectors: Y1, Y2, Y3 (with Local Loops 4/5/6 Z1, Z2, ALA 81 Z3, ALA 82 EIA Z4, ALA 83 EIA Z5, Local Loops 7/8 Z6)

## Expanded Storage   Card Side   PN 4404290

| Position | Content | |
|---|---|---|
| A | Cables to Basic Controller | |
| B | | |
| C | | |
| D | FSU 3, 4 Vol 3 | Type F |
| E | FSU 1, 2 Vol 3 | Type F |
| F | FSU 7, 8 Vol 2 | Type F |
| G | FSU 5, 6 Vol 2 | Type F |
| H | FSU 3, 4 Vol 2 | Type F |
| J | FSU 1, 2 Vol 2 | Type F |
| K | FSU 1, 2 Vol 1   Type C or<br>FSU 1, 2, 3, 4 Vol 1   Type D | |

Connectors: Y1, Y2, Y3; Z1, Z2, Z3

## Expanded Storage   Card Side   PN 4404296

| Position | Content | |
|---|---|---|
| A | FSU 1, 2, Vol 1   Type C or<br>FSU 1, 2, 3, 4 Vol 1   Type D | |
| B | FSU 1, 2 Vol 2 | Type F |
| C | FSU 3, 4 Vol 2 | Type F |
| D | FSU 5, 6 Vol 2 | Type F |
| E | FSU 7, 8 Vol 2 | Type F |
| F | FSU 1, 2 Vol 3 | Type F |
| G | FSU 3, 4 Vol 3 | Type F |
| H | | |
| J | | |
| K | Cables to Basic Controller | |

Connectors: Y1, Y2, Y3; Z1, Z2, Z3

## 1.131 (cont)

|  | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 |
|---|---|---|---|---|---|---|
| 1 | Host EIA/Modem | Loop PTT  2 \| 3 | Local Loops  1 \| 2 \| 3 | Special Voltages |  |  |

|  | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | M/D Wrap (Host) (15) | M/D Xmit (Host 15) | CCA or HPCA (Host 15) |  |  |  |  | Ctlr 3 | Ctlr 2 | Ctlr 1 | ESA 1 | ESA 2 | Type A | Type F | Type F | Type F | Type C | Type F | Type F | Type F |
| 3 | EIA (Host) (15) |  |  | Loop Ctrl (1) | Loop Ctrl (2) | Loop Ctrl (3) | Diskette Adapter |  |  |  |  |  | FSU 1,2 Vol 0 | FSU 3,4 Vol 0 | FSU 5,6 Vol 0 | FSU 7,8 Vol 0 | FSU 1,2 Vol 1 | FSU 3,4 Vol 1 | FSU 5,6 Vol 1 | FSU 7,8 Vol 1 |
| 4 | EIA PTT (Loop) (2) | M/D Rcvr (Host 15) |  |  |  |  |  |  |  |  |  | Reset |  |  |  |  |  |  |  |  |
| 5 | EIA PTT (Loop) (3) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| 6 | Data to Adapter | Control to Adapter | Diskette Ctrl | To M/D Loops 2,3 | Operator Panel |  |
|  | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 |

**Basic Controller, Card Slide  PN 4944490**

|  | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 |
|---|---|---|---|---|---|---|
| 1 | Loop PTT  4 \| 5 \| 6 | M/D for Loops 2,3 |  | Data to Basic Controller | Ctrl to Basic Controller | Loop PTT  7 \| 8 |

|  | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | EIA PTT (Loop) (4) |  |  |  |  |  |  |  |  |  |  |  | M/D Rcvr (ALA 80) |  |  |  |  |  |  | EIA PTT (Loop) (7) |
| 3 | EIA PTT (Loop) (5) | M/D Rcvr/Xmit (2) | M/D Rcvr/Xmit (3) | M/D Rcvr/Xmit (6) | M/D Rcvr/Xmit (5) | M/D Rcvr/Xmit (4) | Loop Ctrl (4) | Loop Ctrl (5) | Loop Ctrl (6) |  | EIA (ALA 80) | Redrive |  |  | Loop Ctrl (8) | Loop Ctrl (7) |  | M/D Rcvr/Xmit (7) | M/D Rcvr/Xmit (8) | EIA PTT (Loop) (8) |
| 4 | EIA PTT (Loop) (6) |  |  |  |  |  |  |  |  | CCA (ALA 80) |  |  | M/D Xmit (ALA 80) |  |  |  |  |  |  | Data To Disk Storage |
| 5 | Remote Loops  2 3 4 5 6 |  |  |  |  |  |  |  |  |  |  |  |  | M/D Wrap (ALA 80) |  |  |  |  |  | Ctrl To Disk Storage |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| 6 | Local Loops  4 \| 5 \| 6 | ALA 80 EIA/Modem | Special Voltages |  |  | Loops  7L \| 8L \| 7R \| 8R |
|  | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 |

**Adapter, Card Side  PN 4944496**

EC 745948

## 1.131 (cont)

**First chart (Basic Controller Card Set)**

| | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 |
|---|---|---|---|---|---|---|
| 1 | Host EIA/Modem | ALA 80 EIA | Local Loops 1 2 3 | Special Voltages | | |

| | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 38LS M/D or 38LS EIA (Host 15) | CCA (ALA 80) | CCA or HPCA (Host 15) | ① Loop Ctrl | ② Loop Ctrl | ③ Loop Ctrl | Diskette Adapter | Ctrl 3 | Ctrl 2 | Ctrl 1 | ESA 1 | ESA 2 / Reset | Type B / FSU 1, 2, 3, 4 Vol 0 | Type F / FSU 5, 6 Vol 0 | Type F / FSU 7, 8 Vol 0 | Type D / FSU 1, 2, 3, 4 Vol 1 | Type F / FSU 5, 6 Vol 1 | Type F / FSU 7, 8 Vol 1 | | Cables to Expanded Storage |
| 3 | | | | | | | | | | | | | | | | | | | | |
| 4 | 38LS M/D or 38LS EIA (ALA 80) | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | |

| | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 |
|---|---|---|---|---|---|---|
| 6 | Data to Adapter | Control to Adapter | Diskette Ctrl | To M/D Loops 2, 3 | Operator Panel | |

**Basic Controller Card Set PN 6813046**

### Legend

Ctrl = Controller card
EIA = Electronic Industries Association converter for external modem.

ESA = Extended storage addressing.
FSU = Functional storage unit.
M/D = Modem
SDLC = Synchronous data link control.

① = Number 1.
⋮
⑧ = Number 8.

= Crossover, PN 2633938

**Second chart (Basic Controller Card Side)**

| | Y1 | Y2 | Y3 | Y4 |
|---|---|---|---|---|
| 1 | Host EIA/Modem | Local Loop 1 2 | To J2 X ESA 1 | To J3 W ESA 1 |

| | A | B | C | D | E | F | G | H | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 38LS M/D or 38LS EIA (Host 15) | CCA (Host 15) | ② Loop Ctrl | ① Loop Ctrl | Diskette Adapter | Ctrl 3 | Ctrl 2 | Ctrl 1 | W X ESA 1 | Type B / FSU 1, 2, 3, 4 Vol 0 | Type F / FSU 5, 6 Vol 0 | Type E / FSU 1, 2, 3, 4 Vol 1 | Type F / FSU 5, 6 Vol 1 |
| 3 | | | | | | | | | | | | | |
| 4 | Reset | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |

| | Z1 | Z2 | Z3 | Z4 |
|---|---|---|---|---|
| 6 | Operator Panel | Diskette Ctrl | Special Voltages | |
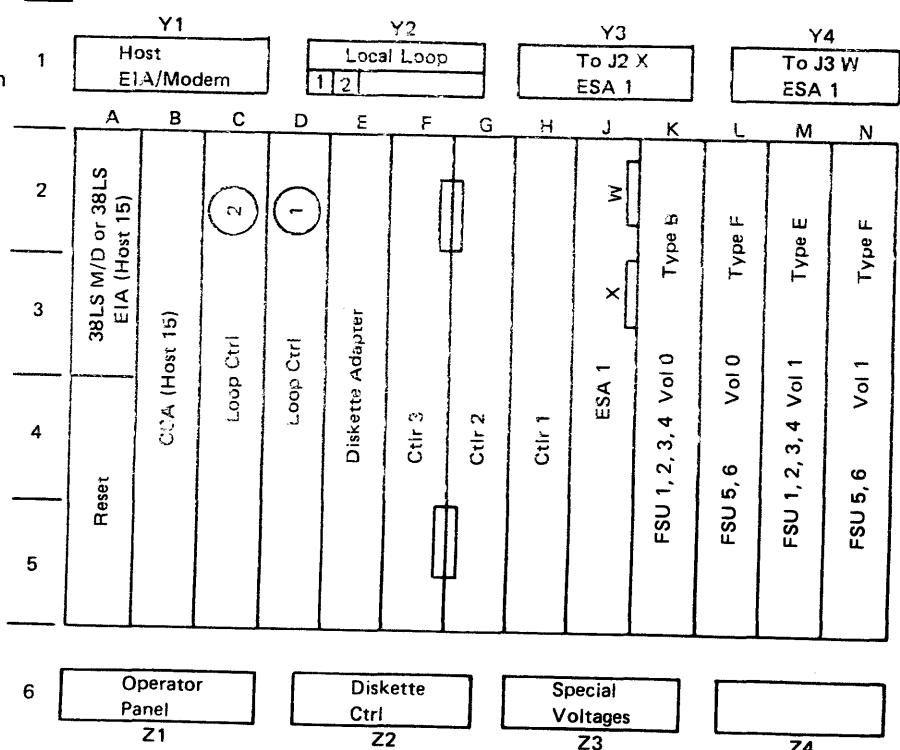
**Basic Controller Card Side PN 6813048**

BLANK PAGE

# Chapter 2. Maintenance Approach, Aids, and Special Tools

## Contents

This chapter introduces the Customer Engineer (CE) to maintenance of the Finance Communication Controllers by outlining:

- Functional parts of the controllers
- Maintenance approach.
- Maintenance facilities.
- Special tools.
- Use of the Maintenance Analysis Procedures (MAPs) and the supporting information in this manual.
- Maintenance aids.

## 2.1 FUNCTIONAL PARTS OF THE CONTROLLERS

The functional parts of the controllers are:

1. The basic controller.
2. Functional storage.
3. Diskette storage.
4. Disk storage (3602 only).
5. Control of local and remote loops and the terminals connected to the loops. (A terminal may include one or more separately addressable parts. Each addressable part is called a terminal component.)
6. Host communication link control.
7. Operator controls (a power switch and a reset switch).

For a functional description of the controller, refer to 3.2 in this manual.

## 2.2 MAINTENANCE APPROACH

Maintenance of the controller and connected terminals is based upon:

- The availability to the CE of the maintenance information manuals for the controller and each of the connected terminals. Each manual includes Maintenance Analysis Procedures (MAPs) to isolate troubles.
- CE use of the MAPs.
- CE use of the maintenance facilities, outlined in 2.3, to aid in use of the MAPs.
- The availability of replacement Field Replacement Units (FRUs) at the Branch Office.

Customer engineers (CEs) are directed by the customer to the branch experiencing the trouble. (The customer normally determines that a branch or particular unit is causing trouble when he tries to recover from an error condition.)

If the CE knows that a particular unit is not functioning correctly, he will go directly to the manual for that unit (for example, the 3604). Otherwise, he will select the controller, 3604, or 3614 manual depending upon the nature of the problem. For example, a local branch problem not yet defined will cause the CE to select the controller manual; a remote branch problem not yet defined will cause the CE to select the manual for the unit that contains the modem (3604 or 3614). Further, the Error Indication Index in each manual directs the CE to a particular MAP.

Replacement FRUs are available at the Branch Office; at the option of the Branch Office, the FRUs may be available to the CE when he makes the call or after the CE has performed initial troubleshooting.

Note: *When a call has been completed, any good FRUs that were originally removed from a unit while troubleshooting should be returned to the unit.*

If the trouble is not found, the CE follows Branch Office procedures to call for aid.

## 2.3 MAINTENANCE FACILITIES

The facilities for maintenance of the controller and connected terminals are outlined in the following text.

### 2.3.1 Startup (Reset) Diagnostic Messages

A sequence of diagnostic messages is displayed on the 3604 at address 1 on loop 1 at startup (reset). As shown in the Error Indication Index (MAP 1), termination of the startup in one of these messages is an error indication that leads to a MAP. Also, individual controller MAPs refer to these diagnostic messages. These messages are listed under "Startup Errors" in 1.1.2.

### 2.3.2 Keyed Input Commands

These commands enable the CE to:

1. Examine the controller log.
2. Examine the statistic counters.
3. Exercise the components of the controller and the components of terminals connected to the controller.

### 2.3.3 Controller Log

The controller log is data that is located on the diskette. Into this log, the controller places messages that contain maintenance information and engineering data. (Refer to 3.3.5 for details on the controller log.) The user's programs also have the ability to place messages in this log. For those messages that require immediate action, the controller turns on the CHECK light of the control operator's 3604. (Refer to 3.3.1 for the definition of this 3604.)

Note: *The log messages are lost only on a cold start. They are not lost on a warm start. (Refer to "Error-Free Startup" under 3.3.2 to see how the different types of starts are selected.)*

### 2.3.4 Statistic Counters

In addition to recording errors in the log, the controller maintains statistic counters for each of the components of the system listed in 3.3.6. As described in 3.3.6, keyboard commands are available to display or print the contents of statistic counters.

Note: *Statistic counts are located in functional storage and are lost each time there is a startup (reset), regardless of whether it is a warm start or a cold start.*

### 2.3.5 Displayed Messages and Status

To communicate with the CE, the controller displays five-digit (8XXXX and 9XXXX) error messages and informational messages on the gas panel of one of the following 3604s: the 3604 at address 1 on loop 1, the control operator's 3604, or the 3604 at which the CE is logged on. Table 3-3 lists the 3604 display the controller uses when it must communicate with the CE.

Some of the displayed error messages are followed by two status bytes, described in 3.3.8.

### 2.3.6 Starter Diskette

The IBM-controlled starter diskette is used to separate or identify problems connected with application programs. The procedures given in 3.3.3 *must* be followed to obtain correct operation of the system while using the starter diskette.

### 2.3.7 Diagnostic Diskette (3602 Only)

This diagnostic diskette is used to identify failures in the disk storage. Its use is described in paragraphs 1.114 and 1.115.

## 2.4 SPECIAL TOOLS

The following tools are required to maintain the diskette drive assembly with one read/write head:

*   CE alignment tool, PN 2200698. This tool is used to:
    (1) align the read/write head by adjusting it to track 0, and (2) adjust the phototransistor assembly by mechanical alignment. Refer to procedures 1.36 and 1.45 for a sketch of this tool.

*   Head-cleaning tools:

    Brush, PN 2200106.
    Isopropyl alcohol, PN 2200200.
    Cloth, PN 2108930.

CAUTION: If the diskette drive has two read/write heads, do not clean the read/write heads for any reason. The two read/write head assembly contains parts that are easily damaged by solvents, including isopropyl alcohol and IBM cleaning fluid.

To maintain the diskette drive assembly with two read/write heads, use two timing pins (PN 1611189), located inside the diskette drive cover assembly. These pins are used to: (1) align the stepper motor and (2) align the LED assembly.

IBM DB meter PN 453545 is required if it becomes necessary to check the transmit level of a modem.

## 2.5 USE OF MAPS

The MAPs have been developed to provide a systematic logical approach to identifying and correcting problems in the 3600 system. They are the primary maintenance tool for the CE. In this controller manual, the MAPs are on 8-1/2 x 11 pages that should be inserted in the left half of an 11 x 17 binder. (The maintenance procedures, also on 8-1/2 x 11 pages, should be inserted in the right half of the binder.)

### 2.5.1 Entering the MAPs

The starting point for each call is the Error Indication Index, MAP 1. This index directs the CE to MAPs which will isolate the trouble indicated by the error indication. Each MAP contains step-by-step procedures to locate the failing part. Where necessary, the MAPs refer to operating procedures and maintenance procedures located in Chapter 1, right half.

When the CE gets to a point in the MAPs that indicates "Call for aid", the error indications should be checked again before calling for aid. If other indications are present, the MAPs pointed to by MAP 1 should be used. If no other error indications are present, MAP 2 should be used. This MAP provides a systematic approach for finding error indications. Additionally, MAP 2 leads to use of the starter diskette in the attempt to identify the problem. (Refer to 3.3.3 for details on starter diskette operation.)

Note: *As you become familiar with the system, you may choose to enter the MAPs at any point based upon your observation, the customer's description of the trouble, and your experience. If, however, you do not correct a problem on your first pass through the MAPs, you should use MAP 2. This will make sure that you observe error indications which you may not have observed before, or which you may have observed but believed to be not connected with the problem.*

### 2.5.2 MAP Format

*   Each MAP is identified by a number and title, most MAPs being more than one page long.

*   MAP pages contain two columns. The left column is the "command" column, which contains step-by-step procedures for isolating and repairing a failure. The right column may also be a "command" column or, when necessary, a "supplemental" column, containing notes, reference material, and figures.

*   Statements such as "Replace drive motor (1.64)" are referring you to a procedure in the right-hand group of 8-1/2 by 11 pages.

*   Entry and exit points may be used to direct the CE to some other MAP or another part of the same MAP. Example: Go to MAP 12, Entry Point A.

*   At the top of Part 1 of each MAP are tables of Entry Points leading to this MAP and Exit Points leaving this MAP.

*   At the bottom of each path on a MAP page are statements such as $\frac{3}{A}$. This means go to A on page 3 of the MAP and continue on the path.

*   At the top of each MAP page, except page 1, are statements such as $\frac{A}{1}$. This means that the path is a continuation of the path that left page 1 of that MAP with an A designation.

*   Logic cards are called by name; refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

*   At the end of most paths you will find a statement "Verify Fix". It is intended that you make sure that the reported problem has been corrected. You may have repaired another problem. The method of verifying the fix will depend on the problem; it may require the customer to perform the operation with which he had a problem.

*   If you do not correct the problem, it may have disappeared or you will be instructed to call for aid. Your management will have its own procedures for obtaining aid.

### 2.5.3 Information That Supports the MAPs

In addition to the introductory information here in Chapter 2, this manual contains the following chapters to support the MAPs:

*   Chapter 1, Maintenance Procedures. Contains the following kinds of maintenance help: system operation, check, adjustment, removal, replacement, board layouts, and card part numbers. These procedures are on 8-1/2 x 11 pages that should be inserted in the right half of an 11 x 17 binder next to the MAPs.

*   Chapter 3, Reference Data, on 11 x 17 pages. This chapter includes tables of information on keyed commands and displayed messages. Also, it includes internal and external cabling information and power distribution wiring diagrams.

*   Chapter 4, Component Locations. This chapter describes the designation system for logic boards and cards, and the pins on the logic boards.

*   Chapter 5, Parts Catalog.

*   Chapter 6, Installation Instructions; self-explanatory.

### 2.6 MAINTENANCE AIDS

The following service aids are provided as helpful hints:

1.  Loop cable problems may not fail in a logical manner. A check may be performed by powering off all terminals on the suspect loop, powering off the controller, removing the loop card, and measuring for continuity at the logic board cable connectors. Maximum ring-to-ring, tip-to-tip resistance must be less than 40 ohms per 2000 feet. Refer to Figure 3-7.

2.  Intermittent power failures may be identified by causing some vibration in the area of the power supply.

3.  Some logic failures have been traced to the clear board coating getting on the card socket pins.

4.  When the MAPs direct you to replace a logic card, you may wish to measure the voltages at the card socket first. The voltages are listed in Chapter 3.

5. Problems during installation are quite often caused by improper setting of the terminal address switches or failure to have the speed switches for each terminal in agreement with the controller speed jumpering.

6. Before calling for aid, you should always use the starter diskette to separate or identify problems connected with application programs.

7. You *must* follow the procedure in 3.3.3 to obtain correct operation of the system while using the starter diskette.

8. A more complete wrap test of 4-wire, integrated 1200-bps modems, both in host links and remote loops, may be performed by removing the wrap card, unplugging the communication cable at the communication facility end, and connecting the transmit pair of lines to the receive pair of lines preferably with a 16-db attenuator jack, PN 1760940. If a start loop command (040) or a start link command (041) is issued and an error is detected, the controller will perform wrap tests and place the results in the controller log.

9. When working on an intermittent problem, try to select the correct MAP by using visual error indications and/or the controller log and error counter data. Refer to MAP 1 for the most probable FRU to repair/replace. Also, you may swap storage volume 0 cards with storage volume 1 cards in an attempt to identify the failure by changing the symptoms. Some of these cards are optional features; check part numbers before swapping cards.

   If you are unable to identify the failure, try a systematic adjustment/card replacement, or call for aid.

10. Some problems can be caused by shorts that occur when feature jumpers are pushed too far on the backpanel pins and cut through the clear insulation.

11. If you know how to add in hexadecimal,* following procedure for determining the current host link parameters may be of value to you. After logging on, the procedure, in general, is: (1) enter debug mode,** (2) display location X'1C', and (3) display the location at the address equal to X'15' plus the address found at X'1C'. Details of the procedure are as follows:
    (1) Keyboard entry:
        123 1
    (2) Keyboard entry:
        11 1 X1C
    (2) Observe display:
        001C – AAAA BBBB CCCC DDDD
    (3) On scratch paper:
        X'15' + AAAA = YYYY

    (3) Keyboard entry:
        11 1 XYYYY
    (3) Observe display:
        YYYY – PPMM MMMM MMMM MMMM

The meaning of each bit in hexadecimal PP is as follows:

| Bit | Meaning |
|-----|---------|
| 0 off | Data terminal ready |
| 0 on | Connect modem to line |
| 1 off | Non NRZI |
| 1 on | NRZI |
| 2 off | Switched line |
| 2 on | Leased line |
| 3 off | Disconnect response mode |
| 3 on | Normal response |
| 4 off | No select standby |
| 4 on | Select standby |
| 5 off | High-speed line |
| 5 on | Low-speed line |
| 6 off | Control request to send |
| 6 on | Permanent request to send |
| 7 off | Tone generation |
| 7 on | Omit tone generation |

To determine if a wrappable modem is configured, add X'35' to the address found at 1C and display that location. If bit 2 of the first character at that location is on, a wrappable modem is configured. To leave debug mode, enter 00.

---
*Refer to Appendix C in the 3600 System FE MIM for the hexadecimal add-subtract table.
**Refer to Chapter 10 in the 3600 System FE MIM.

12. Some additional suggestions for unresolved problems include:
    a. Exchange storage volume 0 cards with volume 1 cards to try to change the trouble symptoms. Some of these cards are optional features; check part numbers before swapping cards.
    b. Test the logic cards from this machine in another known good machine, if one is available.
    c. Replace a group of cards at one time to provide for the possibility of two cards failing at one time.
    d. Systematically replace each card in the machine.
    e. Bypass loop devices by turning them off or changing the loop cabling.
    f. Exchange major components (such as boards, power supply, cables, diskette drive assembly) with those of another machine if one is available and the component EC levels are the same.

13. If you are required to transmit diskette data to the host site or the design support center using TDAT, the following information will be helpful. Any other necessary information should be provided by the requesting group.
    a. The system must be started using a starter diskette at EC level 741848 or higher.
    b. Communication must be made, either normal host link or TDAT as instructed.
    c. Log on and enter command code 888.
    d. Respond to the displayed messages as follows (press EM (enter) after each entry):
       00091 = Mount the diskette containing the data to be transmitted. No entry is required.
       00092 = Enter a code to define data to be transmitted as follows:

| | |
|---|---|
| Enter key only | = Dump data |
| 0 | = Full diskette |
| TTRR TTRR | = From/to track and record (decimal) |
| X'TTRR' X'TTRR' | = From/to track and record (hexadecimal) |

       00093 = Waiting for start:
          0 = Host will start
          1 = Controller start
       00099 = Transmission complete
    e. To interrupt the transmission, press reset on the 3604. 00090 will display. Respond as follows:
       0 = Continue
       1 = Terminate

14. Actual loop speeds must match the loop speed specified on the diskette, or difficult timing failures may occur. Examples are device timeouts or link timeouts.

15. On some systems, when the 3604 at address 1 on loop 1 is not physically the first terminal on the loop, there exists a possibility that the startup diagnostic messages may not be displayed correctly. (Normal operation after startup is not affected by this incorrect display and the problem will be corrected in the future.) If it is required that you see these messages, turn off power on the terminals that physically precede the 3604.

16. If you find a feature jumper missing, or if you change feature jumpering, be sure there is no conflict with existing jumpers; i.e., 2 speeds, 2 echo clamp delays, 4 wire and 2 wire, etc.

**BLANK PAGE**

# Chapter 3. Reference Data

## Contents

## Contents

## List of Figures

## List of Tables

## 3.1 3600 FINANCE COMMUNICATION SYSTEM

The IBM 3600 Finance Communication System brings online system processing, with quick response, to a financial institution's central and branch office locations. In this system, IBM terminals located in branch offices are under the immediate control of a Finance Communication Controller.

Branch office terminals are connected to a controller in loop-type arrangements. As shown in Figure 3-1, there are local loops and remote loops. A controller may have a maximum of eight loops connected to it. One loop must be the basic local loop, each remaining loop being local or remote. The number of terminals connected to a controller is dependent on the terminal configuration.

Terminals that are within the same location as the controller will normally be connected to a local loop. Terminals located farther away must be connected to a controller by a communication line. In this case, the communication line and the terminals are said to form a remote loop. (It is possible for the terminals in several small branch offices to be part of one remote loop.) A loop of terminals on a remote loop is termed a remote subloop. The maximum recommended length of the cabling, between powered on terminals, is not more than 2000 feet (610 m).

As indicated on Figure 3-1, features can be ordered that enable the 3614 Consumer Transaction Facility (Models 1 and 2) to be connected to the central processing site through a communication link without going through a controller. These features provide a wider choice of physical locations for these terminals.

## 3.2 FINANCE COMMUNICATIONS CONTROLLERS

Normal operation of a controller is *online*. That is, it communicates with the institution's host computer via communication lines, and has access to the customer files for information inquiry and for updating. However, should a failure occur in the communication link between branch location and host computer, the controller can operate *offline*.

When the controller is offline, branch operations can continue, but without access to the host computer. Transactions that require information not available in the controller must wait until communications are restored. However, many routine transactions may be performed by using the controller's diskette for information storage. Offline transaction data can be collected and stored temporarily, so that when communications are reestablished, this data is sent to the host computer and the affected files are updated.

For introduction purposes, the following text briefly describes some functional areas and components of the controller.

**Note:** *This introduction gives the number of logic cards required for some functional areas, but does not go into detail. For detailed information on logic boards and logic cards, refer to Chapter 4, Component Locations.*

### 3.2.1 Basic Controller

The basic controller has three logic cards. At startup time, the basic controller directs the loading of the configuration image and the customer's application programs into functional storage from the diskette storage. After startup, as directed by the application program(s), the basic controller:

1. Performs the arithmetic and logical operations required to process transactions.
2. Controls the operation of the terminal components attached to the loops.

   **Note:** *A terminal component is a separately addressable part of a terminal. The component performs an input or output function, but usually not both.*

3. Controls the transfer of data between functional storage and the customer's permanent and temporary files located on the diskette.
4. Controls the flow of messages between the host computer and the branch location.

### 3.2.2 Functional Storage

The basic functional storage consists of control storage and programmable storage. Additional control storage and programmable storage are available as features. For storage sizes, check the plug chart for your controller.

### 3.2.3 Diskette Storage

The diskette storage is a direct access, read/write data storage device designed to provide low-cost data entry and data storage. It does this by using removable, magnetic diskettes.

Each controller has one of two different diskette drive assemblies, one with a single read/write head that uses only diskettes with one magnetic surface, the other with two read/write heads that use diskettes with either one or two magnetic surfaces.

Connected with the diskette storage are two logic cards and a diskette drive assembly. One logic card, the diskette drive control card, is located on the diskette drive assembly; the other, the diskette adapter card, is located on the logic board containing the basic controller cards.

The customer's operating diskette is used for normal operation. The IBM-controlled starter and diagnostic (3602 only) diskettes are available to assist in maintenance. Also, the starter diskette must be used by the customer in the procedure for creating operating diskettes.

The customer creates (generates) operating diskettes from formatted diskettes. The operating diskettes provide a storage area for:

1. The configuration image. (See Glossary.)
2. The application programs that enable the controller and the connected terminals to perform the required transactions.
3. The customer's permanent and temporary files.

After the operating diskette has been generated, items 1 and 2 are read-only storage areas.

### 3.2.4 Disk Storage (3602 Only)

The disk storage is a direct access storage device that stores information on a magnetic disk by use of two movable heads and, if installed, eight fixed heads.

The 3602 Model 1A has approximately 5.2 million bytes of disk storage, the Model 1B approximately 9.3 million. As an option, eight fixed heads can be installed on either model to provide an additional 122K bytes.

Connected with the disk storage are up to 15 logic cards. Two of the cards (three if fixed heads are installed) are located on the disk enclosure (DE), a sealed assembly containing the recording disk and the movable and fixed heads. The other 12 logic cards are located on the disk storage logic board 01A1. Refer to section 3.4 for more detailed information on the disk enclosure.

### 3.2.5 Local and Remote Loops

Some controllers may have up to eight loops, with loop 1, the basic loop, being local, and the remaining loops being local or remote. Local loops operate at 600 bps, 1200 bps, 2400 bps, and 4800 bps, but only one 4800-bps local loop is allowed.

Connected with each loop, local or remote, is one loop card. Although all loop cards are identical, the sockets are jumpered to select speed and for remote loop operation. Jumpering instructions are on a label located on the logic gate in the controller.

Each remote loop requires an integrated modem, an external modem, or a 3603 Terminal Attachment Unit. Integrated modems consist of one logic card.

In the event of a 1200-bps remote loop problem, the controller wrap-tests the loop card. If the loop card passes the wrap-test, and an integrated modem is used, the controller wrap-tests the modem. The wrap-test results are entered in the controller log. (Refer to 3.3.5 for controller log details.)

### 3.2.6 Address and Speed Switches on Terminals

Each 3600 terminal has two groups of switches. Group 1 is used to set the terminal address, and Group 2 is used to set the terminal speed. Each group has four individual switches labeled 1, 2, 3, and 4; and each switch has an ON and an OFF position. Tables 3-1 and 3-2 show how to set these switches.

When the operating diskette is being used, the address and speed switches on the individual terminals must agree with the configuration information on that diskette. The customer will have configuration documentation for reference.

**Note:** *When a loop is functioning correctly, the READY lights on all powered terminals will be on continuously.*

### Table 3-1. Terminal Address Switches (Switch Group 1)

| Terminal Address | Switches | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 | * | | | |
| 2 | | * | | |
| 3 | * | * | | |
| 4 | | | * | |
| 5 | * | | * | |
| 6 | | * | * | |
| 7 | * | * | * | |
| 8 | | | | * |
| 9 | * | | | * |
| 10 | | * | | * |
| 11 | * | * | | * |
| 12 | | | * | * |
| 13 | * | | * | * |
| 14 | | * | * | * |
| 15 | * | * | * | * |
| 16 | | | | |

\* = ON
blank = OFF

### Table 3-2. Terminal Speed Switches (Switch Group 2)

| Speed bps | Switches | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 600 | * | | | |
| 1200 | | * | | |
| 2400 | | | * | |
| 4800 | | | | * |

\* = ON
blank = OFF

### 3.2.7 Alternative Line Attachment

The Alternative Line Attachment permits the controller to attach nonloop discipline control units and terminals.

### 3.2.8 Host Communication Link

For communicating with the host computer, the controller requires one CA card (communication adapter card) and one modem. The modem may be a 1200-bps integrated modem or an external modem. For an external modem, the controller must have one EIA (Electronic Industries Associated) card.

There are two types of CA cards, one with clocking and one without clocking. The 1200-bps integrated modem requires a CA card with clocking.

The 1200-bps integrated modem consists of three cards: transmit, receive, and wrap.

**BRANCH A**

Work Station — Work Station

Tt — T — T

Basic Local Loop (Loop 1)

Note 4

3602 Controller

Modem (Note 1)
Modem (Note 1)
Modem (Note 2)

Work Station — Work Station

T — T — T

Local Loop

Note 4

**3602**

Note 3

Functional Controller
Disk Storage
Basic Controller
Diskette Storage

Loop 1
Loop 2 — Modem
Loop 3 — Modem
Loop 4 — Modem
Loop 5 — Modem
Loop 6 — Modem
Loop 7 — Modem
Loop 8 — Modem

Modem — CA
Modem — CA

Central Processor Site (Host)

To other branches

**BRANCH D**

Modem (Note 1)

3614 Consumer Transaction Facility (Model 1 or 2)

Alternative Line to Down-Line Equipment

**BRANCH B (Remote)**

Remote Subloop

Work Station — Work Station

Modem (Note 2) — T* — T — T

Note 4

**BRANCH C (Remote)**

Work Station

Modem (Note 2) — T* — T

Note 4

Remote Subloop

Legend:

‡ = Communication lines

T = any of 3600 system terminals, including the 3614 Consumer Transaction Facility.

Tt = a 3604 Keyboard Display at address 1 on loop 1. This 3604 displays diagnostic messages during startup (reset). This 3604 need not be physically the first terminal on the loop, although it is shown as such on this diagram. For other 3604 functions relating to the CE, refer to 3.3.1.

T* = a 3604 Keyboard Display Model 2, 3, or 4, or a 3614 Consumer Transaction Facility Model 1 or 2. If both are on one remote subloop, the 3614 must interface the communication link.

Modem = modulation/demodulation.

Work Station = a group of one or more terminals that are recognized by the controller as being grouped. Operators use a work station to perform a set of operations under control of an application program.

Remote loop = combination of the subloops within remote branch offices and the communication lines that connect the subloops to the controller.

Notes:

1. The modem (modulation/demodulation device) for the communication link may be a standalone modem or it may be contained within the controller or 3614 (an integrated modem).

2. Remote loops require an integrated modem, an external modem, or a 3603 Terminal Attachment Unit at each site.

3. Some controllers may have up to eight loops. Loop one must be the basic local loop, each remaining loop being local or remote.

4. Each interconnecting cable segment used for wiring local loops or remote subloops is limited in length by the driving or redriving capability of each unit. Each unit that has its power on is capable of driving a maximum of 2000 feet (610 meters) of cable. When its power is off, the terminal is automatically bypassed to maintain the loop integrity. However, the result is to connect the two cable segments together. If it is desired to keep the loop operational for other units (local or remote) on the loop, the sum of the cable segment lengths between the units with power on must not exceed 2000 feet (610 meters).

Figure 3-1. 3600 Finance Communication System Example Using a 3602 Controller

Fig. 3-1                SY27-2519-0                (4/78)  3-3

In the event of a host communication link problem, the controller wrap-tests the CA card. If the CA card passes this test, the controller wrap-tests the modem if it is an integrated modem. An external modem may or may not be wrap-tested by the controller. Wrap-test results are entered in the controller log. (Refer to 3.3.5 for controller log details.)

· **Note**: *MAP 6 gives information to help determine whether the controller is automatically wrap-testing the external modem.*

### 3.2.9  Operator Controls

The controller operator controls are two switches: a power on-off switch and a reset switch. Turning on the power switch not only applies power to the controller, but also causes a system reset (startup). Activating the reset switch causes a system reset (startup).

**Note**: *A reset (startup) always causes the diskette head carriage assembly to 'access' (move from one track position to the next) 80 times in the direction of track 0. The diskette has 77 tracks, and the head carriage assembly may be at any track when reset begins. Thus, shortly after you activate the power switch or the reset switch, you can see and hear the head carriage assembly striking against the lower stop a number of times.*

## 3.3  COMMUNICATIONS BETWEEN CONTROLLER AND CONTROL OPERATOR OR CE

**Note**: *In order to log on, the CE must obtain the identification code that is assigned by the customer and used by the customer's control operator. Thus, the control operator and the CE have the same capability for communicating with the controller. However, the following text, in most cases, mentions only the CE as the person communicating with the controller.*

### 3.3.1  3604 Keyboard Display Terminals

The controller and the CE communicate through a 3604 Keyboard Display. Functionally, three 3604s can be identified in this person/machine communication process: (1) the 3604 address 1 on loop 1, (2) the control operator's 3604, and (3) the 3604 at which the CE is logged on. (Physically, these functions may be done at one, two, or three 3604s.) The immediately following text defines these 3604s, and Table 3-3 shows which 3604 is used at the various times that the controller and the CE must communicate. Also shown in Table 3-3 are the various levels of diskettes as indicated by the EC number displayed to the CE by the 3604.

**Table 3-3.  Controller/CE Communication**

| Time | 3604 Components Used |
|------|----------------------|
| The diagnostic part of startup. This time begins when the CE activates the power switch or the reset switch on the controller. It ends when the diagnostic test complete (DTC) message is displayed. | The display of the 3604 at address 1 on loop 1. |
| The part of startup after DTC:<br>1. 82XXX error messages, if any.<br>2. Two-line message, ending 00001. This message identifies the diskette used and requests a response to select the type of start wanted. If there is no response within 2 minutes, a warm start is done automatically.<br>3. The keyboard responses to the above message.<br>4. 9XXXX error messages, if any. | 1. Display of 3604 at address 1, loop 1.<br>2. Display of control operator's 3604.<br><br><br><br><br><br><br>3. Keyboard of control operator's 3604.<br>4. Display of control operator's 3604. |
| When the CE is not logged on, and the controller wishes to inform the CE about a controller log message that requires attention. | The CHECK light of the control operator's 3604. |
| After startup has been completed and the CE is logged on. | The keyboard and display of 3604 at which the CE is logged on. |

**Diskette EC Levels**

| Starter Diskette PN 1652106 | Operational Diskette | Level |
|------------------------------|----------------------|-------|
| EC 741883 | EC 741883 | 4.8 |
| EC 741181 | EC 741181 | 4.9 |
| EC 741846 | EC 741847 | 5.0 |
| EC 741848 | EC 741849 | 5.1 |
| EC 741850 | EC 741851 | 5.2 |
| EC 741852 | EC 741853 | 5.3 |
| EC 741854 | EC 741855 | 5.4 |
| EC 745120 | EC 745121 | 5.5 |
| EC 745122 | EC 745123 | 5.6 |
| EC 745124 | EC 745125 | 5.7 |

1. The 3604 at address 1 on loop 1. This is the 3604 on loop 1 whose address switches are set to 1. Physically, this may or may not be the 3604 that is nearest to the controller.
2. The control operator's 3604. This is the first 3604 in a table that is set up in the configuration process. If this 3604 is not working at a time when the controller wishes to communicate with it, the controller searches the table, from top to bottom, until it finds a 3604 that is operating. With an operating diskette, the control operator's 3604 may be any 3604 on any loop. With a starter diskette, the control operator's 3604 is the 3604 at address 1 on loop 1.
3. The 3604 at which the CE is logged on.
   a. With an operating diskette, the CE is automatically logged on the control operator's 3604 during startup time to enable the CE to enter the keyboard responses that complete the startup. After startup is complete, the CE may manually log on at any 3604 that is idle.
   b. With a starter diskette, the CE is automatically logged on the 3604 at address 1 on loop 1 during startup and after startup is complete. (A good logon of this type is indicated when message 92222 is displayed.) If desired, the CE may manually log off this 3604 and log on at another 3604.

   At startup time and after the CE is logged on, the specified 3604 keyboard operates with the Universal Translate Table (Figure 3-2). After being logged on, the CE has the option of keying a command that returns the keyboard to the original translate table. (See the 045 X command in the IBM 3600 System FE MIM, SY27-2520.)

**Note**: *After the keying of any command or response has been completed, this information is entered into the controller by pressing the EM key shown on Figure 3-2. To avoid much repetition, this step is usually omitted in the following text.*

### 3.3.2  Operating Diskette

**Error-Free Startup (Reset)**

The startup sequence is as follows:
1. The CE activates the power switch or the reset switch on the controller.
2. The 3604 at address 1 on loop 1 displays a series of messages in the upper left corner of the gas panel to indicate the progress of the startup diagnostic tests. (This 3604 may require a power off/on reset). The first message of this series is IDL (initial diagnostic load) and the final message is DTC (diagnostic test complete). Each message is displayed for a number of seconds and is then replaced by the succeeding one.
3. The control operator's 3604 displays a message on the top two lines of the gas panel. (This message indicates that the configuration image and the application programs have been successfully loaded from the diskette.) The top line contains seven groups of characters. From left to right, the groups give the following information:
   a. The control code supplemental version ID.
   b. Diskette identification (Volume ID).
   c. Configuration identification (GEN ID).
   d. The EC level of the controller data.
   e. Control unit (controller) address (CUA). The CUA is used by the host to address this controller.
   f. Relocate count. A count of the diskette records moved to the error track because of diskette surface defects.
   g. Session identification. As used here, a session is one or more periods of time that the customer thinks of as one continuous period of time for the purpose or record keeping

The second line of the gas panel contains a five-digit message, 00001. This message requests the CE to key and enter one digit to specify the type of start wanted. The type of start specified by each valid digit is as follows:

   0  XX = Load utility, where 70 = diskette format*
   1 = Cold start
   2 = Warm start
   3 = Diagnostic loop
   4 = Prompt mode
   5 = Prompt mode for optional operations
   6  X = Describe the 3604 model number, where X = model number
   7  XX = Load link module, where,
       01 = CCA TAM
       02 = HPCA TAM
       03 = CCA CREDIT LYONNAIS
       04 = HPCA CREDIT LYONNAIS
       05 = BSC
   8 = Cold start with no start link issued
   9 = Warm start with no start link issued
*Starter diskette only.

**Note**: *Use the Universal Translate Table Keyboard locations when entering the required digit. See keyboard chart in Figure 3-2.*

**Special Note**: *When using an operating diskette, never specify a cold start (digit 1 or digit 8) unless the customer allows you to do so.*

4. The CE keys and enters the correct digit. If 1, 2, 8, or 9 are entered, go to step 5 in this sequence. If 4 is entered, go to step 6. If 5 is entered, go to step 7. If 3 is entered, the controller will loop on the startup diagnostic sequence (IDL to DTC).

5. After entering 1, 2, 8, or 9, the gas panel goes blank and the customer's application program takes control.

6. If the CE requests a prompt mode start by keying and entering 4, the control operator's 3604 displays a sequence of five-digit messages (00002 through 00004) in the position where 00001 was displayed. After each message is displayed, the CE enters a response as shown in Table 3-4, and the next message then appears. After the response to message 00004 has been completed, the screen again displays 00001. The CE now enters a 1, 2, 3, 4, 5, 8, or 9 to specify the startup, as in step 4.

7. If the CE requests a prompt mode start by keying and entering 5, the control operator's 3604 displays the message 00005 in place of 00001. The CE keys and enters responses to this message as shown in Table 3-4. After the responses to 00005 have been completed, the screen again displays 00001. The CE now enters 1, 2, 3, 4, 5, 8, or 9 to specify the startup, as in step 4.

8. The CE may describe the 3604 by entering 6 X, where X is the 3604 model number.

**Startup Errors**

1. If the startup diagnostics detect an error, the startup terminates with no message displayed, or one of the following messages displayed on the 3604 at address 1 on loop 1. (See MAP 1, Error Indication Index.)

| | | | |
|---|---|---|---|
| IDL | INS | HSH | MV2 XXX |
| HSH | MV0 XXX | LEC | MV3 XXX |
| LDI | ROS | MV2 0 | ESA |
| IRT | PCK | MV3 0 | INV |
| HSH | LSW | MV1 XXX | DTC |
| LDC | | | |

MV2 and MV3 messages will only appear with the extended memory. HSH will only appear if there is a diskette read error.

2. If the controller detects an error during the remainder of the startup: 82XXX error messages are displayed on the 3604 at address 1 on loop 1, and 9XXXX error messages are displayed at the control operator's 3604. (Refer to the IBM 3600 System FE MIM, SY27-2520.)

**Manual Logon/Logoff Procedure**

1. At an idle 3604, press the RE (reset) key three times. If reset is not marked, ask the customer to identify the reset key.

2. Message 90000 should be displayed. When 90000 is displayed, the layout of the keyboard keys is as assigned by the Universal Translate Table (UTT). Refer to Figure 3-2 for the keyboard layout for the different 3604 keyboards.

Note: *If 90000 is not displayed and the CHECK indicator lights, another 3604 is already logged on.*

3. Obtain the control operator identification (ID) code from the customer and enter this code at the 3604, using the 3604 UTT keyboard layout.

Note: *The control operator ID is not displayed.*

4. Message 91111 should be displayed, indicating a successful logon. If 91111 is not displayed, go to step 1.

5. Logoff Procedure: To log off, key in 000 and then press the EM (enter) key.

**Table 3-4. Prompt Mode Message Sequence***

| Displayed Message | CE Response |
|---|---|
| 00002 | Enter a one- or two-character control unit address (CUA) in hex. This CUA replaces the one on the diskette.** |
| 00003 | Enter a 1 to request dump option. Enter a 0 to request no dump option.** Note: *The dump is taken only after a system failure. See 82060.* |
| 00004 | Enter a 1- to 16-character control operator identification code, supplied by the customer. Valid characters are: 0–9, A–F, X, and blank.** If 90000 is displayed after entering a new identification (ID) code, the earlier ID code must be entered. If it is not entered correctly, 00004 will again display; if it is entered correctly, the ID code will be changed and 00001 will display. |
| 00005 | Enter the ID codes for as many as 16 optional modules of controller data. (Press the EM (enter) key after each ID code of one or two hex characters.) The 00005 message will remain after each entry unless the CE has responded by entering 00 or FF, or by pressing the EM (enter) key or the RE (reset) key. If 00 is entered, no optional modules will be loaded. If FF is entered, all optional modules will be loaded. For optional module ID codes on starter diskette, see 3.3.3.** |
| 00006 | Enter a 5-character XID.** |

*See 3600 System FE MIM, SY27-2520, for Prompt Mode Startup.

**If only the EM (enter) key is pressed, this input is bypassed and the operation continues. If the RE (reset) key is pressed twice, the prompt mode sequence is terminated.
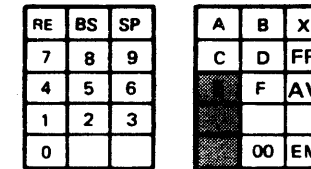


A. 30-Key Keyboard
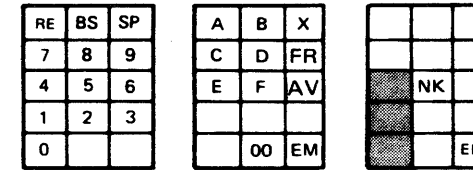
B. 45-Key Keyboard
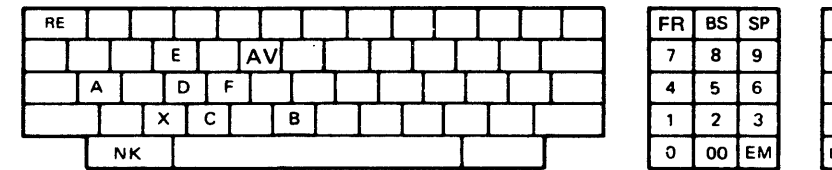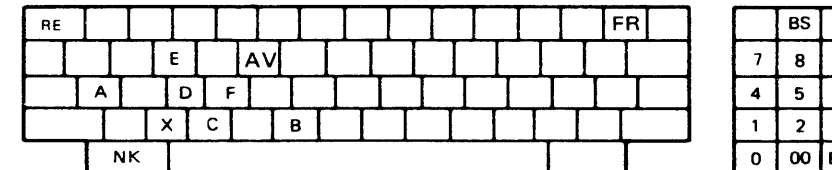
C. 74-Key Keyboard
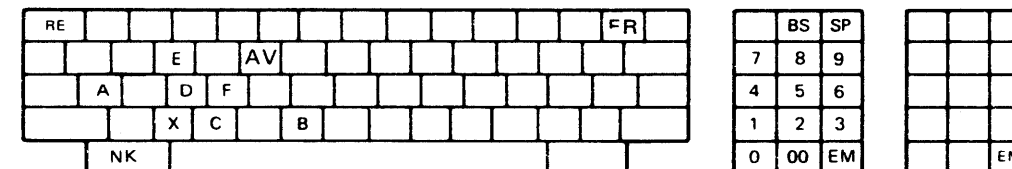
D. 77-Key Keyboard
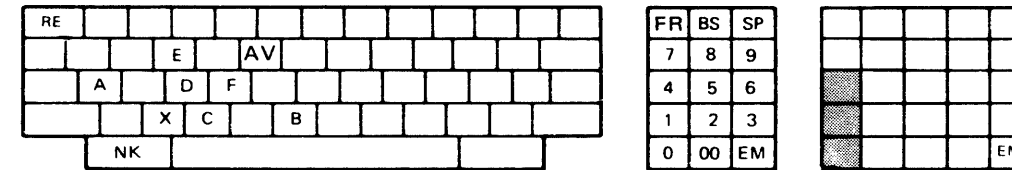
E. 92-Key Keyboard
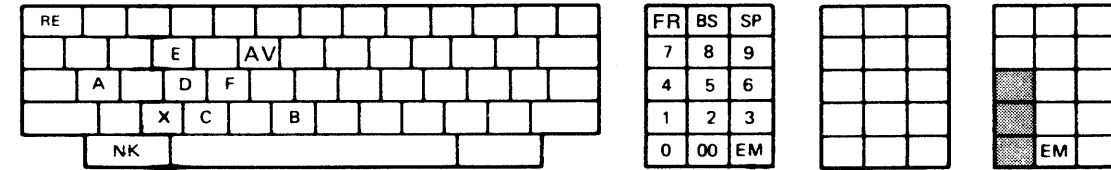
F. 94-Key Keyboard

G. 99-Key Keyboard

Legend:

BS = backspace
RE = reset
EM = end of message
NK = return to normal keyboard = 045
SP = space
AV = advance/clear*
FR = free*

= motor bar available
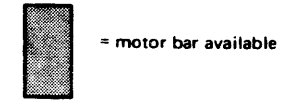
* Used only for large disk storage utilities and error code diagnostics.

Figure 3-2. 3604 Universal Translate Table Keyboard Locations

### 3.3.3 Starter Diskette

An IBM-controlled starter diskette is shipped with each controller. All the exerciser tests that can be performed with an operating diskette are available on the starter diskette. (Refer to the IBM System 3600 FE MIM, SY27-2520. for the list of keyboard commands that control these tests.) Also, the starter diskette includes the create diskette function (capability) that is not available on the operating diskette. This function is used by the customer to create (generate) operating diskettes. For CE reference, a general description of this function is given in the IBM System 3600 FE MIM.

### Preparing to Use the Starter Diskette

The starter diskette supplied to the customer has been configured for one terminal of each type on each of two loops, loops 1 and 2. (Loop 1 contains the control operator's 3604 at address 1.) After startup is complete, loops 1 and 2 are both running. Keyboard commands are available to stop loop 2, specify another loop to take loop 2's place, and start the other loop.

For all loops, the starter diskette is configured as shown in Table 3-5. Thus, if a terminal is being used in the testing, its address switches must be set as shown in Table 3-5. For terminals that are on the loop being tested but are not being used in the testing, configuration requirements may be met by turning off their power switches rather than changing the normal setting of their address switches.

There is no need to change the address switches or the power switches of terminals on loops not being tested.

### Table 3-5. Starter Diskette Configuration

For starter diskettes at EC 745122 and above, see command code 973 in the IBM 3600 FE MIM, SY27-2520. Only addresses 01, 02, and 03 are valid on these diskettes.

| Terminal | Address | Slots Used | Components |
|---|---|---|---|
| 3604 | 01 | 1,9 | Keyboard (magnetic stripe reader), and display. |
| 3618 | 02 | 2,10 | 132 print positions, dual forms feed. |
| 3604 | 03 | 3,11 | Keyboard (magnetic stripe reader), display, and magnetic stripe encoder. |
| 3610 | 04 | 4,12 | Continuous form/cut form. |
| 3611, 3612 | 05 | 5,13 | Document: Continuous form/cut form. Passbook: 28 lines, centerfold starts on line 14, and ends on line 17. |
| 3614 | 08 | 8,16 | Cash issuer. |

### Startup

With the starter diskette, the startup is the same as with the operating diskette. Note that the control operator's 3604 is the 3604 at address 1 on loop 1.

### Logon/Logoff Procedure

As soon as the CE completes the startup by responding to the 00001 message, the gas panel on the operator's 3604 (address 1 on loop 1) goes blank and the message 92222 appears. This message indicates that the CE is automatically logged on that 3604 and may run exerciser tests by using its keyboard. The CE can log off that 3604 by keying 000 and the enter (EM) key; he can then manually log on at another 3604 in the same way as with an operating diskette.

### Testing a Component

After being logged on, the CE can test a component by using the commands described in the IBM 3600 System FE MIM.

If the component to be tested is on loop 1, it is assigned as the test component with command code 007, just as with an operating diskette.

With the starter diskette, loop 2 is named as having a wrappable modem. If loop 2 actually has a wrappable modem, it is only necessary to use the 007 command to assign the component to be tested, just as with an operating diskette. If loop 2 has no modem or has a modem that is not wrappable, the following commands should be given before giving the 007 command:

```
040 0 02 00 02
040 0
```

If the component to be tested is on a loop other than 1 or 2, it is necessary to enter the following commands, before using the 007 command:

```
040 0 0X 00 0Y
040 0
```

X is set to 2 if there is no wrappable modem on the loop (local loop or World Trade 600-bps remote loop).

X is set to 3 if there is a wrappable modem (1200-bps remote loop).

Y is set to the loop number of the loop to be tested. This same number is also used to specify the loop when using the 007 command to assign the component to be tested.

The first of the above commands (040 0 0X 00 0Y) stops all loops except loop 1 and specifies the loop to be tested. The 040 0 command starts the loop to be tested.

The host link is configured for a nonwrappable modem. If your modem is capable of an automatic wrap test, you must set this parameter with the 041 command. See Table 3-6.

**Note:** *You must use a prompt mode startup to specify the component to be tested. (See 3.3.2.) The starter diskette optional module ID codes are:*

| ID | Component |
|---|---|
| 0A | Address Sharing |
| 0B | PIN Keyboard |
| 5E | Optional module required for use of command code 063. |
| 6A | ALA/Host Communication Link Test |
| 83 | 3610, 3611, or 3612 |
| 85 | 3618 |
| 86 | 3604 magnetic stripe encoder |
| 87 | 3614 |
| 88 | 3606/3608 keyboard/display |
| 89 | 3608 printer |

### 3.3.4　Keyed Input Commands*

After logging on the system at a 3604, the CE can use the keyboard at that 3604 to issue commands to the system. These commands enable the CE to perform the following functions:

1. Examine the controller log. For example, see command code 001. Controller log details are in 3.3.5.
2. Examine the statistic counters. For example, see command code 010. Statistic counter details are in paragraph 3.3.6.
3. Exercise a controller or terminal component.

---

*Refer to the IBM 3600 FE MIM, SY27-2520.

Note the following points concerning the use of these commands: *

1. As soon as the CE presses the RE (reset) key three times, the Universal Translate Table (Figure 3-2) is in effect. While logged on, the CE can use command code 045 or the NK key to return to the original translate table.

   **Note:** *When the Universal Translate Table is in effect, some of the other keys may still be active.*

2. The fields of a command are to be entered in decimal unless the field representation is preceded by X. In that case, the field may be entered in decimal or hexadecimal. If the field is entered in hexadecimal, the first character of the field should be immediately preceded by X. For an example, see command code 031.

3. Leading zeros are not required in any input field except for the command codes, and the SS portion of the LSSD field in commands 006 through 010.

4. Before exercising a component, the CE must assign that component as the test component. See command code 007.

5. The CE has the option of assigning a component as the output printer. (See command code 006.) The output printer may be used to provide a hard copy of log messages (command code 046) and statistic counters (command code 012). Also, it may be used for a hard-copy record of all keyboard commands and display messages (command code 061).

6. If the controller detects an error while the CE is logged on, it displays a five-digit error message that begins with digit 9. These five digits are followed by four hexadecimal characters that are the two status bytes of the component associated with the error.*

EC 745948

### 3.3.5 Controller Log

The controller log is a file located on the diskette. The system monitor places messages in this log that relate to maintenance and engineering data. The user's programs also have the ability to place messages in this log. The first two digits of any log message are significant. The meanings of these digits are as follows:

First digit = 1: System written log message.
First digit = Not 1: User-written log message. User should not begin the message with a 1.

Second digit = 1: The log message requires immediate attention. To alert the CE to the presence of such a message, the controller turns on the CHECK, 1, 2, or 3 indicator light of the control operator's 3604. (The configuration process at generation time determines which light will be used for this purpose. Usually, it is the CHECK light.) If the control operator's 3604 is not operating, the controller turns on the corresponding light of the first available 3604 that is operating.

Second digit = Not 1: This message does not require immediate attention and does not turn on the CHECK light at a 3604.

**Note:** *The controller log is lost through a cold start. It is not lost through a warm start.*

The CE can examine a display or a printout of the controller log by logging on at any operating 3604, and then giving a 001, 002, or 046 command as described in the IBM 3600 System FE MIM, SY27-2520.

**Log Usage Notes**

1. When displaying and paging down the log by repeatedly pressing the enter (EM) key after entering the 001 command, the controller will cause message 90001 to be displayed if the enter key is pressed after message number one has been displayed.

2. If an attempt is made to write a log message while you are logged on and the log area is full, the controller will cause message 90012 4000 to be displayed.

**Detailed log messages are in the IBM 3600 System FE MIM, SY27-2520.**

### 3.3.6 Statistic Counters

In addition to recording errors in the system log, the controller maintains statistic counters for each of the following components of the system:

Controller Diskette
Controller Loop control (for each loop)
Controller Host communication link
3602 Disk Storage
3604 Keyboard
3604 Display
3604 Encoder
3606 Keyboard/Display
3608 Keyboard/Display
3608 Printer
3610 Document Printer
3612 Document Printer
3612 Passbook Printer
3614 Consumer Transaction Facility
3618 Administrative Line Printer

Alternative line attachment information is contained in *Alternative Line Attachment General Information* manual, GA27-2856.

**Note:** *Statistic counts are located in functional storage and are lost each time there is a startup (warm or cold). In contrast, the controller log is located on the diskette. Thus, this log is lost only on a cold start.*

After logging on at a 3604, the CE can key in either of two commands to obtain statistic counts.

1. 010 LSSD is keyed to display the statistic counters of a specified component.

2. 012 X is keyed to print statistic counters for all components on the assigned output printer. X is the number of loops attached to the controller.

Refer to the IBM 3600 System FE MIM, SY27-2520 for details on the 010 and 012 commands and on the format of the printed/displayed statistic counter messages.

Concerning the displayed or printed counts, note that:

1. Each three-digit count represents the decimal count in one counter. The counters are designated as counter 1, counter 2, etc., from left to right.

2. If a count reaches 256, additional counts of that type will cause the count to return to 128 and continue from there. Thus, counts of 128 or over, are not definitive.

3. Counts represent the number of operation failures, not the number of retries per operation.

Tables in the IBM 3600 System FE MIM, SY27-2520, explain the counts for the controller components.

### 3.3.7 Displayed Messages

The controller communicates with the CE by displaying the messages described in the IBM 3600 System FE MIM, SY27-2520. Note that:

- All 82XXX messages are displayed only on the 3604 at address 1 on loop 1.

- 900NN error messages may be accompanied by four hexadecimal characters (two bytes) that give the status of the terminal component connected with the error. Tables in the IBM 3600 System FE MIM, SY27-2520, describe status information.

### 3.3.8 Displayed Status

Some of the 900NN messages explained in the IBM 3600 System FE MIM, SY27-2520, are accompanied by two status bytes, displayed as four hexadecimal characters. These bytes and characters are identified, as follows:

Byte 1 ——————————⌐    ⌐—————— Byte 2
                         XXXX
Character 1 ——————————⌐ ‖‖
Character 2 ————————————‖‖
Character 3 —————————————‖
Character 4 ——————————————
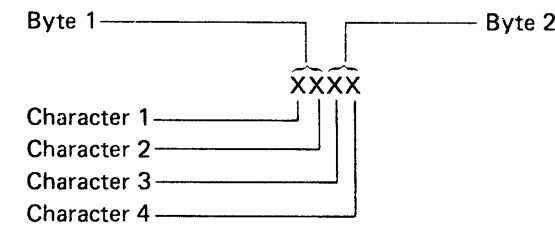
Byte 1 has general meaning not specific to any component. The specific information is contained in byte 2. The meaning of the individual bits of byte 1 is given in Table 3-6. Note that more than one bit of a status character can be activated at the same time. If this occurs, the displayed character is the sum of the activated bits. For example, a displayed first status byte of 63 indicates that bits 4 and 2 of the first status character and bits 2 and 1 of the second status character are activated. Similarly, more than one bit of status characters 3 and 4 can be activated simultaneously.

The IBM 3600 System FE MIM, SY27-2520 presents a list of status messages that assume no more than one bit activated in each character at any one time. From this you can determine the meaning of status messages that include characters with more than one activated bit.

Alternative line attachment information is contained in *Alternative Line Attachment General Information* Manual, GA27-2856.

Table 3-6. First Status Byte

| | Bit Meaning |
|---|---|
| First Character (Byte 1) | 8 = Intervention Required<br>4 = Unit Exception.<br>2 = Data Check.<br>1 = Status is for prior write operation combined with any residual status. The current write status is lost. |
| Second Character (Byte 1) | 8 = Operation terminated by attention (pressing 3604 reset key twice).<br>4 = Command Reject.<br>2 = Unit Check.<br>1 = Wrong length record. |

**3.4  Disk Storage**

**3.4.1  Locations**

DE Holding Clip

Actuator Arm

Actuator Position
Indicator

Inner Stop

Outer Stop  Home

Motor
Tension
Spring

Thermal
Reset Button
(50 Hz Motors)

Drive
Motor

Logic Board W1

Motor Spindle
Antistatic Brush

Motor Brake

Thermal
Reset Button
(60 Hz Motors)

Disk Enclosure (DE)

DE Label
White = 5.2 Megabytes w/o Fixed Heads
Pink = 5.2 Megabytes with Fixed Heads
Orange = 9.3 Megabytes w/o Fixed Heads
Blue = 9.3 Megabytes with Fixed Heads

**FRONT VIEW**

Terminal Board
(Disk TB2)
Not present on 3602 Model 1A

CAUTION:  Always lock
the actuator before mov-
ing the DE or removing
any parts from the DE.

Access Arm
Actuator Lock

Off

On    Lock

Shock Mount

Terminal Board
(Disk TB1)

DE Ground
Connection

Speed Sensing
Transducer
Spindle
Pulley
Antistatic
Brush and
Spindle Lock

Drive Belt

Drive Belt
Guard

Drive Motor
Pulley

Subframe
Ground

Disk Enclosure
Mounting Studs

Subframe

Shock Mounts

**REAR VIEW**

### 3.4.2 Component Description

#### Disk Enclosure

The Disk Enclosure (DE) is a factory-sealed unit that houses the disk, spindle access arm, actuator, and fixed heads (where installed). These components may be visible through the clear cover, but are not accessible by the customer or CE.

The card sockets for data channel, head selection cards, and the connecting cables are mounted on the DE casting; they are not enclosed with the sealed cover. Two cards are used on a DE (three, if fixed head is installed).

#### Fixed Heads (Optional)

The fixed heads are on the servo side of the disk and may not be visible. Because the heads touch the disk surface during power up/down, the data and IDs on the fixed head tracks cannot be guaranteed after the power cycle and must be recreated following power-up.

#### Disk

The disk is one permanently mounted, 14-inch, magnetic-coated disk. It is driven by an ac motor at a nominal speed of 2964 rpm.

Diagrammatic cross-section of disk
LZ : Landing Zone
G : Guard Band

Data can be recorded on 304 concentric tracks per moving head. The pair of tracks, 0 and 1, equal one cylinder; this format is used because all of the customer data that is written with the moving heads is on the same side of the disk. The other side of the disk is prewritten with patterns (corresponding to each data track location) on the outer half of the disk (area A). This is used by the servo head to perform a seek operation.

Note: *Two tracks (one available to each movable head) are reserved for read and write tests. The two tracks at cylinder position 303 are reserved for this purpose.*

#### Disk Spindle

The disk spindle assembly is mounted in a housing (which contains two bearings) in the back of the DE. The housing is sealed to prevent contamination from being drawn into the DE through the bearings.

The disk spindle has a mounting hub to which the disk is clamped. A pulley is attached to the other end of the spindle; the pulley is belt-driven by an ac induction motor that is mounted on the subframe.

Belt tension is maintained by a spring acting on the pivot-mounted motor/brake assembly. The spindle and belt are grounded to the DE casting through an antistatic brush. An electromagnetic transducer, mounted on the DE, senses a slot in the spindle pulley to give an indication of speed.

#### Access Arm Actuator

The actuator arm is pivoted beside the disk and carries the heads across the disk to the track that is specified by the Disk Control. The movable data heads and the servo head are attached to one end of the actuator arm, and a rectangular coil is attached to the other end. The coil, which is located in a two-gap magnet, moves when current passes through it. This causes the heads to be moved in an arc across the disk surface. Track crossing information is obtained from the servo tracks to position the heads over the required track. A preamplifier for the servo is mounted on the actuator arm, close to the head element. The actuator has no mechanical detent when it completes a seek, but constantly servos. When the heads are over the landing zones, however, a magnetic catch on the actuator makes sure they do not move in a normal power-off state. During removal, installation, and in transit of the DE, the mechanical actuator and spindle locks must be set.

#### Motor

The disk is driven by a 1/6-Hp, ac-induction motor that is mounted on the subframe. The motor has a thermal cut-out switch with manual reset to prevent overheating. The motor has a fail-safe brake that is applied immediately following power off. The disk speed during start and stop operations is important because the time the heads touch the disk while it is rotating must be kept to a minimum. The fail-safe brake releases a spring-loaded plate that pushes the brake on when controller power turns off.

#### Data Recording

Data is transferred by heads that fly above the disk when the disk is spinning at 2964 rpm. When the disk is stationary, the heads are in contact with it. To minimize head wear, the stop/start times of the disk are controlled.

During a normal start or stop cycle, the data and servo heads are positioned over the landing zones. The landing zones are not used for recording. An actuator retract circuit ensures that the heads are moved over the landing zone if ac power fails.

#### Servo

The servo head follows prewritten patterns at the cylinder locations to ensure that the moving data heads maintain track alignment. The servo tracks provide information that is used by the servo circuitry to detect track crossing.

A seek error occurs when a read/write head is incorrectly positioned over the desired track after a seek operation. The disk maintains track alignment through the servo error signal, but cannot detect or recover from a seek error unless the heads enter the guard band area (that is, the area between the data tracks and the landing zone). If the read/write heads do enter the guard band, the servo head detects it and sends a signal to the Disk Control, which ends the seek operation.



Disk Enclosure — Transparent Cover — Card Socket — Air Flow — Disk — Disk Spindle — Rotational Axis — Fixed-Heads (8) — Servo Head — Read/Write Heads

| Data Tracks | LZ | | (Hub) | LZ | Data Tracks | LZ | Data Tracks |
| Fixed-Head Tracks | | | | | Fixed-Head Tracks | LZ | G | Servo Tracks |



Movable Heads
Access Arm Actuator
Access Arm Actuator Lock
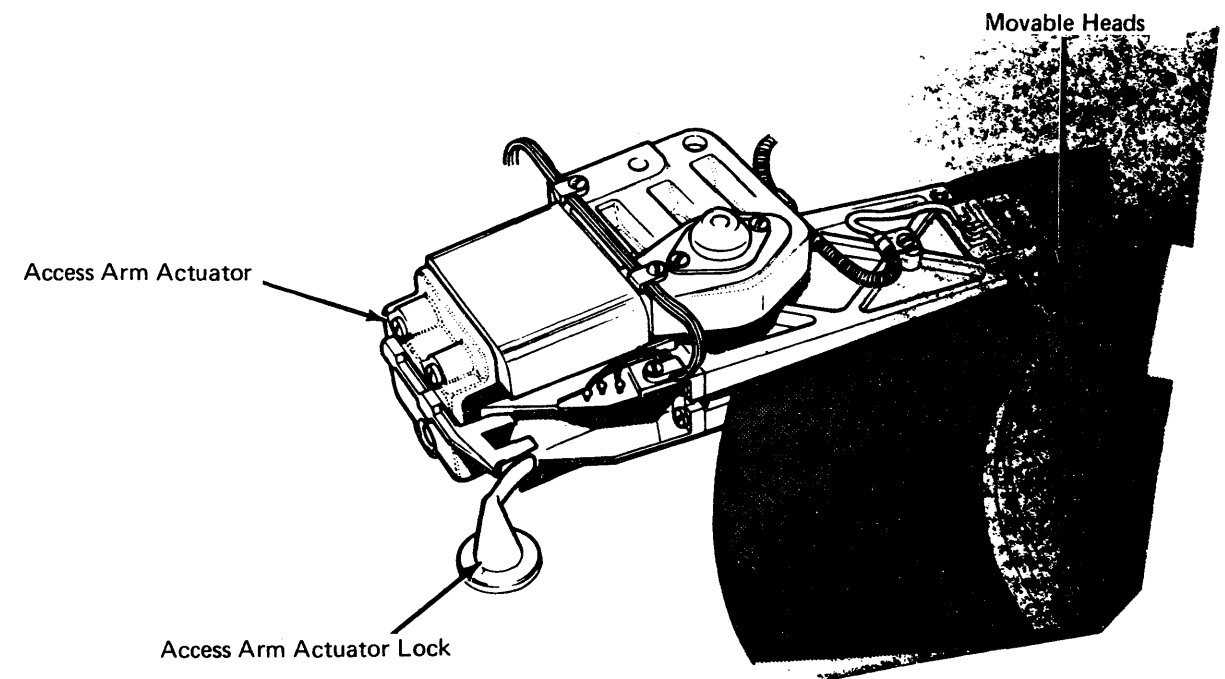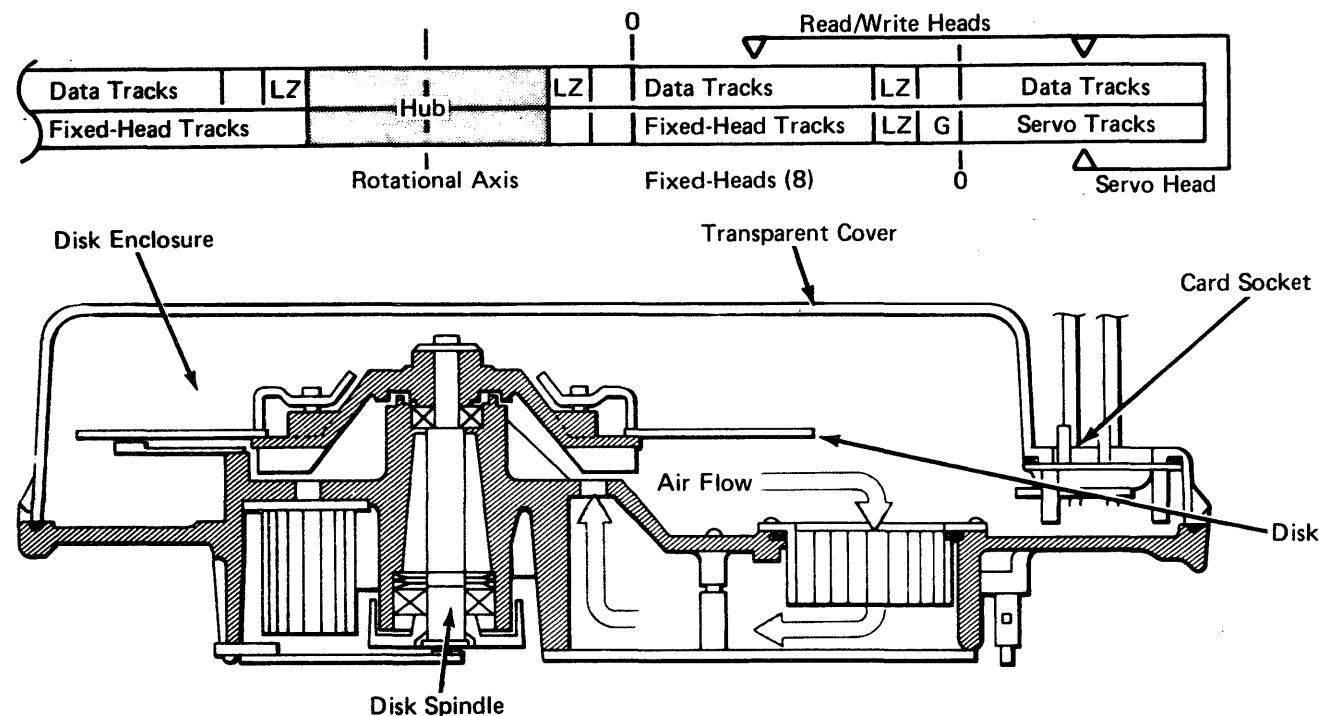
## 3.5 DISKETTE DRIVE ASSEMBLY (SINGLE SIDE)

### 3.5.1 General Description

**3** **Diskette Drive Cover**

The diskette drive cover permits insertion and removal of the diskette

**2** **Diskette Collet Assembly**

When the diskette drive cover is closed, the spring-loaded collet centers and clamps the diskette to the diskette drive hub.

**1** **Head Load Actuator Assembly**

The head load actuator assembly consists of a magnet and an armature. During a read or write operation, the head load actuator is energized and allows the pressure pad arm to push the diskette against the read/write head. At the same time, the head load actuator armature forces the diskette package against the flexible disk for cleaning. While not reading or writing, the head load actuator is deenergized and holds the pressure pad assembly away from the diskette to reduce diskette and head wear.

**11** **Preload Spring**

The preload spring loads the leadscrew to maintain head alignment with the diskette.

**10** **Limit Stops**

The upper limit stop prevents the head from being driven beyond track 77. The lower limit stop prevents the head from being driven lower than track 00.

**9** **Read/Write Head**

The read/write head provides the read, write, and erase functions.

**8** **Leadscrew Nut and Spring**

The leadscrew nut and spring load the head and carriage assembly to maintain head alignment with the diskette.
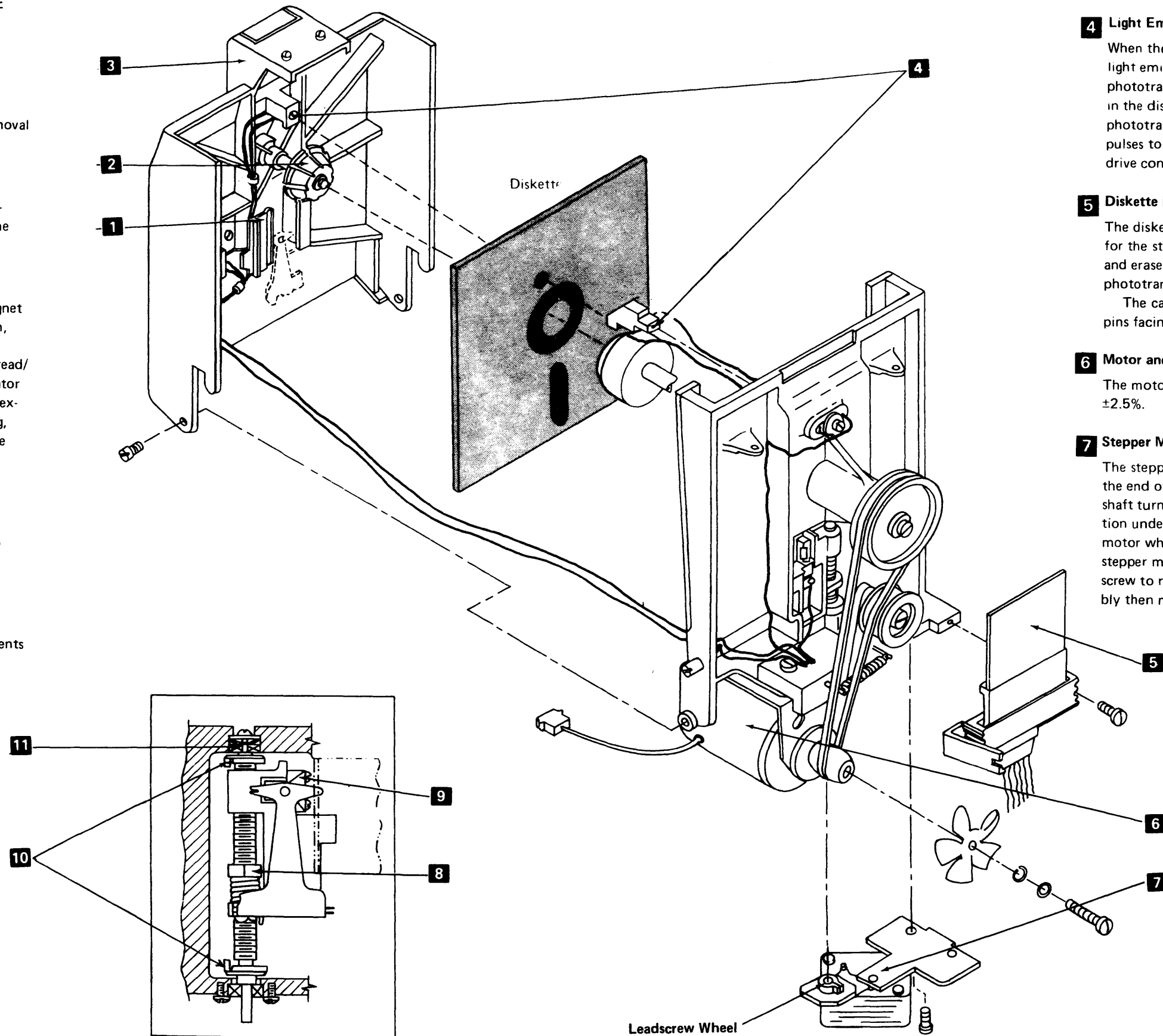
**4** **Light Emitting Diode (LED) and Phototransistor**

When the diskette drive cover is closed, the continuous light emitted from the LED is directed toward the phototransistor Once every revolution, the index hole in the diskette allows light from the LED to reach the phototransistor The phototransistor sends index pulses to the diskette adapter card via the diskette drive control card.

**5** **Diskette Drive Control Card**

The diskette drive control card provides drive circuits for the stepper motor, head load actuator, and write and erase heads. It also provides the amplifiers for the phototransistor and read head.

The card is mounted with the components and test pins facing out for service.

**6** **Motor and Drive**

The motor turns the diskette at a speed of 360 rpm ±2.5%.

**7** **Stepper Motor Assembly**

The stepper motor wheel is permanently mounted on the end of the stepper motor shaft. The stepper motor shaft turns in increments of 90 degrees in either direction under the control of access pulses. The stepper motor wheel engages the leadscrew wheel. When the stepper motor rotates 90 degrees, it causes the leadscrew to rotate 90 degrees. The head carriage assembly then moves up or down one track on the diskette.



Diskette

Leadscrew Wheel

EC 745948

### 3.5.2 Operating Sequence

1. The controller activates motor power. Diskette can be inserted or removed with power up.

2. Insert diskette and close cover. Closing the cover engages the diskette clamp **9** in the drive hub **8**, clamping the diskette in place. With power up, the diskette is now turning.

3. After a 10-second delay from power on, index pulses **1** every 166.6 ms nominal are read.

4. 'Head engage' line **2** is activated. This causes the pressure pad **11** to push the flexible diskette against the read head **10**. After 80-ms settle time **5**, data is valid for the system. Head location is determined by reading track **3** or by returning the read head to track 0.

5. For each access command, the stepper motor **13** rotates the leadscrew **12** 90 degrees clockwise or counterclockwise. This moves the read head one track position. (Clockwise rotation of leadscrew, looking down on unit, moves the carriage up.) Two adjacent signal lines must be energized at the same time when accessing **8**. Overlapping must be no less than 50 ms **6**. Prior to read or write operations, the two lines for the selected track must be energized for 150 ms minimum **7** (50 ms for travel and 100 ms to stabilize).

6. Full track read occurs **4**.

7. Pressure pad is lifted as soon as possible after completion of last read, write, or access operation to reduce diskette and head wear **2**.

**Typical Timing Sequence**
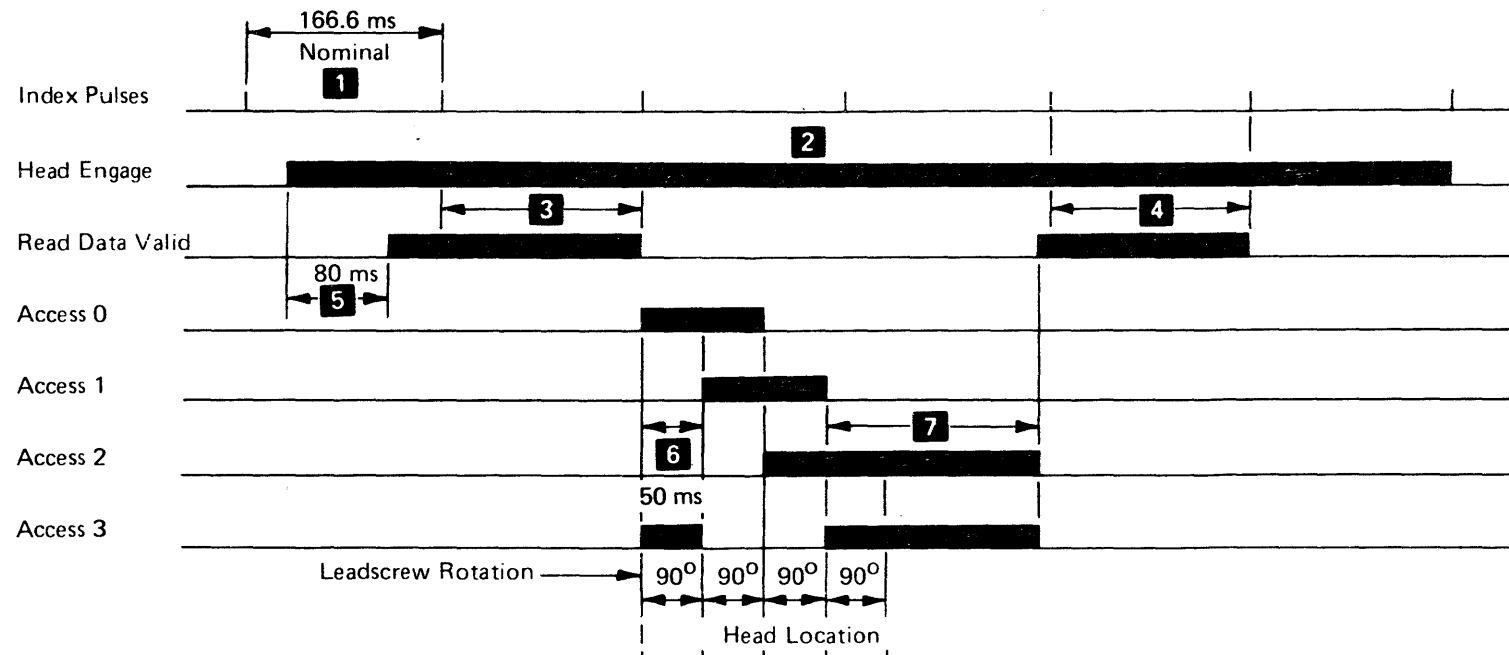


Motor is at phase 0 when read head is at track 0 and every track divisible by 4.
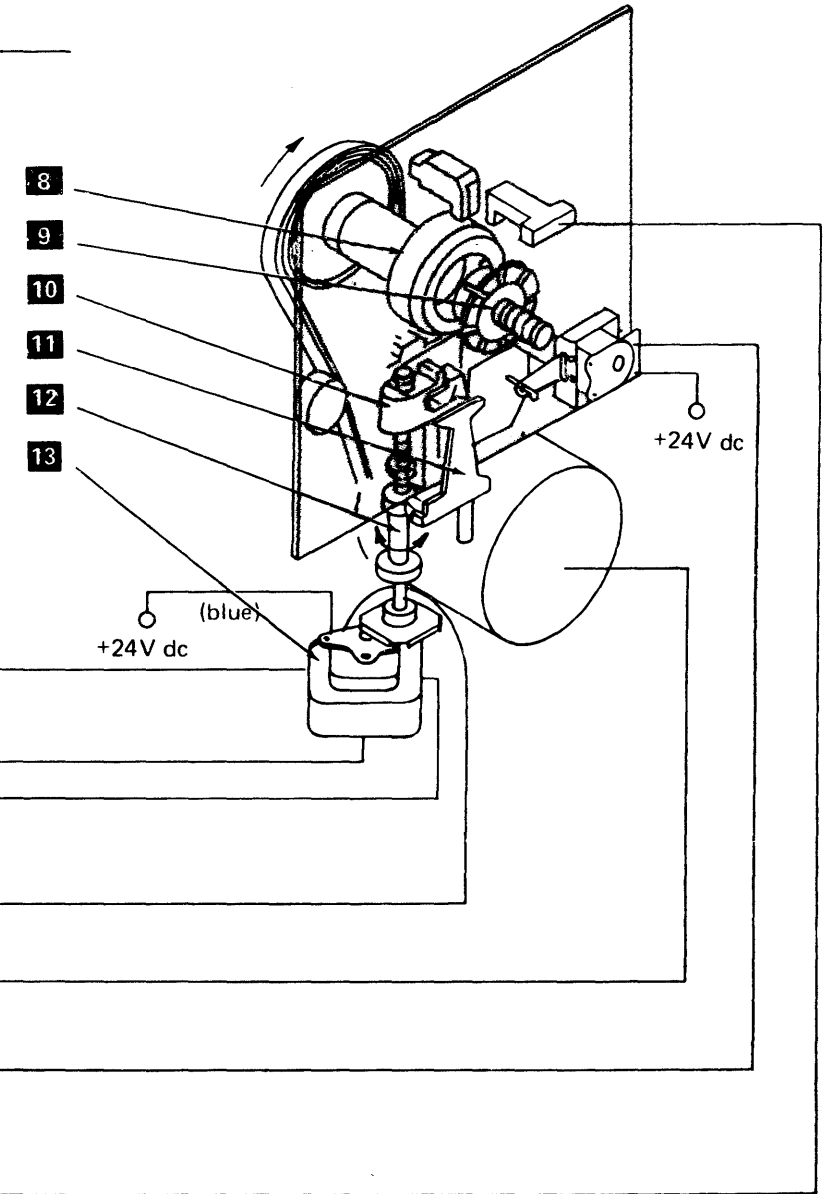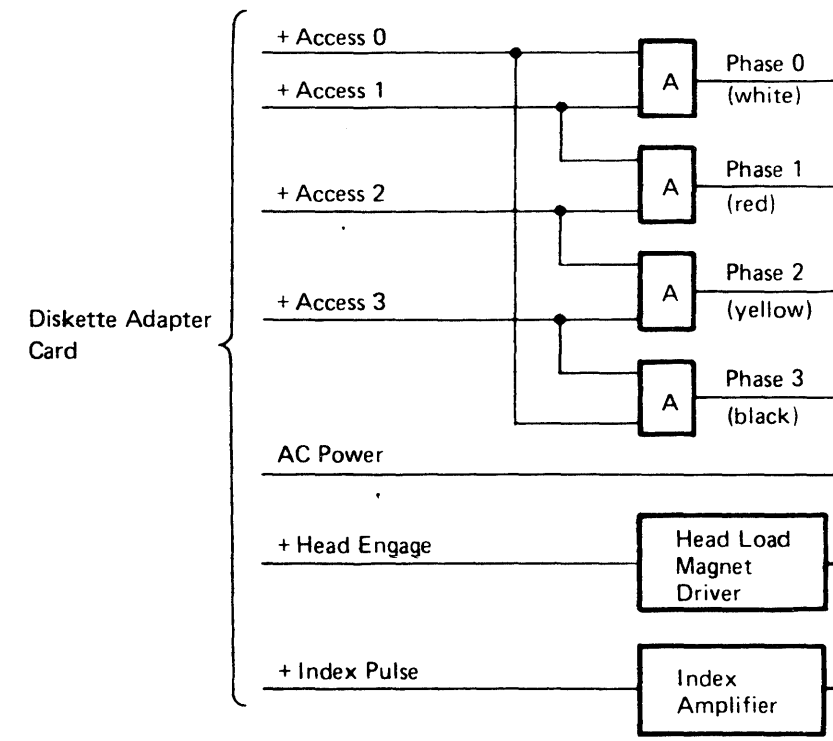
## 3.5.3  Read/Write Circuit Principles

**Write Data**

For each transition in the 'write data' line, current is switched in the read/write head causing a flux change on the diskette.

**Raw Read Data**

- Sine wave signal:

    125 kHz (all 0's)
    250 kHz (all 1's)

- Higher voltage at outer track because of higher diskette speed and lower bit density.

- All 0's pattern gives higher voltage amplitude than all 1's.

**Limit Amplifier**

- High-gain differential amplifier increases signal so one of amplifier transistors is cut off. Outputs of limiter are two out-of-phase square waves.

- Differential rectifier RC network differentiates square waves. Resulting positive- and negative-going pulses (180° out of phase) are input to an OR circuit. Output is a train of positive pulses. Positive leading edges of output pulses correspond to peaks in read signal delayed by a constant amount.

- Data is a string of 150-ns pulses (+Diskette Data) which are fed to the VFO in the diskette adapter card.



CAUTION: Do not measure the resistance of the head coils—damage to head may result.

Preamp TP 1    Preamp TP 2.

CE Test Points
13-560 mV (all 0's)
6.5-420 mV (all 1's)
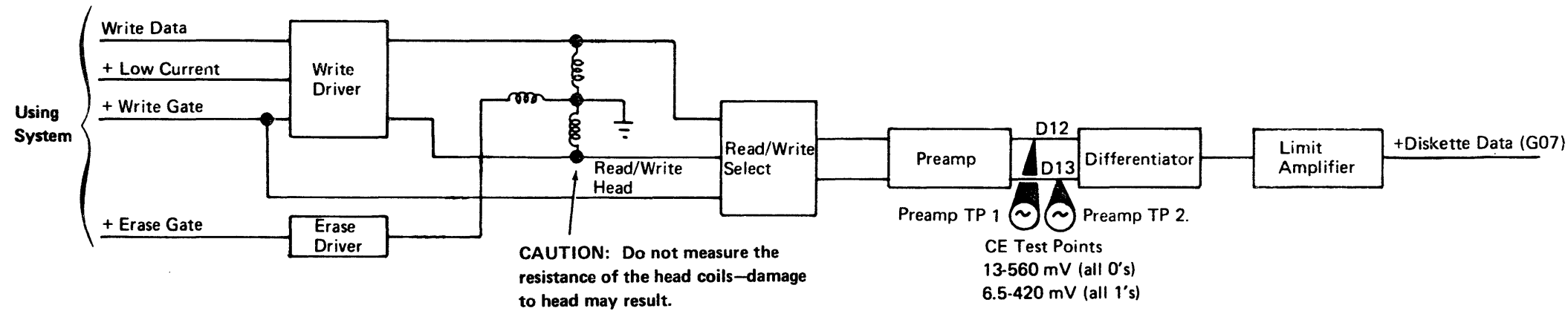
**Erase**

The edges of the data track are erased to prevent reading of adjacent tracks.



**Full Track Differential Read Signal at CE Test Points**



50 mV/cm

Beginning of Track        1 Record

20 ms/cm



0.5 V/cm

All 1's        All 0's

10 μs/cm

EC 745948
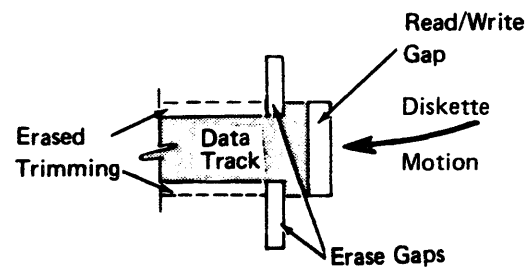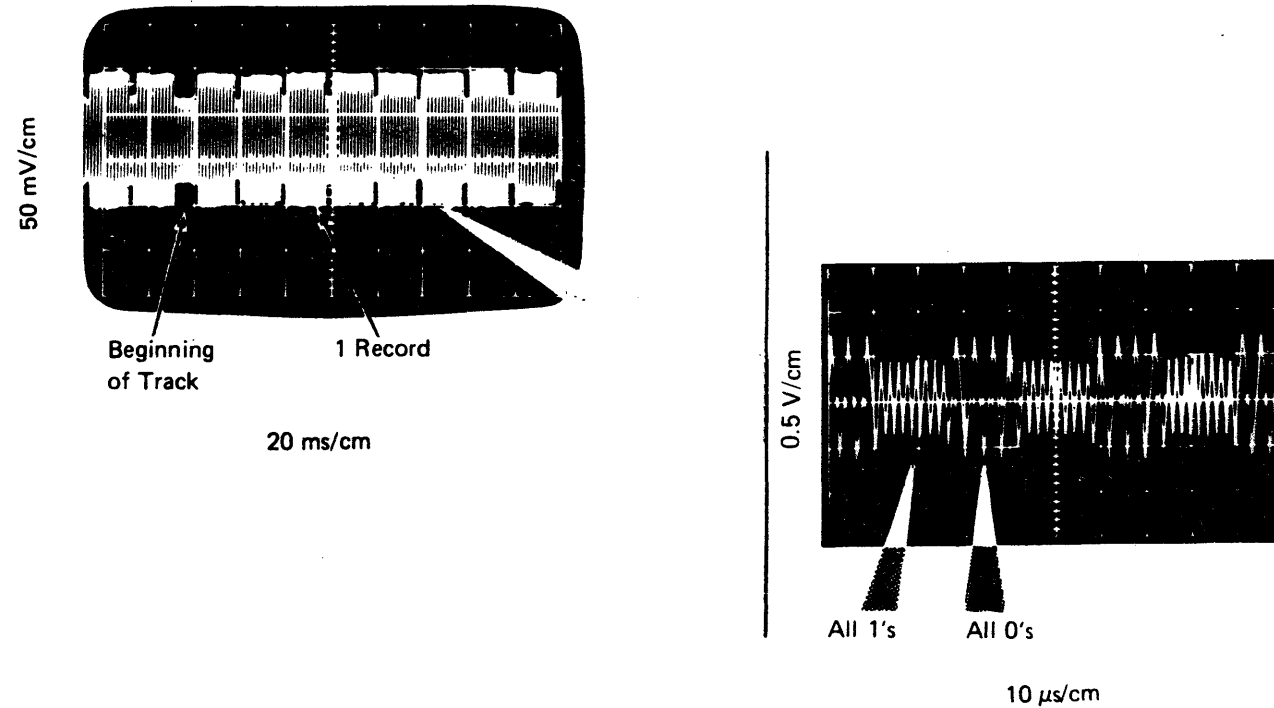
## 3.6 DISKETTE DRIVE ASSEMBLY (TWO-SIDED)

### 3.6.1 General Description

#### Cover Assembly

**1** Latch assembly
**2** Collet

The diskette drive cover assembly **3** pivots to accept the diskette **5**. The diskette is automatically centered and clamped to the drive hub **18** by the collet.

Two timing pins **4** are stored in a holder located inside the cover assembly.

#### AC Drive Components

**13** Belt
**8** Drive motor
**16** Drive pulley
**14** Idler assembly
**15** Idler spring

These components drive the hub. The motor rotates the diskettes clockwise (viewed from the front) at a speed of 360 rpm with the heads loaded.
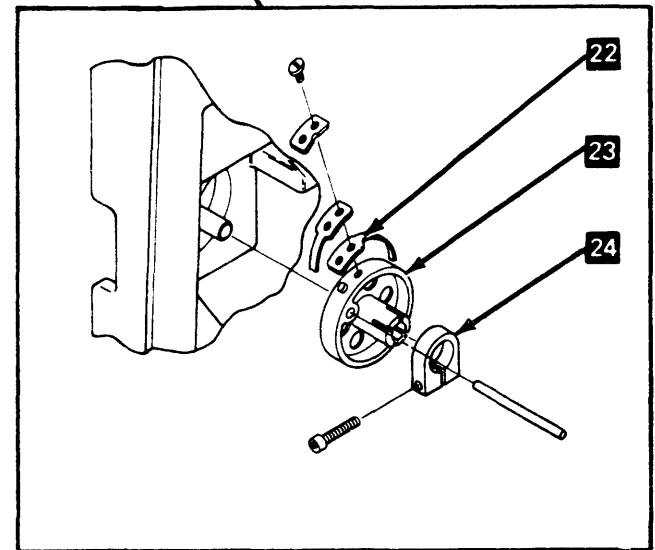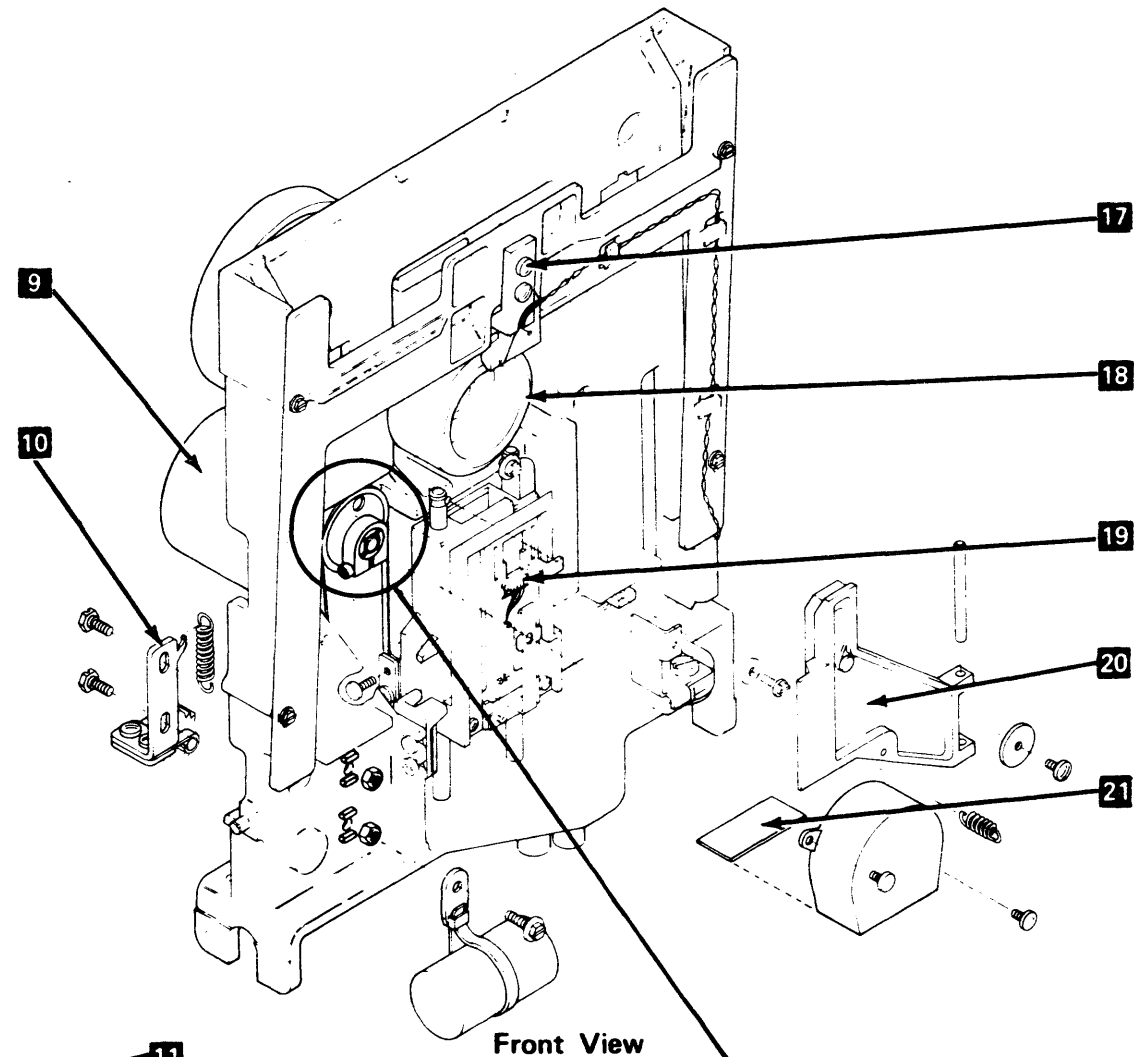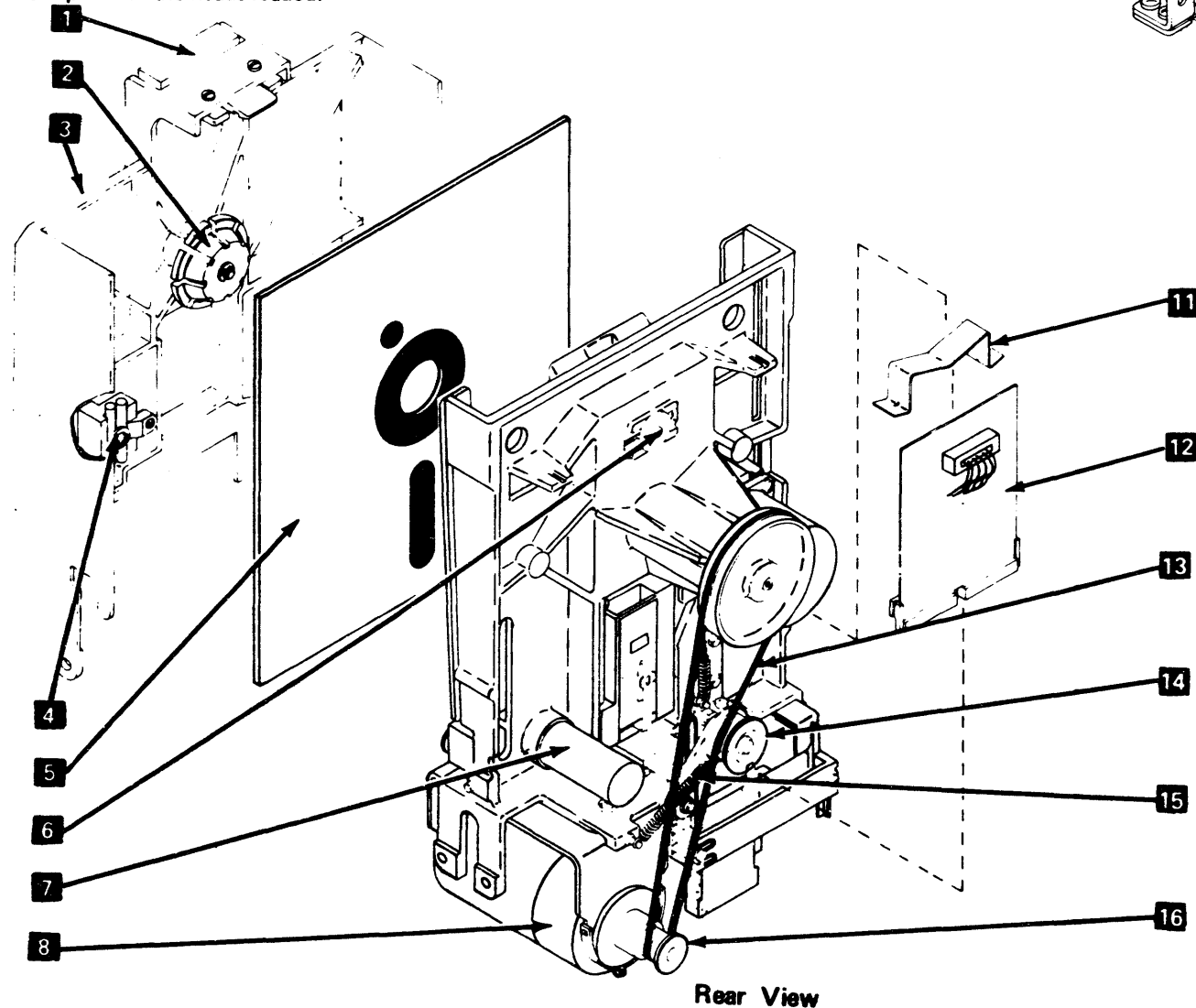
#### Stepper Drive Components

**9** Stepper motor
**23** Stepper motor pulley
**24** Stepper motor pulley clamp
**21** Wiper
**22** Stepper drive band
**10** Stepper idler assembly

The stepper motor shaft turns in increments of 1.8° in either direction under control of access pulses. This motion causes the head/carriage assembly to move the heads across the diskette surface a distance equal to one track.

#### Head/Carriage Assembly

The head/carriage assembly **19** consists of two read/write heads mounted on a common carriage. The assembly moves under control of the stepper motor. The read/write heads provide the read, write, and erase functions required to record and retrieve data from either side of the diskette.

**CAUTION:** The head/carriage assembly is a factory-adjusted and tested assembly. Any attempt to adjust, repair, or clean any part of this internal component is likely to cause serious damage to the read/write heads or carriage assembly.

#### Head Load Solenoid/Bail Assembly

The head load solenoid **7** is energized, causing the bail assembly **20** to load the heads. The heads are loaded before a read or write operation. The heads are unloaded after no more than one revolution if another read or write operation is not to be executed. This reduces wear to the diskette and read/write heads.

#### LED/PTX Assemblies

The LED (light emitting diode) **17** and PTX (phototransistor) **6** assemblies provide a means of detecting the diskette index and identifying the type of diskette inserted (one-sided or two-sided).

#### Diskette Drive Control Card

The diskette drive control card **12** provides the drive circuits for the stepper motor, head load solenoid, and the write and erase functions. It also provides the amplifiers for the read heads and the LED/PTX circuitry. The diskette drive control card is supported by a card retainer **11** located between it and the stepper motor.



Front View

Rear View

### 3.6.2  Operating Sequence

1. The controller activates motor power and the diskette motor starts turning.

2. Insert a one-sided or two-sided diskette. The type of diskette is identified by the diskette sense line. An up level indicates a two-sided diskette.

3. Close the cover assembly. This causes the collet to engage the drive hub, clamping the diskette in place. The diskette starts turning.

4. After a 10-second delay from power on, index pulses **1** are sensed every 166.7 ms (nominal).

5. Head Engage **2** is activated causing the heads to load. After 80-ms head settle time **5**, data is valid for the controller, and head location is determined by reading **3** the track address.

6. Access to the desired track is done by sequencing the four access lines to move the head/carriage assembly in (toward the hub) or out (away from the hub). Energizing adjacent access lines **7** rotates the stepper motor 1.8°, a distance of one track. The two access lines for the last track accessed remain energized.

7. Reading occurs **4** 35 ms after the last track access **6**.

8. The heads are lifted after the last read, write, or access operation to reduce diskette and head wear.

**Typical Timing Sequence**



Motor is at phase 0 when read head is at track 0 and every track divisible by 4.



EC 745948
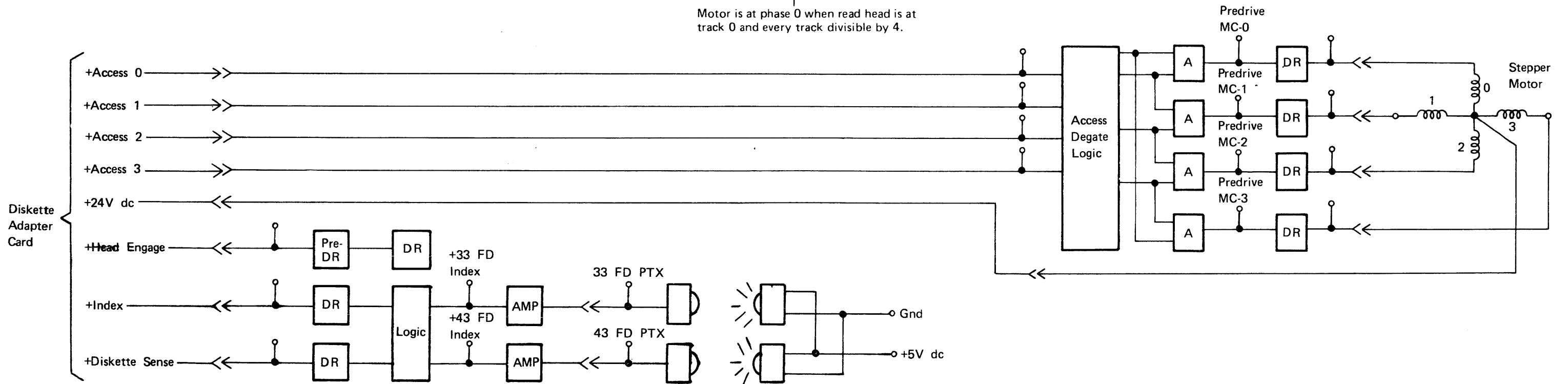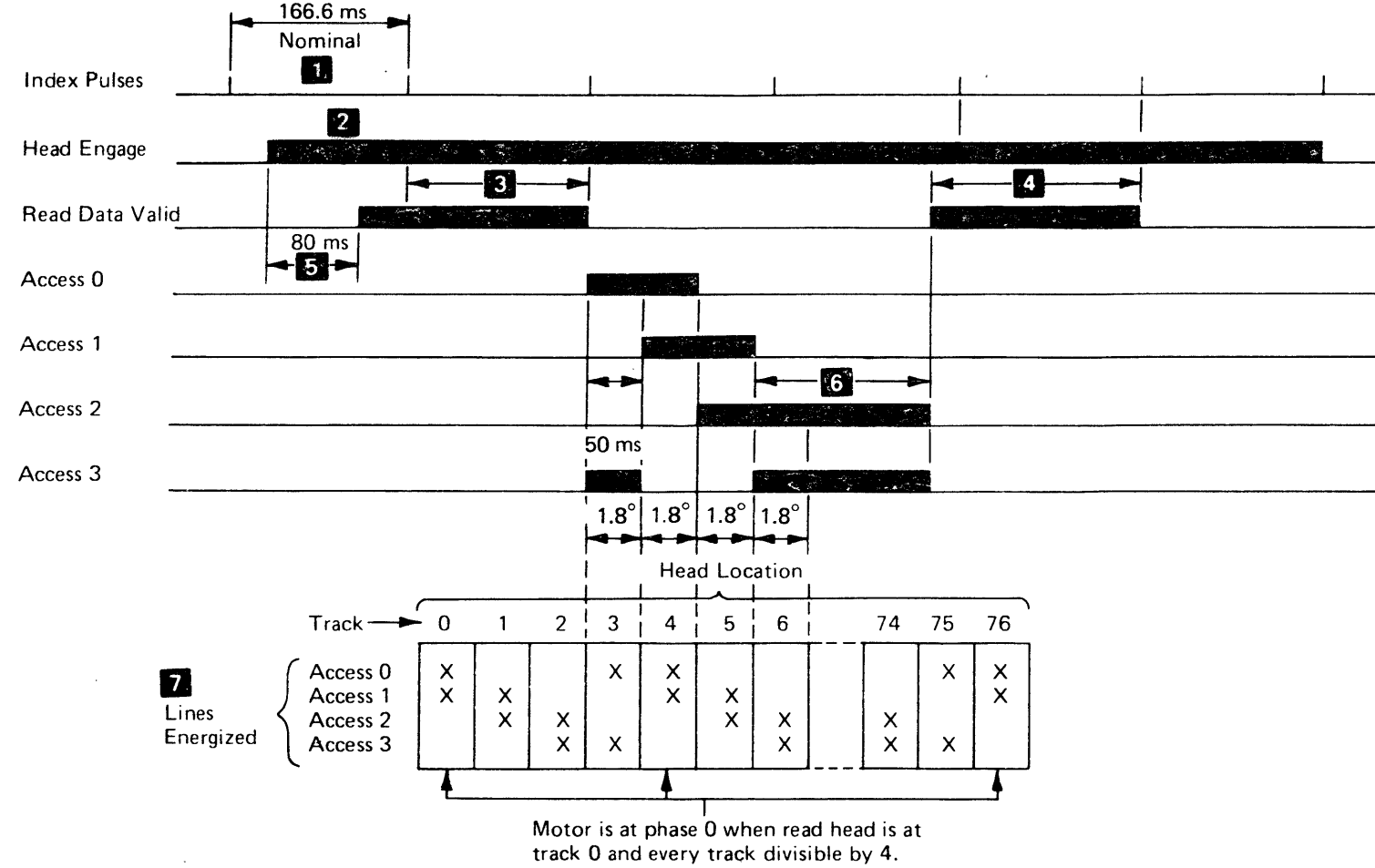
### 3.6.3 Read/Write Circuit Principles

**Write Data**

For each transition in the 'write data' line, current is switched in the read/write head, causing a flux change on the diskette surface.

**Raw Read Data**

- Sine wave signal:

  125 kHz (all 0's)
  250 kHz (all 1's)

- Higher voltage at outer tracks because of higher track speed and lower bit density.

- All 0's pattern gives higher voltage amplitude than all 1's.

**Limit Amplifier**

- High-gain differential amplifier increases signal so one of amplifier transistors is cut off. Outputs of limiter are two out-of-phase square waves.

- Differential rectifier RC network differentiates square waves. Resulting positive- and negative-going pulses (180° out of phase) are input to an OR circuit. Output is a train of positive pulses. Positive leading edges of output pulses correspond to peaks in read signal delayed by a constant amount.

- File data is a string of pulses (+Diskette Data), 150 ns to 500 ns long, which are fed to the VFO in the diskette adapter card.



From Using System:
- Write Data
- + Inner Tracks
- + Write Gate
- + Select Head 1
- + Erase Gate
- + Erase Current Sense

WRITE DRIVER
ERASE DRIVER
SENSE DRIVER
HEAD SELECT LOGIC

+5V dc

White / Blue / Black / Red — R/W Head 0
Yellow — Erase Head 0
White / Blue / Black / Red — R/W Head 1
Yellow — Erase Head 1

− 5V dc

PREAMP
DIFF
DETECTOR
LINE DRIVER

Diff RD A
Diff RD B

+Diskette Data

To Using System

Preamp TP 1    Preamp TP 2
CE Test Points
13-560 mV (all 0's)
6.5-420 mV (all 1's)

**Erase**

The edges of the data track are erased to prevent reading of adjacent tracks.

Read/Write Gap
Disk
Motion
Data Track
Erased Trimming
Erase Gaps

Full Track Differential Read Signal at CE Test Points

0.5 V/cm
2 ms/cm
1 record
ID field
Beginning of record

0.5 V/cm
All 1's    All 0's
10 μs/cm

## 3.7 DISKETTE

**Characteristics**

**Diskette**



— Cartridge
— Flexible Disk
— Hole for index pulse
— Hole in diskette for diskette clamping collet
— Read head aperture

**Flexible Disk**



0.003" (0.076mm)
Flexible Disk

Track 00

Track 76

360 rpm

**Handling**

**CAUTION: Observe the following cautions:**

- Do not insert damaged diskettes into diskette drive. Diskettes which are physically damaged (torn, creased, warped) or contaminated with foreign materials (eraser dust, fingerprints, cleaning fluid, etc.) may cause operation errors, equipment errors, or head damage.

- Placing heavy objects on diskettes may damage diskette.

- Return diskette to envelope whenever it is not being used. Storage space for diskettes enclosed in envelopes is provided inside front cover of the controller. When diskettes are stored outside of the controller, additional protection is provided by returning the diskettes to their shipping containers.



— Envelope

- Do not use clips. Never write on diskette with erasable pencil.
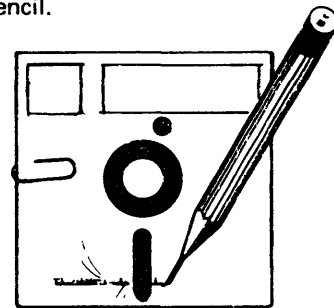


- Do not touch or clean the flexible disk surface. Contaminated diskettes must be discarded.
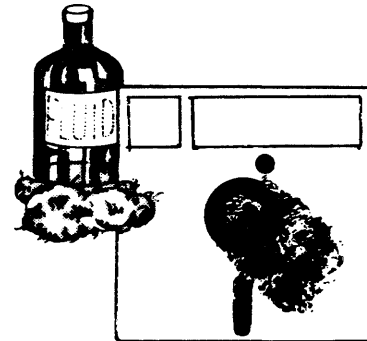


- Keep diskette away from magnetic fields and from ferromagnetic materials which might be magnetized. Any diskette exposed to a magnetic field may lose information.
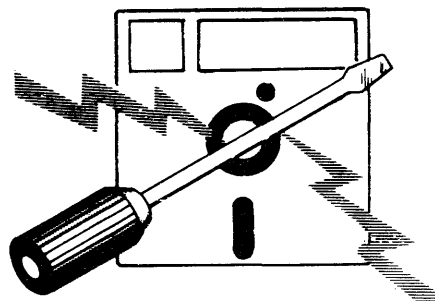


- Do not expose diskette to excessive heat (125°F or 51.5°C) or direct sunlight.
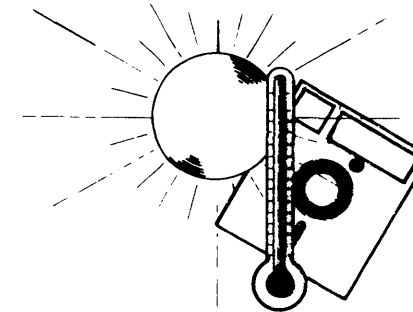


**Long Term Storage**

Place diskettes in their envelopes and store in the following environment:

- Temperature: 50° to 125°F (10.0° to 51.5°C)
- Relative humidity: 8% to 80%
- Maximum wet bulb: 85°F (29.4°C)

If a diskette has been exposed to temperatures outside of the machine's environmental range, allow five minutes acclimation time before use. The diskette should be removed from its shipping container during this time, but should be kept in its envelope.

**Shipping and Receiving**

**CAUTION:** Ship diskette inside the original shipping container. An ordinary mailing envelope does not provide sufficient protection.

Be sure to label the package: DO NOT EXPOSE TO EXCESSIVE HEAT (125°F or 51.5°C) OR DIRECT SUNLIGHT.

Upon receiving diskettes, check for container and diskette damage. Save the container for storing the diskette and for shipment later.

**Insertion**

1. Open cover.

Press to Open



2. Remove diskette from envelope. Grasp diskette by upper edge.

Hold Here



3. Lower diskette squarely into the file.
   **CAUTION:** Do not insert damaged diskettes.

4. Close cover after diskette is fully inserted.



Push to Close

5. Place the empty envelope in a clean storage area.

**Removal**

Reverse above procedure.

EC 745948

## 3.8 INTERCONNECT DIAGRAMS

Figures 3-3 through 3-18 illustrate the internal and external cables and power distribution wiring diagrams essential to controller maintenance. For a listing of these diagrams, refer to page 3-1.

| Volts | Wire No. | 3601 Location | 3602 01B1 End | Diskette Drive End |
|---|---|---|---|---|
| +5* | 1 | 01A/TB-1 | TB1-6 | B03 |
| | T1 | 01A/TB1-9 | TB1-3 | Bus |
| +24 | 2 | 01A/A1Z-B10 | Z3B10 | B10 |
| | T2 | 01A/A1Z-BUS | Z3 Bus | Bus |
| –5* | 3 | 01A/TB1-4 | TB1-10 | B11 |
| | T3 | 01A/TB1-10 | TB1-3 | Bus |
| Ground | Bus | | | B08 |

*This cable wire is not point to point.

**Note:** *Wire numbers prefixed by "T" indicate black wire of twisted pair.*

| Function | Wire No. | Both Ends |
|---|---|---|
| Write Data | 4 | B02 |
| | T4 | Bus |
| Erase Gate | 5 | B04 |
| | T5 | Bus |
| Write Gate | 6 | B05 |
| | T6 | Bus |
| Write I Sel | 7 | B06 |
| | T7 | Bus |
| Access 0 | 8 | D02 |
| | T8 | Bus |
| Access 1 | 9 | D03 |
| | T9 | Bus |
| Access 2 | 10 | D04 |
| | T10 | Bus |
| Access 3 | 11 | D05 |
| | T11 | Bus |
| Diskette Data | 12 | D07 |
| | T12 | Bus |
| Head Engage | 13 | D10 |
| | T13 | Bus |
| Index | 14 | D13 |
| | T14 | Bus |
| Head Select | 15 | B07 |
| | T15 | Bus |
| Two-Sided Diskette Sense | 16 | D08 |
| | T16 | Bus |
| Two-Sided Drive Sense | 17 | D09 |
| | T17 | Bus |

Cable PNs 4943641 or 1652549 or 1747295

| Wire No. | Y/Z Connector | EIA Conn. on Panel |
|---|---|---|
| 1 | D02 | 22 |
| 2* | B02 | 25 |
| T2* | B13 | 14 |
| 3 | D03 | 3 |
| 4 | B04 | 2 |
| 5 | D05 | 5 |
| 6* | B05 | 10 |
| T6* | D06 | 9 |
| 7 | B06 | 17 |
| 8 | B07 | 11 |
| 9 | D07 | 12 |
| 10 | D08 | 7 |
| 11 | B09 | 8 |
| 12 | D10 | 4 |
| 13 | B10 | 16 |
| 14 | D11 | 18 |
| 15 | B11 | 15 |
| 16 | D12 | 6 |
| 17 | B12 | 23 |
| 18 | D13 | 20 |
| 19 | D09 | 21 |
| T19 | D04 | 24 |
| 20 | B03 | 13 |

*These wires are used only on internal modems. Remainder are used only for external modems.

**Note:** *Wire numbers prefixed by "T" indicate black wire of twisted pair.*

Cable PN 4409516

| Wire No. | Y/Z Connector | EIA Conn. on Panel |
|---|---|---|
| 1 | D02 | 22 |
| 2 | D03 | 3 |
| 3 | B04 | 2 |
| 4 | D05 | 5 |
| 5 | B06 | 17 |
| 6 | B07 | 11 |
| 7 | D08 | 7 |
| 8 | B09 | 8 |
| 9 | D10 | 4 |
| 10 | D11 | 18 |
| 11 | B11 | 15 |
| 12 | D12 | 6 |
| 13 | B12 | 23 |
| 14 | D13 | 20 |
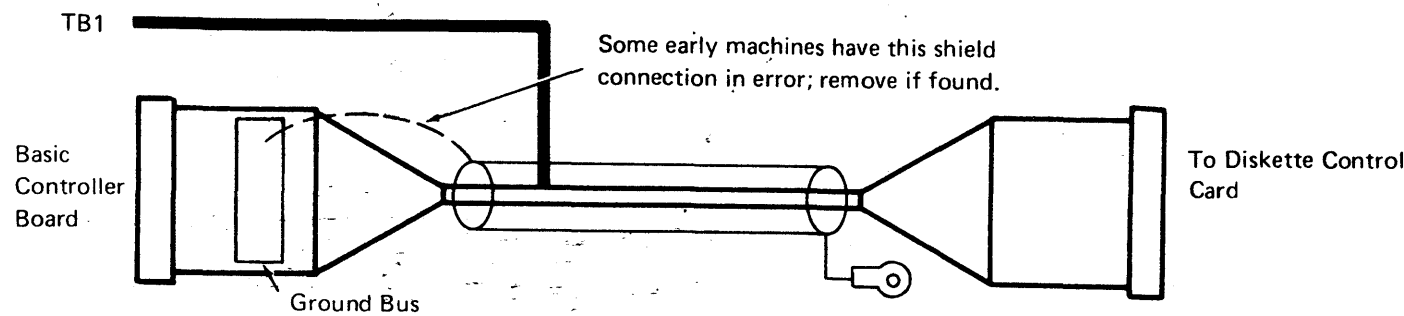


**Figure 3-3. Internal Cable PN 4943638/1741686/5645325, Basic Controller Board Connector/Diskette File Control Card**
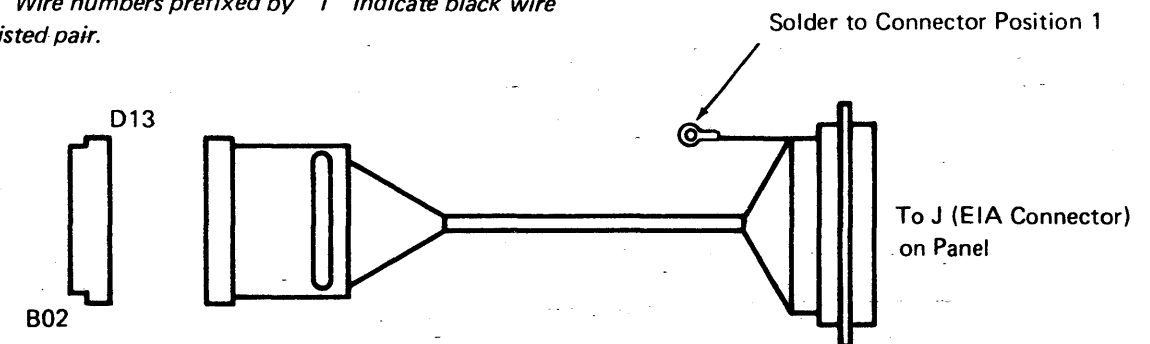


**Figure 3-4. Internal Cable PN 4943641/1652549/1747295/4409516/Modem/EIA Connector for Communication Link**

Fig. 3-5                                    SY27-2519-0                                    (7/78)  3-18
                                          TNL SN31-0864
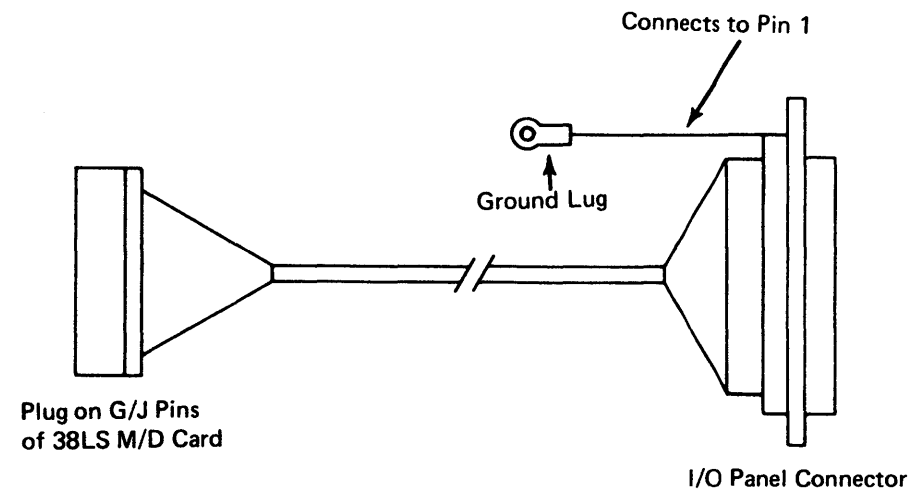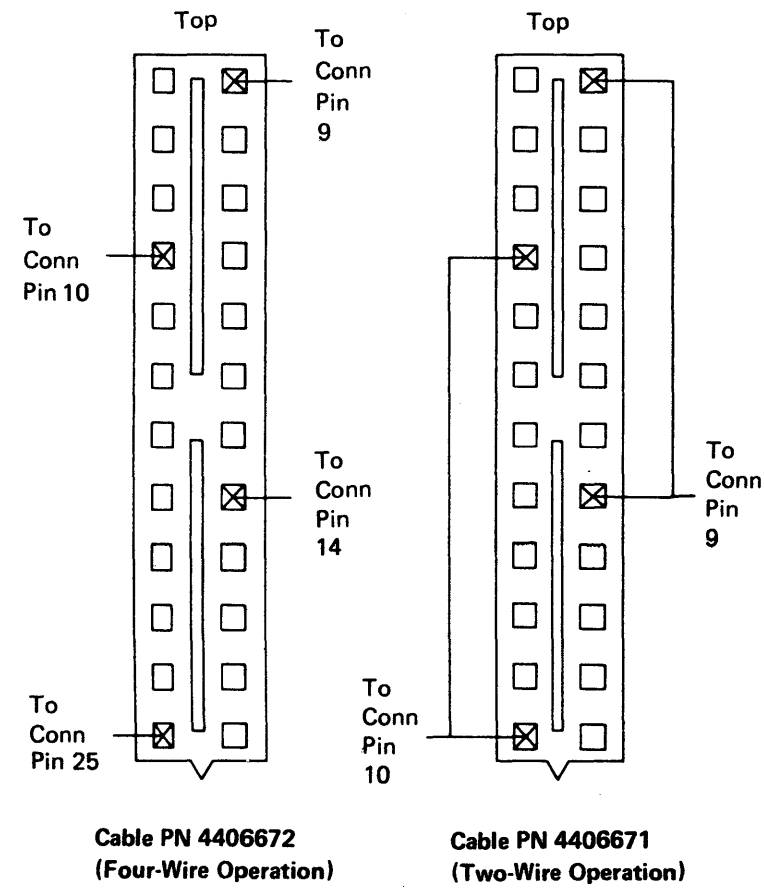


Figure 3-5. Internal Modem Cables, Board/Cable Panel

Top

To
Conn
Pin
9

To
Conn
Pin 10

To
Conn
Pin
14

To
Conn
Pin 25

Cable PN 4406672
(Four-Wire Operation)

Top

To
Conn
Pin
9

To
Conn
Pin
10

Cable PN 4406671
(Two-Wire Operation)

Connects to Pin 1

Ground Lug

Plug on G/J Pins
of 38LS M/D Card

I/O Panel Connector

EC 745949

Top
4
3
2
1

Plug on G/J
pins of 38LS
M/D card.

CABLE PN 4406670

Top
1   3
2   4

CABLE PN'S  1563175
1741682
4943640

Sleeve · Tip · Transmit (Out) · Shield · Ring · Receive (In) · Tip · Sleeve

(4) (3) (2) (1) (4) (3) (1) (2)

### 3601-2/3

| | Local | Cable Panel | | | Remote † | |
|---|---|---|---|---|---|---|
| | | Color* | Connector | Terminal | | |
| Loop 1 | A1H1A11 | Black | J2 | Ring | | |
| | A1H1A13 | White | J2 | Tip | | |
| | A1H1B11 | Black | J3 | Ring | Twisted Pair | |
| | A1H1B13 | White | J3 | Tip | | |
| Loop 2 | A1H1C11 | Black | J4 | Ring | A2A5D02 | A2B2B02 |
| | A1H1C13 | White | J4 | Tip | A2A5B02 | A2B2B03 |
| | A1H1D11 | Black | J5 | Ring | A2A5D03 | A2B5D11 |
| | A1H1D13 | White | J5 | Tip | A2A5B03 | A2B5B09 |
| Loop 3 | A1H1E11 | Black | J6 | Ring | A2A5D04 | A2C2B02 |
| | A1H1E13 | White | J6 | Tip | A2A5B04 | A2C2B03 |
| | A1J1A11 | Black | J7 | Ring | A2A5D05 | A2C5D11 |
| | A1J1A13 | White | J7 | Tip | A2A5B05 | A2C5B09 |
| Loop 4 | A2A6D02 | Black | J8 | Ring | A2A5D06 | A2F2B02 |
| | A2A6D04 | White | J8 | Tip | A2A5B06 | A2F2B03 |
| | A2A6E02 | Black | J9 | Ring | A2A5D07 | A2F5D11 |
| | A2A6E04 | White | J9 | Tip | A2A5B07 | A2F5B09 |
| Loop 5 | A2B6A02 | Black | J10 | Ring | A2A5D10 | A2E2B02 |
| | A2B6A04 | White | J10 | Tip | A2A5B10 | A2E2B03 |
| | A2B6B02 | Black | J11 | Ring | A2A5D11 | A2E5D11 |
| | A2B6B04 | White | J11 | Tip | A2A5B11 | A2E5B09 |
| Loop 6 | A2B6C02 | Black | J12 | Ring | A2A5D12 | A2D2B02 |
| | A2B6C04 | White | J12 | Tip | A2A5B12 | A2D2B03 |
| | A2B6D02 | Black | J13 | Ring | A2A5D13 | A2D5D11 |
| | A2B6D04 | White | J13 | Tip | A2A5B13 | A2D5B09 |

PN 4943640

### 3601-C/D

| | Local | Cable Panel | | |
|---|---|---|---|---|
| | | Color* | Connector | Terminal |
| Loop 1 | A1D1E11 | Black | J2 | Ring |
| | A1D1E13 | White | J2 | Tip |
| | A1E1A11 | Black | J3 | Ring |
| | A1E1A13 | White | J3 | Tip |

PN 4406670

*Black may be black or white/black; and white
may be white or white/red
†REMOTE LOOPS: On later level boards (38LS modems),
the transmit pair (jack) go directly to the card socket pins-
Ring J05, Tip G02; the receive pair (plug), Ring J13, Tip
G09.

### 3602

| | Local | Cable Panel | | | Remote † | |
|---|---|---|---|---|---|---|
| | | Color* | Connector | Terminal | | |
| Loop 1 | B1H1A11 | Black | J3 | Ring | | |
| | B1H1A13 | White | J3 | Tip | | |
| ** | B1H1B11 | Black | J2 | Ring | Twisted Pair | |
| | B1H1B13 | White | J2 | Tip | | |
| Loop 2 | B1H1C11 | Black | J5 | Ring | A2A5D02 | A2B2B02 |
| | B1H1C13 | White | J5 | Tip | A2A5B02 | A2B2B03 |
| ** | B1H1D11 | Black | J4 | Ring | A2A5D03 | A2B5D11 |
| | B1H1D13 | White | J4 | Tip | A2A5B03 | A2B5B09 |
| Loop 3 | B1H1E11 | Black | J7 | Ring | A2A5D04 | A2C2B02 |
| | B1H1E13 | White | J7 | Tip | A2A5B04 | A2C2B03 |
| ** | B1J1A11 | Black | J6 | Ring | A2A5D05 | A2C5D11 |
| | B1J1A13 | White | J6 | Tip | A2A5B05 | A2C5B09 |
| Loop 4 | A2A6D02 | Black | J9 | Ring | A2A5D06 | A2F2B02 |
| | A2A6D04 | White | J9 | Tip | A2A5B06 | A2F2B03 |
| *** | A2A6E02 | Black | J8 | Ring | A2A5D07 | A2F5D11 |
| | A2A6E04 | White | J8 | Tip | A2A5B07 | A2F5B09 |
| Loop 5 | A2B6A02 | Black | J11 | Ring | A2A5D10 | A2E2B02 |
| | A2B6A04 | White | J11 | Tip | A2A5B10 | A2E2B03 |
| *** | A2B6B02 | Black | J10 | Ring | A2A5D11 | A2E5D11 |
| | A2B6B04 | White | J10 | Tip | A2A5B11 | A2E5B09 |
| Loop 6 | A2B6C02 | Black | J13 | Ring | A2A5D12 | A2D2B02 |
| | A2B6C04 | White | J13 | Tip | A2A5B12 | A2D2B03 |
| *** | A2B6D02 | Black | J12 | Ring | A2A5D13 | A2D5D11 |
| | A2B6D04 | White | J12 | Tip | A2A5B13 | A2D5B09 |
| Loop 7 | A2T6A02 | Black | J15 | Ring | A2U6D02 | A2T2B02 |
| | A2T6A04 | White | J15 | Tip | A2U6D04 | A2T2B03 |
| *** | A2T6B02 | Black | J14 | Ring | A2U6E02 | A2T5D11 |
| | A2T6B04 | White | J14 | Tip | A2U6E04 | A2T5B09 |
| Loop 8 | A2T6C02 | Black | J17 | Ring | A2V6A02 | A2U2B02 |
| | A2T6C04 | White | J17 | Tip | A2V6A04 | A2U2B03 |
| *** | A2T6D02 | Black | J16 | Ring | A2V6B02 | A2U5D11 |
| | A2T6D04 | White | J16 | Tip | A2V6B04 | A2U5B09 |

**PN 1563175, ***PN 1741682

Figure 3-6. Internal Loop Cables, Board/Cable Panel

Fig. 3-6

TNL SN31-0864
SY27-2519-0

(7/78)  3-19

Fig. 3-7    SY27-2519-0    (4/78)  3-20
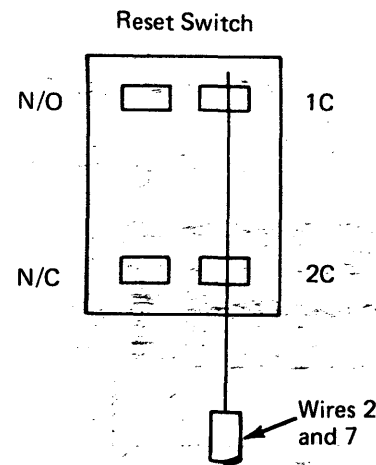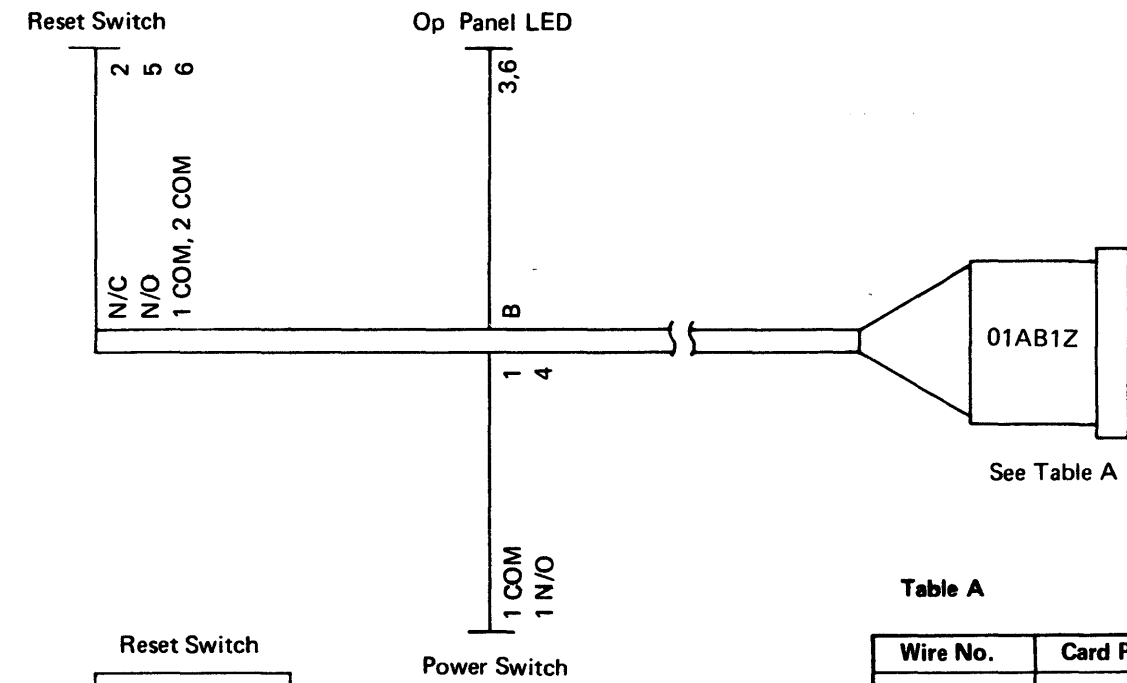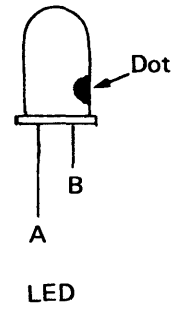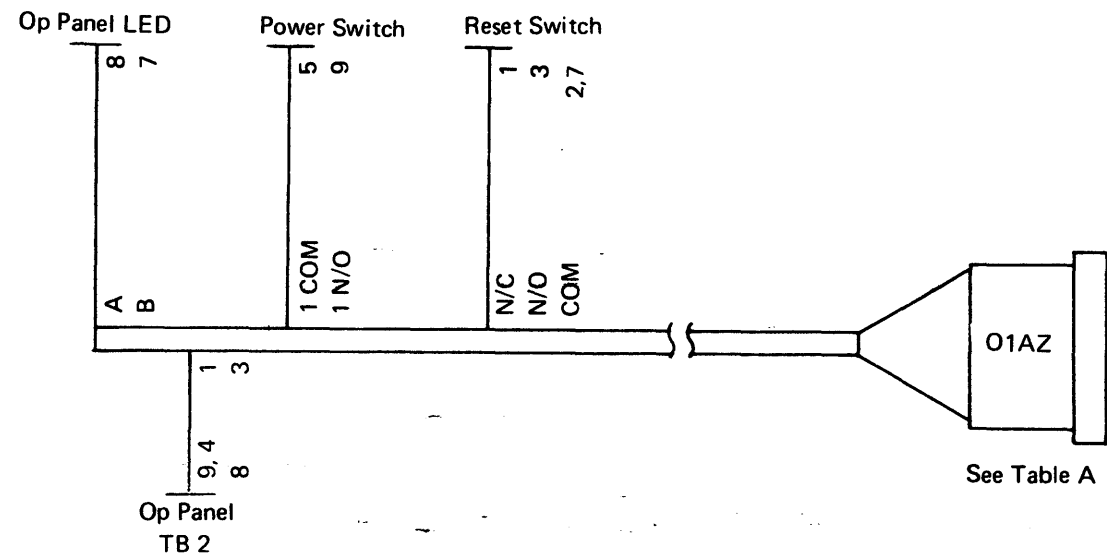


**Table A**

| Wire No. | Card Pos | Function |
|---|---|---|
| 1 | B02 | +Reset |
| 2 | D08 | Gnd |
| 3 | D02 | -Reset |
| 4 | D03 | +5V |
| 5 | B04 | +5V Spec |
| 6 | | Not used |
| 7 | | -LED |
| 8 | | +LED |
| 9 | | +5V |

Ⓐ 3601 Internal Cable, PN 4943646, 01A1Z/Operator's Panel

**Table A**

| Wire No. | Card Pos | Function |
|---|---|---|
| 1 | B03 | +5V |
| 2 | D02 | +Reset |
| 3 | B08 | Gnd. |
| 4 | D04 | +5V Spec |
| 5 | B02 | -Reset |
| 6 | | Gnd |

Ⓑ 3602 Internal Cable, PN 1652519, 01AB1Z/Operator's Panel

Figure 3-7. Controller Internal Cable to Operator's Panel

EC 745948

Select the controller you have by the model and the power system used. Refer to the figure number indicated for your controller for the correct Power Distribution Wiring Diagram and Cable Assemblies.

| Controller Model and Number of Power Supplies | Power Distribution Wiring Diagram | Power Distribution Cable Assemblies |
|---|---|---|
| 3601-2A, 2B, 3A, 3B (Single TSR-3 power supply) | Figure 3-9, Part 1 | Figure 3-9, Part 2 |
| 3601-2A, 2B, 3A, 3B (One or two TSR-2 power supplies) | Figure 3-10, Part 1 | Figure 3-10, Part 2 |
| 3601-C, D | Figure 3-11, Part 1 | Figure 3-11, Part 2 |
| 3602-1A, 1B (TSR-3 power supply, more than 2 wires on B1Y4) | Figure 3-12, Parts 1, 2 | Figure 3-12, Part 2 |
| 3602-1A, 1B (TSR-3 power supply, only 2 wires on B1Y4) | Figure 3-13, Parts 1, 2 | Figure 3-13, Part 2 |

Figure 3-8. Power Distribution Wiring Diagram and Cable Assembly Selection
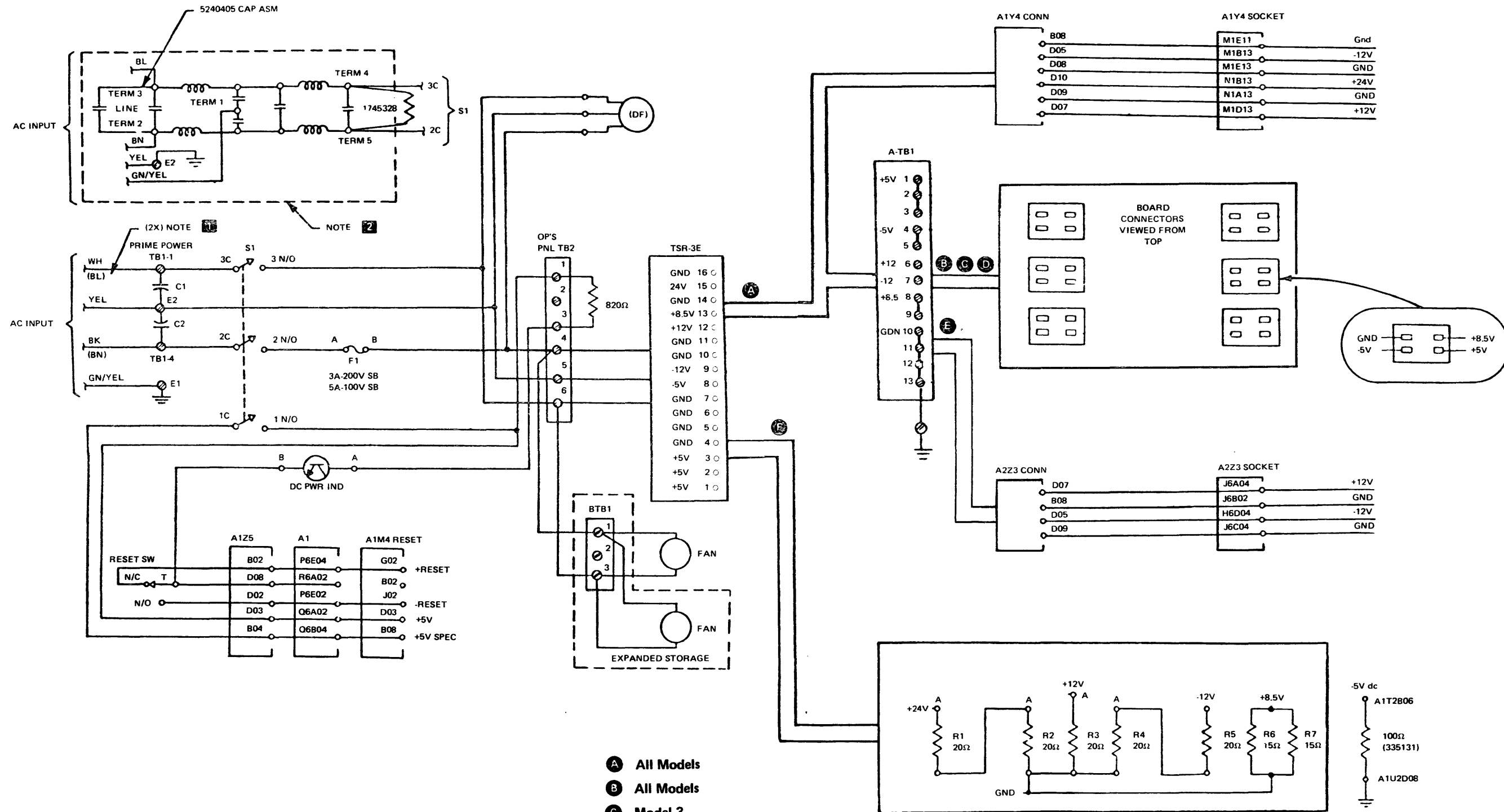
Fig. 3-9, Part 1                                                    SY27-2519-0                                                    (4/78)   3-22



Notes:

**1** Wire colors shown in parentheses are applicable for World Trade.

**2** RFI (Radio Frequency Interference) feature only for use with filter ASM 1860276.

**A**  All Models
**B**  All Models
**C**  Model 3
**D**  Expanded storage
**E**  Models
**F**  All Models

A. Wiring Diagram

**Figure 3-9 (Part 1 of 2). Power Distribution, 3601-2A, 2B, 3A, 3B (Single TSR-3 Power)**

EC 745948

| Wire No. | From TSR-TB | To 01A-TB1- | To 01A1-Y4- |
|---|---|---|---|
| 1 | 1 (+5) | 1 | — |
| 2 | 2 (+5) | 2 | — |
| 3 | 3 (+5) | 3 | — |
| 4 | 4 (Gnd) | 13 | — |
| 5 | 5 (Gnd) | 10 | — |
| 6 | 6 (Gnd) | 11 | — |
| 7 | 7 (Gnd) | 12 | — |
| 8 | 8 (-5) | 4 | — |
| 9 | 9 (-12) | 7 | — |
| 10 | 10 (Gnd) | 11 | — |
| 11 | 11 (Gnd) | — | Gnd Bus |
| 12 | 12 (+12) | 6 | — |
| 13 | 13 (8.5) | 8 | — |
| 14 | 14 (Gnd) | 12 | — |
| 15 | 15 (+24) | — | D10 |
| 16 | 16 (Gnd) | — | Gnd Bus |
| 17 | 01A-TB1-7 (-12) to | | D05 |
| 18 | 01A-TB1-13 (Gnd) to | | Gnd Bus |
| 19 | 01A-TB1-6 (+12) to | | D07 |

**A** Cable PN 4943637

| Wire No. | From 01A/TB1- | To Board A1 Pwr Conn |
|---|---|---|
| 1 | 12 (Gnd) | B2E14 |
| 2 | 12 (Gnd) | B3E14 |
| 3 | 11 (Gnd) | B4E14 |
| 4 | 8 (8.5) | B2A14 |
| 5 | 8 (8.5) | B3A14 |
| 6 | 9 (8.5) | B4A14 |
| 7 | 4 (-5) | B3E01 |
| 8 | 5 (-5) | B4E01 |
| 9 | 5 (-5) | B5E01 |
| 10 | 1 (+5) | B3A01 |
| 11 | 1 (+5) | B4A01 |
| 12 | 2 (+5) | B5A01 |
| 13 | 2 (+5) | U3A01 |
| 14 | 3 (+5) | U4A01 |
| 15 | 3 (+5) | U5A01 |
| 16 | 11 (Gnd) | U2E14 |
| 17 | 10 (Gnd) | U3E14 |
| 18 | 10 (Gnd) | U4E14 |

**B** Cable PN 4943639

| Wire No. | From 01A/TB1- | To Board A2 Pwr Conn |
|---|---|---|
| 1 | 10 (Gnd) | U2E14 |
| 2 | 11 (Gnd) | U3E14 |
| 3 | 12 (Gnd) | U4E14 |
| 4 | 8 (8.5) | U2A14 |
| 5 | 8 (8.5) | U3A14 |
| 6 | 8 (8.5) | U4A14 |
| 7 | 4 (-5) | U3E01 |
| 8 | 5 (-5) | U4E01 |
| 9 | 5 (-5) | U5E01 |
| 10 | 1 (+5) | U3A01 |
| 11 | 2 (+5) | U4A01 |
| 12 | 3 (+5) | U5A01 |
| 13 | 1 (+5) | B3A01 |
| 14 | 2 (+5) | B4A01 |
| 15 | 3 (+5) | B5A01 |
| 16 | 10 (Gnd) | B2E14 |
| 17 | 11 (Gnd) | B3E14 |
| 18 | 12 (Gnd) | B4E14 |

**C** Cable PN 4943643

| Wire No. | From 01A/TB1- | To Board B1 Pwr Conn |
|---|---|---|
| 1 | 1 (+5) | B3A01 |
| 2 | 2 (+5) | B5A01 |
| 3 | 8 (8.5) | B2A14 |
| 4 | 9 (8.5) | B4A14 |
| 5 | 10 (Gnd) | B2E14 |
| 6 | 10 (Gnd) | B4E14 |

**D** Cable PN 4405854

| Wire No. | From 01A/TB1- | To A2Z3 |
|---|---|---|
| 1 | 6 (+12) | D07 |
| T1 | 13 (Gnd) | B08 |
| 2 | 7 (-12) | D05 |
| T2 | 13 (Gnd) | D09 |

**E** Cable PN 4943652

| Cable & Load Resistor Conn | |
|---|---|
| From | To TSR TB |
| R1A | 15 (+24) |
| R3A | 12 (+12) |
| R5A | 9 (-12) |
| R6A | 13 (8.5) |
| R2B | 4 (Gnd) |
| R7B | 5 (Gnd) |

**F** Cable & Resistor Assy PN 4943645

**A** All Models
**B** All Models
**C** Model 3
**D** Expanded Storage
**E** Model 3
**F** All Models

B. Cable Assemblies

Figure 3-9 (Part 2 of 2). Power Distribution 3601-2A,2B,3A,3B (Single TSR-3 Power Supply)

Fig. 3-10, Part 1

SY27-2519-0
TNL SN31-0864

(7/78)   3-24

5240405 CAP ASM

AC INPUT

TERM 3
TERM 1
LINE
TERM 2
BL
BN
YEL
GN/YEL
E2
TERM 4
TERM 5
1745328
3C
2C
S1

(2X) NOTE **1**

NOTE **2**

PRIME POWER
TB1-1
WH
(BL)
YEL
BK
(BN)
TB1-4
GN/YEL
E1
AC INPUT

C1
E2
C2
S1
3C
2C
1C
3 N/O
2 N/O
1 N/O
A    B
F1

Single TSR
3A-200V SB
5A-100V SB

2-TSRs
5A-200V SB
10A-100V SB

OP'S
PNL TB2
1
2
3
4
5
6
7
8
9
10
B20Ω

B
A
DC PWR IND

Fan

A1Z5    A1    A1M4 RESET
RESET SW
N/C    T
N/O

B02    P6E04    G02    +RESET
D08    R6A02    B02
D02    P6E02    J02    -RESET
D03    Q6A02    D03    +5V
B04    Q6B04    B08    +5V SPEC

TSR-2
-5      15
GND    14
GND    13
GND    12
GND    11
GND    10
+5      9
+5      8
+5      7
+5      6
+24     5
-12     4
GND     3
GND     2
+8.5    1
GND  J5-1
+5   J5-2

(DF)

**A**

A1Y4 CONN                A1Y4 SOCKET
D05          M1B13    -12V
D10          N1B13    +24V

A-TB1
+5V   1
2
3
-5V   4
5
-12   6
+24   7
+8.5  8
9
GND  10
11
12
13

**F**

Two 130 Ohms
on -12  PN 5645359
One 75 Ohms
on -5  PN 2102593

BOARD
CONNECTORS
VIEWED FROM
TOP

GND        +8.5V
-5V        +5V

+5V  A    +5V  A    -5V  A         A    A        A
R1   R2   R3   R4   R5   R6
2Ω   2Ω   5Ω   5Ω   2Ω   2Ω
GND
GND    +8.5V

TSR-2
-5      15
-5      14
GND    13
GND    12
GND    11
GND    10
Gnd     9
+5      8
+5      7
+5      6
+5      5
Gnd     4
GND     3
+8.5    2
+8.5    1

**B**

A-TB2
GND   1
2
3
+5V   4
5
6
+8.5  7
8
-5V   9
10

**C**
**D**
**E**

U4D07          B4D07
BOARD
CONNECTORS
VIEWED FROM
TOP

GND        +8.5V
-5V        +5V

BTB1
1
2
3
FAN
EXPANDED STORAGE

NOTES

**1** Wire colors shown in parentheses are applicable
for World Trade.

**2** RFI (Radio Frequency Interference) feature only for use with
filter ASM 1860276.

**A**  All Models
**B**  Model 3 or Expanded Storage
**C**  Model 3
**D**  Model 3
**E**  Expanded Storage
**F**  Remote Loop Interface to External Modem (Model 2A only)

A. Wiring Diagram

Figure 3-10 (Part 1 of 2). Power Distribution 3601-2A,2B,3A,3B (One or two TSR-2 Power Supplies)

EC 745949

| Wire No. | From TSR2 Conn | To 01ATB2 |
|---|---|---|
| 1 | 1 (8.5) | 7 |
| 2 | 2 (8.5) | 8 |
| 3 | 3 (Gnd) | 2 |
| 4 | 4 (Gnd) | 1 |
| 5 | 5 (+5) | 4 |
| 6 | 6 (+5) | 4 |
| 7 | 7 (+5) | 5 |
| 8 | 8 (+5) | 6 |
| 9 | 9 (Gnd) | 2 |
| 10 | 10 (Gnd) | 2 |
| 11 | 11 (Gnd) | 1 |
| 12 | 12 (Gnd) | 3 |
| 13 | 13 (Gnd) | 3 |
| 14 | 14 (-5) | 9 |
| 15 | 15 (-5) | 10 |
| 16 | 01A-TB2-3 to 01A-TB1-13 | |

**B** Cable PN 4406660

| Wire No. | From Resistors | To 01A-TB2- |
|---|---|---|
| 1 | R1 - A | 4(+5)* |
| 2 | R3 - A | 9(-5) |
| 3 | R6 - B | 7(+8.5) |
| 4 | R1 - B | 1(Gnd) |
| 5 | R2 - A | 5(+5)* |
| 6 | R5 - B | 3(Gnd) |

**C** Cable PN 4406661

\* With 3 or more logic cards on the expanded storage board, remove and tape wire #1 at TB2 - 4; with 6 or more logic cards, wire #5 at TB2 - 5 *also*.

B. Cable Assemblies

Figure 3-10 (Part 2 of 2). Power Distribution 3601-2A,2B,3A,3B (One or two TSR-2 Power Supplies)

| Wire No. | From 01A-TB2- | To Board A2 Pwr Conn |
|---|---|---|
| 1 | 1 (Gnd) | U2E14 |
| 2 | 1 | U3E14 |
| 3 | 2 (Gnd) | U4E14 |
| 4 | 2 | B2E14 |
| 6 | 3 (Gnd) | B4E14 |
| 7 | 4 (+5) | U3A01 |
| 8 | 4 | U4A01 |
| 9 | 5 (+5) | U5A01 |
| 10 | 5 | B3A01 |
| 12 | 6 (+5) | B5A01 |
| 13 | 7 (8.5) | U2A14 |
| 14 | 7 | U3A14 |
| 15 | 8 (8.5) | U4A14 |
| 16 | 8 | B2A14 |
| 18 | 8 | B4A14 |
| 19 | 9 (-5) | U3E01 |
| 20 | 9 | U4E01 |
| 21 | 10 (-5) | U5E01 |
| 22 | 10 | B3E01 |
| 24 | 10 | B5E01 |
| 25 | 01A-TB1-6 to A2U4D07 | |
| 26 | 01A-TB1-6 to A2B4D07 | |

**D** Cable PN 4406662

| Wire No. | From TSR-2B | To 01A-TB1 |
|---|---|---|
| 1 | 1 (8.5 | 9 |
| 2 | 2 (Gnd) | 10 |
| 3 | 3 (Gnd) | 10 |
| 4 | 4 (-12) | 6 |
| 5 | 5 (+24) | 7 |
| 6 | 6 (+5) | 1 |
| 7 | 7 (+5) | 2 |
| 8 | 8 (+5) | 3 |
| 9 | 9 (+5) | 3 |
| 10 | 10 (Gnd) | 11 |
| 11 | 11 (Gnd) | 11 |
| 12 | 12 (Gnd) | 12 |
| 13 | 13 (Gnd) | 12 |
| 14 | 14 (Gnd) | 13 |
| 15 | 15 (-5) | 5 |
| 37 | J5-1 (Gnd) | 2 |
| 38 | J5-2 (+5) | 10 |

**A** Cable PN 4406074

| From 01A-TB1- | Wire No. | To Board A1 Pwr Conn |
|---|---|---|
| 1 (+5) | 29 | B3A01 |
| | 30 | B4A01 |
| 2 (+5) | 16 | U4A01 |
| | 17 | U5A01 |
| 3 (+5) | 31 | B5A01 |
| | 32 | U3A01 |
| 4 (-5) | 21 | B5E01 |
| | 33 | B3E01 |
| 5 (-5) | 20 | B4E01 |
| 6 (-12) | 39 | to A1Y4-D05 |
| 7 (+24) | 40 | to A1Y4-D10 |
| 8 (8.5) | 24 | U2A14 |
| | 25 | U3A14 |
| | 26 | U4A14 |
| 9 (8.5) | 22 | B3A14 |
| | 23 | B4A14 |
| | 27 | B2A14 |
| 10 (Gnd) | 18 | U3E14 |
| 11 (Gnd) | 19 | U4E14 |
| 12 (Gnd) | 28 | U2E14 |
| 13 (Gnd) | 34 | B2E14 |
| | 35 | B3E14 |
| | 36 | B4E14 |

| Wire No. | 01A-TB2 | Board B1 Pwr Conn |
|---|---|---|
| 1 (Gnd) | 1 | B2E14 |
| 2 (Gnd) | 1 | B3E14 |
| 3 (Gnd) | 1 | B4E14 |
| 4 (8.5) | 7 | B2A14 |
| 5 (8.5) | 7 | B3A14 |
| 6 (8.5) | 7 | B4A14 |
| 7 (+5) | 4 | B3A01 |
| 8 (+5) | 4 | B4A01 |
| 9 (+5) | 4 | B5A01 |

**E** Cable PN 8269854

| Line Name | Connect from | To Loop 2 | To Loop 3 |
|---|---|---|---|
| | TB1 - (+8.5V) | A2B2B11 | A2C2B11 |
| | TB1 - (+5V) | A2B2D03 | A2C2D03 |
| | TB1 - (-12V) | A2B2D07 | A2C2D07 |
| | TB1 - (Gnd) | A2B2D08 | A2C2D08 |
| Wrap | A1Z4D03 | A2B2B05 | |
| Clock | A1Z4D04 | A2B2D09 | |
| Rcv Data | A1Z4B03 | A2B2B10 | |
| Send Data | A1Z4B04 | A2B2D04 | |
| Wrap | A1Z4D05 | | A2C2B05 |
| Clock | A1Z4B05 | | A2C2D09 |
| Rcv Data | A1Z4B06 | | A2C2B10 |
| Send Data | A1Z4D06 | | A2C2D04 |

**F** Cable PN 4409771

**A** All Models

**B** Model 3 or Expanded Storage

**C** Model 3

**D** Model 3

**E** Expanded Storage

**F** Remote Loop Interface to External Modem (Model 2A only)

Fig. 3-10, Part 2     3-25

TNL SN31-0864
SY27-2519-0

(7/78)   3-25
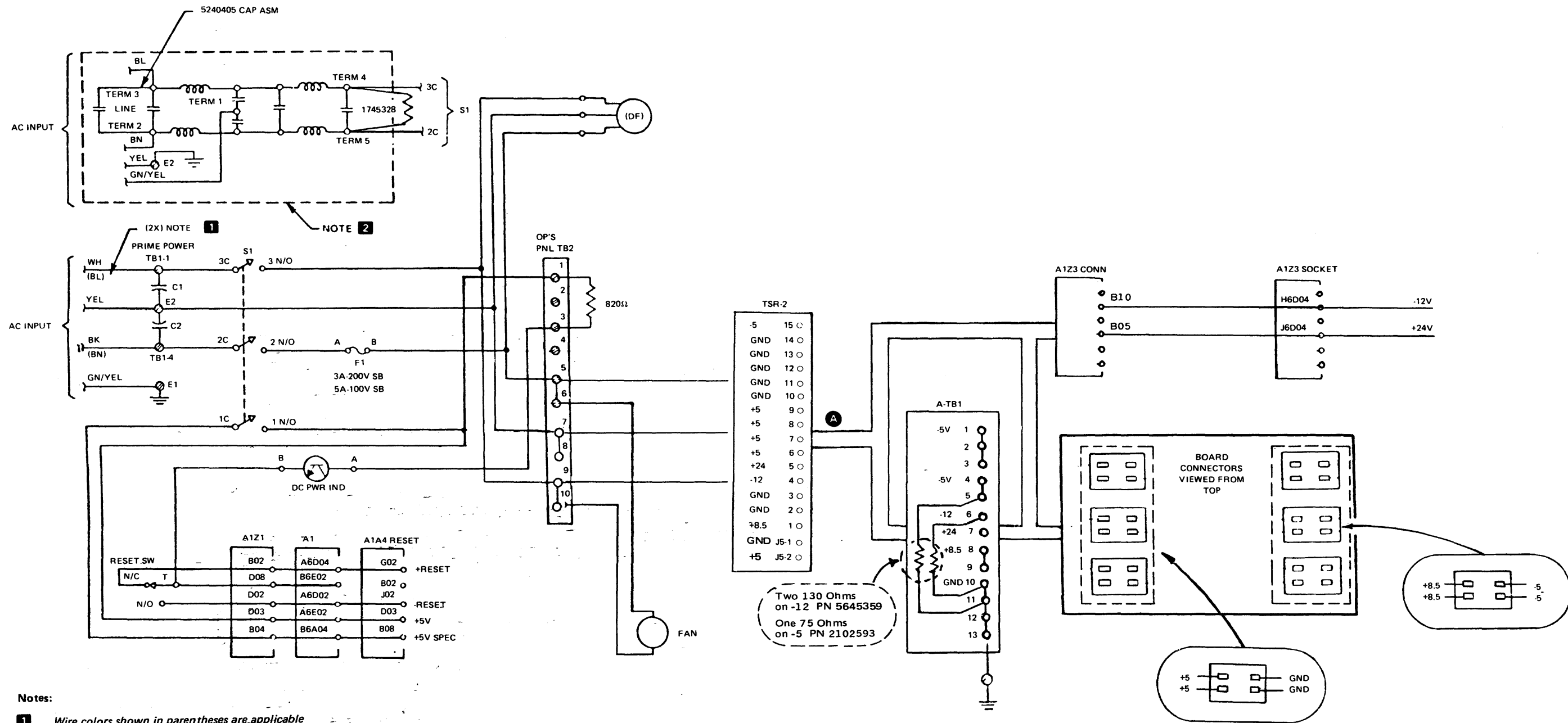
A. Wiring Diagram

Figure 3-11 (Part 1 of 2). Power Distribution, 3601 C, D

Notes:

**1** Wire colors shown in parentheses are applicable for World Trade.

**2** RFI (Radio Frequency Interference) feature only for use with filter ASM 1860276.

**A** ALL MODELS

EC 745949

| Wire No. | From TSR-2 | To 01A-TB1 |
|---|---|---|
| 1 | 1 (8.5) | 8 |
| 2 | 2 (Gnd) | 11 |
| 3 | 3 (Gnd) | 12 |
| 4 | 4 (-12) | 6 |
| 5 | 5 (+24) | 7 |
| 6 | 6 (+5) | 1 |
| 7 | 7 (+5) | 2 |
| 8 | 8 (+5) | 3 |
| 9 | 9 (+5) | 1 |
| 10 | 10 (Gnd) | 10 |
| 11 | 11 (Gnd) | 11 |
| 12 | 12 (Gnd) | 12 |
| 13 | 13 (Gnd) | 13 |
| 14 | 14 (Gnd) | 10 |
| 15 | 15 (-5) | 5 |
| 16 | J5-1 (Gnd) | 2 |
| 17 | J5-2 (+5) | 13 |

| From 01A-TB1 | Wire No. | To Board A1 Pwr Conn |
|---|---|---|
| 1 (+5) | 19 | B3A01 |
|  | 22 | B4A01 |
| 2 (+5) | 20 | B3A14 |
|  | 23 | B5A01 |
| 3 (+5) | 18 | B2A14 |
|  | 21 | B4A01 |
| 4 (-5) | 36 | M2E14 |
|  | 37 | M3E01 |
|  | 38 | M3E14 |
|  | 41 | M5E01 |
| 5 (-5) | 39 | M4E01 |
|  | 40 | M4E14 |
| 6 (-12) | 42 | To A1Z3B10 |
| 7 (+24) | 43 | To A1Z3B05 |
| 8 (8.5) | 32 | M3A14 |
|  | 35 | M5A01 |
| 9 (8.5) | 30 | M2A14 |
|  | 31 | M3A01 |
|  | 33 | M4A01 |
|  | 34 | M4A14 |
| 10 (Gnd) | 24 | B2E14 |
|  | 28 | B4E14 |
| 11 (Gnd) | 25 | B3E01 |
|  | 29 | B5E01 |
| 12 (Gnd) | – | – |
| 13 (Gnd) | 26 | B3E14 |
|  | 27 | B4E01 |

Ⓐ Cable PN 4406682

B. Cable Assemblies

Figure 3-11 (Part 2 of 2). Power Distribution 3601 C,D

Fig. 3-11, Part 2   3-27

TNL SN31-0864
SY27-2519-0

(7/78)   3-27

Fig. 3-12, Part 1

SY27-2519-0
TNL SN31-0864

(7/78)  3-28
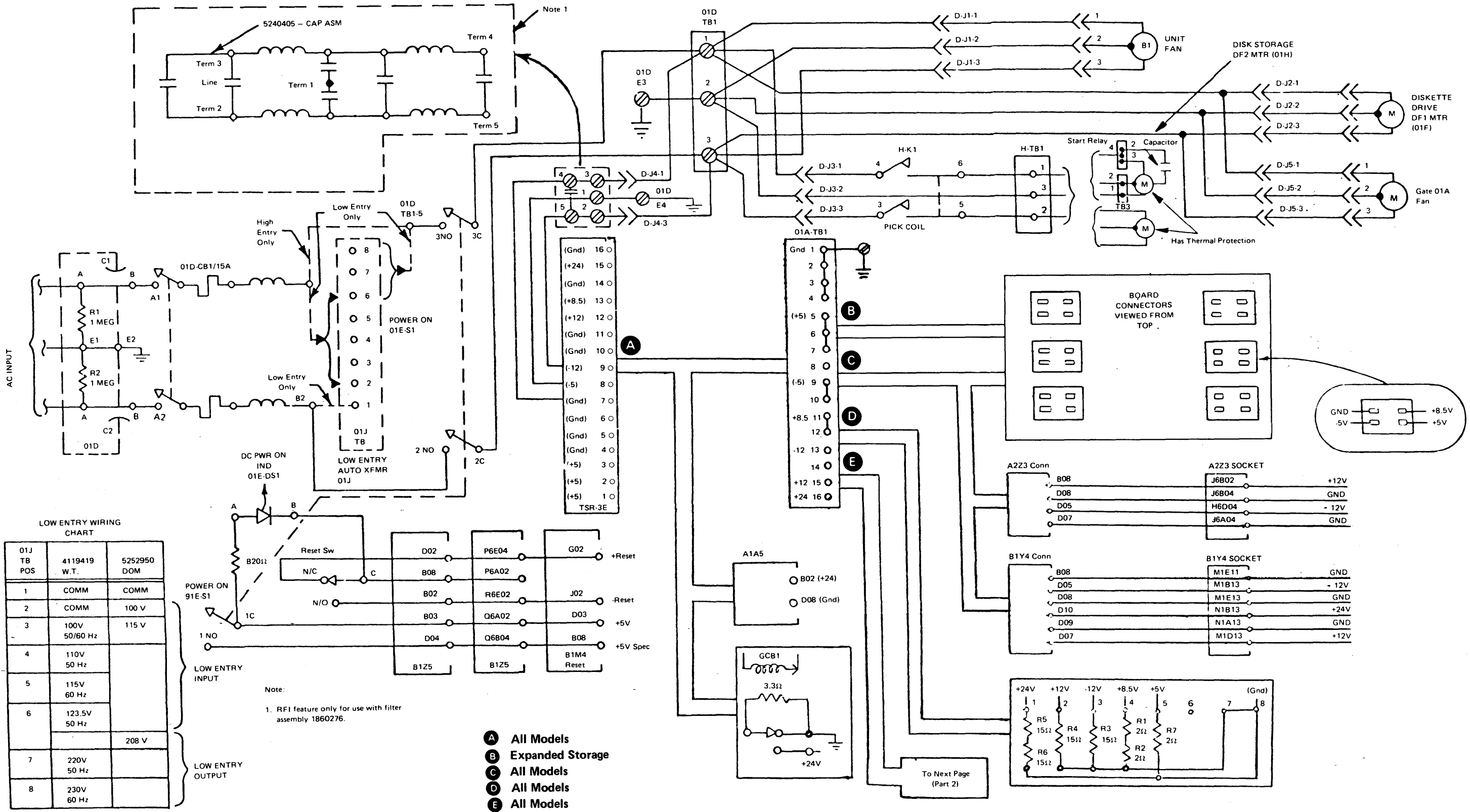


A. Wiring Diagram

Figure 3-12 (Part 1 of 2). Power Distribution, 3602-1A, 1B (TSR-3 Power Supply, more than 2 wires on B1Y4)

EC 745949

**A. Wiring Diagram (Cont)**

01A-A1 BOARD — DE BOARD

+24V Act. — A5B02 — A1B02
Act. Return — A5D08 — A1D08
+5V — +5V TO ALL D03 PINS B2-B5 THRU U2-U5
-5V
+8.5V
+24V — DE TB1 — 6
MC RETRACT
PWR SUPPLY TSR 1 1740340 — Z3 GND BUS — 01H-C1 — SIG. RET.
+24V 2 Ret
3
9
-4V/1.1A 1 — B5B06 / A2B06 / B5B11 / A2B11
-12V
+6V/.3A 4 — B5B13 / A5B13 / A5G13
-24V/.48A 6 — B3B13
01G2
+24V Cntl 1 — H-K1 — 2 — + BRK FLT

**B. Cable Assemblies**

**Ⓐ Cable PN 1741691**

| Wire No. | | TSR 3E | 01A–TB1 | G–CB1 |
|---|---|---|---|---|
| 1 | Gnd | 4 | 1 | |
| 2 | Gnd | 5 | 2 | |
| 3 | Gnd | 6 | 3 | |
| 4 | Gnd | 7 | 4 | |
| 5 | +5 | 1 | 5 | |
| 6 | +5 | 2 | 6 | |
| 7 | +5 | 3 | 7 | |
| 8 | +8.5 | 13 | 11 | |
| 9 | Gnd | 10 | 1 | |
| 10 | Gnd | 14 | 3 | |
| 11 | −12 | 9 | 13 | |
| 12 | +12 | 12 | 15 | |
| 13 | +24 | 15 | 16 | |
| 14 | Gnd | 16 | 2 | |
| 15 | +24 | 15 | 01A1A5B02 | |
| T15 | Gnd | 16 | 01A1A5D08 | |
| 16 | −5 | 8 | | Line |
| 17 | | | 9 | Load |
| 18 | Gnd | | 4 | N/C |
| 19 | +24 | | 16 | N/O |

**Ⓑ Cable PN 4404337**

| Wire No. | | From 01A-TB1 | To Board B2 Pwr Conn |
|---|---|---|---|
| 1 | +5 | 5 | B3A01 |
| 2 | +5 | 5 | B4A01 |
| 3 | +5 | 5 | B5A01 |
| 4 | +5 | 7 | J3A01 |
| 5 | +5 | 7 | J4A01 |
| 6 | +5 | 7 | J5A01 |
| 7 | Gnd | 1 | B2E14 |
| 8 | Gnd | 1 | B3E14 |
| 9 | Gnd | 1 | B4E14 |
| 10 | Gnd | 2 | J2E14 |
| 11 | Gnd | 2 | J3E14 |
| 12 | Gnd | 2 | J4E14 |
| 13 | +8.5 | 11 | B2A14 |
| 14 | +8.5 | 11 | B3A14 |
| 15 | +8.5 | 11 | B4A14 |
| 16 | +8.5 | 12 | J2A14 |
| 17 | +8.5 | 12 | J3A14 |
| 18 | +8.5 | 12 | J4A14 |

**Ⓒ Cable PN 1741681**

| Wire No. | | 01A-TB1 | Board Pwr Conn |
|---|---|---|---|
| 1 | Gnd | 1 | A2M2E14 |
| 2 | Gnd | 1 | A2M3E14 |
| 3 | Gnd | 1 | A2M4E14 |
| 4 | Gnd | 2 | B1B2E14 |
| 5 | Gnd | 2 | B1B3E14 |
| 6 | Gnd | 2 | B1B4E14 |
| 7 | +5 | 5 | A2M3A01 |
| 8 | +5 | 5 | A2M4A01 |
| 9 | +5 | 5 | A2M5A01 |
| 10 | +5 | 7 | B1B3A01 |
| 11 | +5 | 7 | B1B4A01 |
| 12 | +5 | 7 | B1B5A01 |
| 13 | -5 | 9 | A2M3E01 |
| 14 | -5 | 9 | A2M4E01 |
| 15 | -5 | 9 | A2M5E01 |
| 16 | -5 | 9 | B1B3E01 |
| 17 | -5 | 9 | B1B4E01 |
| 18 | -5 | 9 | B1B5E01 |
| 19 | +8.5 | 12 | A2M2A14 |
| 20 | +8.5 | 12 | A2M3A14 |
| 21 | +8.5 | 12 | A2M4A14 |
| 22 | +8.5 | 12 | B1B2A14 |
| 23 | +8.5 | 12 | B1B3A14 |
| 24 | +8.5 | 12 | B1B4A14 |
| 25 | -12 | 13 | A2Z3D05 |
| 26 | +12 | 15 | A2Z3D07 |
| 27 | +24 | 16 | B1Y4D10 |
| 28 | Gnd | 3 | A2B2E14 |
| 29 | Gnd | 3 | A2B3E14 |
| 30 | Gnd | 3 | A2B4E14 |
| 31 | Gnd | 4 | B1M2E14 |
| 32 | Gnd | 4 | B1M3E14 |
| 33 | Gnd | 4 | B1M4E14 |
| 34 | +5 | 5 | A2B3A01 |
| 35 | +5 | 5 | A2B4A01 |
| 36 | +5 | 5 | A2B5A01 |
| 37 | +5 | 7 | B1M3A01 |
| 38 | +5 | 7 | B1M4A01 |
| 39 | +5 | 7 | B1M5A01 |
| 40 | +8.5 | 11 | A2B2A14 |
| 41 | +8.5 | 11 | A2B3A14 |
| 42 | +8.5 | 11 | A2B4A14 |
| 43 | +8.5 | 11 | B1M2A14 |
| 44 | +8.5 | 11 | B1M3A14 |
| 45 | +8.5 | 11 | B1M4A14 |
| 46 | Gnd | 1 | A2Z3D09 |
| 47 | Gnd | 1 | A2Z3B08 |
| 48 | Gnd | 1 | B1Y4D09 |
| 49 | -12 | 13 | B1Y4D05 |
| 50 | +12 | 15 | B1Y4D07 |
| 51 | Gnd | 4 | B1Y4D08 |
| 52 | Gnd | 4 | B1Y4B08 |

**Ⓓ Cable PN 1741702**

| Wire No. | | 01A-TB1 | Resistor TB Assembly |
|---|---|---|---|
| 1 | Gnd | 1 | 7 |
| 2 | Gnd | 2 | 8 |
| 3 | +5 | 7 | 5 |
| 4 | +8.5 | 11 | 4 |
| 5 | -12 | 13 | 3 |
| 6 | +12 | 15 | 2 |
| 7 | +24 | 16 | 1 |

**Ⓔ Cable PN 1741690**

| Wire No | | 01A–A1 | 01A-TB1 | TSR–1 | Misc Connection |
|---|---|---|---|---|---|
| 1 | −4 | | | | Wire No's. 9, 24,25 |
| 2 | Gnd | | 4 | | Wire No. 10 |
| 3 | −12 | | 13 | 12 | |
| 4 | +24 | Z3B10 | 16 | | |
| 5 | +24 | | 16 | 11 | |
| 6 | +6 | Z3D11 | | 4 | |
| 7 | Gnd | Z3 Bus | | 3 | |
| 8 | Gnd | Z3 Bus | | 9 | |
| 9 | −4 | | | 1 | Wire No. 1 |
| 10 | Gnd | | | 2 | Wire No. 2 |
| 11 | −24 | Z3D13 | | 6 | |
| 12 | Gnd | Z3 Bus | | | 01H–C1− |
| 13 | −5 | Z3D10 | 10 | | |
| 14 | +8.5 | Z3D09 | 12 | | |
| 15 | M.C.Ret | Z3B02 | | | 01H–C1+ |
| 16 | +Brk Flt | Z3D04 | | | 01H-K1-2 |
| 17 | Gnd | | 2 | | 01H-TB1-4 |
| 18 | Gnd | Gnd Bus | 3 | | |
| 19 | Gnd | Gnd Bus | 3 | | |
| 20 | +5 | +5 Bus | 6 | | |
| 21 | +5 | +5 Bus | 6 | | |
| 22 | +5 | +5 Bus | 6 | | |
| 23 | +5 | +5 Bus | 6 | | |
| 24 | −4 | C2B06 | | | Wire No. 1 |
| 25 | −4 | A4B06 | | | Wire No. 1 |
| 26 | Gnd | Gnd Bus | 2 | | |
| 27 | Gnd | Gnd Bus | 2 | | |
| 28 | +24 Ctrl | | 16 | | 01H-K1-1 |

**Figure 3-12 (Part 2 of 2). Power Distribution, 3602-1A, 1B (TSR-3 Power Supply, more than 2 wires on B1Y4)**

TNL SN31-0864
SY27-2519-0

Fig. 3-12, Part 2    (7/78)   3-29

Fig. 3-13, Part 1

SY27-2519-0
TNL SN31-0864

(7/78)   3-30

Note 1

5240405 – CAP ASM

Term 4
Term 3
Line
Term 1
Term 2
Term 5

01D TB1

D-J1-1 — 1
D-J1-2 — 2    UNIT FAN  B1
D-J1-3 — 3

DISK STORAGE DF2 MTR (01H)

01D E3

D-J2-1
D-J2-2    DISKETTE DRIVE DF1 MTR (01F)  M
D-J2-3

Start Relay   2   Capacitor

4 3
D-J4-1
01D E4
D-J4-3

H-K1   H-TB1

D-J3-1 — 4 — 6
D-J3-2 — 1 — 3    M   Gate 01A Fan
D-J3-3 — 3 — 5
PICK COIL

D-J5-1 — 1
D-J5-2 — 2   M
D-J5-3 — 3

M   Has Thermal Protection

High Entry Only
Low Entry Only

01D TB1-5

3NO   3C

POWER ON 01E-S1

8
7
6
5
4
3
2
1
01J TB

01D-CB1/15A

C1   A   B   A1
R1 1 MEG
E1   E2
R2 1 MEG
A   B   A2
C2
01D
AC INPUT
B'2

Low Entry Only

LOW ENTRY AUTO XFMR 01J

2 NO   2C

01A-TB1

Gnd 1
2
3
4
(+5) 5   B
6
7
8   C
(-5) 9
10
+8.5 11   D
12
-12 13
14   E
15
+24 16

(Gnd) 16
(+24) 15
(Gnd) 14
(+8.5) 13
(-12) 12
(Gnd) 11
(Gnd) 10   A
9
(-5) 8
7
(Gnd) 6
(Gnd) 5
(Gnd) 4
3
(+5) 2
(+5) 1
TSR-3E

U4D07   B4D07
BOARD CONNECTORS VIEWED FROM TOP

GND   +8.5V
-5   +5V

B1Y4 Conn   B1Y4 SOCKET
D10   N1B13   +24V
D05   M1B13   -12V

DC PWR ON IND 01E-DS1

POWER ON 91E-S1

1C   1 NO

B20Ω   Reset Sw   N/C   N/O

D02   P6E04   G02   +Reset
B08   P6A02
B02   R6E02   J02   -Reset
B03   Q6A02   D03   +5V
D04   Q6B04   B08   +5V Spec
B1Z5   B1Z5   B1M4 Reset

A1A5
B02 (+24)
D08 (Gnd)

GCB1
3.3Ω
+24V

+8.5   -5V   (Gnd)
1   2   3   4   5   6   7   8
R1 5Ω   R2 5Ω   R3 5Ω   R4 10Ω

To Next Page (Part 2)

**LOW ENTRY WIRING CHART**

| 01J TB POS | 4119419 W.T. | 5252950 DOM |
|---|---|---|
| 1 | COMM | COMM |
| 2 | COMM | 100 V |
| 3 | 100V 50/60 Hz | 115 V |
| 4 | 110V 50 Hz | |
| 5 | 115V 60 Hz | |
| 6 | 123.5V 50 Hz | |
| | | 208 V |
| 7 | 220V 50 Hz | |
| 8 | 230V 60 Hz | |

LOW ENTRY INPUT
LOW ENTRY OUTPUT
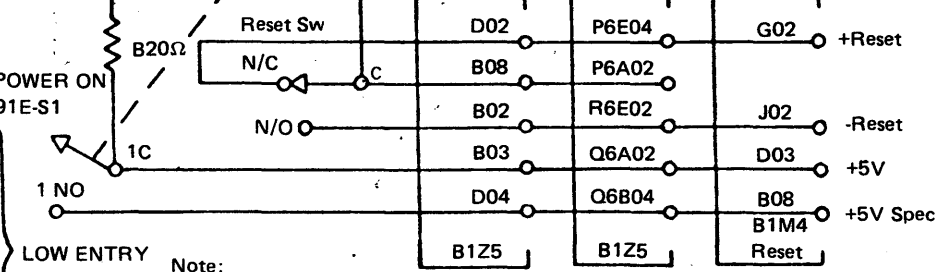
Note:
1. RFI feature only for use with filter assembly 1860276.

Ⓐ All Models
Ⓑ Expanded Storage
Ⓒ All Models
Ⓓ All Models
Ⓔ All Models

A. Wiring Diagram

Figure 3-13 (Part 1 of 2). Power Distribution, 3602-1A,1B (TSR-3 Power Supply, only 2 wires on B1Y4)

EC 745949

**A. Wiring Diagram (Cont)**

Diagram labels (left to right):

01A-A1 BOARD — DE BOARD

- +24V Act — A5B02 — A1B02
- Act Return — A5D08 — A1D08
- +5V — +5V TO ALL D03 PINS B2-B5 THRU U2-U5
- -5V
- +8.5V
- +24V — Z3D10 J6D04 M2B06 / Z3D09 J6C04 M2B11 / Z3B10 J6D02 M2B11 B4G02 C4G02 A5B05 — DE TB1 6
- Z3 GND BUS — PWR SUPPLY TSR 1 1740340 — 01H-C1 — Z3B08 J6B04 — MC RETRACT
- 2 Ret — SIG. RET.
- +24V 3
- 9
- 1 -4V/1.1A — C2B06 B3B06 B4B06 B5B06 C4B06 A4B06 — B5B06 / A2B06 — B5B11 / A2B11
- -12V
- 4 +6V/.3A — Z3D11 J6E04 C2B11 C2G11 B2G11 A4B11 — B5B13 / A5B13 / A5G13 / B3B13
- 6 -24V/.48A — Z3D13 K6B04 B2B13 B4B13 B4G13 C4G13 A4B13
- 01G2
- +24V Cntl 1 — H-K1 — 2 — Z3D04 H6C04 H2J10 — +BRK FLT

**B. Cable Assemblies**

**A — Cable PN 4406665**

| Wire No. | TSR 3E | 01A-TB1 | G-CB1 |
|---|---|---|---|
| 1 Gnd | 4 | 1 | |
| 2 Gnd | 5 | 2 | |
| 3 Gnd | 6 | 3 | |
| 4 Gnd | 7 | 4 | |
| 5 +5 | 1 | 5 | |
| 6 +5 | 2 | 6 | |
| 7 +5 | 3 | 7 | |
| 8 +8.5 | 13 | 11 | |
| 9 Gnd | 10 | 1 | |
| 10 Gnd | 14 | 3 | |
| 11 +24 | 16 | | N/O |
| 12 -12 | 12 | 13 | |
| 13 +24 | 15 | 16 | |
| 14 Gnd | 16 | 2 | |
| 15 +24 | 15 | 01A1A5B02 | |
| T15 Gnd | 16 | 01A1A5D08 | |
| 16 -5 | 8 | | Line |
| 17 | | 9 | Load |
| 18 Gnd | | 4 | N/C |

**B — Cable PN 4404337**

| Wire No. | From 01A-TB1 | To Board B2 Pwr Conn |
|---|---|---|
| 1 +5 | 5 | B3A01 |
| 2 +5 | 5 | B4A01 |
| 3 +5 | 5 | B5A01 |
| 4 +5 | 7 | J3A01 |
| 5 +5 | 7 | J4A01 |
| 6 +5 | 7 | J5A01 |
| 7 Gnd | 1 | B2E14 |
| 8 Gnd | 1 | B3E14 |
| 9 Gnd | 1 | B4E14 |
| 10 Gnd | 2 | J2E14 |
| 11 Gnd | 2 | J3E14 |
| 12 Gnd | 2 | J4E14 |
| 13 +8.5 | 11 | B2A14 |
| 14 +8.5 | 11 | B3A14 |
| 15 +8.5 | 11 | B4A14 |
| 16 +8.5 | 12 | J2A14 |
| 17 +8.5 | 12 | J3A14 |
| 18 +8.5 | 12 | J4A14 |

**D — Cable PN 4406667**

| Wire No. | 01A-TB1 | Resistor TB Assembly |
|---|---|---|
| 1 +8.5 | 11 | 1 |
| 2 -5 | 9 | 3 |
| 3 Gnd | 2 | 8 |

**E — Cable PN 1741690**

| Wire No | 01A-A1 | 01A-TB1 | TSR-1 | Misc Connection |
|---|---|---|---|---|
| 1 -4 | | | | Wire No's. 9, 24,25 |
| 2 Gnd | | 4 | | Wire No. 10 |
| 3 -12 | | 13 | 12 | |
| 4 +24 | Z3B10 | 16 | | |
| 5 +24 | | 16 | 11 | |
| 6 +6 | Z3D11 | | 4 | |
| 7 Gnd | Z3 Bus | | 3 | |
| 8 Gnd | Z3 Bus | | 9 | |
| 9 -4 | | | 1 | Wire No. 1 |
| 10 Gnd | | | 2 | Wire No. 2 |
| 11 -24 | Z3D13 | | 6 | |
| 12 Gnd | Z3 Bus | | | 01H-C1- |
| 13 -5 | Z3D10 | 10 | | |
| 14 +8.5 | Z3D01 | 12 | | |
| 15 M.C.Ret | Z3B02 | | | 01H-C1+ |
| 16 +Brk Flt | Z3D04 | | | 01H-K1-2 |
| 17 Gnd | | 2 | | 01H-TB1-4 |
| 18 Gnd | Gnd Bus | 3 | | |
| 19 Gnd | Gnd Bus | 3 | | |
| 20 +5 | +5 Bus | 6 | | |
| 21 +5 | +5 Bus | 6 | | |
| 22 +5 | +5 Bus | 6 | | |
| 23 +5 | +5 Bus | 6 | | |
| 24 -4 | C2B06 | | | Wire No. 1 |
| 25 -4 | A4B06 | | | Wire No. 1 |
| 26 Gnd | Gnd Bus | 2 | | |
| 27 Gnd | Gnd Bus | 2 | | |
| 28 +24 Ctrl | | 16 | | 01H-K1-1 |

**C — Cable PN 4406666**

| Wire No. | | 01A-TB1 | Board Pwr Conn |
|---|---|---|---|
| 1 | Gnd | 1 | A2M2E14 |
| 2 | Gnd | 1 | A2M3E14 |
| 3 | Gnd | 1 | A2M4E14 |
| 4 | Gnd | 2 | B1B2E14 |
| 5 | Gnd | 2 | B1B3E14 |
| 6 | Gnd | 2 | B1B4E14 |
| 7 | +5 | 5 | A2M3A01 |
| 8 | +5 | 5 | A2M4A01 |
| 9 | +5 | 5 | A2M5A01 |
| 10 | +5 | 7 | B1B3A01 |
| 11 | +5 | 7 | B1B4A01 |
| 12 | +5 | 7 | B1B5A01 |
| 13 | -5 | 9 | A2M3E01 |
| 14 | -5 | 9 | A2M4E01 |
| 15 | -5 | 9 | A2M5E01 |
| 16 | -5 | 9 | B1B3E01 |
| 17 | -5 | 9 | B1B4E01 |
| 18 | -5 | 9 | B1B5E01 |
| 19 | +8.5 | 12 | A2M2A14 |
| 20 | +8.5 | 12 | A2M3A14 |
| 21 | +8.5 | 12 | A2M4A14 |
| 22 | +8.5 | 12 | B1B2A14 |
| 23 | +8.5 | 12 | B1B3A14 |
| 24 | +8.5 | 12 | B1B4A14 |
| 25 | -12 | 13 | A2U4D07 |
| 26 | -12 | 13 | A2B4D07 |
| 27 | +24 | 16 | B1Y4D10 |
| 28 | Gnd | 3 | A2B2E14 |
| 29 | Gnd | 3 | A2B3E14 |
| 30 | Gnd | 3 | A2B4E14 |
| 31 | Gnd | 4 | B1M2E14 |
| 32 | Gnd | 4 | B1M3E14 |
| 33 | Gnd | 4 | B1M4E14 |
| 34 | +5 | 5 | A2B3A01 |
| 35 | +5 | 5 | A2B4A01 |
| 36 | +5 | 5 | A2B5A01 |
| 37 | +5 | 7 | B1M3A01 |
| 38 | +5 | 7 | B1M4A01 |
| 39 | +5 | 7 | B1M5A01 |
| 40 | +8.5 | 11 | A2B2A14 |
| 41 | +8.5 | 11 | A2B3A14 |
| 42 | +8.5 | 11 | A2B4A14 |
| 43 | +8.5 | 11 | B1M2A14 |
| 44 | +8.5 | 11 | B1M3A14 |
| 45 | +8.5 | 11 | B1M4A14 |
| 46 | -12 | 13 | B1Y4D05 |
| 47 | -5 | 10 | B1M3E01 |
| 48 | -5 | 10 | B1M4E01 |
| 49 | -5 | 10 | B1M5E01 |
| 50 | -5 | 10 | A2B3E01 |
| 51 | -5 | 10 | A2B4E01 |
| 52 | -5 | 10 | A2B5E01 |

**Figure 3-13 (Part 2 of 2). Power Distribution, 3602-1A, 1B (TSR-3 Power Supply, only 2 wires on B1Y4)**

Fig. 3-13, Part 2

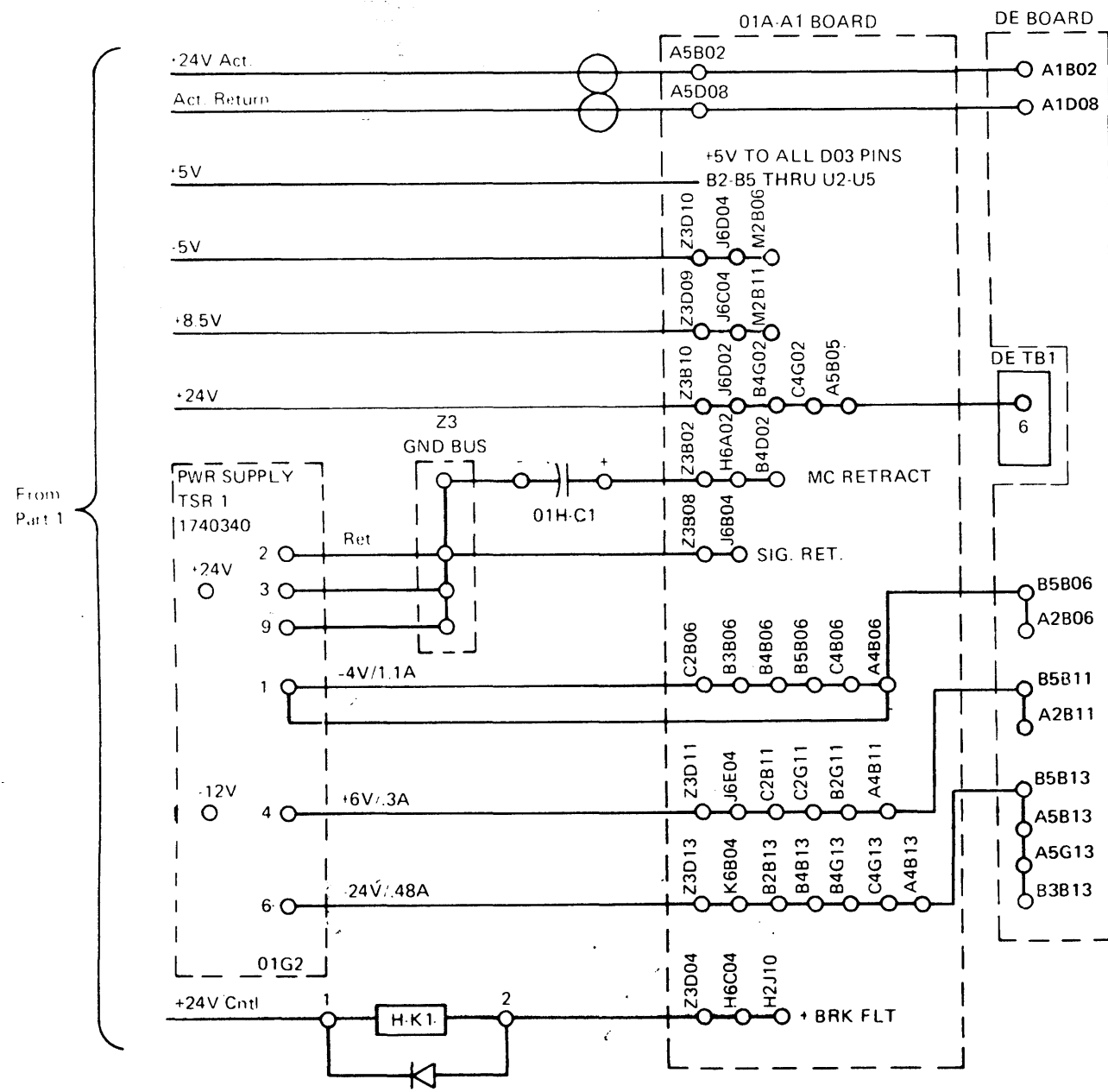TNL SN31-0864
SY27-2519-0

(7/78)   3-31

Communication Line End      Controller End

(Green, Black, Yellow, Red, Shield Terminal)

Communication Line End (Male)      Controller End (Female)

Communication Line End (Red, White, Yellow, Black)      Controller End
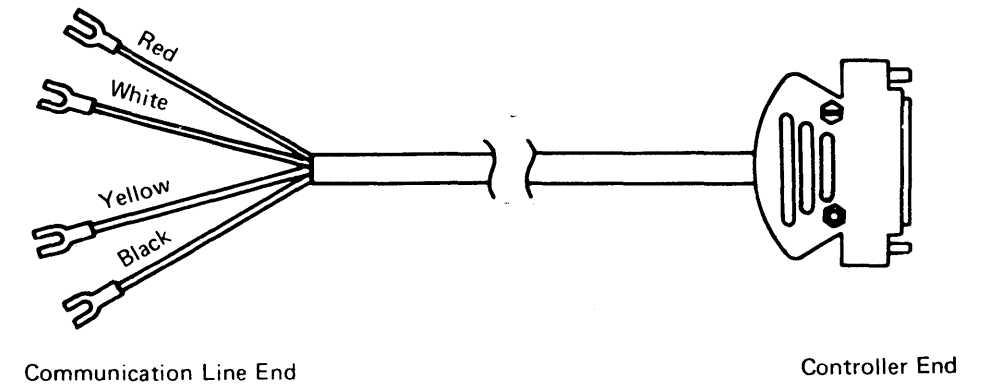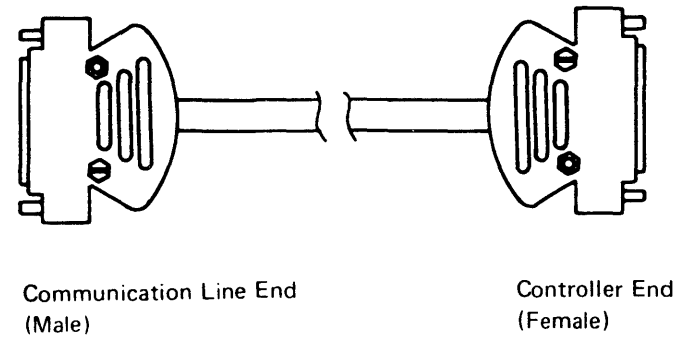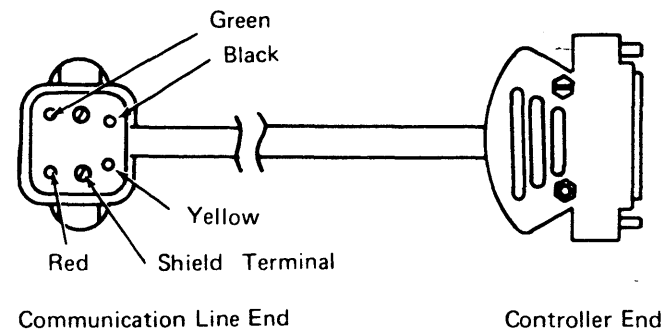
| Comm. Line Terminal Position | Wire Color | Controller Connector Position | Function |
|---|---|---|---|
| Red | Red | 10 | Transmit |
| Green | White | 9 | Transmit |
| Yellow | Yellow | 25 | Receive |
| Black | Black | 14 | Receive |
| See sketch above | Shield | 1 | |

**Note:** *For Japanese connection, see Figure 3-16.*

EIA 25-Pin Receptacle

13 12 11 10 9 8 7 6 5 4 3 2 1
25 24 23 22 21 20 19 18 17 16 15 14

**A. Internal Modem, USA, Canada and Japan (PN 1563205) or equivalent**

**PN1563204, 4404219 or equivalent**

| Modem End | Controller End | Lead† Number |
|---|---|---|
| 2 | 2 | 1 |
| 3 | 3 | 2 |
| 4 | 4 | 3 |
| 5 | 5 | 4 |
| 6 | 6 | 5 |
| 7 | 7 | 6 |
| 8 | 8 | 7 |
| 11 | 11 | 8 |
| 12 | 12 | 9 |
| 15 | 15 | 10 |
| 16 | 16 | 11 |
| 17 | 17 | 12 |
| 18 | 18 | 13 |
| 19 | 19 | 14 |
| 20 | 20 | 15 |
| 21 | 21 | 16 |
| 22 | 22 | 17 |
| 23 | 23 | 18 |
| 24 | 24 | 19 |
| * | * | 20 |

†Leads through 19 are numbered and coded in accordance with EIA standards. Lead Number 20 is green.

*Lead Number 20 is tied back on cable body inside hood.

**B. External Modem**

**PN 1620182 or equivalent**

| Wire No. | Male Pin No. | Color Body | Color Tracer | Female Pin No. |
|---|---|---|---|---|
| 1 | 24 | Black | | 24 |
| 2 | 2 | Brown | | 2 |
| 3 | 3 | Red | | 3 |
| 4 | 4 | Orange | | 4 |
| 5 | 5 | Yellow | | 5 |
| 6 | 6 | Pink | | 6 |
| 7 | 7 | Blue | | 7 |
| 8 | 8 | Violet | | 8 |
| 9 | 23 | Gray | | 23 |
| 10 | 15 | Black | Red | 15 |
| 11 | 22 | Black | Orange | 22 |
| 12 | 17 | Black | Yellow | 17 |
| 13 | 20 | Black | Gray | 20 |
| 14 | | Black | Blue | |
| 15 | | Black | Violet | |

| Controller Connector Position | Wire Color | Function |
|---|---|---|
| 10 | Red | Transmit |
| 9 | White | Transmit |
| 25 | Yellow | Receive |
| 14 | Black | Receive |
| 1 | Shield | |

**C. Internal Modem, World Trade Except Japan (PN 1563243) or equivalent**
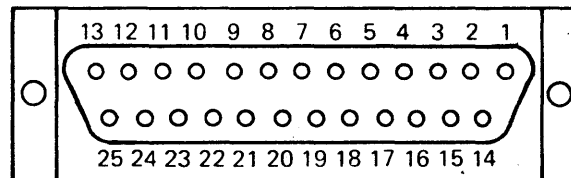
**PN 4404219, 4404220, 4404221 or equivalent**

| Wire No. | Body Color | Conn Pos |
|---|---|---|
| 1 | Black | 5 - 5 |
| 2 | Brown | 14 - 14 |
| 3 | Red | 6 - 6 |
| 4 | Orange | 18 - 18 |
| 5 | Blue | 23 - 23 |
| 6 | Green | 17 - 17 |
| 7 | White | 20 - 20 |
| 8 | Black | 8 - 8 |
| 9 | Brown | 3 - 3 |
| 10 | Red | 11 - 11 |
| 11 | Orange | 2 - 2 |
| 12 | Blue | 22 - 22 |
| 13 | Green | 4 - 4 |
| 14 | White | 15 - 15 |
| Cond Shlds | Drain Wire | 7 - 7 |
| Outer Shld | Drain Wire | 1 - — |

**Figure 3-14. External Cables, Controller/Communication Link**

| Comm Line Terminal Position | Wire Color | Controller Connectors | Function |
|---|---|---|---|
| Red | Red | Plug | Transmit |
| Green | White | | |
| Yellow | Yellow | Jack | Receive |
| Black | Black | | |
| See sketch below | Shield | Plug and Jack | |

Green    Black

Communication Line End

Red    Yellow

Shield Terminal

Black, Yellow and Shield

Jack (See Detail A)

Controller End

Red, White, and Shield

Plug (See Detail A)

*Note:* For Japanese connection, see Figure 3-16.

Detail A

White or Yellow Wire

Strain Relief

Red or Black Wire    Shield Wire

Plug or Jack
R=Ring
T=Tip
S=Shield
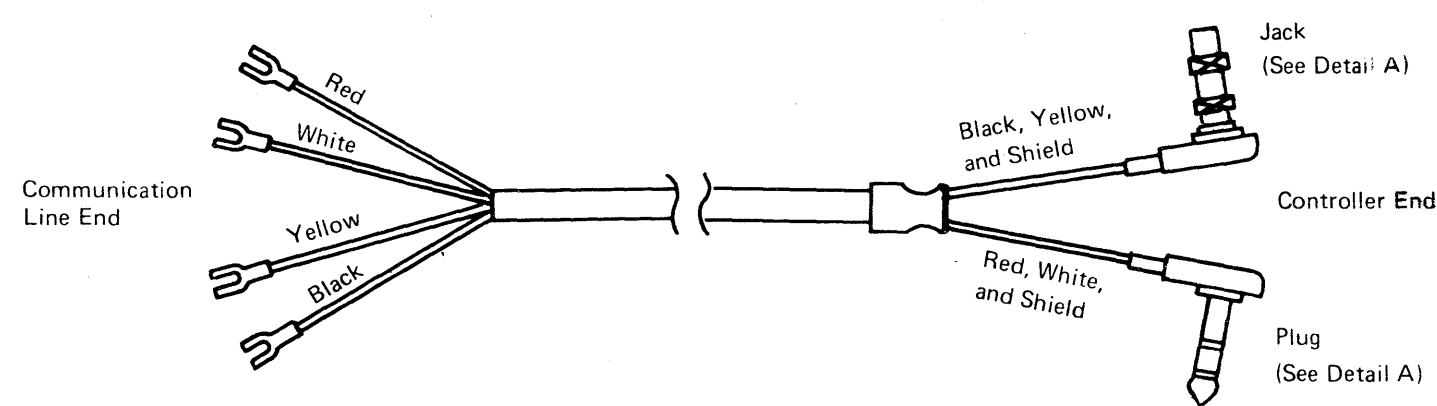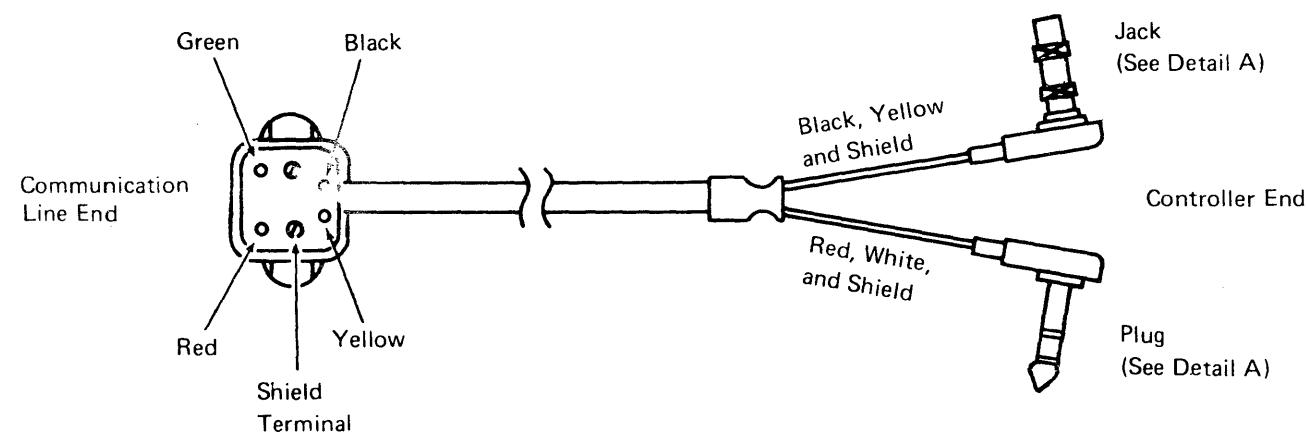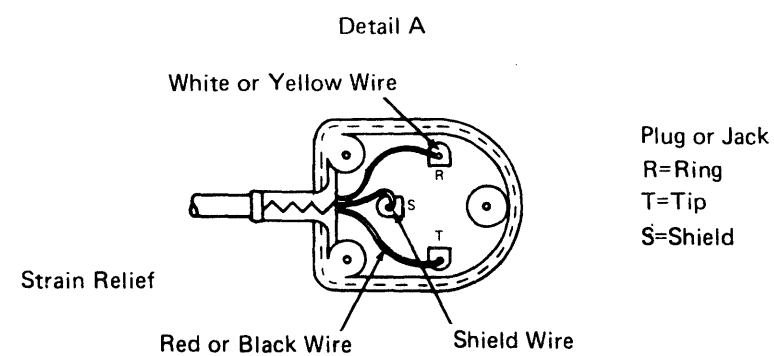
A. USA, Canada, and Japan (PN 1563206) or equivalent

---

Communication Line End

Red

White

Yellow

Black

Black, Yellow, and Shield

Jack (See Detail A)

Controller End

Red, White, and Shield

Plug (See Detail A)

Detail A

White or Yellow Wire

Strain Relief

Red or Black Wire    Shield Wire

Plug or Jack
R=Ring
T=Tip
S=Shield
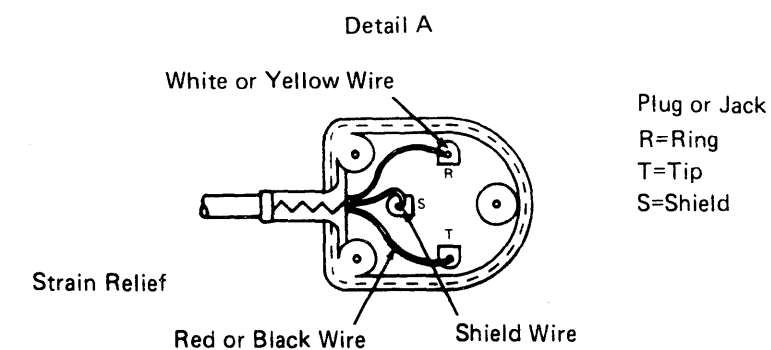
B. World Trade Except Japan (PN 1563242) or equivalent

**Figure 3-15. External Cables, Controller/Communication Line for a Remote Loop**

Fig. 3-15                                    SY27-2519-0                                    (4/78)   3-33

COMMUNICATION END

CONTROLLER END

Twisted Pair (White and Black)

Solder the skinned ends
of cable to PD-1A
terminals marked "DS".

White

Black

PN 5182523

Phone
Jack

GN

R    BLK

Y

Solder the skinned ends
of cable to PD-1A
terminals marked "DR".

Yellow

Black

Twisted Pair (Yellow and Black)
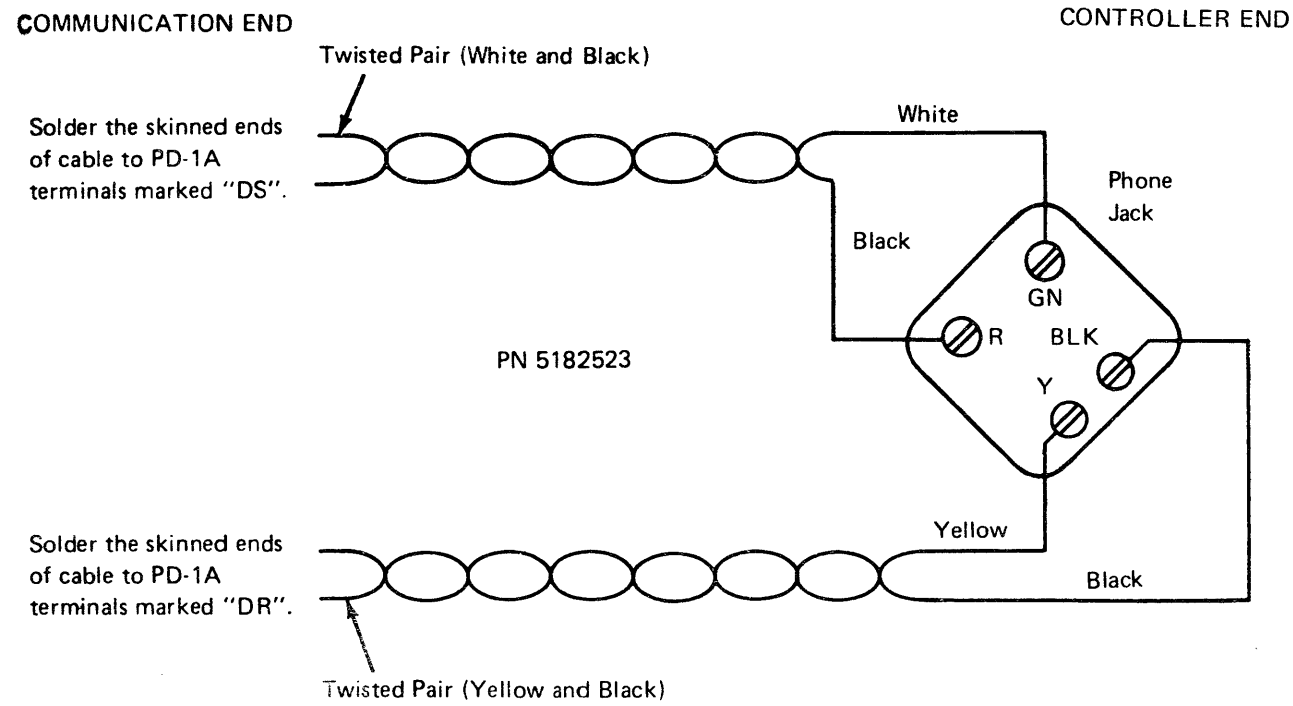
Normal Operation: Plug the phone plug of cable 1563205
or 1563206 into the phone jack of cable 5182523.

Wrap Test: Disconnect the above-mentioned plug and jack,
and connect plug assembly 1864271, 1864272, or jack
assembly 1864671 into their respective counterparts. See
the installation instruction for details of wrap test of NTT
D1 Service Requirement.

**Figure 3-16. Japanese Connection of External Cables to Communication Line (Loop or Host Link)**

IBM PN 341200
IBM PN 483674 (4) Term R.T.

IBM PN 483674 (4) Term.R.T.
IBM PN 5162880

IBM PN 483674 Term.R.T.
IBM PN 341200

IBM PN 5252769 Bulk Cable

WE 283B
Plug

WE 404B
Jack

WE 283B
Plug

White Wire

Black Wire

Black Wire

Common
Carrier
Half-Duplex
Facility
(Transmit)

R

Y

GN

R

BK

GN

GN

BK

Y

Y

R

Common
Carrier
Half-Duplex
Facility
(Receive)

Shield Wire

Black Wire

White Wire

White Wire

Shield Wire

Transmit

Receive

**Figure 3-17. Adapter Cable PN 1741656**

Transmitted Data    2

Received Data    3

Request to Send    4

Clear to Send    5

Data Set Ready    6

Signal Ground    7

Received Line Signal Detector    8

(Reserved for Data Set Testing)    9

(Reserved for Data Set Testing)    10

Unassigned    11

Sec. Received Line Signal Detector    12

Sec. Clear to Send    13

Sec. Transmitted Data    14

Transmission Signal Element Timing    15

Sec. Received Data    16

Receiver Signal Element Timing    17

Unassigned    18

Sec. Request to Send    19

Data Terminal Ready    20

Signal Quality Detector    21

Ring Indicator    22

Data Signal Rate Selector    23

Transmit Signal Element Timing    24

Operate Position

Test Position

"To" Data Set
5252592 Conn.
765496 Hood

"From" Terminal
5252593 Conn.
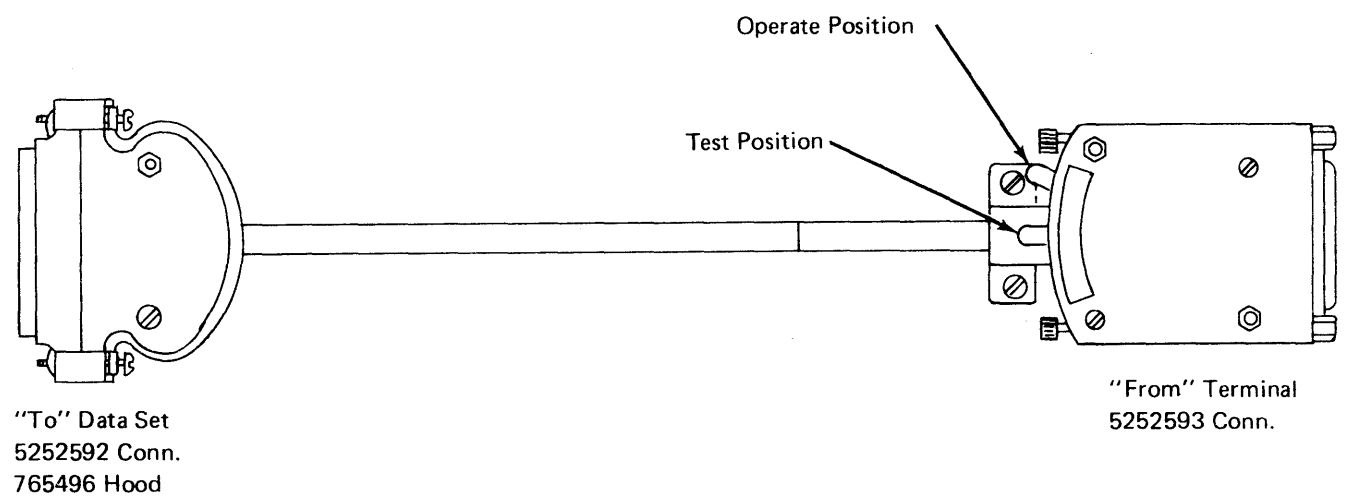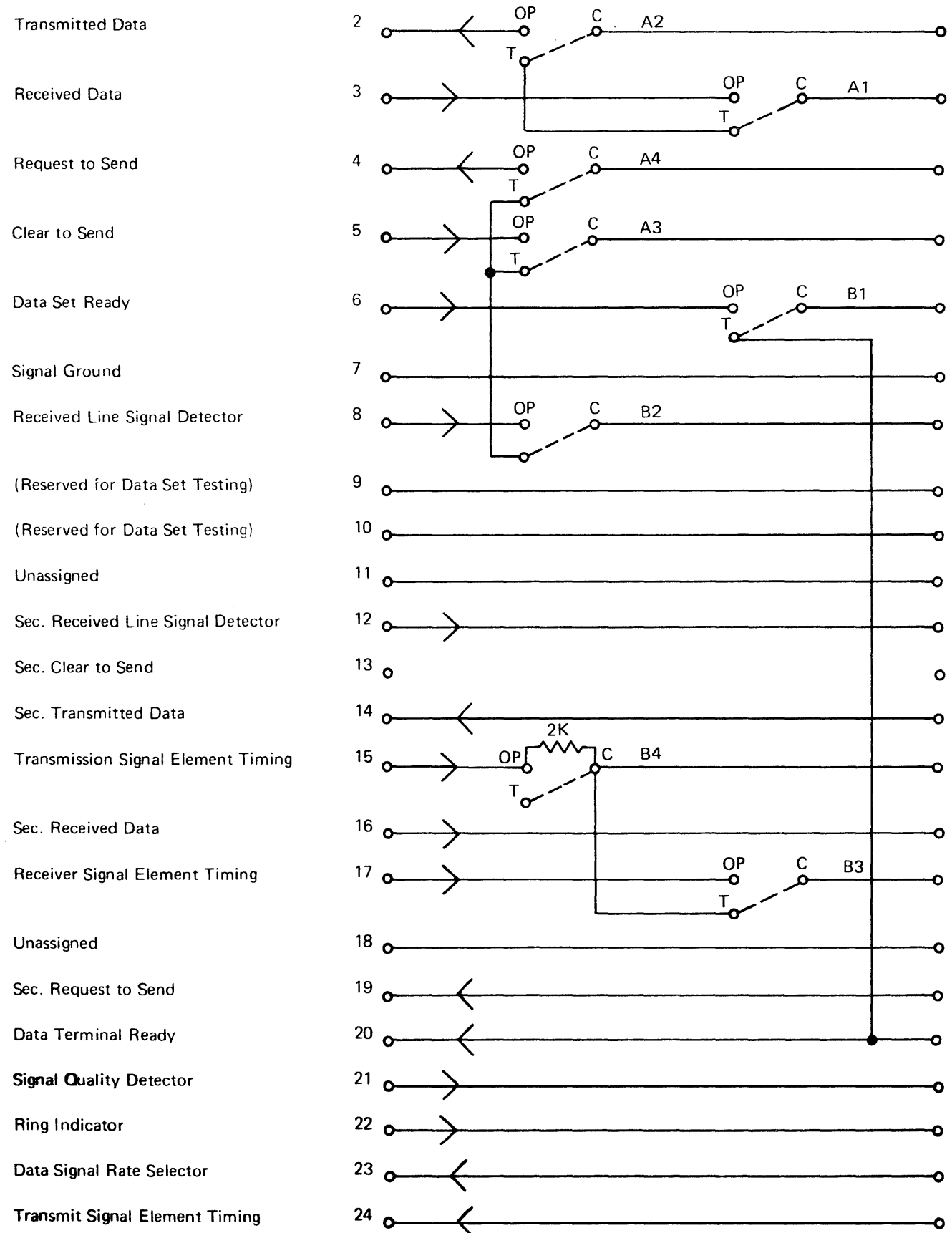
**Figure 3-18. Japanese Wrap Test Cable PN 2722052**

## 3.9 COMMUNICATION CONNECTIONS

### 3.9.1 Selection of Controller/Communication Connections

From the following chart, select the controller you have by model and number of power supplies used; refer to the indicated paragraph number for the correct communication connections for your controller:

| Controller Model and Number of Power Supplies Used | Communication Connections Paragraph Number |
|---|---|
| 3601-2A, 2B, 3A, 3B (Single TSR-3 power supply) | 3.9.2 |
| 3601-2A, 2B, 3A, 3B (One or two TSR-2 power supplies) | 3.9.3 |
| 3601-C, D | 3.9.4 |
| 3602-1A, 1B (TSR-3 power supply, more than 2 wires on B1Y4) | 3.9.5 |
| 3602-1A, 1B (TSR-3 power supply, only 2 wires on B1Y4) | 3.9.6 |

### 3.9.2 Communication Connections, 3601-2A, 2B, 3A, 3B (Single TSR-3 Power Supply)

NOTES

1  If B/M 4941040 or 4941110 is used with B/M 4941942, 4941043, 4941044, or 4941045, then wirewrap PN 811425 from A1C2S13 to A1C2U08.

2  If B/M 4941016 or 4941018 is used with B/M 4941112, 4941113, 4941114, or 4941115, then wirewrap PN 811425 from A2K2S13 to A2K2U08.

3  If B/M 4941042 or 4941043 is to be installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A1B2B03 | A1B5B09 |
| A1B2B02 | A1B5D11 |
| A1B4B09 | A1B4D04 |
| A1B3B10 | A1B3D12 |
| A1B3B08 | A1B3B09 |
| A1B3B05 | A1B3B07 |
| A1A2B09 | A1A2B13 |
| A1A2B04 | A1A2D11 |

Also wire-twisted pair PN 5347623.

| From | To |
|---|---|
| A1B2B02 (YEL) | A1B1B11 (YEL) |
| A1A2D09 (BK) | A1B1C13 (BK) |

4  If B/M 4941044 or 4941045 is to be installed, then wirewrap PN 8111425.

| From | To |
|---|---|
| A1B4B09 | A1B4D07 |
| A1B3B10 | A1B3B12 |
| A1B5B08 | A1B5B10 |
| A1B3B05 | A1B3B07 |
| A1A2B09 | A1A2B13 |
| A1A2B04 | A1A2D11 |

Also wire-twisted pair PN 5347623.

| From | To |
|---|---|
| A1B2B02 (YEL) | A1B1B11 (YEL) |
| A1A2D09 (BK) | A1B1C13 (BK) |
| and | |
| A1B5B09 (YEL) | A1C1E11 (YEL) |
| A1B5D11 (BK) | A1A1D11 (BK) |

5  If B/M 4941046 is to be installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A1C5D12 | A1A2B13 |
| A1C5B03 | A1A2D10 |
| A1C5D09 | A1A2B05 |
| A1C5B02 | A1A2D05 |
| A1C5D04 | A1A2D09 |
| A1C5B04 | A1A2D07 |
| A1C5D11 | A1A2B04 |

6  If B/M 4941112 or 4941113 is to be installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A2N4D05 | A2N3B09 |
| A2N4B02 | A2N3D11 |
| A2N2B09 | A2N2D04 |
| A2N5B10 | A2N5D12 |
| A2N5B08 | A2N5B09 |
| A2N5B05 | A2N5B07 |

Also wire-twisted pair PN 5347623.

| From | To |
|---|---|
| A2N4B02 (YEL) | A2F6C04 (YEL) |
| A2N4D05 (BK) | A2F6B02 (BK) |

7  If B/M 4941114 or 4941115 is to be installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A2N2B09 | A2N2D07 |
| A2N5B10 | A2N5B12 |
| A2N3B08 | A2N3B10 |
| A2N5B05 | A2N5B07 |
| A2N3B02 | A2P5B10 |
| A2N3B05 | A2P5D05 |

Also wire-twisted pair PN 5347623.

| From | To |
|---|---|
| A2N4B02 (YEL) | A2F6C04 (YEL) |
| A2N4D05 (BK) | A2F6B02 (BK) |
| and | |
| A2N3B09 (YEL) | A2D6E04 (YEL) |
| A2N3D11 (BK) | A2G6A04 (BK) |

8  If B/M 1864633 (Japan only) is requested, then this B/M must be included in addition to USA B/M 4941042, 4941044, 4941112, or 4941114.

9  If B/M 1739375 (PTT wrap – Japan only) is requested, then this B/M must be included in addition to B/M 4941046 or 4941116.

10  If B/M 1739373 (German only) is requested, then this B/M must be included in addition to B/M 4941046 or 4941116.

11  If B/M 4941040, 4941041 or 4403161 is installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A1G5B10 | A1F6B02 |
| A1C3D06 | A1C3B05 |
| A1C2B07 | A1G3D04 |
| A1C3D07 | A1G3D07 |

12  If B/M 4941110 or 4941111 is installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A1G5B10 | A1C4D05 |
| A1C4D04 | A1F6B02 |
| A1C3B05 | A1C3D07 |
| A1C3D06 | A1G3D04 |
| A1C2B07 | A1G3D07 |
| A1C4B13 | A1G4B05 |
| A1C4D11 | A1G5D13 |

13  If B/M 4941110 is installed, then wirewrap PN 811425.

| From | To |
|---|---|
| A1C5D06 | A1C5D11 |
| A1C4D12 | A1C5D10 |

14  If B/M 4941016 or 4941017 is installed, then delete by reaming.

| Delete by reaming | Test for no continuity between reamed pin and respective pins below |
|---|---|
| A2K2B03 (Card Side) | A2K2D08 |
| A2K3B07 (Card Side) | A2M3D06 |
| | A2J3D06 |
| A2K2B12 (Pin Side) | A2K2B10 |
| A2K3D09 (Pin Side) | A2K3D08 |

Also wirewrap PN 811425.

| From | To |
|---|---|
| A2M3D06 | A2J3D06 |
| A2K3B07 | A2K3B05 |
| A2K3D06 | A2J3B12 |
| A2K2B07 | A2J3D06 |
| A2K3D07 | A2J3B05 |
| A2K2B12 | A2K2D12 |

15  If B/M 4941116 is installed, then wirewrap PN 8111425.

| From | To |
|---|---|
| A2L5B10 | A2E6A02 |

16  If the line discipline is to be in asynchronous mode (i.e., start-stop line control), then wirewrap (PN 811425) between the following location:

| From | To |
|---|---|
| A2K4B13 | A2K4D08 |

17  If B/M 4941110 is used with B/M 4941046, then wirewrap PN 811425.

| From | To |
|---|---|
| A1A3D09 | A1A3D08 |
| A1A3D04 | A1A3D08 |

18  If B/M 4403163 is installed, then wirewrap PN 811425.

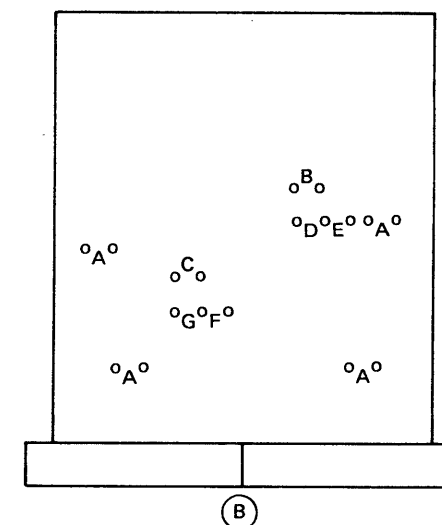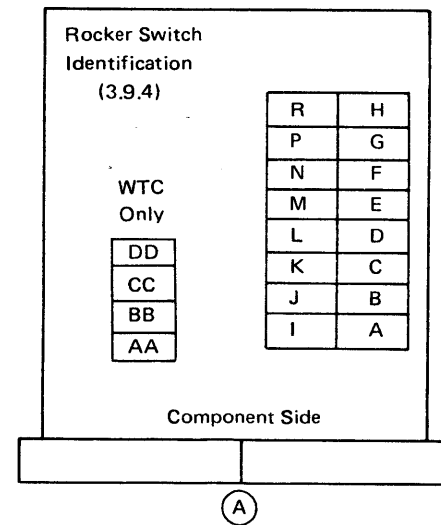| From | To |
|---|---|
| A2L4G05 | A2L4N08 |
| A2L4J09 | A2D4N08 |
| A2L4J04 | A2M4N08 |
| A2L4J13 | A2M4N08 |
| A2L4G04 | A2L4D08 |
| A2L4G03 | A2L4D08 |

### 3.9.2 Communication Connections (Cont)

| B/M No. | Adapter Card Location | Adapter Speed BPS | Speed Select Wirewrap PN 811425 From Pin A1C2 P08 TO | Data Set Ready | Line Adapter B/M No. Notes [8] [9] [10] | EIA | Line Adapter Card Location Receive | Transmit | Wrap |
|---|---|---|---|---|---|---|---|---|---|
| 4941040 CCA W/Clk Note [11] | A1C2 | 300 600 1200 2400 | G13 M04 M05 M03 | Note [1] | 4941046-EIA Note [5] | A1A2 | | | |
| | | | | | 4941042-2W-USA Note [3] 4941043-2W-WTC Note [3] | | A1B4 | A1B2 | A1A2 |
| | | | | | 4941044-4W-USA Note [4] 4941045-4W-WTC Note [4] | | | | |
| 4941041 CCA W/O Clk Note [11] | A1C2 | | | | 4941046-EIA Note [5] | A1A2 | | | |
| 4941110 HPCA W/Clk Note [12] [13] | A1C2 | 600 1200 2400 | M04 M05 M03 | Note [1] | 4941046-EIA Note [5] [17] | A1A2 | | | |
| | | | | | 4941042-2W-USA Note [3] 4941043-2W-WTC Note [3] | | A1B4 | A1B2 | A1A2 |
| | | | | | 4941044-4W-USA Note [4] 4941045-4W-WTC Note [4] | | | | |
| 4941111 HPCA W/O Clk Note [12] | A1C2 | | | | 4941046-EIA Note [5] | A1A2 | | | |
| 4941016 ALA CCA W/Clk Note [14] | A2K2 | 300 600 1200 2400 | G13 M04 M05 M03 | Note [2] | 4403163-Local attach Note [18] | | | | |
| | | | | | 4941116-EIA Note [15] | A2L4 | | | |
| | | | | | 4941112-2W-USA Note [6] 4941113-2W-WTC Note [6] | | A2N2 | A2N4 | A2P5 |
| | | | | | 4941114-4W-USA Note [7] 4941115-4W-WTC Note [7] | | | | |
| 4941017 ALA CCA W/O Clk Note [14] | A2K2 | | | | 4941116-EIA Note [15] | A2L4 | | | |
| 4403161 No Host RPQ S25142 Note [11] | None | | | | None | | | | |

## 3.9.3 Communication Connections 3601-2A, 2B, 3A, 3B (One or Two TSR-2 Power Supplies)

| | FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings. Following Switches "ON", All Others "OFF" | Notes |
|---|---|---|---|---|---|---|---|
| **Hdst Link (15)** | 4946042 No Host Line | 1  4 | N/A | N/A | N/A | | |
| | 4946045 CCA W/Clock | 1  4  5 | AIC2 | 4406036 - UCM2WUSA | AIA2 | J, N, L | 2 |
| | | | | 4406037 - UCM2WWTC | | M, J, L, A   See Ⓐ | 2 |
| | | | | 4406038 - UCM4WUSA | | K, P | 3 |
| | | | | 4406039 - UCM4WWTC | | I, K, A | 3 |
| | 4946046 CCA W/O Clock | 1  4 | | 4406043 - EIA/CCITT | | Remove all Jumpers from card. See Ⓑ | |
| | 4946041 HPCA W/O Clock | 6 | | | | | 8 |
| | 4946040 HPCA W/Clock | 6  7 | | 4406036 - UCM2WUSA | | J, N, L | 2 |
| | | | | 4406037 - UCM2WWTC | | M, J, L, A   See Ⓐ | 2 |
| | | | | 4406038 - UCM4WUSA | | K, P | 3 |
| | | | | 4406039 - UCM4WWTC | | I, K, A | 3 |
| **ALA Port 1 (80)** | 4409500 ASYNC CCA W/Clock | 9  10 | AIB2 | 4409476 - UCM2WUSA | AIA4 | J, N, L | |
| | | | | 4409492 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409484 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | | 4409480 - UCM4WUSA | | K, P | |
| | | | | 4409496 - UCM4WWTC | | I, K, A | |
| | | | | 4409488 - UCM4WJAP | | I, K, A | |
| | 4409504 SYNC CCA W/O Clock | | | 4409512 - EIA/CCITT | | | |
| | | | | 4409508 - EIA/CCITT EMI | | Remove all Jumpers from card. See Ⓑ | |
| | 4409472 SYNC CCA W/Clock | 10 | | 4409512 - EIA/CCITT | | | |
| | | | | 4409476 - UCM2WUSA | | J, N, L | |
| | | | | 4409492 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409484 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | | 4409480 - UCM4WUSA | | K, P | |
| | | | | 4409496 - UCM4WWTC | | I, K, A | |
| | | | | 4409488 - UCM4WJAP | | I, K, A | |
| **ALA Port 2 (81)** | 4409501 ASYNC CCA W/Clock | 9  10 | A2N2 | 4409477 - UCM2WUSA | A2E2 | J, N, L | |
| | | | | 4409493 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409485 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | | 4409481 - UCM4WUSA | | K, P | |
| | | | | 4409497 - UCM4WWTC | | I, K, A | |
| | | | | 4409489 - UCM4WJAP | | I, K, A | |
| | 4409505 SYNC CCA W/O Clock | | A2N2 | 4409513 - EIA/CCITT | | | |
| | | | | 4409509 - EIA/CCITT EMI | | Remove all Jumpers from card. See Ⓑ | |
| | 4409473 SYNC CCA W/Clock | 10 | | 4409513 - EIA/CCITT | | | |
| | | | | 4409477 - UCM2WUSA | | J, N, L | |
| | | | | 4409493 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409485 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | | 4409481 - UCM4WUSA | | K, P | |
| | | | | 4409497 - UCM4WWTC | | I, K, A | |
| | | | | 4409489 - UCM4WJAP | | I, K, A | |

| | FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings. Following Switches "ON", All Others "OFF" | Notes |
|---|---|---|---|---|---|---|---|
| **ALA Port 3 (82)** | 4409502 ASYN CCA W/Clock | 9  10 | A2P2 | 4409478 - UCM2WUSA | A2T2 | J, N, L | |
| | | | | 4409494 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409486 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | | 4409482 - UCM4WUSA | | K, P | |
| | | | | 4409498 - UCM4WWTC | | I, K, A | |
| | | | | 4409490 - UCM4WJAP | | I, K, A | |
| | 4409506 SYNC CCA W/O Clock | | | 4409514 - EIA/CCITT | | | |
| | | | | 4409510 - EIA/CCITT EMI | | Remove all Jumpers from card. See Ⓑ | |
| | 4409474 SYNC CCA W/Clock | 10 | | 4409514 - EIA/CCITT | | | |
| | | | | 4409478 - UCM2WUSA | | J, N, L | |
| | | | | 4409494 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409486 - UCM2WJAP | | M, J, L, A | |
| | | | | 4409482 - UCM4WUSA | | K, P   See Ⓐ | |
| | | | | 4409498 - UCM4WWCT | | I, K, A | |
| | | | | 4409490 - UCM4WJAP | | I, K, A | |
| **ALA Port 4 (83)** | 4409503 ASYNC CCA W/Clock | 9  10 | A2Q2 | 4409479 - UCM2WUSA | A2T4 | J, N, L | |
| | | | | 4409495 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409487 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | | 4409483 - UCM4WUSA | | K, P | |
| | | | | 4409499 - UCM4WWTC | | I, K, A | |
| | | | | 4409491 - UCM4WJAP | | I, K, A | |
| | 4409507 SYNC CCA W/O Clock | | | 4409515 - EIA/CCITT | | | |
| | | | | 4409511 - EIA/CCITT EMI | | Remove all Jumpers from card. See Ⓑ | |
| | 4409475 SYNC CCA W/Clock | 10 | | 4409515 - EIA/CCITT | | | |
| | | | | 4409479 - UCM2WUSA | | J, N, L | |
| | | | | 4409495 - UCM2WWTC | | M, J, L, A | |
| | | | | 4409487 - UCM2WJAP | | M, J, L, A | |
| | | | | 4409483 - UCM4WUSA | | K, P   See Ⓐ | |
| | | | | 4409499 - UCM4WWTC | | I, K, A | |
| | | | | 4409511 - UCM4WJAP | | I, K, A | |

**Rocker Switch Identification (3.9.4)**

WTC Only

| | |
|---|---|
| DD | |
| CC | |
| BB | |
| AA | |

| | |
|---|---|
| R | H |
| P | G |
| N | F |
| M | E |
| L | D |
| K | C |
| J | B |
| I | A |

Component Side

Ⓐ

Ⓑ

EC 745949

## 3.9.3 Communication Connections (Cont)

| B/M No. | Loop Adapter NO. | Loop Adapter Card Location [15] | Loop Speed [11] | Speed Select. Install Jumper PN 5492084 From Pin S10 To | Remote Only. Install Jumper PN 5492081 From Pin U08 To [12] | Local Loop Cable PN 4943640 [12] [18] | Integrated Modem USA and Canada B/M No. [13] [16] | Integrated Modem WTC B/M No. [13] [14] [17] | Undercover Modem Card Card Location | Remote Loop Cable PN 4406670 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4946036 [19] | 1 | A1D2 | 600<br>1200<br>2400<br>4800 | J11<br>J07<br>J10<br>J09 | Local Only | A1Y3<br>Local Only<br>To J2-J3 | | | | |
| 4946051 | 2 | A1E2 | 600<br>1200<br>2400<br>4800 | J11<br>J07<br>J10<br>J09 | U07 | A1Y3<br>To J4-J5 | 4946061 | 4946071 | 1A-A2B2 | A2B3<br>To J4-J5 |
| 4946052 | 3 | A1F2 | 600<br>1200<br>2400<br>4800 | J11<br>J07<br>J10<br>J09 | U07 | A1Y3<br>To J6-J7 | 4946062 | 4946062 | 1A-A2C3 | A2C3<br>To J6-J7 |
| 4946053 | 4 | A2G2 | 600<br>1200<br>2400<br>4800 | J11<br>J07<br>J10<br>J09 | U07 | A2Z1<br>To J8-J9 | 4946063 | 4946063 | 1A-A2B4 | A2B5<br>To J8-J9 |
| 4946054 | 5 | A2H2 | 600<br>1200<br>2400<br>4800 | J11<br>J07<br>J10<br>J09 | U07 | A2Z1<br>To J10-J11 | 4946064 | 4946074 | 1A-A2C4 | A2C5<br>To J10-J11 |
| 4946055 | 6 | A2J2 | 600<br>1200<br>2400<br>4800 | J11<br>J07<br>J10<br>J09 | U07 | A2Z1<br>To J12-J13 | 4946065 | 4946075 | 1A-A2D4 | A2D5<br>To J12-J13 |

Notes:

[1] If B/M 4946042, 4946045 or 4946046 is to be installed, then wire-wrap PN 811425
From O1A-A1G2S10   To O1A-A1F6B02

[2] If B/M 4406036 or 4406037 is to be installed, then wire-wrap PN 811425
From O1A-A1A2G09   To O1A-A1A2J13
     O1A-A1A2J13   O1A-A1A2J05
Also wire-wrap twisted pair PN 5347623
From O1A-A1B1B11 (YEL)   To O1A-A1A2J13
     O1A-A1B1C13 (BK)   O1A-A-1A2G09

[3] If B/M 4406038 or 4406039 is to be installed, then wire-wrap PN 811425
From O1A-A1B1B11 (YEL)   To O1A-A1A2G02
     O1A-A1B1C13 (BK)   O1A-A1A2J05
     O1A-A1C1E11 (BK)   O1A-A1A2J13
     O1A-A1A1D11 (YEL)   O1A-A1A2G09

[4] If B/M 4946042, 4946045, or 4946046 is to be installed, then wire-wrap PN 811425
From O1A-A1C2J06   To O1A-A1C2G05
     O1A-A1C2B07   O1A-A1D2G12
     O1A-A1C2J07   O1A-A1D2G05

[5] If B/M 4946045 is to be installed, then wire-wrap PN 811425
From O1A-A1C2M05   To O1A-A1C2P08

[6] If B/M 4946040 or 4946041 is to be installed, then wire-wrap PN 811425
From O1A-A1C2J07   To O1A-A1C2G05
     O1A-A1C2B07   O1A-A1D2G05
     O1A-A1C2J06   O1A-A1D2G12
     O1A-A1C2M13   O1A-A1G2M05
     O1A-A1C2P11   O1A-A1G2U13
     O1A-A1C2P05   O1A-A1G2S10
     O1A-A1C2P04   O1A-A1F6B02

[7] If B/M 4946040 is to be installed, then wire-wrap PN 811425
From O1A-A1C2M05   To O1A-A1C2P08
     O1A-A1C2U11   O1A-A1C2U06
     O1A-A1C2U10   O1A-A1C2P12

[8] If B/M 4946040 and 4406043 are to be installed, then wire-wrap PN 811425
From O1A-A1A2J04   To O1A-A1A2J08
     O1A-A1A2J10   O1A-A1A2J08

[9] If B/M 4409500, 4409501, 4409502, or 4409503 is to be installed, then wire-wrap PN 811425
From card loc pin M13   To card loc pin P08

[10] If B/M 4409472, 4409473, 4409474, 4409475, 4409500, 4409501, 4409502, or 4409503 is to be installed, then wire-wrap PN 811425
From card loc pin M05   To card loc pin P08

[11] Local loops will be assigned beginning at position 1. Speeds will be assigned in descending order (position 1 will have the highest speed).

[12] Remote loops will be assigned beginning at position immediately following the last local loop position.

[13] Undercover modems applicable to Models 03A or 03B only.

[14] If B/M 1864633 (Japan only) is requested, then this B/M must be included in addition to USA B/Ms.

[15] Loop adapters 1, 2, 3 are applicable to Models 02A, 02B, 03A, 03B. Loop adapters 4, 5, 6 and applicable to Models 03A, 03B only.

[16] Set rocker switches K and P "ON". All other switches should be "OFF". See (A).

[17] Set rocker switches I, A and K "ON". All other switches should be "OFF". See (A).

[18] If integrated modem (remote loop) is also being installed, do not install local loop cable.

[19] Wire wrap PN 811425
From A1E5B12 To A1L6E04
     A1F5B12 To A1M6C04

## 3.9.4 Communication Connections, 3601 C,D

| FFBM No. | Card Location OIA | Adapter Speed BPS | Speed Select Wire Wrap #811425 From Pin P08 To | Line Adapter FFBM No. | Line Adapter Card Location OIA | Strapping Options Set the Following Rocker Switches ON. All Others Should Be OFF. See Ⓐ | Notes |
|---|---|---|---|---|---|---|---|
| 4406041 CCA W/CLK Note 🔳3 | A1B2 | 1200 | M05 | 4406043-EIA/CCITT | A1A2 | Remove all jumpers from card. See Ⓑ | |
| | | | | 4406036-UCM2WUSA | | J, N, L | 🔳1 |
| | | | | 4406037-UCM 2WWTC | | M, J, L, A | 🔳1 |
| | | 2400 | M03 | 4406038-UCM 4WUSA | | K, P | 🔳2 |
| | | | | 4406039-UCM 4WWTC | | I, K, A | 🔳2 |
| 4406042 CCA W/O CLK Note 🔳3 | A1B2 | | | 4406043-EIA/CCITT | A1A2 | Remove all jumpers from card. See Ⓑ. | |

| Loop Adapter Card Location OIA | Loop Speed | Speed Select Install Jumper P/N 5492084 From Pin S10 To | Plug Loop Cable From |
|---|---|---|---|
| A1D2 | 600 1200 2400 4800 | J11 J07 J10 J09 | 01A-A1Y2 TO 01S-J2 & J3 |
| A1C2 | 600 1200 2400 4800 | J11 J07 J10 J09 | 01A-A1Y2 TO 01S-J4 & J5 |

Rocker Switch Identification

| | R | H |
|---|---|---|
| | P | G |
| | N | F |
| WTC Only | M | E |
| | L | D |
| DD | K | C |
| CC | J | B |
| BB | | |
| AA | I | A |

Component Side

Ⓐ                          Ⓑ

**Notes:**
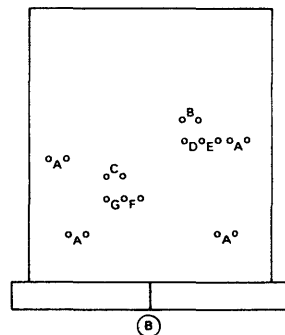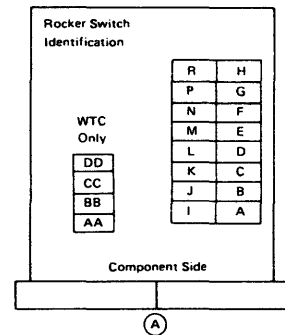
🔳1  If B/M 4406037 or 4406036 is to be installed, then wire-wrap PN 811425
    From   01A-A1A2G09      To   01A-A1A2G02
           01A-A1A2J13            01A-A1A2J05
    Also wire-wrap twisted pair PN 5347623
    From   01A-A1B1B11(YEL)   To   01A-A1A2J13
           01A-A1B1C13(BLK)         01A-A1A2G09

🔳2  If B/M 4406038 or 4406039 is to be installed, then wire-wrap twisted pair
    PN 5347623
    From   01A-A1B1B11(YEL)   To   01A-A1A2G02
           01A-A1B1C13(BLK)         01A-A1A2J05
    And
           01A-A1C1E11(BLK)         01A-A1A2J13
           01A-A1A1D11(YEL)         01A-A1A2G09

🔳3  If B/M 4406041 or 4406042 is to be installed, then wire-wrap PN 811425
    From   01A-A1A5D07      To   01A-A1H5D05

**Switch Description**

| | U.S. Card | W.T.Card |
|---|---|---|
| 2-Wire | J on, K off | M on, I off. |
| | Must use board/panel cable PN4406671 | |
| 4-Wire | K on, J off | I on, M off |
| | Must use board/panel cable PN4406672 | |
| Echo Clamp | 50-ms delay, L, on 150-ms delay, L off | 50-ms delay, L on 150-ms delay, L off |
| Clear to Send | 30-ms delay, P on, N off 80-ms delay, N on, P off 230-ms delay, N off, P off | 30-ms delay, K on, J off 80-ms delay, J on, K off 230-ms delay, J off, K off |
| Equalizer * | W.T. Only | Normal delay, CC on High-Frequency delay, AA on Mid-Frequency delay, DD on Low-Frequency delay, BB on |

*To be used by TP specialist only. Requires line distortion information.
For transmit level, see 1.123.

Blank Page

**3.9.5 Communication Connections 3602-1A, 1B (TSR-3 Power Supply, More Than 2 Wires on B1Y4)**

NOTES

[1] If B/M 1652526 or 4941142 is used with B/M 1745441, 1745442, 1745443 or 1745444 then wire wrap PN 811425 from B1C2S13 to B1C2U08.

[2] If B/M 4944360 is used with B/M 4941145, 4941146, 4941147 or 4941148 then wire wrap PN 811425 from A2K2S13 to A2K2U08.

[3] If B/M 1864633 (Japan only) is requested, then this B/M must be included in addition to B/M 1745441, 1745442, 4941146 or 4941145.

[4] If B/M 1745442 or 1745444 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| B1 B2B03 | B1 B5B09 |
| B1 B2B02 | B1 B5D11 |
| B1 B4B09 | B1 B4D04 |
| B1 B3B10 | B1 B3D12 |
| B1 B3B08 | B1 B3B09 |
| B1 B3B05 | B1 B3B07 |
| B1 A2B09 | B1 A2B13 |
| B1 A2B04 | B1 A2D11 |

Also wire-twisted pair PN 5347623.

| From | To |
|------|------|
| B1 B2B02 | B1 B1B11 (YEL) |
| B1 A2D09 | B1 B1C13 (BK) |

[5] If B/M 1745441 or 1745443 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| B1 B4B09 | B1 B4D07 |
| B1 B3B10 | B1 B3D12 |
| B1 B5B08 | B1 B5D10 |
| B1 B3B05 | B1 B3B07 |
| B1 A2B09 | B1 A2B13 |
| B1 A2B04 | B1 A2D11 |

Also wire-twisted pair PN 5347623.

| From | To |
|------|------|
| B1 B2B02 | B1 B1B11 (YEL) |
| B1 A2D09 | B1 B1C13 (BK) |
| and | |
| B1 B5B09 | B1 C1E11 (YEL) |
| B1 B5D11 | B1 A1D11 (BK) |

[6] If B/M 1652528 is to be installed, then wire wrap PN 811425

| From | To |
|------|------|
| B1 C5D12 | B1 A2B13 |
| B1 C5B03 | B1 A2D10 |
| B1 C5D09 | B1 A2B05 |
| B1 C5B02 | B1 A2D05 |
| B1 C5D04 | B1 A2D09 |
| B1 C5B04 | B1 A2D07 |
| B1 C5D11 | B1 A2B04 |

[7] If B/M 4941146 or 4941148 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| A2 N4D05 | A2 N3B09 |
| A2 N4B02 | A2 N3D11 |
| A2 N2B09 | A2 N2D04 |
| A2 N5B10 | A2 N5D12 |
| A2 N5B08 | A2 N5B09 |
| A2 N5B05 | A2 N5B07 |

Also wire-twisted pair PN 5347623.

| From | To |
|------|------|
| A2 N4B02 | A2 F6C04 (YEL) |
| A2 N4D05 | A2 F6B02 (BK) |

[8] If B/M 4941145 or 4941147 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| A2 N2B09 | A2 N2D07 |
| A2 N5B10 | A2 N5B12 |
| A2 N3B08 | A2 N3B10 |
| A2 N5B05 | A2 N5B07 |
| A2 N3B02 | A2 P5B10 |
| A2 N3B05 | A2 P5D05 |

Also wire-twisted pair PN 5347623.

| From | To |
|------|------|
| A2 N4B02 | A2 F6C04 (YEL) |
| A2 N4D05 | A2 F6B02 (BK) |
| and | |
| A2 N3B09 | A2 D6E04 (YEL) |
| A2 N3D11 | A2 G6A04 (BK) |

[9] If B/M 1652526, 1652527, or 4944362 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| B1 G5B10 | B1 F6B02 |
| B1 C3D06 | B1 C3B05 |
| B1 C2B07 | B1 G3D04 |
| B1 C3D07 | B1 G3D07 |

[10] If B/M 4941142 or 4941143 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| B1 G5B10 | B1 C4D05 |
| B1 C4D04 | B1 F6B02 |
| B1 C3B05 | B1 C3D07 |
| B1 C3D06 | B1 G3D04 |
| B1 C2B07 | B1 G3D07 |
| B1 C4B13 | B1 G4B05 |
| B1 C4D11 | B1 G5D13 |

[11] If B/M 4941142 is to be installed, then wire wrap PN 811425.

| From | To |
|------|------|
| B1 C5D06 | B1 C5D11 |
| B1 C4D12 | B1 C5D10 |

[12] If B/M 4944360 or 4944361 is to be installed, then delete by reaming the following:

| Delete | Test for No Continuity |
|--------|------------------------|
| A2K2B03 (cardside) | A2K2D08 |
| A2K2B07 (cardside) | A2M3D06 |
| | A2J3D06 |
| A2K2B12 (pinside) | A2K2B10 |
| A2K3D09 (pinside) | A2K3D08 |

Also wire wrap PN 811425.

| From | To |
|------|------|
| A2M3D06 | A2J3D06 |
| A2K3B07 | A2K3B05 |
| A2K3D06 | A2J3B12 |
| A2K2B07 | A2J3D06 |
| A2K3D07 | A2J3B05 |
| A2K2B12 | A2K2D12 |

[13] If B/M 1739375 (PTT wrap-Japan only) is requested, then this B/M must be included in addition to B/M 1652528 or 4941144.

[14] If B/M 1739373 (Germany only) is requested, then this B/M must be included in addition to B/M 1652528 or 4941144.

[15] If B/M 4941144 is installed, then wire wrap PN 811425.

| From | To |
|------|------|
| A2L5B10 | A2E6A02 |

[16] If the line discipline is to be in an asynchronous mode (i.e., start-stop line control), then wire wrap PN 811425.

| From | To |
|------|------|
| A4K4B13 | A2K4D08 |

[17] If B/M 4941142 is used with B/M 1652528, then wire wrap PN 811425.

| From | To |
|------|------|
| B1 A3D09 | B1 A3D08 |
| B1 A3D04 | B1 A3D08 |

[18] If B/M 4403178 is installed, then wire wrap PN 811425.

| From | To |
|------|------|
| A2 L4G05 | A2 L4J08 |
| A2 L4J09 | A2 L4J08 |
| A2 L4J04 | A2 M4J08 |
| A2 L4J13 | A2 M4J08 |
| A2 L4G04 | A2 L4D08 |
| A2 L4G03 | A2 L4D08 |

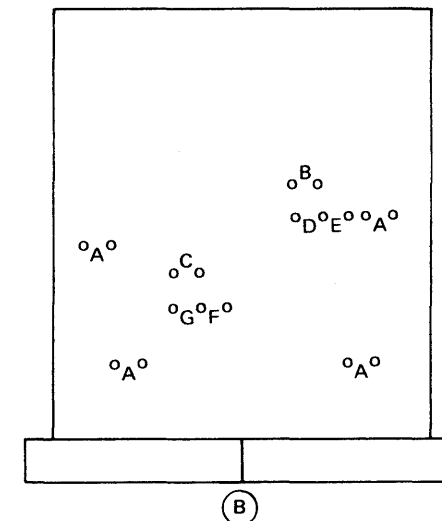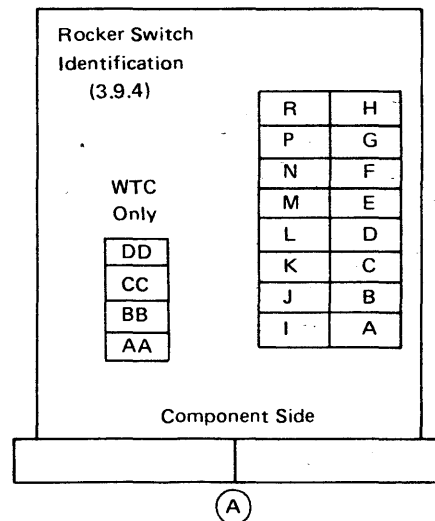## 3.9.5 Communication Connections (Cont)

| B/M No. | Communication Adapter Card Location | Adapter Speed BPS | Speed Select Wirewrap PN 811425 From Pin B1C2 P08 TO | Data Set Ready | Line Adapter B/M No. Notes 3 13 14 | EIA | Line Adapter Card Location Receive | Transmit | Wrap |
|---|---|---|---|---|---|---|---|---|---|
| 1652526 CCA W/Clk | B1C2 Note 9 | 300 600 1200 2400 | G13 M04 M05 M03 | | EIA 1652528 Note 6 | B1A2 | | | |
| | | 1200 | M05 | Note 1 | M-12 1745442 2-Wire, Note 4 M-12 1745444 2-Wire, Note 4 M-12 1745441 2-Wire, Note 5 M-12 1745443 2-Wire, Note 5 | | B1B4 | B1B2 | B1A2 |
| 1652527 CCA W/O Clk | B1C2 Note 9 | | | | EIA 1652528 Note 6 17 | B1A2 | | | |
| 4941142 HPCA W/Clk | B1C2 Note 10 Note 11 | 600 1200 2400 | M04 M05 M03 | | EIA 1652528 Note 6 17 | B1A2 | | | |
| | | 1200 | M05 | Note 1 | M-12 1745442 2-Wire, Note 4 M-12 1745444 2-Wire, Note 4 M-12 1745441 4-Wire, Note 5 M-12 1745443 4-Wire, Note 5 | | B1B4 | B1B2 | B1A2 |
| 4941143 HPCA W/O Clk | B1C2 Note 10 | | | | EIA 1652528 Note 6 | B1A2 | | | |
| 4944360 ALA CCA W/Clk ALA | A2K2 Note 12 16 | 300 600 1200 2400 | G13 M04 M05 M03 | | EIA 4941144 Note 15 Local 4403178 Note 15 18 | A2L4 | | | |
| | | 1200 | M05 | Note 2 | M-12 4941146 2-Wire, Note 7 M-12 4941148 2-Wire, Note 7 M-12 4941145 4-Wire, Note 8 M-12 4941147 4-Wire, Note 8 | | A2N2 | A2N4 | A2P5 |
| 4944361 ALA CCA W/O Clk | A2K2 Note 12 | | | | EIA 4941144 Note 15 | A2L4 | | | |
| 4944362 RPQ S25142 | Note 9 | | | | None | | | | |

## 3.9.6 Communication Connections 3602-1A, 1B (TSR-3 Power Supply; Only 2 Wires on B1Y4)

### Host Link (15)

| FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings. Following Switches "ON", All Others "OFF" | Notes |
|---|---|---|---|---|---|---|
| 4946124 No Host Line | [1] [4] | N/A | N/A | N/A | | |
| 4946120 CCA W/Clock | [1] [4] [5] | AIC2 | 4946126 - UCM2WUSA | AIA2 | J, N, L | [2] |
| | | | 4946127 - UCM2WWTC | | M, J, L, A | [2] |
| | | | 4946128 - UCM4WUSA | | K, P   See Ⓐ | [3] |
| | | | 4946129 - UCM4WWTC | | I, K, A | [3] |
| 4946121 CCA W/O Clock | [1] [4] | | 4946125 - EIA/CCITT | | Remove all Jumpers from card. See Ⓑ | |
| 4946123 HPCA W/O Clock | [6] | | | | | [8] |
| 4946122 HPCA W/Clock | [6] [7] | | 4946126 - UCM2WUSA | | J, N, L | [2] |
| | | | 4946127 - UCM2WWTC | | M, J, L, A   See Ⓐ | [2] |
| | | | 4946128 - UCM4WUSA | | K, P | [3] |
| | | | 4946129 - UCM4WWTC | | I, K, A | [3] |

### ALA Port 1 (80)

| FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings | Notes |
|---|---|---|---|---|---|---|
| 6814500 ASYNC CCA W/Clock | [9] [10] | AIB2 | 6814520 - UCM2WUSA | | J, N, L | |
| | | | 6814536 - UCM2WWTC | | M, J, L, A | |
| | | | 6814528 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814524 - UCM4WUSA | | K, P | |
| | | | 6814540 - UCM4WWTC | | I, K, A | |
| | | | 6814532 - UCM4WJAP | | I, K, A | |
| | | | 6814516 - EIA/CCITT | | | |
| 6814508 SYNC CCA W/O Clock | | | 6814512 - EIA/CCITT EMI | AIA4 | Remove all Jumpers from card. See Ⓑ | |
| | | | 6814516 - EIA/CCITT | | | |
| 6814504 SYNC CCA W/Clock | [10] | | 6814520 - UCM2WUSA | | J, N, L | |
| | | | 6814536 - UCM2WWTC | | M, J, L, A | |
| | | | 6814528 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814524 - UCM4WUSA | | K, P | |
| | | | 6814540 - UCM4WWTC | | I, K, A | |
| | | | 6814532 - UCM4WJAP | | I, K, A | |

### ALA Port 2 (81)

| FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings | Notes |
|---|---|---|---|---|---|---|
| 6814501 ASYNC CCA W/Clock | [9] [10] | A2N2 | 6814521 - UCM2WUSA | | J, N, L | |
| | | | 6814537 - UCM2WWTC | | M, J, L, A | |
| | | | 6814529 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814525 - UCM4WUSA | | K, P | |
| | | | 6814541 - UCM4WWTC | | I, K, A | |
| | | | 6814533 - UCM4WJAP | | I, K, A | |
| | | | 6814517 - EIA/CCITT | | | |
| 6814509 SYNC CCA W/O Clock | | | 6814513 - EIA/CCITT EMI | A2E2 | Remove all Jumpers from card. See Ⓑ | |
| | | | 6814517 - EIA/CCITT | | | |
| 6814505 SYNC CCA W/Clock | [10] | | 6814521 - UCM2WUSA | | J, N, L | |
| | | | 6814537 - UCM2WWTC | | M, J, L, A | |
| | | | 6814529 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814525 - UCM4WUSA | | K, P | |
| | | | 6814541 - UCM4WWTC | | I, K, A | |
| | | | 6814533 - UCM4WJAP | | I, K, A | |

### ALA Port 3 (82)

| FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings | Notes |
|---|---|---|---|---|---|---|
| 6814502 ASYN CCA W/Clock | [9] [10] | A2P2 | 6814522 - UCM2WUSA | | J, N, L | |
| | | | 6814538 - UCM2WWTC | | M, J, L, A | |
| | | | 6814530 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814526 - UCM4WUSA | | K, P | |
| | | | 6814542 - UCM4WWTC | | I, K, A | |
| | | | 6814534 - UCM4WJAP | | I, K, A | |
| | | | 6814518 - EIA/CCITT | | | |
| 6814510 SYNC CCA W/O Clock | | | 6814514 - EIA/CCITT EMI | A2T2 | Remove all Jumpers from card. See Ⓑ | |
| | | | 6814518 - EIA/CCITT | | | |
| 6814506 SYNC CCA W/Clock | [10] | | 6814522 - UCM2WUSA | | J, N, L | |
| | | | 6814538 - UCM2WWTC | | M, J, L, A | |
| | | | 6814530 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814526 - UCM4WUSA | | K, P | |
| | | | 6814542 - UCM4WWCT | | I, K, A | |
| | | | 6814534 - UCM4WJAP | | I, K, A | |

### ALA Port 4 (83)

| FFBM No. | Notes | Card Location 01A- | Line Adapter FFBM No. | Adapter Card Location 01A- | Optional Switch Settings | Notes |
|---|---|---|---|---|---|---|
| 6814503 ASYNC CCA W/Clock | [9] [10] | A2Q2 | 6814523 - UCM2WUSA | | J, N, L | |
| | | | 6814539 - UCM2WWTC | | M, J, L, A | |
| | | | 6814531 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814527 - UCM4WUSA | | K, P | |
| | | | 6814543 - UCM4WWTC | | I, K, A | |
| | | | 6814535 - UCM4WJAP | | I, K, A | |
| | | | 6814519 - EIA/CCITT | | | |
| 6814511 SYNC CCA W/O Clock | | | 6814515 - EIA/CCITT EMI | A2T4 | Remove all Jumpers from card. See Ⓑ | |
| | | | 6814519 - EIA/CCITT | | | |
| 6814507 SYNC CCA W/Clock | [10] | | 6814523 - UCM2WUSA | | J, N, L | |
| | | | 6814539 - UCM2WWTC | | M, J, L, A | |
| | | | 6814531 - UCM2WJAP | | M, J, L, A   See Ⓐ | |
| | | | 6814527 - UCM4WUSA | | K, P | |
| | | | 6814543 - UCM4WWTC | | I, K, A | |
| | | | 6814535 - UCM4WJAP | | I, K, A | |

### Rocker Switch Identification (3.9.4)

WTC Only: DD, CC, BB, AA

| R | H |
|---|---|
| P | G |
| N | F |
| M | E |
| L | D |
| K | C |
| J | B |
| I | A |

Component Side

Ⓐ

Ⓑ

### Notes:

[1] If B/M 4946120, 4946121 or 4946124 is to be installed, then wire-wrap PN 811425
From O1A-B1G2S10   To O1A-B1F6B02

[2] If B/M 4406126 or 4406127 is to be installed, then wire-wrap PN 811425
From O1A-B1A2G09   To O1A-B1A2G02
O1A-B1A2J13   O1A-B1A2J05
Also wire-wrap twisted pair PN 5347623
From O1A-B1B1B11 (YEL) To O1A-B1A2J13
O1A-B1B1C13 (BK)   O1A-B-1A2G09

[3] If B/M 4406128 or 4406129 is to be installed, then wire-wrap twisted pair PN 5347623
From O1A-B1B1B11 (YEL) To O1A-B1A2J13
O1A-B1B1C13 (BK)   O1A-B1A2G09
O1A-B1C1E11 (BN)   O1A-B1A2G02
O1A-B1A1D11 (YEL) O1A-B1A2J05

[4] If B/M 4946120, 4946121, or 4946124 is to be installed, then wire-wrap PN 811425
From O1A-B1C2G05   To O1A-B1D2G12
O1A-B1C2B07   O1A-B1D2G05
O1A-B1C2J07

[5] If B/M 4946120 is to be installed, then wire-wrap PN 811425
From O1A-B1C2M05   To O1A-B1C2P08

[6] If B/M 4946122 or 4946123 is to be installed, then wire-wrap PN 811425
From O1A-B1C2J07   To O1A-B1C2G05
O1A-B1C2B07   O1A-B1D2G05
O1A-B1C2J06   O1A-B1D2G12
O1A-B1C2M13   O1A-B1G2M05
O1A-B1C2P11   O1A-B1G2U13
O1A-B1C2P05   O1A-B1G2S10
O1A-B1C2P04   O1A-B1F6B02

[7] If B/M 4946122 is to be installed, then wire-wrap PN 811425
From O1A-B1C2M05   To O1A-B1C2P08
O1A-B1C2U11   O1A-B1C2U06
O1A-B1C2U10   O1A-B1C2P12

[8] If B/M 4946122 and 8 4406125 are to be installed, then wire-wrap PN 811425
From O1A-B1A2J04   To O1A-B1A2J08
O1A-B1A2J10   O1A-B1A2J08

[9] If B/M 6814500, 6814501, 6814502, or 6814503 is to be installed, then wire-wrap PN 811425
From card loc pin M13   To card loc pin P08

[10] If B/M 6814500, 6814501, 6814502, 6814503, 6814504, 6814505, 6814506, or 6814507 is to be installed, then wire-wrap PN 811425
From card loc pin M05   To card loc pin P08

[11] Local loops will be assigned beginning at position 1. Speeds will be assigned in descending order (position 1 will have the highest speed).

[12] Remote loops will be assigned beginning at position immediately following the last local loop position.

[13] If B/M 1864633 (Japan only) is requested, then this B/M must be included in addition to USA B/Ms.

[14] Set rocker switches K and P "ON". All other switches should be "OFF". See Ⓐ.

[15] Set rocker switches I, A and K "ON". All other switches should be "OFF". See Ⓐ.

[16] If integrated modem (remote loop) is also being installed, do not install local loop cable.

[17] Wire wrap PN 811425
From B1E5B12   To B1L6E04
B1F5B12   B1M6C04

EC 745949

### 3.9.6 Communication Connections (Cont)

| B/M No. | Loop Adapter No. | Loop Adapter Card Location | Loop Speed | Speed Select. Intall Jumper PN 5492084 From Pin S10 To [11] | Remote Only. Install Jumper PN 5492081 From Pin U08 To [12] | Local Loop Cable PN 1563675 Loops 1–3 PN 1741662 Loops 4–8 [12] [16] | Integrated Modem USA and Canada B/M No. [14] | Integrated Modem WTC B/M No. [13] [15] | Undercover Modem Card Location | Remote Loop Cable PN 4406670 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4946110 [17] | 1 | B1D2 | 600 1200 2400 4800 | J11 J07 J10 J09 | Local Only | B1Y3 Local Only To J2-J3 | | | | |
| 4946139 | 2 | B1E2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | B1Y3 To J4-J5 | 4946146 | 4946153 | 1A-A2B2 | A2B3 To J4-J5 |
| 4946140 | 3 | B1F2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | B1Y3 To J6-J7 | 4946147 | 4946154 | 1A-A2C3 | A2C3 To J6-J7 |
| 4946141 | 4 | A2G2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | A2Z1 To J8-J9 | 4946148 | 4946155 | 1A-A2B4 | A2B5 To J8-J9 |
| 4946143 | 5 | A2H2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | A2Z1 To J10-J11 | 4946149 | 4946156 | 1A-A2C4 | A2C5 To J10-J11 |
| 4946143 | 6 | A2J2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | A2Z1 To J12-J13 | 4946150 | 4946157 | 1A-A2D4 | A2D5 To J12-J13 |
| 4946144 | 7 | A2S2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | A2Z6 To J14-J13 | 4946151 | 4946158 | 1A-A2U2 | A2U3 To J14-J15 |
| 4946145 | 8 | A2R2 | 600 1200 2400 4800 | J11 J07 J10 J09 | U07 | A2Z6 To J16-J17 | 4946152 | 4946159 | 1A-A2U4 | A2U3 To J16-J17 |

## 3.10 SUPPLY VOLTAGES ON LOGIC BOARDS AND CARDS

Note: *Refer to Chapter 1 (right side) to determine the location of a specific card.*

All card locations on both logic boards are supplied with +8.5V, +5V, -5V, and ground. These voltages are distributed by the internal voltage and ground planes in the board.

| +8.5V | +5V* | -5V* | Ground |
|-------|------|------|--------|
| B11 | D03 | B06 | D08 |
| G11 | J03 | G06 | J08 |
| M11 | P03 | M06 | P08 |
| S11 | U03 | S06 | U08 |

Special voltages (+12V, -12V and +24V) are supplied on the logic boards through surface busing and are distributed only to those card locations requiring them. The +5V is also wired to the modem cards. The following chart shows the pins to which these special voltages are distributed.

| Card | +12V* | -12V* | +24V* | +5V* |
|------|-------|-------|-------|------|
| 1200-bps modem: | | | | |
| Receive | B04,G04 | D10,J10 | — — | B13 |
| Transmit | B04,G04 | D10,J10 | — — | B12 |
| Wrap | B04 | — — | — — | — — |
| 600-bps modem: | | | | |
| Receive | B04,G04 | D10,J10 | — — | B13 |
| Transmit | B04,G04 | D10,J10 | — — | B12 |
| EIA | D11 | J06 | — — | — — |
| Diskette Adapter | — — | — — | B13 | — — |
| Diskette Drive Control (01X2W2) | — — | — — | D10 | — — |
| M/D RCVR XMIT | B04,G04 M04,J04 | D10,J10 P10,U10 | — — | B12 M13 |
| 38LS EIA | — — | D07 | — — | — — |
| Remote Loop EIA | | D07 | | |

*Voltage limits

| V dc | Limits |
|------|--------|
| -5 | -4.5 and -5.5 |
| -12 | -10.8 and -13.2 |
| +5 | +4.5 and +5.5 |
| +8.5 | +7.6 and +9.4 |
| +12 | +10.8 and +13.2 |
| +24 | +21.0 and +27.0 |

## 3.11 BACK PANEL CONNECTIONS

Note: *Refer to Chapter 1 (right side) to determine the location of a specific card.*

### 3.11.1 Loop Control Cards

**Speed Selection**

At each loop control card location, connect pin S10 to one of the following:

    4800 bps = J09
    2400 bps = J10
    1200 bps = J07
     600 bps = J11

**Remote Loop Operation**

If a loop is connected to a modem, connect pin U07 at the loop control card location to pin U08 (ground) at that card location.

### 3.11.2 Modem Compatibility (Internal Modem M-12)

In order for modems to communicate properly, the Clear to Send delay of the transmit location must be greater than the Echo Clamp at the receiver location. The following options are available to achieve this compatibility.

**Clear to Send delay:**

(Approximately)

    25 ms M/D Xmit Card G10 to G12
    90 ms M/D Xmit Card G10 to J12
    250 ms M/D Xmit Card G10 to G13

**Echo Clamp:**

(Approximately)

    0 ms M/D Xmit Card G07 to G05
    60 ms M/D Xmit Card G08 to G09
                        G07 to G05
    175 ms M/D Xmit Card G08 to G09
                        G07 to J05

See communications connections for 38LS M/D options.

### 3.11.3 External Modems

| Modem | Internal Clock | Speed (bps) | Comments |
|-------|---------|-------------|----------|
| 3872 | Yes | 2400 | Has a switched network feature |
| 3874 | Yes | 4800 | Has a switched network feature |
| 3976-3 | No | 1200 | World Trade only |
| 3978-14 | Yes | 4800 | World Trade only |
| 4872 | Yes | 4800 | US and Canada only |
| GH 2002-Q13 | No | 1200 | Swedish modem |
| ZAT | Yes | 2400 | Swedish modem |

**Grounding of EIA Lines Not Used**

When using the EIA card to drive external modems, all lines not used (both inputs and outputs) should be connected to ground at the EIA card location. The following chart shows lines that are not used for various external modems and which pin is to be grounded for these not-used lines.

**8523023 Card Only**

| EIA Pin No. | EIA Line Name | Ground the following pins at the EIA card if not used |
|-------------|---------------|-------------------------------------------------------|
| 11 | Select Standby * | G05 |
| 15 | Transmit Signal Element Timing | J09 |
| 17 | Receive Signal Element Timing | J04 |
| 18 | Test | J13 |
| 20 | Data Terminal Ready | G12 |
| 22 | Ring Indicator * | G04 |
| 23 | Data Signal Rate Selector | G03 |

*These lines are used only when the switched network feature is present.

### 3.11.4 Communications Link Connections

| Standard EIA Pin | 3601 | Line Name | Modem |
|------------------|------|-----------|-------|
| 1 | X | Protective Frame Gnd | X |
| 2 | X | Transmit Data | |
| 3 | | Received Data | X |
| 4 | X | Request to Send | |
| 5 | | Clear to Send | X |
| 6 | | Data Set Ready | X |
| 7 | X | Signal Gnd | X |
| 8 | | Received Carrier Det | X |
| 9 | | * | X |
| 10 | | * | X |
| 11 | X | Select Standby | |
| 12 | | Sec Received Carrier Det | |
| 13 | | Sec Clear to Send | |
| 14 | X | * | |
| 15 | | Transmit Timing | X |
| 16 | | Sec Received Data | |
| 17 | | Receive Timing | X |
| 18 | X | Test | |
| 19 | | Sec Request to Send | |
| 20 | X | Data Terminal Ready | |
| 21 | | Signal Quality Det | |
| 22 | | Ring Indicator | X |
| 23 | X | Data Signal Rate Sel | |
| 24 | X | Sec Transmit Timing | |
| 25 | X | * | |

*These signals are used with integrated modems. All other signals are for external modems.

### 3.11.5 Storage Connections (Basic Controller Board)

**Basic Storage**

L2M07 to M2G13
L2B13 to M2G08

**Expanded Storage**

L2M07 to V2M12
L2B13 to V2P05

## 3.12 DISK STORAGE DIAGNOSTICS (3602 Only)

### 3.12.1 General Description

The disk storage tests are used with the MAPs for trouble-shooting disk storage.

The tests verify all disk operations and force error conditions to check the error detection logic.

The tests are provided on the diagnostic diskette. After a test is run, status and error information is displayed on the keyboard/display.

The tests are divided into four major areas. They are:

1. Basic checkout
2. Diagnostic mode
3. Extended
4. Selectable

#### Basic Checkout (Routines 01,02,03, and 04)

These routines test the communications between the controller and the storage logic, and test for Disk Ready.

#### Diagnostic Mode (Routines 10,11,12,13,14, and 15)

These routines test and single-step various operations through the disk storage logic (Read, Write, Seek, and Test controls).

#### Extended (Routines 21,22,23,24,25,26,31,32,33,34,35,36, 41,42,43,44,45,46,47,48, and 49)

These routines test the ability of the entire disk storage logic and the Disk Enclosure (DE) to run in an operational mode.

#### Selectable (Routines 50,51,53,54,55,56, and 57)

These routines test for a certain status, do format tasks, or other special operations.

### 3.12.2 Operating Procedure

Results of this diagnostic are valid only if the complete procedure is followed from power on reset.

1. Power off all terminals other than the 3604 at address 1 on loop 1, to prevent interference.
2. Insert the diagnostic diskette, and activate the controller power-on or reset switch.
3. When the control program has been loaded, BCB0 may display; respond with the model number of the 3604 that you are using, followed by enter (EM). BC80 should then display on this 3604.

4. Enter data LASLRR
   where:
   LA = 10 (Logical Address)
   S = Test Selection Option
       0 = Test disk storage logic (not DE)
       1 = Test disk storage and DE
       2 = Test disk storage and DE with manual intervention
   L = Loop Option (Routines 3, 24 and 32 should not be looped. The Free key cannot stop them).
       0 = No looping
       1 = Loop; stop on error
       2 = Loop; do not stop on error
   RR = Specific Routine to Run (otherwise, no entry is required)

5. Messages will be displayed defining machine status:
   1000 = Tests completed successfully.
   1080 = Temporarily unable to do input/output. This is normal for short periods of time during the tests. A stop (one minute or more) at this point indicates a controller problem; see MAP 2.
   10EE = Machine failure; see Error Codes (1.115).
   10F0 = Test running.
   BCXX = Procedure error; see 3.12.4

Note: The diagnostic run can be ended at any time by pressing the FR (free) key on the 3604 (see Figure 3-2 for keyboard locations).

CAUTION: Do not use reset to end. This could terminate an incomplete write operation. Use the free key.

### 3.12.3 Test Routines

#### Routine 01 - Test Basic Operations

#### Routine 02 - Test Control Data

This routine reads Control Data, and tests for Machine Check and correct status.

#### Routine 03 - Disk Speed Test (Do not loop)

This routine reads the speed pulses from the speed transducer to verify that the disk speed is correct.

#### Routine 04 - Test for Disk Ready

#### Routine 10 - Read Diagnostic Step Mode

This routine steps through a Read Data operation and checks for proper completion.

#### Routine 11 - Checks the Ability to Detect a CRC Error

#### Routine 12 - Write in Diagnostic Mode

This routine steps through a Write Data operation and checks for proper completion.

#### Routine 13 - Seek in Diagnostic Mode

This routine steps through a Seek operation and checks for proper completion.

#### Routine 14 - Test Time Out Logic

#### Routine 15 - Interrupt Logic Test

#### Routine 21 - Recalibrate and Test for Correct Status

#### Routine 22 - Read Track ID Head 0

#### Routine 23 - Read Track ID Head 1

#### Routine 24 - Read Track ID 61 Times (Do not loop)

#### Routine 25 - Read IDs, Sectors 00-59 Track 0

#### Routine 26 - Read IDs, Sectors 00-59 Track 1

#### Routine 31 - Initial Seek Testing

#### Routine 32 - Initial Seek Testing and Verify Seeks (Do not loop)

#### Routine 33 - Seeks Behind Home

#### Routine 34 - Single Cylinder Seek

#### Routine 35 - Seek in 1, 7, and 11 Track Increments

#### Routine 36 - Seek in All Seek Increments

#### Routine 41 - Read IDs on CE Cylinder

#### Routine 42 - Write/ Read Sector ID on CE Cylinder

#### Routine 43 - Sector ID Flag Bit Test

#### Routine 44 - Read/Write Data Transfer Test

#### Routine 46 - Test Disk Diagnostic Operations

#### Routine 47 - Status Bit Test

#### Routine 48 - CE Track Sector ID Write and Compare Test

#### Routine 49 - Fixed-Head Read ID Test

This routine reads IDs on the fixed-head tracks.

The basic status is for the first fixed-head error encountered.

| Count Field Bit | 0123 | 4567 | 8 → 15 |
|---|---|---|---|
| Fixed-Head Number | 2345 | 6789 | Not Used |

#### Routine 50 - Fixed-Head Write ID Test

This routine writes IDs on the fixed-head tracks, then reads the IDs just written.

The basic status is for the first fixed-head error encountered.

| Count Field Bit | 0123 | 4567 | 8 → 15 |
|---|---|---|---|
| Fixed-Head Number | 2345 | 6789 | Not Used |

#### Routine 51 - Write CE Cylinder Routine

#### Routine 53 - Write if Read Cannot Be Performed

CAUTION: Do not run this routine without visually making sure the head is at the CE Track. This routine attempts to write on the CE track.

Manual intervention stop:

1005 5300 = Visually observe the access to verify it is at the outer stop indicator (3.6.1). Then press Enter (EM) to start execution of the routine.

#### Error Data Bits

0 Not Used
1 No Interrupt Head 0
2 Write Bit Check Head 0
3 Data Unsafe Head 0
4 Not Used
5 No Interrupt Head 1
6 Write Bit Check Head 1
7 Data Unsafe Head 1
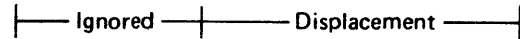8—15 Not Used

## 3.12.3 Test Routines (Cont)

**Routine 54 - Seek Between Selected Cylinders**

This routine seeks between two selected cylinders. The selected cylinders must be entered as four right justified hex digits.

Seek Data Format

Bit 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|—— Ignored ——|——— Displacement ———|

To loop routine, enter the loop option at load.

Manual intervention stops:

1007 5400 = Enter selected cylinders.
1008 5400 = Cylinders selected are too large or are equal.

**Routine 55 - Read Selected Sector**

This routine reads a selected sector. The selected cylinder must be entered as four right justified digits.

Read/Write data format - movable heads.

Bit 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|——— Track ID ——|

|—— Cylinder ID ——|      Sector ID
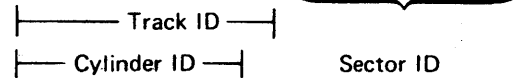
Bit 8 Even/Odd
Bit 9 In/Out

Manual intervention stops:

1009 5500 = Enter selected ID;
100A 5500 = Sector or cylinder ID invalid.

**Routine 56 - Test for Disk Ready after Power On or Reset.**

This routine must be selected and run before any other routines are run after power on or reset for the sense information to be valid. Should be run for all Not Ready conditions.

**Routine 57 - Test for Bus Hangs after Power-On Reset**

This routine must be selected and run before any other routines are run after power on or reset for the sense information to be valid. Should be run for all Not Ready conditions.

Error hang will be 1081 and will probably hang the bus, not allowing interrupts from the panel.

## 3.12.4 Procedure Errors

| Message | Cause | Action |
|---------|-------|--------|
| BC81 | RR has been entered without a valid L field (0, 1 and 2 are valid). | Correct input.* |
| BC82 | L=2 has been entered without a routine number. | Correct input.* |
| BC83 | No routine (RR) has been entered. S field is invalid (0, 1 and 2 are valid), and L field is not 2. | Correct input.* |
| BC84 | No routine (RR) has been entered. L field is invalid (0, 1 and 2 are valid), and S field is valid' | Correct input.* |
| BC85 | A request has been made to loop, and R does not equal 0. | Correct input.* |
| BC86 | A logical address, other than 10, has been entered. | Correct input.* |
| BC87 | Selected routine is invalid. | Correct input.* |
| BC88 | A failure was detected while using the keyboard/display. | Test basic loop and keyboard/display. |
| BC89 | An invalid interrupt has occurred. | Power off unused terminals. |
| BC8A | Diskette read error | Try another diskette Test basic machine |
| BC90 | A request has been made to loop, and S does not equal 0 or 1. | Correct input.* |
| BC92 | Machine check occurred. | Test basic machine. |
| BC93 | Incorrect keyboard input was made at a manual intervention stop. | Correct input.* |
| BC94 | Input message was too long. | Correct input.* |
| BC96 | Program check occurred. | Try another diskette. Test basic machine. |
| BC97 | Machine check occurred. | Test basic machine. |

| Message | Cause | Action |
|---------|-------|--------|
| BC98 | Routine requested is not able to loop. | Correct input.* |
| BC99 | Selected routine is invalid. | Correct input.* |
| BC9A | Program check occurred. | Try another diskette. Test basic machine. |
| BC9B | Program check occurred. | Try another diskette. Test basic machine. |
| BC9C | Program check occurred. | Try another diskette. Test basic machine. |
| BC9D | Program check occurred. | Try another diskette. Test basic machine. |
| BCA0** thru BCA7 | An invalid interrupt has occurred. | Power off unused terminals. Test basic machine |

*To correct the input, press the FR (free) key (see Figure 3-2 for keyboard locations). When BC80 is displayed, enter the correct input. If this fails, reload the diagnostic diskette.

**Except BCB0, which requires entry of the 3604 model number.

EC 745949

## 3.12.5 Disk Storage Utility Programs

CAUTION: *Running programs 1, 3, or 4 will destroy disk data.*

These programs are provided on the stand-alone diskette used for the disk storage maintenance. The procedure to use any of these programs is as follows:

1. Power off all terminals other than the 3604 at address 1 on loop 1 to prevent any interference from them.
2. Insert the diagnostic diskette and activate the controller power on or reset switch.
3. When the control program has been loaded, BCB0 may display; respond with the model number of the 3604 that you are using, followed by enter (EM). BC80 should then display on this 3604.
4. You may then request the routine desired (00000X and enter, where X is the routine number).
5. 00F0 is the system response to valid input.
6. Respond with EM (enter key) to the routine complete message to terminate.

1 = Start = This routine zeros the system sectors and the relocate sectors used for defective sector recovery (alternates). Routine 3 or 4 must be run following this routine.

3 = Bad ID = This routine attempts to read every ID field on the disk element. It assigns new alternates for all sectors that had alternates assigned.

> CAUTION: **This routine uses new alternates each time it is run. To reclaim alternates again, routine 1 must be run; then run this routine once.**

4 = Write ID = This routine rewrites the IDs on the entire disk, a single sector, or the fixed head area in accordance with the options requested by the CE as described in the detailed description of messages.

5 = Analysis = This routine analyzes the surface of the entire disk, a single sector, or the fixed head area in accordance with the options requested by the CE as described in the detailed description of messages.

Each routine, when loaded, reads the sense information from the hardware jumpers (1.72) that define this 3602. The control program can then determine when the operation indicates an error or expected results. This configuration information remains with the control program through subsequent starts until changed by running a utility with a different configuration.

**Utility Program Routine Messages**

| Message | Meaning | Action |
|---|---|---|
| 0000 | Routine complete and terminated. | Enter another request if desired. |
| 0012 | Manual stop to insure that this routine should be run. | F and EM (enter key) to run or free key to terminate. |
| 0014 | Routine complete. | C EM (enter key) to terminate. |
| 0031,DDD | Unable to write a displaced ID for this sector, where DDD is the sector ID. | EM (enter key) alone to try again. If this fails, replace the DE. |
| 0034,DDD | Routine complete, where DD is the decimal count of bad sectors (alternates assigned). | C EM (enter key) to terminate. |
| 0041,DDD | Unable to write an ID or displaced ID to this sector, where DDD is the sector ID. | EM (enter key) alone to try again. If this fails, replace the DE. |
| 0044,DDD | Routine complete, where DDD is the decimal count of bad sectors (alternates assigned). | C EM (enter key) to terminate. |
| 0045 | Option request. | Specify the options desired as follows:<br>CX EM (enter key) or<br>AOIDID EM (enter key) or<br>A = unconditionally assign an alternate for IDID.<br>FXIDID EM (enter key) where:<br>C = Write IDs on the entire disk<br>F = Write IDs on a single sector, where IDID is the four-digit sector ID<br>X=8 = Write IDs to the fixed head area<br>X=4 = Zero the data fields<br>X=2 = Write IDs to all sectors<br>X=1 = Write IDs and zero the data field on sectors that have unreadable displaced IDs<br>6,A,C, and E Combinations of X are valid |
| 0046,DDD | Unable to write data to this sector, where DDD is the sector ID. | EM (enter key) alone to try again. If this fails, respond with C EM (enter key) to try to assign an alternate. |
| 0051,DDD | A displaced ID has been read, where DDD is the sector ID. | C EM (enter key) to continue. |
| 0052,DDD | An unreadable ID has been detected, where DDD is the sector ID. | C EM (enter key) to continue. |
| 0053,DDD | Unable to read data, where DDD is the sector ID. | C EM (enter key) to continue. |
| 0054,DDD | Routine complete, where DDD is the decimal count (four digits each) of the number of displaced ID sectors, number of displaced ID sectors with alternates assigned, number of unreadable ID sectors, number of unreadable data sectors, and actual number of alternates used. | C EM (enter key) to terminate. |

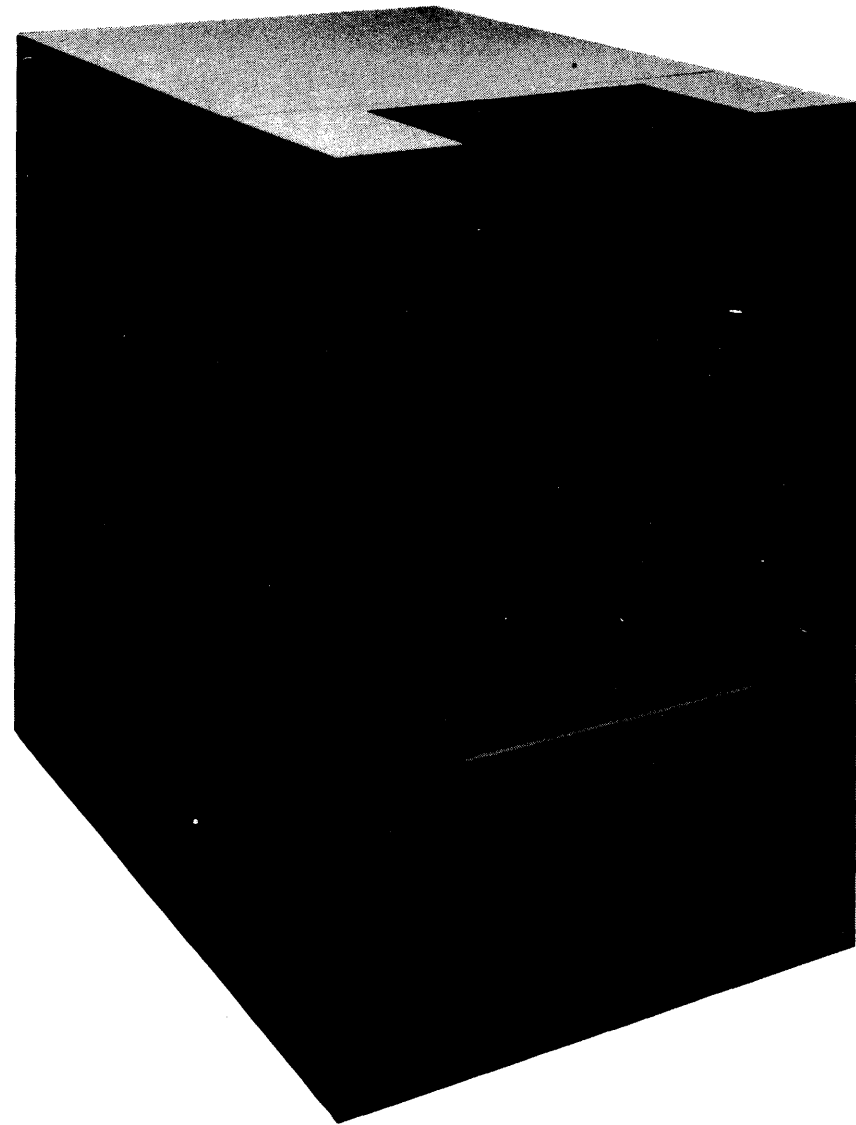**Utility Program Routine Message (Cont)**

| Message | Meaning | Action |
|---|---|---|
| 0055 | Option request. | Specify the options desired as follows:<br>CX EM (enter key) or<br>FXIDID EM (enter key) where:<br>C=Whole disk<br>F=Single sector where IDID is the four-digit sector ID<br>X=8=Fixed head area<br>X=4=Stop on displaced ID    Combinations of<br>X=2=Stop on unreadable state   X are valid<br>X=1=Stop on unreadable ID |
| 0181 | Disk storage error. | Use MAPs. |
| 0182 | Disk storage error. | Use MAPs. |
| 0183 | Diskette error. | Test basic system with starter diskette. |
| 0184 | Disk storage error. | Use MAPs. |
| 0381 | Unable to read the label record. | Run routine 1. If failure still occurs, replace the DE. |
| 0382,DDD | Unable to initialize the control program. | Run machine diagnostics. |
| 0383 | Unable to update configuration. | Run machine diagnostics. |
| 0384 | Configuration incorrect. | Run machine diagnostics. |
| 0385 | Unable to assign alternate sector. | Replace DE. |
| 0386 | Relocate tracks are full. | Run routine 1. If failure still occurs, replace the DE. |
| 0387 | Unable to restore label record. | Run routine 1. If failure still occurs, replace the DE. |
| 038A,DDD | Unable to read ID or displaced ID for this sector, where DDD is the sector ID. | EM (enter key) alone to try to write the ID or, if that fails, write a displaced ID to try to recover this sector. |
| 038B | Unable to find the correct track. | Run machine diagnostics. |
| 038C<br>IDID<br>XXYY<br>XXYY<br>. . . .<br>XXYY | If processing of the track identified in IDID resulted in any of the track's sector(s) being reformatted, the facility will verify the readability of the track by reading all of that track's sector IDs. If any sector IDs are found to be bad during the verification, this message is displayed. IDID is the address of the last reformatted sector of this track. Each XXYY addresses a sector whose ID is bad. | Replace DE. |
| 038D<br>IDID | This facility was unable to verify that the read/write head is positioned over the correct track before rewriting a sector ID. Verify by attempting to read a sector ID containing the expected track number. If this is not possible with any of the 60 sectors, then the head position is not verified. | If the machine diagnostics run without error, enter E to force writing. Then if error repeats, replace the DE. |

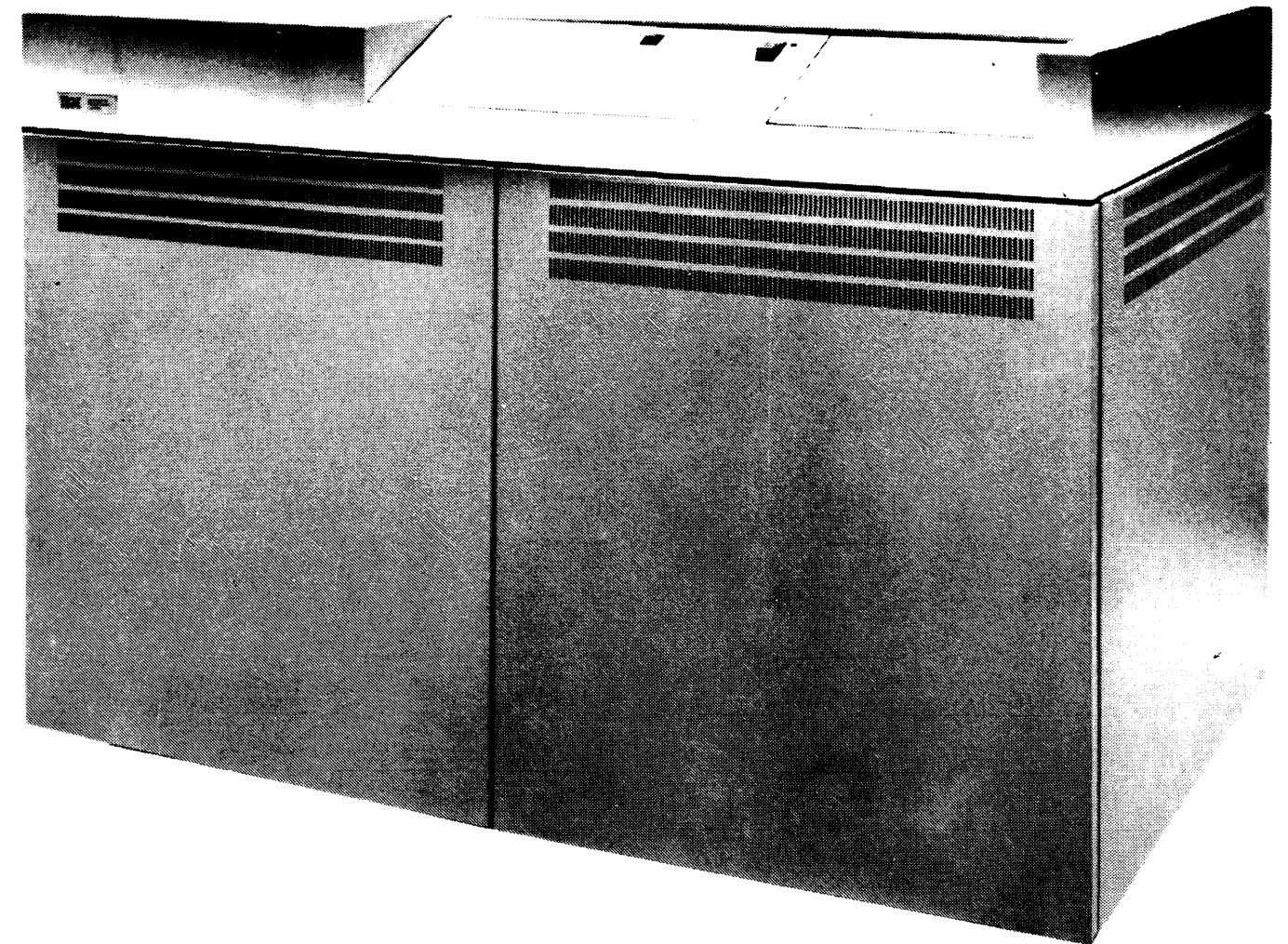| Message | Meaning | Action |
|---|---|---|
| 0481 | Unable to read the label record. | Run routine 1. If failure still occurs, replace the DE. |
| 0482,DDD | Unable to initialize the control program. | Run machine diagnostics. |
| 0483 | Unable to update configuration. | Run machine diagnostics. |
| 0484 | Configuration incorrect. | Run machine diagnostics. |
| 0485 | Unable to assign alternate sector. | Replace DE. |
| 0486 | Relocate tracks are full. | Run routine 1. If failure still occurs, replace the DE. |
| 0487 | Unable to restore label record. | Run routine 1. If failure still occurs, replace the DE. |
| 048B | Unable to find correct track. | Replace the DE. |
| 048C<br>IDID<br>XXYY<br>XXYY<br>. . . .<br>XXYY | This sector, IDID, has been successfully formatted; the IDs of sector(s) XXYY (in IDID format) of this same track could not be read.<br><br>If processing of the track identified in IDID resulted in any of the track's sector(s) being reformatted, the facility will verify the readability of the track by reading all of that track's sector IDs. If any sector IDs are found to be bad during the verification, this message is displayed. IDID is the address of the last reformatted sector of this track. Each XXYY addresses a sector whose ID is bad. | If FXIDID or AOIDID was used: Use this facility to correct the XXYY sectors.<br><br>If CX was used: Replace the DE. |
| 048D<br>TDID | This facility was unable to verify that the read/write head is positioned over the correct track before rewriting a sector ID. Verify by attempting to read a sector ID containing the expected track number. If this is not possible with any of the 60 sectors, then the head position is not verified. | If the machine diagnostics ran without error, enter E to force writing. Then if error repeats, replace the DE. |
| 0581 | Unable to read the label record. | Run routine 1. If failure still occurs, replace the DE. |
| 0582,DDD | Unable to initialize the control program. | Run machine diagnostics. |
| 0583 | Unable to update configuration. | Run machine diagnostics. |
| 0584 | Configuration incorrect. | Run machine diagnostics. |
| BC80 | Control program loaded. | Enter request. |
| BCB0 | 3604 Type request | Enter 3604 model number. |

CAUTION: Do not use RESET to end. This could terminate an incomplete write operation. Use the FREE key.

Contents

3601 Finance Communication Controller, Model 2A, 2B, 3A, 3B, C and D



3602 Finance Communication Controller

Fig. 4-1

SY27-2519-0

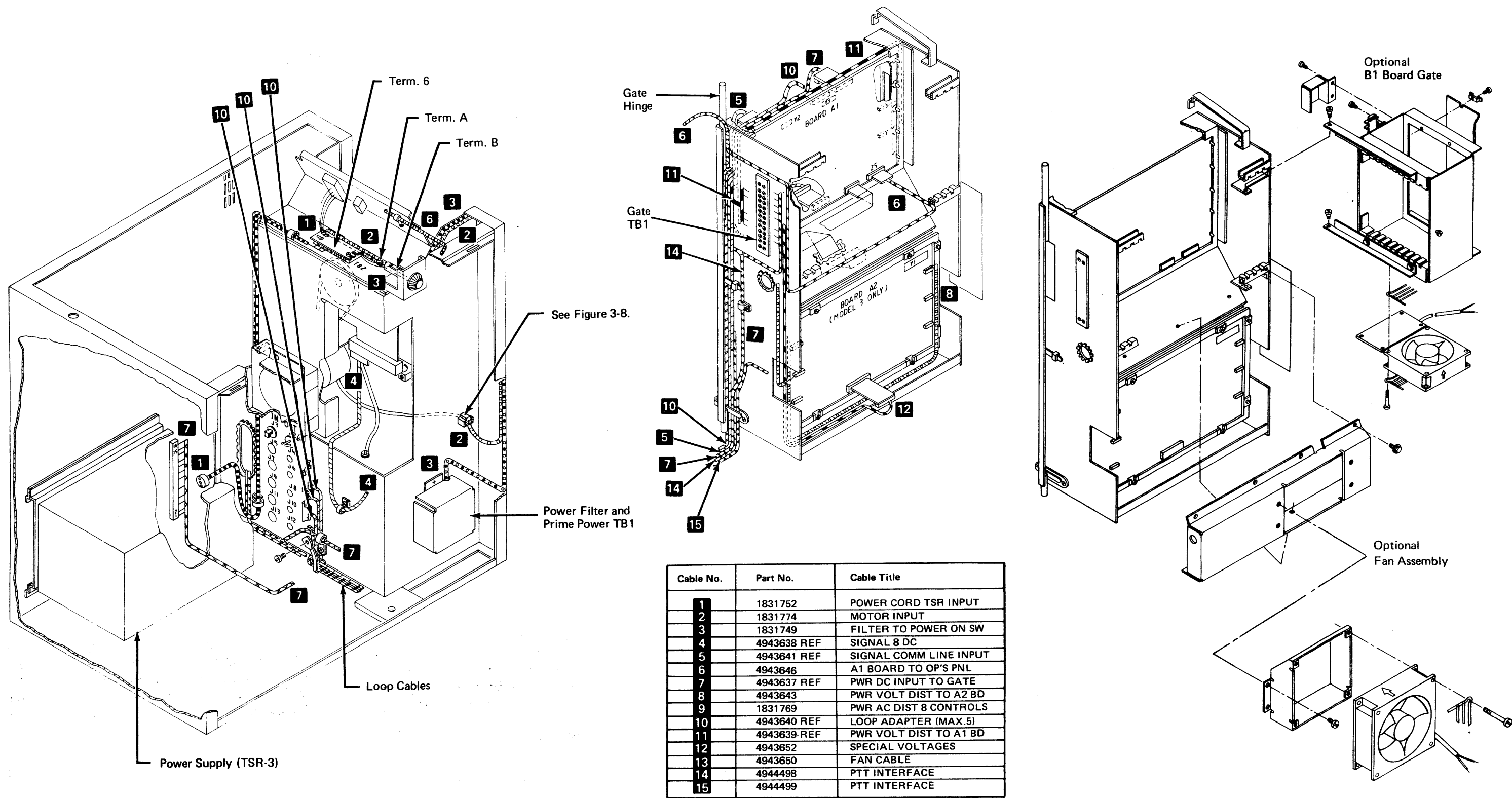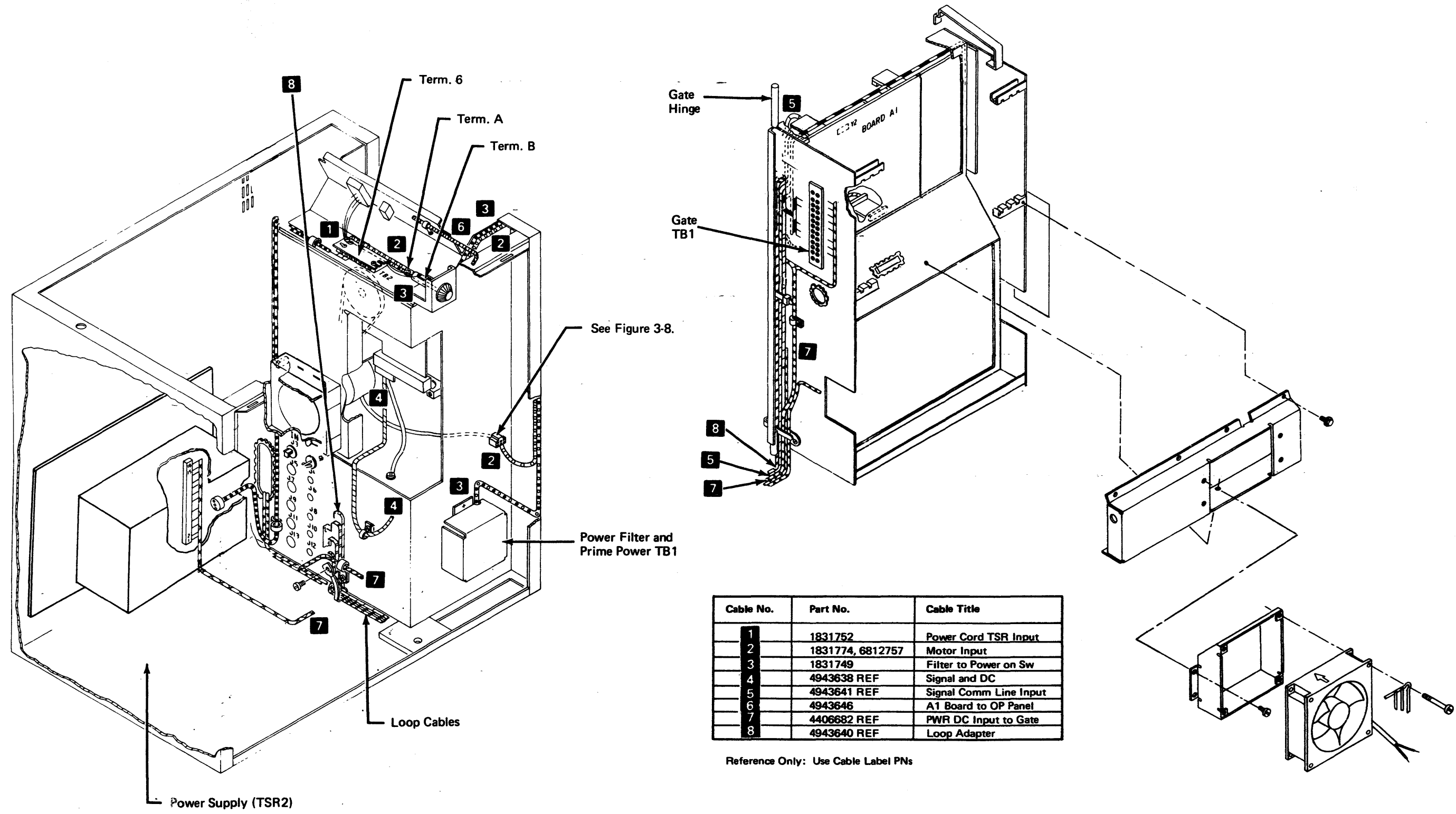(4/78)   4-2



Term. 6
Term. A
Term. B

See Figure 3-8.

Power Filter and
Prime Power TB1

Loop Cables

Power Supply (TSR-3)

Gate
Hinge

Gate
TB1

BOARD A1

BOARD A2
(MODEL 3 ONLY)

Optional
B1 Board Gate

Optional
Fan Assembly

| Cable No. | Part No. | Cable Title |
|---|---|---|
| 1 | 1831752 | POWER CORD TSR INPUT |
| 2 | 1831774 | MOTOR INPUT |
| 3 | 1831749 | FILTER TO POWER ON SW |
| 4 | 4943638 REF | SIGNAL 8 DC |
| 5 | 4943641 REF | SIGNAL COMM LINE INPUT |
| 6 | 4943646 | A1 BOARD TO OP'S PNL |
| 7 | 4943637 REF | PWR DC INPUT TO GATE |
| 8 | 4943643 | PWR VOLT DIST TO A2 BD |
| 9 | 1831769 | PWR AC DIST 8 CONTROLS |
| 10 | 4943640 REF | LOOP ADAPTER (MAX.5) |
| 11 | 4943639 REF | PWR VOLT DIST TO A1 BD |
| 12 | 4943652 | SPECIAL VOLTAGES |
| 13 | 4943650 | FAN CABLE |
| 14 | 4944498 | PTT INTERFACE |
| 15 | 4944499 | PTT INTERFACE |

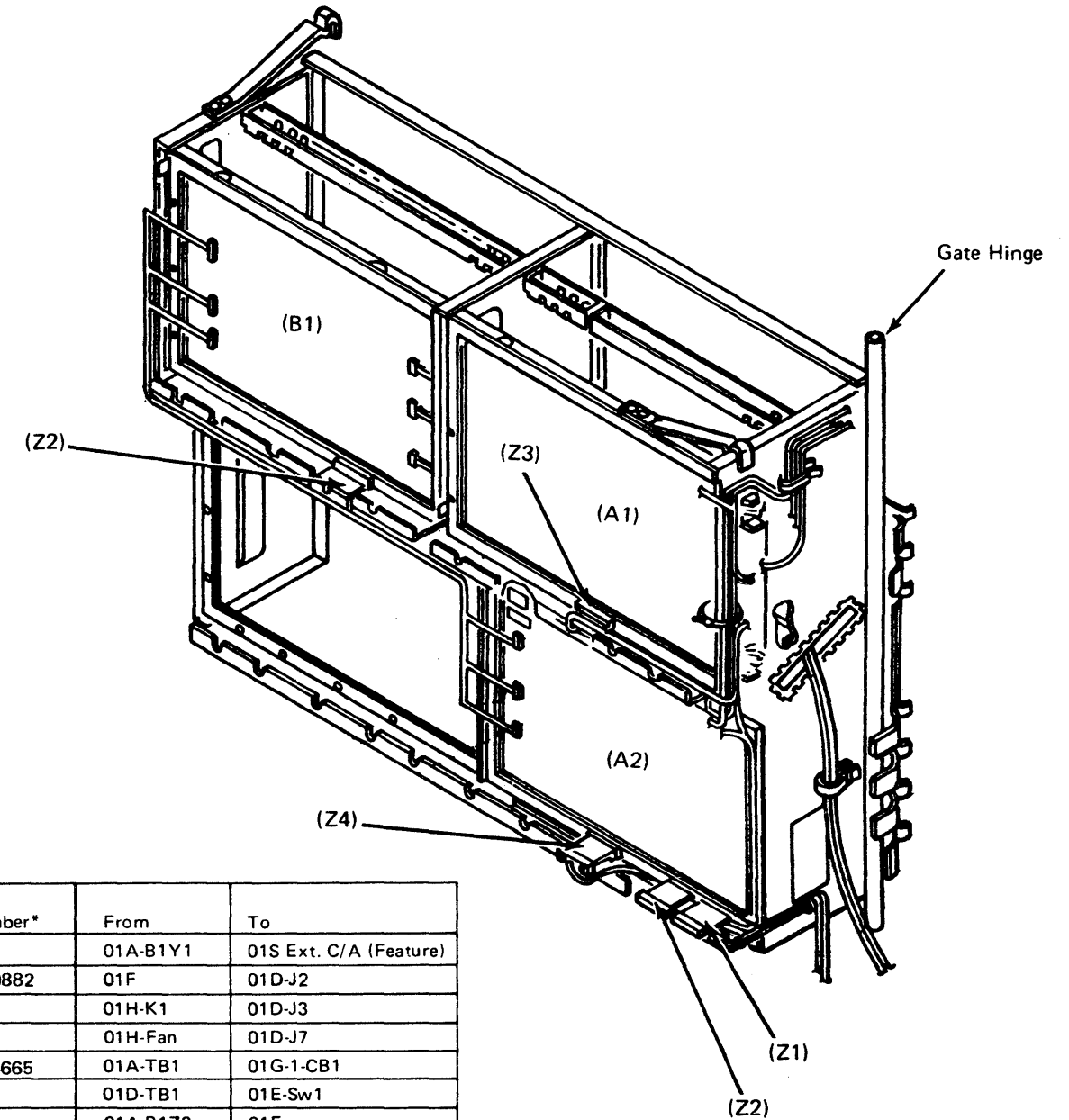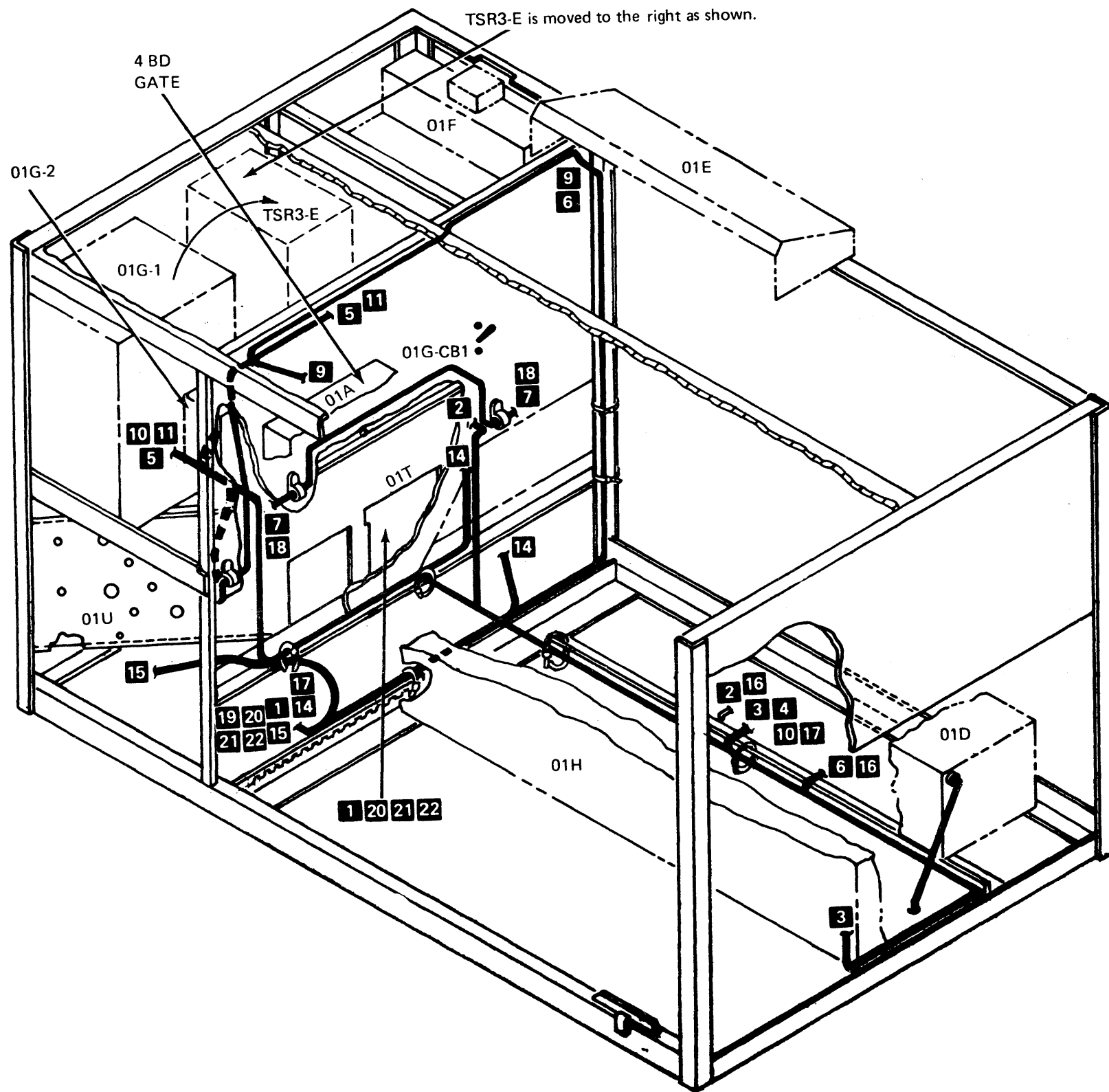Figure 4-1.  Component Locations 3601-2A, 2B, 3A, 3B (Single TSR-3 Power Supply)

EC 745948

Figure 4-2. Component Locations 3601-2A, 2B, 3A, 3B (One or two TSR-2 Power Supplies)
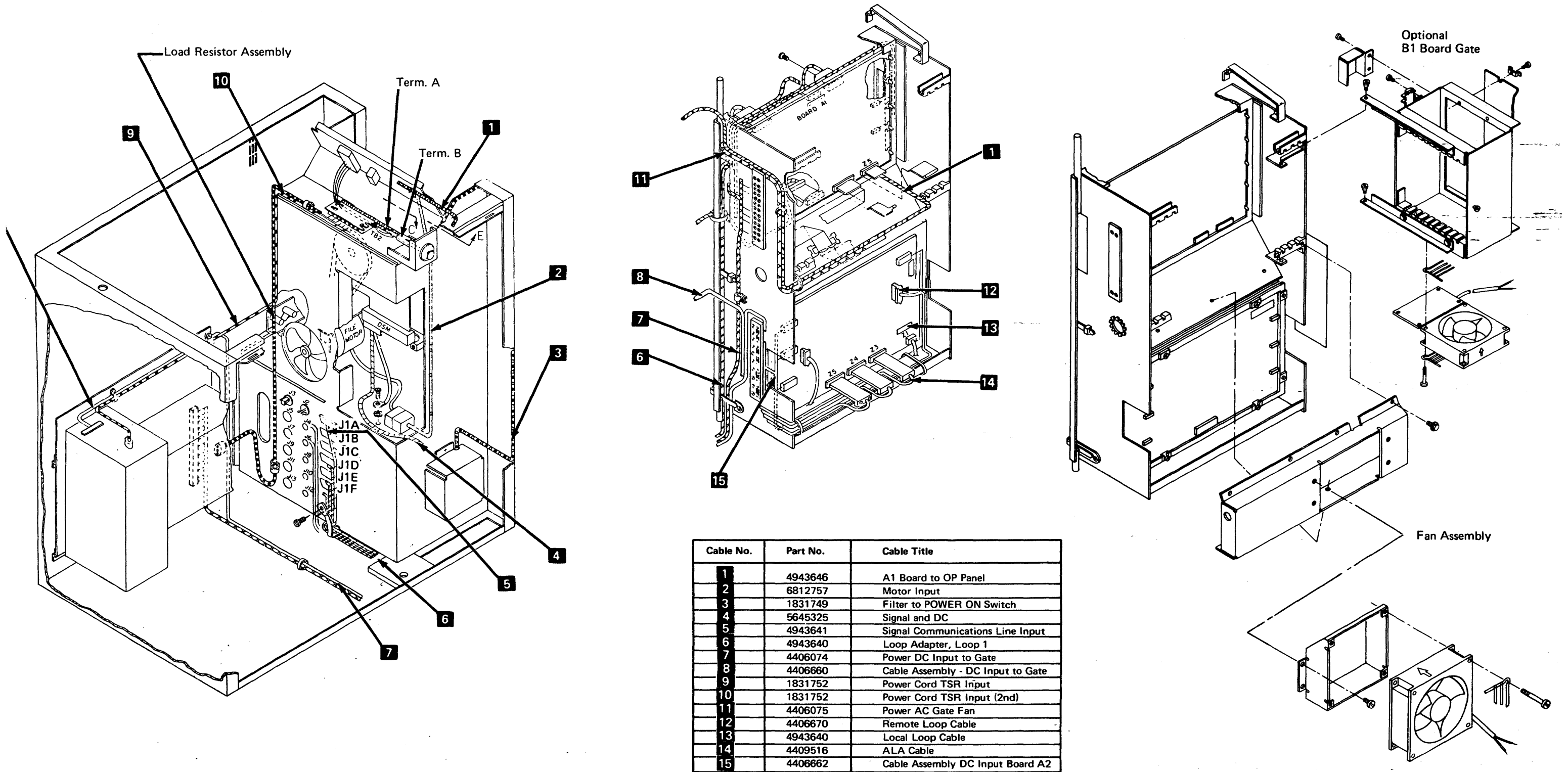
| Cable No. | Part No. | Cable Title |
|---|---|---|
| 1 | 4943646 | A1 Board to OP Panel |
| 2 | 6812757 | Motor Input |
| 3 | 1831749 | Filter to POWER ON Switch |
| 4 | 5645325 | Signal and DC |
| 5 | 4943641 | Signal Communications Line Input |
| 6 | 4943640 | Loop Adapter, Loop 1 |
| 7 | 4406074 | Power DC Input to Gate |
| 8 | 4406660 | Cable Assembly - DC Input to Gate |
| 9 | 1831752 | Power Cord TSR Input |
| 10 | 1831752 | Power Cord TSR Input (2nd) |
| 11 | 4406075 | Power AC Gate Fan |
| 12 | 4406670 | Remote Loop Cable |
| 13 | 4943640 | Local Loop Cable |
| 14 | 4409516 | ALA Cable |
| 15 | 4406662 | Cable Assembly DC Input Board A2 |

Reference Only: Use cable label PNs.

Fig. 4-2

TNL SN31-0864
SY27-2519-0

(7/78)   4-3

Fig. 4-3

SY27-2519-0
TNL SN31-0864

(7/78)    4-4



Term. 6

Term. A

Term. B

See Figure 3-8.

Power Filter and
Prime Power TB1

Loop Cables

Power Supply (TSR2)

Gate
Hinge

Gate
TB1

BOARD A1

Reference Only: Use Cable Label PNs

| Cable No. | Part No. | Cable Title |
|---|---|---|
| 1 | 1831752 | Power Cord TSR Input |
| 2 | 1831774, 6812757 | Motor Input |
| 3 | 1831749 | Filter to Power on Sw |
| 4 | 4943638 REF | Signal and DC |
| 5 | 4943641 REF | Signal Comm Line Input |
| 6 | 4943646 | A1 Board to OP Panel |
| 7 | 4406682 REF | PWR DC Input to Gate |
| 8 | 4943640 REF | Loop Adapter |

Figure 4-3. Component Locations (3601 Models C, D)

TSR3-E is moved to the right as shown.

4 BD GATE

01G-2

TSR3-E

01G-1

01F

01E

01G-CB1

01A

01T

01U

01H

01D

Gate Hinge

(B1)

(Z2)

(Z3)

(A1)

(A2)

(Z4)

(Z1)

(Z2)

Figure 4-4. Component Locations, 3602-1A, 1B

| Cable No. | Cable Part Number* | From | To |
|---|---|---|---|
| 1 | 4944498 | 01A-B1Y1 | 01S Ext. C/A (Feature) |
| 2 | 1741683, 8269882 | 01F | 01D-J2 |
| 3 | 1741685 | 01H-K1 | 01D-J3 |
| 4 | 1741684 | 01H-Fan | 01D-J7 |
| 5 | 1741691, 4406665 | 01A-TB1 | 01G-1-CB1 |
| 6 | 1741689 | 01D-TB1 | 01E-Sw1 |
| 7 | 1741686 | 01A-B1Z3 | 01F |
| 8 | 1741702, 4406667 | 01G-3 | 01A-TB1 |
| 9 | 1652519 | 01E | 01A-B1Z5 |
| 10 | 1842168 | 01D-J4 | 01G-1 |
| 11 | 1741690 | 01A | 01H, 01G-2 |
| 12 | 1741681, 4406666 | 01A Only | |
| 13 | 1741693 (Flat Cable List 01A Only) | | |
| 14 | 1652549 | 01A-A2Z2 | 01S-J2 |
| 15 | 1741682 | 01A-A2 | 01U |
| 16 | 1741679 | 01D | 01J |
| 17 | 1747294 | 01D-J5 | 01A-Fan |
| 18 | 1747295 | 01A-B1Y1 | 01S-J1 |
| 19 | 1563175 | 01A-B1Y1 | 01U |
| 20 | 4944498 | 01A-A2Y1 or A2Y6 | Ext. C/A |
| 21 | 4944499 | 01A-A2Y1 or A2Y6 | Ext. C/A |
| 22 | 4944499 | 01A-B1Y2 | Ext. C/A |

**Note:** *Refer to Power Distribution Diagram*

* Reference Only; Use Cable Label PNs.

Fig. 4-4

TNL SN31-0864
SY27-2519-0

(7/78)   4-5

Fig. 4-5                                    SY27-2519-0                                                    (4/78)   4-6



Figure 4-5. Logic Boards, Card and Pin Locations

Legend
● Probe Pin

Notes:
1. For multiple—socket cards (such as cards G2, E4, D3, and C2 in illustration), card location designation is specified by the uppermost row. Example: The location of card G2 (which actually occupies four sockets) is specified by the uppermost row, G2. If this card is located on board A1, its location is identified as A1G2.
2. Pin-column letter designations are signified by card size (rather than vertical position of card on board), beginning with DB in the first pin row used. Subsequent designations are JG, PM, and US, which, when required, specify pin columns in the second, third, and fourth card row, respectively. See examples in the illustration.
3. Ground = Any D08, J08, P08, or U08 pin; identified by a square surrounding each ground pin. (The square is not shown.) +5 = Any D03, J03, P03, or U03 pin.
4. Cards are shown for instruction purposes only. See Figure 4-2 for actual card locations.

```
Frame
|   Board
|   |   Card Column  } Socket
|   |   Card Row     } Location
|   |       |   Pin Column  } Generally Called
|   |       |   |   Pin Row } Pin Number
|   |   |   |   |   |
01  A1  M   2   B   09
```

# Chapter 5. Parts Catalog

Refer to S126-0013 for 3601 Parts Catalog and to
S126-0014 for 3602 Parts Catalog.

BLANK PAGE

# Chapter 6. Installation Instructions

## Contents

## Figures

## Tables

## 6.1 PRELIMINARY INSTRUCTIONS

### 6.1.1 Basic Installation Procedure

A 3600 system is installed in the following sequence:

1. Install the controller and a local 3604 to be used as the control operator terminal for receiving system messages and for starting terminal tests.
2. Connect each local loop, starting with the mandatory loop 1, and test that the loop operates properly.
3. Once a loop has been tested, connect terminals, one at a time, to the loop and run exercisers to test the terminals.
4. After all terminals on all local loops are operational, install any remote loops.
5. Set the address and speed switches on all terminals according to the customer's configuration.
6. Clean up and turn the system over to the customer; INSTALLATION IS NOW COMPLETE.
7. If a communication link to the computer is available, the customer should test communications with the computer.

**Note:** *In World Trade countries, if a communication link to the computer is available, this step should be done by the customer before step 6.*

8. When the 3604 at address 1 on loop 1 is not physically the first terminal on the loop, the startup diagnostic messages may not be displayed correctly. (Normal operation after startup is not affected by this incorrect display.) If you must see these messages, turn power off on the terminals that physically precede the 3604.

Instructions for performing these steps follow.

### 6.1.2 Manuals Available

- *IBM 3604 Keyboard Display Maintenance Information,* SY27-2361.
- *IBM 3610 Document Printer Maintenance Information,* SY27-2362.
- *IBM 3611 Passbook Printer Maintenance Information,* SY27-2408.
- *IBM 3612 Passbook and Document Printer Maintenance Information,* SY27-2363.
- *IBM 3614 Consumer Transaction Facility Maintenance Library Manual.*
- *IBM 3618 Administrative Line Printer Maintenance Information,* SY27-2364.
- Maintenance Information, Installation, and other manuals for IBM modems to be installed with the 3600 System.
- *IBM 3600 System, Field Engineering Maintenance Information Manual,* SY27-2520.

Also, the following customer's manuals are available for reference:

- *IBM 3600 Finance Communication System — System Summary,* GC27-0001. This manual introduces the 3600 System.
- *IBM 3600 Finance Communication System Configurator,* GA19-0063 (World Trade) or GA27-2762 (U.S.A.). This manual lists the terminals and features that are available for the 3600 System and shows how they can be connected.
- *IBM 3600 Finance Communication System Installation Manual — Physical Planning,* GA27-2766. This manual describes: (1) what the customer must do to prepare the location before installation and (2) the cables that are needed.
- *Operating Guide for the IBM 3600 Finance Communication System,* GA27-2776. This manual gives operating instructions and problem-recovery procedures for customer personnel.
- *IBM 3614 Consumer Transaction Facility Operator's Guide,* GA26-1624. This manual contains procedures for preparing the 3614 for operation and for determining the cause of a failure.

### 6.1.3 Special Tools Needed

The following special tools are shipped as required:

- Passbook printer test form, PN 1842880 (with 3611 and 3612).
- Test card, PN 2143816 (MSR machines).
- Magnetic stripe reader/encoder passbook, PN 1652251 (MSR machines).

The following branch office tools may be required:

- 453 oscilloscope or equivalent, PN 453047.
- 33FD head alignment tool, PN 2200698.
- DB meter, PN 453545.
- General logic probe, PN 453212.
- Berg connector extractor tool, PN 453705.
- Berg connector screwdriver, PN 460811.
- Berg connector probe tip, PN 453718.
- Card caddy — container, PN 963400.
- Chute adjusting tool, PN 1738543.

### 6.1.4 Preparing the Location

Before installation, the customer should have:

- Obtained and installed loop cables.

- Completed all location changes as needed (such as expansion of electrical wiring, installation of communications equipment, and preparing an outside wall for the 3614 Model 2).
- Tested all electrical and communications equipment.

Also, when the equipment comes, the customer must unpack it and place it in the proper location. He should show you: (1) which terminals are on each loop, (2) the address of each terminal, and (3) the proper loop speed for each terminal. The customer should also label* loop cables at each end with information that identifies: (1) the loop, (2) the terminal to which that cable end is to be connected, and (3) the terminal to which the other end of the cable is to be connected. He should have also filled out an installation reference page (from the *3600 Operating Guide,* GA27-2776), showing the location of terminals on each loop and their addresses

For the 3614, the customer must also:

- Install and provide any protection for the signal cable.
- Obtain, install, and provide any protection for alarm and control cables. These cables are not supplied by IBM.
- Connect and supply dc power for the alarm and control system. (Alarm and control cables and dc power should be ready before the terminal is sent.)
- Install the floor fastening stud for the Model 1.
- Install the heavy-duty enclosure, bezel, mounting stand, and baseplate for the Model 2.
- Place the 3614 Model 2 in the heavy-duty enclosure.

If, during installation, you find that the customer has not prepared the location properly, inform the customer, your branch office, and the responsible DP branch office.

### 6.1.5 Setting the Loop Speed and the Terminal Address

Each 3600 terminal has two groups of switches. Group 1 is used to set the terminal address, and group 2 is used to set the terminal to the loop speed. Each group has four switches, labeled 1 to 4. Table 6-1 shows the setting of the address switches for each terminal address, and Table 6-2 shows the setting of the loop speed switches for each loop speed.

*Labels are shipped with the 3602 and with the remote location 3604.

Table 6-1. Address (Group 1) Switch Settings

| Terminal Address | Switch Settings | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 | On | Off | Off | Off |
| 2 | Off | On | Off | Off |
| 3 | On | On | Off | Off |
| 4 | Off | Off | On | Off |
| 5 | On | Off | On | Off |
| 6 | Off | On | On | Off |
| 7 | On | On | On | Off |
| 8 | Off | Off | Off | On |
| 9 | On | Off | Off | On |
| 10 | Off | On | Off | On |
| 11 | On | On | Off | On |
| 12 | Off | Off | On | On |
| 13 | On | Off | On | On |
| 14 | Off | On | On | On |
| 15 | On | On | On | On |
| 16 | Off | Off | Off | Off |

Table 6-2. Loop Speed (Group 2) Switch Settings

| Loop Speed in Bits per Second (bps) | Switch Settings | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 600 | On | Off | Off | Off |
| 1200 | Off | On | Off | Off |
| 2400 | Off | Off | On | Off |
| 4800 | Off | Off | Off | On |

### 6.1.6 Use of the Starter Diskette

An IBM-controlled starter diskette is shipped with each controller. During installation, it is recommended that you use the starter diskette instead of the customer's operational diskette. (But, if you use the customer's operational diskette and set the address switches to the customer's address and then run into a problem, use the starter diskette and follow the procedures in this manual.)

The starter diskette is configured for one terminal of each type on each of two loops, loops 1 and 2. (Loop 1 contains the control operator's 3604 at address 1, and loop 2 is named as having a wrappable modem.) After initial loading of the starter diskette is complete, loops 1 and 2 are both running. Keyboard commands are available to stop loop 2, name another loop to take loop 2's place, and start the other loop.

Note: *You must use a prompt mode startup to specify the component that is to be tested (section 1.1.1). The starter diskette optional module ID codes are:*
    *0A= ADDRESS SHARING*
    *0B= PIN keyboard*
    *83= 3610, 3611, 3612*
    *85= 3618*
    *86= 3604 magnetic stripe encoder*
    *87= 3614*
    *6A= ALA/Host Link Test*

For all loops, the starter diskette is configured as shown in Table 6-3. Thus, if a terminal is being used in the testing, its address switches must be set as shown in Table 6-3. For terminals that are on the loop being tested but are not being used in the testing, configuration needs are met by turning off their power switches instead of changing the normal setting of their address switches. There is no need to change the address switches or the power switches of terminals on loops that are not being tested.

The system tries to start loops 1 and 2. If it can, the READY lights on the terminals on loops 1 and 2 will light. Logon on loop 1 is automatic, following initial loading; message 92222 appears on the control operator display (address 1 on loop 1), indicating the CE is automatically logged on that 3604 and may run exerciser tests by using its keyboard.

To test other loops and their terminals, enter the following to stop all loops except loop 1:

040 0 0X 00 0Y

where: X   is set to 2 if there is no wrappable modem on the loop (local loop or World Trade 600-bps remote loop).
     X   is set to 3 if there is a wrappable modem (1200-bps remote loop) or an external loop modem.
     Y   is set to the loop number of the loop that is to be tested.

Then enter:

040 0 to start the loop that is to be tested.

You can then test the terminals on the selected loop.

For more information on the starter diskette and for the commands you can enter at the 3604, refer to 3600 System, FE MIM, SY27-2520.

Table 6-3. Starter Diskette Configuration

For starter diskettes at EC 745122 and above, see command code 973 in the IBM 3600 FE MIM, SY27-2520. Only addresses 01, 02, and 03 are valid on these diskettes.

| Terminal | Address | Slots Used | Components |
|---|---|---|---|
| 3604 | 01 | 1, 9 | Keyboard (magnetic stripe reader) and display. |
| 3618 | 02 | 2, 10 | 132 print positions and dual forms feed. |
| 3604 | 03 | 3, 11 | Keyboard (magnetic stripe reader), display, and magnetic stripe encoder. |
| 3610 | 04 | 4, 12 | Cut form - continuous form printer. |
| 3611 | 05 | 5, 13 | Passbook printer: 28 lines, centerfold starts on line 14 and ends on line 17. |
| 3612 | 05 | 5, 13 | Cut form-continuous form printer. Passbook printer: 28 lines, centerfold starts on line 14 and ends on line 17. |
| 3614 | 08 | 8, 16 | Cash issuer. |

## 6.2 INSTALLATION: Controller

These are the step-by-step instructions, in the preferred order, for installing a 3600 system. Controller and system installation instructions are given in detail in this chapter; refer to the appropriate terminal Maintenance Information Manual, Chapter 6, for detailed terminal installation instructions. For your convenience, a box is provided next to each step to allow you to check off completed steps.

The customer must have installed electrical and communications equipment, installed cables, and unpacked and placed terminals. If you observe that any of these steps have not been completed correctly, inform the customer, your branch office, and the responsible DP branch office.

If, during installation, you observe an error indication in a terminal or determine that a terminal is in need of repair or adjustment, refer to the error indication index or to the repair and adjustment procedures in the terminal Maintenance Information manual. For system error indications, refer to Chapter 1 MAPs.

Perform steps in 6.2.1 or 6.2.2 for your controller type.

### 6.2.1 Check Controller and Apply Power (3601)

☐ 1. If the communication link to the computer is to be checked, have the customer tell the computer operator to vary this controller location (online) at this time.

☐ 2. Remove the left cover on the 3601 (Figure 6-1). To remove, push the cover up from the bottom, tilt out from the top, and lift up.

☐ 3. Remove the diskette cover by opening with a key obtained from the customer, rotate it open and disengage.

☐ 4. Remove the 3601 front cover by unscrewing the two screws that hold it on (Figure 6-2). Go to step 10.

☐ 5. Check the controller for damage and loose parts.

   6. Check the seating of all cards and internal cable connectors.

☐ 7. Remove the shipping block under the diskette assembly (between the diskette assembly and the lower shock mount). On the two-sided diskette drive, remove the plastic shipping clamps from the frame.

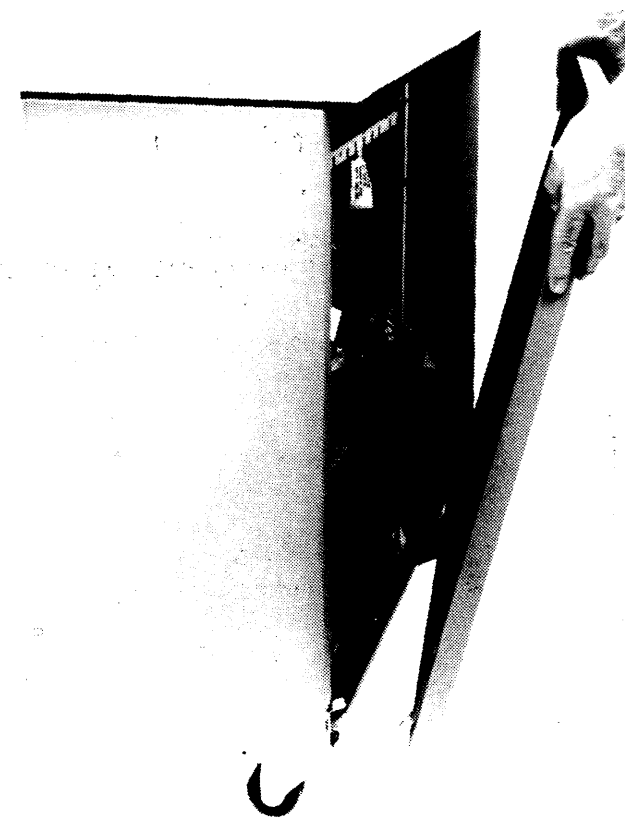☐ 8. Check the diskette assembly for damage and loose parts.
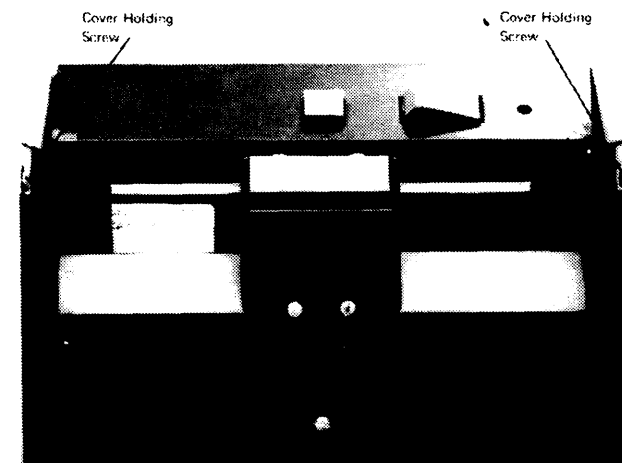


**Figure 6-1. 3601 Left Cover Removal**



**Figure 6-2. 3601 Front Cover Holding Screws**

☐ 9. Using your CE volt-ohmmeter (VOM), check that the ac voltage at the customer's outlet, provided for the controller, equals the voltage shown on the controller voltage plate (Figure 6-3).

CAUTION: Before performing the next step, check that the power ON/OFF switch on the controller is in the OFF position.

☐ 10. Insert the controller power plug in the customer's outlet.

**DANGER**
AC voltage is now present in the controller.

☐ 11. Go to step 13 of 6.2.3.

### 6.2.2 Check Controller and Apply Power (3602)

☐ 1. If the communication link to the computer is to be checked, have the customer tell the computer operator to vary this controller location (online) at this time.

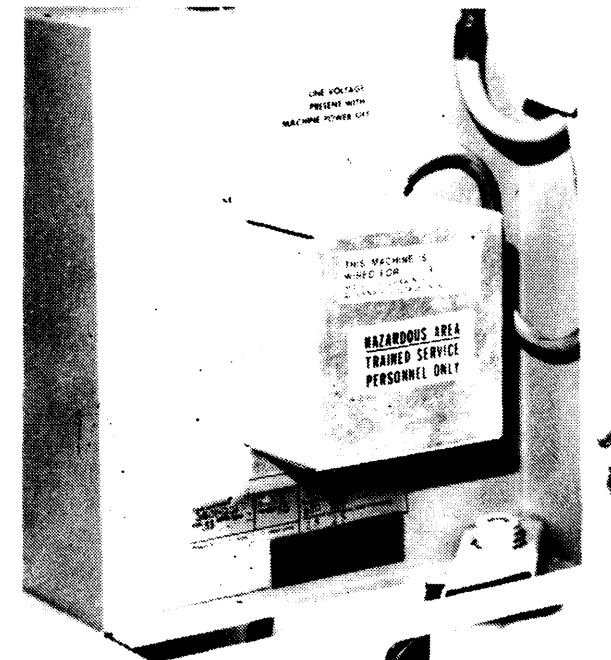☐ 2. Swing open the front and rear covers by pulling slightly up and out.



**Figure 6-3. Controller Voltage Plate**

☐ 3.   Remove the left and right covers by pulling out at the bottom and unhooking the top.

☐ 4.   Move the three shock mount locking spacers and bolts from the lock position to the upper (storage) position (Figure 6-4).

☐ 5.   Unlock the disk storage spindle, remove the drive motor locking bolt (Figure 6-4), and install the drive belt (smooth side to pulleys).
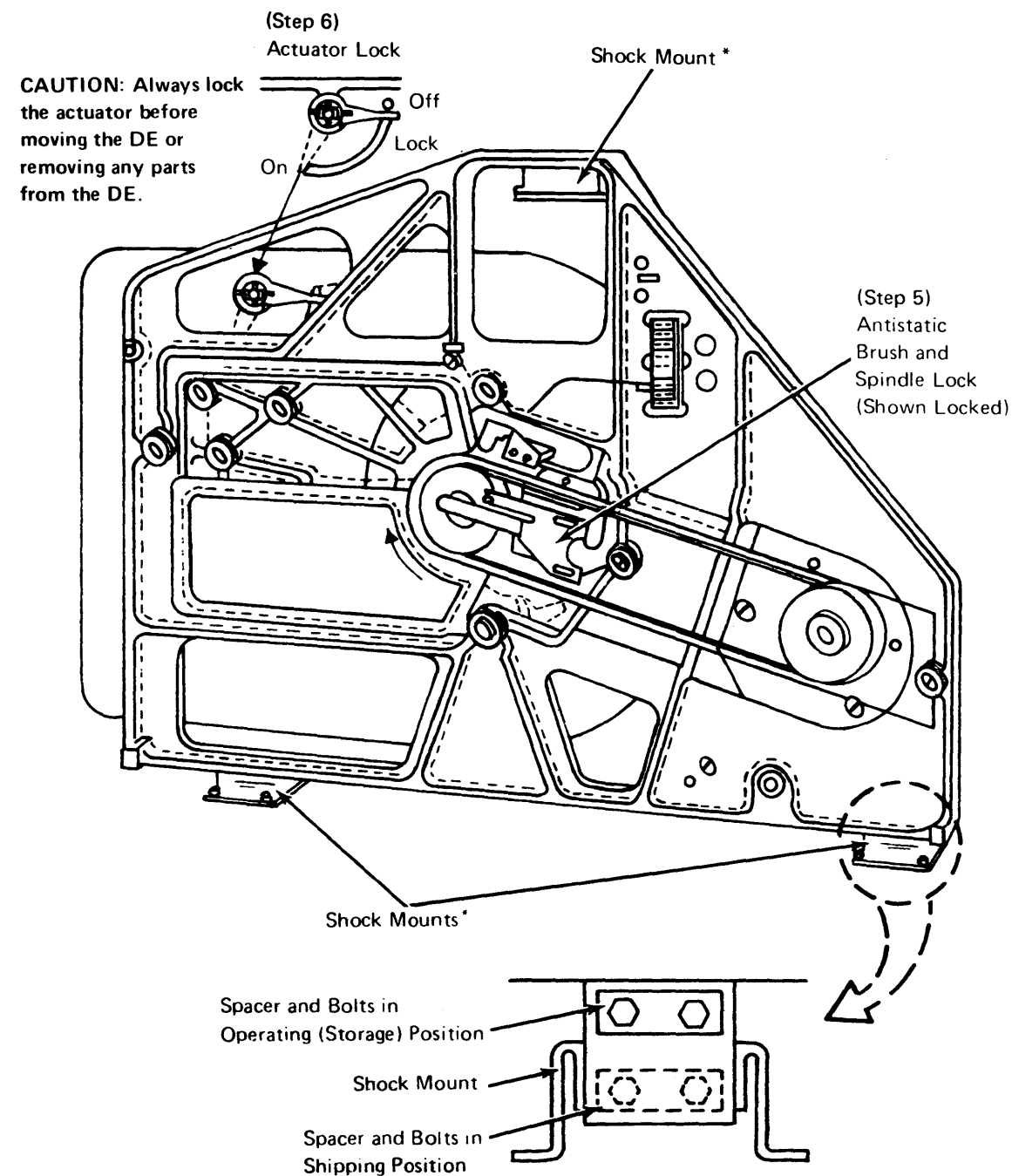
**CAUTION: Observe the arrow by the spindle pully; do not turn the spindle counterclockwise.**

☐ 6.   Unlock the disk storage access assembly (Figure 6-4).

7.   Check the controller for damage and loose parts.

☐ 8.   Check the seating of all cards and internal cable connectors.

☐ 9.   Remove the shipping block under the diskette assembly (between the diskette assembly and the lower shock mount). Remove the two plastic shipping clamps (Figure 6-5) from the frame.

☐ 10.  Check the diskette assembly for damage and loose parts.

☐ 11.  Using your CE volt-ohmmeter (VOM), check that the ac voltage at the customer's outlet, provided for the controller, equals the voltage shown on the controller voltage plate (Figure 6-3).

**CAUTION: Before performing the next step, check that the power ON/OFF switch on the controller is in the OFF position.**

☐ 12.  Insert the controller power plug in the customer's outlet.

**DANGER**
**AC voltage is now present in the controller.**



Figure 6-4. Disk Enclosure (DE)

(Step 6)
Actuator Lock

CAUTION: Always lock the actuator before moving the DE or removing any parts from the DE.

Off
Lock
On

Shock Mount *

(Step 5)
Antistatic Brush and Spindle Lock (Shown Locked)

Shock Mounts *

Spacer and Bolts in Operating (Storage) Position

Shock Mount

Spacer and Bolts in Shipping Position

* Locking bolts are on the other side.



Figure 6-5. Shipping Clamps

Shipping Clamp

HAZARDOUS AREA TRAINED SERVICE PERSONNEL ONLY

* Note: Another shipping clamp (not shown) on opposite side.
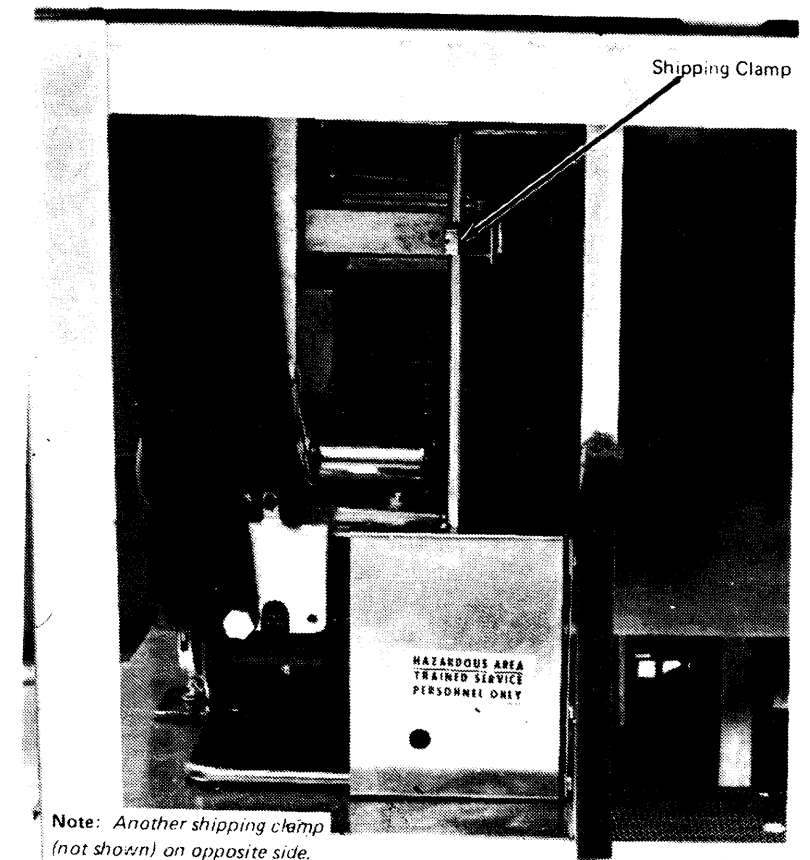
## 6.2.3 Install Mandatory Local Loop 1

The following steps are used: (1) to install and test a small loop that is made up of the controller and the control operator's 3604 and (2) then to install the test other terminals, one at a time, until the mandatory local loop 1 is complete.

☐ 13. Check the 3604 to be used as the control operator terminal (address 1 on loop 1 on the starter diskette) for damage.

**Note:** *Remove the protective, transparent tape from the screen, if present.*

☐ 14. Using your CE VOM, check that the ac voltage at the customer's outlet, provided for the 3604, equals the voltage shown on the 3604 voltage plate.

**CAUTION: Before performing the next step, check that the power ON/OFF switch on the 3604 is in the OFF position.**

☐ 15. Insert the 3604 power plug in the customer's outlet.

**DANGER**
**AC voltage is now present in the 3604.**

☐ 16. Connect the loop cables to the 3604.

☐ 17. Set the 3604 address switches to 1 (switch 1 on), and the speed switches to the speed requested by the customer. If the customer is unavailable, set the speed switches to the same speed as the 3602 (Figure 6-6 and paragraph 6.1.5).

☐ 18. Connect the loop cables for loop 1 to the controller.

☐ 19. Refer to the chart on the end of the controller logic gate, and jumper the speed requested by the customer (if the customer is unavailable, leave the speed at the factory setting).
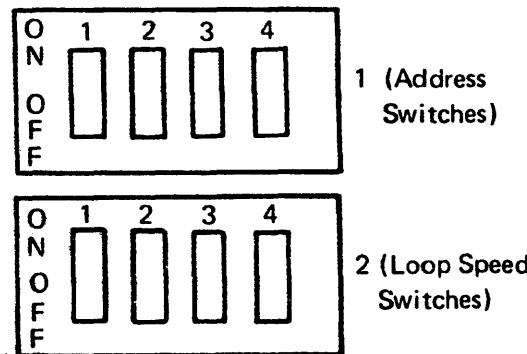


1 (Address Switches)

2 (Loop Speed Switches)

**Figure 6-6. 3604 Switches**

☐ 20. Complete loop 1 by connecting the remaining connectors together. Insert the plug end into the jack end of the two cables that normally connect to each terminal on the loop.

**Note:** *At this point, loop 1 is made up of the controller and the control operator's 3604. To complete start-up faster using the starter diskette, jumper loop 2 at the controller.*

☐ 21. Turn power on at the controller. Observe that the diskette drive motor and fans are operating.

☐ 22. Turn power on at the 3604.

☐ 23. Insert the starter diskette in the controller, and press the controller RESET key.

☐ 24. Observe that a series of three-letter messages appears in the upper left corner of the 3604 display within a short time. The first of these messages is IDL (initial diagnostic load), and the last message is DTC (diagnostic test complete). Each message is displayed for a short time and is then replaced by the following message. These messages indicate the part of the start-up tests that is operating. If one of these messages remains on the display, a start-up test error has occurred. Refer to MAP 1 to resolve the problem.

☐ 25. If the automatic start-up tests are good, a message similar in format to the following message is displayed in the upper left corner of the 3604 display:
24 STRTR01 03/13/74 D4 00 0001
00001
The 5-digit code, 00001, requests a 1-digit answer to indicate the type of start that is needed.

**Note:** *For step 25, be aware of component test requirements (see 6.1.6). If there are gaps between the top and bottom of the displayed characters, define the 3604 at this time by entering "6X" where "X" is the model number of the 3604 which is to be used. Also be aware of the link requirements. See 1.1.1.*

☐ 26. Enter the start. If the computer link is available, enter 1 for a cold start. If the computer link is not available, enter 8 for a cold start with no Start Link sent. The display will then go blank.

**Note:** *The location of the keyboard keys is as named by the Universal Translation Table (UTT). Refer to Figure 6-7 for the key locations for the different 3604 keyboards.*
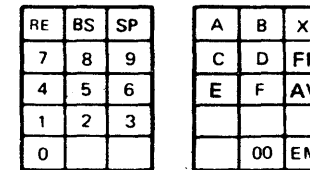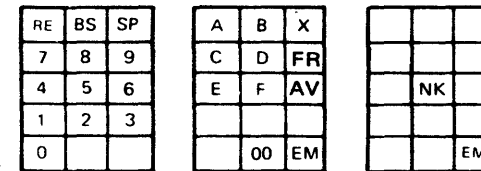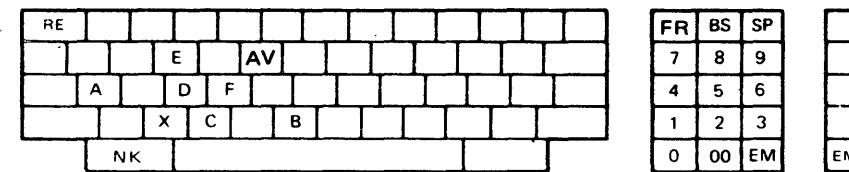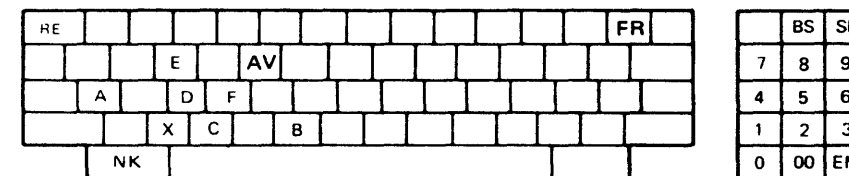


Legend:
BS = backspace
RE = reset
EM = end of message
NK = return to normal keyboard = 045
SP = space
AV = advance/clear*
FR = free*

☐ = motor bar available
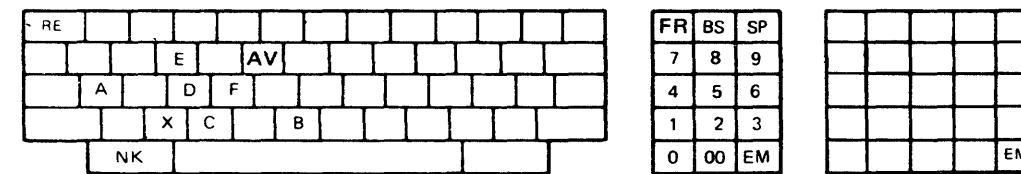
* Used only for large disk storage utilities and error code diagnostics.

A. 30-Key Keyboard

B. 45-Key Keyboard

C. 74-Key Keyboard

D. 77-Key Keyboard

E. 92-Key Keyboard

F. 94-Key Keyboard

G. 99-Key Keyboard
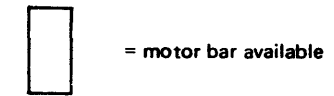
**Figure 6-7. 3604 Universal Translation Table Key Locations**

27. Logon at the 3604 is automatic at reset with the starter diskette. A good logon is indicated by 92222 on the display. If (1) you are not using the starter diskette, or (2) if you log off this 3604 and wish to log on this 3604 again, or (3) if you wish to log on any other 3604, proceed as follows:

   a. Press the RESET (RE) key three times (Figure 6-7).

   b. Message 90000 should be displayed.

   Note: *If 90000 is not displayed and the CHECK indicator lights, try to log on again by pressing the RESET (RE) key three times. If the CHECK indicator still lights, make sure that you are not already logged on at a 3604, and then refer to the error indication index in the 3604 Maintenance Information.*

   c. Enter the starter diskette identification (ID) code (12345) at the 3604, using the 3604 UTT keyboard locations.

   Note: *The ID is not displayed.*

   d. Message 91111 should be displayed, indicating a good logon. If 91111 is not displayed, press the RESET (RE) key, and enter the correct ID again.

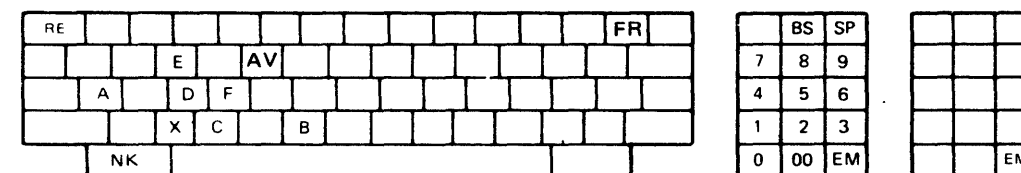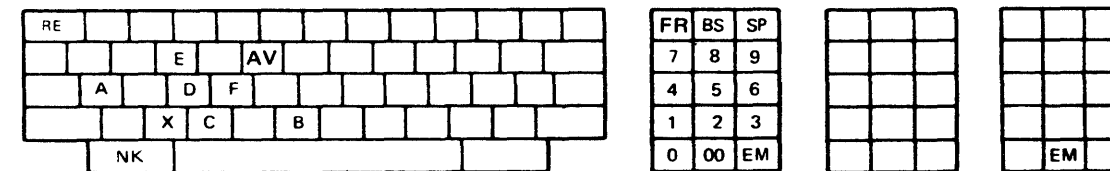   If you want to log off, press the 0 key three times and the ENTER (EM) key once.

28. If the 3604 has the magnetic strip reader feature or the magnetic stripe encoder feature, test the feature as instructed in the 3604 Maintenance Information manual.

29. Install the remaining terminals on loop 1, one at a time, using the starter diskette loop configuration (refer to 6.1.6). (See terminal Maintenance Information manual for terminal installation instructions).

30. (3602 only) Verify the operation of the disk storage by running the diagnostic as described in section 1.114. Refer to Chapter 1 MAPs if any errors occur.

**Notes:**

1. *After testing each remaining terminal, turn its power off.*

2. *If you observe an error indication in a terminal or determine that a terminal is in need of repair or adjustment, refer to the error indication index or to the repair and adjustment procedures in the terminal Maintenance Information manual. For system error indications, refer to Chapter 1 MAPs of this manual.*

### 6.2.4  Install Additional Local Loops

31. Connect the loop cables to the loop connectors on the controller.

32. Refer to the chart on the end of the controller logic gate and jumper the speed requested by the customer (if the customer is unavailable, leave the speed at the factory setting).

33. Connect the loop cables to one terminal on this loop.

34. Complete the loop by connecting the remaining cable connectors together. Insert the plug end into the jack end of the two cables that would attach to each terminal on the loop.

35. Name the loop and terminal per the instructions in 6.1.6.

36. Perform the installation instructions for the terminal. (See the terminal Maintenance Information manual.)

Note: *After testing any terminal, turn its power off.*

37. Repeat steps 33, 35, and 36 for each terminal on the loop.

38. Repeat steps 35–38 for each local loop.

### 6.2.5  Install Remote Loops

If two locations are on one loop, it is necessary to apply power to all 3604s or 3614s with a teleprocessing interface, and to connect the loop cables before starting to install the loops within each remote location.

39. Install the cables from the controller to the communications facilities. Normally the transmit level is factory set to 0 db. If the transmit level must be adjusted, refer to the Chapter 1 procedures.

40. Name the loop and terminal per the procedure in 6.1.6. If the remote loop has a 3604, log off the loop 1 3604 by pressing the 0 key three times and the enter (EM) key.

41. Complete the loop at the remote location by connecting the loop cable connectors together, except the connectors that attach to the 3604 or the 3614 that contains the teleprocessing interface.

42. Install the 3604 or 3614 that contains the teleprocessing interface (see the 3604 or the 3614 Maintenance Information manual). Log on a 3604 at this location to name tests for the rest of the terminals at this location. See Figure 6-8 for World Trade cable connectors.
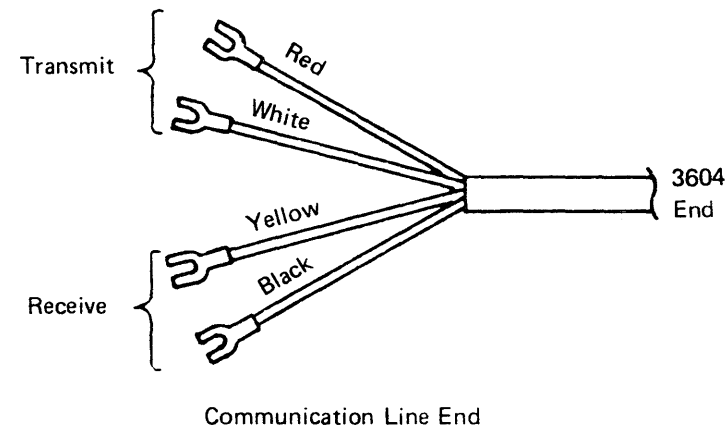


Figure 6-8. World Trade Communication Cable

43. Install the remaining terminals on the remote loop, one at a time.

Note: *After testing any terminal, turn its power off, except for terminals with a teleprocessing interface.*

### 6.2.6  Complete the Installation

44. Connect the communication link cables. Normally, the transmit level is factory set to 0 db. If the transmit level must be adjusted, refer to the Chapter 1 procedures. For external modems, refer to section 3.11.3 to ground unused lines. Also, verify whether speed jumpering is required (3.9).

45. Perform a wrap test of the controller (issue a start-link command, command 041, and specify a wrappable modem if the modem may be automatically wrapped. An example is the 1200-bps internal modem). Perform a wrap test of the ALA with command code 929 if present. See 3600 System, FE MIM, SY27-2520.

46. Display the system log to make sure there are no hardware errors.

47. Set up the address switches on all installed terminals per the customer's request. (Refer to 6.1.5).

48. Replace all covers.

49. INSTALLATION IS NOW COMPLETE; turn the system over to the customer.

50. If a communication link to the computer is available, the customer should now test communications with the computer.

Note: *In World Trade countries, if a communication link to the computer is available, this step should be done by the customer before step 49.*

# Appendix A. List of Abbreviations

| | | | | |
|---|---|---|---|---|
| BCC | block check count | | MAP | maintenance analysis procedure |
| BS | back space | | MC | motor current (stepper motor) |
| | | | MI | maintenance information |
| CA | cancel | | MV0 | memory volume 0 |
| COM | common | | MV1 | memory volume 1 |
| CRC | cyclic redundancy check | | M/D | modem |
| CUA | control unit address | | | |
| | | | NK | return to normal keyboard translate table |
| DTC | diagnostic test complete | | N/C | normally closed |
| | | | N/O | normally open |
| EIA | Electronic Industries Association | | | |
| EM | enter | | SCR | silicon controlled rectifier |
| ESA | extended storage addressing | | SDLC | synchronous data link control |
| | | | SP | space |
| FRU | field-replaceable unit | | | |
| FSU | functional storage unit | | TP | test point |
| | | | TSR | transistor switching regulator (power supply) |
| GEN | generation | | | |
| GL probe | General Logic Probe | | UTT | Universal Translate Table |
| | | | | |
| ID | identification | | VOLID | volume identification (diskette) |
| IDL | initial diagnostic load | | VOM | volt-ohmmeter |
| | | | VTL | vendor transistor logic |
| LED | light emitter diode | | | |

BLANK PAGE

# Appendix B. Glossary

**Acknowledgment to the American National Standards Institute**

IBM is grateful to the American National Standards Institute (ANSI) for permission to reprint definitions from the *American National Standard Vocabulary for Information Processing* (Copyright 1970 by American National Standards Institute, Inc.), which was prepared by Subcommittee X3K5 on Terminology and Glossary of the American National Standards Committee X3. In this glossary, a complete commentary taken from ANSI is identified by an asterisk (*) that appears between the term and the beginning of the commentary; a single definition taken from ANSI is identified by an asterisk after the item number for that definition.

*access:* The manner in which files on the disk storage and the diskette storage are referred to by the controller.

*assign a test component:* To enter a command at a 3604 keyboard to designate the terminal component that will be tested by subsequent keyboard commands. This assignment remains in effect until any of the following occurs: (1) the CE assigns a different test component, (2) the CE logs off, or (3) the controller is reset. See *terminal component.*

*assign an output printer:* To enter a command at a 3604 keyboard that designates the printer (or display) that will be the output printer. (Additional commands are entered to cause the output printer to print/display specific information during the time the CE is logged on.) This assignment remains in effect until any of the following occurs: (1) the CE assigns a different output printer, (2) the CE logs off, or (3) the controller is reset.

*axe circuit:* A circuit that detects out-of-tolerance conditions in a supply voltage and turns off the power supply by causing a direct short circuit across the power supply output.

*component:* (1) In general, a part of a larger unit. (2) In connection with the 3600 system, a shortened name for a terminal component. See *terminal component.*

*configuration image:* A combination of formatted configuration data with selected modules of controller data which, when loaded into controller storage, determines the operations of the controller. A configuration image is produced by the Finance Image Processor. The completed image is stored in the 3600 and is later transmitted to a controller.

*data byte:* See *parameter data byte.*

*debug* *To detect locate, and remove mistakes from a routine or malfunctions from a computer Synonymous with troubleshoot

*displacement:* With reference to addressing a field in a segment of storage, the number of bytes that the first byte of the field is away from byte 1 of the segment.

*dump:* With reference to the 3600 controller, to copy a part of storage onto a diskette.

*flag byte:* See *parameter flag byte.*

*frame:* (1) The basic fixed-format entity that is transmitted under SDLC procedures. Each frame is delimited by a unique sequence (FLAG) at its beginning and end. The frame format consists of a station address (8 bits), a control field (8 bits), an information field (variable in length), and block checking information. (2) For transmissions on terminal loops, see *loop transmission frame.*

*hang:* With reference to startup (reset) of the controller, a failure of the controller not only to complete the startup, but also a failure to establish any communication with the CE.

*inquiry:* A request from a terminal for information from storage.

*log:* In a 3600 controller, a temporary file on the diskette in which hardware error statistics are recorded and in which other operational data can be recorded, such as commands and messages from control operators.

*logical work station:* The combination of a section of storage and a controller application program that the controller treats as a unit; terminals may be associated with the unit, and the unit may communicate with the host system. See also *user work station.*

*loop transmission frame:* A group of 16 message slots for terminals (plus a frame synchronization slot) transmitted around a loop as an entity.

*operating diskette:* A diskette containing the configuration image (and other data) relating to the operation of a particular controller. The operating diskette must be in the controller during its operations. A second diskette containing the same configuration image and data is sometimes referred to as a *backup operating diskette.*

*parameter:* (1) *A variable that is given a constant value for a specific purpose or process. (2) See *parameter flag byte* and *parameter data byte.*

*parameter data byte:* When setting up or changing the parameters of a terminal component, the data bytes give values to the various parameters. See *parameter flag byte.*

*parameter flag byte* When setting up or changing the parameters of a terminal component that can operate with different groups of parameters, the flag byte specifies which group of parameters are being set up or changed by the connected parameter data bytes. See *parameter data byte.*

*permanent file* (on a controller diskette): An optional file on a diskette that can be used to store data to be retained from one controller startup to another Permanent data might include such things as a customized image for a 3614 Consumer Transaction Facility, day-to-day totals, or checkpoint/restart data.

*prompt:* To help a terminal user by displaying messages that request him to enter information necessary to continue an operation.

*seat:* To plug a logic card into its socket correctly, or to plug two cable connectors together correctly. Contrast with *unseat.*

*seek:* To position the read/write head of the disk drive at a specified location.

*segment:* In a 3600 controller, one of 16 portions into which the programmable storage related to an application program can be divided. The length of each segment is specified by the user.

*segment header:* In a 3600 controller, an 8-byte field at the beginning of each segment. The segment header contains four 2-byte fields, as follows: primary field pointer, secondary field pointer, field-length indicator, and segment-length indicator.

*session:* With reference to communications between the controller and the host system, the period of time during which a logical connection exists between a controller application program (which is serving terminals) and a host application program; thus, the period of time between the point at which a host application program recognizes a controller application program and agrees to exchange messages with it, and the point at which the host application program breaks its connection with the controller application program.

*slot:* A portion of a transmission frame that is sent around a loop. See *loop transmission frame.*

*starter diskette:* A diskette used in a 3600 controller to initiate communication with the host computer and to prepare the controller for reception and recording of the configuration image. Just before the configuration image is to be sent to the controller, the starter diskette is removed and replaced by a formatted diskette on which the image is actually written. After a configuration image has been written on a diskette, it is known as an *operating diskette.* See also *operating diskette.*

*synchronous data link control* (SDLC) A line-control discipline that allows efficient serial-by-bit synchronous transmissions between buffered units on a data transmission link under central control. The data-transmission link may be customer-owned, leased, or switched facilities in a duplex, half-duplex, or loop configuration.

*system monitor:* The portion of the configuration image in a controller that handles communications with control operators and records error statistics and other operational data.

*temporary file* (on a controller diskette): A file on a diskette that can be overwritten when it is no longer needed. Data in a temporary file is not retained from one controller startup to the next. Contrast with *permanent file.*

*terminal:* A point in a communication network at which data can enter and leave. See also *terminal component.*

*terminal component:* A separately addressable part of a terminal. The component performs an input or an output function, but usually not both.

*track:* (1) *The portion of a moving storage medium, such as drum, tape, or disk, that is accessible to a given reading head position. (2) In the controller, the portion of the diskette that is accessible to a given position of the diskette drive read/write head. (3) In a 3600 system, to display the information entered at a 3604 keyboard on the display screen of the same 3604.

*transaction:* (1) In a 3600 system, generally, an exchange between a terminal and another unit to effect a particular action or result. (2) More specifically, a single communication action involving an inquiry from a terminal that produces a response containing desired information (such as a request from a terminal for a customer's account balance) or a more complex action in which data records must be changed (such as a request to update a customer's balance with a new deposit).

*unseat:* With reference to logic cards on controller boards 01A1, 01A2, and 01B1, to open both levers (upper and lower) of a logic card holder. This action breaks the electrical connection between the card and the card socket without the necessity of removing the card from the socket.

*user work station:* (1) A terminal or group of terminals, usually located near each other in a financial establishment, that are considered by one or two operators to be the terminal or group of terminals at which they are to perform their transactions. (2) Logically related terminals that are associated with the same logical work station inside the controller. (3) See also *logical work station.*

*work station:* See *user work station* and *logical work station.*

BLANK PAGE

# Appendix C. Index

BLANK PAGE

# Appendix D. List of Pages

| Page | EC | REA | Form Number |
|---|---|---|---|
| Title Page | | | SY27-2519-0 |
| Preface | 745948 | | |
| MAP 01 | | | |
| 1-1 | | | |
| 1-2 | | | |
| 1-3 | | | |
| MAP 2-1 | | | |
| 2-2 | | | |
| 2-3 | | | |
| 2-4 | | | |
| 2-5 | | | |
| 2-6 | 745948 | | SY27-2519-0 |
| 2-7 | 745949 | | TNL SN31-0864 |
| 2-8 | 745949 | | TNL SN31-0864 |
| 2-9 | 745948 | | SY27-2519-0 |
| 2-10 | | | |
| 2-11 | | | |
| MAP 3-1 | | | |
| 3-2 | | | |
| 3-3 | | | |
| 3-4 | | | |
| MAP 4-1 | | | |
| 4-2 | | | |
| 4-3 | 745948 | | SY27-2519-0 |
| MAP 5-1 | 745949 | | TNL SN31-0864 |
| 5-2 | 745949 | | TNL SN31-0864 |
| 5-3 | 745948 | | SY27-2519-0 |
| MAP 6-1 | | | |
| 6-2 | | | |
| 6-3 | | | |
| 6-4 | | | |
| MAP 7-1 | | | |
| 7-2 | | | |
| 7-3 | | | |
| MAP 8-1 | | | |
| 8-2 | | | |
| 8-3 | | | |
| 8-4 | | | |
| MAP 9-1 | | | |
| 9-2 | | | |
| 9-3 | | | |
| MAP 10-1 | | | |
| 10-2 | | | |
| 10-3 | | | |
| 10-4 | | | |
| MAP 11-1 | 745948 | | SY27-2519-0 |

| Page | EC | REA | Form Number |
|---|---|---|---|
| MAP 12-1 | 745948 | | SY27-2519-0 |
| 12-2 | 745949 | | TNL SN31-0864 |
| 12-3 | 745948 | | SY27-2519-0 |
| 12-4 | | | |
| MAP 13-1 | | | |
| MAP 14-1 | | | |
| 14-2 | | | |
| 14-3 | | | |
| MAP 15-1 | | | |
| MAP 16-1 | | | |
| 16-2 | | | |
| 16-3 | | | |
| 16-4 | | | |
| MAP 17-1 | | | |
| 17-2 | | | |
| 17-3 | | | |
| 17-4 | | | |
| 1-1R | | | |
| 1-2R | | | |
| 1-3R | | | |
| 1-4R | 745948 | | SY27-2519-0 |
| 1-5R | 745949 | | TNL SN31-0864 |
| 1-6R | 745948 | | SY27-2519-0 |
| 1-7R | | | |
| 1-8R | | | |
| 1-9R | | | |
| 1-10R | | | |
| 1-11R | | | |
| 1-12R | | | |
| 1-13R | | | |
| 1-14R | | | |
| 1-15R | | | |
| 1-16R | | | |
| 1-17R | | | |
| 1-18R | | | |
| 1-19R | | | |
| 1-20R | | | |
| 1-21R | | | |
| 1-22R | | | |
| 1-23R | | | |
| 1-24R | | | |
| 1-25R | | | |
| 1-26R | | | |
| 1-27R | | | |
| 1-28R | | | |
| 1-29R | | | |
| 1-30R | 745948 | | SY27-2519-0 |

| Page | EC | REA | Form Number |
|---|---|---|---|
| 1-31R | 745948 | | SY27-2519-0 |
| 1-32R | | | |
| 1-33R | | | |
| 1-34R | | | |
| 1-35R | | | |
| 1-36R | | | |
| 1-37R | | | |
| 1-38R | | | |
| 1-39R | | | |
| 1-40R | | | |
| 1-41R | | | |
| 1-42R | | | |
| 1-43R | | | |
| 1-44R | | | |
| 1-45R | | | |
| 1-46R | | | |
| 1-47R | | | |
| 1-48R | | | |
| 1-49R | | | |
| 1-50R | | | |
| 1-51R | | | |
| 1-52R | | | |
| 1-53R | | | |
| 1-54R | | | |
| 1-55R | | | |
| 1-56R | | | |
| 1-57R | | | |
| 1-58R | | | |
| 1-59R | | | |
| 1-60R | 745948 | | SY27-2519-0 |
| 1-61R | 745949 | | TNL SN31-0864 |
| 1-62R | 745948 | | SY27-2519-0 |
| 1-63R | | | |
| 1-64R | | | |
| 1-65R | 745948 | | SY27-2519-0 |
| 1-66R | 745949 | | TNL SN31-0864 |
| 1-67R | 745948 | | SY27-2519-0 |
| 1-68R | | | |
| 1-69R | | | |
| 1-70R | | | |
| 1-71R | | | |
| 1-72R | | | |
| 1-73R | | | |
| 1-74R | | | |
| 1-75R | | | |
| 1-76R | 745948 | | SY27-2519-0 |
| 1-77R | 745949 | | TNL SN31-0864 |
| 1-78R | 745948 | | SY27-2519-0 |
| 1-79R | 745948 | | SY27-2519-0 |

| Page | EC | REA | Form Number |
|---|---|---|---|
| 1-80R | 745948 | | SY27-2519-0 |
| 1-81R | 745949 | | TNL SN31-0864 |
| 1-82R | 745948 | | SY27-2519-0 |
| 1-83R | | | |
| 1-84R | | | |
| 1-85R | | | |
| 1-86R | | | |
| 1-87R | | | |
| 1-88R | | | |
| 1-89R | | | |
| 1-90R | | | |
| 1-91R | | | |
| 1-92R | | | |
| 1-93R | | | |
| 1-94R | 745948 | | SY27-2519-0 |
| 1-95R | 745949 | | TNL SN31-0864 |
| 1-96R | 745948 | | SY27-2519-0 |
| 1-97R | | | |
| 1-98R | | | |
| 1-99R | | | |
| 1-100R | 745948 | | SY27-2519-0 |
| 1-101R | 745949 | | TNL SN31-0864 |
| 1-102R | | | |
| 1-103R | | | |
| 1-104R | | | |
| 1-105R | | | |
| 1-106R | | | |
| 1-107R | 745949 | | TNL SN31-0864 |
| 1-108R | 745948 | | SY27-2519-0 |
| 1-109R | 745949 | | TNL SN31-0864 |
| 1-110R | 745948 | | SY27-2519-0 |
| 1-111R | | | |
| 1-112R | | | |
| 2-1 | | | |
| 2-2 | 745948 | | SY27-2519-0 |
| 2-3 | 745949 | | TNL SN31-0864 |
| 2-4 | 745948 | | SY27-2519-0 |
| 3-1 | 745949 | | TNL SN31-0864 |
| 3-2 | 745948 | | SY27-2519-0 |
| 3-3 | | | |
| 3-4 | | | |
| 3-5 | | | |
| 3-6 | | | |
| 3-7 | | | |
| 3-8 | | | |
| 3-9 | | | |
| 3-10 | | | |
| 3-11 | | | |
| 3-12 | 745948 | | SY27-2519-0 |

Appendix D.  List of Pages (Cont)

| Page | EC | REA | Form Number |
|------|-----|-----|-------------|
| 3-13 | 745948 | | SY27-2519-0 |
| 3-14 | | | |
| 3-15 | | | |
| 3-16 | 745948 | | SY27-2519-0 |
| 3-17 | 745949 | | TNL SN31-0864 |
| 3-18 | 745949 | | TNL SN31-0864 |
| 3-19 | 745949 | | TNL SN31-0864 |
| 3-20 | 745948 | | SY27-2519-0 |
| 3-21 | | | |
| 3-22 | | | |
| 3-23 | 745948 | | SY27-2519-0 |
| 3-24 | 745949 | | TNL SN31-0864 |
| 3-25 | 745949 | | TNL SN31-0864 |
| 3-26 | 745949 | | TNL SN31-0864 |
| 3-27 | 745949 | | TNL SN31-0864 |
| 3-28 | 745948 | | SY27-2519-0 |
| 3-29 | 745949 | | TNL SN31-0864 |
| 3-30 | 745949 | | TNL SN31-0864 |
| 3-31 | 745949 | | TNL SN31-0864 |
| 3-32 | 745948 | | SY27-2519-0 |
| 3-33 | | | |
| 3-34 | | | |
| 3-35 | | | |
| 3-36 | | | |
| 3-37 | 745948 | | SY27-2519-0 |
| 3-38 | 745949 | | TNL SN31-0864 |
| 3-39 | 745949 | | TNL SN31-0864 |
| 3-40 | 745949 | | TNL SN31-0864 |
| 3-41 | 745948 | | SY27-2519-0 |
| 3-42 | 745948 | | SY27-2519-0 |
| 3-43 | 745948 | | SY27-2519-0 |
| 3-44 | 745949 | | TNL SN31-0864 |
| 3-45 | | | |
| 3-46 | | | |
| 3-47 | | | |
| 3-48 | 745949 | | TNL SN31-0864 |
| 3-49 | 745948 | | SY27-2519-0 |
| 3-50 | | | |
| 4-1 | | | |
| 4-2 | 745948 | | SY27-2519-0 |
| 4-3 | 745949 | | TNL SN31-0864 |
| 4-4 | 745949 | | TNL SN31-0864 |
| 4-5 | 745949 | | TNL SN31-0864 |
| 4-6 | 745948 | | SY27-2519-0 |
| 5-1 | | | |
| 5-2 | | | |
| 6-1 | | | |
| 6-2 | | | |
| 6-3 | 745948 | | SY27-2519-0 |

| Page | EC | REA | Form Number |
|------|-----|-----|-------------|
| 6-4 | 745948 | | SY27-2519-0 |
| 6-5 | | | |
| 6-6 | | | |
| A-1 | | | |
| A-2 | | | |
| B-1 | | | |
| B-2 | | | |
| C-1 | | | |
| C-2 | 745948 | | SY27-2519-0 |
| D-1 | 745949 | | TNL SN31-0864 |
| D-2 | 745949 | | TNL SN31-0864 |
| Reader's Comment | | | SY27-2519-0 |
| Business Reply | | | SY27-2519-0 |
| Back Cover | | | SY27-2519-0 |

EC 745948

G H          3602 Power
1 1

PAGE 2 OF 4

**010**
Go to Step 012, Entry Point D.

**011**
Turn off power.
- Replug all voltage connectors on board 01A1, including 01A1Z3.
- Unplug all voltage connectors on board 01B2.
- Turn on power.

**Are all voltages within limits?**
Y N

   **012**
   **(Entry Point D)**

   - Replug all voltage connectors on board 01A1, including 01A1Z3 and/or 01B2.
   - Unplug the voltage connector on power supply TSR 1 (3-8).
   - Turn on power.

   **Are all voltages within limits?**
   Y N

      **013**
             **CAUTION**
      Turn off power.
      - Unplug all voltage connectors on boards 01B1, 01B2, 01A1, 01A2.
      - Unplug the special voltage cables at 01B1Y4, 01A1Z3, and 01A2Z3. (Slip-on connectors A2D07,V2D07 on later machines).
      - Unplug the cable from 01B1Z3 at the diskette drive control card, including the ground wire.
      - Disconnect the ground strap at 01A1TB1 (3-8).
      - Measure the resistance between the dc return, various voltage leads, and frame ground. Refer to Figure 3-8.

      **Are there any short circuits?**
      Y N

         **014**
                **CAUTION**
         Turn off power.
         - Replace power supply TSR 3.
         - Replug all connectors and ground straps.
         - Turn on power.

         **Are all voltages within limits?**
         Y N

            **015**
            - Call for aid.

         **016**
         - Verify fix.

J K L

---

F J K L
1

**017**
- Repair or replace cable, or cause of short.
- Verify fix.

**018**
- Replace power supply TSR 1.
- Verify fix.

**019**
          **CAUTION**
Turn off power.
- Replug all board 01B2 voltage connectors.
- Unseat all cards on board 01B2.
- Turn on power.

**Are all voltages now within limits?**
Y N

   **020**
   - Replace board 01B2.
   - Verify fix.

**021**
          **CAUTION**

Turn off power when reseating a card.
- Reseat a few cards at a time on board 01B2 to find problem card.
- Replace problem card and reseat others.
- Verify fix.

**022**
          **CAUTION**
Turn off power.
- Replug all board 01A1 voltage connectors.
- Unseat all cards on board 01A1.
- Turn on power.

**Are all voltages now within limits?**
Y N

   **023**
   - Replace board 01A1.
   - Verify fix.

**024**
          **CAUTION**
Turn off power when reseating a card.
- Reseat a few cards at a time on board 01A1 to find problem card.
- Replace problem card and reseat others.
- Verify fix.

# Chapter 1. Maintenance Analysis Procedures (MAPs)

PAGE 1 OF 1

3600 CONTROLLER

MAINTENANCE ANALYSIS PROCEDURES (MAPs)

CAUTION: These MAP's deal with more than one
machine type/feature. Included are questions
about items this machine may not have.

Logic cards are called by name, refer to the
card list and board layout in Chapter 1, Maintenance
Procedures or the board charts located in later
machines for locations.

Contents

**Error Indication Index**

PAGE 1 OF 3

CAUTION: These MAP's deal with more than one machine type/feature.
Included are questions about items this machine may not have.

| Error Indication | Go to MAP |
|---|---|
| Controller Log Messages:<br>11 001 ** 900XX XXXX **<br>11 005 Loop X Error Code Y Z<br>11 006<br>11 007 XX--XX<br>11 008 | 12<br>3,4,5<br>6<br>12<br>7 |
| Displayed Messages:<br>82000, 82001, 82031-82037, 82070, 82071<br>82074, 82075<br>82080, 82090, 82093, 82094<br>82092<br>90002, 90012, 90014<br>82010, 82020<br>82030<br>90027, 90028 | 2<br>2<br>9<br>3<br>10<br>10<br>2<br>12 |
| Diskette Statistic Counters<br>1<br>7<br>2, 3, 4, 5, 6, 8<br>9 | 8<br>9<br>10<br>No action needed |
| Miscellaneous:<br>Nothing displayed at startup time<br>Diskette not turning<br>Diskette seek error<br>Diskette data check or write error<br>All terminals on one local loop failing,<br>READY lights off or flashing<br>All terminals on one remote 1200 bps loop<br>failing, READY light off or flashing<br>All terminals on one remote external<br>modem loop failing, READY lights off<br>or flashing<br>Loop statistic counters<br>Host communication link problem<br>Link statistic counters<br>No reported symptom, or symptom reported<br>does not definitely lead to one MAP<br>Startup error occurs only on 1 or 2 start<br>Power | 2<br>8<br>9<br>10<br><br>3<br><br>4<br><br><br>5<br>3,4,5<br>6<br>6<br><br>2<br>2<br>14 |

**Error Indication Index**

```
----------------------------------------------------------------
|  Error Indication                        |  Go to MAP        |
|------------------------------------------|-------------------|
|  Startup diagnostic message sequence stops |                 |
|  At:                                     |                   |
|  MVX XXX                                 |  2                |
|  LSW, LDI                                |  2                |
|  INS                                     |  2                |
|  IDL, IRT, HSH                           |  8                |
|  LDC, PCK, ESA, INV, ROS, LEC            |  13               |
|  DTC                                     |  2                |
----------------------------------------------------------------
```

MAPs    and possible FRUs
Suggestion:
For intermittent problems, refer to
the possible FRU list for the indicated
MAP.

NOTE: As you become familiar with the system you may choose to
enter the MAPs at any point based upon your observation, the
customer's description of the trouble, and your experience.
If, however, you do not correct a problem on your first pass
through the MAPs, you should use MAP 2. This will make sure that
you observe error indications which you may not have observed,
or which you believed to be not connected with the problem.

**Error Indication Index**

PAGE 3 OF 3

| MAP | FRUs |
|-----|------|
| 2 | This MAP is for use when problem is not defined. Therefore, it is not reasonable to list possible FRUs |
| 3 | Loop CTRL card |
| 4 | Loop CTRL card<br>M/D Rcvr/Xmit card |
| 5 | Loop CTRL card<br>EIA/PTT card |
| 6 | CA card (with or without clocking)<br>M/D Xmit card (Host 15)<br>M/D Rcvr card (Host 15)<br>M/D Wrap card (Host 15)<br>EIA card (Host 15)<br>38LS EIA card (Host 15)<br>38LS M/D card (Host 15) |
| 7 | CA card (with or without clocking)<br>M/D Xmit card (ALA XX)<br>M/D Rcvr card (ALA XX)<br>M/D wrap card (ALA XX)<br>EIA card (ALA XX)<br>38LS M/D card (ALA XX)<br>38LS EIA card (ALA XX) |
| 8<br>9<br>or<br>10 | Diskette drive control card<br>Diskette adapter card<br>Phototransistor<br>Light emitter diode<br>Diskette drive mechanical and electromechanical parts |
| 10 | All cards on basic controller board |
| 11-12 | DE unit parts |
| 13 | CTLR 1 card<br>CTLR 2 card<br>CTLR 3 card<br>FSU 1 Vol. 0 card<br>ESA 1 card<br>ESA 2 card |
| 14 | All cards |
| 15-19 | Power:<br>Circuit breaker<br>Fuse<br>Power switch<br>Power supplies |

## Check for Error

## Indications

PAGE 1 OF 11

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 1 | A | 1 | 001 |
| 13 | F | 5 | 027 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 11 | 114 | 10 | A |
| 11 | 109 | 10 | A |
| 9 | 073 | 10 | A |
| 8 | 057 | 10 | A |
| 8 | 048 | 10 | A |
| 9 | 063 | 11 | A |
| 10 | 097 | 12 | A |
| 10 | 096 | 12 | A |
| 10 | 090 | 12 | A |
| 3 | 009 | 14 | A |
| 5 | 026 | 14 | A |
| 9 | 060 | 14 | A |
| 8 | 058 | 14 | A |
| 8 | 055 | 14 | A |
| 8 | 051 | 14 | A |
| 2 | 004 | 15 | A |
| 10 | 104 | 3 | A |
| 7 | 042 | 3 | A |
| 10 | 103 | 4 | A |
| 10 | 102 | 5 | A |
| 11 | 113 | 6 | A |
| 11 | 112 | 7 | A |
| 10 | 094 | 7 | A |
| 11 | 115 | 8 | A |
| 11 | 111 | 8 | A |
| 9 | 075 | 8 | A |
| 6 | 030 | 8 | A |
| 11 | 110 | 9 | A |
| 9 | 074 | 9 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

**(Entry Point A)**
- Check for loose cards and cables. Be sure to check all small cards and cable connectors.
- Insure that fan/s are running. (Power distribution diagrams)
- For a failure that occurs when the controller RESET switch is activated but does not occur when the controller power switch is activated, refer to Power
(Step 001 continues)

**Check for Error Indications**

PAGE  2 OF  11

(Step 001 continued)
    distribution diagrams.
**Is the controller power indicator on?**
Y  **N**

|   **002**
|   **Is the controller power cord plugged in and power**
|   **switch turned on?**
|   Y  **N**
|   |
|   |   **003**
|   |   Plug cord in and/or turn on power.
|   |   • Verify fix.
|   |
|   **004**
|   **Go To Map 15, Entry Point A.**

**005**
• Open the outside front cover.
**Is there a diskette rotation problem that you can**
**readily observe?**
Y  **N**

|   **006**
|   • Attempt to log on (1.2) at a 3604.  If unsuccessful,
|     try others.
|   **Is logon successful?**
|   Y  **N**
|   |
|   |   **007**
|   |   **Go to Page 4, Step 017, Entry Point D.**
|   |
|   **008**
|   **(Entry Point B)**
|   • If a functioning printer is available, key the
|     command that assigns it to be the output printer.
|   006 XXXX Y Assign printer XXXX, side
|             Y, as output printer. See
|             procedures (1.4) for more
|             detail.
|   • Now, key the command to print statistic counters
|     for all components.  If no printer is available, key the
|     command to display statistic counters of one
|     component at a time.  On your first pass through
|     this MAP, display only those associated with the
|     customer complaint.
|   012 Y (Print statistic counters for all components,
|   where Y=total number of loops attached to controller.)
|   010 LSSD (Print statistic counters for component
|   specified by LSSD.) See procedures (1.5) for more
|   detail.
|   **Does the system print or display the statistic**
|   **counters?**
|   Y  **N**
|   |  |
|   |  |
|   |  |
|   |  |
1  |  |
1  3  3
A  B  C

B C    **Check for Error Indications**
2 2

PAGE 3 OF 11

**009**
**Go To Map 14, Entry Point A.**

**010**
• Key a command to display or print some or all of the controller log (1.6).
**Does the system respond by displaying error message 90002?**
Y N

   **011**
   • Check the statistic counters and the controller log. Also note the condition of the READY light on all powered terminals.*A* On your first pass through this MAP, check only those easily available.
   • Also use the customers complaint in answering the following questions.
   **(Entry Point C)**

   **Does the data checked above indicate a host communication link problem?**
   Y N

      **012**
      **Does the data indicate an alternative line failure?**
      Y N

         **013**
         **Does the data indicate a diskette problem?**
         Y N

            **014**
            **Does the data indicate a loop problem?**
            Y N

*A*
Refer to IBM 3600 System, FE Maintenance Information Manual, SY27-2520 for the meaning of the statistic counters and the log messages. The READY lights of all powered terminals should be on solid. A loop problem is indicated if any of these lights are off or flashing.
• If the data directs you to a Map in this manual go to that MAP.
• If the data indicates that a terminal is failing, go to the Maintenance Information manual for that terminal.
• Otherwise return to Entry Point C of this MAP.

```
1 1 1 1 1
1 1 1 0 0 4
1 1 1 0 0 4
D E F G H J
```

J
3

**Check for Error Indications**


PAGE  4 OF  11


**015**
**Does the data indicate a disk storage problem?**
Y  N
.

  **016**
  • If your machine has disk storage, key in the
    commands to run the disk storage tests (command
    codes 091,2,3).
  **Do these tests fail?**
  Y  N

    **017**
    **(Entry Point D)**
    **Has backup operating diskette been tried?**
    Y  N

      **018**
      • Remove original diskette.
      • Load backup operating diskette.
      • Press controller RESET switch to startup.
      **Is startup good (1.1.3)?**
      Y  N

        **019**
        **Go to Step 021, Entry Point E.**

      **020**
      The original diskette was the problem, or the
      problem no longer exists.
      • Request customer to verify fix.
      • Verify fix.

  **021**
  **(Entry Point E)**
  Turn off power.
  • Remove the diskette that is in the controller.
  • Load the Starter Diskette.*B*
  • Manually move Read/Write Head upward (away
    from track 0) by at least four tracks.*C*.
  • Turn power on (reset).
  **Is startup good (1.1.3)?**
  Y  N

    **022**
                    **CAUTION**
    Turn off power.
    • Unseat the redrive card, if present.
    • Lock the DE access arm, if present (3.4.1).
    • Turn on power.
    **Is startup good (1.1.3)?**
    Y  N

*B*
For starter diskette information, refer to 3.3.3.  If the
starter diskette does not operate correctly, try the backup
starter diskette, if available.
*C*
Moving head away from track 0 enables you to see head
step from track to track as it seeks track 0 during startup.

1  1
0  0  9  9  5
K  L  M  N  P

P
4

**Check for Error Indications**

PAGE 5 OF 11

**023**
**CAUTION**
Turn off power.
• Reseat the redrive card, if present.
• Unlock the DE access arm, if present (3.4.1).
**Did the diagnostic message sequence get started (IDL displayed)?**
Y N

  **024**
  **Did the ready light of the 3604 at address 1 on loop 1 flash on and off during the startup attempt?**
  Y N

    **025**
    **Did the diskette drive seek (head assembly move to track 0 of the diskette)?**
    Y N

      **026**
      **Go To Map 14, Entry Point A.**

  **027**
  **(Entry Point F)**
  The problem appears to be a failure to communicate with the 3604 at address 1 on loop 1. The method of isolating the problem depends on your configuration. The following isolation methods are recommended. They are not necessarily connected with each other, nor are they in any order.
  • Check that the 3604 address and speed switches are set correctly.*D*
  • Turn off power at other terminals on loop 1. Another terminal may be causing loop to fail.
  • Change the cabling, if necessary, so that the 3604 at address 1 on loop 1 is physically the first terminal on the loop. Another terminal may be causing the loop to fail.
  • Observe READY indicators at other terminals to determine if failure is in controller or 3604. If any of these indicators flash ON and OFF, problem is in 3604.
  • Check the continuity from the controller board to the terminal address card in the 3604.*E*
  • Check the speed jumper for the loop 1 control card for correct setting and continuity.*F*
  • Change the loop 1 control card in the controller.
  **CAUTION**
  Turn off power whenever you change a card.
  • If the above checks do not result in problem identification, the problem is most likely a 3604 problem. Refer to the 3604 Maintenance Information manual.

*D*
The address switches are Switch Group 1. For address 1, switch 1 should be ON. Switches 2, 3, and 4 should be OFF.
The speed switches are Switch Group 2. One switch should be turned on, as follows.

| Switch | Speed (bps) |
| ------ | ----------- |
| 1 | 600 |
| 2 | 1200 |
| 3 | 2400 |
| 4 | 4800 |

*E*
Refer to Figure 3-6 for internal loop 1 cabling from board to the controller cable panel. Refer to the 3604 Maintenance Information manual for wiring internal to the 3604.
*F*
For all loop cards, the speed is selected by jumpering as follows:

| | Jumper | |
| Speed (bps) | From Pin | To Pin |
| ----------- | -------- | ------ |
| 600 | S10 | J11 |
| 1200 | S10 | J07 |
| 2400 | S10 | J10 |
| 4800 | S10 | J09 |

6 6
Q R

Q R                **Check for Error Indications**          X
5 5

PAGE 6 OF 11

**028**
The problem appears to be in 3604.
• Turn off power to all loop 1 devices to prevent address interference. At least IDL should display when the 3604 READY light flashes.
• Change loop 1 control card, if that does not correct the problem, go to the 3604 MAPs.

**029**
**(Entry Point G)**
**Does the head carriage assembly go toward track 0 and the pressure pad or head push against the diskette?**
Y N

|
| **030**
| Go To Map 8, Entry Point A.

**031**
**Did the diagnostic message sequence terminate at an identified storage card (MVX message)? Sometimes, the message may identify more than one card as a possibility. MVX 0, take the No Leg, MVX MAX, take the yes leg.**
Y N

|
| **032**
| **Did diagnostic message sequence terminate at any of the following: LDC, ROS, PCK, ESA, LEC, MV2 0, MV3 0, or INV?**
| Y N
|
| | **033**
| | **Did diagnostic message sequence terminate at IDL or IRT or repeat a part of the diagnostic message sequence?**
| | Y N
| |
| | | **034**
| | | **Did diagnostic message sequence terminate at LSW?**
| | | Y N
| | |
| | | | **035**
| | | | **Did diagnostic message sequence terminate at LDI?**
| | | | Y N

**036**
**Did diagnostic message sequence terminate in HSH?**
Y N

|
| **037**
| **(Entry Point H)**
| **Did operation terminate with INS, 82000, 82001, 82030-82037, 82070, 82071, 82074, or 82075 displayed?**
| Y N
|
| | **038**
| | **Did the startup message sequence terminate with 82092 displayed?**
| | Y N
| |
| | | **039**
| | | **Were any other 82XXX or 9XXXX error messages displayed?**
| | | Y N
| | |
| | | | **040**
| | | | You have reached this point possibly for one of the reasons given below (and possibly under the condition that the startup message sequence terminated in DTC). Check these possibilities now. If problem is not corrected, return to beginning of this map and/or call for aid.
| | | | • Check speed jumpers for all loop cards. See chart on end of gate.
| | | | • The startup message appeared on a 3604 that you did not observe. Unseat the loop cards in the controller for all loops other than loop 1, if you wish to remove the requirement of looking at 3604s on other loops.
| | | | • If this failure occurs only on a '1' or a '2' start (3.3.2), change the HOST CA card.
| | | | • Loop 1 is failing. Check speed jumper for loop 1 for continuity, and change the loop 1 control card.
| | | | Check continuity of internal cabling for loop 1 (Figure 3-6). Also, check continuity of external cabling for loop 1, or try substitute cabling.
| | | | • A diskette signal failed. Change diskette card.
| | | | • You may not have followed MAP correctly.
| | | | • The problem no longer exists.

```
8 8 8 8 8                       8 7 7 7
S T U V W   X                   Y Z A A
            X                       A B
```

EC 745948

```
Z  A  A
6  A  B
   A  A
   6  6
```

**Check for Error Indications**

**041**
Refer to the IBM 3600 System, FE Maintenance Informatioal Manual, SY27-2520 for meaning of the message. Then reenter controller MAPs or go to the MAPs for correct terminal.

**042**
**Go To Map 3, Entry Point A.**

**043**
These messages are usually caused by a configuration image error or by a storage card not being seated correctly **J**. To identify configuration image errors, use the starter diskette (Ref. 3.3.3).
**CAUTION**
Turn off power.
• If this failure occurs only on a '1' or '2' start (3.3.2), change the HOST CA card.
• If this failure occurs only on the customers diskette, use the starter diskette to start any optional loops (command code 040) to determine if there is a loop problem. If yes, refer to the appropriate loop MAP.
• Reseat all memory cards (Some of these cards are optional.)
Turn on power.

**J**
• When the startup diagnostic routine finds an error in functional storage, the displayed diagnostic message sequence terminates with MVX N, where N identifies an 8K block of memory, if the error is not at the first address on that block.
• When the diagnostic routine finds an error at the first address of an 8K block, it assumes that card location is not included in this specific storage configuration, and temporarily displays MVX with the card identifier. MVX 0 indicates that there are no cards in this volume.
• Press RESET to startup and view the temporary messages again.
• If there is a card in the location given by a temporary MVX message, then the possible corrective actions are: change the card, check the supply voltages at the card sockets (see 3.10) and inspect socket pins.

| Displayed Message | OR | Displayed Message | 8K Block |
|---|---|---|---|
| MVX H/P | | MVX 1 | FSU 1 |
| MVX G/Q | | MVX 2 | FSU 2 |
| MVX F/R | | MVX 3 | FSU 3 |
| MVX E/S | | MVX 4 | FSU 4 |
| MVX D/T | | MVX 5 | FSU 4 |
| MVX C/U | | MVX 6 | FSU 5 |
| MVX B/V | | MVX 7 | FSU 7 |
| MVX A/W | | MVX 8 | FSU 8 |
| MVX MAX | | MVX MAX | ** |

**All volume tested ok.

**Is operation good (1.1.3)? J**
Y N

**044**
**CAUTION**
Turn off power.
• One at a time, change all of the FSU memory cards and adapter cards (loop, diskette, etc.).
• Remember to return the original card each time a card does not correct problem.
**Does any card change result in good operation?**
Y N

```
8  8  8
A  A  A
C  D  E
```

W Y A A A   **Check for Error Indications**
6 6 C D E
   7 7 7

PAGE  8 OF  11

**045**
Problem appears to be in user's program.
• If this problem appears only when the
  customers operating diskette is used,
  advise the customer.
• Otherwise, call for aid.

**046**
• Verify fix.

**047**
• Verify fix.

**048**
Go To Map 10, Entry Point A.

**049**
            **CAUTION**
Turn off power.
• Change FSU 1 Vol. 0 card.
• Turn on power (reset).
**Is startup good (1.1.3)?**
Y N

    **050**
            **CAUTION**
   Turn off power.

   • Return original FSU 1 card Vol. 0
   • Change FSU 3 Vol. 0 card.
   • Turn on power (reset).
   **Is startup good (1.1.3)?**
   Y N

      **051**
                **CAUTION**
      Turn off power.
      • Return original FSU 3 Vol. 0 card.
      **Go To Map 14, Entry Point A.**

   **052**
   • Verify fix.

**053**
• Verify fix.

**054**
            **CAUTION**
Turn off power.
• One at a time change the following cards:

ESA 1
FSU 1 Vol. 1
ESA 2
CTLR 1
CTLR 2
CTLR 3
FSU 1 Vol. 0

Turn on power after each card change.
• Remember to return original card each time a
  card change does not correct the problem.
**Does any card change result in a good
startup(1.1.3)?**
Y N

   **055**
   Go To Map 14, Entry Point A.

**056**
• Verify fix.

**057**
Diskette Data Check,
Go To Map 10, Entry Point A.

**058**
Go To Map 14, Entry Point A.

**059**
            **CAUTION**
Turn off power.
• Change the identified storage card/cards.

| Displayed Message | OR | Displayed Message | 8K Block |
|---|---|---|---|
| MVX H/P | | MVX 1 | FSU 1 |
| MVX G/Q | | MVX 2 | FSU 2 |
| MVX F/R | | MVX 3 | FSU 3 |
| MVX E/S | | MVX 4 | FSU 4 |
| MVX D/T | | MVX 5 | FSU 4 |
| MVX C/U | | MVX 6 | FSU 5 |
| MVX B/V | | MVX 7 | FSU 7 |
| MVX A/W | | MVX 8 | FSU 8 |
| MVX MAX | | MVX MAX | ** |

**All volume tested ok.
NOTE: If there is no card in the
identified location, or if all tested
good, go to MAP 14 Entry Point A.
(Step 059 continues)

EC 745949

M N                    **Check for Error Indications**                    A A
4 4                                                                       G H

PAGE  9 OF  11

(Step 059 continued)

• Turn on power (reset).
**Is startup good (1.1.3)?**
Y N

> **060**
> **CAUTION**
> Turn off power.
> • Return original storage card/cards.
> **Go To Map 14, Entry Point A.**

**061**
• Verify fix.

**062**
• Turn off power.
• Unseat loop control cards 7 and 8, if present.
• Reseat the redrive card.
• Turn on power (reset).
**Is startup good (1.1.3)?**
Y N

> **063**
> **Go To Map 11, Entry Point A.**

**064**
• Turn off power.
• One at a time, reseat loop control cards 7 and 8 to determine which is causing the failure.
• Replace the failing card and reseat the other.
• Unlock the DE access arm, if required (3.4.1).
• Verify fix.

**065**
**(Entry Point I)**
• Key the commands to run diskette exerciser tests:

Diskette read test: Command code 031.
Diskette seek test: Command code 034.

CAUTION: Once a diskette is written on by this command, it may no longer be used for startup. Do not write on the starter diskette.

Diskette write test: Command code 936.

Note: Test both sides of the diskette, if 2 sided.
**Do these tests run without error?**
Y N

> **066**
> **Is the failure only on the second side of the diskette?**
> Y N

1
0
A   A   A
F   G   H

**067**
**Is diskette drive Not Ready?**
Y N

> **068**
> **Does diskette drive have a seek error?**
> Y N
>
> > **069**
> > **Does diskette drive have a data check?**
> > Y N
> >
> > > **070**
> > > **Is this the first time at this step?**
> > > Y N
> > >
> > > > **071**
> > > > • Call for aid
> > >
> > > **072**
> > > **Go to Page 4, Step 021, Entry Point E.**
> >
> > **073**
> > **Go To Map 10, Entry Point A.**
>
> **074**
> **Go To Map 9, Entry Point A.**

**075**
**Go To Map 8, Entry Point A.**

**076**
**(Entry Point J)**
• Turn off power.
• Replace the diskette drive control card (1.93).
• Turn on power and retest the diskette.
**Is the problem corrected?**
Y N

> **077**
> • Turn off power.
> • Return the original diskette drive control card.
> • Replace the diskette adapter card.
> • Turn on power and retest the diskette.
> **Is the problem corrected?**
> Y N
>
> > **078**
> > • Turn off power.
> > • Return the original diskette adapter card.
> > • Check wires 15, 16 and 17 of the cable in Figure 3-3 for continuity and no shorts.
> > **Are the wires good?**
> > Y N

1   1   1   1
0   0   0   0
A   A   A   A
J   K   L   M

A A A A A   **Check for Error Indications**
F J K L M
9 9 9 9 9

PAGE 10 OF 11

G H K L ·A
3 3 4 4 N

**079**
• Repair or replace as required.
• Verify fix.

**080**
• Do the LED/PTX alignment (1.85) and LED service check (1.86).
**Is the problem corrected?**
Y N

  **081**
  • Replace the PTX (1.90 and 1.91).
  **Is the problem corrected?**
  Y N

    **082**
    • Change the head assembly (1.65, 1.66).
    **Is the problem corrected?**
    Y N

      **083**
      • Call for aid.

    **084**
    • Verify fix.

  **085**
  • Verify fix.

**086**
• Verify fix.

**087**
• Verify fix.

**088**
• Verify fix.

**089**
• Load and run the disk storage diagnostic tests, if this is a large file machine. (1.114) (take YES leg if no disk storage).
**Do tests run without error?**
Y N

  **090**
  **Go To Map 12, Entry Point A.**

**091**
**Does this machine have alternative line attachment?**
Y N

  **092**
  • Reload the operating diskette.
  **Go to Page 6, Step 037, Entry Point H.**

A
N

**093**
Load the starter diskette with optional module 6A and run the ALA wrap tests, command code 929.
**Do these tests run without error?**
Y N

  **094**
  **Go To Map 7, Entry Point A.**

**095**
• Reload the operating diskette.
**Go to Page 6, Step 037, Entry Point H.**

**096**
**Go To Map 12, Entry Point A.**

**097**
**Go To Map 12, Entry Point A.**

**098**
**Is the problem with a Local Loop?**
Y N

  **099**
  **Is the problem with a Remote Loop, 1200 bps Internal Modem?**
  Y N

    **100**
    **Is the problem with a Remote Loop, External Modem?**
    Y N

      **101**
      **Go to Page 2, Step 008, Entry Point B.**

    **102**
    **Go To Map 5, Entry Point A.**

  **103**
  **Go To Map 4, Entry Point A.**

**104**
**Go To Map 3, Entry Point A.**

**105**
**Is diskette Not Ready?**
Y N

  **106**
  **Does diskette have Seek Error?**
  Y N

1 1 1
1 1 1
A A A
P Q R

EC 745948

```
D  E  F  A  A  A   Check for Error Indications        A
3  3  3  P  Q  R                                       2
         1  T  1
         0  0  0
                   PAGE 11 OF 11

                   107                                 115
                   Does diskette have Data Check?      Go To Map 8, Entry Point A.
                   Y  N

                      108
                      Go to Page 2, Step 008,
                      Entry Point B.

                      109
                      Go To Map 10, Entry Point A.

                   110
                   Go To Map 9, Entry Point A.

                   111
                   Go To Map 8, Entry Point A.

                112
                Go To Map 7, Entry Point A.

             113
             Go To Map 6, Entry Point A.

114
Go To Map 10, Entry Point A.
```

**Local Loop Problem**

PAGE 1 OF 4

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|------|------|------|------|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
NOTE: In your first pass through this MAP, 'bypass' a suspect terminal by turning off its power switch. In your second pass, 'bypass' a suspect terminal by disconnecting its cables and plugging the cable connectors together.

**(Entry Point B)**
•Verify that the jumper *A* for the loop control card and the speed switches *B* of each terminal on the problem loop are all set for the same speed. The customer will provide you with the information required to locate all the terminals on a loop.
• If only loop 7 or 8 is failing, replace the redrive card first.
• Use the starter diskette to ensure that the loop should be running (Command code 040).
Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

**Are any READY lights flashing on the problem loop?**
Y N

  **002**
  No READY lights are flashing.
  •Bypass the first terminal on loop.
  **Is problem corrected,**
  Y N

    **003**
            **CAUTION**
    Turn off power.
    •Change loop control card.
    •Turn on power (Reset).
    **Is problem corrected?**
    Y N

```
2  2  2  2
A  B  C  D
```

*A*
For each loop control card, the speed is selected by jumpering as follows:

|  | Jumper * | |
|------|------|------|
| Speed (bps) | From Pin | To Pin |
| 600 | S10 | J11 |
| 1200 | S10 | J07 |
| 2400 | S10 | J10 |
| 4800 | S10 | J09 |

*B*
At each terminal the speed is selected by switches (Switch Group 2) that are labeled 1,2,3, and4. To select a speed, set the appropiate switch to the ON position as follows:

| Speed (bps) | Switch |
|------|------|
| 600 | 1 |
| 1200 | 2 |
| 2400 | 3 |
| 4800 | 4 |

B C D     **Local Loop Problem**                 A
1 1 1                                           1

PAGE 2 OF 4

**004**

**CAUTION**

Turn off power.
- Return original loop control card.
- Check the cable from the controller to the first terminal on the loop. (If available, try a substitute cable).

**Is cable good?**
Y N

    **005**
    External cables are customer responsibility. Inform customer of problem.
    • Verify fix.

**006**
- Check the internal cable between logic board and the cable panel for continuity and no shorts. See figure 3-6
- If working on loop 4 or higher check the cables from the basic controller board Z1 and Z2 to the adapter board Y4 and Y5, for continuity and no shorts. Cables are wired point to point with B08, B13, D02, and D08 common.

**Are cables good?**
Y N

    **007**
    • Repair or replace the bad cable.
    • Verify fix.

**008**
**Is this your first pass through the MAP?**
Y N

    **009**
    **Go to Page 3, Step 034, Entry Point D.**

**010**
**Go to Page 1, Step 001, Entry Point B.**

**011**
• Verify fix.

**012**
Problem is with a bypassed terminal.
- Go to the Maintenance Information manual for that terminal.
Also,
**Go to Page 3, Step 034, Entry Point D.**

**013**
**Are all READY lights flashing on this loop?**
Y N

    **014**
    Some, but not all, READY lights are flashing.
    • Bypass the last terminal on which the READY light is flashing.
    **Do the READY lights of the remaining terminals on the loop turn on solid?**
    Y N

        **015**
        • Bypass the first terminal on which the READY light is off.
        **Do the READY lights of the remaining terminals on the loop turn on solid?**
        Y N

            **016**
            • Check the cable between the last terminal on which the READY light is flashing and the first terminal on which the ready light is off. (If available, try a substitute cable.)
            **Is cable good?**
            Y N

                **017**
                External cables are customers responsibility. Inform customer of the problem.
                • Verify fix.

            **018**
            **Is this your first pass through this MAP?**
            Y N

                **019**
                **Go to Page 3, Step 034, Entry Point D.**

            **020**
            **Go to Page 1, Step 001, Entry Point B.**

    **021**
    Problem is with bypassed terminal.
    • Go to Maintenance Information manual for that terminal.
    Also,
    **Go to Page 3, Step 034, Entry Point D.**

    **022**
    Problem is with bypassed terminal-
    • Go to Maintenance Information manual for that terminal.
    Also,
    **Go to Page 3, Step 034, Entry Point D.**

3
E

E
2

**Local Loop Problem**                                    G H

PAGE  3 OF  4

**023**
• Bypass the last terminal on the loop.
**Do the READY lights of remaining terminals on the
loop turn on solid?**
Y  N

   **024**
               **CAUTION**
   Turn off power.
   • Change the loop control card.
   • Turn on power (reset).
   **Is problem corrected?**
   Y  N

      **025**
      **Is this loop #4 or higher?**
      Y  N

         **026**
         **Go to Step 029, Entry Point C.**

      **027**
      Check the cables from the basic controller board
      Z1 and Z2 to the adapter board Y4 and Y5, for
      continuity and no shorts.  Cables are wired point to
      point with B08, B13, D02, and D08 common.
      **Are cables good?**
      Y  N

         **028**
         • Repair or replace bad cable.
         • Verify fix.

      **029**
      **(Entry Point C)**
               **CAUTION**
      Turn off power.
      • Return the original loop control card.
      • Check the cable from the last terminal on the loop
        to the controller.  (If available, try a substitute
        cable.)
      **Is this cable good?**
      Y  N

         **030**
         External    loop    cables    are    customers
         responsibility. Inform customer of problem.
         • Verify fix.

**031**
• Check the internal cable between logic board and the
  cable panel for continuity and no shorts.  See figure
  3-6
**Is cable good?**
Y  N

   **032**
   • Repair or replace internal cable.
   • Verify fix.

**033**
**Is this your first pass through the MAP?**
Y  N

   **034**
   **(Entry Point D)**
   You have just made your second pass through the
   MAP, without finding the problem.  Breaks in loop
   cabling can cause problems that appear not logical.
   Test for a loop cabling break, as follows:
               **CAUTION**
   Turn off power.
   • Remove loop control card.
   • Turn off power at all terminals on the loop.
   • At the board, measure for continuity (no more
     than 40 ohms per 2000 feet) from ring to ring and
     tip to tip around the entire loop.  See Figure 3-6.
     There should also be infinite resistance between
     ring, tip, and shield.
   **Does  the  loop  cabling  have  the  required
   continuity and no shorts?**
   Y  N

      **035**
      Determine whether the problem is in an external
      cable or inside one of the terminals.  If the
      problem is inside one of the terminals, go to the
      maintenance   information   manual   for   that
      terminal.
      External cables are the customers responsibility.

**036**
Possible operating diskette generation problem.
Try starter diskette.  See 3.3.3 for starter diskette
information.
• Call for aid.

**037**
**Go to Page 1, Step 001, Entry Point B.**

**038**
• Verify fix.

4
F  G  H

F
3

**Local Loop Problem**

**039**
Problem is with the bypassed terminal.    Go  to  the
Maintenance Information manual for that terminal.
Also,
**Go to Page 3, Step 034, Entry Point D.**

## 1200 bps Remote Loop Problem

### Internal Modem

PAGE 1 OF 3

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 2 | 009 | 15 | A |
| 2 | 019 | 15 | A |
| 3 | 027 | 15 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
- For the loop in error, verify that it is jumpered for 1200 bps, remote operation, and that its modem cards are 1200 bps cards. See the chart on the end of the gate. *A* If you wish to verify that you are receiving a signal, refer to 1.125.
- Log on (1.2) if you are not already logged on.
- Key in start loop message, 040 0.
- Display/print controller log (1.6) if you have not already done so, and analyze the loop error message (1.7).
- If only loop 7 or 8 is failing, replace the redrive card first.
- If the loop is reported failing but there is no error log message, change the loop control card and the M/D Rcvr/Xmit card, one at a time, to try to correct the problem. Also, use the starter diskette to ensure that the loop should be running (command code 040).

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.
**Is code Y=0?**
Y **N**

  **002**
  **Is code Y=2 or 4?**
  Y **N**

3 2 2
A B C

*A*
For transmit level check, refer to 1.123.

C
1

**1200 bps Remote Loop Problem**

**Internal Modem**

PAGE 2 OF 3

B
1

**003**
Code Y=1 (modem check).
**CAUTION**
Turn off power.
• One at a time, in order indicated, change the following:
  M/D Rcvr/Xmit card.
  Loop control card.
• After each card change: turn on controller power, log on (1.2) and display the controller log (key in 001) to determine if the problem is corrected.
NOTE: Return original card each time a card change does not correct problem.
**Does any card change correct problem?**
Y N

> **004**
> **Is this loop 2 or 3.**
> Y N
>
> > **005**
> > **Go to Step 008, Entry Point B.**
>
> **006**
> Check the cable from the basic controller board Z4 to the adapter board Y2 for continuity and no shorts. The cable is wired point to point with B07, B13, D02, and D08 common.
> **Is cable good?**
> Y N
>
> > **007**
> > • Repair or replace cable.
> > • Verify fix.
>
> **008**
> **(Entry Point B)**
> • Measure the voltages with reference to ground (D08) on the M/D Rcvr/Xmit card and the loop card. See 3.10
> **Are all supply voltages within limits,**
> Y N
>
> > **009**
> > **Go To Map 15, Entry Point A.**
>
> **010**
> • Call for aid.

**011**
• Verify fix.

**012**
Code Y=2 or 4.
**CAUTION**
Turn off power.
• Change loop control card.
• Turn on power, log on (1.2), and display the controller log (key in 001) to determine if problem is corrected.
**Is problem corrected?**
Y N

> **013**
> **CAUTION**
> Turn off power.
> • Return the original loop control card.
> • Change the M/D Rcvr/Xmit card. *A*
> • Turn on power, log on (1.2), and display the controller log (key in 001) to determine if problem is corrected.
> **Is problem corrected?**
> Y N
>
> > **014**
> > **Is this loop #4 or higher?**
> > Y N
> >
> > > **015**
> > > **Go to Step 018, Entry Point C.**
> >
> > **016**
> > Check the cables from the basic controller board Z1 and Z2 to the adapter board Y4 and Y5, for continuity and no shorts. Cables are wired point to point with B07, B13, D02, and D08 common.
> > **Are the cables good?**
> > Y N
> >
> > > **017**
> > > • Repair or replace cable.
> > > • Verify fix.
> >
> > **018**
> > **(Entry Point C)**
> > **CAUTION**
> > Turn off power.
> > • Return original M/D Rcvr/Xmit card.
> > Turn on power.
> > • On the loop control card and modem card, measure the voltages with reference to ground. See 3.10
> > **Are these voltages within limits,**
> > Y N
> >
> > > **019**
> > > **Go To Map 15, Entry Point A.**

3   3   3
D   E   F

A D E F  **1200 bps Remote Loop Problem**
1 2 2 2
**Internal Modem**

PAGE 3 OF 3

**020**
• Call for aid.

**021**
• Verify fix.

**022**
• Verify fix.

**023**
Loop error message has reported good wrap tests at controller end of the loop.
**Have wrap tests at remote branch(es) on this loop been good.**
Y N

  **024**
  Trouble is at remote branch that failed wrap test.
  • Verify that a CE is at that branch or is being dispatched there.
  • Verify fix.

**025**
• Now use the starter diskette to start this loop with a wrapable modem (command code 040). If this indicates a modem failure, enter this MAP again and inform the customer that his diskette gen should specify this loop as having a wrapable modem.
The good wrap test indicates that the problem is most likely in the communication channel. However, a small possibility exists for a failure in the following IBM equipment. Also, see Maintenance Aid 8 (Ref. 2.6).
• M/D Rcvr/Xmit card.
• Supply voltages to this card.
• Cable between logic board and the cable panel. See Figure 3-6.
• Cable between the controller and the communication line termination.
• Teleprocessing equipment at remote branch.

Note: If this is a callback, or if the required cards are available, proceed along this path. Otherwise notify customer that the trouble is external to our equipment.

**CAUTION**
Turn off power.
• Change the M/D Rcvr/Xmit card. *A*
• Turn on power, log on (1.2), and display the controller log (key in 001) to determine if problem is corrected.
NOTE: Return original card if it does not correct problem.
**Does M/D Rcvr/Xmit card change correct the problem?**
Y N

G H

---

G H

**026**
• Measure the voltages with reference to ground (D08) on the M/D Rcvr/Xmit card. See 3.10.
**Are all voltages within limits?**
Y N

  **027**
  **Go To Map 15, Entry Point A.**

**028**
• Check the internal cable between logic board and the connectors on the cable panel, for continuity and no shorts. See figure 3-6.
**Is the cable good?**
Y N

  **029**
  • Repair or replace cable.
  • Verify fix.

**030**
• Check for continuity and lack of shorts in the external cable between cable panel connectors and the communication channel termination. (See Figure 3-15.)
**Is this cable good?**
Y N

  **031**
  • Repair or replace cable.
  • Verify fix.

**032**
Indications are that the problem is not the controller.
Inform the customer that the problem appears to be in the communication channel.
• Verify fix.

**033**
• Verify fix.

**Remote Loop Problem**

**External Modem**

PAGE 1 OF 3

| ENTRY POINTS | | | | | EXIT POINTS | | | |
|---|---|---|---|---|---|---|---|---|

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 2 | 005 | 15 | A |
| 2 | 010 | 15 | A |
| 3 | 017 | 15 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
- For the loop in error, verify that the board is jumpered correctly. See the chart at the end of the logic gate. Also verify that the EIA PTT card is jumpered properly (1.121).
- Log on (1.2) if you are not already.
- For loops 2 and 3, verify the cable from Basic Controller board Z4 to the interface cards (small board or Adapter board).
- Display print controller log (1.6) if you have not already done so, and analyze the loop error message (1.7).
- If the loop is failing but there is no error message in the controller log after approximately 2 minutes, you should start up the controller again (power on or reset). Use the starter diskette to ensure that the loop should be running (Command code 040).
- If only loop 7 or 8 is failing, replace the redrive card.

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.
**Is code Y=0?**
Y N

  **002**
  **Is code Y=2 or 4?**
  Y N
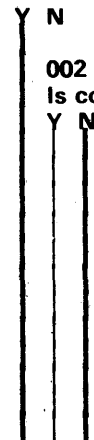
2 2 2
A B C

```
B C                    Remote Loop Problem           A D E F
1 1                                                  1
  |                    External Modem                |   | |
  |                                                  |   | |
  |                    PAGE  2 OF  3                 |   | |
  |                                                  |   | |
  |                                                  |   | |
  |                                                  |   | |
  003                                                |   | |  010
  Code Y=1 (modem interface check).                  |   | |  Go To Map 15, Entry Point A.
                    CAUTION                           |   | |
  Turn off power when changing a card.               |   | 011
  • One at a time, in the order indicated, change the |   | • Call for aid.
    following cards:                                 |   |
    EIA PTT (1.121)                                  |   012
    Loop adapter                                     |   • Verify fix.
  • After each card change:                          |
  • Turn on power, log on (1.2), and display the   013
    controller log (key in 001) to determine if problem  • Loop error message has reported good wrap tests at
    is corrected.                                         controller end of the loop.
  NOTE: Return original card each time a card change  Have wrap tests at remote branch(es) on this loop
  does not correct problem.                          been good?
  Does any card change correct problem?              Y N
  Y N
                                                         014
      004                                                • Trouble is at remote branch that failed wrap test.
      • Measure the voltages with reference to ground    • Verify that a CE is at that branch or is being
        (D08) on the EIA PTT card and the loop control     dispatched there.
        card.  See 3.10                                   • Verify fix.
      Are all supply voltages within limits?
      Y N                                            015
                                                     • Now use the starter diskette to start this loop with a
          005                                          wrapable modem (command code 040).   If this
          Go To Map 15, Entry Point A.                 indicates a modem failure, enter this MAP again and
                                                       inform the customer that his diskette gen should
      006                                              specify this loop as having a wrapable modem.
      • Call for aid.                                 The good wrap test indicates that the problem is most
                                                     likely in the communication channel.  However, a small
  007                                                possibility exists for a failure in the following IBM
  • Verify fix.                                      equipment.

008                                                  Note: If this is a call back, or if the required card is
Code Y=2 or 4.                                       available, proceed along this path.  Otherwise, notify the
                    CAUTION                           customer that trouble is external to our equipment.
Turn off power.                                      • EIA PTT card.
• Change loop control card.                          • Supply voltages to this card.
• Turn on power, log on (1.2), and display the controller  • Cable between controller and the modem.
  log (key in 001) to determine if problem is corrected.   • Teleprocessing equipment at remote branch.
Is problem corrected?                                               CAUTION
Y N                                                  Turn power off when you change a card.
                                                     • Change EIA PTT card (1.121).
    009                                              • Turn on power, log on (1.2), and display the controller
                    CAUTION                             log (key in 001) to determine if problem is corrected.
    Turn off power.                                  NOTE: Return original card if it does not correct
    • Return original loop control card.             problem.
    • For loop 4 and above, verify the cables from Basic  Does the card change correct the problem?
      Controller board Z1 and Z2 to the Adapter board.  Y N
    Turn on power.                                    |  |
    • On the loop control card measure the voltages with  |  |
      reference to ground.  See 3.10                 |  |
    Are these voltages within limits?                |  |
    Y N                                              |  |
    |  |                                             |  |
    |  |                                             |  |
    |  |                                             |  |
    |  |                                             |  |
    |  |                                             |  |
    |  |                                             |  |
D E F                                                3 3
                                                     G H
```

G H    **Remote Loop Problem**
2 2
       **External Modem**

       PAGE  3 OF  3

**016**
• Measure the voltages with reference to ground
  (D08) on the EIA PTT card.  See 3.10
**Are all voltages within limits?**
**Y N**

    **017**
    **Go To Map 15, Entry Point A.**

**018**
• Check the cable between logic board and the
  connector for continuity and no shorts (1.122).
**Is cable good?**
**Y N**

    **019**
    • Repair or replace cable.
    • Verify fix.

**020**
• Indications are that the problem is not in the
  controller.
• Inform the customer that the problem appears to
  be in the communication channel.
• Verify fix.

**021**
• Verify fix.

**Host Communication Link**

**Problem**

PAGE 1 OF 4

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 2 | 008 | 15 | A |
| 4 | 038 | 15 | A |
| 4 | 029 | 15 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
If Host Link configuration never worked, verify feature jumpering. See 3.9.
• Verify that correct parameters are being used. See command code 041.

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.
Observe controller log (1.6) for link wrap test messages.

Note: Log messages:

```
11 006 0
0=Good wrap test.

11 006 1xxxYxxxxxxxxxxx.
 1=wrap failure.
 Y=9=CA wrap failure.
 Y=D=modem wrap failure.

11 006 2.
 2=link stopped (users request).
```

**Are all link wrap tests good?**
Y N

    **002**
    **Does the controller log report a CA wrap test failure?**
    Y N

4 4 2
A B C

C
1
| 
**Host Communication Link**

**Problem**

PAGE 2 OF 4

**003**
**(Entry Point B)**
Check the plug chart to see if there is a host link internal modem.
**Is the modem internal to the controller?**
Y **N**

> **004**
> • Determine if the external modem is automatically wrap tested by the controller.
>
> Note: The controller automatically wrap tests the CA card and integrated modems, and may or may not automatically wrap test an external modem. This is determined by the configuration image and the external modems capability. The customers DP group can tell you whether the controller is configured to wrap test an external modem automatically. If the external modem is an IBM modem, check the IBM modem manual for details on wrap testing that modem.
> Also you can determine if the controller is trying to wrap test the external modem. To do this: (1) key in ⁻041 0 (start link command), and (2) use the GL probe to probe pin S05 on the Host CA card. A down-level pulse indicates that the controller is trying to wrap test the external modem.
> **Is the external modem automatically wrap tested by the controller?**
> Y **N**
>
>> **005**
>> **(Entry Point C)**
>> **CAUTION**
>> Turn off power.
>> • Change EIA (Host 15) card, or 38LS EIA (Host 15) card.
>> Turn on power.
>> **Is problem corrected?**
>> Y **N**

3 3 3
D E F  G

G
|
**006**
Turn off power.
• Return original EIA (Host 15) card, or 38LS EIA (Host 15) card.
• Problem appears to be in the communication channel or the external modem. If this is a callback, or if you already have a replacement CA card, proceed along this path. Otherwise, inform customer that trouble is external to IBM equipment.
**CAUTION**
Turn off power.
• Change CA (Host 15) card.
Turn on power.
**Is problem corrected?**
Y **N**

> **007**
> **CAUTION**
> Turn off power.
> • Return original CA (Host 15) card, or 38LS EIA (Host 15) card.
> • Turn on power and check the voltages on CA and EIA cards with reference to ground (D08). See 3.10
> **Are these voltages within limits?**
> Y **N**
>
>> **008**
>> Go To Map 15, Entry Point A.
>
> **009**
> • Check for continuity and no shorts.
> • Cable between the basic controller board and cable panel connector J1 (Figure 3-5).
> • External cable between controller and the external modem (Figure 3-14).
> **Are cables good?**
> Y **N**
>
>> **010**
>> • Repair or replace, as required.
>> • Verify fix.
>
> **011**
> **Is external modem an IBM modem?**
> Y **N**
>
>> **012**
>> • Notify customer that problem appears to be in the external modem or the communication channel, or call for aid if this is a callback.

3 3
H J

E F H J    **Host Communication Link**
2 2 2 2
           **Problem**

           PAGE 3 OF 4

**013**
• Use IBM modem manual to check the external
  modem.
**Is the external modem good?**
Y N
│
│   **014**
│   • Repair the IBM modem.
│   • Verify fix.
│
**015**
• Notify customer that trouble appears to be in
  the communication channel, or call for aid if
  this is a callback.
• Verify fix.

**016**
• Verify fix.

**017**
• Verify fix.

**018**
• Observe controller log (1.6) for modem wrap test
  messages.

Note: Log messages:

11 006 0
0=Good wrap test.

11 006 1xxxYxxxxxxxxxx.
 1=wrap failure.
 Y=9=CA wrap failure.
 Y=D=modem wrap failure.

11 006 2.
 2=link stopped (users request).

**Does controller log report a modem wrap failure?**
Y N
│
│   **019**
│   Go to Page 2, Step 005, Entry Point C.
│
**020**
**Is external modem an IBM MODEM?**
Y N
│
│   **021**
│   Go to Page 2, Step 005, Entry Point C.

K

D K
2
│
│
**022**
           **CAUTION**
Turn off power.
• Change EIA (Host 15) card, or 38LS EIA (Host 15)
  card.
Turn on power.
**Is problem corrected?**
Y N
│
│   **023**
│   Turn off power.
│   • Return original EIA (Host 15) or 38LS EIA (Host
│     15) card.
│   • Use IBM modem manual to repair the modem.
│   • Verify fix.
│
**024**
• Verify fix.

**025**
**Does the controller log report a modem wrap failure?**
Y N
│
│   **026**
│   The good wrap test indicates that the problem is most
│   probably in the communication channel.  If this is a
│   callback, or if the required cards are available, proceed
│   along this path.  Otherwise, inform customer that
│   trouble is external to our equipment.  Also see
│   maintenance aid 8(2.6).
│   **Go to Step 027, Entry Point D.**
│
**027**
**(Entry Point D)**
           **CAUTION**
Turn off power whenever you change a card.
• Make sure that the transmit level potentiometer is
  adjusted correctly (1.123).
• One at a time, in the order indicated, change the
  following cards:
• M/D Rcvr (Host 15).
• M/D Xmit (Host 15).
• M/D wrap (Host 15) (jumper, PN 816645, must be
  installed on wrap card.).
• On later machines, the modem is one card, 38LS M/D
  (Host 15).
• CA (Host 15) card.
NOTE: Remember to return the original card if a card
change does not correct problem.
**Does any card change correct the problem?**
Y N
│ │
│ │
│ │

4 4
L M

B L M     **Host Communication Link**
1 3 3

**Problem**

PAGE 4 OF 4

**028**
Check the voltages with reference to ground (D08) on cards just changed. See 3.10
**Are these voltages correct?**
Y N

    **029**
    **Go To Map 15, Entry Point A.**

**030**
- Check for continuity and no shorts:
- Cable between the basic controller board and cable panel connector J1 (Figure 3-5).
- External cable between controller and communication channel termination or external modem (Figure 3-14).
**Are cables good?**
Y N

    **031**
    - Repair or replace as required.
    - Verify fix.

**032**
**Were the wrap tests all good?**
Y N

    **033**
    The problem appears to be the board assembly.
    - Replace the board, or call for aid.

**034**
Problem appears to be in the communication channel, advise customer.

**035**
- Verify fix.

**036**
              **CAUTION**
Turn off power.
- Change CA (Host 15) card.
- Turn on power (reset).
**Is problem corrected?**
Y N

    **037**
              **CAUTION**
    Turn off power.
    - Return original CA (Host 15) card.
    - Turn on power and check the voltages on CA card with reference to ground (D08). See 3.10
    **Are these voltages within limits?**
    Y N

N P Q

---

A N P Q
1

    **038**
    **Go To Map 15, Entry Point A.**

**039**
**Is this your first time through this MAP?**
Y N

    **040**
    Problem appears to be the basic controller board assembly.
    - Replace board or call for aid.

**041**
**Go to Page 1, Step 001, Entry Point A.**

**042**
- Verify fix.

**043**
If you wish to verify that you are receiving a signal refer to 1.125.
**Is the host transmitting?**
Y N

    **044**
    Host problem.
    - Verify fix.

**045**
**Are wrap tests good at host end?**
Y N

    **046**
    Host problem.
    - Verify fix.

**047**
**Are other controllers connected to the same communication line as yours?**
Y N

    **048**
    **Go to Page 2, Step 003, Entry Point B.**

**049**
**Are other controllers having host communication link problems?**
Y N

    **050**
    **Go to Page 2, Step 003, Entry Point B.**

**051**
Problem appears to be in communication channel.
Advise customer.

**Alternative Line Problem**

PAGE 1 OF 3

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|------|------|------|------|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |

No entries in this table

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|------|------|------|------|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 1 | 004 | 15 | A |
| 2 | 011 | 15 | A |
| 2 | 020 | 15 | A |
| 3 | 025 | 15 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
- For the alternative line in error, verify that the correct cards are plugged and that the feature jumpering is correct. Refer to Chapter 3 for jumper requirements and chapter 1 plug charts for card locations.
- Load the starter diskette with optional module 6A. (3.3.3).
- Run command code 929 to wrap test the adapter.

**Was the adapter wrap test good?**
Y N

  **002**
  Turn off power.
  - Replace the CA (ALA XX) card.
  Turn on power.
  **Is the problem corrected?**
  Y N

    **003**
    - Measure the voltages on the CA (ALA XX) card. See 3.10.
    **Are these voltages within limits?**
    Y N

      **004**
      Go To Map 15, Entry Point A.

    **005**
    Problem appears to be the adapter board.
    - Replace board or call for aid.

  **006**
  - Verify fix.

2
A

EC 745948

A
1

**Alternative Line Problem**

B C D E

PAGE 2 OF 3

**007**
Is the modem internal to the controller?
Y N

**008**
Turn off power.
• Change the EIA or 38LS EIA (ALA XX) card.
Turn on power.
Is the problem corrected?
Y N

**009**
Turn off power.
• Return the original EIA or 38LS EIA (ALA XX) card.
• The problem appears to be in the communication channel or the external modem. If this is a call-back or if you have a replacement CA card proceed along this path. Otherwise, advise customer that problem is external to the controller.
Turn off power.
• Change the CA (ALA XX) card.
Turn on power.
Is the problem corrected?
Y N

**010**
Turn off power.
• Return the original CA (ALA XX) card.
• Turn on power and measure the voltages on the EIA and CA cards.
See 3.10
Are these voltages within limits?
Y N

**011**
Go To Map 15, Entry Point A.

**012**
Turn off power.
• Check the following for continuity and no shorts.
• Cable between the adapter board and the cable panel connector.
• Cable between controller and external modem.
Are cables good?
Y N

**013**
• Repair or replace as required.
• Verify fix.

**014**
Notify customer that problem appears to be in the external modem or communication channel, or call for aid if this is a call back.

**015**
• Verify fix.

**016**
• Verify fix.

**017**
• Run command code 929 to wrap test the modem.
Was the modem wrap test good.
Y N

**018**
CAUTION

Turn off power whenever you change a card.
• Make sure that the transmit level potentiometer is adjusted correctly 1.123, 1.124.
• One at a time, in the following order, change the following cards.
• M/D Rcvr (ALA XX) card.
• M/D Xmit (ALA XX) card.
• M/D Wrap (ALA XX) card (Jumper, PN816645 must be installed on the wrap card.)
• On later machines, the above is one card 38LS M/D(ALA XX) card.
• CA (ALA XX) card.

Note: Remember to return the original card if a card change does not correct the problem.
Does any card change correct the problem?
Y N

**019**
Check the voltages on the cards just changed.
See 3.10
Are these voltages within limits?
Y N

**020**
Go To Map 15, Entry Point A.

**021**
The problem appears to be the adapter board.
• Replace the board or call for aid.

**022**
• Verify fix.

B C D E

3
F

F
2

G

**Alternative Line Problem**

PAGE 3 OF 3

**023**
The good wrap test indicates that the problem is most probably in the communication channel. If this is a callback, or if the required cards are available, proceed along this path. Otherwise, inform customer that trouble is external to our equipment.

**029**
• Verify fix.

**CAUTION**

Turn off power whenever you change a card.

• Make sure that the transmit level potentiometer is adjusted correctly. 1.123, 1.124.
• One at a time, in the order indicated, change the following cards:
• M/D Rcvr (ALA XX) card.
• M/D Xmit (ALA XX) card.
• M/D Wrap (ALA XX) card (Jumper, PN816645, must be installed on wrap card.)
• On later machines the above is one card 38LS M/D (ALA XX) card.
• CA (ALA XX) card.

Note: Remember to return the original card if a card change does not correct problem.
**Does any card change correct the problem?**
Y  N

    **024**
    Check the voltages on the cards just changed 3.10.
    **Are these voltages within limits?**
    Y  N

        **025**
        **Go To Map 15, Entry Point A.**

    **026**
    Turn off power.
    • Check the following for continuity and no shorts.
    • Cable between adapter and the cable panel connector.
    • Cable between controller and communication channel.
    **Are cables good?**
    Y  N

        **027**
        • Repair or replace as required.
        • Verify fix.

    **028**
    Notify customer that problem appears to be the communication channel or call for aid if this is a call-back.

G

**Diskette Drive Assembly**

**Not Ready**

PAGE 1 OF 4

## ENTRY POINTS

| FROM | ENTER THIS MAP | | |
| --- | --- | --- | --- |
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 11 | A | 1 | 001 |
| 12 | B | 1 | 005 |
| 2 | A | 1 | 001 |
| 9 | D | 4 | 041 |

## EXIT POINTS

| EXIT THIS MAP | | TO | |
| --- | --- | --- | --- |
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 1 | 004 | 15 | A |
| 3 | 027 | 15 | A |
| 3 | 034 | 15 | A |
| 3 | 039 | 9 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
• Check that the diskette is not visibly damaged or bound in the diskette drive assembly.
• Check that the diskette is in the correct operating position and the drive belt is in place.
Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.
**Is the drive hub turning?**
Y N

> **002**
> **Is the drive motor turning?**
> Y N
>
> > **003**
> > • Measure ac line voltage at motor connector.
> > **Is measured voltage within ±10% of line voltage specified on label in controller?**
> > Y N
> >
> > > **004**
> > > Go To Map 15, Entry Point A.
> >
> > **005**
> > **(Entry Point B)**
> > • Unplug motor connector.
> > • Remove drive belt.
> > • Replug motor connector.
> >
> > Note: The motor may require up to 5 minutes to start if the thermal protector has been tripped.
> > **Does the motor start?**
> > Y N

```
2   2  2 2
A   B  C D
```

B C D        **Diskette Drive Assembly**          A E F G
1 1 1                                            1
             **Not Ready**

             PAGE  2 OF  4

        **006**                                        **016**
        • Remove binds, if any or,                     **Is there a bind in the idler assembly?**
        • remove and replace drive motor (1.25 and 1.26,  Y  N
          or 1.70 and 1.71).
        • Verify fix.                                       **017**
                                                            • Install a new belt.
    **007**                                                 • Verify fix.
    • Unplug motor connector.
    **Is there a bind in the hub assembly?**           **018**
    Y  N                                               • Remove bind or replace the idler assembly
                                                         (1.28 or 1.74).
        **008**                                        • Verify fix.
        **Is there a bind in the idler assembly?**
        Y  N                                        **019**
                                                    • Open the cover of the diskette drive assembly.
            **009**                                 **Is there still a bind in the hub assembly?**
            • Install a new belt and adjust (1.27 or 1.69).  Y  N
            • If trouble still exists, install a new drive motor
              (1.25 and 1.26, or 1.70 and 1.71).            **020**
            • Verify fix.                                   • Replace cover (1.22 or 1.62) or collet (1.23 or
                                                              1.63) as required.
        **010**                                             • Verify fix.
        • Remove bind or replace the idler assembly (1.28
          or 1.74).                                     **021**
        • Verify fix.                                   • Remove bind or replace the diskette hub and
                                                          shaft assembly (1.29).
    **011**                                             • Verify fix.
    • Open the cover of the diskette drive assembly.
    **Is there still a bind in the hub assembly?**  **022**
    Y  N                                            • Tighten loose pulleys.
                                                    • Verify fix.
        **012**
        • Replace cover (1.22 or 1.62) or collet (1.23 or  **023**
          1.63) as required.                         • Use the GL probe to test for pulsing index line at the
        • Verify fix.                                  '+Index' test point on the diskette drive control card
                                                       (1.51 or 1.94).
    **013**                                          **Is the line pulsing(Up and Down lights both on)?**
    • Remove bind or remove and replace hub and shaft  Y  N
      assembly (1.29).
    • Verify fix.                                        **024**
                                                         • Perform the phototransistor service check (1.44 or
**014**                                                    1.87).
**(Entry Point C)**                                      **Is the phototransistor output good?**
• Unplug motor connector.                                Y  N
**Are any pulleys loose?**
Y  N                                                         **025**
                                                             • Measure for +1.3 ±0.3V between the 'LED
    **015**                                                    CURRENT' test point (two test points for a 2
    • Remove drive belt.                                       sided drive) and the 'ground' test point on the
    **Is there a bind in the hub assembly?**                   diskette drive control card (1.51 or 1.94).
    Y  N                                                      **Is the voltage within limits?**
                                                             Y  N




E F G                                            3 3 3 3
                                                 H J K L



EC 745948

J K L
2 2 2

**Diskette Drive Assembly**

**Not Ready**

PAGE 3 OF 4

**026**
- Measure the following voltages at the test points on the diskette drive control card (1.51 or 1.94).

| Test Point | Limits |
|---|---|
| +5V dc | +4.5 and 5.5 |
| +24V dc | +21 and +27 |
| -5V dc | -4.5 and -5.5 |

**Are the voltages within limits?**
Y N

    **027**
    Go To Map 15, Entry Point A.

**028**
- Replace the LED (1.48, or 1.88 and 1.89).
- Verify fix.

**029**
- Check the two-wire cable from the diskette drive control card to the phototransistor for continuity and no shorts.

**Is this cable good?**
Y N

    **030**
    - Repair or replace the cable.
    - Verify fix.

**031**
- Replace and adjust the phototransistor (1.46, or 1.90 and 1.91).
- Verify fix.

**032**
               **CAUTION**
Turn off power.
- Change diskette drive control card (1.50 or 1.93).
Turn on power.
**Is the problem corrected?**
Y N

M N

---

H M N
2

**033**
               **CAUTION**
Turn off power.
- Return the original diskette drive control card.
Turn on power.
- Measure the following voltages at the test points on the diskette drive control card (1.51 or 1.94):

| Test Point | Limits |
|---|---|
| +5V dc | +4.5 and +5.5 |
| +24V dc | +21 and +27 |
| -5V dc | -4.5 and -5.5 |

**Are the voltages within limits?**
Y N

    **034**
    Go To Map 15, Entry Point A.

**035**
- Call for aid.

**036**
- Verify fix.

**037**
- If an oscilloscope is available check the diskette speed, look for index pulses every 166.6 ms at the '+Index' test point on the diskette drive control card (1.51 or 1.94). Pulse width should be 1.7 to 8.0 ms. (1.95).

**Is there a diskette rotation problem that you can readily observe?**
Y N

    **038**
               **CAUTION**
    Turn off power.
    - Change diskette drive control card (1.50 or 1.93).
    Turn on power.
    **Is problem corrected?**
    Y N

        **039**
                   **CAUTION**
        Turn off power.
        - Return original diskette drive control card.
        **Go To Map 9, Entry Point A.**

**040**
- Verify fix.

4
P

P
3

**Diskette Drive Assembly**

**Not Ready**

PAGE 4 OF 4

**041**
**(Entry Point D)**
• Check cover latch pivots and collet assembly for
  defects that are readily observed.
**Do these parts appear to be functioning properly?**
**Y  N**

   **042**
   Replace as required:
      Cover latch(1.21 or 1.61).
      Pivots (1.22 or 1.62).
      Collet (1.23 or 1.63).
   • Verify fix.

**043**
**Does this controller have a one head diskette drive?**
**Y  N**

   **044**
   • Check the head load operation.
   **Is operation correct?**
   **Y  N**

      **045**
      • Repair, adjust, or replace.
      End of call.

   **046**
   Go to Page 2, Step 014, Entry Point C.

**047**
**Is the pressure pad arm in front of the actuator bail?**
**Y  N**

   **048**
   • Place the pressure pad arm in front of the actuator
     bail.
   **Go to Step 049, Entry Point E.**

**049**
**(Entry Point E)**
**Is bail adjustment correct?**
**Y  N**

   **050**
   Adjust pressure pad actuator (1.33) or replace it
   (1.32).
   End of call.

**051**
**Go to Page 2, Step 014, Entry Point C.**

**Diskette Drive Assembly**

**Seek Error**

PAGE 1 OF 3

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |
| 7 | B | 2 | 005 |
| 9 | A | 1 | 001 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 3 | 031 | 10 | A |
| 1 | 003 | 15 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
• Load starter diskette, if not previously loaded.

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

Note: For starter diskette information, refer to 3.3.3. If starter diskette does not operate properly try backup starter diskette.
NOTE: Intermittent seek problems may be caused by diskette control card.

**CAUTION**
Turn off power.
• Manually move diskette head upwards (away from track 0 by at least four tracks).
• Turn on power (reset).
**Does the head carriage assembly go to track 0?**
Y N

   **002**
   • Measure +24V on diskette drive control card (1.50 or 1.93) at '+24V dc' test point (1.51 or 1.94).
   **Is voltage within +21.6V and +26.4V?**
   Y N

      **003**
      **Go To Map 15, Entry Point A.**

   **004**
   • Press controller RESET switch to cause accessing.
   • Using GL probe, probe for pulsing lines on diskette drive control card while accessing. Probe test points and access 0, 1, 2, and 3 (1.51 or 1.94).
   **Are all lines pulsing (UP and DOWN lights on)?**
   Y N

3  2  2
A  B  C

B C           Seek Error                          E F G
1 1

              PAGE 2 OF 3

005                                               013
(Entry Point B)                                   Call for aid.
              CAUTION
Turn off power.                                   014
• Change diskette adapter card.                   • Verify fix.
• Turn on power (reset).
Is startup good (1.1.3)?                           015
Y N                                               Is the leadscrew wheel loose on shaft (1.36)?
                                                  Y N
  006
              CAUTION                               016
  Turn off power.                                  • With power off, manually rotate leadscrew wheel to
  • Return original diskette adapter card.           check for binds in the access mechanism.
  • Check diskette drive control cable (Figure 3-3) Are there any binds in the access mechanism?
    continuity and lack of shorts.                 Y N
  Is cable good?
  Y N                                                017
                                                     • Replace the stepper motor and adjust (1.42 and
    007                                                1.43).
    • Repair or replace cable.                       • Verify fix.
    • Verify fix.
                                                   018
  008                                              • Check the gap between the leadscrew wheel and
  • Call for aid.                                    the stepper motor wheel (1.36).
                                                   Is this gap as indicated in step 6 of 1.36?
009                                                Y N
• Verify fix.
                                                     019
010                                                  • Perform the read/write head adjustment (1.36).
              CAUTION                                 • Verify fix.
Turn off power.
• Change the diskette drive control card (1.50 or 1.93). 020
• Turn on power (reset).                           • Check the upper and lower limit carriage stop
Is startup good (1.1.3)?                             adjustments (1.40 and 1.41).
Y N                                                Are the carriage stop adjustments correct?
                                                  Y N
  011
              CAUTION                                021
  Turn off power.                                   • As necessary, do one or more of the following.
  • Return original diskette drive control card.    • Adjust lower limit stop (1.40).
  Does this controller have a one head diskette    • Adjust upper limit stop (1.41).
  drive?                                            • Replace upper or lower stop (1.34 and 1.35).
  Y N                                               • Verify fix.

    012                                            022
    The following may be causing the error.       • Loosen stepper motor screws (1.42).
      Bad diskette adapter card. Power off and     • Check the leadscrew preload spring.
      replace.
      Head/carriage position adjustment. (1.64)   Note: The leadscrew should have an up and down
      Bind in head/carriage. (1.65 and 1.66).     movement of about 0.030 inch (0.76mm) against the
      Stepper motor bad. (1.75 and 1.76).         preload spring.
    Is the problem corrected?
    Y N                                            Does the preload spring have correct action?
                                                  Y N

3                                                 3 3 3
D E F G                                           H J K

```
A  D  H  J  K    Seek Error
1  2  2  2  2
```

PAGE 3 OF 3

**023**
- Replace the preload spring (1.34 and 1.35).
- Verify fix.

**024**
- Check for binds in the head carriage, leadscrew, and bearings.

**Are there any binds in these components?**
Y N

  **025**
  **Is there a bind in the stepper motor itself?**
  Y  N

    **026**
    - Reinstall the same stepper motor and adjust (1.42 and 1.43).
    - Verify fix.

  **027**
  - Install and adjust a new stepper motor (1.42 and 1.43).
  - Verify fix.

**028**
- As necessary replace or adjust:
- Head carriage (1.34 and 1.35).
- Bearings (1.34 and 1.35).
- Leadscrew and head (1.38 and 1.36).
- Verify fix.

**029**
- As required, replace leadscrew wheel (1.38) or adjust leadscrew wheel per steps 10 through 16 of 1.36.
- Verify fix.

**030**
- Verify fix.

**031**
Go To Map 10, Entry Point A.

**Diskette Drive Assembly**

**Data Check**

PAGE 1 OF 4

## ENTRY POINTS

| FROM | ENTER THIS MAP | | |
|------|------|------|------|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |
| 8 | A | 1 | 001 |

## EXIT POINTS

| EXIT THIS MAP | | TO | |
|------|------|------|------|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 2 | 015 | 13 | A |
| 3 | 029 | 14 | A |
| 2 | 011 | 15 | A |
| 1 | 002 | 8 | A |
| 4 | 041 | 8 | D |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**
• Load starter diskette if not already loaded.

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

Note: For starter diskette information, refer to 3.3.3. If starter diskette does not operate correctly, try backup starter diskette.

**CAUTION**
Turn off power.
• Manually move diskette head away from track 0 (upwards) by at least four tracks.
• Turn on power (reset).
**Does the head carriage assembly go to track 0?**

Note: For a one head diskette drive assure the pressure pad arm contacts the diskette (1.33). For a two head diskette drive check head load operation (1.67).

Y N

  **002**
  Go To Map 8, Entry Point A.

**003**
• If an oscilloscope is available, check the diskette speed, check for index pulses every 166.6 ms at the '+Index' test point on the diskette drive control card (1.51 or 1.94). Pulse width should be 1.7ms to 8.0ms. (1.95).
**Is there a diskette rotation problem that you can readily observe?**

Y N

4 2
A B

B
1

**Diskette Drive Assembly**

**Data Check**

PAGE 2 OF 4

**004**

CAUTION

Turn off power.
• Change the diskette adapter card.
• Turn on power (reset).
**Is startup good (1.1.3)?**
Y N

> **005**
>
> CAUTION
>
> Turn off power.
> • Return the original diskette adapter card.
> • Change the diskette drive control card (1.50 or 1.93).
> • Turn on power (reset).
> **Is startup good (1.1.3)?**
> Y N
>
> > **006**
> >
> > CAUTION
> >
> > Turn off power.
> > • Return the original diskette drive control card.
> > **Does this controller have a one head diskette drive?**
> > Y N
> >
> > > **007**
> > > The following may be causing the error.
> > > Head/carriage position adjustment. (1.64)
> > > Head assembly bad. (1.65 and 1.66)
> > > Stepper motor bad. (1.75 and 1.76)
> > > Diskette drive control cable bad. Check for continuity and lack of shorts. See Figure 3-3.
> > > Incorrect voltage on the diskette drive control card. (1.94)
> > > **Is problem corrected?**
> > > Y N
> > >
> > > > **008**
> > > > Go to Page 3, Step 028, Entry Point B.
> > >
> > > **009**
> > > • Verify fix.

4 4
C D E

---

E

**010**
Turn on power.
• Measure the following voltages on the diskette drive control card at test points (1.51).

Vdc  Limits
+5   +4.5 and +5.5
-5   -4.5 and -5.5
+24  +21.6 and +26.4

**Are these voltages within limits?**
Y N

> **011**
> Go To Map 15, Entry Point A.

**012**
• Press the controller RESET switch.
• Visually check for movement of pressure pad arm or head load actuator during startup.

Note: For a one head diskette drive, assure the pressure pad arm contacts the diskette (1.33).
**Does this arm move?**
Y N

> **013**
> • Connect the GL probe to the 'Head Load' test point on diskette drive control card (1.51).
> • Press the controller RESET switch.
> **Is there at least one pulse prior to DTC?**
> Y N
>
> > **014**
> >
> > CAUTION
> >
> > Turn off power.
> > • Check the diskette drive control cable (Figure 3-3) for continuity and lack of shorts.
> > Turn on power.
> > **Does the pressure pad arm now move during startup?**
> > Y N
> >
> > > **015**
> > > Go To Map 13, Entry Point A.
> >
> > **016**
> > • Verify fix.

3 3
F G

F G
2 2

**Diskette Drive Assembly**

**Data Check**

PAGE 3 OF 4

**017**
- Check the head load actuator cable for opens and shorts (two wires from electromagnet to diskette drive control card connector (1.49).
**Is this cable good?**
Y N

   **018**
   - Repair or replace cable, as required.
   - Verify fix.

**019**
- Replace pressure pad (head load) actuator and adjust (1.32 and 1.33).
- Verify fix.

**020**
- Check the diskette drive control cable (Figure 3-3) for continuity and lack of shorts.
**Is the cable good?**
Y N

   **021**
   - Repair or replace.
   - Verify fix.

**022**
- Press controller RESET switch.
**Is startup good (1.1.3)?**
Y N

   **023**
   - Remove head cable connector from socket.
   **CAUTION**
   Do not try to measure coil continuity. Meter current could damage coil.
   **Are any of the head cable connector pins (1.34) grounded (none of these pins should be grounded)?**
   Y N

      **024**
      - Perform the Read/Write Head adjustment and the phototransistor adjustment (1.36 and 1.45).
      Turn on power (reset).
      **Is startup good (1.1.3)?**
      Y N

4 4 4
H J K L

L

**025**
**CAUTION**
Turn off power.
- Clean the Read/Write head (1.37).
- Turn on power (reset).
**Is startup good (1.1.3)?**
Y N

   **026**
   - Replace the head and carriage assembly (1.34 and 1.35).
   - Turn on power (reset).
   **Is startup good (1.1.3)?**
   Y N

      **027**
      - Replace the stopper motor (1.42).
      - Turn on power (reset).
      **Is start up good (1.13)?**
      Y N

         **028**
         **(Entry Point B)**
         The problem may be that the diskette contents are being destroyed by erasing or writing at the wrong time. To eliminate this possibility, proceed as follows:
         **CAUTION**
         Turn off power.
         - Change the diskette adapter card.
         - Change the diskette drive control card (1.50 or 1.93).
         - Obtain and load another known-to-be-good diskette.
         - Turn on power (reset).
         **Is startup good (1.1.3)?**
         Y N

            **029**
            Go To Map 14, Entry Point A.

         **030**
         - If you have enough backup diskettes available, isolate the card that was destroying the diskette. Otherwise allow both new cards to remain plugged in the machine.
         - Verify fix.

      **031**
      - Verify fix.

**032**
- Verify fix.

4
M

EC 745948

```
C D H J K M   Diskette Drive Assembly
2 2 3 3 3 3
                Data Check

                PAGE 4 OF 4
```

```
A
1
```

033
• Verify fix.

041
Go To Map 8, Entry Point D.

034
• Verify fix.

035
• Check the head cables and connector.
**Are the cables and connector good?**
Y  N

036
• Repair or replace, as required.
• Verify fix.

037
• Replace the head and carriage assembly (1.34
  and 1.35).
• Verify fix.

038
• Verify fix.

039
• Verify fix.

040
• Verify fix.

**Disk Storage-System Hang**

PAGE 1 OF 1

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |

**001**
**(Entry Point A)**
- Turn power off.
- Unseat all logic cards on 01A1 board.
- Lock the DE access arm (3.4.1).
- Turn on power (reset).
**Is startup good?**
Y N

   **002**
   - Replace the redrive card.
   **Is startup good?**
   Y N

      **003**
      - Return the original redrive card.
      - Check the cables from 01A1Z4 to 01A2V4 and 01A1Z5 to 01A2V5 for continuity and lack of shorts (cables wired point to point, with B07, B13, D02 and D08 common).
      **Are cables good?**
      Y N

         **004**
         - Repair or replace the cable.
         - Reseat any unseated cards and cables.
         - Unlock the DE access arm (3.4.1).
         - Verify fix.

      **005**
      - Inspect 01A1 board for bent pins, shorted pins.
      **Did you find a problem?**
      Y N

         **006**
         - Replace board 01A1 (1.127).
         - Verify fix.

      **007**
      - Remove the short.
      - Reseat any unseated cards and cables.
      - Unlock the DE access arm (3.4.1).
      - Verify fix.

A B

A B

   **008**
   - Reseat any unseated cards and cables.
   - Unlock the DE access arm (3.4.1).
   - Verify fix.

**009**
- Turn off power.
- Reseat one card at a time to locate the failing card (crossovers on cards J2 and K2 may be a cause of failure).
- Replace failing card and reseat the others.
- Unlock the DE access arm (3.4.1).
- Verify fix.

EC 745948

**Disk Storage-Operational Failure**

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 2 | 013 | 15 | A |
| 3 | 030 | 15 | A |

**001**
**(Entry Point A)**
• Turn off power.
• Disconnect disk storage power plug (DJ3) at the power box.
• Turn on power.

**CAUTION**
Parts may be hot.

**CAUTION**
Ensure drive motor has stopped.

**CAUTION**
Observe the rotation arrow on the DE (3.4.1). Failure to do so may result in DE damage.
• Rotate the brake pulley to test for binds in the drive assembly (1.107).

Note: If your machine has HPCA host communication, a good HPCA card must be installed in order for the disk storage to function.
**Does the drive assembly turn freely?**
Y N

   **002**
   • Remove the drive belt guard.
   • Remove the drive belt by pivoting the drive motor upward.
   **Does the disk spindle turn free?**
   Y N

      **003**
      • Replace the disk enclosure (DE) (1.100, 1.101).
      • Verify fix.

   **004**
   **Does the disk storage relay (H-K1) pick with power on?**
   Y N

      **005**
      • Repair relay wiring (1.113).
      • Verify fix.

2 2
A B

A B        **Disk Storage-Operational Failure**      E
1 1

PAGE 2 OF 4

**006**
- Evenly loosen the three brake assembly mounting screws to disengage the pad and coil pins (1.106).

**Does the drive motor turn freely?**
Y N

    **007**
    - Replace the drive motor (1.102 and 1.103).
    - Verify fix.

**008**
- Tighten the 3 brake assembly mounting screws. Be sure brake pad slots and coil pins align.

**Does the brake assembly energize with power on (cable still unplugged)?**
Y N

    **009**
    - Repair wiring (1.113).
    - Verify fix.

**010**
- Adjust or replace brake as required (1.105, 1.106, 1.107).
- Verify fix.

**011**
- Turn off power.
- Remove the drive belt guard.
- Inspect the drive belt for wear.
- Ensure motor mount maintains tension on belt.
- Connect disk storage power plug at the power box.

**Did you find the problem?**
Y N

    **012**
    - Turn on power.
    **Does the storage drive motor run?**
    Y N

        **013**
        **Go To Map 15, Entry Point A.**

    **014**
    - Turn off power.
    - Ensure the two antistatic brush arms have tension and are in place (1.101, 1.107).
    - Replace the drive belt guard.
    - Turn on power.
    - Load the disk storage diagnostics (1.114).
    **Is there a 10EE error stop?**
    Y N

4 3
C D   E

---

**015**
**Did the customer have an 11 007 message?**
Y N

    **016**
    **Did the statistic counters indicate a disk storage problem?**
    Y N

        **017**
        There is no disk storage problem at this time.
        - Return the system to the customer or reenter the beginning of the MAP's.

**018**
**(Entry Point B)**
- Advise the customer that some information on the disk has been destroyed.
- Utility program routines are provided for his use for data correction.

**Does the customer wish to attempt salvage of the remaining data?**
Y N

    **019**
    The following steps are going to write all data sectors on the disk to zero's. Run utility program routines 1 and 4 as follows:
    1. Load the diagnostic/utility diskette in the diskette drive.
    2. Power off all devices on loop 1 other than the 3604 at address 1 on loop 1 to prevent any interference.
    3. Press reset on the controller.
    4. When the control program has been loaded, BCB0 may display, respond with the model number of the 3604 that you are using, followed by EM (enter key). BC80 should then display on this 3604. When BC80 is displayed, respond with 000001 EM (enter key).
    5. When 0012 is displayed, respond with F and EM (enter key).
    6. When 0014 is displayed, respond with C and EM (enter key).
    7. When 0000 is displayed (routine complete) respond with 000004 EM (enter key).
    8. When 0045 is displayed, respond with C6 EM (enter key). This should write all sector ID's and write zero's in all data fields.
    9. When this routine is complete (nearly 1 hour) 0044, DDD should display, where DDD is the decimal count of the sectors with alternates assigned (recoverable surface defects). Respond with C and EM enter key) to terminate. Any other error messages indicate that there is a permanent
    (Step 019 continues)

3 3
F G

D F G
2 2 2

**Disk Storage–Operational Failure**     H J K

PAGE 3 OF 4

(Step 019 continued)
unrecoverable disk defect and the DE must be
replaced. Refer to chapter 3 for the meaning of
the error messages and 1.100/1.101 for DE
removal and replacement.

**020**
Return the system to the customer. If the
customer requires assistance, call for aid.

**021**
Go to Page 2, Step 018, Entry Point B.

**022**
Refer to diagnostic error list for corrective action (1.115).
Is problem resolved?
Y N

>    **023**
>                    CAUTION
>    Turn off power when changing cards.
>    • If you have not already done so, change the
>      following cards on 01A1 board one at a time, in the
>      order indicated:
>    G2  D2  J2  C4  K2  F2
>    • After each card change, turn on power and run the
>      diagnostics.
>    Note: Return the original card each time it does not
>    correct the problem.
>    Is the problem resolved?
>    Y N
>
>    >    **024**
>    >    • Turn off power.
>    >    • Replace redrive card.
>    >    • Turn on power.
>    >    • Run the disk storage diagnostics.
>    >    Is the problem resolved?
>    >    Y N
>    >
>    >    >    **025**
>    >    >    • Turn off power.
>    >    >    • Return origional redrive card.
>    >    >                    CAUTION
>    >    >    Turn off power when changing cards.
>    >    >    • If you have not already done so, change the
>    >    >      following cards one at a time in the order
>    >    >      indicated:
>    >    >
>    >    >    01A1 board– L2, B2, B4, C2, H2, M2
>    >    >
>    >    >    On the DE–  B3, A5, A2
>    >    >
>    >    >    • After each card change, turn on power and run
>    >    >      the diagnostic.
>    >    >    (Step 025 continues)

H J K

(Step 025 continued)
Note: Return the original card each time it does
not correct the problem.
Is the problem resolved?
Y N

>    **026**
>    • Test the cables from 01A1 to the DE for
>      continuity and no shorts (1.112).
>    • Test the cables from 01A2V4 to 01A1Z4
>      and 01A2V5 to 01A1Z5, for continuity and
>      no shorts. The cables are wired point to
>      point, with B07, B13, D02, and D08
>      common.
>    Are the cables good?
>    Y N
>
>    >    **027**
>    >    • Repair or replace the defective cable.
>    >    • Verify fix.
>
>    **028**
>    • Inspect card jumpers (1.111).
>    • Inspect board jumpers (1.111).
>    Did you resolve the problem?
>    Y N
>
>    >    **029**
>    >    • Check the power to 01A1 board and to
>    >      the DE (Figure 3-8).
>    >    Is the power good?
>    >    Y N
>    >
>    >    >    **030**
>    >    >    Go To Map 15, Entry Point A.
>    >
>    >    **031**
>    >    • Suspect board 01A1 (1.127) or the DE
>    >      (1.100).
>    >    • Call for aid.
>
>    **032**
>    • Verify fix.

**033**
• Verify fix.

**034**
• Verify fix.

**035**
• Verify fix.

**036**
• Verify fix.

C
2

**Disk Storage-Operational Failure**

PAGE 4 OF 4

**037**
- Repair or replace as required.
- Verify fix.

## Basic Controller Problem

PAGE 1 OF 1

### ENTRY POINTS

| FROM | ENTER THIS MAP | | |
|------|------|------|------|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 13 | A | 1 | 001 |
| 2 | A | 1 | 001 |

**001**
CAUTION: These MAP's deal with more than one machine type/feature. Included are questions about items this machine may not have.

**(Entry Point A)**

**CAUTION·**
Turn off power when you change a card.
Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

- One at a time, in the order indicated, change the following cards:
  CTLR 2.
  CTLR 3.
  CTLR 1.
  FSU 1 Vol 0.
  ESA 1.
  RESET.
  Loop Ctrl (1).
  Diskette Adapter.
  FSU 1 Vol 1, if present.
  ESA 2, if present.
- After each card change, turn on power (RESET).
- Check location and continuity of crossovers.

NOTE: Return original card each time a card change does not correct problem.

**Does any card change result in a good startup? (1.1.3) (If there is no FSU 1 Vol. 1 card, a display of LSW is as far as startup can go.**
Y N

**002**
- Check the special +5V to the reset card (Fig. 3-8).
- Check that G02 and J02 on the reset card change voltage levels when the reset switch is opperated. If no, check the reset switch and its wiring (Fig. 3-8).

**Did you find the problem?**
Y N 05

A B C

A B C

**003**
- Call for aid.
It is possible that one of the replacement cards was defective. Also, suspect the basic controller board and voltages to it (3.8).

**004**
- Turn off power.
- Repair the reset switch or wiring.
- Reseat any unseated cards and cables.
- Unlock the DE access arm (3.4.1) if it was locked.
- Verify fix.

**005**
- Turn off power.
- Reseat any unseated cards and cables.
- Unlock the DE access arm (3.4.1) if it was locked.
- Verify fix.

**Minimum Configuration Method**

**Of Fault Isolation**

PAGE  1 OF  3

## ENTRY POINTS

| FROM | ENTER THIS MAP | | |
| --- | --- | --- | --- |
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 2 | A | 1 | 001 |
| 9 | A | 1 | 001 |

## EXIT POINTS

| EXIT THIS MAP | | TO | |
| --- | --- | --- | --- |
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 2 | 014 | 13 | A |
| 3 | 017 | 13 | A |
| 1 | 002 | 15 | A |
| 3 | 016 | 2 | F |
| 3 | 025 | 8 | A |

**001**
CAUTION: These MAP's deal with more than one machine type/feature.  Included are questions about items this machine may not have.

**(Entry Point A)**
If starter diskette is not loaded, load diskette.

Note: For starter diskette information, refer to 3.3.3.

Logic cards are called by name, refer to the card list and board layout in Chapter 1, Maintenance Procedures or the board charts located in later machines for locations.

• Check the supply voltages for the BASIC CONTROLLER board (3.10).
**Are all of these voltages within limits?**
Y N

  **002**
  **Go To Map 15, Entry Point A.**

**003**
• Open the outside cover and observe the diskette assembly.
**Is there any obvious mechanical problem with the diskette drive?**
Y N

  **004**
  **At the 3604 designated by customer to be address 1 on loop 1, are the address switches set correctly (See Chapter 3, Table 3-1)?**
  Y N

    **005**
    Set address switches of the designated 3604 to address 1.
    **Go to Page 2, Step 006, Entry Point B.**

3 2
A B

EC 745948

B
1

**Minimum Configuration Method**

**Of Fault Isolation**

PAGE 2 OF 3

**006**
**(Entry Point B)**
See if the speed switches (switch group 2) of all terminals on loop 1 agree with the speed jumper for the loop 1 adapter card in the controller?

- Either check the speed switches of all terminals on loop 1, or check only the speed switches on the 3604 at address 1 and temporarily turn off power on other terminals on loop 1.
- Loop jumpering instructions are on a label on the controller logic gate.
- Speed switches are set as follows:

| Switch | Speed (bps) |
|--------|-------------|
| 1 on   | 600         |
| 2 on   | 1200        |
| 3 on   | 2400        |
| 4 on   | 4800        |

Do they agree?
Y N

  **007**
  - Consult customers configuration chart to determine correct speed on loop 1.
  - Correct loop or terminal speed as required.
  - Load operating diskette.
  Verify fix.

  Note: Verification will include turning on power at all terminals that you may have turned off.

**008**
- Turn on power or press RESET to cause a startup.
Is startup good (1.1.3)?
Y N

  **009**
                    CAUTION
  Turn off power.
  - Unseat cables Z1 and Z2 coming out of the basic controller board. If none present, take the No leg.
  - Lock the DE access arm, if present (3.4.1).
  - Turn on power (reset).
  Is startup good?
  Y N

3   3
C   E
    D

E

**010**
                    CAUTION
Turn off power.

- Unseat all the cards from the basic controller board except the following:
  CTLR 2.
  CTLR 3.
  CTLR 1.
  FSU 1 Vol 0.
  ESA 1.
  RESET.
  Loop Ctrl (1).
  Diskette Adapter.
  FSU 1 Vol 1, if present.
  ESA 2, if present.
- Turn on power (reset).
Did diagnostic message sequence reach DTC? (This is as far as the sequence can go without error with the minimum storage.)
Y N

  **011**
  Did diagnostic message sequence start (IDL displayed)?
  Y N

    **012**
                    CAUTION
    Turn off power.
    - Move the head assembly at least four tracks from track 0.
    - Turn on power (reset).
    Did the head assembly go to track 0?
    Y N

      **013**
      - Unseat the diskette adapter card.
      - Turn on power (Reset).
      Did IDL display?
      Y N

        **014**
        Go To Map 13, Entry Point A.

    **015**
    - Change the bad diskette adapter card.
    - Reseat the unseated cards and cables.
    - Load the operating diskette.
    - Unlock the DE access arm, if present (3.4.1).
    - Verify Fix.

3   3   3
F   G   H

D F G H    **Minimum Configuration Method**    A C J
2 2 2 2                                         1 2

**Of Fault Isolation**

PAGE 3 OF 3

**016**
• Reseat any unseated cards and cables.
• Unlock the DE access arm (3.4.1.).
**Go To Map 2, Entry Point F.**

**017**
**Go To Map 13, Entry Point A.**

**018**
CAUTION
Turn off power each time you reseat or change a card.
• Reseat the cards, one at a time until you identify the card that causes the diagnostic message sequence to fail to reach DTC.
• Change the bad card and reseat any unseated cards and cables.
• Load the operating diskette.
• Unlock the DE access arm, if present (3.4.1).
• Verify fix.

**019**
CAUTION
Turn off power.
• Replug cables Z1, Z2 on the basic controller board.
• Unseat all logic cards on the adapter board.
• Turn on power (reset).
**Is startup good?**
Y N

**020**
CAUTION
Turn off power.
• Unseat cables Y4, Y5 on the adapter board.
• Turn on power (reset).
**Is startup good?**
Y N

**021**
• Replace the cable that causes the failure.
• Unlock the DE access arm, if present (3.4.1).
• Verify fix.

**022**
• Replace the adapter board.
• Unlock the DE access arm (3.4.1).
• Verify fix.

J

**023**
CAUTION
Turn off power.
• Reseat the cards, one at a time to identify the one causing the failure.
• Replace that card and reseat any unseated cards and cables.
• If reseating the redrive card causes the failure, the problem may be loop control card 7 or 8 or any card on the disk storage adapter board.
• Unlock the DE access arm, if present (3.4.1).
• Verify fix.

**024**
• Load the operating diskette.
Verify fix.

Note: Verification will include turning on power at all terminals that you may have turned off.

**025**
**Go To Map 8, Entry Point A.**

**Power**

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|---|---|---|---|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| No entries in this table | | | |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|---|---|---|---|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 1 | 003 | 16 | A |
| 1 | 002 | 17 | A |

**001**
**(Entry Point A)**
**Is this a 3601?**
**Y N**

> **002**
> • You have a 3602.
> **Go To Map 17, Entry Point A.**

**003**
**Go To Map 16, Entry Point A.**

**3601 Power**

PAGE 1 OF 4

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|------|-------|------|------|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 15 | A | 1 | 001 |

**EXIT POINTS**

| EXIT THIS MAP | | TO | |
|------|------|------|------|
| PAGE NUMBER | STEP NUMBER | MAP NUMBER | ENTRY POINT |
| 1 | 006 | 8 | B |

**001**
**(Entry Point A)**
• With power off, verify that ribbon cables are properly seated on board 01A1, and for a Model 3 machine, 01A2.
• Verify that the controller power cord is plugged into an outlet and that the controller power switch is on.
• Verify that the dc indicator lamp circuit is good (3-8).
• Remove the diskette from the diskette drive assembly.
**Is the diskette drive motor turning?**
Y N

   **002**
   • Measure the ac voltage across the black and white leads at the drive motor connector.
   **Is the measured voltage within ±10% of the voltage specified on label in controller?**
   Y N

      **003**
      • Check the power cord, fuse, and power switch. (Refer to Power Distribution Diagram, Figure 3-8).
      **Are these parts good?**
      Y N

         **004**
         • Repair or replace the failing part.
         • If the fuse opens, also repair the cause of the fuse opening. Look for shorts/grounds or defective power supply using Power Distribution Diagram, Figure 3-8.
         • Verify fix.

      **005**
      Customer power input to controller must be incorrect.
      • Verify fix.

   **006**
   **Go To Map 8, Entry Point B.**

2
A

A
1

## 3601 Power

**007**
- Verify input power to the supply. If not present, refer to the power distribution diagram for repair.

NOTE: If the power supply is failing to remain on, connect voltmeter to the terminal of any dc voltage and look upon this voltage as the 'failing' voltage.

| Vdc | Limits |
|-----|--------|
| +5 | +4.5 and +5.5 |
| +8.5 | +7.7 and +9.3 |
| +12 | +10.8 and +13.2 |
| +24 | +21.6 and +26.4 |
| -5 | -4.5 and -5.5 |
| -12 | -10.8 and -13.2 |

- Do not disconnect leads from the power supply. Insert any suitable probe (paper clip, scribe, probe tip) into the connector to connect this meter lead.
- If your machine has 2 power supplies, the vertical one primarily goes to board A2, the horizontal one to A1. see the power distribution diagram.
- Connect voltmeter to the terminal of the failing voltage at the power supply. If the voltage is correct at the power supply refer to Power Distribution Diagram, (Figure 3-8) and the cabling diagrams to correct the problem. If voltage is not correct at power supply, continue on this path.

**CAUTION**
Turn off power.
- At the diskette drive control card, unplug the cable that goes to 01A1.
Turn on power.
- Check the power supply output voltages.
**Are all voltages now within limits?**
Y **N**

> **008**
> **CAUTION**
> Turn off power.
> - Replug the cable to the diskette drive control card.
> - Unplug the voltage connectors on board 01A1, including the connector for special voltages at 01A1Y4. (Z3 on model C or D).
> Turn on power.
> - Check the power supply output voltages.
>
> | Vdc | Limits |
> |-----|--------|
> | +5 | +4.5 and +5.5 |
> | +8.5 | +7.7 and +9.3 |
> | +12 | +10.8 and +13.2 |
> | +24 | +21.6 and +26.4 |
> | -5 | -4.5 and -5.5 |
> | -12 | -10.8 and -13.2 |
>
> (Step 008 continues)

3
B

(Step 008 continued)
**Are all voltages now within limits?**
Y **N**

> **009**
> **CAUTION**
> Turn off power.
> - Replug the voltage connectors on board 01A1.
> - Unplug the voltage connectors on board 01A2, including 01A2Z3 (Model 3 only). (Slip connectors on A2D07, V2D07 on later machines.).
> Turn on power.
> **Are all voltages now within limits?**
> Y **N**
>
> > **010**
> > **Do you have expanded storage (B1 Board)?**
> > Y **N**
> >
> > > **011**
> > > **Go to Step 013, Entry Point B.**
> >
> > **012**
> > Turn off power.
> > - Unplug the voltage connectors on board 01B1.
> > **Are all voltages now within limits?**
> > Y **N**
> >
> > > **013**
> > > **(Entry Point B)**
> > >
> > > **CAUTION**
> > > Turn off power.
> > > - Unplug the voltage connectors on board 01A1.
> > > - Remove the frame ground strap on the hinge side of the gate, and the ground wire on the diskette cable.
> > > - Measure the resistance of all power supply terminals to frame ground. (Resistance should be infinite.)
> > > **Are resistance readings good?**
> > > Y **N**
> > >
> > > > **014**
> > > > - Repair or replace power distribution cabling. Refer to Figure 3-8, Power Distribution Diagram.
> > > > - Verify fix.
> > >
> > > **015**
> > > - Replace the power supply (1.126).
> > > - Verify fix.

3 3 3
C D E

D E                    3601 Power                    B C
2 2                                                  2 2
|                                                    | |
|                   PAGE  3 OF  4                    | |
|                                                    | |
| 016                                                | 022
                    CAUTION                                          CAUTION
Turn off power.                                      Turn off power.
• Replug board 01B1 voltage connectors.             • Replug voltage connectors on board 01A1.
• Unseat all cards on board 01B1.                   • If this machine has a TSR 3 power supply, verify
Turn on power.                                         that the resistor A1U2D08 to A1T2B06 is on the
**Are all voltages still within limits?**             correct pins.
Y N                                                  • Unseat all cards on board 01A1.
|                                                    Turn on power.
|   017                                              • Check the following power supply output voltages.
|   • Replace board 01B1.
|   • Verify fix.                                      Vdc     Limits
|                                                      +5      +4.5 and +5.5
018                                                    +8.5    +7.7 and +9.3
                    CAUTION                             +12     +10.8 and +13.2
                                                       +24     +21.6 and +26.4
Turn off power when reseating or changing a card.      -5      -4.5 and -5.5
• Reseat a few cards at a time on board 01B1 to find   -12     -10.8 and -13.2
  the one that causes failure.                       **Are all voltages now within limits?**
• Change the card that causes failure, reseat the    Y N
  others, and replug the connectors on board 01A2.   |
• Verify fix.                                        |   023
                                                     |   • Replace 01A1 board assembly.
019                                                  |   • Verify fix.
                    CAUTION                           |
Turn off power.                                      024
• Replug board 01A2 voltage connectors, including                   CAUTION
  01A2Y3. (Slip connectors on A2D07, V2D07 on later  Turn off power each time you reseat or change a card.
  machines.).                                        • Reseat one card at a time on board 01A1 to find the
• Unseat all cards on board 01A2.                      one that causes failure.
Turn on power.                                       • Change the card that causes failure, reseat the
**Are all voltages still within limits?**              others.
Y N                                                  • Verify fix.
|
|   020                                              025
|   • Replace board 01A2.                                           CAUTION
|   • Verify fix.                                    Turn off power.
|                                                    • Change the diskette drive control card (1.50 or 1.93).
021                                                  • Replug the cable to diskette drive control card.
                    CAUTION                           Turn on power.
Turn off power when reseating or changing a card.    **Are all voltages still within limits?**
• Reseat a few cards at a time on board 01A2 to find  Y N
  the one that causes failure.                        | |
• Change the card that causes failure, reseat the others.  | |
• Verify fix.                                         | |
                                                      | |
                                                      | |
                                                      | |
                                                      | |
                                                      | |
                                                      | |
                                                      | |
                                                      4 4
                                                      F G

F G   **3601 Power**
3 3

**026**
### CAUTION
Turn off power.
• Return original diskette drive control card.
• Check the wiring in the diskette drive assembly.

Note: Wiring is from the diskette drive control card
connector (1.49,1.92) to:
Stepper motor
Head assembly
Phototransistor
Light emitter diode
Pressure pad actuator magnet

**Does this wiring check good?**
Y  N

  **027**
  • Repair or replace the diskette drive assembly
    wiring.
  • Verify fix.

**028**
• Call for aid.

**029**
• Verify fix.

**3602 Power**

PAGE 1 OF 4

**ENTRY POINTS**

| FROM | ENTER THIS MAP | | |
|------|------|------|------|
| MAP NUMBER | ENTRY POINT | PAGE NUMBER | STEP NUMBER |
| 15 | A | 1 | 001 |

**001**
**(Entry Point A)**
• Verify that the controller power cord is plugged into an outlet and that the controller power switch is on.
• Verify that ribbon cables are properly seated on TSR 1 and boards 01A1, 01A2, and 01B1.
                    **CAUTION**
• When working on a power problem, lock the DE access arm (3.4.1). Be sure to unlock it at the end of the call.
• Observe the fan and the diskette drive motor (ignore the storage drive motor at this time).
**Are both turning?**
Y N

   **002**
   • See Power Distribution Diagram, Figure 3-8, to make repair.
   • Verify fix.

**003**
**Is the power indicator on?**
Y N

   **004**
   • Measure the dc voltages on 01B1. See Figure 3-8.
   **Are all voltages within limits?**
   Y N

      **005**
      **(Entry Point B)**
      • Verify input power to the supply. If not present, refer to the power distribution diagram for repair.
      • If the power supply is failing to remain on, connect voltmeter to any dc voltage terminal and use this voltage for the 'failing' voltage. If G-CB1 trips, reset it for each power test.
      • Use a suitable probe to connect voltmeter to power supply (figure 3-8). Do not remove wires from power supply terminals.
      • Connect a voltmeter to the terminal of the failing voltage at the power supply (TSR 3). If the voltage is correct at the supply, see the Power Distribution Diagram, 3-8, to make repair.
         **CAUTION**
      Turn off power.
      (Step 005 continues)

3 3
A B

(Step 005 continued)
• Unplug cable at 01B1Z3.
• Turn on power.
**Are all voltages within limits?**
Y N

   **006**
        **CAUTION**
   Turn off power.
   • Replug cable at 01B1Z3.
   • Unplug voltage connectors on board 01B1 including 01B1Y4.
   • Turn on power.
   **Are all voltages within limits?**
   Y N

      **007**
         **CAUTION**
      Turn off power.
      • Replug all voltage connectors on board 01B1.
      • Unplug voltage connectors on board 01A2, including 01A2Z3. (Slip-on connectors on A2D07,V2D07 on later machines).
      • Turn on power.
      **Are all voltages within limits?**
      Y N

         **008**
             **CAUTION**
         Turn off power.
         • Replug all voltage connectors on board 01A2, including 01A2Z3. (Slip-on connectors on A2D07,V2D07 on later machines).
         • Unplug all voltage connectors on board 01A1, including 01A1Z3.
         • Turn on power.
         **Are all voltages within limits?**
         Y N

            **009**
            Do you have expanded memory (B2 Board)?
            Y N

3 3 3 2 2 2
C D E F G H

C D E
1 1 1     **3602 Power**          A B M N
                        1 1

PAGE 3 OF 4

**025**
### CAUTION
Turn off power.
• Replug all board 01A2 voltage connectors, including 01A2Z3. (Slip-on connectors A2D07,V2D07 on later machines).
• Unseat all cards on board 01A2.
• Turn on power.
**Are all voltages within limits?**
Y N

   **026**
   • Replace board 01A2.
   • Verify fix.

**027**
### CAUTION
Turn off power when reseating a card.
• Reseat a few cards at a time on board 01A2 to find problem card.
• Replace problem card and reseat others.
• Verify fix.

**028**
### CAUTION
Turn off power.
• Replug all voltage connectors on board 01B1, including 01B1Y4.
• Unseat all cards on board 01B1.
• Turn on power.
**Are all voltages within limits?**
Y N

   **029**
   • Replace 01B1 board.
   • Verify fix.

**030**
### CAUTION
Turn off power when reseating a card.
• Reseat a few cards at a time on board 01B1 to find problem card.
• Replace problem card and reseat others.
• Verify fix.

**031**
### CAUTION
Turn off power.
• Change diskette drive control card (1.53).
• Replug cable 01B1Z3.
• Turn on power.
**Are all voltages within limits?**
Y N

M N

**032**
### CAUTION
Turn off power.
• Return original diskette drive control card.
• Check the diskette drive wiring.

Note: Wiring is from the diskette drive control card connector (1.92) to:
• Stepper motor
• Head assembly
• Phototransistor
• Light emitter diode (LED)
• Pressure pad actuator magnet
• Board 01B1 connector Z3.
**Does wiring check good?**
Y N

   **033**
   • Repair or replace wiring.
   • Verify fix.

**034**
• Call for aid.

**035**
• Verify fix.

**036**
There is no power problem.
• Repair the power indicator circuit. See Figure 3-8.
• Verify fix.

**037**
**Is the disk storage drive motor turning?**
Y N

   **038**
   (Entry Point C)
   **Does the motor relay H-K1 pick with power on?**
   Y N

      **039**
      • Refer to 1.113 to correct the problem.
      • Verify fix.

   **040**
   • Check the ac path to the drive motor (3-8).
   **Is the problem corrected?**
   Y N

      **041**
      • Replace the drive motor (1.102 and 1.103).
      • Verify fix.

4 4
P Q

EC 745948

P Q     **3602 Power**
3 3


PAGE  4 OF  4


**042**
- Repair or replace as required.
- Verify fix.

**043**
- Measure the voltages on board 01A1 and the DE, supplied by TSR 1 on Figure 3-8.
**Are all voltages within limits?**
Y N

   **044**
            **CAUTION**
   Turn power off when reseating a card.
   - Unseat a few cards on board 01A1 at a time to determine if a card is loading the supply.  At each power off, reseat all cards before unseating more.
   - Unseat cards in the DE to determine if one is loading the supply.
   **Is a card causing the problem?**
   Y N

      **045**
      - Measure the voltage at pins 11 and 12 of power supply TSR 1 (3-8).
      **Is voltage good?**
      Y N

         **046**
         **Go to Page 1, Step 005, Entry Point B.**

      **047**
      - Replace TSR 1, or if the problem voltage is from 01A1TB1,
      **Go to Page 1, Step 001, Entry Point A.**

   **048**
   - Replace problem card and reseat the others.
   - Verify fix.

**049**
- Measure the dc voltages at each board, supplied by TSR 3 on Figure 3-8.
**Are all voltages within limits?**
Y N

   **050**
   **Go to Page 1, Step 005, Entry Point B.**

**051**
There is no power problem at this time.

3601/3602 Finance Communication
Controllers
Maintenance Information

Order No. SY27-2519-0

**READER'S
COMMENT
FORM**

*Your views about this publication may help improve its usefulness; this form
will be sent to the author's department for appropriate action.* Using this
form to request system assistance or additional publications will delay response,
however. *For more direct handling of such request, please contact your
IBM representative or the IBM Branch Office serving your locality.*

Possible topics for comment are:

Clarity    Accuracy    Completeness    Organization    Index    Figures    Examples    Legibility

What is your occupation? _____

Number of latest Technical Newsletter (if any) concerning this publication: _____

Please indicate if you wish a reply.          ☐ Yes          ☐ No

If yes:    Name _____

           Address _____

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office
or representative will be happy to forward your comments.)

Cut or Fold Along Line

**Your comments, please . . .**

Your comments, together with your answer to the questions on the back of this form
will help us produce better publications for your use. Your comments will be carefully
reviewed by the persons responsible for writing and publishing this material. All
comments and suggestions become the property of IBM.

Cut or Fold Along Line

Fold                                                                                        Fold

First Class
Permit 40
Armonk
New York

**Business Reply Mail**

No postage stamp necessary if mailed in the U.S.A.

Postage will be paid by:

International Business Machines Corporation
Department 63T
Neighborhood Road
Kingston, New York 12401
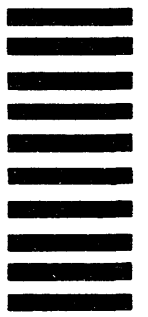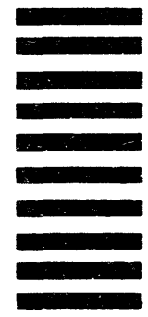
3601/3602 Finance Communication Controllers (MI)   Printed in U.S.A.   SY27-2519-0

Fold                                                                                        Fold

**IBM**

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, N.Y. 10604

IBM World Trade Americas/Far East Corporation
Town of Mount Pleasant, Route 9, North Terrytown, N.Y., U.S.A. 10551

IBM World Trade Europe/Middle East/Africa Corporation
360 Hamilton Avenue, White Plains, N.Y., U.S.A. 10601

**IBM**