

IBM

Maintenance Library

3803-2/ 3420 S/N	3803-2/ 3420 S/N	3803-2/ 3420 S/N	3803-2/ 3420 S/N
MLM	MLM	MLM	MLM
PLAN	INTF	MAP	OPER
START	07-000	16-000	40-000
SENSE	CARR	21-XXX	58-XXX
MAP	08-000		REF
00-000	MAP		75-001
1A-000	11-000		85-XXX
6A-XXX	15-XXX		INST
1B-000			90-000
6B-XXX			INDEX
VOL. 1	VOL. 2	VOL. 3	VOL. 4



3803-2 / 3420

Magnetic Tape Subsystem

Maintenance Manual

3803-2/3420							
XG0005	2736038	See EC	845958				
Seq 1 of 2	Part Number	History	1 Sep 79				

SAFETY

PERSONAL

The importance of personal safety cannot be overemphasized. To ensure personal safety and the safety of co-workers, follow established safety practices and procedures at all times.

Look for and obey the DANGER notices found in the maintenance documentation. All CEs must be familiar with the general safety practices and the procedures for artificial respiration outlines in IBM Form 229-1264. For convenience, this form is duplicated to the right.

MACHINE

To protect machines from damage, turn off power before removing or inserting circuit cards of components. Do not leave internal machine areas needlessly exposed, avoid shoring panel pins when scoping, and handle machine parts safely, in addition, look for and observe the CAUTION notices found in maintenance documentation.

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 areas of power supplies, performing mechanical inspection of power supplies, or installing changes in machine circuitry.
- 3. After turning off wall box power switch, lock it in the Off position or tag it with a "Do Not Operate" tag, Form 229-1266. 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, observe the following precautions:
  - a. Another person familiar with power off controls must be in immediate vicinity.
  - b. Do not wear rings, wrist watches, chains, bracelets, or metal cuff links.
  - c. Use only insulated pliers and screwdrivers.
  - d. Keep one hand in pocket.
  - e. When using test instruments, be certain that controls are set correctly and that insulated probes of proper capacity are used.
  - f. Avoid contacting ground potential (metal floor strips, machine frames, etc.). Use suitable rubber mats, purchased locally if necessary.
- 5. Wear safety glasses when:
  - a. Using a hammer to drive pins, riveting, staking, etc.
  - b. Power or hand drilling, reaming, grinding, etc.
  - c. Using spring hooks, attaching springs.
  - d. Soldering, wire cutting, removing steel bands.
  - e. Cleaning parts with solvents, sprays, cleaners, chemicals, etc.
  - f. Performing any other work that may be hazardous to your eyes. REMEMBER — THEY ARE YOUR EYES.
- 6. Follow special safety instructions when performing specialized tasks, such as handling cathode ray tubes and extremely high voltages. These instructions are outlined in CEMs and the safety portion 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. Lift by standing or pushing up with stronger leg muscles — this takes strain off back muscles. Do not lift any equipment or parts weighing over 60 pounds.
- 11. After maintenance, restore all safety devices, such as guards, shields, signs, and grounding wires.
- 12. Each Customer Engineer is responsible to be certain that no action on his part renders products unsafe or exposes customer personnel to hazards.
- 13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.
- 14. Ensure that all machine covers are in place before returning machine to customer.
- 15. Always place CE tool kit away from walk areas where no one can trip over it; for example, under desk or table.

- 16. Avoid touching moving mechanical parts 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 CEs and customer personnel are not in a hazardous position.
- 21. Maintain good housekeeping in area of machine while performing and after completing maintenance.

Knowing safety rules is not enough.  
An unsafe act will inevitably lead to an accident.  
Use good judgment - eliminate unsafe acts.

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 Victim 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

- 1. Place victim on his back immediately.
- 2. Clear throat of water, food, or foreign matter.
- 3. Tilt head back to open air passage.
- 4. Lift jaw up to keep tongue out of air passage.
- 5. Pinch nostrils to prevent air leakage when you blow.
- 6. Blow until you see chest rise.
- 7. Remove your lips and allow lungs to empty.
- 8. Listen for snoring and gurglings — signs of throat obstruction.
- 9. Repeat mouth to mouth breathing 10-20 times a minute. Continue rescue breathing until victim breathes for himself.



Thumb and finger positions



Final mouth-to-mouth position

3803-2/3420

XG0005	2736038	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

VOLUME 4 CONTENTS BY SECTION

40-000

For subject details or subjects not found in this table of contents, refer to the general INDEX section in this volume.

**SECTION 40**

Subsystem Concepts . . . . .	40-001
Subsystem Recording Methods . . . . .	40-002
3803-2 Controls . . . . .	40-003
3803-2 Features . . . . .	40-004
Tape Commands . . . . .	40-005

**SECTION 50**

Channel Buffer Circuits . . . . .	50-000
Write Circuits . . . . .	50-001
Read Circuits . . . . .	50-002
MP1/MP2 Circuits . . . . .	50-003
ROS Circuits . . . . .	50-010
6250 bpi . . . . .	50-020

**SECTION 52**

Microprocessor Clocks . . . . .	52-005
MP1 Instruction Counter . . . . .	52-010
Local Storage Register . . . . .	52-015
XOUTA/XOUTB Registers . . . . .	52-025
High/Low Order ROS Registers . . . . .	52-030
D and Special MP1/2 Registers . . . . .	52-035
Channel Tag In/Bus In Registers . . . . .	52-040
TUBO Registers . . . . .	52-045
Microprocessor Information . . . . .	52-060
Microprocessor Instructions . . . . .	52-065

**SECTION 53**

Oscillator . . . . .	53-005
Read/Write Counters/Clocks . . . . .	53-010
Data Flow Clock . . . . .	53-015
Write Clock/Counter . . . . .	53-020
Write Group Buffer . . . . .	53-025
Channel Buffer Controls . . . . .	53-030
CRIC/CROC . . . . .	53-035
Write Service Controls . . . . .	53-040
Miscellaneous Write Registers . . . . .	53-045
Read Sequencing and A/B Registers . . . . .	53-055
CRC Generators . . . . .	53-065
Write Triggers . . . . .	53-070
Read Track Register . . . . .	53-075
RIC/ROC . . . . .	53-080
Skew Detection . . . . .	53-085
Group Buffer Counter . . . . .	53-090
Read Cycle Controls . . . . .	53-095

**SECTION 54**

Interface . . . . .	54-000
Command Typing . . . . .	54-001
Selection and Priority . . . . .	54-005

**SECTION 55**

LWR (Loop Write Read) . . . . .	55-005
Basic Recording Technique . . . . .	55-007
Common Microprogram Routines . . . . .	55-020

**SECTION 57**

NRZI . . . . .	57-006
Translate . . . . .	57-020
Write Data Convert . . . . .	57-025
Read Data Convert . . . . .	57-026

**SECTION 58**

S/360, S/370 Switching . . . . .	58-005
Two Channel Switch . . . . .	58-010
Tie Breaker . . . . .	58-030
Device Switching . . . . .	58-050
Inbound Crosspoint Switching . . . . .	58-101

**SECTION 75**

CE Panel Information . . . . .	75-001
--------------------------------	--------

**SECTION 80**

Tools and Test Equipment . . . . .	80-000
------------------------------------	--------

**SECTION 85**

PM Procedures and Schedules . . . . .	85-000
---------------------------------------	--------

**SECTION 90**

Installation . . . . .	90-000
------------------------	--------

**INDEX**

Detailed Index (Volumes 1 through 4) . . . . .	INDEX 1
--	---------

40-000

BASIC SUBSYSTEM

The IBM 3803-2/3420 Magnetic Tape Subsystem consists of an IBM 3803 Model 2 Tape Control and one or more IBM 3420 Magnetic Tape Units. The 3420 tape units are available in six models with tape speeds of 75, 125, and 200 inches per second (ips) (190,5/317,5/508 cm/sec) for Models 3 and 4, 5 and 6, and 7 and 8, respectively.

The 3803 Model 2 operates in 6250 bpi and 1600 bpi modes.

A 3803 tape control without any switching features controls up to eight 3420 tape units (1×8 configuration, also called selection logic).

The 3803 command set, status responses, and basic sense data are compatible with those used by IBM 2400-series tape subsystems. However, there are some minor programming differences. For example:

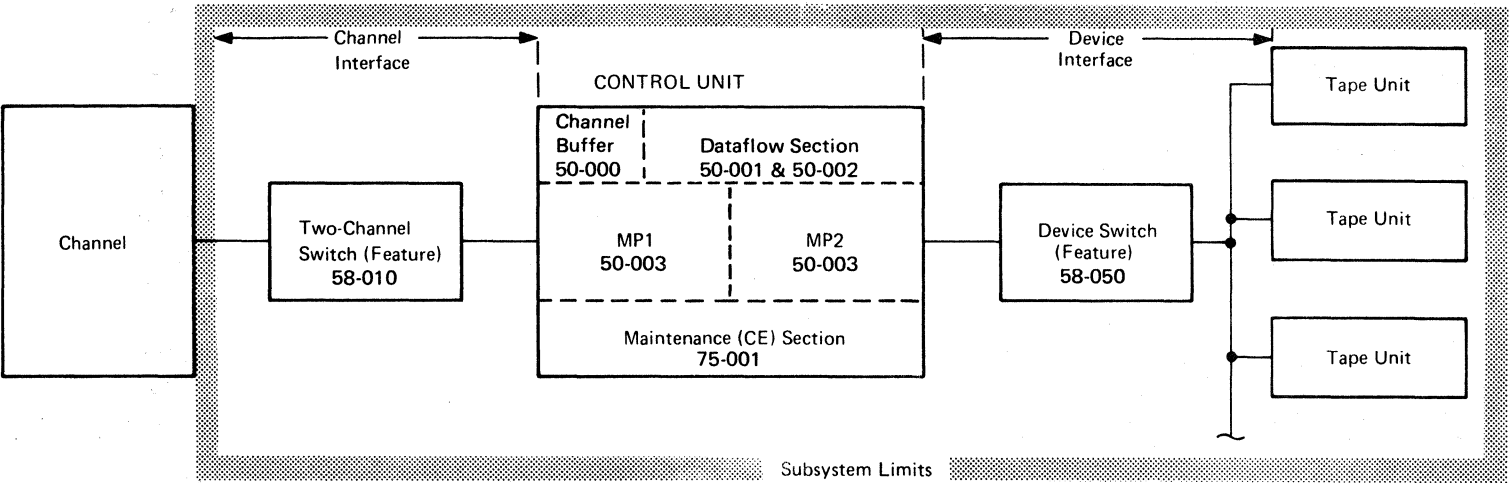
- 1. The number of sense bytes and contents of those bytes differ from those used by 2400-series subsystems.
- 2. All commands not shown on 40-005 and 40-008 set COMMAND REJECT in the sense information which, in turn, sets Unit Check in the status byte, indicating to the system that something is wrong.
- 3. A sense command must be issued after an error condition sets Unit Check in the unit status byte.

In most instances, non-time dependent programs that operate successfully on an IBM 2400-series tape subsystem will operate correctly on an IBM 3803-2/3420 subsystem.

3420 TAPE UNIT

Information presented in this section applies to all models of the tape unit.

With compatible features, 3420 Models 3, 5, and 7 can be attached to the 3803-2 without modification.



3803/3420 Subsystem Schematic

AUTOMATIC THREADING

A write reel latch secures the file reel to the reel hub automatically. When the operator places a file reel or cartridge on the reel hub and presses LOAD/REWIND, the power window closes, the write reel latch secures the file reel to the hub, and tape is automatically threaded, loaded into the vacuum columns, and positioned at load point without further operator action.

IBM Easy load cartridge

When used with a solid-flange tape reel (standard IBM 10.5 inch), the optional, IBM Easy Load Cartridge reduces tape handling and helps prevent tape contamination or physical damage.

During a load operation, if the first threading sequence is unsuccessful, tape is rewound into the cartridge and another attempt is made.

TAPE TRANSPORT

A single direct-drive capstan moves tape forward or backward. Air bearings reduce friction and tape wear since the oxide (recording) surface of the tape contacts only the read/write head and the tape cleaner. Short, tapered vacuum columns greatly reduce tape inertia when starting and stopping tape. The tapered columns and single, direct-drive capstan start and stop tape quickly and smoothly.

REWINDING

Tape remains in the vacuum columns during rewind operations. Rewind ends when a photocell senses a ) reflective marker on

beginning-of-tape (load point) reflective marker on tape.

During a rewind unload operation, tape is rewound completely onto the file reel. The tape unit is left in unloaded status, with the tape reel latch unlocked and the window open, allowing the operator to remove the file reel.

READ BACK CHECKING

A two-gap read/write head with 0.150 inch (3,81 mm) between read and write gaps allows read back checking during a write operation. Moving forward, tape passes first the write gap, then the read gap.

FULL-WIDTH ERASURE

An erase head applies a strong magnetic field that erases the entire width of tape during write operations. Full-width erasure prevents interchangeability problems when tape is written on one tape unit and read on another; it also reduces the chances of leaving extraneous bits in interblock gaps or skip areas.

During a write, write tape mark, or erase operation, the tape unit monitors the erase head operation. On a 3420 Model 4, 6, or 8, an erase head failure drops tape unit ready status and halts tape motion. On a 3420 Model 3, 5, or 7, an erase head failure sets Unit Check, but does not drop ready status.

FILE PROTECTION

A write enable ring must be present in the file reel when writing. To avoid destroying information on tape, the write enable ring is removed. A reel without the ring is "file-protected". FILE PROTECT turns on when the reel is mounted and no writing can occur.

3420 MODELS 4, 6, AND 8

Models 4, 6, and 8 tape units can write and read 6250 bpi tapes with 0.3-inch interblock gaps. Nominal data rates are 470, 780, and 1250 kilobytes per second at 6250 bpi.

A tape cleaning mechanism is added.

3420 Models 3, 5, and 7 can be converted in the field to Models 4, 6, and 8.

3803-2/3420							
XG0090	4169702	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				



RECORDING METHODS

6250 BPI

In 6250 bpi mode, 6250 data bytes per inch (246 data bytes per mm) are recorded in nine parallel tracks on tape. 6250 bpi tapes are written with an identification burst (ID burst) in track 1 at load point. The ID burst is followed by a control burst and a 0.3-inch (7,62 mm) IBG before a data block is written.

6250 bpi is a basic density on 3803 Model 2 and on 3420 Models 4, 6, and 8.

6250 BPI ERROR CORRECTION

The 6250 bpi format employs an error-correcting/detecting code capable of correcting all single-track errors on the strength of the code alone and correcting all double-track errors with the aid of track pointers. Pointers such as phase error and incorrect pattern are indications of questionable data. If the errors fall outside the code capability, Data Check and Unit Check are set and Error Recovery Procedures (ERPs) are invoked.

1600 BPI

In 1600 bpi mode, 1600 bytes per inch (63 bytes per mm) are recorded in nine parallel tracks on tape. The data format uses eight of the nine bits for data, the ninth is a parity bit. Data is recorded in odd parity. The eight bits of one byte can represent an alphabetic character, zoned decimal digit, two decimal digits (packed), a special character, or eight binary bits.

1600 bpi is a basic density on the 3803 Model 2 and on 3420 Models 3, 5, and 7, and a feature on 3420 Models 4, 6, and 8.

NINE-TRACK NRZI

In nine-track NRZI, data is recorded at 800 bpi (31,5 bytes per mm) in nine parallel tracks on tape. Data representation is the same as for 1600 bpi PE. For nine-track NRZI operation, the dual density feature is required on a Model 3, 5, or 7 tape unit and the nine-track NRZI feature is required on a 3803 Model 2.

SEVEN-TRACK NRZI

In seven-track NRZI mode, data is recorded at 200, 556, or 800 bpi (7, 6/21, 9/31, 5 bytes per mm). The data format uses six of the seven bits for data and the seventh bit for parity checking. Data is recorded in either odd or even parity. The six bits of one character can represent a BCD character or six binary bits. For seven-track NRZI operation, a seven-track feature is required on both a 3420 Model 3, 5, or 7 and on the 3803-2.

INTERBLOCK GAP

An interblock gap (IBG) is the erased section of tape used to indicate the end of a block or record. Interblock gaps are:

- 6250 bpi: 0.3 inch (7,6 mm) nominal.
- Nine-track PE/NRZI: 0.6 inch (15,2 mm) nominal; 0.5 inch (12,7 mm) minimum.
- Seven-track: 0.75 inch (19,05 mm) nominal; 0.68 inch (17,27 mm) minimum.

MAGNETIC TAPE AND REELS

Most tape volumes that operate satisfactorily on 3420 Models 3, 5, and 7 will operate with equal or better read/write reliability for an equivalent number of bytes transferred on 3420 Models 4, 6, or 8. Tape must conform to *IBM Half-Inch Tape Specifications, GA32-0006*.

3420 SUBSYSTEM CHARACTERISTICS

	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Tape Speed (Read or Write) (ips) (cm/sec)	75 190,5	75 190,5	125 317,5	125 317,5	200 508	200 508
6250 Read Access Time, nominal*(ms)		2.3		1.6		1.1
1600 Read Access Time, nominal*(ms)	4.0	4.0	2.9	2.6	2.0	1.65
6250 Write Access Time, nominal*(ms)		2.1		1.5		0.95
1600 Write Access Time, nominal*(ms)	4.0	3.0	2.9	2.0	2.0	1.28
Forward Start Time, nominal**(ms)	1.8	1.4	1.4	1.1	1.3	.08
Data Rates (Kb/sec; Kd/sec): 6250 BPI 1600 BPI PE 800 BPI NRZI (9-Track) 800 BPI NRZI (7-Track) 556 BPI NRZI (7-Track) 200 BPI NRZI (7-Track)	 120/240 60/120 60 41.7	 470/940 120/240  15.0	 200/400 100/200 100 69.5 25.0	 780/1560 200/400    	 320/640 160/320 160 111.2 40.0	 1250/2500 320/640
Passing Times per Byte (µsec): 6250 BPI 1600 BPI PE 800 BPI NRZI 556 BPI NRZI 200 BPI NRZI	 8.3 16.7 24.0 66.7	 2.133 8.3   	 5.0 10.0 14.4 40.0	 1.28 5.0   	 3.1 6.2 9.0 25.0	 0.80 3.1
Passing Times, IBG (ms): 6250 BPI 9-track (PE and NRZI) 7-track (NRZI)	 8.0 10.0	 4.0 8.0	 4.8 6.0	 2.4 4.8	 3.0 3.75	 1.5 3.0
Rewind Time (2400-foot reel)	60	60	60	60	45	45
Rewind/Unload Time: (2400-foot reel) (sec)	66	66	66	66	51	51
Load Operation, approximate time (in sec.) to 'tape unit ready' (after reel/cartridge is mounted and LOAD/REWIND is pressed)	10	10	10	10	7	7
* Read access time is the interval from initiation of a Forward Read command given to the tape control when tape is not at load point, until the first data byte is read when tape is brought up to speed from stopped status. Write access time is the interval from the issuance of a Move command given to the tape unit when tape is not at load point, until the first data byte is written on tape when tape is brought up to speed from stopped status. ** Start time is the interval from the issuance of a Move command to the tape unit, until tape attains 90% of specified velocity.						

3803 MODEL 2 TAPE CONTROL

The 3803 Model 2 Tape Control connects to the I/O interface of an IBM System/360 Model 50 and above (by RPQ only) or an IBM System/370, Model 135 and above. The tape control has a CE panel, two microprogram control sections, a read section, a write section, and a channel buffer section.

**Note:** "I/O Interface" refers to a set of lines over which the tape control and system channel exchange control and data signals. Interface lines and operations are described in *IBM System/360 and System/370 I/O Interface, Channel to Control Unit, Original Equipment Manufacturers' Information*, Order Number GA22-6974. The 3803 may exceed an interface signal sequence of 32 microseconds, and may produce a worst case interface signal sequence of up to 50 microseconds on some instructions when in seven-track mode with the two-channel switch feature installed.

The 3803 Model 2 operates at 6250 or 1600 bpi. The 3803 Model 2 with appropriate features can process nine-track, 800 bpi NRZI and seven-track, 200/556/800 bpi NRZI tape when used with 3420 Model 3, 5, and 7 tape units having the companion NRZI features.

All data transfers are in burst mode. The tape control executes one command on one tape unit at a time. The tape control parity checks each data byte transferred between the system and a tape unit. On write operations, bus out parity is checked and parity is generated, if necessary, before the byte is sent to the tape unit. On read operations, tape control parity is checked and generated, if necessary, before the byte is placed on the I/O interface. On sense operations, correct parity is supplied for each byte. Parity is also checked on command bytes.

I/O commands issued by the channel are executed with microprograms resident in two independent read-only storage (ROS) units. One ROS unit controls communication lines to the channel, while the other ROS unit controls communication lines to the tape unit.

ADDRESSING

Every tape unit has a unique device address, which consists of a channel address, a tape control address, and a tape unit address. Pluggable jumpers assign the tape control address when the system is installed. The tape control has separate device interface connectors for each tape unit address. A tape unit's address is determined by the tape control connector to which it is attached. There is no address decoding at the tape unit or device interface level.

METERING

A usage meter is installed in the tape control and in each tape unit. The tape control's usage meter records elapsed time whenever the METERING OUT line is active and the tape control is in online status (Enabled). A tape unit's usage meter records elapsed time when the tape control METERING OUT line is active, tape unit is loaded, and the tape is not at load point. METERING IN is used by the central processing unit (CPU) metering circuits; this line is active from the time a command is accepted by the tape control until Device End is generated for that command. See *IBM System/360 and System/370 I/O Interface: Channel to Control Unit OEMI*, Order Number GA22-6974.

ENABLE/DISABLE SWITCH

This switch allows the tape control and all attached tape units to be put online or taken offline so a customer engineer can use the CE panel switches and indicators to diagnose errors. Whenever the tape control is placed in offline status (Disabled), the usage meters in the tape control and all attached tape units are prevented from running. When the two-channel switch feature is installed, a second Enable/Disable switch is provided on the 3803.

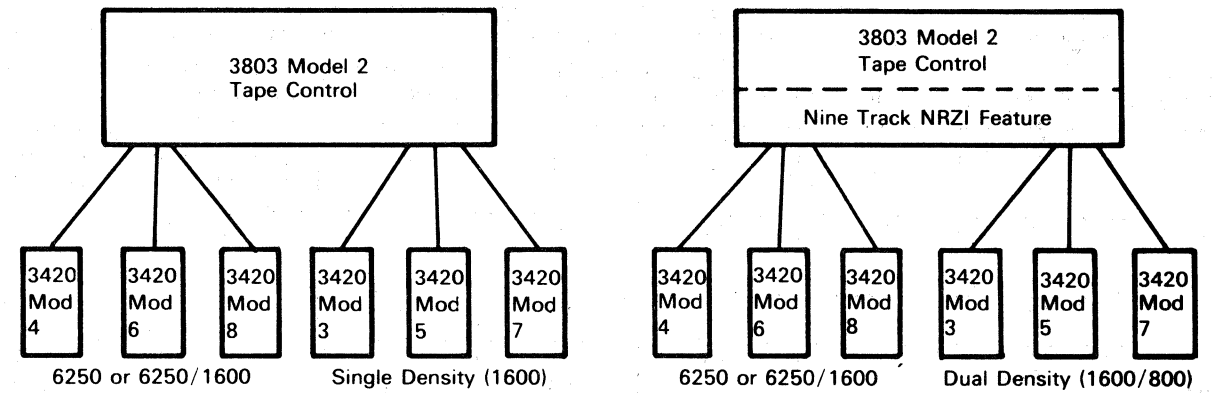
POWER ON/OFF SEQUENCING

Normal power on/power off sequencing for the 3803-2/3420 tape subsystem is controlled by system power interlock circuits. Maintenance activities may necessitate dropping power in the tape control and attached tape units while power remains on in the system. To take the subsystem offline, see 12-010.

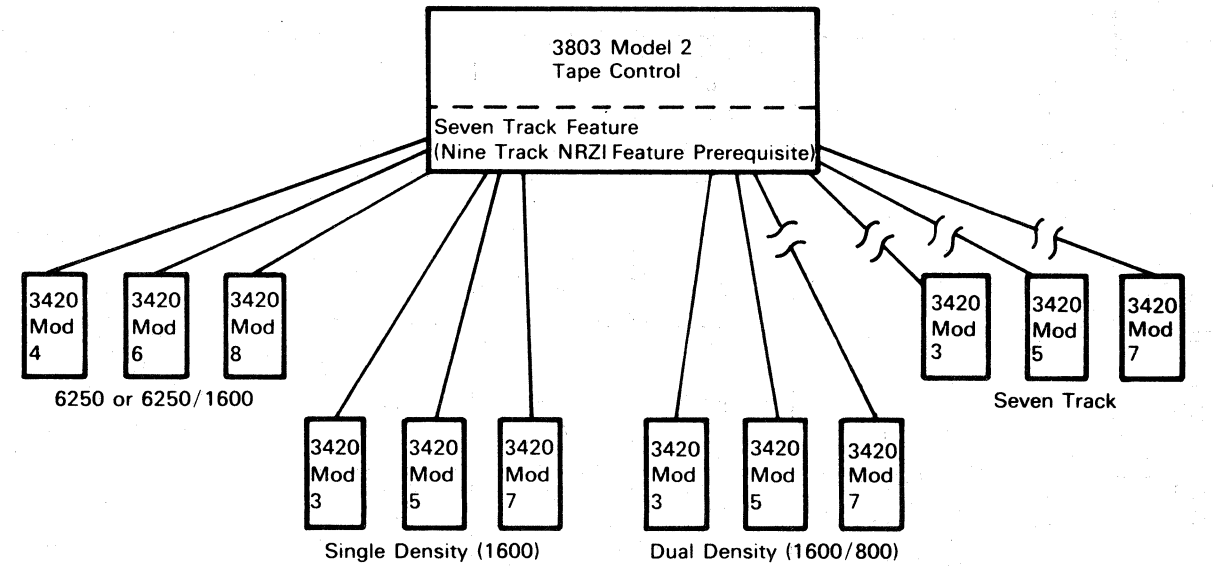
3803-2/3420 CONFIGURATIONS

Operation with Model 4/6/8 Tape Units (6250 or 1600 bpi Mode and Models 3/5/7 1600 bpi Tape Units

Operation with Model 4/6/8 Tape Units (6250 or 1600 bpi Mode) and Model 3/5/7 Tape Units (1600 bpi PE and 800 NRZI Modes)



Operation with 3420 Model 4/6/8 Tape Units (6250 or 6250/1600 bpi Modes) and Nine and Seven Track Tape Units (Nine Track 1600 bpi PE and Nine Track 1600/800 bpi and Seven Track 200/556/800 bpi NRZI Modes)



MAXIMUM OF 8 TAPE UNITS PER TAPE CONTROL

For 3420 Model 8 Power Requirements, see 90-180.

3803-2/3420							
XG0100	2735971	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

3803 MODEL 2 FEATURES

Features available on a 3803 Model 2 are nine-track NRZI, seven-track (NRZI), two-channel switch, and device switch. For switch feature descriptions, see Section 58-005 through 58-111.

NINE-TRACK NRZI

The nine-track NRZI feature, available on the 3803 Model 2, permits operation in nine-track NRZI mode. Nine-track NRZI operation requires a 3420 Model 3, 5, or 7 Tape Unit with the dual density feature.

SEVEN-TRACK NRZI

The seven-track feature permits operation in seven-track NRZI mode. Seven-track operation with a 3803 Model 2 is at 800/556/200 bpi. The seven-track feature contains both the data translator and data converter for seven-track operations. The operation is similar to that of the 3803-1 with the seven-track feature. For seven-track operation, the seven-track feature on a 3420 Model 3, 5, or 7 and on the 3803 Model 2 is required. The nine-track NRZI feature is a prerequisite for the seven-track feature on the 3803 Model 2.

Writing a tape with the translator on causes eight-bit bytes from the I/O interface to be written on tape as six-bit BCD characters; reading such a tape causes six-bit BCD characters to be translated into their EBCDIC equivalents. When using the translator, data rates are not changed and there are no changes in the tape unit's operation.

Writing a tape with the data converter on causes four tape characters (24 data bits) to be written for every three storage bytes (24 data bits); reading such a tape reverses the process by converting four tape characters into three storage bytes. When operating with the data converter on, the data transfer rate is 75 percent of the rate with data converter off.

DENSITY FEATURE COMBINATIONS

Density (bpi) (Note 1)	3803-1	3803-2	3420-3/5/7 (Note 2)	3420-4/6/8 (Note 3)
6250, 9-Track	Not Applicable	Standard	Not Applicable	6250 Feature
1600, 9-Track	Standard	Standard	1600 Feature	6250/1600 Feature
800, 9-Track	Dual Density Feature	9-Track NRZI Feature	Dual Density Feature	Not Applicable
800, 7-Track	7-Track Feature	7-Track Feature (Note 4)	7-Track Feature	Not Applicable
556, 7-Track	7-Track Feature	7-Track Feature (Note 4)	7-Track Feature	Not Applicable
200, 7-Track	RPQ only	7-Track Feature (Note 4)	7-Track Feature	Not Applicable
<b>Notes:</b> 1. Density must be specified for each 9-track 3420 tape unit. 2. 3420-3/5/7 can be operated by a 3803-1 or 3803-2. 3. 3420-4/6/8 can be operated by a 3803-2 only. 4. 9-track NRZI feature is a prerequisite for 7-track feature on 3803-2.				

COMMANDS AND INSTRUCTIONS

COMMANDS

Commands executed by this subsystem fall into one of the following three categories:

- 1. Burst Commands
- 2. Motion Control Commands
- 3. Non-Motion Control Commands

The table on this page and the one on 40-008 list the subsystem commands and command codes. Commands not listed will set COMMAND REJECT.

**Programming Note:** The 3803/3420 subsystem has no interlocking to prevent improper sequencing of write- and read-type operations that may result in writing extraneous bits or leaving partial blocks on tape. Avoiding these improper sequences is a program responsibility.

Avoid the following two basic sequences:

- 1. A write-type operation after a forward read-type operation **except**:
  - a. When the block or Tape Mark (TM) read is known to be followed by a TM. A tape mark is a special block used to separate files.
  - b. When the block or TM read is known to have been followed by erase record gap (ERG) or is known to have been the last block written before a backward operation.

For example: **R R W\*** avoid.  
**W B R W\*** allowed.

- 2. A read forward-type operation following write-type operations.

For example: **R B W R\*** avoid.  
**W B R R\*** avoid.

**W** indicates a write-type operation: write, write TM, or (ERG).

**R** indicates a forward read-type operation: read forward, forward space block, or forward space file.

**B** indicates a backward read-type operation: read backward, backspace block, or backspace file.

\* indicates the logical record on which problems may occur.

Because it may be difficult or impossible to ensure the above safe situations, a write after read forward sequence should be used only in applications where strict control of format and command sequence exists.

Write is allowable following a backspace. Assume the following tape format with labels where \* is used to denote a TM:

VOL HDR \* DATA SET \* EOF \* HDR \* DATA SET \* EOF \*\*

A rewrite of the last data set involves the following safe and proper sequence. After processing the next to last end of file (EOF) and TM, read forward to verify the header (HDR) label of the last data set, backspace, write a new HDR, and rewrite the data-set. If a new data set is being added, the read forward verifies the second consecutive TM, and thus, the true end of a data set on this tape. A backspace, write new HDR, etc., completes the sequence.

Burst Commands	Command Byte							
	0	1	2	3	4	5	6	7 Hex
Write	0	0	0	0	0	0	0	1 01
Read Forward	0	0	0	0	0	0	1	0 02
Read Backward	0	0	0	0	1	1	0	0 0C
Sense	0	0	0	0	0	1	0	0 04
Sense Reserve	1	1	1	1	0	1	0	0 F4
Sense Release	1	1	0	1	0	1	0	0 D4
Request Track-In-Error	0	0	0	1	1	0	1	1 1B
Loop Write-To-Read	1	0	0	0	1	0	1	1 8B
Set Diagnose	0	1	0	0	1	0	1	1 4B

Motion Control Commands	Command Byte							
	0	1	2	3	4	5	6	7 Hex
Rewind	0	0	0	0	0	1	1	1 07
Rewind Unload	0	0	0	0	1	1	1	1 0F
Erase Gap	0	0	0	1	0	1	1	1 17
Write Tape Mark	0	0	0	1	1	1	1	1 1F
Backspace Block	0	0	1	0	0	1	1	1 27
Backspace File	0	0	1	0	1	1	1	1 2F
Forward Space Block	0	0	1	1	0	1	1	1 37
Forward Space File	0	0	1	1	1	1	1	1 3F
Data Security Erase	1	0	0	1	0	1	1	1 97

Non-Motion Control Commands	Command Byte							
	0	1	2	3	4	5	6	7 Hex
No-Operation	0	0	0	0	0	0	1	1 03
Diagnostic Mode Set	0	0	0	0	1	0	1	1 0B
Mode Set 1	See 40-008							
Mode Set 2	See 40-008							

BURST COMMANDS

Burst commands transfer data across the channel/tape control interface. Channel End and Device End are signaled when the operation is complete (ending status).

The burst commands are:

- Write
- Read Forward
- Read Backward
- Sense
- Sense Reserve
- Sense Release
- Request Track-In-Error
- Loop Write-To-Read (maintenance aid\*)
- Set Diagnose (maintenance aid\*)

\* Diagnostic programs issue maintenance aid commands via start I/Os (SIOs) that are op-codes in the Channel Command Word (CCW).

WRITE

Write records data on tape as it moves forward and creates an interblock gap (IBG) at the end of each block. The tape control checks the parity of each data byte received from the I/O interface.

READ FORWARD

Read Forward sets the tape unit to forward read status. As the tape moves, data is read until the read head detects the next IBG. The tape control checks and, if necessary and possible, corrects the bits of each byte transferred to the I/O interface. Sensing a tape mark sets Unit Exception with Channel End and Device End in the Unit Status byte.

READ BACKWARD

Read Backward sets the tape unit to backward read status. The operation of the command is similar to Read Forward, except that the 7-track NRZI data converter mode cannot be used. Data flow and controls are the same as in Read Forward. A Read Backward, given at load point or into load point, sets Unit Check. The tape unit remains in backward status at the end of a Read Backward command.

SENSE

Sense transfers the sense bytes to channel. There are 24 bytes of sense data available. The CCW specifies the number of sense bytes to be transferred and the starting storage address. The information transferred includes unusual conditions associated with the last operation and provides details about the current conditions present in the tape control and tape unit. A sense command addressed to a tape unit that is not ready will be executed.

SENSE RESERVE

Sense Reserve reserves the addressed tape control for the channel issuing this command. The tape control will remain reserved for the channel until either:

- A Sense Release command is issued from the reserving channel, or
- A system reset occurs.

Attempting to select a tape control that is reserved to another channel results in a Control Unit Busy indication. The Sense Reserve command should only be issued by the Control Program.

SENSE RELEASE

Sense Release releases the reserved tape control so it is available to either channel. The Sense Release command should only be issued by the control program.

**Programming Note:** Sense Reserve and Sense Release commands can only be used on subsystems having the two-channel switch feature. If these commands are issued to a tape control without this feature, COMMAND REJECT results. When using these commands, they must be the first command in a chain or COMMAND REJECT results.

The Sense Reserve and Sense Release commands are not supported by IBM Operating Systems.

REQUEST TRACK-IN-ERROR (REQUEST TIE)

Request TIE returns to the tape control a data byte containing track-in-error information for 9-track and sensing level information for 7-track tape units. This information is transmitted to the channel in sense byte 2 on a Sense command following a Read, Read Backward, Write, or Loop Write to Read command. When issued following a 6250 bpi or PE operation, Request TIE is treated as a No Operation (NOP Reset Sense.

When issued following a 9-track NRZI read operation, a Request TIE either:

- Enables the tape control to perform a correction read operation if the data byte contains a single bit, or
- Does not enable the tape control to perform a correction read operation if the data byte contains bits 6 and 7, which indicate an uncorrectable error.

When issued following a 7-track read operation, the Request TIE byte controls the read clipping level in the following sequence:

Second attempt—Middle Level  
Third attempt—Low Level  
Fourth attempt—High Level

Clipping levels are cyclically altered in this way as long as read attempts result in Vertical Redundancy Check (VRC) errors.

LOOP WRITE-TO-READ (LWR)

Loop Write-to-Read checks the tape control and tape unit data and control paths without moving tape. In 6250 or 1600 bpi mode, LWR writes and error checks the record. In NRZI mode, LWR writes the record but checks only for Write Trigger VRC errors. Read errors will occur during the NRZI operation but will be reset by ALU2 when the LWR operation is completed.

On 9-track 3420 tape units, a LWR command issued at beginning-of-tape (BOT) is executed in 1600 bpi mode. Elsewhere on tape, LWR is executed in the current operating mode of the tape unit.

LWR does not require the tape unit to be in write status, but the tape unit must be ready. Execution of an LWR does not change the status of the tape unit. An LWR performed from the processing unit uses the same data path as a Write command.

SET DIAGNOSE '4B'

Set Diagnose is used to call microdiagnostic routines. Bytes are transferred from channel to the tape control to modify the operation of succeeding commands in the chain.

FLAG BYTE 1

Bit	Write	Read
0	Diagnostic Write	N/A
1	N/A	IBG Measure
2	Inhibit Postamble	Read Access
3	Var Go-down Time	Var Go-down Time
4	Inhibit Preamble	N/A
5	LWR	DMR
6	TUBO Mask	N/A
7	Change Direction	Change Direction

Diagnostic Write

Performs the same function as the 'OB' command.

- PE - causes writing to be inhibited in any track when the write data contains successive one bits.
- NRZI - 9 track - Inhibits writing P bits.  
7 track - Inhibits writing C bits.

Inhibit Postamble

Prevents writing the last 39 zeros of the postamble. The ending all-ones marker and the first zero is written.

Variable Go-down Time

Two bytes (flag bytes 3 and 4) are sent to the tape control unit. These bytes are used to control the wait time before starting the next operation in the chain following the Set Diagnostic (48) command.

Count values are:

- 103.15 Microseconds to decrement one count.
- 27 Milliseconds to decrement the low order counter 256 ('FF') counts and cause one decrement of the high order count.

Inhibit Preamble

Prevents writing the first 39 zeros of the preamble. The last (40th) zero and the beginning all-ones marker is written.

Loop Write-To-Read

Write data is sent to the tape unit. In the MST board it is gated to the read circuits and then returned to the tape control unit for read checking.

Set TUBO Mask

Flag byte 3 is used as a mask to control the tape unit Bus Out. Any bit on in flag byte 3 causes that tape unit Bus Out bit to be held active, and thus prevents the tape unit from writing data for that specific bit.

Change Direction

Change Direction allows the following word (CCW) chain to progress through turnaround, if necessary, and up to the point of activating the Move line to the tape unit. At this point, the operation is terminated. The tape unit is left in forward or backward, write or read status, depending on the operation follow the Change Direction instruction.

FLAG BYTE 2

Bit	Description
0	Block Data Check
1	N/A
2	Block Interrupts
3	Force Control Unit Busy
4-7	N/A

FLAG BYTE 3 (OPTIONS)

- DMR Go-Up Time in tack pulses
- GDT Hi order byte of go-down count
- TUBO Mask Byte used to mask TU Bus Out

FLAG BYTE 4 (OPTIONS)

- DMR Go-down time measure count equivalent to tach pulses. No tach pulse when tape is not moving.
- GDT Lo order byte of go-down count.

MOTION CONTROL COMMANDS

Motion control commands move tape but do not transfer information across the channel/tape control interface.

All motion control commands operate as follows:

- 1. Channel End is signaled when the command is accepted (initial status).
- 2. For commands other than Rewind/Unload, device end is signaled when the operation is completed (ending status).
- 3. The tape control responds with BUSY if the tape control is addressed while executing the command. As a result, the 3803 is obligated to present a CUE interrupt to the channel that received the BUSY as soon as the current operation is complete.

**Note:** For Rewind/Unload, Channel End is signaled in initial status, and Device End, Control Unit End, and Unit Check are signaled in an interrupt status cycle after the command becomes effective at the tape unit. Device End is signaled again when the operator reloads tape, presses START, and the tape unit goes from not-ready to ready providing the tape control has not been offline in the interim.

Motion control commands are:

- Rewind
- Rewind/Unload
- Erase Gap
- Write Tape Mark
- Backspace Block
- Backspace File
- Forward Space Block
- Forward Space File
- Data Security Erase

REWIND (REW)

Rewind causes the selected tape unit to rewind tape to load point.

REWIND UNLOAD (RUN)

Rewind Unload causes the selected tape unit to rewind tape to load point, removes tape from the columns, finishes winding tape onto the right reel, closes the cartridge (if used), and opens the window.

ERASE RECORD GAP (ERG)

Erase Record Gap causes the selected tape unit to move tape forward and erase tape as follows:

	Single ERG	Successive ERGs
6250 bpi	3.75 in. (95,3 mm)	3.45 in. (87,6 mm)
1600 bpi and 800 bpi 9-track	4.2 in. (106,7 mm)	3.6 in. (91,4 mm)
7-track	4.5 in. (114,3 mm)	3.75 in. (95,3 mm)

WRITE TAPE MARK (WTM)

Write Tape Mark causes the selected tape unit to move tape forward and write a tape mark block.

At 6250 and 1600 bpi, a WTM causes the subsystem to write a tape mark preceded by an Erase record gap.

Data Check, Equipment Check, and Unit Check can be set during a Write Tape Mark (WTM) operation.

Attempting to write a tape mark on a file-protected tape unit sets COMMAND REJECT.

BACKSPACE BLOCK (BSB)

Backspace Block causes tape to move backward to the next interblock gap or to load point, whichever comes first. No data bytes are transferred. Channel End is signaled when the command is accepted. Device End is signaled at the next interblock gap or load point. Sensing a tape mark sets Unit Exception, with Device End in the status byte. Backspacing into or at load point sets Unit Check with Device End in the status byte. The tape unit remains in backward status.

BACKSPACE FILE (BSF)

Backspace File causes the selected tape unit to move tape backward to the interblock gap on the load point side of a tape mark, or to load point, whichever comes first. No data bytes are transferred. Unit Exception is not set when tape mark is sensed.

Backspacing into or at load point sets Unit Check with Device End in the status byte. Device End is signaled at the completion of the operation. The tape unit remains in backward status.

FORWARD SPACE BLOCK (FSB)

Forward Space Block causes the selected tape unit to move tape forward to the next interblock gap. Initial status contains Channel End. Sensing a tape mark sets Unit Exception, with Device End in the status byte.

FORWARD SPACE FILE (FSF)

Forward Space File causes the selected tape unit to move tape forward to the interblock gap beyond the next tape mark. No data bytes are transferred. Initial status contains Channel End. Device End is signaled at the completion of the operation. Sensing the tape mark does not set the Unit Exception bit.

**Programming Note:** The tape control responds with a Control Unit Busy sequence while performing an ERG, WTM, BSB, BSF, FSB, or FSF operation.

DATA SECURITY ERASE (DSE)

Data Security Erase causes the selected tape unit to erase tape from the point at which the operation is initiated until the end-of-tape marker is sensed.

The DSE command is accepted by the tape control only when chained immediately following an Erase Gap command. Receipt of this command under any other condition results in COMMAND REJECT. If the command is accepted, initial status contains Channel End, and Device End is signaled when the operation is complete. An attempt to erase a file-protected tape sets COMMAND REJECT. Unit Exception never occurs as a result of this command. Data Security Erase at end of tape (EOT) causes an immediate ending sequence. The tape control does not remain busy after initial selection. An attempt to select the tape unit while executing a DSE results in busy status.

During DSE execution, the tape unit monitors erase head current to ensure that tape is erased. If erase head failure is detected, the operation is terminated by dropping TAPE UNIT READY. Device End and Unit Check are issued as a result of dropping READY. At the completion of a DSE, the tape control presents Device End to channel.

**Programming Note:** If the tape unit drops ready or fails logically during DSE, the ending status containing Device End and sense byte 7, bit 4 (Erase Head Failure) is also set.

Device End is signaled when the EOT marker is sensed during a normal DSE completion. However, a sense command should be performed to assure EOT was reached. Upon completion of the DSE, the operating program must issue sufficient erase gap commands to ensure erasure of any data written beyond the EOT marker. Issuing 14 erase gap commands, which erases about 4 feet (1,22m) of tape, is generally sufficient. The channel must be enabled for interrupts to detect a Unit Check condition due to manual intervention. When Device End is signaled, a sense command should be performed to ensure the tape unit reached EOT.

The Data Security Erase command is not currently supported by IBM Operating Systems. DOS supports DSE via a Magnetic Tape Command (MTC).



NON-MOTION CONTROL COMMANDS

Non-motion control commands do not move tape and do not transfer data across the channel/tape control interface.

Channel End and Device End are signaled when non-motion control commands are accepted (initial status).

Non-motion control commands are:

- No-Operation
- Mode Set 1
- Mode Set 2
- Diagnostic Mode Set (maintenance aid)

NO-OPERATION (NOP)

NOP performs no function in the tape control or tape unit, and does not transmit data or move tape. NOP does not reset tape control sense data.

**Programming Note:** Placing a NOP command at the end of a series of chained commands delays channel disconnect from the tape control until the NOP is executed. Indiscriminate use of this command delays the channel program, and may contribute to a channel overload condition.

MODE SET 1 (MS 1)

Mode Set 1 commands sent to tape controls with the 7-track NRZI feature establish an operating mode for succeeding 7-track NRZI operations. Bits 0 and 1 control density (200/556/800 bpi) and bits 2, 3, and 4 control parity (odd or even), data converter (on or off), and translator (on or off) circuits in the tape control. See chart on this page.

A Mode Set 1 command affects operation of all 7-track tape units attached to the tape control. Unless reset, the tape control retains its mode setting until it receives another Mode Set command.

MODE SET 2 (MS 2)

Mode Set 2 commands sent to a 3803 Model 2, set the operating mode for succeeding write-type operations. Modes are: 6250 bpi, 1600 bpi PE, or 800 bpi nine-track NRZI. Unless reset, the tape control retains its mode setting until it receives another Mode Set command.

DIAGNOSTIC MODE SET (DMS)

DMS causes an artificial signal-loss condition that checks read and write error detection circuits.

- At 6250 bpi, track P is made all zeros and the program supplies the error correcting code as part of the data.
- At 6250 bpi Diagnostic Read inhibits single- and double-track error corr check characters to channel with data.
- At 1600 bpi, whenever write data contains successive one bits in any track, writing in that track is inhibited until the last one bit is reached.
- In 9-track NRZI mode, no bits are written in track P.
- In 7-track NRZI mode, no bits are written in track C.

A Diagnostic Mode Set command affects only operations for the command chain in which it is issued.

Mode Set Commands

Set Density			Parity		Data Converter		Translator		Command Byte							Hex	
200	556	800	Odd	Even	On	Off	On	Off	0	1	2	3	4	5	6		7
Mode Set 1 (7-Track) (See Note)																	
X			X		X			X	0	0	0	1	0	0	1	1	13
X				X		X		X	0	0	1	0	0	0	1	1	23
X				X		X	X		0	0	1	0	1	0	1	1	2B
X			X			X		X	0	0	1	1	0	0	1	1	33
X			X			X	X		0	0	1	1	1	0	1	1	3B
	X		X		X			X	0	1	0	1	0	0	1	1	53
	X			X		X		X	0	1	1	0	0	0	1	1	63
	X			X		X	X		0	1	1	0	1	0	1	1	6B
	X		X			X		X	0	1	1	1	0	0	1	1	73
	X		X			X	X		0	1	1	1	1	0	1	1	7B
		X	X		X			X	1	0	0	1	0	0	1	1	93
		X		X		X		X	1	0	1	0	0	0	1	1	A3
		X		X		X	X		1	0	1	0	1	0	1	1	AB
		X	X			X		X	1	0	1	1	0	0	1	1	B3
		X	X			X	X		1	0	1	1	1	0	1	1	BB
Mode Set 2 (9-Track)																	
800	1600	6250															
		X										1	1	0	1	0	D3
	X											1	1	0	0	0	C3
X												1	1	0	0	1	CB
Note: Seven-track Mode Set 1 commands are treated as 'NOP reset sense' when issued to a tape control without the seven-track NRZI compatibility feature.																	

I/O INSTRUCTIONS

In addition to initiating one of the I/O operations by means of the Start I/O (SIO) instruction, the program can cause certain actions at the tape control by using the Test I/O and Halt I/O instructions.

TEST I/O

A Test I/O instruction performed by the Central Processing Unit (CPU), causes the status byte for the selected tape unit to be sent to the channel for analysis. No actual operation is performed.

**Note:** A Test I/O command issued to a not ready tape unit results in a contingent connection on tape control units with the two-channel switch.

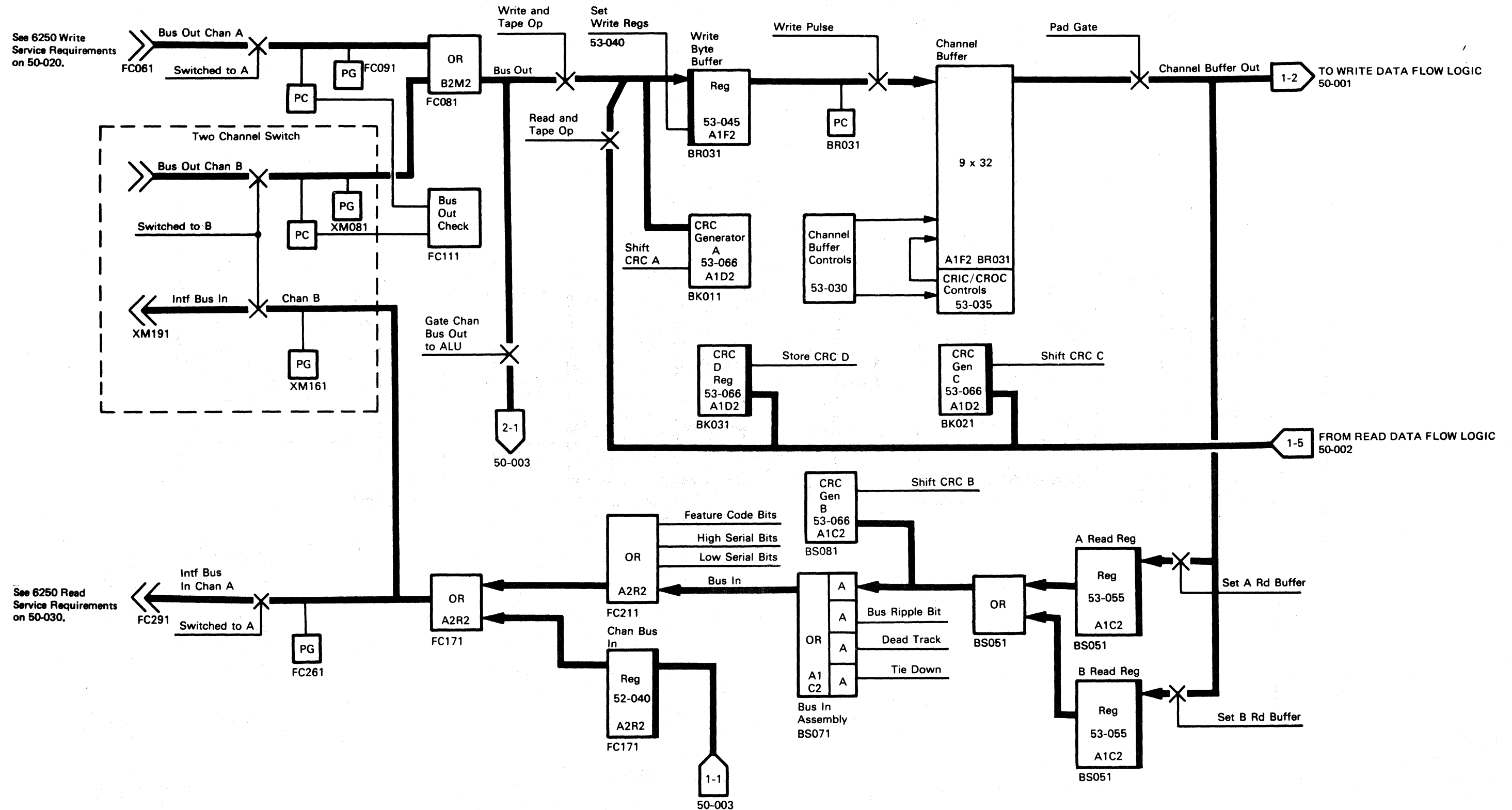
HALT I/O

A Halt I/O instruction causes data transfer to stop. The tape control disconnects from the channel and proceeds independently to the completion of the operation. When the operation is completed, the tape control tries to re-establish connection with the channel to transfer ending status. If addressed while completing the operation, the tape control returns a BUSY signal.

If a Halt I/O instruction is executed after STATUS IN and before tape motion is started during a Write or Read operation, the operation is canceled, and Channel End, Device End, Unit Check, and Data Check are generated.



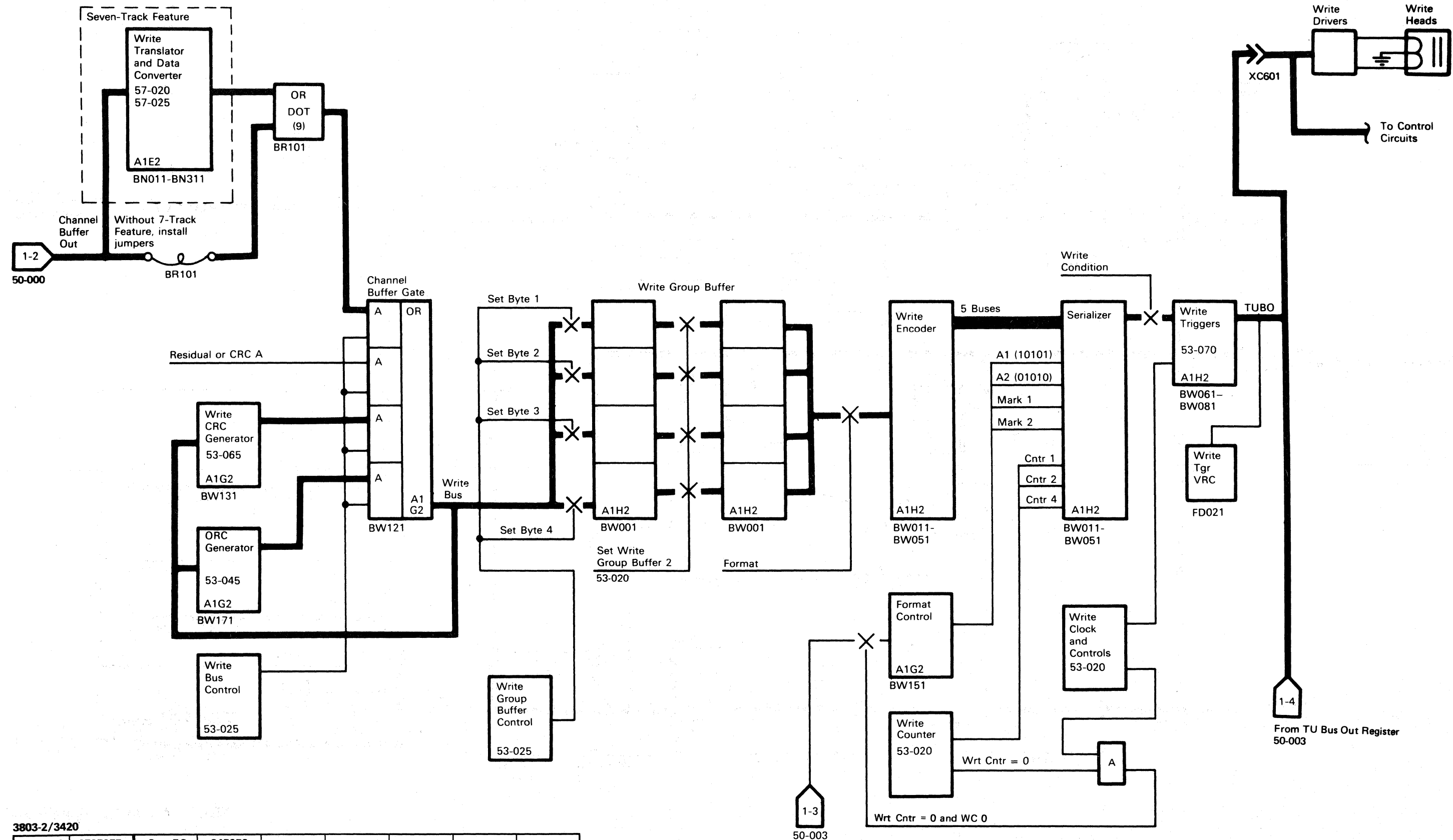
## READ/WRITE FLOW LOGIC



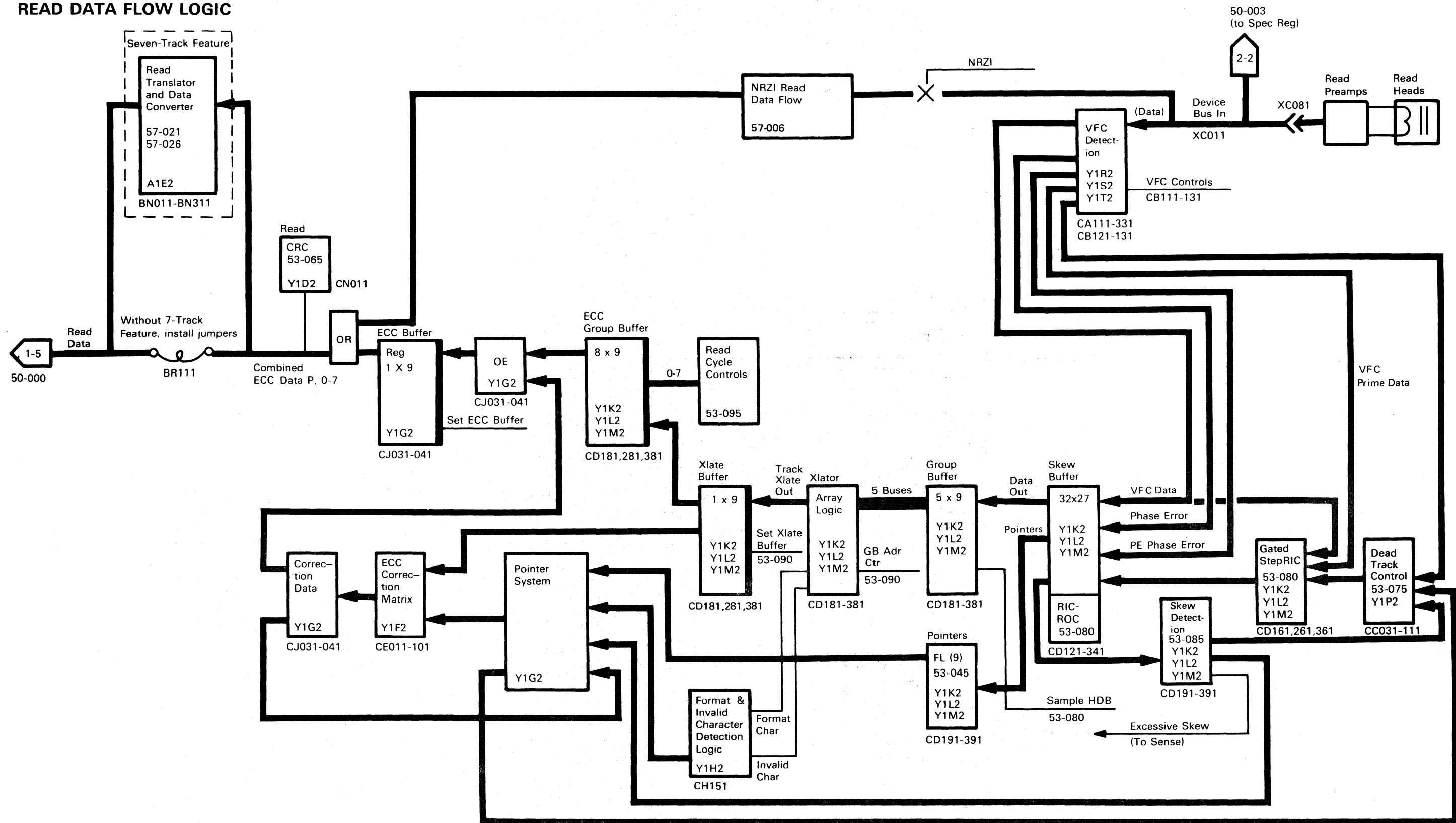
**3803-2/3420**

<b>XG0500</b> Seq 1 of 2	<b>2735975</b> Part Number	<b>See EC History</b>	<b>845958</b> 1 Sep 79					
-----------------------------	-------------------------------	-----------------------	---------------------------	--	--	--	--	--

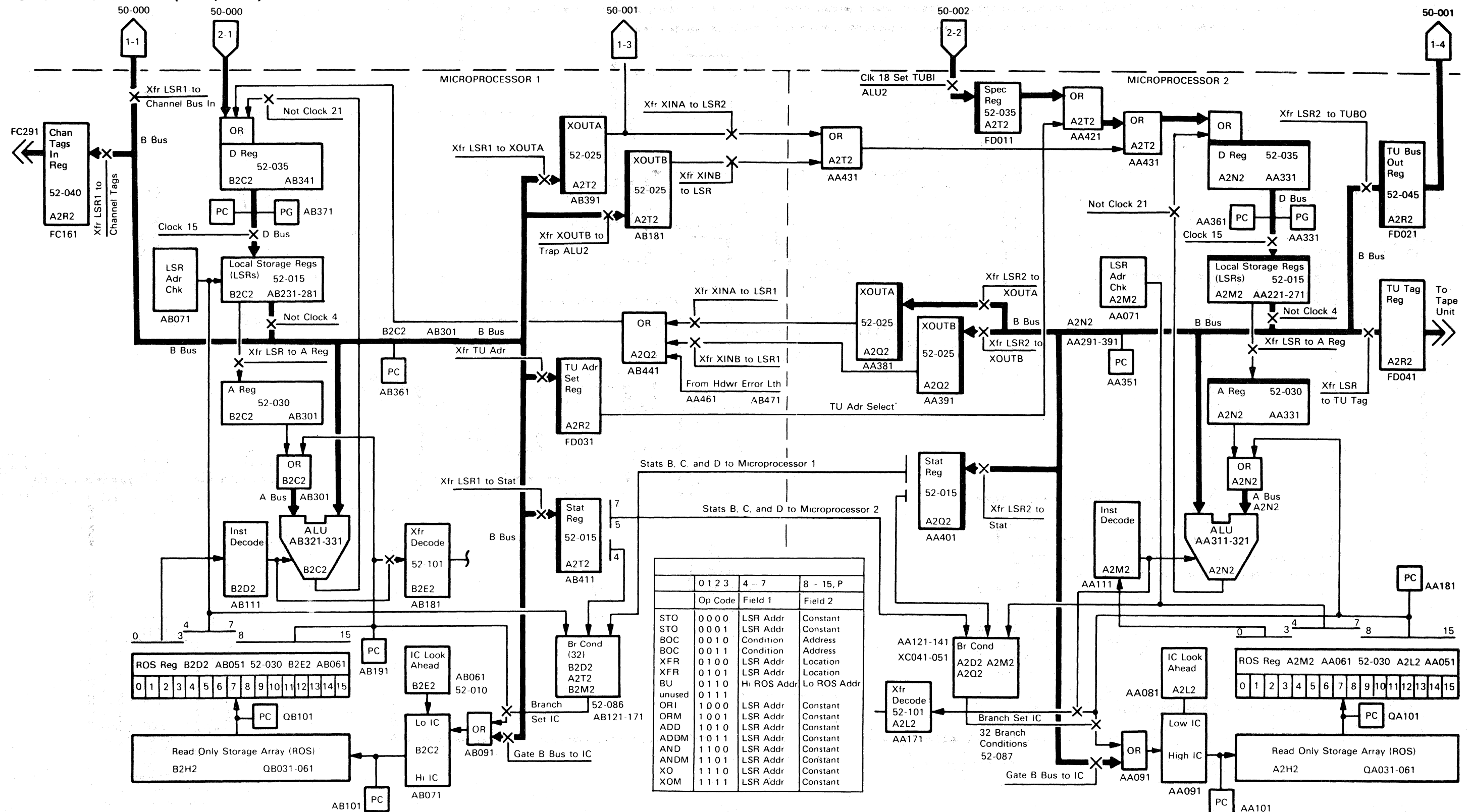
## WRITE DATA FLOW LOGIC



## READ DATA FLOW LOGIC



## MICROPROCESSORS (MP1/MP2) SCHEMATIC

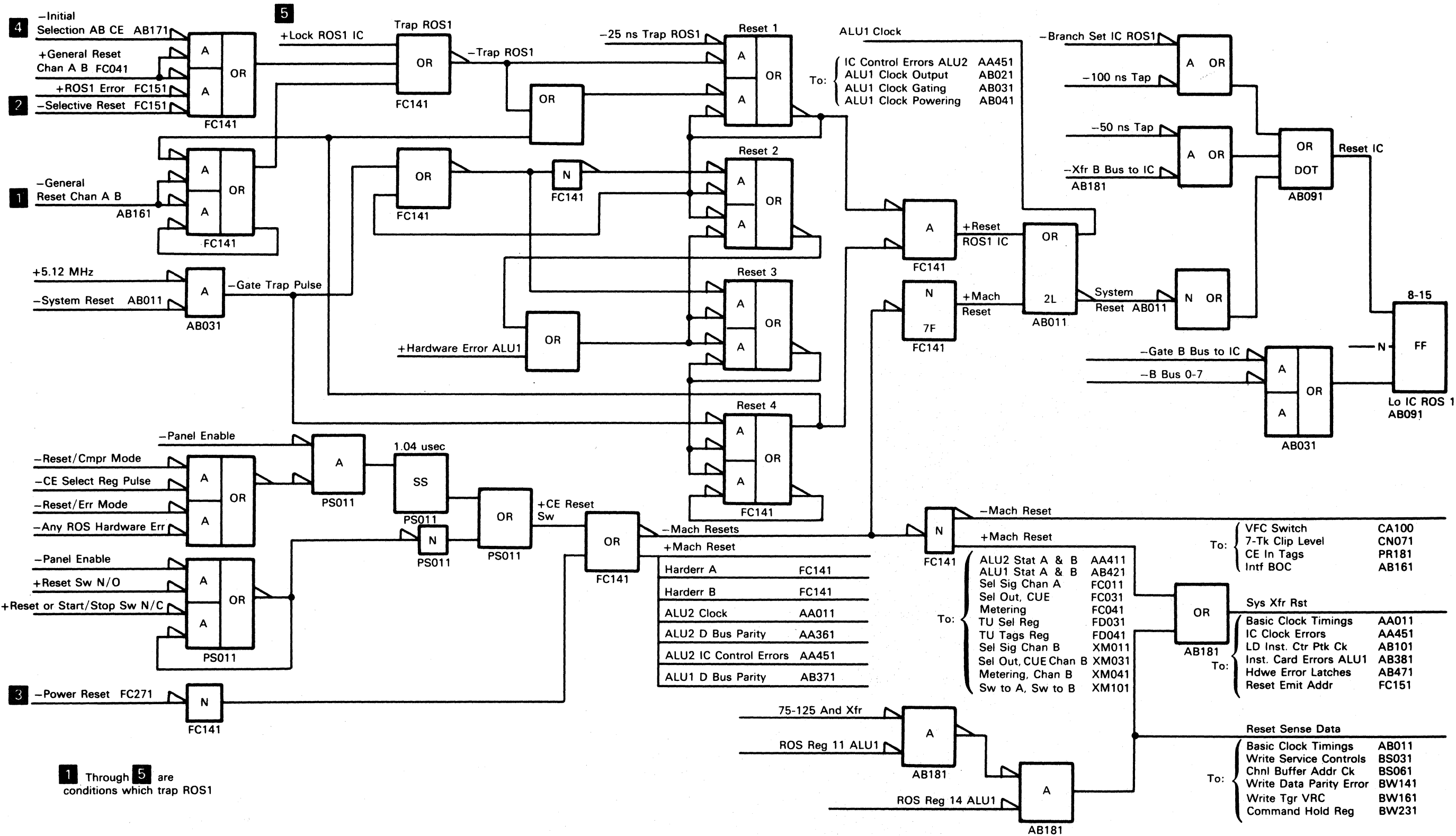


**3803-2/3420**

<b>XG0600</b> Seq 2 of 2	<b>2735976</b> Part Number	<b>See EC History</b>	<b>845958</b> 1 Sep 79					
-----------------------------	-------------------------------	-----------------------	---------------------------	--	--	--	--	--

© Copyright International Business Machines Corporation 1976, 1979

ROS 1 TRAP CONDITIONS



1 Through 5 are conditions which trap ROS1

ROS 1 TRAP CONDITIONS (Cont'd)

Both hardware and microprograms generate resets.  
Types of resets are General, Selective, and Machine.

- [1] GENERAL RESET resets all flags, stats, and reserve bits that apply to the selecting interface.
- [2] SELECTIVE RESET performs the same functions except the Control Unit Reserve and Hold Interface bits are not reset.
- [3] POWER ON RESET and CE panel resets generate MACHINE RESET. Turning power on and pressing RESET both generate POWER ON RESET. POWER ON RESET clears some LSRs and initiates INTERFACE CHECKOUT. Channel outbound tags are checked to ensure all are inactive and all inbound tags except OP IN are activated. Contents of the CHANNEL BUS IN register are sent to CHANNEL BUS OUT.
- [4] INITIAL SELECTION AB CE traps ROS 1 to 000 at each selection of the tape control.
- [5] LOCK ROS 1 IC traps ROS 1 to 000 when an ALU 1 hardware error occurs.

MP2 is activated for the proper reset after Stat B has been set on or off to reset only the selecting interface. CONTROL UNIT BUSY is activated for the duration of the reset and is deactivated at completion of MP2 reset.

If MP2 has hardware errors, the tape control "hangs up" with BUSY active and loops on a trap address.

If all steps are completed correctly, the reset is finished. Any failure "hangs up" the tape control at a trap address and BUSY remains active.

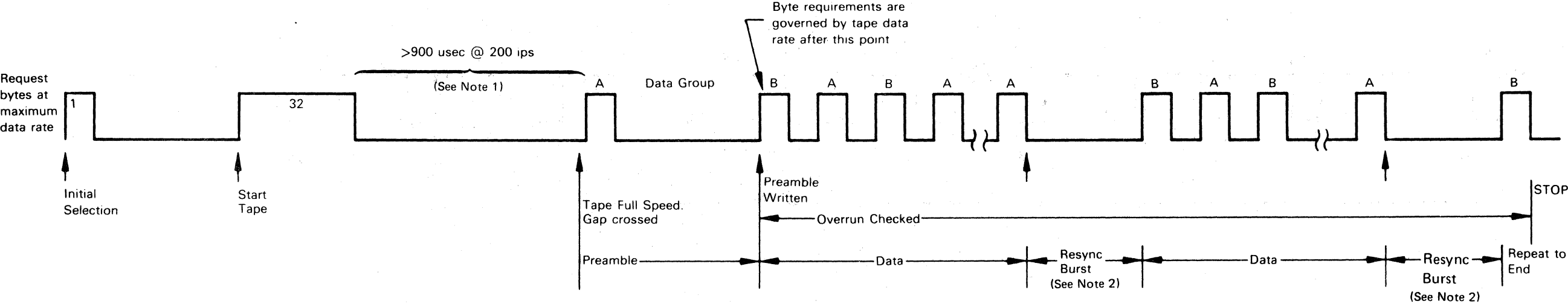
3803-2/3420

XG0700	2735977	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

6250 WRITE SERVICE REQUIREMENTS

The write buffers fill automatically at the maximum rate permitted by the control unit, cable, and channel delays. This diagram shows when byte requirements occur. The channel must respond only to the average need during the period of overrun, checking such that at least one ECC (error correction code) group remains in control unit buffers at all times until stop occurs. Note that no individual channel byte transfer is overrun checked.

36 bytes are pre-buffered and one ECC group or more must remain in the buffer at all times prior to Stop. This time could permit some data chaining or be considered a safety factor.

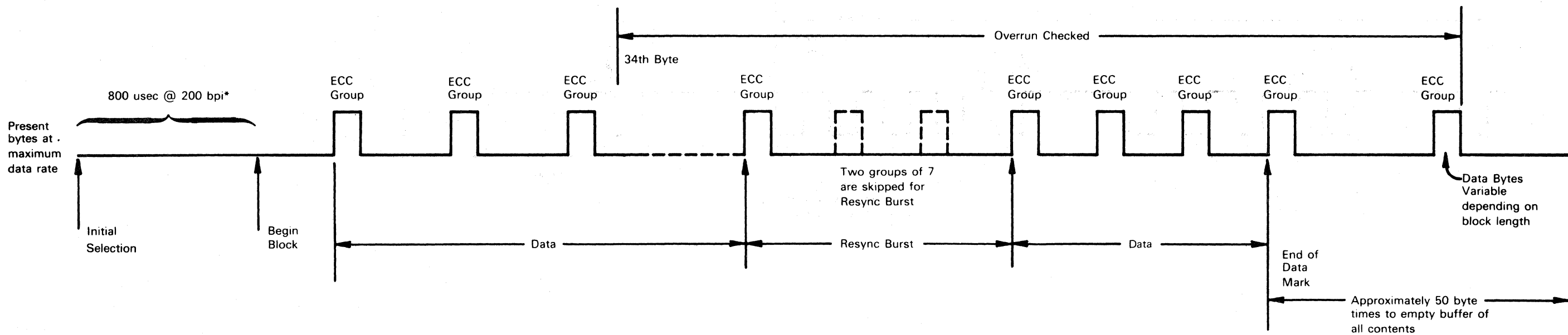


- Notes:
- [1] Proportionately more on lower speed tape units.
  - [2] The Resync Burst consists of a mark 1 group, 2 sync groups, and a mark 2 group. It is interleaved in a block of data after every 158 data groups, and is used to re-synchronize the read circuits during a 6250 read operation.

6250 READ SERVICE REQUIREMENTS

The channel buffer and both read byte buffers are empty at the start. Overrun is called only if there is insufficient room in the buffer for a waiting ECC group. The ECC rate varies according to corrections required but follows the tape rate average over periods of 50 bytes or more. The channel has until the postamble end to accept all data from the buffer. Note that no individual data transfer is checked for overrun. To overrun, the buffer fills during a channel lag.

There is excess read buffer capacity equivalent to 10 usec\* available for "slip" or possible data chaining. The time may be distributed or lumped. Overrun check effectively starts at the 34th byte since that is the total buffer capacity.



3803-2/3420

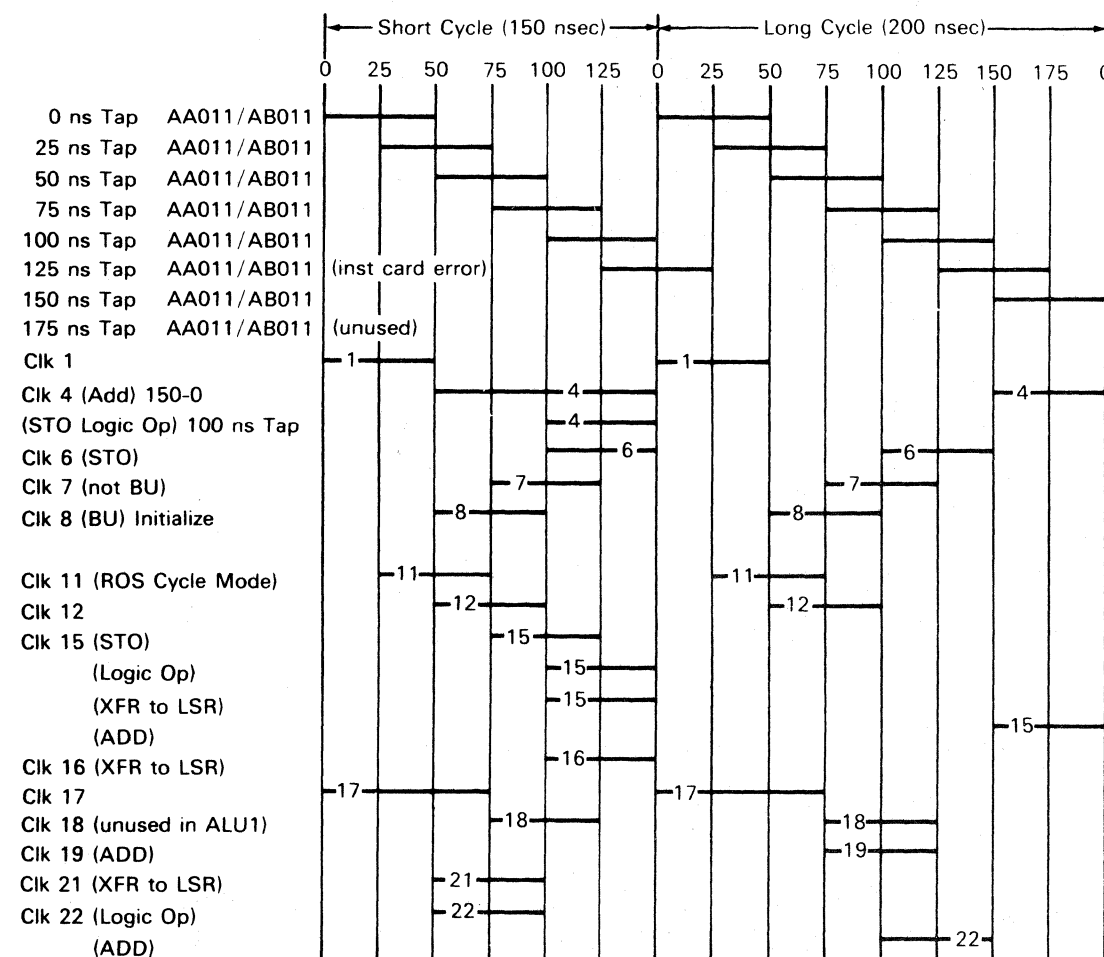
XG0800	2735978	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

Copyright International Business Machines Corporation 1976, 1979



## MP1 Clock Control Logic

The numbers on the clock outputs (CLK1—CLK22) bear no relationship to the times these lines become active within the clock cycle.

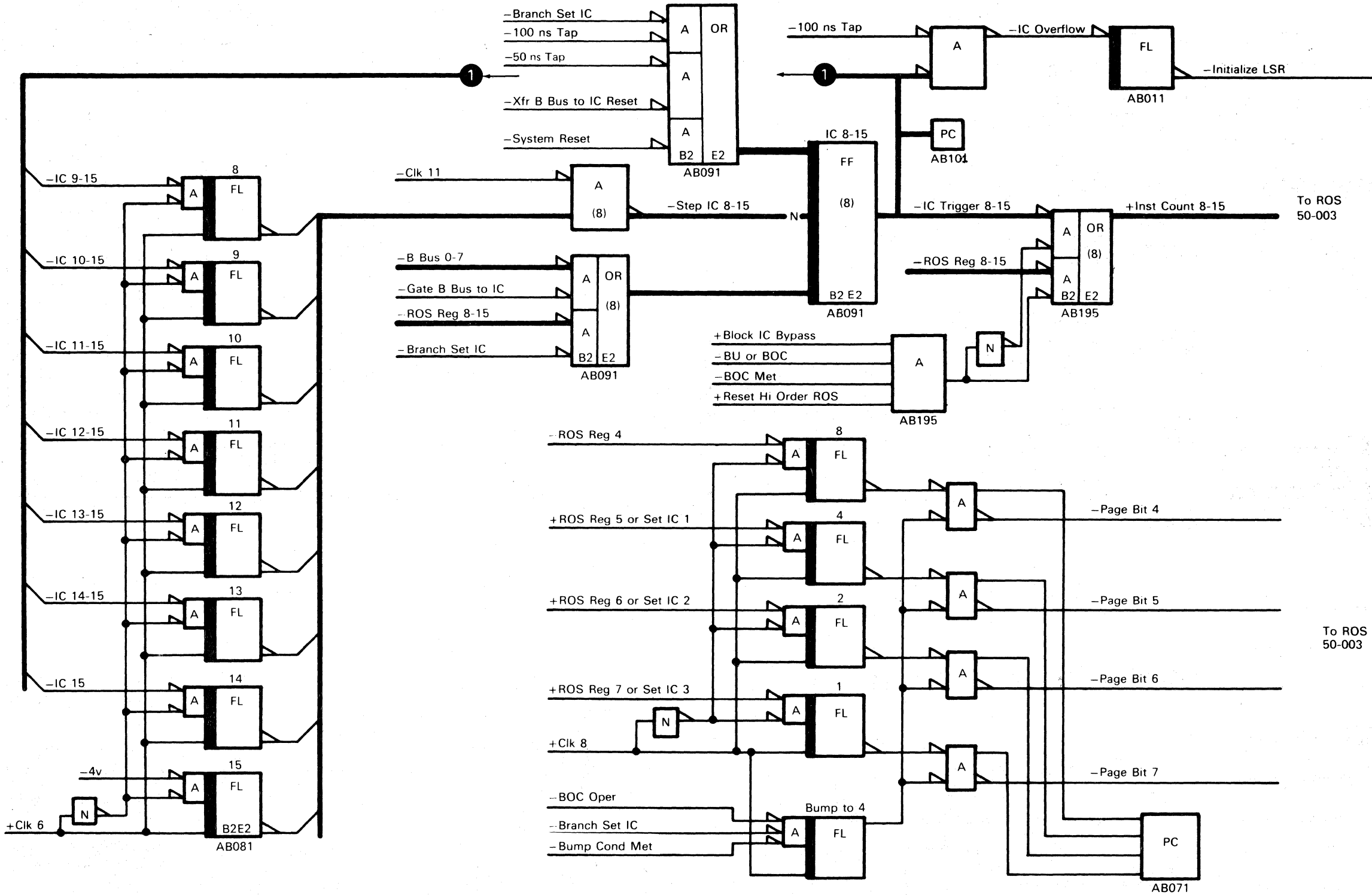
[illegible]

<b>XG0900</b> Seq 1 of 2	<b>2735979</b> Part Number	<b>See EC History</b>	<b>845958</b> 1 Sep 79				
-----------------------------	-------------------------------	-----------------------	---------------------------	--	--	--	--

MICROPROCESSOR 1 INSTRUCTION COUNTER (IC)

MP2 IC is similar on:

ALD    AA071, 081, 091  
Cards   A2L2, A2M2



3803-2/3420							
XG0900	2735979	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

© Copyright International Business Machines Corporation 1976, 1979

LOCAL STORAGE REGISTERS

The Local Storage Registers (LSRs) serve as buffers to hold command codes, addresses, error conditions, and any other data the microprocessors use. Each microprocessor has 32 Local Storage Registers. Each register holds one byte (8 bits) of data and a parity bit. The registers are numbered LSR 0 through LSR 31.

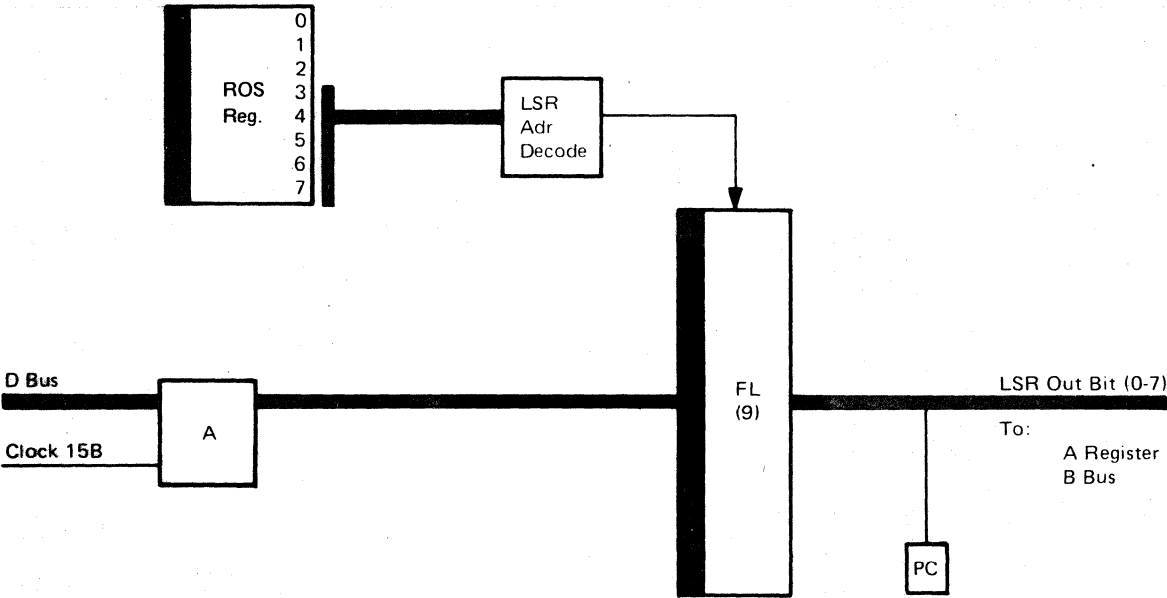
Data from the D Register is stored in the LSRs, and the output from the LSRs goes to the A Register and the B Bus.

Microprogram instructions gate the contents of the LSRs to other registers.

When the LSRs are used, Field 1 of the microprogram instruction addresses a specific register.

The procedure on page 12-012 displays contents of local storage registers.

ROS/LSR Logic



	MP1		MP2	
	ALD	Card	ALD	Card
LSRs	AB231	B2C2	AA221	A2N2
LSR Decode	AB201	B2D2	AA191	A2N2
Address Decode	AB071	B2D2	AA071	A2N2
Parity Check	AB361	B2C2	AA351	A2N2

STAT REGISTERS

STAT registers are used for microprocessor to microprocessor communication and for microprocessor to data flow communication.

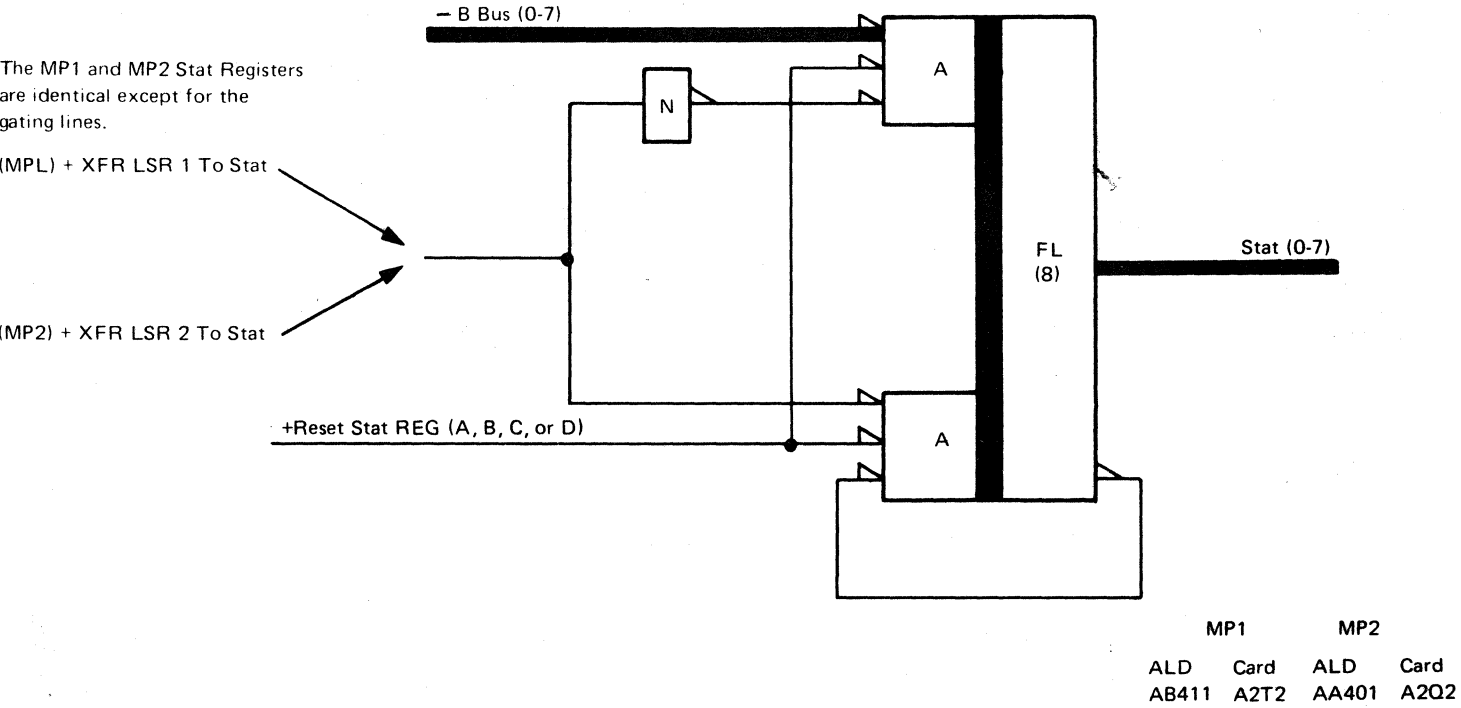
MP1 Stat Register Usage

MP1 Stat	
0	Stop
1	Sense
2	Sense II
3	Diag. Mode
4	Stat A
5	Stat B
6	Stat C
7	Stat D

MP2 Stat Register Usage

MP2 Stat	
0	Tape Op
1	Start R/W
2	Wr ID
3	7 Trk
4	Stat A
5	Stat B
6	Stat C
7	Stat D

MP1/MP2 Stat Registers



MP1		MP2	
ALD	Card	ALD	Card
AB411	A2T2	AA401	A2Q2

CROSSOVER (XOUTA/XOUTB)
REGISTERS

The MP1 XOUTA Crossover Register is both a buffer for MP1 control information and a transfer register when sending a byte of information to MP2.

The individual bits from XOUTA (XOUTA BIT x) are used for the following:

Table with 3 columns: Bit, Location, Function. Rows 0-7 detailing bit functions like Gates unit serial number, Gates EC level, Gates 7-track Mode Sets, etc.

The contents of XOUTA are gated to MP2 by XFR XINA TO LSR 2 on AA431. Output of XOUTA in MP1 is called XINA in MP2.

MP1 XOUTB crossover register is a transfer register sending a byte of information to MP2. When MP1 XOUTB is used, MP2 traps to address 000. The contents of XOUTA becomes an index to a specific routine in MP2.

The MP2 XOUTA crossover register is both a buffer for MP2 control information and a transfer register when sending a byte of information to MP1.

Bits from XOUTA (XOUTA BIT x) are used as follows:

Table with 3 columns: Bit, ALD, Function. Rows 0-7 detailing bit functions like Gates PE Mode, Gates forward operation, etc.

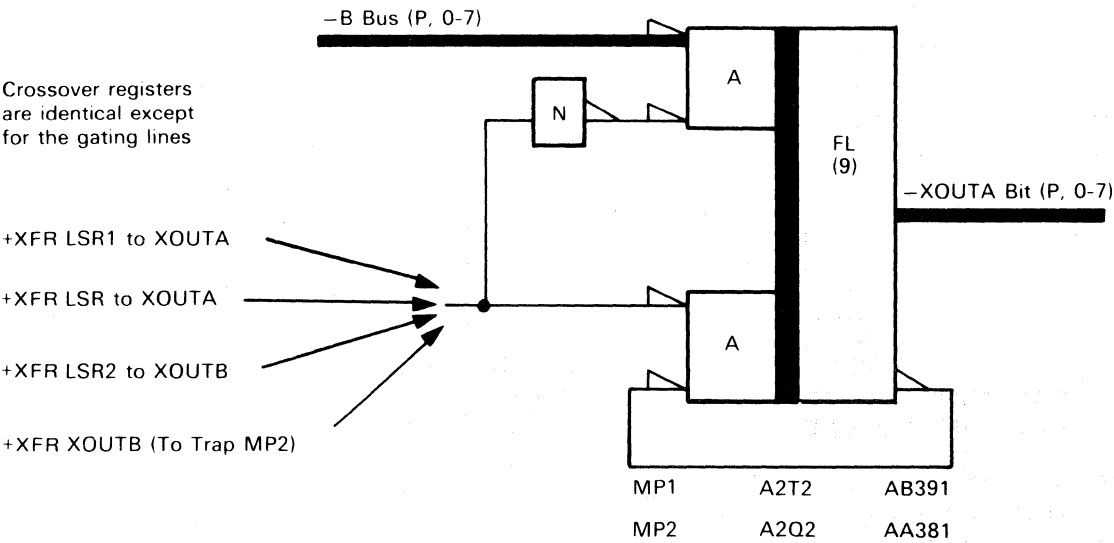
The contents of XOUTA are gated to MP1 by XFR XINA TO LSR 1 on AB441. Output of XOUTA in MP2 is known as XINA in MP1.

The MP2 XOUTB Crossover Register is a transfer register sending a byte of information to MP1. This register is primarily used to send sense bytes from MP2 to MP1 for transfer to channel.

MP1 XOUTA Register Bit Usage

Table with 7 columns: MP1 XOUTA, Sense Stat On, Dataflow Control, 6250 BPI Write, 1600 BPI Write, NRZI Write, XFR TIE. Rows 0-7 detailing bit usage for various dataflow and write operations.

Crossover Register



MP2 XOUTA Bit Usage

Table with 2 columns: MP2 XOUTA, Data Control. Rows 0-7 detailing bit usage for PE, Forward, Allow Env. Loss, Sync, 6250, Speed, Low Gain, and Speed.

MICROPROCESSOR LISTINGS

Microprocessors 1 and 2 have different listings that can be identified by ALU1 or ALU2 printed in the upper left corner of each page.

Listings are in four parts:

- 1. General reference information, sense byte descriptions, Local Storage Register layout, branch condition codes, transfer codes, etc.
- 2. Equate statements which specify a symbolic name for a value. Equate statements are generally followed by a description of the use of the constant.
- 3. Listing of the executable instructions.
- 4. Cross reference table containing all symbolic names used in the listing. This table includes the length of the referenced field, its value, the statement number in which it is defined, and the statement number of all instructions using the symbolic name.

COMMUNICATION BETWEEN MICROPROCESSORS

Either microprocessor can move a byte of information from an LSR to either the XOUTA or XOUTB registers. The other microprocessor can then move the byte of information from the XOUTA or XOUTB register to an LSR.

Each microprocessor can test, with Branch On Condition instructions, STAT BITS B, C, and D from the other microprocessor.

LINKING MICROPROGRAM ROUTINES

LINK registers store microprogram addresses for return to a major routine from subroutines. Before branching to a subroutine, the address of a Branch Unconditional instruction is stored in a LINK register. The Branch Unconditional instruction must be in the same page as the subroutine to which the program is branching. When the subroutine has completed its function, the contents of the LINK register are transferred to the Instruction Counter. The microprogram then branches to the Branch Unconditional instruction, which, in turn, branches to the return point in the calling routine.

MP1 has six link registers named LINK1 through LINK6 and MP2 has three LINK registers named LINK1 through LINK3. The LINK registers are local storage registers used for linkage purposes. The specific local storage registers used for linkage are:

LINK	MP1	MP2
LINK1	LSR16	LSR28
LINK2	LSR17	LSR25
LINK3	LSR18	LSR26
LINK4	LSR19	
LINK5	LSR24	
LINK6	LSR25	

Multiple link registers are available because there may be several possible branches out of a subroutine.

MICROPROCESSOR (MP1 AND MP2) FUNCTIONS

Two microprocessors (50-003) control logic operations of the tape control.

Operation of MP2 is dependent on the operation of MP1. MP2 remains idle until MP1 supplies it with an address at which to begin. MP1 operates constantly, either executing a routine required by the operation being performed or polling the possible conditions that can require the execution of a routine.

Microprocessors consist of:

Read Only Storage (ROS) in which the microprogram is stored for use by the microprocessor. The contents of ROS cannot be modified by the microprogram.

An Arithmetic Logic Unit (ALU) which performs all arithmetic and logic operations: ADD, AND, OR, and XOR.

Registers and Buses to hold or transfer data for subsequent use.

Read Only Storage is addressed by three-digit hexadecimal numbers 000 through 7FF. Each addressable unit in the Read Only Storage is 16 bits long. The first digit of the address specifies a page (block of 256 addresses) of Read Only Storage. Each microprocessor has 8 pages of storage, 0 through 7. The two low-order digits specify one of the possible 256 addresses in a page.

In general, MP1 handles all logic operations dealing with the channel and MP2 handles the operations dealing with the tape units.

The microprocessors can transfer bytes of information between them and test single bits stored in the other microprocessor.

MICROPROCESSOR INSTRUCTIONS

The microprocessors use 12 instructions. See following pages.

MICROPROCESSOR INSTRUCTION FORMAT

Microprocessor instructions have the following format:

[label]OPCODE field1,field2[comments]

where **label** is a one- to eight-character name by which the instruction can be referenced. Branch instructions point to locations in the microprogram by label.

**OPCODE** is the operation to be performed on the data or addresses in Field 1 or Field 2.

**Field 1** is generally the address of a Local Storage Register. In some instructions this field may be a branch condition or ROS page number.

**Field 2** is generally a constant, referred to as a decimal number or by a symbolic name. The value of symbolic constants for each microprocessor is listed in the beginning of the listings as EQU statements. In some instructions this field may be a branch address or transfer code.

**Field 2** can contain several symbolic constants combined arithmetically, that is, the sum or difference of two or more constants.

For example, the constant in the instruction:

ADD WORK1,ONES-174

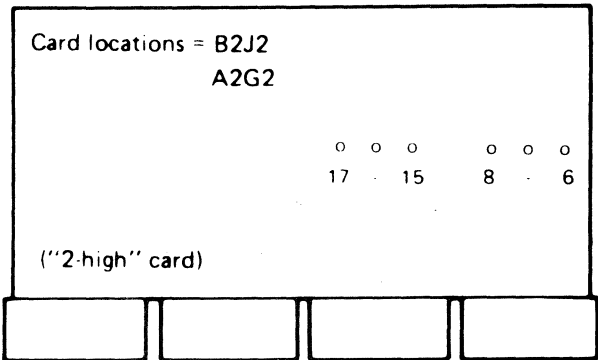
results in the constant hexadecimal FF (ONES) minus the decimal value 174, or a decimal value of 81.

MICROPROGRAM EC's

Microprogram EC's are applied with two Array Patch Cards, type DE01, which provide auxiliary ROS arrays. The arrays contain four sets of microcode patches (ALU1 and 2 for 3803-1 and 2). Plug each card as shown in Figure 1 in order to select the proper patches for it's location. The following patches are active when these two cards are installed (refer to page 52-102 for the patch listings):

- 1. Alternate Path Device Busy
- 2. Velocity Retry Extension
- 3. Turnaround Delay
- 4. Allocated Busy
- 5. Truncated Postamble
- 6. Extra Device End
- 7. Sense Reset

Verify factory plugging:



Note: If RPQ S10231 is installed see plugging instructions on pages 52-103/104.

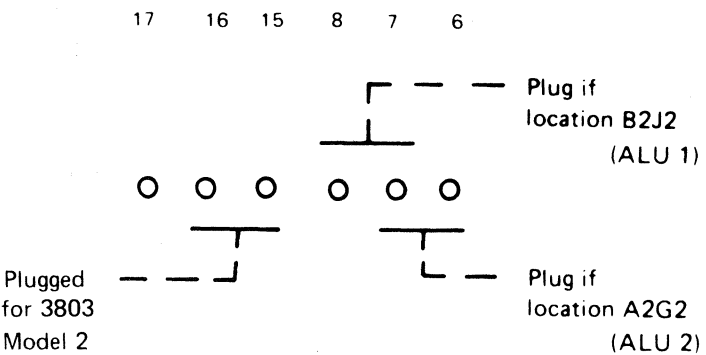


FIGURE 1

XG1100	2735981	See EC	845958	846627A				
Seq 1 of 2	Part Number	History	1 Sep 79	3 Dec 80				

HIGH-ORDER ROS REGISTER

The High-Order ROS Register in each microprocessor holds the 8 high-order bits of a microprogram instruction. The registers in MP1 and MP2 are identical. Bits 0 through 3 contain the operation code. Bits 3 through 7 contain a branch condition or LSR address. Bits 4 through 7 and the Hi/Lo latch can also contain the LSR address.

Bit 3 will be zero for OR, AND, ADD, XO, and STO instructions. In these instructions, bit 3=0 allows the addressed LSR to be updated.

Bit 3 in this register serves different purposes, depending on the instruction being executed. Bit 3 is part of the operation code for the modified instructions ORM, ADDM, ANDM, and XOM. This use prevents updating the LSR by blocking the gate to the LSR, CLK 15.

Bit 3 is part of the branch condition code for the BOC instruction. There are 32 branch condition codes used.

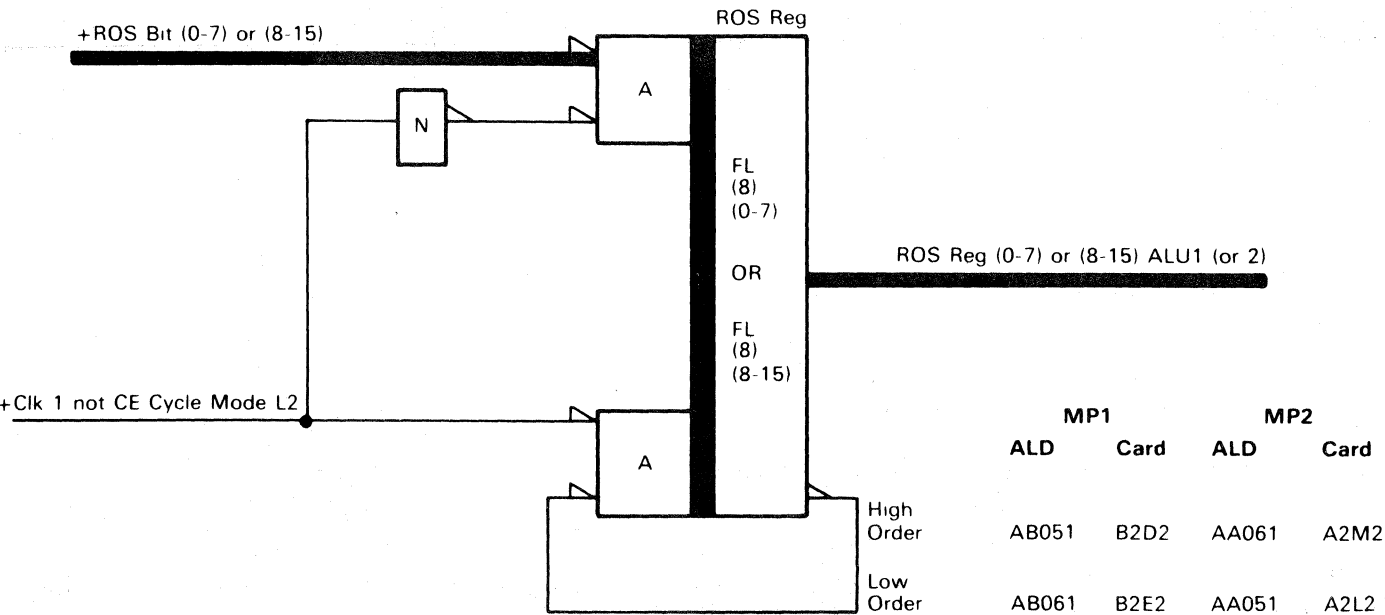
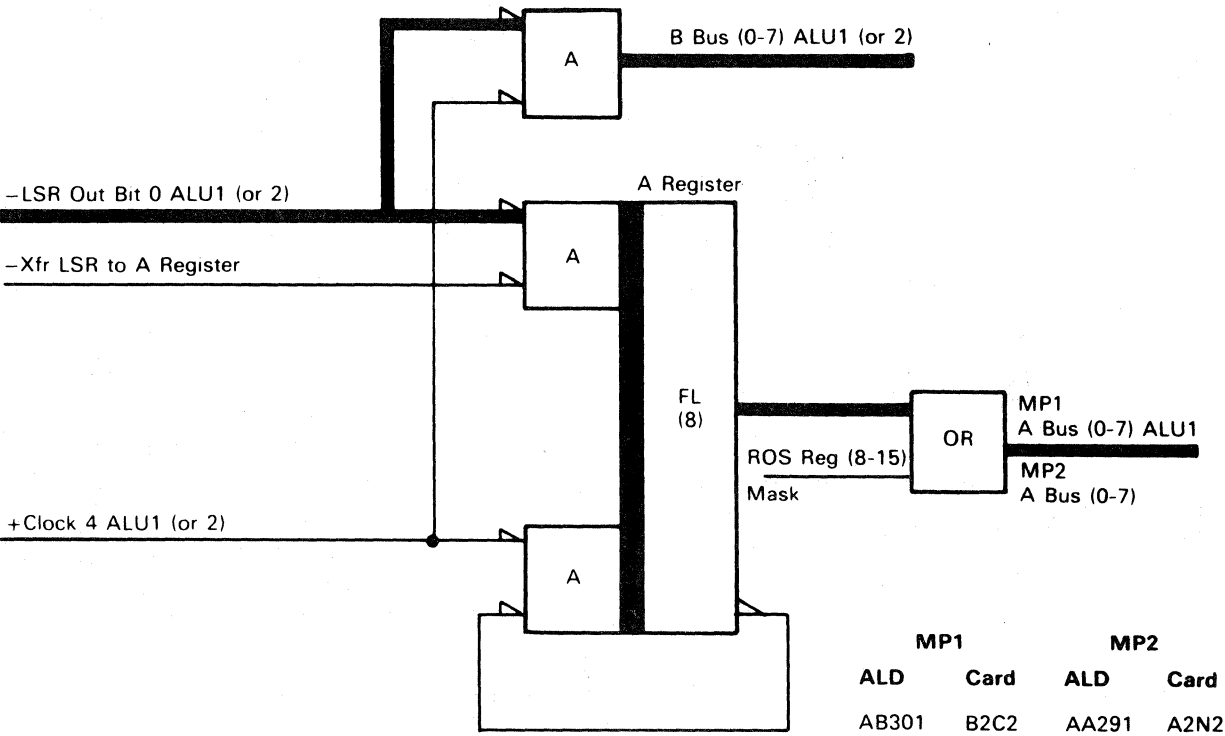
LOW-ORDER ROS REGISTER

The Low-Order ROS register in each microprocessor holds the 8 low-order bits of a microprogram instruction. The registers in MP1 and MP2 are identical. The output from these registers goes to the A Bus, the transfer decode circuits, or the Instruction Counter, depending on the instruction.

A REGISTER

The A Register serves as a buffer for information from an LSR that is used as input to the ALU. The contents of the selected LSR are gated to the A Register by XFR LSR TO A REGISTER. The next logic operation (ADD, AND, OR, or XOR) ORs the contents of the A Register with the contents of the instruction's Field 2 and places the result on the A Bus.

During logic operations, the A Register is reset by the CLK 4 line.



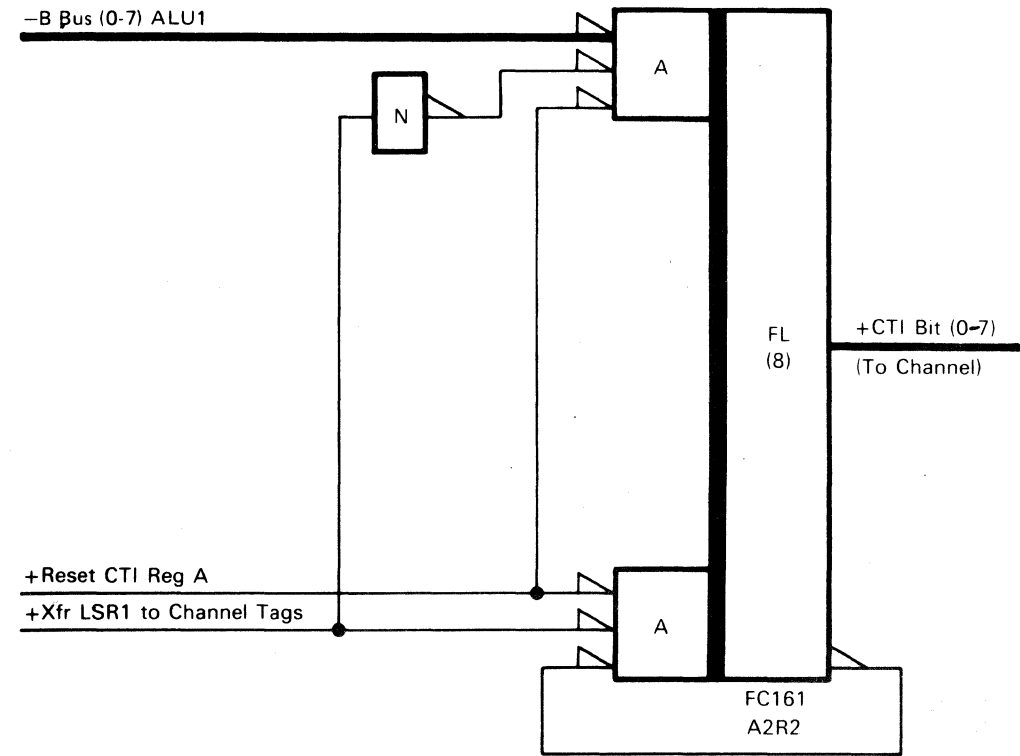
3803-2/3420

XG1100	2735981	See EC	845958	846627A				
Seq 2 of 2	Part Number	History	1 Sep 79	3 Dec 80				

© Copyright International Business Machines Corporation 1976, 1979, 1980

CHANNEL TAGS IN REGISTER

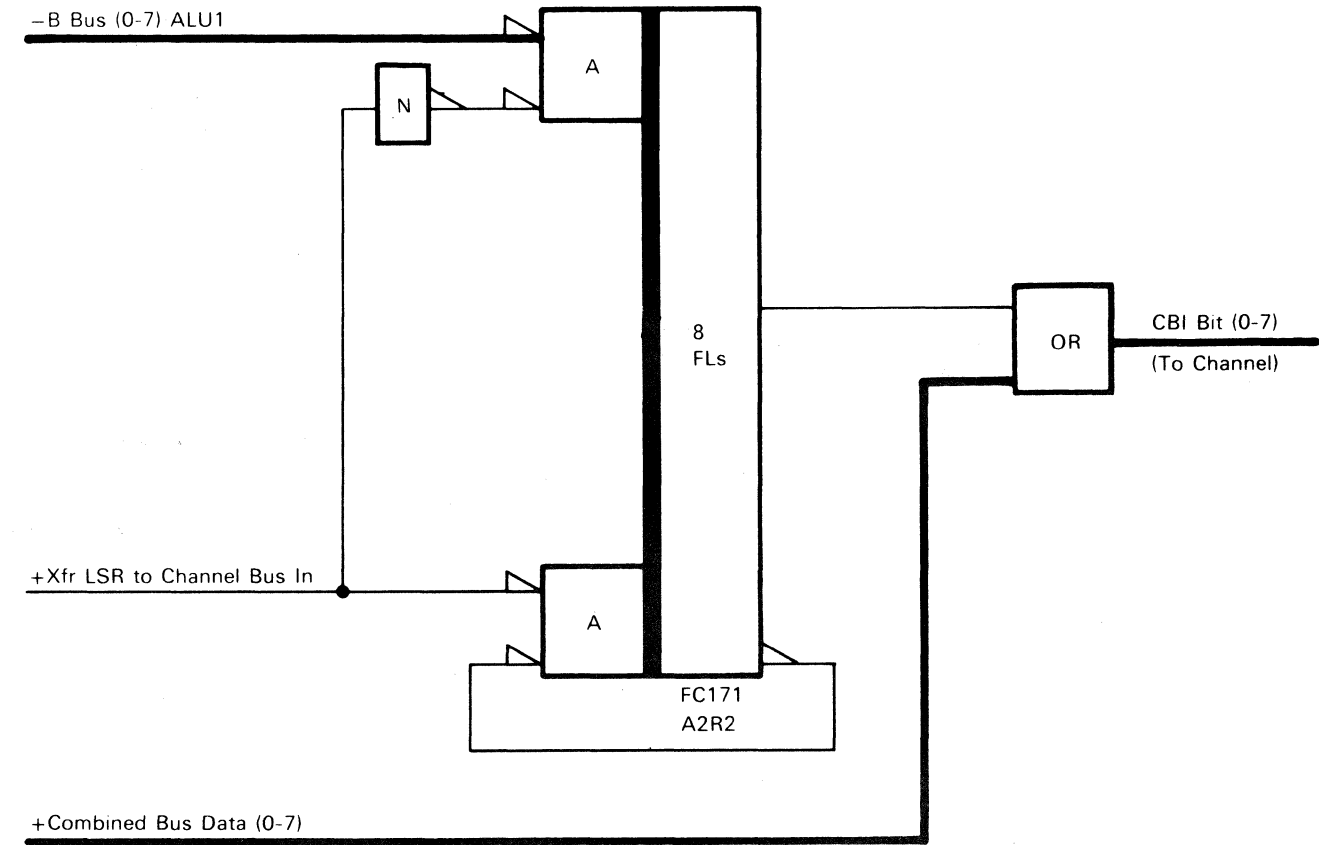
The Channel Tags in register holds the channel tags bits until they are transferred to the Channel Bus In. Individual register bits are used as follows:



Bit	Function
0	Chain Hold A
1	Chain Hold B
2	Hold Interface or Busy
3	CU Busy
4	Service In
5	Status In
6	CTI Bit 5 to CE Address In CTI Bit 6 to CE
7	Op In

CHANNEL BUS IN REGISTER

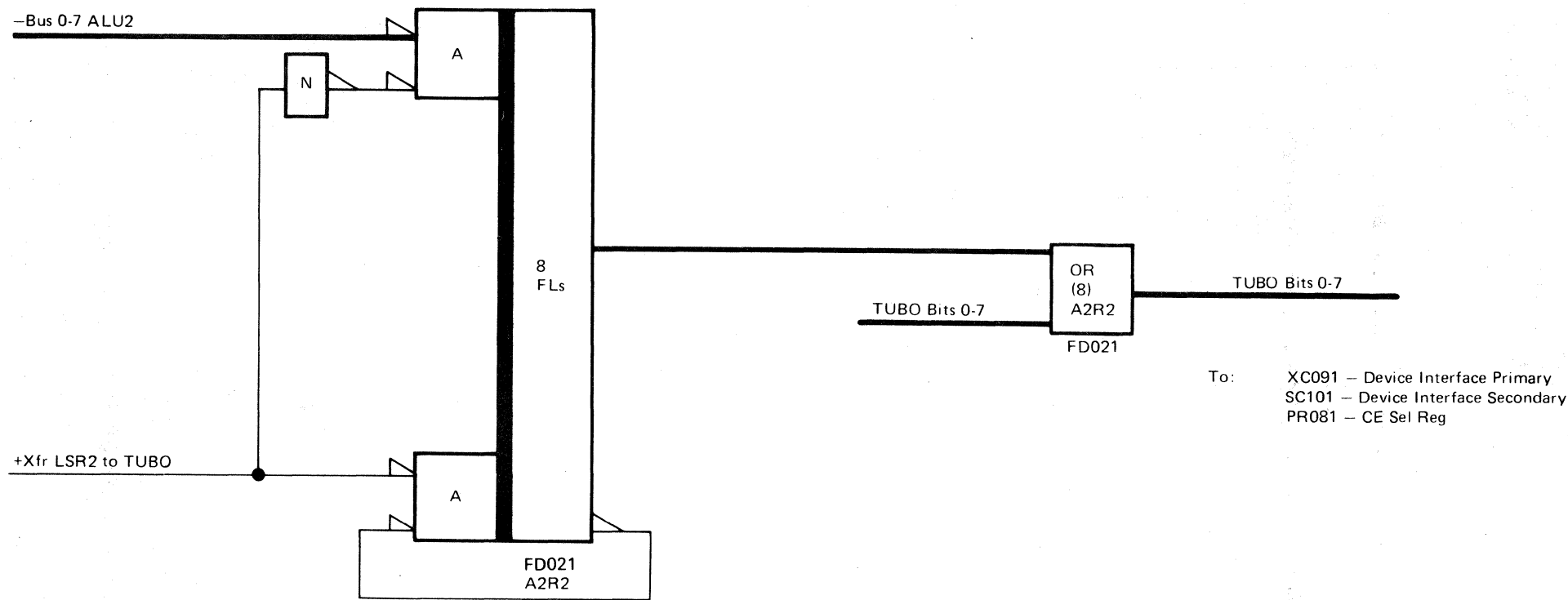
The Channel Bus In register serves as a buffer to transfer bytes from LSRs in MP1 to channel.



TAPE UNIT BUS OUT (TUBO) REGISTER

The TUBO register is a buffer to hold control information. High speed output is ORed with data bus bits.

The TUBO register stores MP2 control information for the 3420. The output information is multiplexed with tag lines (MOVE, CONTROL, COMMAND) to control tape unit functions.





D REGISTERS

The D Register serves as a buffer between the ALUs and LSRs.

A CLK 22 pulse loads the data into the D Register and resets individual positions when no data is available to load them.

Transfer (XFR) microinstructions gate input from BUS OUT.

CLK 21 degates D Register input from the ALU during store and transfer operations. During logic operations, this input remains active because CLK 21 does not occur.

MP1 SPECIAL REGISTER (HARDWARE ERRORS)

The Special Register in MP1 (AB461) is not used as a conventional register, because the input gate is always active and the latchback is always inactive. MP1 hardware errors merely pass through the register becoming SPEC REG BITS 0-7. When needed, parity bit is generated to maintain odd parity.

Special Register bits are activated as follows:

Spec Reg Bit	Error Line
0	ALU Parity Error ALU1
1	ROS Parity Error ALU1
2	IC or XFR Parity Error ALU1
3	Microprogram Error ALU1
4	Instruction Care Error ALU1
5	D Bus Parity error ALU1
6	Unused
7	Branch Error Interface ALU1

MP2 SPECIAL REGISTER (TU BUS IN)

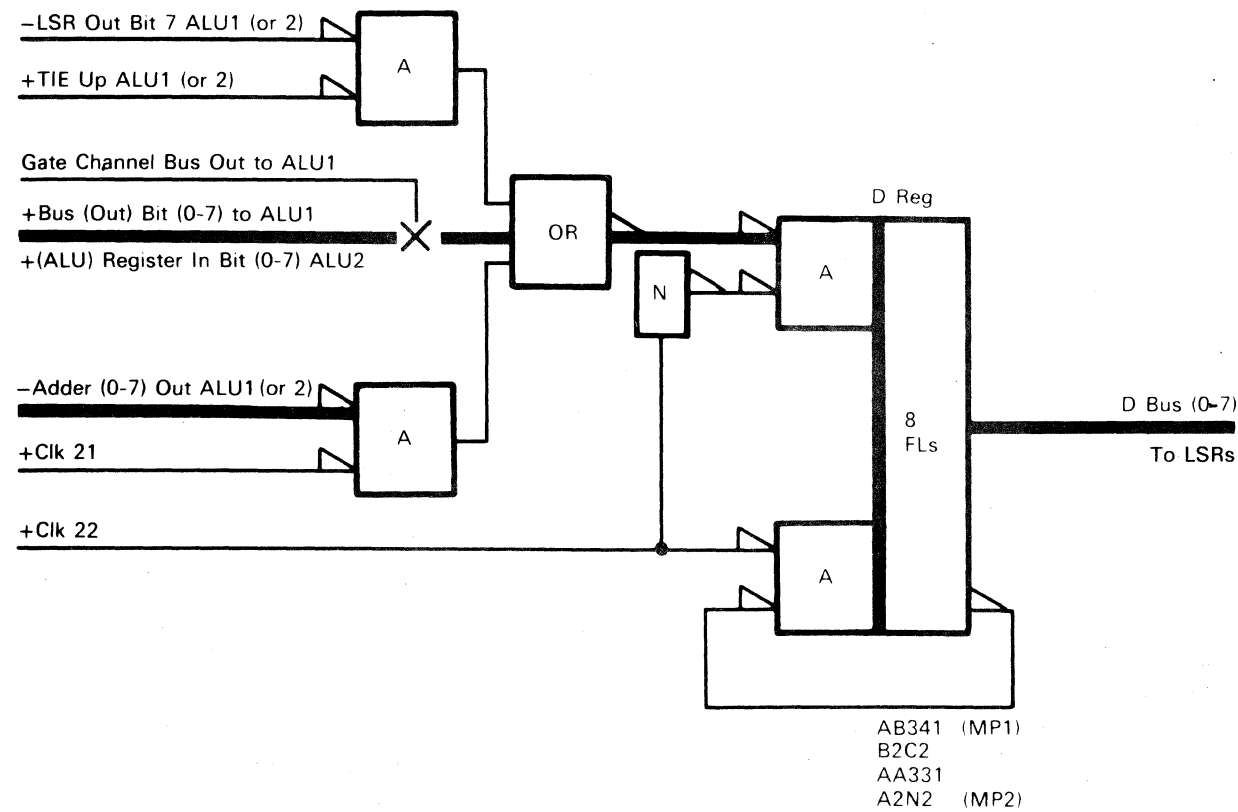
The Special Register in MP2 (FD011) is used as the Tape Unit Bus In Register. The Device Bus In bits are called DEVICE BITS LATCHED. The register gate is CLK 18 SET TUBI ALU2. When needed, parity bit is generated to maintain odd parity.

MIST OR TCS REGISTER (MP1)

The MIST (Multi-Interface Tags) Register (FC181) is used as a Request In Register when the Two-Channel Switch (TCS) feature is installed. This register has four bits assigned as suppressable and non-suppressable REQUEST INS for Channel A and B.

Bit functions are:

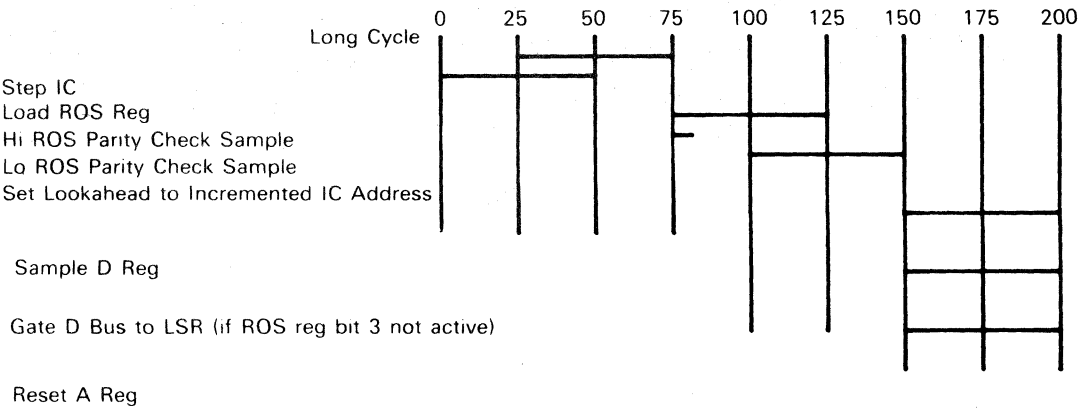
Bit	Function
4	Suppressable REQUEST IN Channel A
5	Non-suppressable REQUEST IN Channel A
6	Suppressable REQUEST IN Channel B
7	Non-suppressable REQUEST IN Channel B



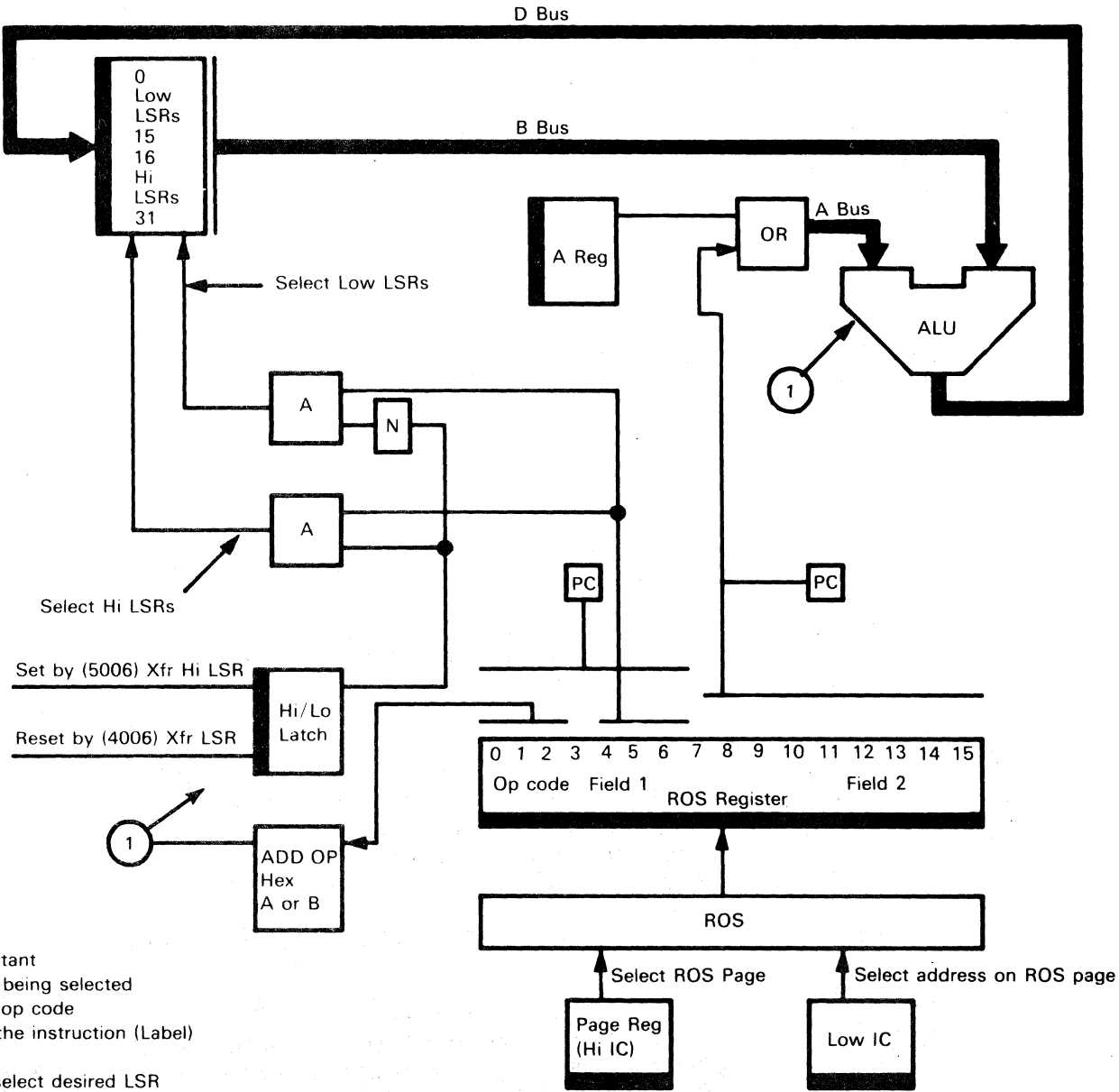
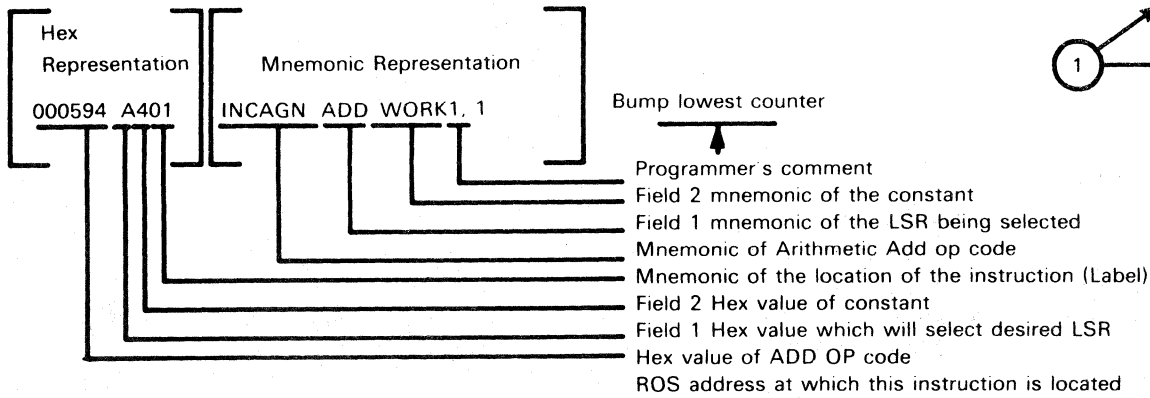
ADD/ADDM (HEX CODE A OR B)

- 1. The LSR byte selected by Field 1 (ROS reg bits 4-7) is placed on the B Bus.
- 2. The A register is ORed with the constant in Field 2 (ROS reg bits 8-15).
- 3. The result is placed on the A bus.
- 4. The A bus and the B bus are added together.
- 5. The result is placed on the D bus.

If the operation is an ADD, the D bus is stored into the LSR byte addressed by Field 1 and the Hi/Lo latch. The result of an ADDM operation is not stored in an LSR. The result of either operation remains on the D bus until the next ALU operation. While on the D bus, the result of the operation is available for branch control. The A Register is reset at the end of the operation.



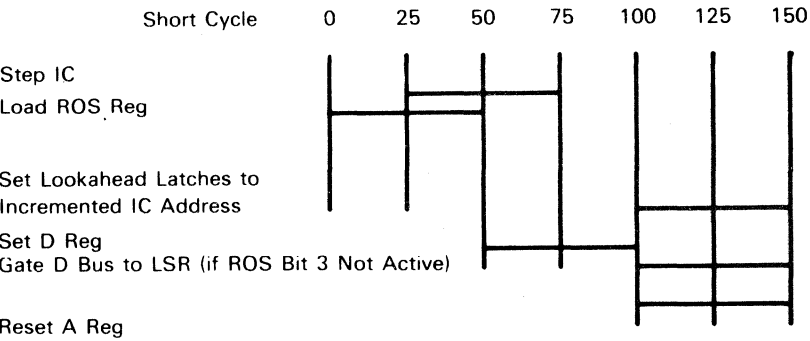
Sample of an Arithmetic ADD Instruction



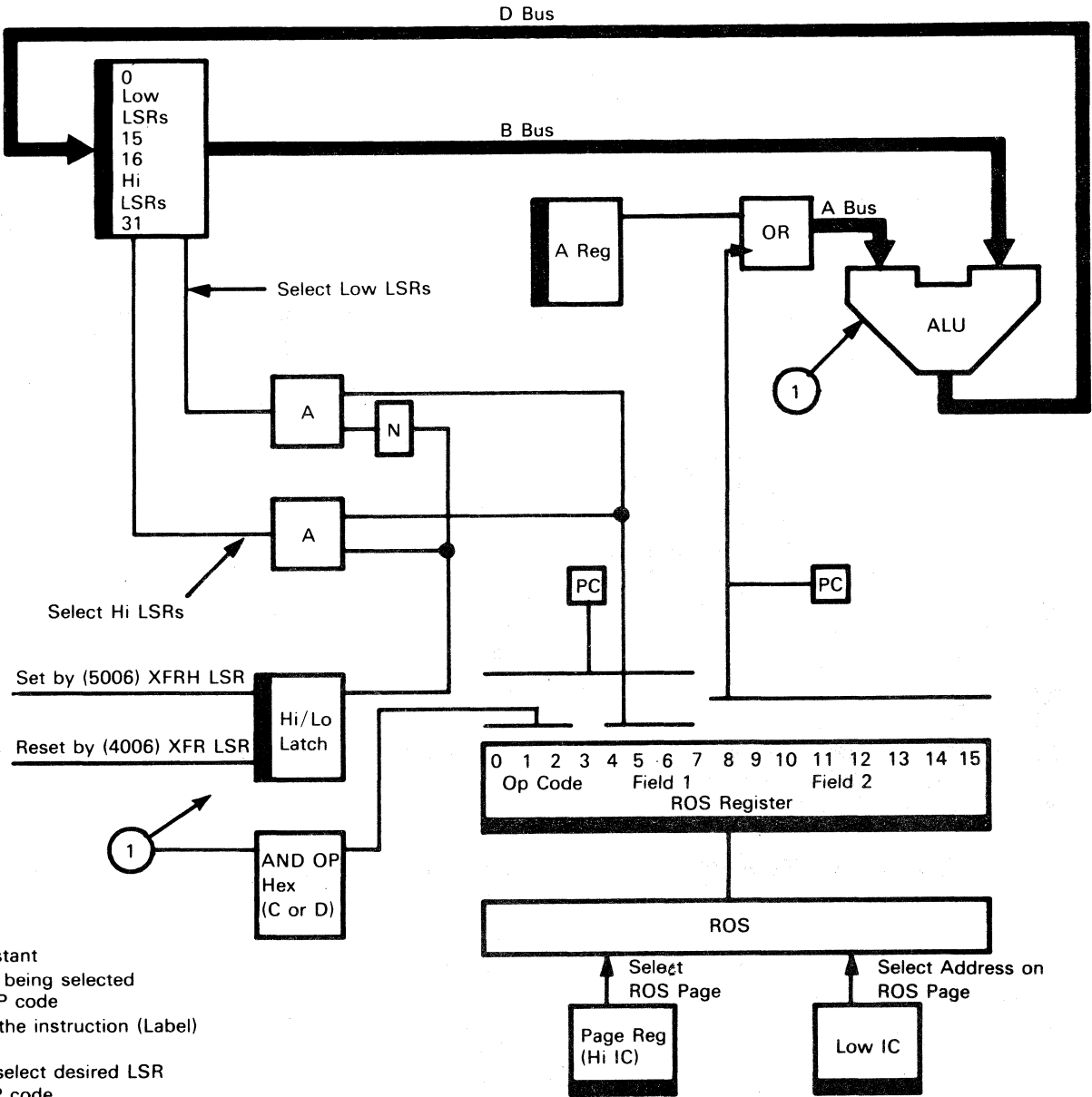
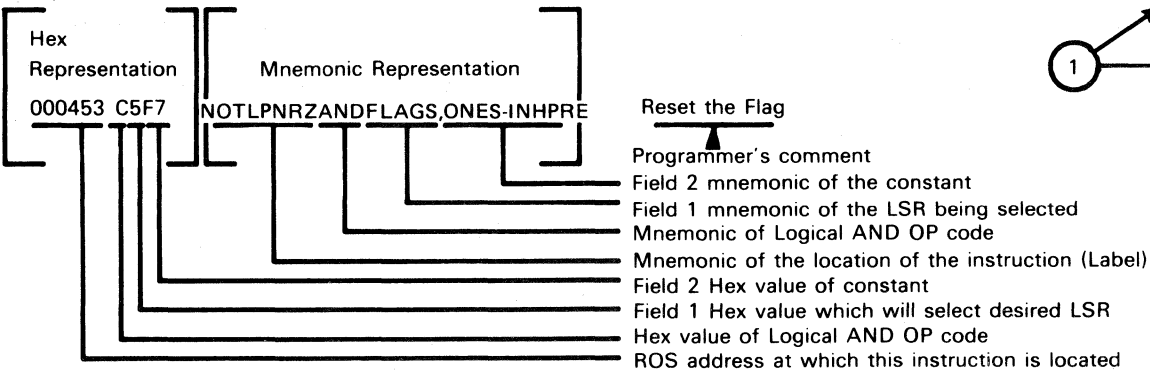
AND/ANDM (HEX CODE C OR D)

- 1. The LSR byte selected by Field 1 is placed on the B bus.
- 2. The A Register is ORed with the constant in Field 2.
- 3. The result is placed on the A bus.
- 4. The A bus and the B bus are ANDed.
- 5. The result is placed on the D bus.

If the operation is an AND, the D bus is stored back into the LSR byte addressed by Field 1 and the HI/LO latch. The result of an ANDM is not stored in an LSR. The result of either operation remains on the D bus until the next ALU operation. While on the D bus, the result of the ANDM operation is available for branch control. The A Register is reset at the end of the operation.



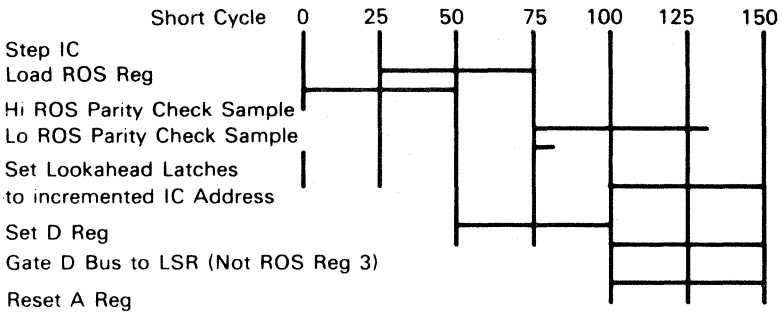
Sample of a Logical AND Instruction



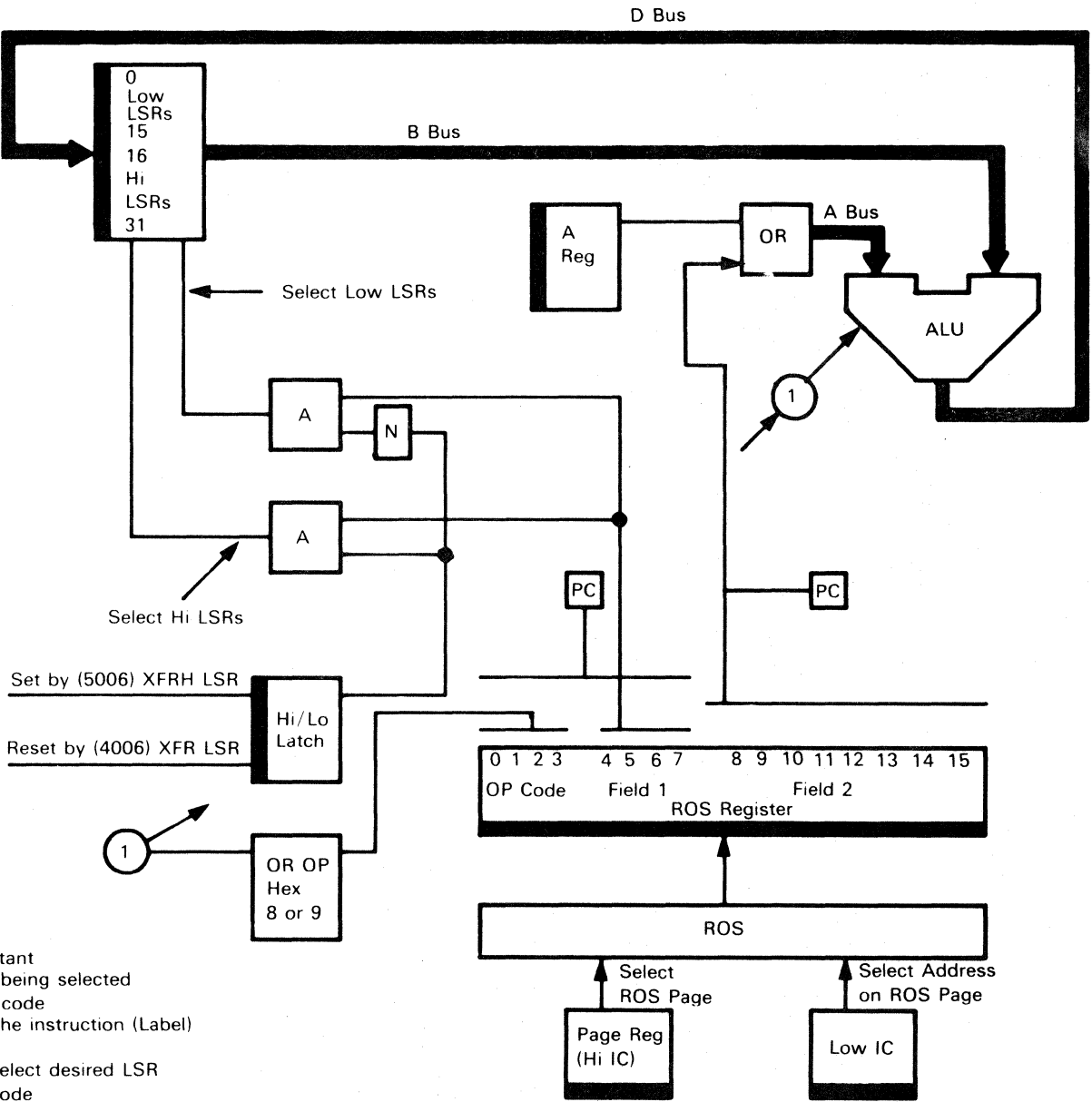
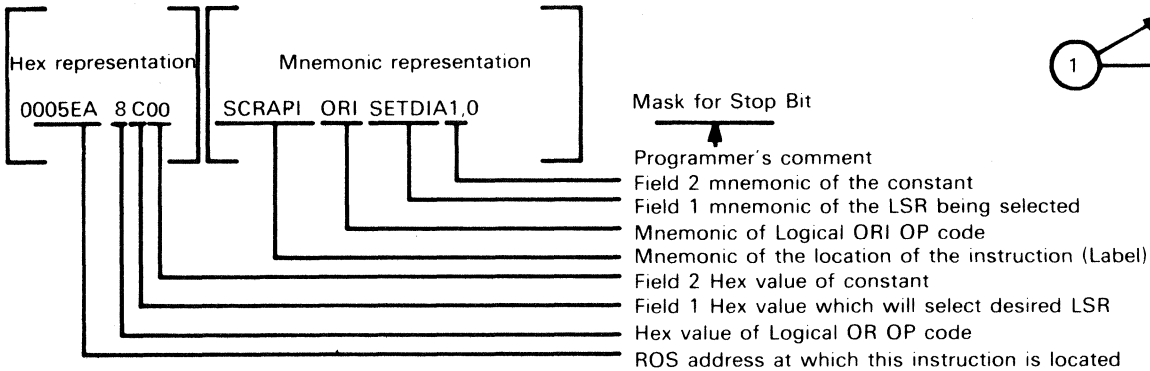
ORI/ORM (HEX CODE 8 OR 9)

- 1. The LSR byte selected by Field 1 is placed on the B bus.
- 2. The A register is ORed with the constant in Field 2.
- 3. The result is placed on the A bus.
- 4. The A bus and the B bus are ORed.
- 5. The result is placed on the D bus.

If the operation is an ORI, the D bus is stored back into the LSR byte addressed by Field 1 and the Hi/Lo latch. The result of an ORM is not stored in the LSR. The result of either operation remains on the D bus until the next ALU operation. While on the D bus, the result of the operation is available for branch control. The A Register is reset at the end of the operation.

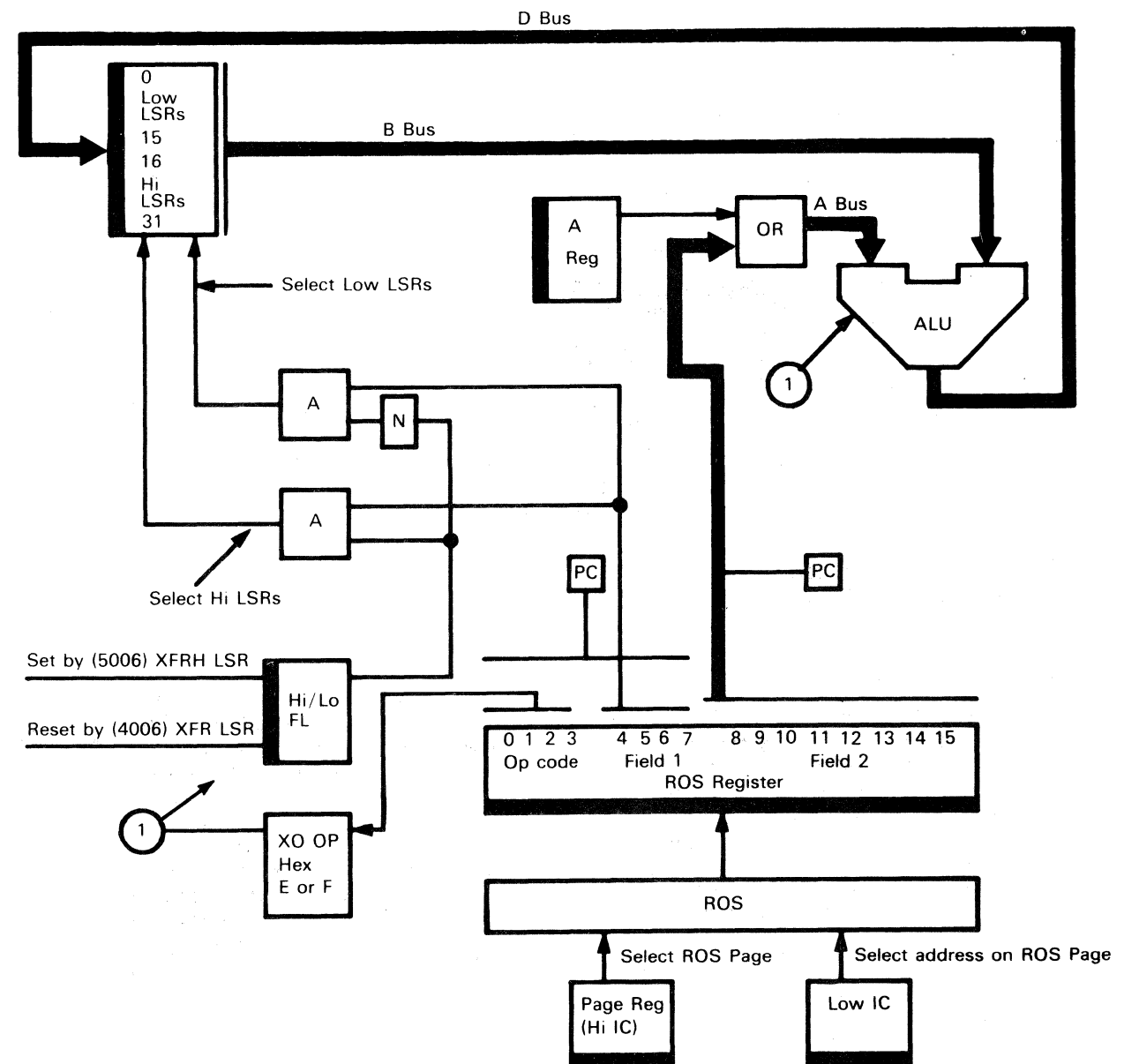
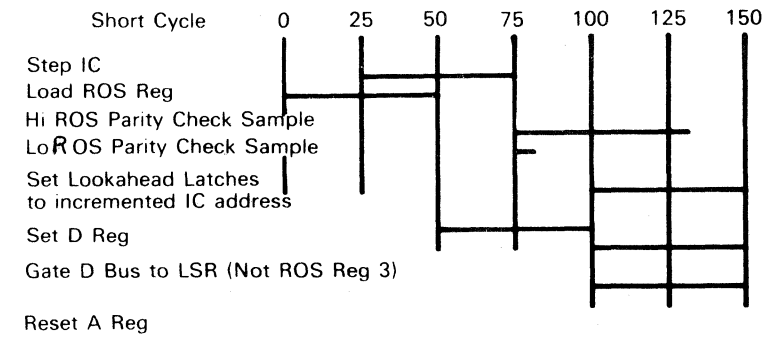
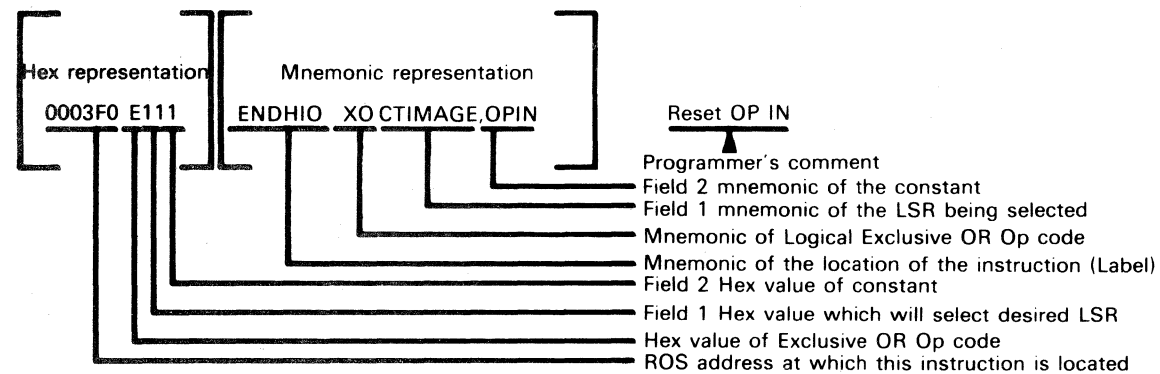


Sample Logical OR Instruction



1. The LSR byte selected by Field 1 is placed on the B bus.
2. The A register is ORed with the constant in Field 2.
3. The result is placed on the A bus.
4. The A bus and the B bus are exclusive ORed.
5. The result is placed on the D bus.

### Sample Logical Exclusive OR Instruction



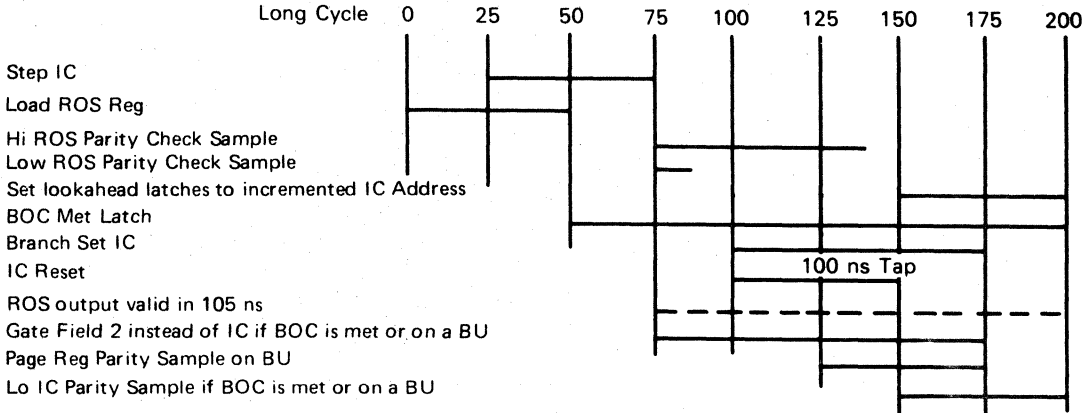
BOC (HEX CODE 2 OR 3)

ROS reg Field 1, together with bit 3, is decoded to test one of 32 conditions. If the BOC is met, ROS reg Field 2 is set into the Lo IC. See 52-086 for a complete listing of MP1 and MP2 branch conditions.

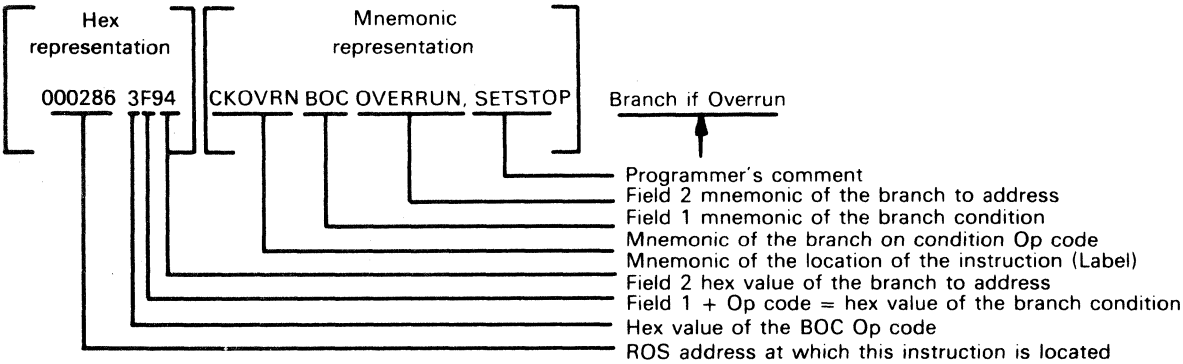
The contents of the A reg are not altered.

**Special Condition**—If the two-channel switch or NRZI features are installed, a BOC on these features (BOC on 'MIFTR' or 'NRZFEAT') results in a successful BOC with the Hi IC forced to ROS page 4. See logic diagram.

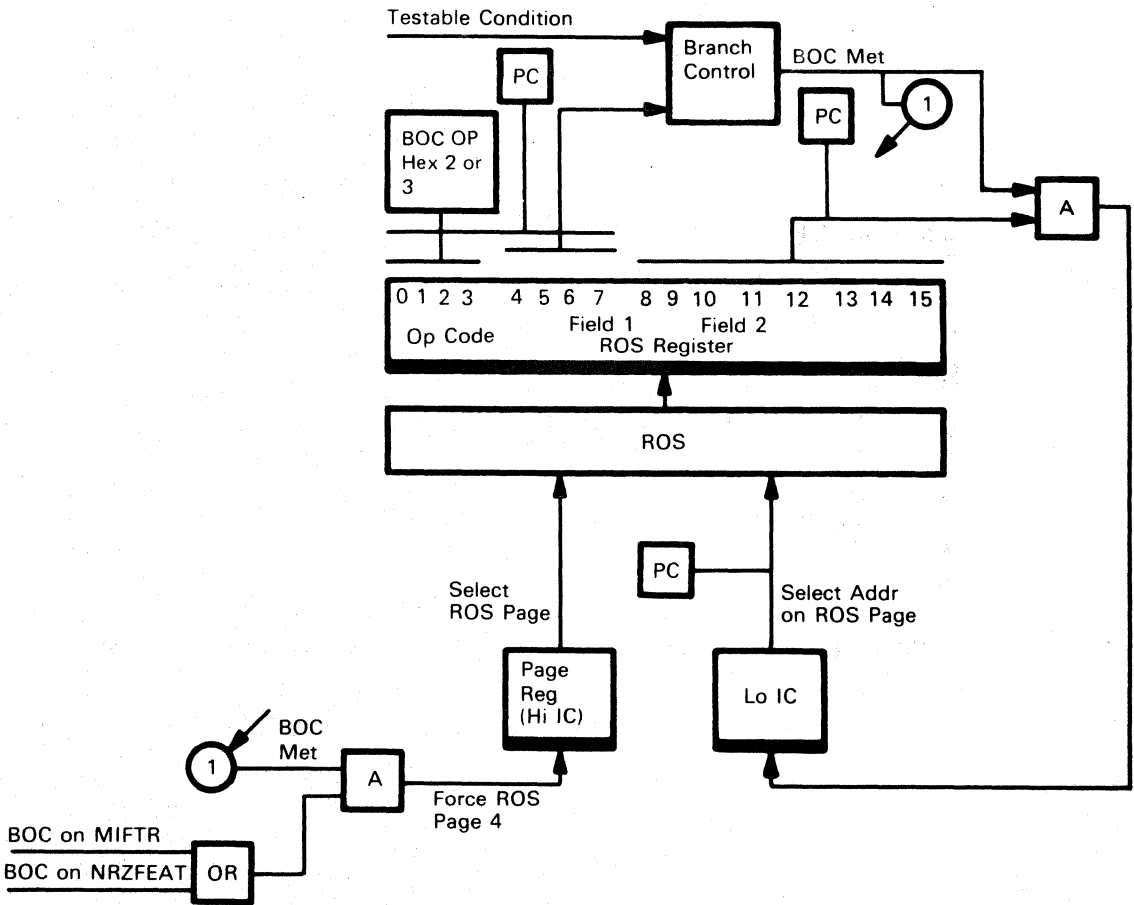
(Note: On a BOC met or on a BU, the content of Field 2 is gated to ROS Address while the IC is being updated.)



Sample of a Branch On Condition Instruction



(Note: On a BOC met or on a BU, the contents of Field 2 are gated to ROS Address while the IC is being updated.)



MP1 BRANCH CONDITIONS

BOC Instr+ Field 1	ROS Reg Bits					Microprogram Name of Line Sensed	Logic Line Name of Condition Sensed	Branch Cond Logic Page	Source Logic
	3	4	5	6	7				
20	0	0	0	0	0	DBUS D Reg equal 0	ALU output all zero ALU1	AB121	AB371
21					1	NALCO not ALU carry out	Not ALU carry ALU1	AB121	AB371
22				1	0	ALUR ALU2/ALU1 Error	Any hardware error ALU2	AB121	AA461
23				1	1	MIFTR** MIS or 7-Trk Feature	Feature present ALU1	AB121	AB131
24			1	0	0	BOPE Bus Out parity error	Not Bus Out parity odd	AB131	FC151
25			1	0	1	NCUEA Not CU End Chan A	Not CUE pending Chan A	AB131	FC031
26			1	1	0	SELO Select Out	Gated Select Out	AB131	FC141
27			1	1	1	DFLER	Data Check (Not Tape Op)	AB131	BW241
27			1	1	1	Clock "B"	Write Grp "B" (Tape Op)	AB131	BW151
28		1	0	0	0	ADROUT Addr Out A or B	Address Out A B CE	AB171	AB171
29		1	0	0	1	CMDOUT Cmd Out A or B	Command Out A B CE	AB171	FC151
2A		1	0	1	0	STATA Stat A ALU1	Stat A ALU1	AB151	AB141
2B		1	0	1	1	STAT B Stat B ALU2	Stat B ALU2 to ALU1	AB151	AA141
2C		1	1	0	0	SELRST Selective Reset	Selective Reset	AB171	FC151
2D		1	1	0	1	SVCOUT Service Out	Service Out only on write ops. Service In or Service Out on read ops.	AB171	FC151
2E		1	1	1	0	SCB Switched to Chan "B"	Switched to Chan "B"	AB161	XM101
2F		1	1	1	1	PWRRST Power On Reset	Mach or Gen Reset Chan A B	AB161	AB161
30	1	0	0	0	0	DREG0* D Reg Bit 0 On	D Bus 0 ALU1	AB121	AB341
31	1	0	0	0	1	DREG1 D Reg Bit 1 On	D Bus 1 ALU1	AB121	AB341
32	1	0	0	1	0	DREG2* D Reg Bit 2 On	D Bus 2 ALU1	AB121	AB341
33	1	0	0	1	1	DREG3* D Reg Bit 3 On	D Bus 3 ALU1	AB121	AB341
34	1	0	1	0	0	DREG4* D Reg Bit 4 On	D Bus 4 ALU1	AB131	AB351
35	1	0	1	0	1	DREG5* D Reg Bit 5 On	D Bus 5 ALU1	AB131	AB351
36	1	0	1	1	0	DREG6* D Reg Bit 6 On	D Bus 6 ALU1	AB131	AB351
37	1	0	1	1	1	DREG7* D Reg Bit 7 On	D Bus 7 ALU1	AB131	AB351
38	1	1	0	0	0	OPRIN Operation In	Channel Operation In	AB171	FC141
39	1	1	0	0	1	SUPO Suppress Out	Suppress A B	AB171	FC151

BOC Instr+ Field 1	ROS Reg Bits					Microprogram Name of Line Sensed	Logic Line Name of Condition Sensed	Branch Cond Logic Page	Source Logic
	3	4	5	6	7				
3A	1	1	0	1	0	STATC Stat C ALU2	Stat C ALU2 to ALU1	AB151	AA141
3B	1	1	0	1	1	STATD Stat D ALU2	ALU2 Locked Status	AB151	AA451
3C	1	1	1	0	0	NGENR Not Gen Reset	Not General Reset Chan A B	AB171	FC041
3D	1	1	1	0	1	ISEL Initial Selection	Initial Selection A B CE	AB171	AB171
3E	1	1	1	1	0	NCUEB Not CUE for Chan	Not CUE PENDING Chan B	AB161	XM031
3E	1	1	1	1	0	Buffer Branch	RD Channel Buffer (Stop to DF)	AB161	BR011
3F	1	1	1	1	1	Overrun	Data Flow Detected Overrun (Not Tape Op)	AB161	BW241
3F	1	1	1	1	1	All Ones	End of Data being written (Tape Op)	AB161	BW151

\* May be called other names as well.  
\*\* If this feature is installed, force Hi IC to ROS Page 4.

MP2 BRANCH CONDITIONS

BOC Instr+ Field 1	ROS Reg Bits					Microprogram Name of Line Sensed	Logic Line Name of Condition Sensed	Branch Cond Logic Page	Source Logic
	3	4	5	6	7				
20	0	0	0	0	0	DBUS D Reg equal 0	ALU0	AA121	AA361
21					1	NALCO	Not ALU carry	AA121	AA361
22				1	0	ROCROT	ROS rotation (Tape Op)	AA121	CB411
22				1	0	CRC NEPR	CRC not equal EPR (Not Tape Op)	AA121	CN011
23				1	1	NRZFEAT** Installed	Feature present	AA121	AA131
24			1	0	0	RD Time	Read Time	AA131	BW221
25			1	0	1	N Seven	Not Seven Track	AA131	AA131
26			1	1	0	TACHFF	Tach Velocity (Write CKT)	AA131	XC031
27			1	1	1	STOP Stop Command	Stat Bit 0 ALU1 to ALU2	AA131	AB141
28		1	0	0	0	ENDATA Ending Zeros	End of Data (Tape Op)	XC041	BW241
28		1	0	0	0	CRCMAT	CRC OK (Not Tape Op)	XC041	CH111
29		1	0	0	1	NCONVCK	Data CC Check (Not Tape Op)	XC041	BN071
29		1	0	0	1	NSAGC ID	Inverse TM (Tape Op)	XC041	CC001
2A		1	0	1	0	STATA Stat A ALU2	Stat A ALU2	XC041	AA141
2B		1	0	1	1	STATB Stat B ALU1	Stat B ALU1	XC041	AB141
2C		1	1	0	0	NPTE	Data P Track Only (Tape Op)	XC051	BW231
2C		1	1	0	0	DEN 556	556 bpi (7-Track)	XC051	BN311
2D		1	1	0	1	DATA RDY	Data Rdy from DF (Tape Op)	XC051	CH131
2D		1	1	0	1	RPQ	RPQ Installed (Not Tape Op)	XC051	RPQ
2E		1	1	1	0	BOR	Beginning of Record (Tape Op)	XC051	CC001
2F		1	1	1	1	IBG	IBG Detected (Tape Op)	XC051	CC001
30	1	0	0	0	0	DREG0* D Reg Bit 0 On	D Bus 0 ALU2	AA121	AA331
31	1	0	0	0	1	DREG1* D Reg Bit 1 On	D Bus 1 ALU2	AA121	AA331
32	1	0	0	1	0	DREG2* D Reg Bit 2 On	D Bus 2 ALU2	AA121	AA331
33	1	0	0	1	1	DREG3* D Reg Bit 3 On	D Bus 3 ALU2	AA121	AA331
34	1	0	1	0	0	DREG4* D Reg Bit 4 On	D Bus 4 ALU2	AA131	AA341
35	1	0	1	0	1	DREG5* D Reg Bit 5 On	D Bus 5 ALU2	AA131	AA341
36	1	0	1	1	0	DREG6* D Reg Bit 6 On	D Bus 6 ALU2	AA131	AA341
37	1	0	1	1	1	DREG7* D Reg Bit 7 On	D Bus 7 ALU2	AA131	AA341
38	1	1	0	0	0	6400	RLC Branch	XC041	BW231
39	1	1	0	0	1	N1TE	Not One Track Envelope	XC041	BW231
39	1	1	0	0	1	DEN 200	Density 200 (Seven Track)	XC041	BN311

BOC Instr+ Field 1	ROS Reg Bits					Microprogram Name of Line Sensed	Logic Line Name of Condition Sensed	Branch Cond Logic Page	Source Logic
	3	4	5	6	7				
3A	1	1	0	1	0	STATC Stat C ALU1	Stat C ALU1 Mark on Wall	XC041	AB141
3B	1	1	0	1	1	STATD Stat D ALU1	Stat D ALU1	XC041	AB141
3C	1	1	1	0	0	NENVLOS	No Envelope Loss (Not Tape Op)	XC051	CC011
3C	1	1	1	0	0	NBLOCK	No Zone Up (Tape Op)	XC051	CC011
3D	1	1	1	0	1	NTM	Tape Mark	XC051	CC001
3E	1	1	1	1	0	BSYTACH	Busy or Tach	XC051	XC031
3F	1	1	1	1	1	DEVATTN	Interrupt	XC051	XC031

\* May be called other names as well.

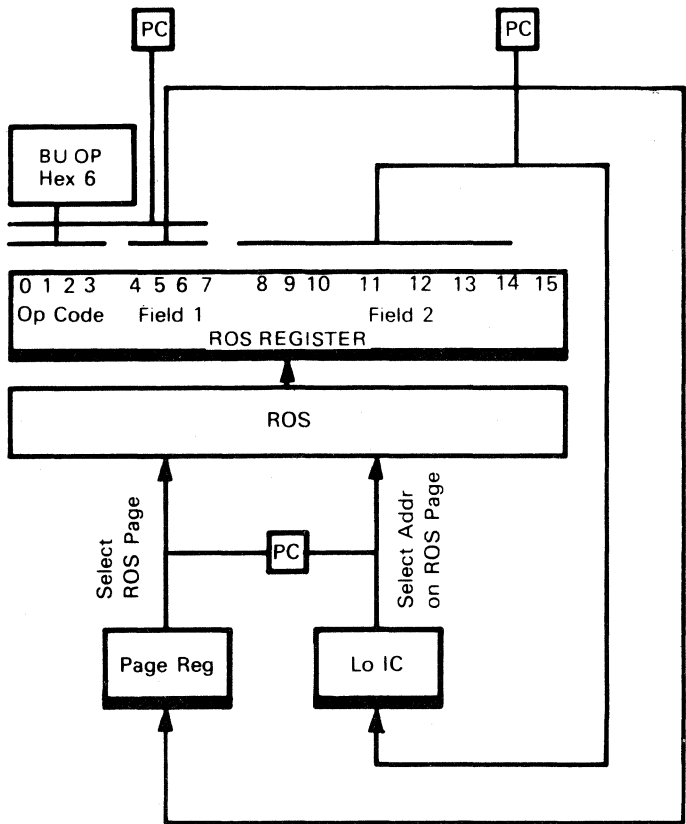
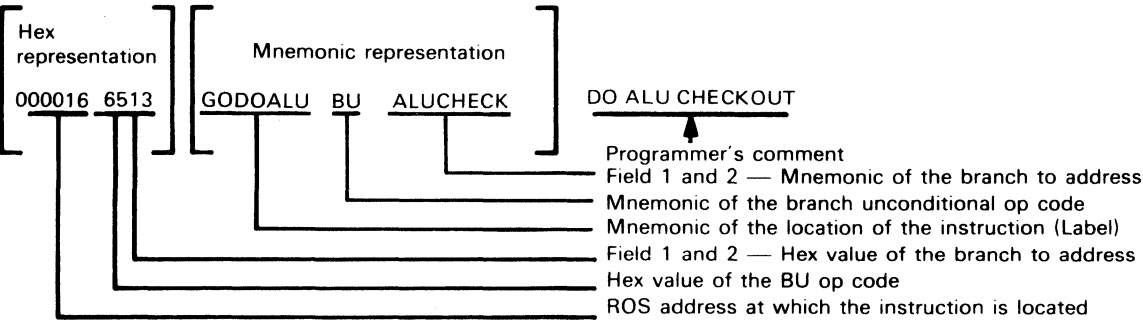
\*\* If this feature is installed, force Hi IC to ROS Page 4.



BRANCH UNCONDITIONAL - BU (HEX CODE 6)

- 1. The contents of ROS reg Fields 1 and 2 are set into the Hi IC and Lo IC.
- 2. The contents of the A reg are not altered.

Sample of a Branch Unconditional Instruction



BRANCH UNCONDITIONAL

Long Cycle	0	25	50	75	100	125	150	175	200
Step IC									
Load ROS Reg									
High ROS Parity Check Sample									
Low ROS Parity Check Sample									
Set Lookahead Latches									
BOC met (BU Op)									
Branch Set IC									
IC Reset									
Gate Field 2 in place of IC									
Page Reg Parity Sample									
Low IC Parity Sample									
Set Page Reg									

NOTES:

52-091

3803-2/3420

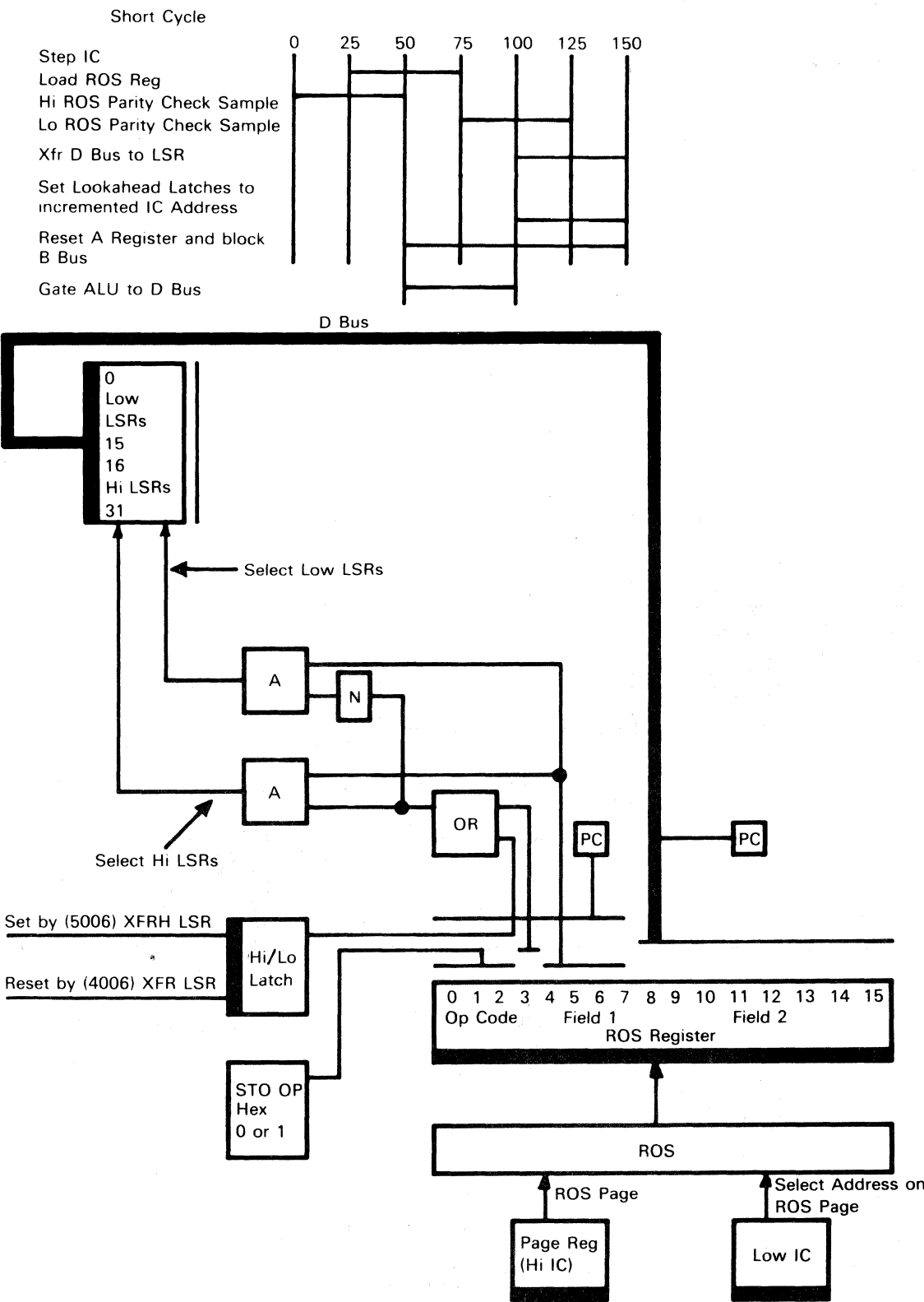
XG1650	2736037	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

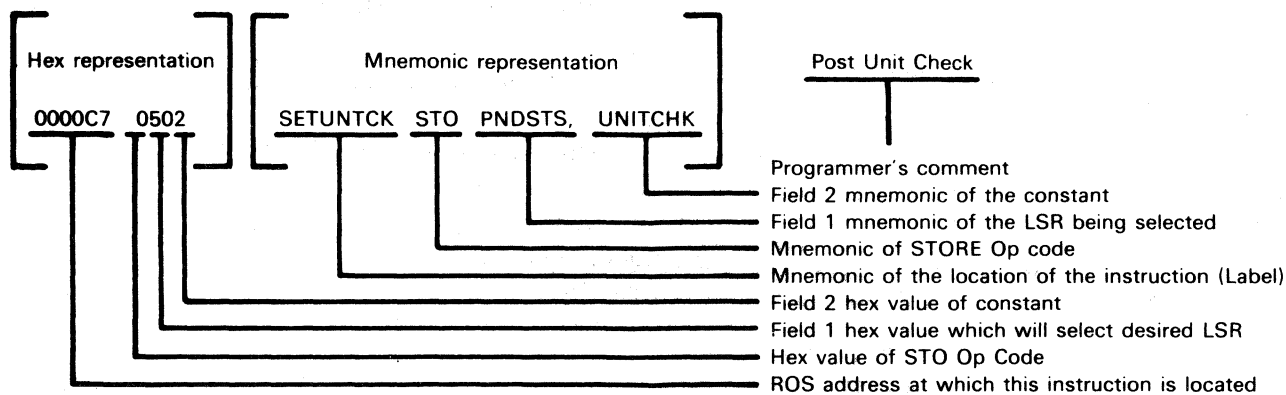
52-091

STORE - STO (HEX CODE 0 OR 1)

- 1. The contents of Field 2 are stored in an LSR selected by Field 1.
- 2. LSR selection is modified by the condition of the HI/LO latch and ROS register bit 3 (see logic diagram).
- 3. The A register is reset.



Sample of a STORE Instruction



TRANSFER - XFR (HEX CODE 4 OR 5)

The hex value (transfer decode) in Field 2 controls all transfer operations. All XFR decodes for both ROS1 and ROS2 are on 52-101.

Some transfer decodes cause data to be transferred between an LSR selected by Field 1 and a hardware register selected by Field 2. LSR selection is modified by the condition of the HI/LO latch and ROS reg bit 3 (see logic diagram).

Some transfer decodes do not select LSRs (that is, Field 1 is ignored). These operations create miscellaneous Set, Reset, and Gating pulses to hardware.

One transfer decode (ROS1 XFR decode of 14) transfers data from one hardware register to another (ROS1 XOUTA TO DEAD TRK REG).

Contents of the A register are not altered except as described under special condition 1 below.

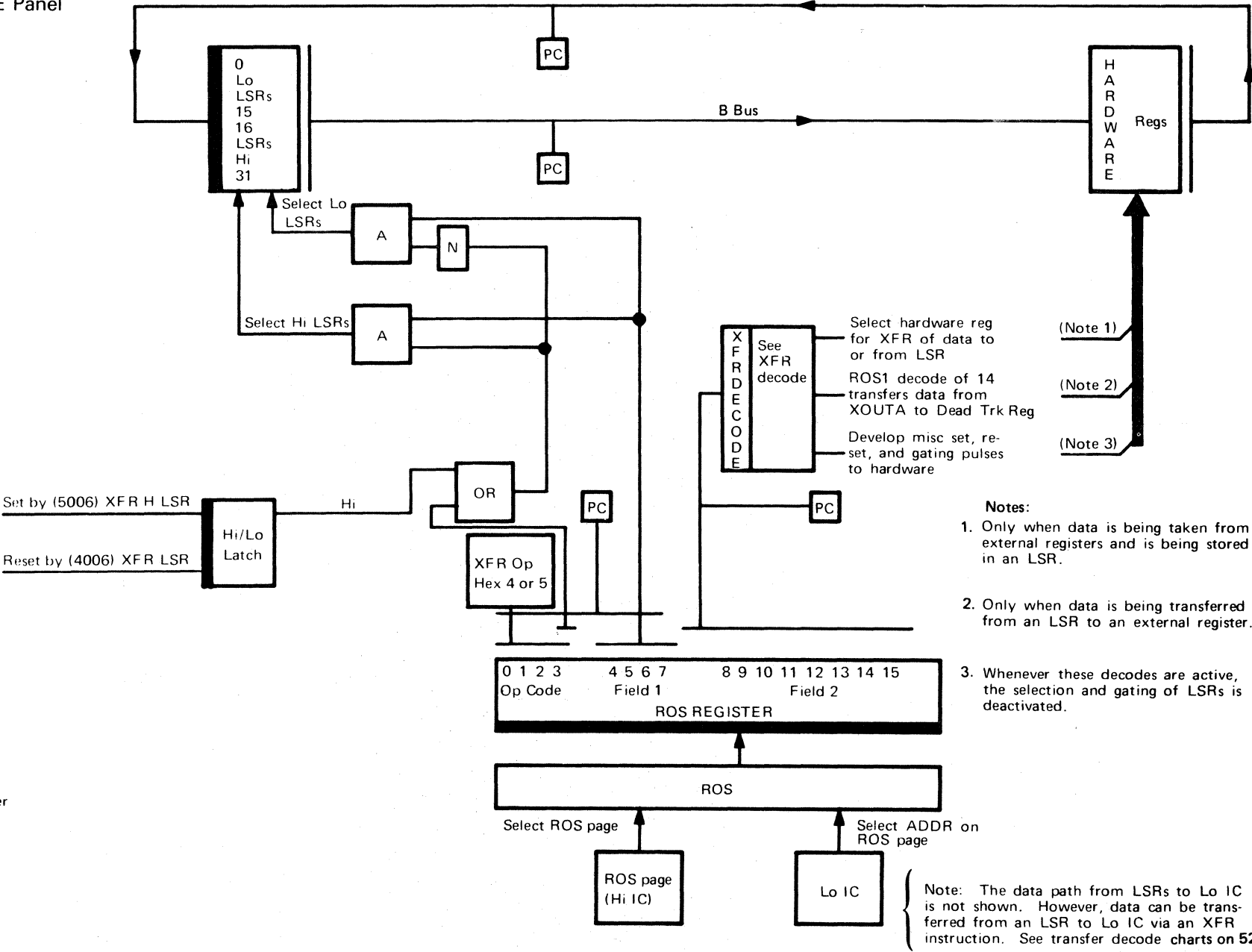
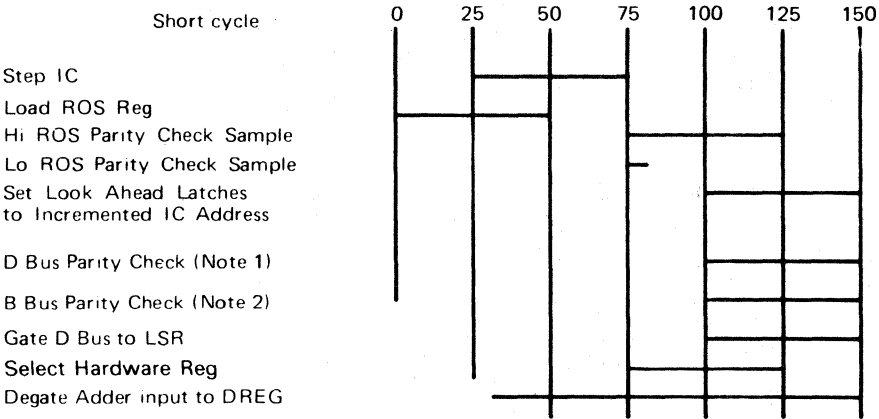
Special Conditions:

- 1. Whenever a XFR from LSR to A reg (Field 2 hex 21) is decoded, the XFR is really a logical OR (for example, A register bits that were ON remain ON).

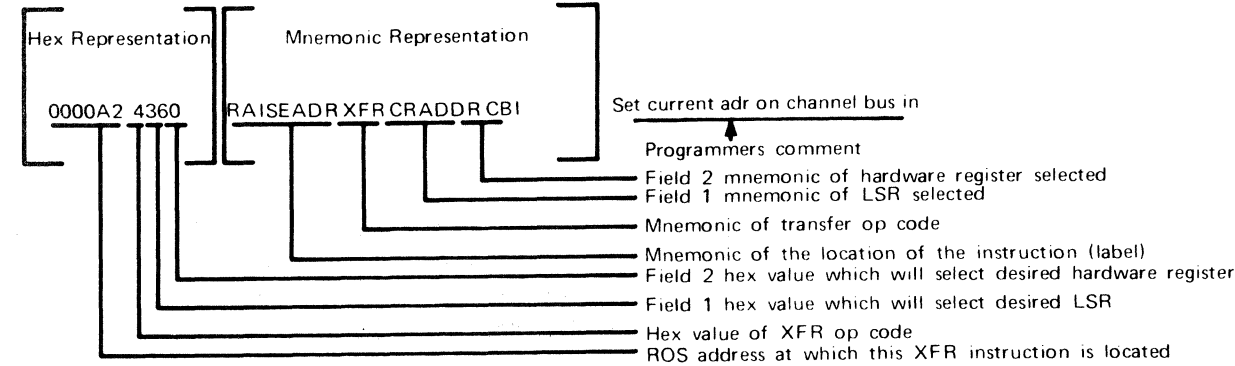
- 2. Whenever a XFR 'HDWERR' (Field 2 ALU1 = 11 or ALU2 = 44) is decoded, the following actions occur:

- a. Bit 4 in sense byte 11 or 12 (ALU1 or ALU2 respectively) is set.
- b. The UPGM Control Check indicator\* on the CE panel is turned on.
- c. IC is reset to 000 (ROS1 starts executing at 000—ROS2 holds at 000).

\* For additional information on microprogram control check, see 75-003: "CE Panel Indicators."



Sample Transfer Instruction



3803-2/3420

XG1700	2735987	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

MICROPROGRAM TRANSFER DECODES  
TRANSFER DECODE—MP1

DECODE MP1			
Field 2	Micro-program Name	Use	Logic Line Names XFR Decode AB181
05	RSTDOMTD	Reset device committed latch	Reset committed latch ALU1*
06	LSR	Set local store sel latch hi or low	Set LSR hi or lo*
09	CUREA	Reset CUE or general reset latch Intf A	Reset CUE Chan A*
0A	CUREB	Reset CUE or general reset latch Intf B	Reset CUE Chan B*
11	HDWERR	Set Sense Byte 11 Bit 4 (force ROS 1 ALU hardware error)***	XFR Set Checkout error*
12	CLEAR	Reset all hardware error latches for ROS1, ROS2 and data flow	Reset Sense Data*
14	TIP	MP1 XOUTA to Dead Track register	Xfr XOUTA to DT Reg
18	Spare		Spare Xfr 18
21	AR	LSR to A Reg	Xfr LSR to A Reg
22	IC	LSR to Instr. Ctr (Lo IC)	Xfr B Bus to IC
24	TUADR	LSR to TU Address Reg	Xfr TU Address
28	STAT	LSR to ROS1 Stat Reg	Xfr LSR1 to Stat
41	XOUTB	LSR to ROS1 XOUTB Reg	Xfr XOUTB TO Trap ALU2
42	XOUTA	LSR to ROS1 XOUTA Reg	Xfr LSR1 to XOUTA
43**		----	----
44	PING	Hardware Error Reset	Reset PING Pulse*
48	MIST	LSR to set or reset Req In Tags	Xfr LSR1 to Request Tags
50	CTI	LSR to Channel Tags In Reg	Xfr LSR1 to Channel Tags
60	CBI	LSR to Channel Bus In Tags Reg	Xfr LSR1 to Channel Bus In
81	EXT	ROS2 ALU hardware error reg to LSR	Xfr Ext inputs to LSR1
82	INHP	Not used	----
84	HDWR	ROS1 ALU hardware error to LSR	Xfr Hardware Reg
88	XINB	ROS2 XOUTB Reg to ROS1 LSR	Xfr XINB to LSR1
90	XINA	ROS2 XOUTA Reg to ROS1 LSR	Xfr XINA to LSR1
A0	CBO	Channel Bus Out Reg to LSR	Gate Chan Bus Out to ALU

TRANSFER DECODE—MP2

DECODE MP2			
Field 2	Micro-program Name	Use	Logic Line Names XFR Decodes AA171
05	Spare sense byte 11 bit 4 (force	----	Spare
06	LSR	Set local store sel latch hi or lo	Set LSR hi or lo*
09	Reset ERR	Reset errors single byte noise	File Operation Pulse
0A	CRC	Shift CRC Pulse	Spare Xfr 0A
11	Indf	Set Diagnostic Channel Buffer Read	Pulse Reset CRC
12	POINTERS	Sample pulse to set TIE	Step Format Count
14	Red Light	Set CE Panel Uprog det DF error	SKB and Det Ctrl
18	Buff CRC	Sample Buffer CRC error latch	Spare Xfr 18
21	AR	LSR to A Reg	Xfr LSR to A Reg
22	IC	LSR to Instr. Ctr (Lo IC)	Xfr B Bus to IC
24	TUTAG	LSR to TU Tags Reg	Xfr LSR2 to TU Tags 24
28	STAT	LSR to ROS2 Stat Reg	Xfr LSR2 to Stat
41	XOUTB	LSR to ROS2 XOUTB Reg	Xfr LSR2 to XOUTB
42	XOUTA	LSR to ROS2 XOUTA Reg	Xfr LSR2 to XOUTA
43**	XANXB	----	----
44	HDWERR	Set sense byte 12, bit 4 (force ROS2 ALU hardware error)***	Xfr Set Checkout Error
48	Spare	----	----
50	COMITD	Reset Device Committed latch	Reset Committed latch pulse*
60	TUBO	LSR to TU Bus Out Reg	Xfr LSR2 to TU Bus Out
81	TUBI	TU Bus In Reg to LSR	Gate Device Bus In to LSR2
82	INHP	Inhibit Parity on D Bus	Inhibit Parity on D Bus
84	XADDR	TU Bit Address Reg to LSR	Gate TU Addr to ALU2
88	XINB	ROS1 XOUTB Reg to ROS2 LSR	Xfr XINB to LSR
90	XINA	ROS1 XOUTA Reg to ROS2 LSR	Xfr XINA to LSR2

\* These transfer operations cause no actual information transfer.  
\*\* With transfer decode of 43, transfer decodes 41 and 42 are executed simultaneously.  
\*\*\* Also sets CE Panel UPGM Error light (Control Check Indicators).

ALU1

Instr Addr	• Patch Store Control	Object Code	Source Statement		Patch Name
2DC	ENTER	C400	AND	WORK 1, ZERO	ALLOCATED BUSY
2DD	RETURN	62DE	BU	2DE	
328	ENTER	4828	DEPRIM4	XFR STATIMG, STAT	ALTERNATE PATH DEVICE BUSY
329		3B8C		BOC STATD, DEPRIM70	
32A		6380	BU	380, FREEAREA	
380		3A82	FREEAREA	BOC STATC, CKCONCHA	
381	RETURN	632B	BU	32B	
382		D981	CKCONCHA	ANDM FLAGS, CONCON+CHAIN	
383		2085	BOC	DBUS, TAG0	
384	RETURN	6338	PCHKONA	BU 338	
385		0202	TAG0	STO XOUTAIM, SETSTATC	
386		4228		XFR XOUTAIM, STAT	
387		A202	PA1DLY	ADD XOUTAIM, X'02'	
388		2187	BOC	NALCO, PA1DLY	
389		0200	STO	XOUTAIM, 0	
38A		4828		XFR STATIMG, STAT	
38B		6384	BU	PCHKONA	
38C	RETURN	633A	DEPRIM70	BU 33A	
335	ENTER	4828	DEPRIM6	XFR STATDMG, STAT	
336		2B82	BOC	STATB, CKCONCHA	
337	RETURN	6337	BU	337	
0A3	ENTER	8520	ORI	PNDSTS, CUE	EXTRA DEVICE END
0A4		D50C	ANDM	PNDSTS, CEND+DEND	
0A5		34AA	BOC	DREG4, RTN1	
0A6		20AA	BOC	DBUS, RTN1	
0A7		4642	XFR	PNDADDR, XOUTA	
0A8		14EB	STO	XOUTBIM, NDXSTS	
0A9		5441	XFR	XOUTBIM, XOUTB	
0AA	RETURN	6296	RTN1	BU TERMSTA2	
0F0	ENTER	1348	STO	LINK4, TERMATE	SENSE RESET
0F1	RETURN	5322	XFR	LINK4, IC	

ALU 2

Instr Addr	• Patch Store Control	Object Code	Source Statement		Patch Name
213	ENTER	1600	WRTSTR1	STOH SENSE 1, 0	VELOCITY RETRY EXTENSION
214	RETURN	1300	VELSTR	STOH WORK 4, ZERO	
7B8	ENTER	0200		STO WORK 3, 0	
7B9	RETURN	1500		STOH WORK 5, ZERO	
15A	ENTER	D708	DODELAY	ANDM SENSE 2, HIDDEN	TURNAROUND DELAY
15B	RETURN	615C		BU 15C	
53F	ENTER	6744	CTLRET6	BU ERASE6	TRUNCATED POSTAMBLE
744	RETURN	0083	ERASE6	STO WORK 1, X'83'	
36E	ENTER	8402	DRVUNTCK	ORI STATIMG, SETSTATC	ALTERNATE PATH DEVICE BUSY
36F		63C0		BU 3C0, FREEAREA	
3C0		4428	FREEAREA	XFR STATIMG, STAT	
3C1		3AC4	PPOLMTIX	BOC STATC, TAG00	
3C2		3BCE		BOC STATD, EXITPTCH	
3C3		63C1		BU PPOLMTIX	
3C4		0002	TAG00	STO WORK 1, RESET	
3C5		4060		XFR WORK 1, TUBO	
3C6		000A		STO WORK 1, DEVSEL+COMMD	
3C7		4024		XFR WORK 1, TUTAG	
3C8		0000		STO WORK 1, 0	
3C9		A000		ADD WORK 1, 0	
3CA		4024		XFR WORK 1, TUTAG	
3CB		A024	TAG002	ADD WORK 1, 36	
3CC		21CB		BOC NALCO, TAG002	
3CD		4050		XFR COMITD	
3CE	RETURN	6370	EXITPTCH	BU POLLMTIX	

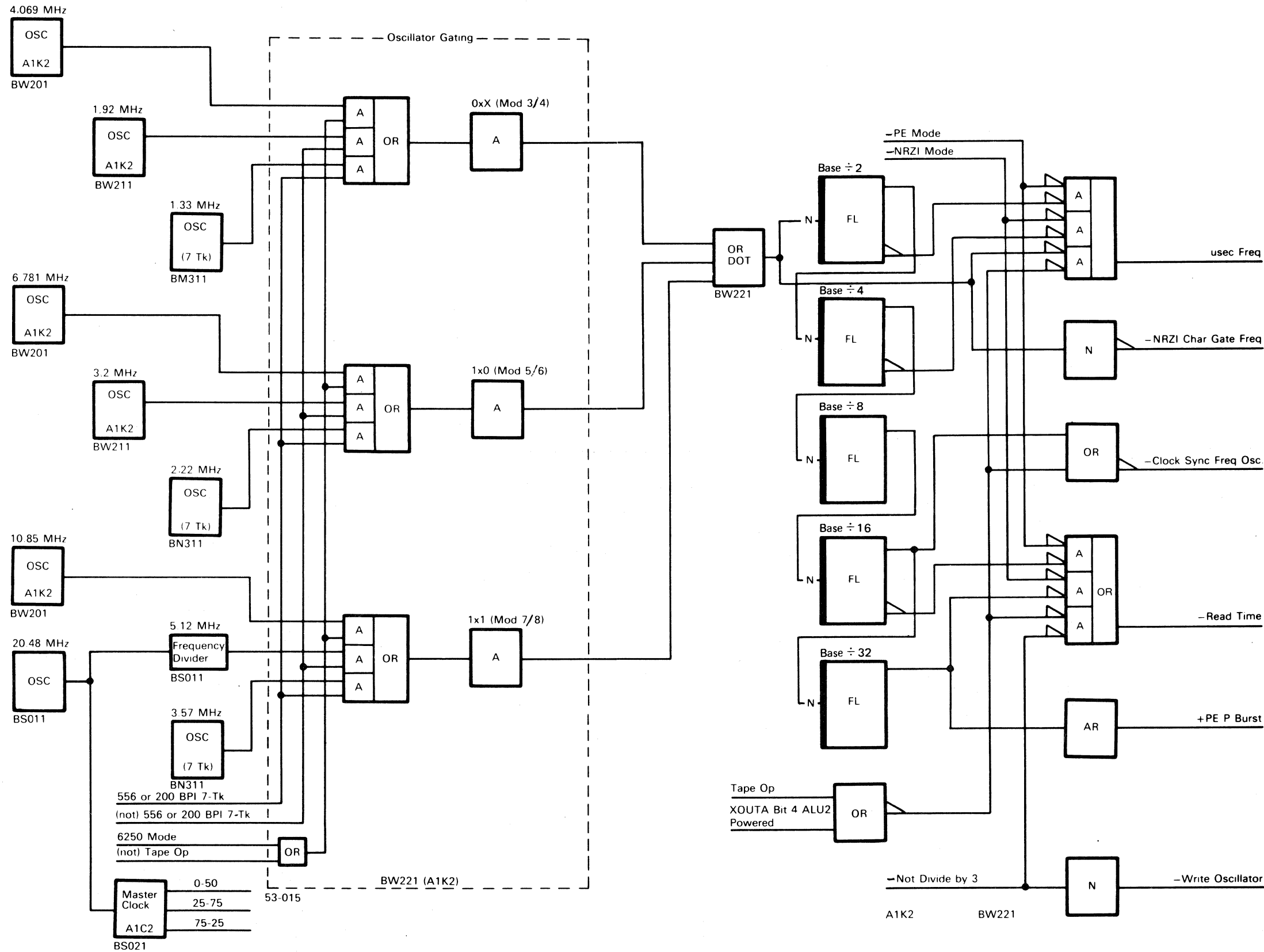
\* Note 1: ENTER Enables the patch store for succeeding instructions, and RETURN Disables the patch store for succeeding instructions.

OSCILLATOR GATING

Crystal oscillators supply the basic timing pulses that drive the clocks and counters throughout the 3803.

The Microsecond Frequency used at any specific time depends on the speed of the tape unit addressed. The Detection Register gates the correct frequency.

The master clock controls the read clock stepping pulses.



READ/WRITE CLOCKS AND COUNTERS

CLOCK/ COUNTER	ALD	CONTROL (Reset)	INPUT	OUTPUT	MLM PAGE	USE
Data Flow Clock	BS021	Tape Op	10.24 MHz	8 pulses *0 - 50 *25 - 75 *50 - 100 *75 - 025	53-015	Controls all data flow. *Plus 4 delayed pulses.
Write Clock	BW101	Wr Cond	usec Freq	WC0 - 11, WC0 - 15 (PE/NRZI)	53-020	Flip write triggers at WC7. Sample VRC at WC3 and 11 Step Write Counter at WC9 and 11.
Write Counter	BW091 BW101	XOUTA 4(6250)	WC9, WC11, WC5(PE)	Cntr 0 - 4	53-020	Gate Write Encoders BW011 - 051.
Byte Counter	BR041	Tape Op Repowered	75 - 25 Del	Set Byte 1 - 4	53-025	Gates CRC and Residual bytes.
Group Buffer Counter	CB441	Tape Op	ROC 25 - 75 or 0 - 25	Binary Counter 1, 2, 4	53-090	Group Buffer and 6250 Xlator Address Control.
CRIC	BR011	Wr Cyc Latch	75 - 25	CRIC 1 - 5	53-035	Channel Buffer Read In.
CROC	BR011	Rd Cyc Latch	75 - 25	CROC 1 - 5	53-035	Channel Buffer Read Out.
Frame Counters	CJ021	Counter Resets	PE Decode A6, C7, 25 - 75	Count = 8	--	Reset Valid Pointer and Hardware Pointer Latches.
Frame Buffer Counter	CH041	Tape Op	25 - 75	FB1, 2, 4 and Decode 0 - 7	53-095	Controls ECC Group Buffer Address, Error Matrix Switching, Data Correction, and Data Xfer to Channel Buffer.
Frame Buffer Format Counter	CH051	Tape Op Step Cntr Latch 75 - 25	75 - 25	Decode A, B, C, AB, ABC	53-095	Controls Format Clocks and Error Correction.
RIC (9)	CDx11	Tape Op or Dead Track	6250 Ones or Step RIC	Count 10 Ones or SKB Addr 0 - 31	53-080	Gates address to write bytes into Skew Buffer, and counts 10 ones (6250) or 10 zeros (PE) during preamble.
ROC (1)	CB411	Tape Op	Step ROC (RD3)	ROC 1 - 5	53-080	Gates address to read bytes out of Skew Buffer.
Microprocessor Clocks	AB011 AA011	Reset ALU IC	20.48 MHz	8 pulses at 0, 25, 50, 75, 100, 125, 150, 175 Nsec	52-005	Control microprocessor operations.

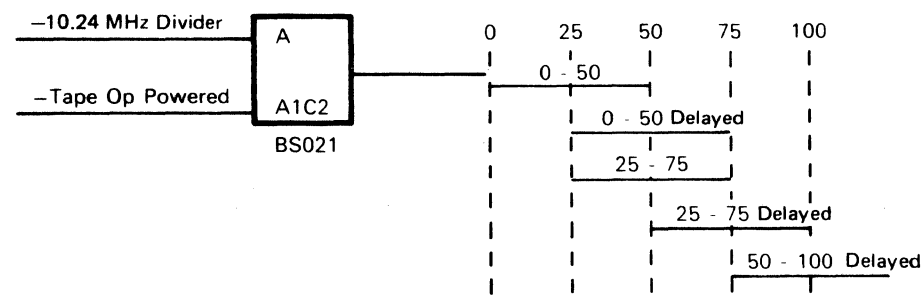
3803-2/3420

XG1900 Seq 2 of 2	2735989 Part Number	See EC History	845958 1 Sep 79					
----------------------	------------------------	-------------------	--------------------	--	--	--	--	--

© Copyright International Business Machines Corporation 1976, 1979

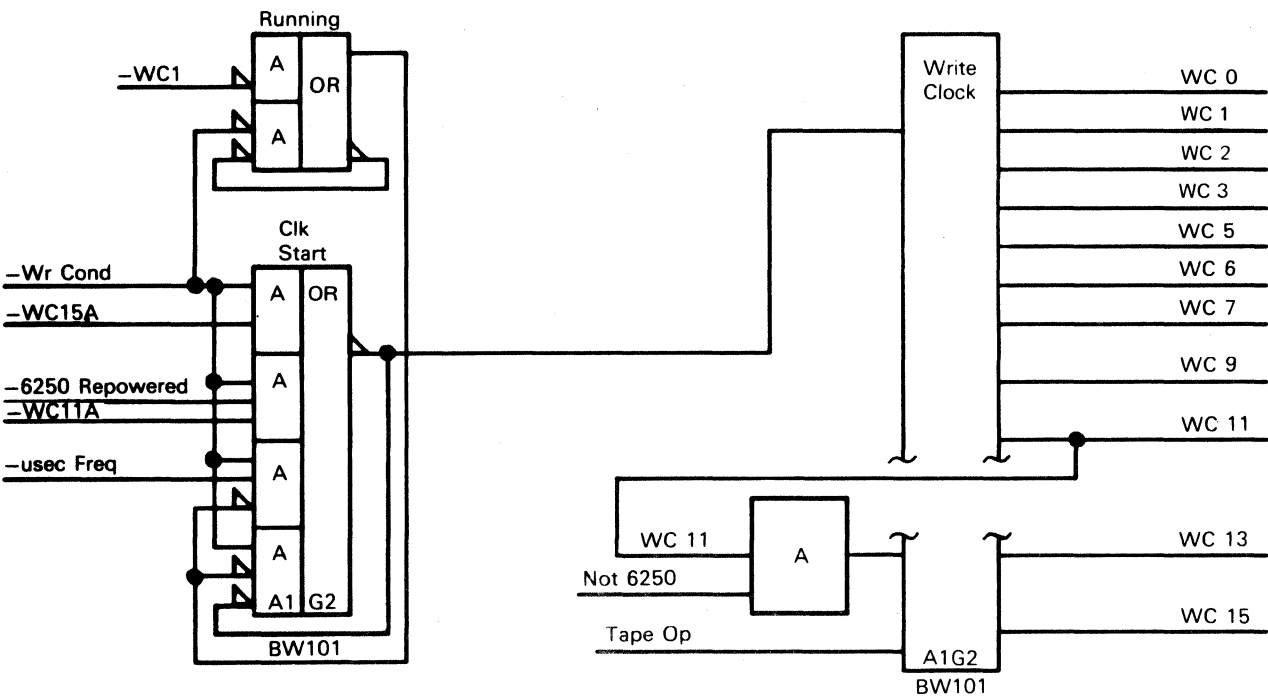


DATA FLOW CLOCK



Clock Output	ALD	Use
-0 - 50 Clock Bus YA	CD151 CD251 CD351 CH061 CH081	Skew and Master Clock Zone 1 Skew and Master Clock Zone 2 Skew and Master Clock Zone 3 Format Character Clocks Residual Frame Controls
-0 - 50 Clock Bus YB	CB411 CE101 CN281	ROC Counter S1 Register NRZI Hi Clip and Read VRC
-0 - 50 Delayed	BS051	Read Buffer Controls
-0 - 50 Clock Bus A1 Delayed	BN051 BR071	DC and Xlate Controls Cycle Request Latches
-25 - 75 Clock Bus YA	CD151 CD251 CH061 CH141	Skew and Master Clock Zone 1 Skew and Master Clock Zone 2 Format Character Clocks Modular 7 Residue Compare Equal
-25 - 75 Clock Bus YB	CB411 CD351 CN281	ROC Counter Skew and Master Clock Zone 3 NRZI Hi Clip and Read VRC
-25 - 75 Clock Bus A1 Delayed	BN071 BR071	Read DC and Xlate Control (7-trk Mode) Cycle Request Latches
-75 - 25 Delayed	BS051	Read Buffer Controls

WRITE CLOCK AND WRITE COUNTER

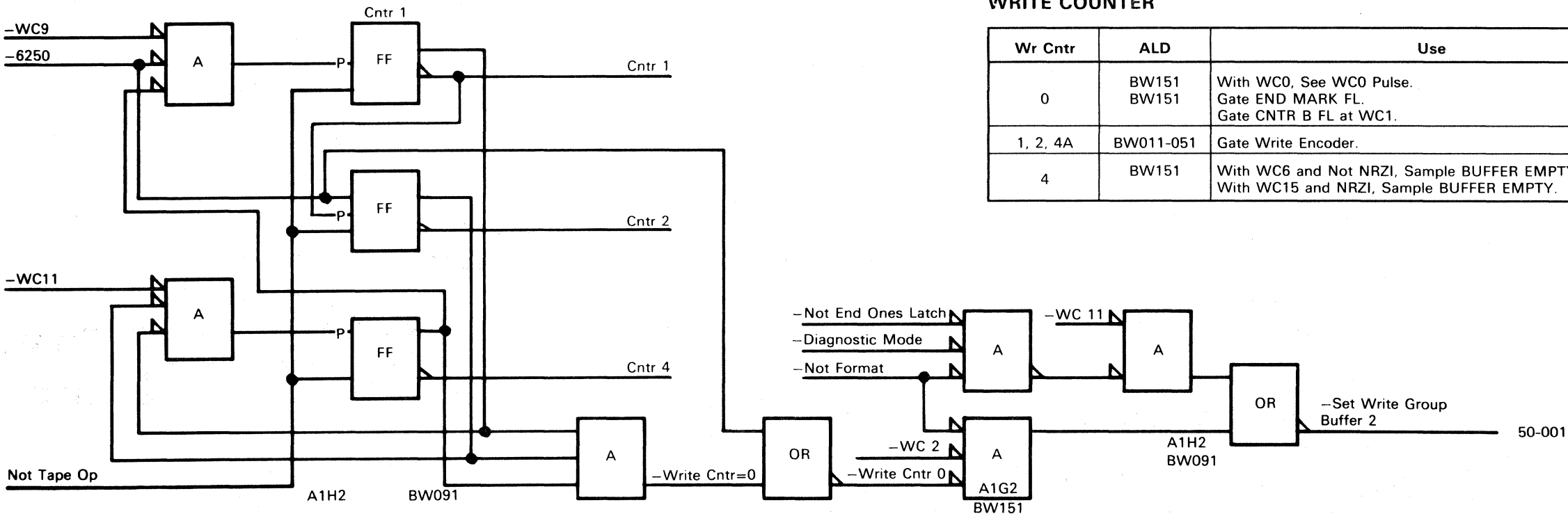


WRITE CLOCK

WC Pulse	ALD	Use
0	BW151	Reset Error Sample. With CNTR=0, Gate Write Controls A1, A2, Mark1, Mark2, Format, Initiate Sample, All Ones Branch Condition.
1	BW161 BW151	Reset WRITE TIME GATE. With WRITE CNTR=0, flip CNTR B FF. (Write Group B Branch)
2	BW151	Gate SET 2ND BUFFER.
3	BW161	Sample WR TGR VRC.
5	BW091	PE Diagnostic Mode.
6	BW151 BW161	Set SAMPLE FL if CNTR 4 is On. Flip ODD/EVEN CHAR FF.
7	BW161	Generate WR TGR GATE if not NRZI.
9	BW091	Step WRITE COUNTER 1.
11	BW091 BW101 BW151 BW161	Step WRITE COUNTER 4 if 1 and 2 are off. Restart Clock (6250). Set Write Controls. Sample WR TGR VRC.
13	BW161	Set WRITE TIME GATE (PE and NRZI).
15	BW151 BW161 BW101	Gate SAMPLE SET trigger. Generate WRITE TRIGGER GATE. Restart Clock (PE and NRZI).

WRITE COUNTER

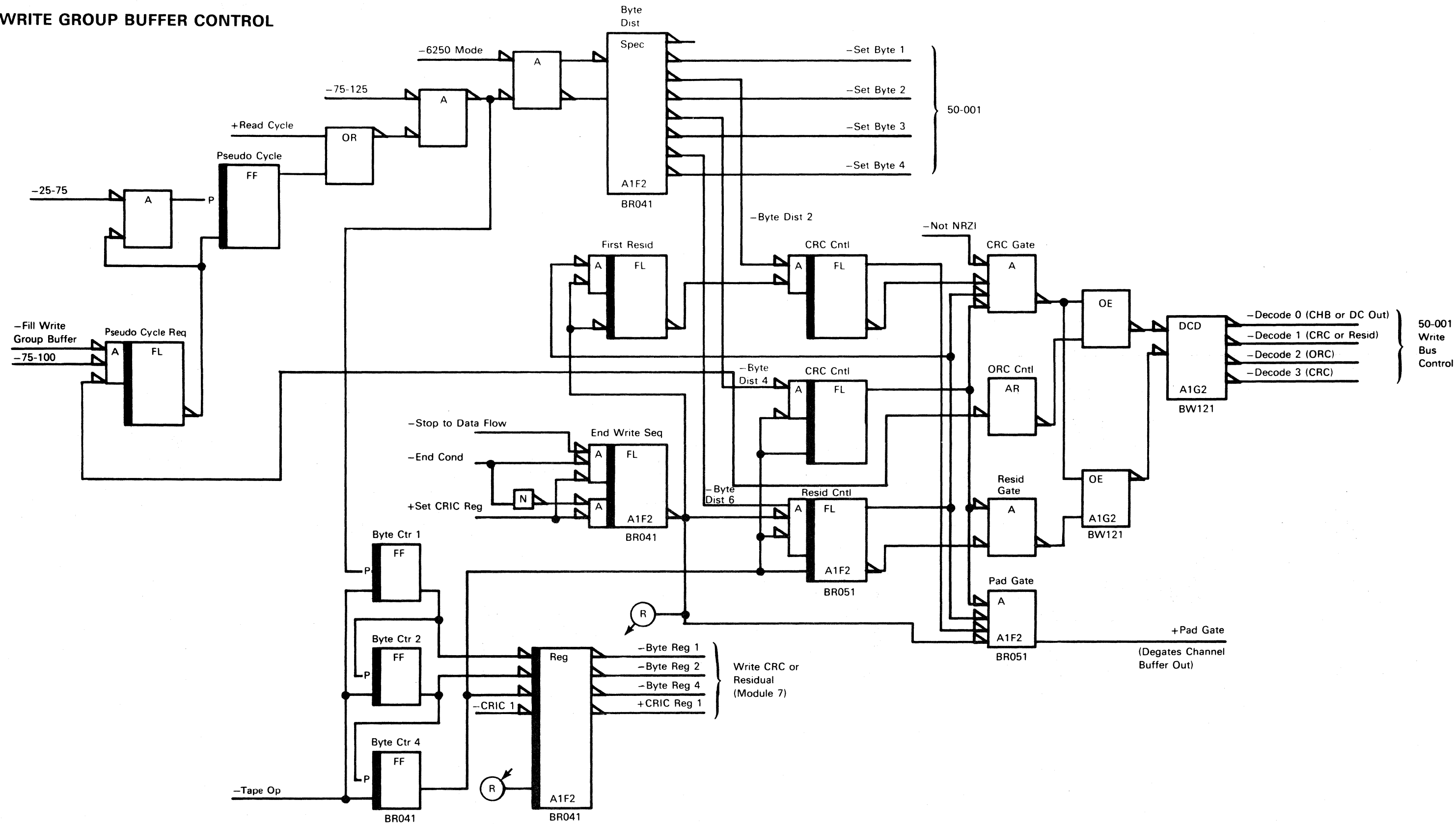
Wr Cntr	ALD	Use
0	BW151 BW151	With WC0, See WC0 Pulse. Gate END MARK FL. Gate CNTR B FL at WC1.
1, 2, 4A	BW011-051	Gate Write Encoder.
4	BW151	With WC6 and Not NRZI, Sample BUFFER EMPTY. With WC15 and NRZI, Sample BUFFER EMPTY.



Write Counter: Gates bytes to the write triggers.

3803-2/3420	XG2000 Seq 2 of 2	2735990 Part Number	See EC History	845958 1 Sep 79					
-------------	----------------------	------------------------	-------------------	--------------------	--	--	--	--	--

WRITE GROUP BUFFER CONTROL

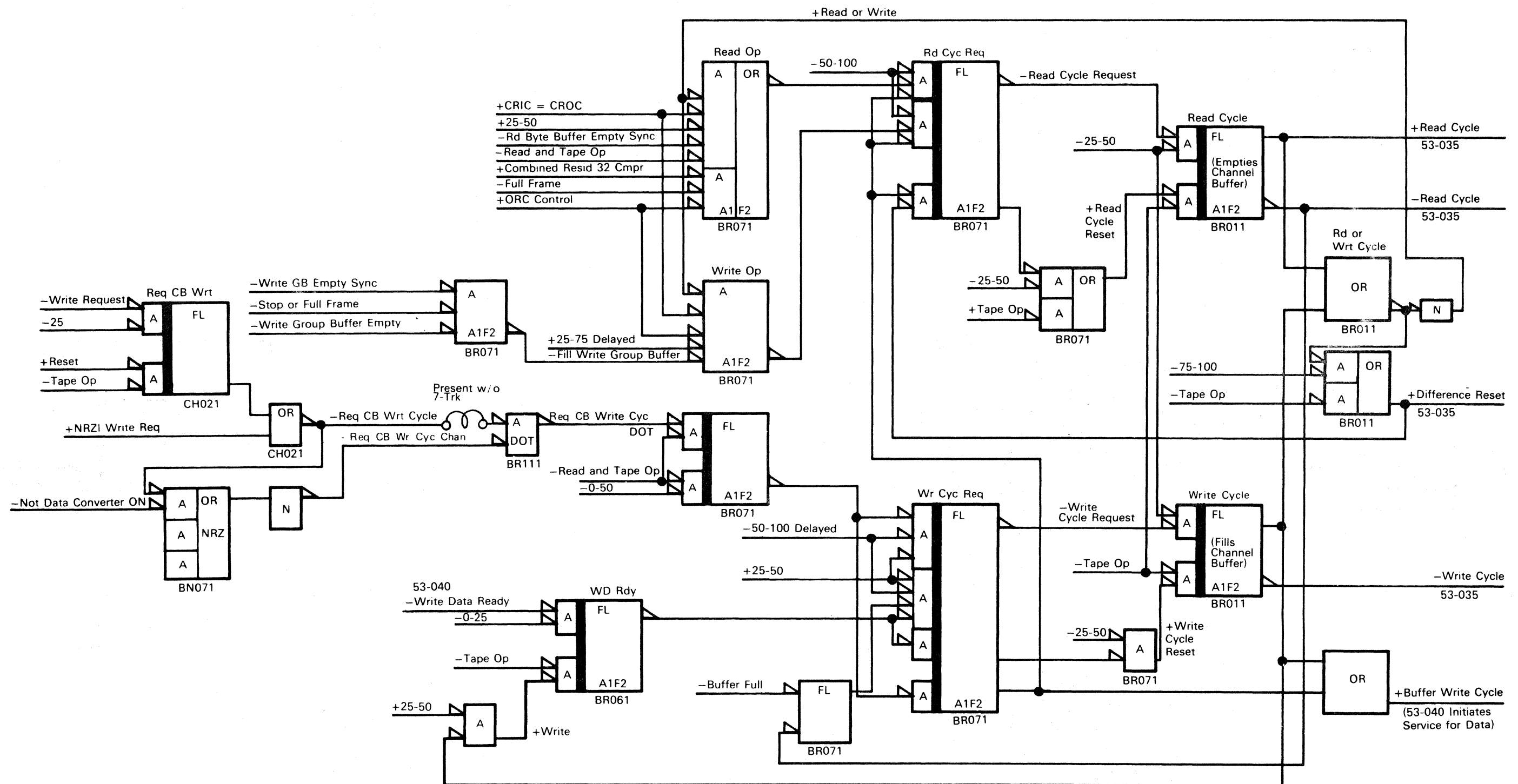


3803-2/3420

XG2100	2735991	See EC	845958						
Seq 1 of 2	Part Number	History	1 Sep 79						

© Copyright International Business Machines Corporation 1976, 1979

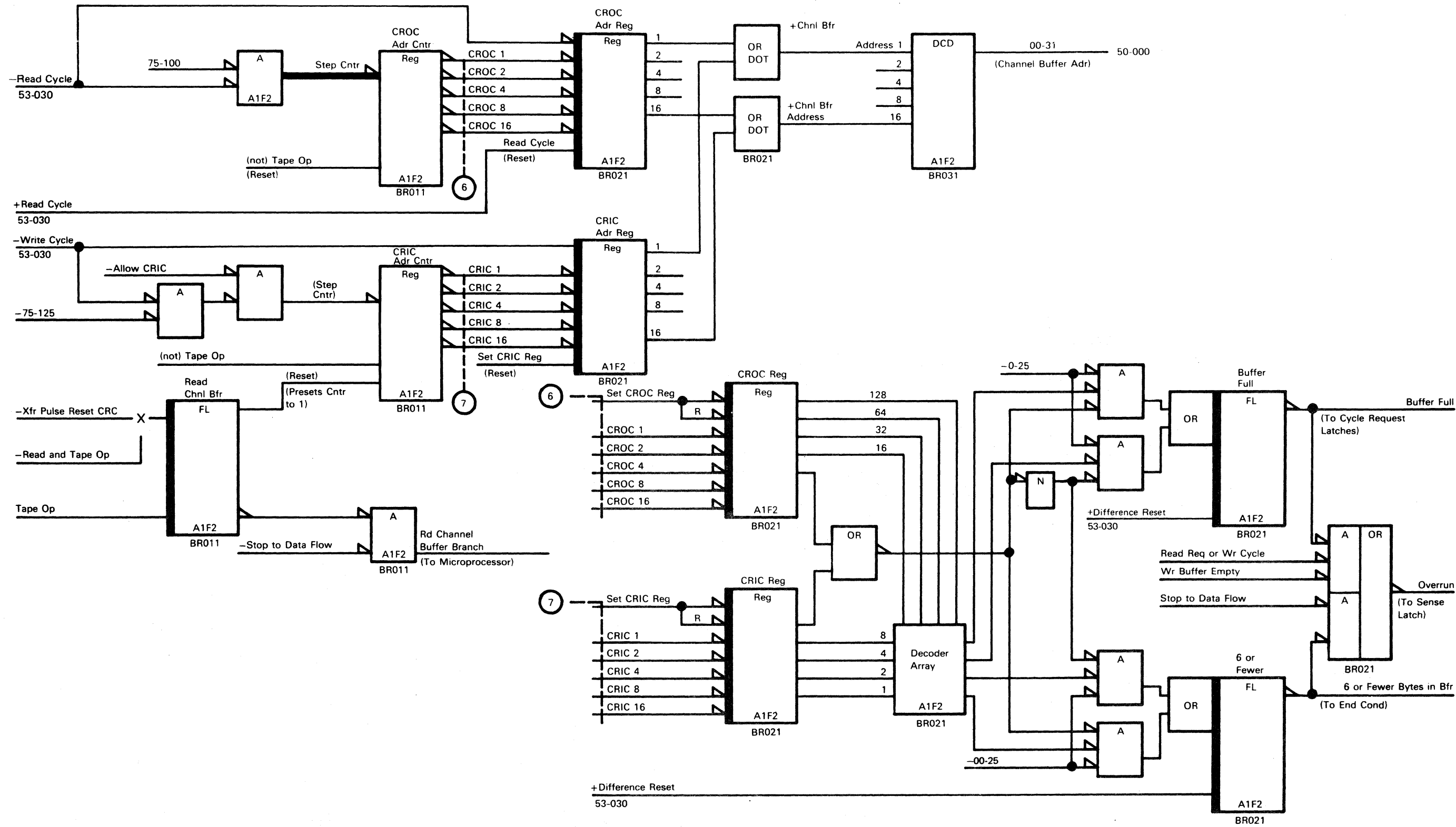
## CHANNEL BUFFER CONTROLS



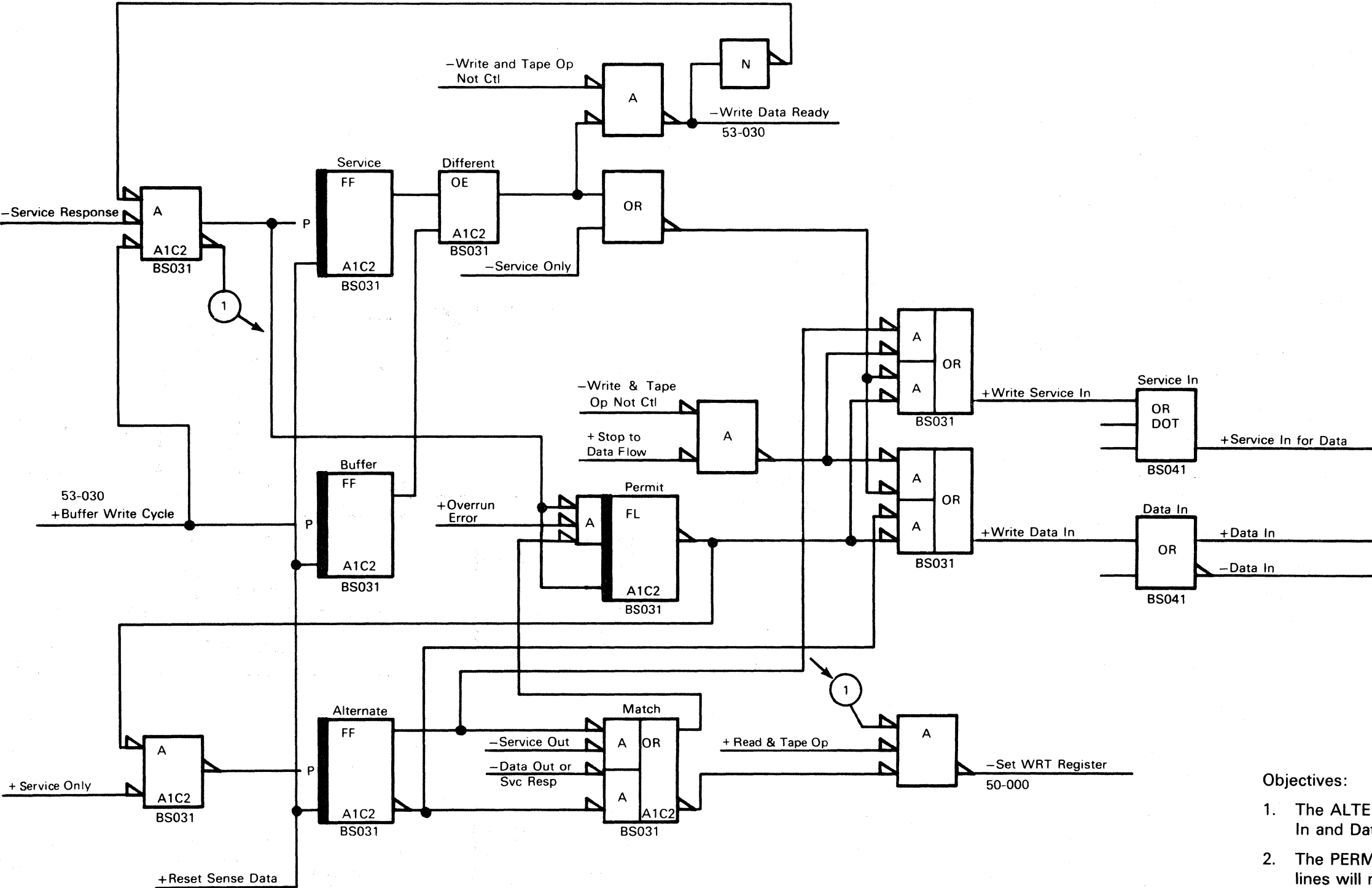
3803-2/3420

<b>YG2100</b> Seq 2 of 2	<b>2735991</b> Part Number	<b>See EC History</b>	<b>845958</b> 1 Sep 79					
-----------------------------	-------------------------------	-----------------------	---------------------------	--	--	--	--	--

© Copyright International Business Machines Corporation 1976, 1979



WRITE SERVICE CONTROLS

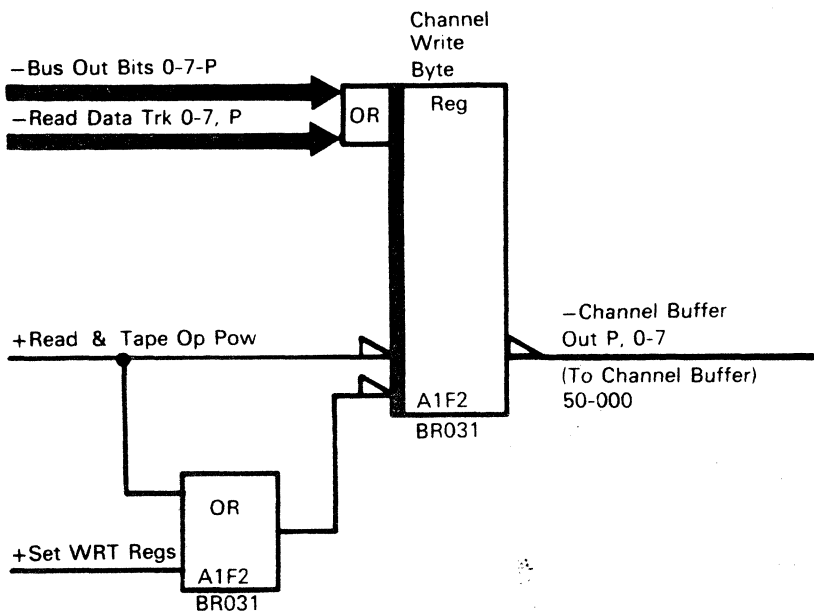


- Objectives:
- 1. The ALTERNATE flip flop controls alternate Service In and Data In cycles.
  - 2. The PERMIT flip latch ensures that multiple tag lines will not be active at the same time.
  - 3. Buffer Write Cycle or Req controls Service Different and Buffer.

3803-2/3420								
XG2200	2735992	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

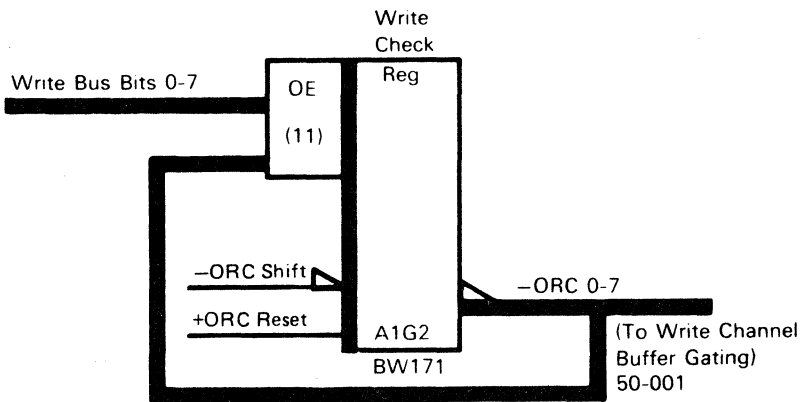
© Copyright International Business Machines Corporation 1976, 1979

CHANNEL WRITE BYTE REGISTER



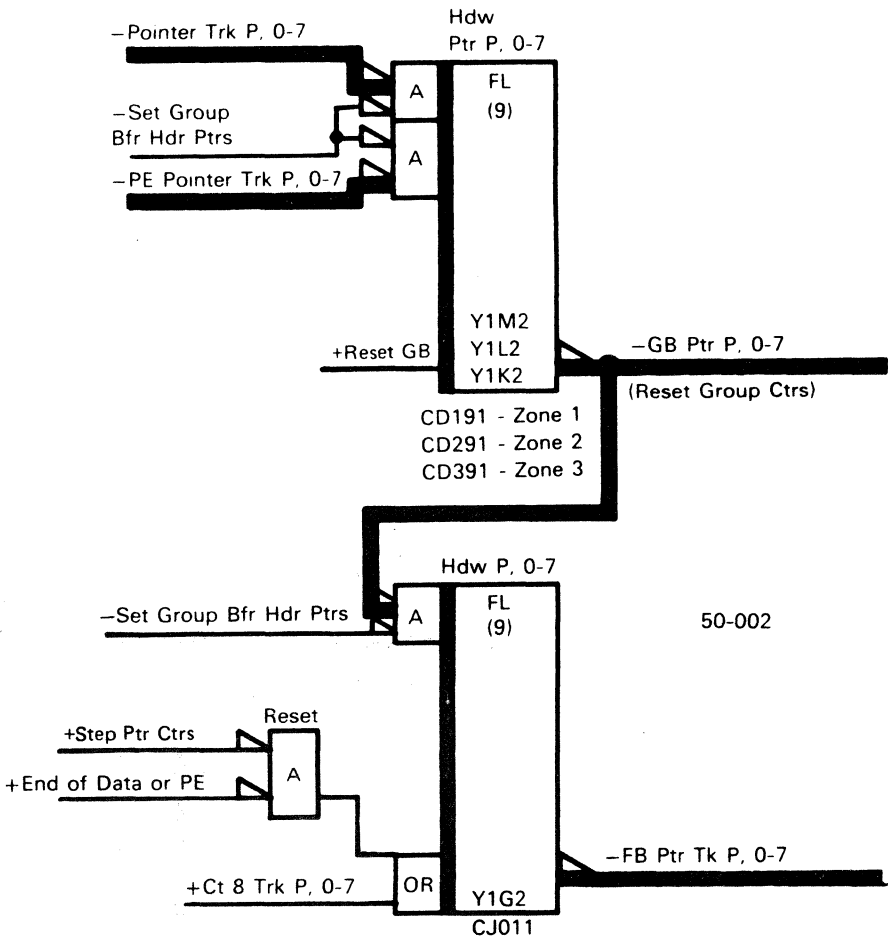
Objective:  
This register is a temporary buffer for the channel buffer write byte from either interface bus out or read data track.

WRITE CHECK REGISTER



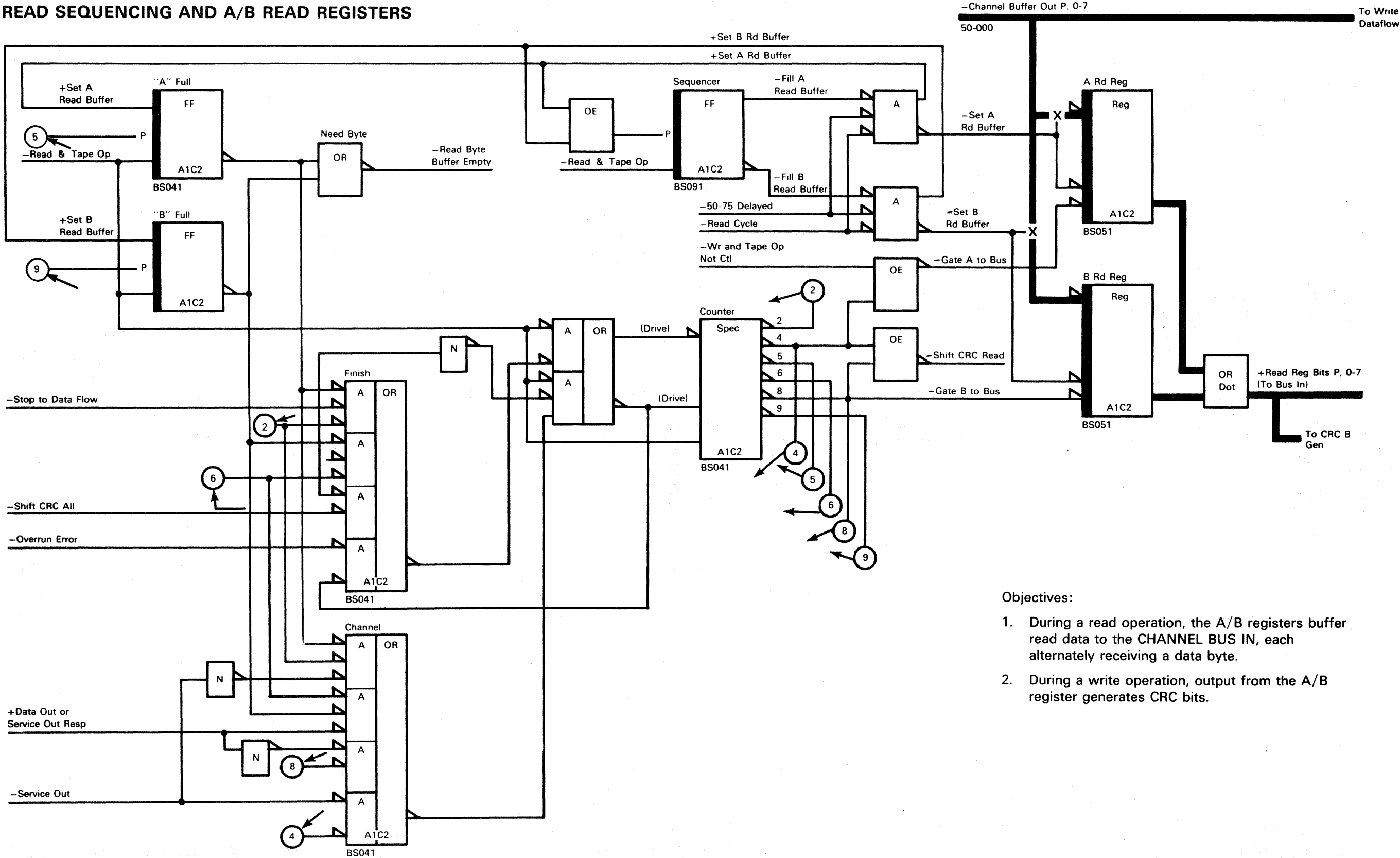
Objective:  
An ORC byte character is generated for each ECC group.

POINTER REGISTERS



Objective:  
The POINTER register accumulates the pointers for one group of 6250 data. These pointers are used for correction as required.

READ SEQUENCING AND A/B READ REGISTERS



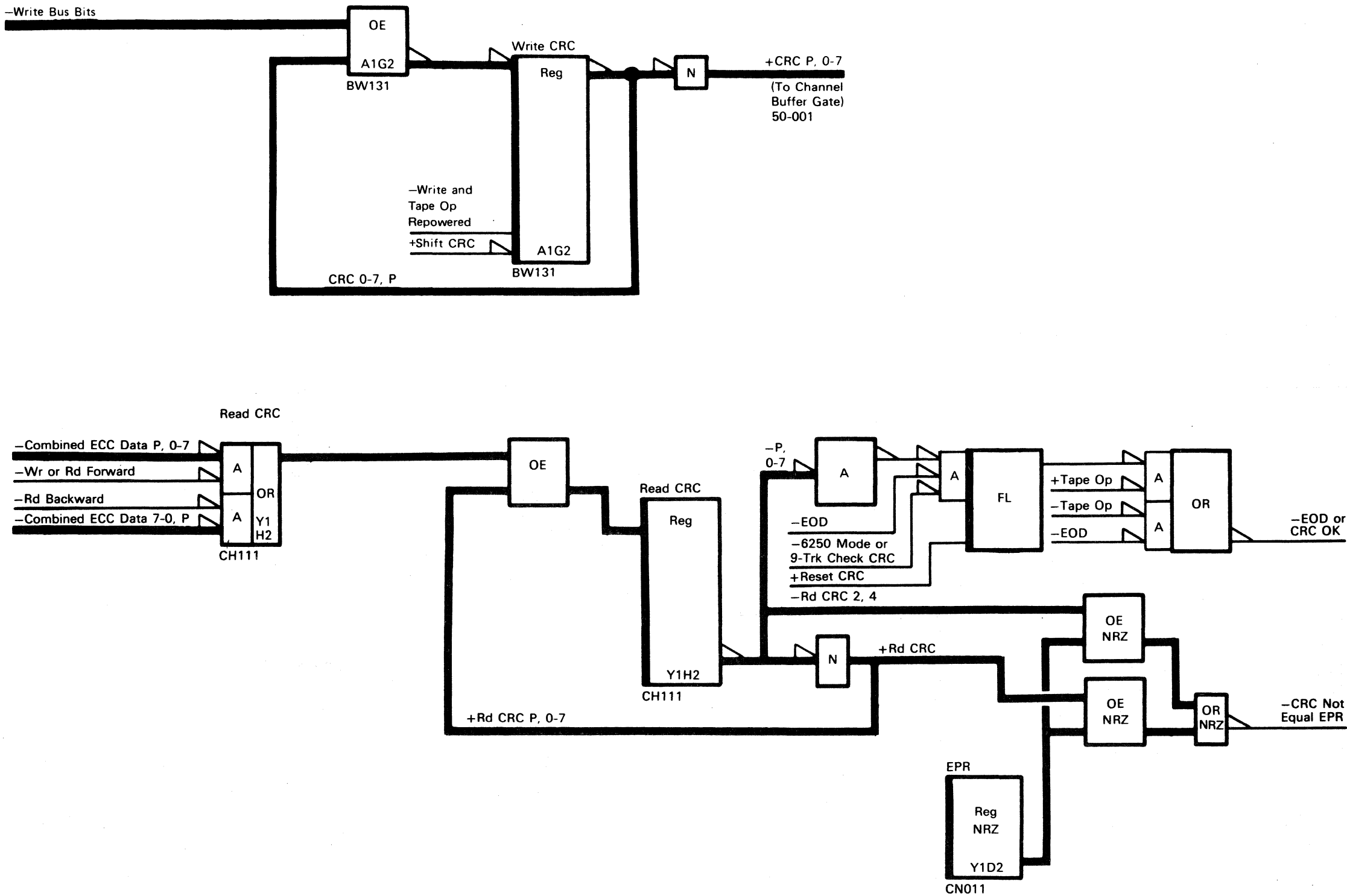
Objectives:

1. During a read operation, the A/B registers buffer read data to the CHANNEL BUS IN, each alternately receiving a data byte.
2. During a write operation, output from the A/B register generates CRC bits.

3803-2/3420		See EC History		845958		1 Sep 79									
XG2300	2735993	Seq 2 of 2	Part Number												



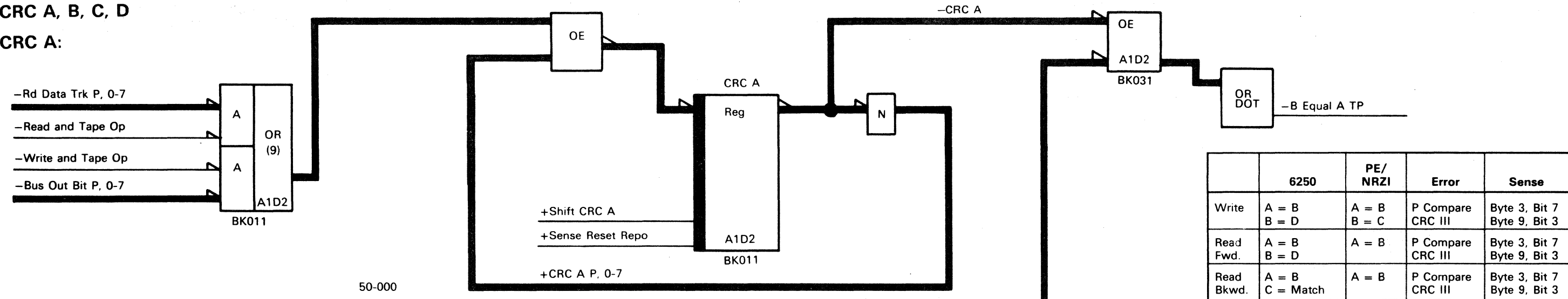
CRC GENERATORS



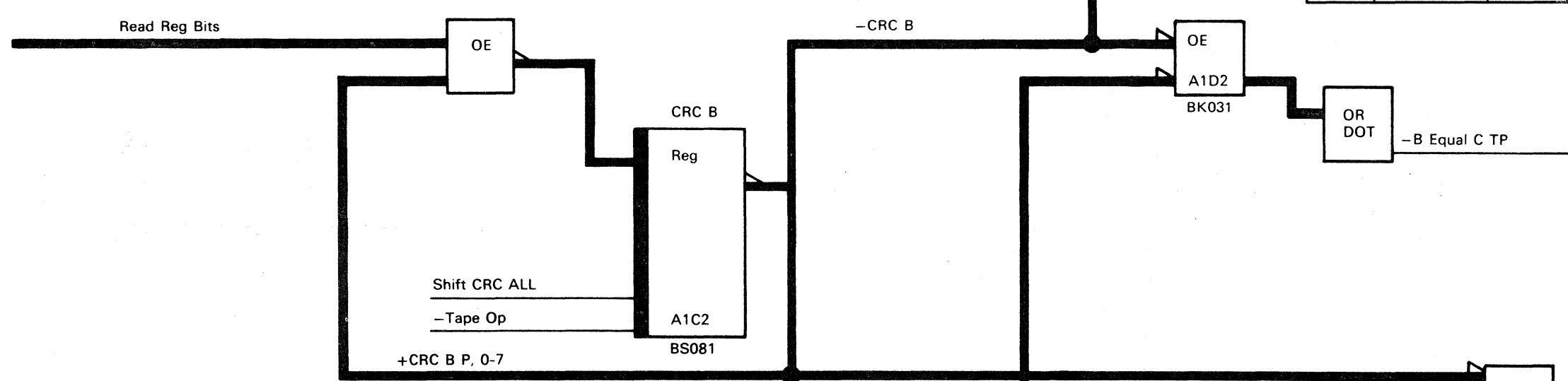
3803-2/3420							
XG2400	2735994	See EC History	845958				
Seq 1 of 2	Part Number		1 Sep 79				

CRC A, B, C, D

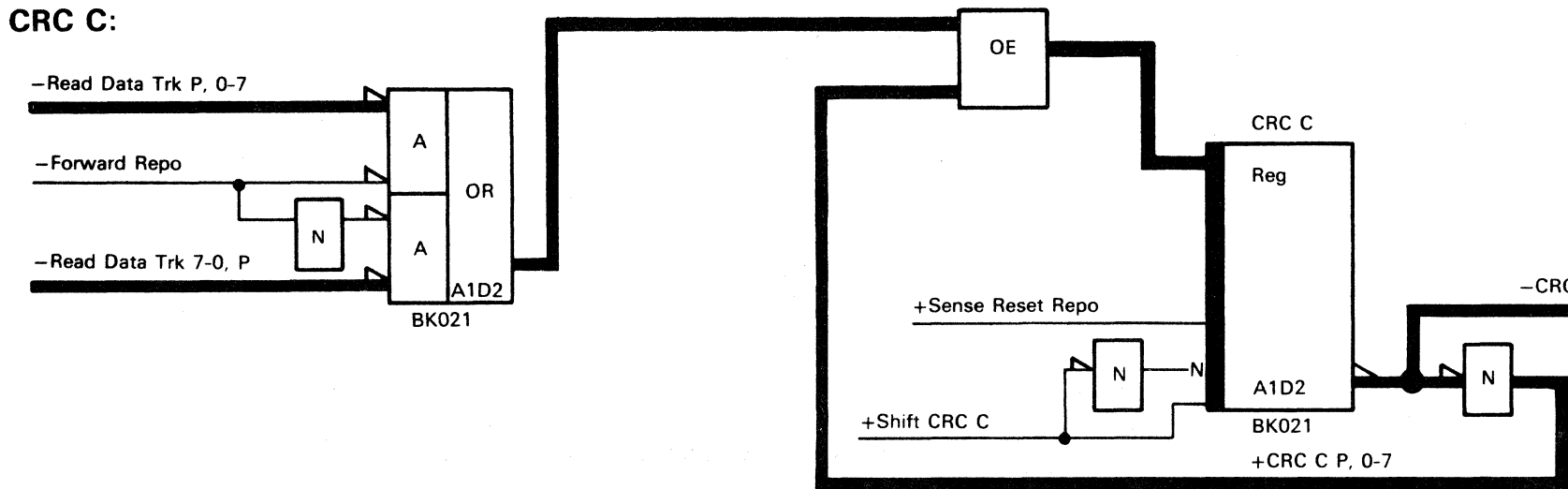
CRC A:



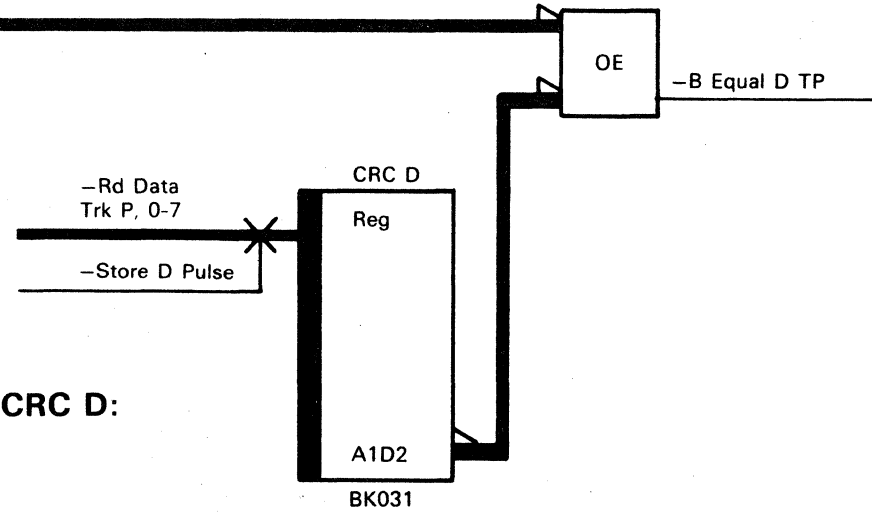
CRC B:



CRC C:



CRC D:



3803-2/3420									
XG2400	2735994	See EC	845958						
Seq 2 of 2	Part Number	History	1 Sep 79						

CYCLIC REDUNDANCY CHECK (CRC) GENERATION

Two cyclic redundancy check (CRC) errors set sense bits. A CRC error sets sense byte 3, bit 3 and a CRC III error sets sense byte 9, bit 3. See 50-000, 50-001, and 50-002 for relationships to data flow.

CRC GENERATION DURING 9-TRACK WRITE OPERATIONS

Write data from the channel is shifted into the CRC A register (50-000), byte by byte, as the channel buffer is loaded. As the data is being read out of the channel buffer, the output is shifted into the CRC B register (50-000), as demanded by the write section. Accumulated contents of CRC A and CRC B registers are compared when the channel buffer empties (53-066). Dropping or picking up a bit or bits in transferring data through the channel buffer results in a mismatch and sets P COMPARE ERROR (byte 3 bit 7) and sense byte 9, bit 2.

a. 6250 bpi Mode

The content of the CRC A register is written on tape as the CRC III byte. The CRC III byte is also shifted into the Write CRC generator (50-001) with data and other bytes. Content of the WRITE CRC register is also written on tape as a CRC byte.

b. PE Mode

CRC III is generated during PE operations for write checking, but is not written on tape.

c. 9-Track NRZI Mode

Only the accumulated data bytes generate the CRC byte.

CRC USE DURING READ BACK CHECK OF WRITE OPERATIONS

a. 6250 bpi Mode

Data previously written is read back through the normal read data path and the Check CRC Byte is stored in the CRC D register (50-000). CRC D is compared with CRC B; a mismatch sets CRC III error and sense byte 9, bit 3.

During the read back check, all data bytes and other bytes are shifted in the READ CRC register. The result should be a match pattern in the READ CRC register. Any other pattern sets CRC error only.

b. PE/9-Track NRZI Modes

Only data bytes are read back and stored in CRC C register (50-000). Contents of CRC C register are compared with CRC B (53-066). A mismatch sets CRC III error and sense byte 9, bit 3.

c. 9-Track NRZI Mode

All data bytes are read back and combined with the CRC byte in the READ CRC register (53-065). The accumulated bits should result in a match pattern. Any other pattern sets CRC Error.

CRC GENERATION DURING 9-TRACK READ FORWARD OPERATIONS

CRC generation during a read forward operation is similar to CRC generation during the read back check of a write operation. Data bytes read from tape go to the channel buffer (50-000) and also into CRC A register. CHANNEL BUFFER FULL initiates data transfer to the Interface Bus In and also shifts bytes into CRC B register. Accumulated contents of CRC A and CRC B registers are compared when the channel buffer empties (53-066). Dropping or picking up a bit or bits in transferring data through the channel buffer results in a mismatch and sets P COMPARE ERROR (byte 3 bit 7) and sense byte 9, bit 2.

6250 bpi Mode:

CRC generation and use during 6250 read operations is identical to CRC use during read back checking.

CRC GENERATION DURING 9-TRACK READ BACKWARD OPERATIONS

CRC generation detects the loss or gain of bits transferred through the channel buffer during both read backward and read forward operations.

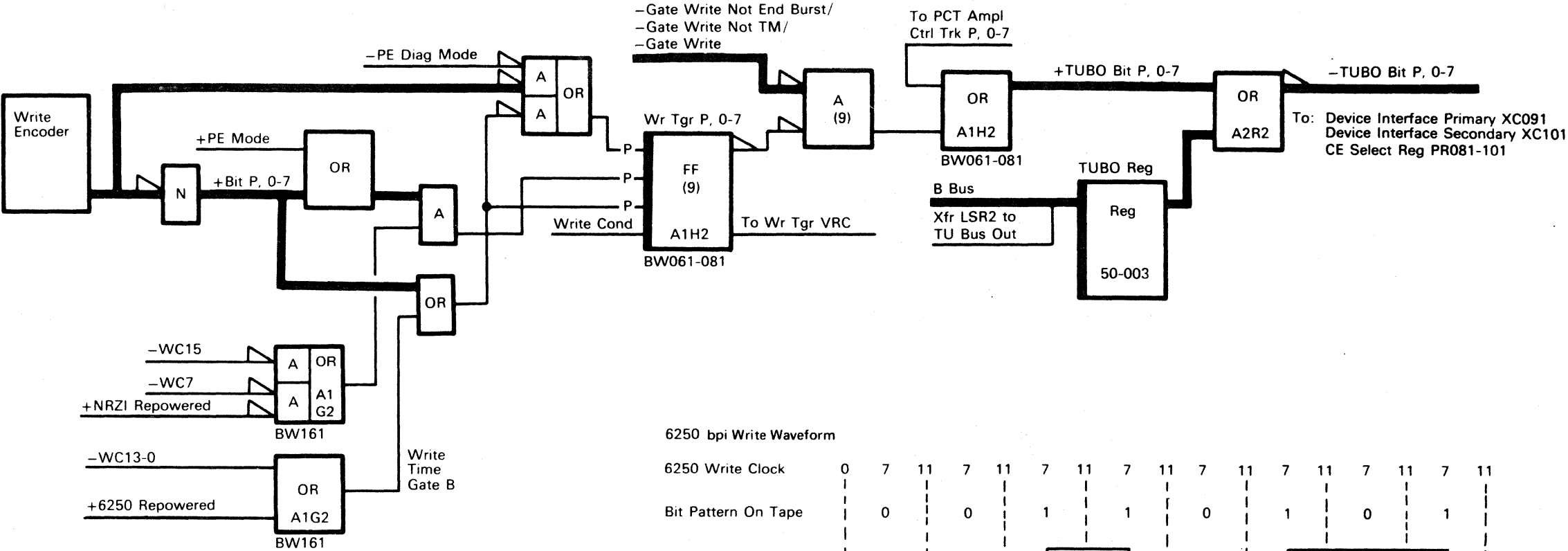
6250 bpi Mode:

Read CRC error determinations are identical in 6250 read backward and read back checking operations except that bytes are shifted into registers in a reverse order.

The CRC C register accumulates combined data bytes and the check CRC bytes. With no read errors, the result should be a match pattern in the CRC C register. Any other pattern sets CRC III error and sense byte 9, bit 3.

7-Track NRZI operations do not use a CRC checking procedure.

WRITE TRIGGERS



WRITE TRIGGER OPERATION

Data bytes from the CHANNEL BUS OUT consist of binary ones and binary zeros. The tape control and tape unit convert these binary bits to flux changes on tape. The 6250 bpi and NRZI methods of writing distinguish ones from zeros by a flux change for a one and no flux change for a zero.

Phase encoding (PE) distinguishes ones from zeros by the direction of flux change. A flux change in one direction indicates a one bit and in the opposite direction indicates a zero bit.

Write triggers produce magnetic flux changes on tape in one direction when they are flipped on and in the opposite direction when they are flipped off.

6250 BPI WRITE TRIGGER OPERATION

6250 bpi method of writing on tape flips the WRITE TRIGGERS at Write Clock 7 to write one bits on tape. The Write Clock runs to Write Clock 11 and then starts over.

PE WRITE TRIGGER OPERATION

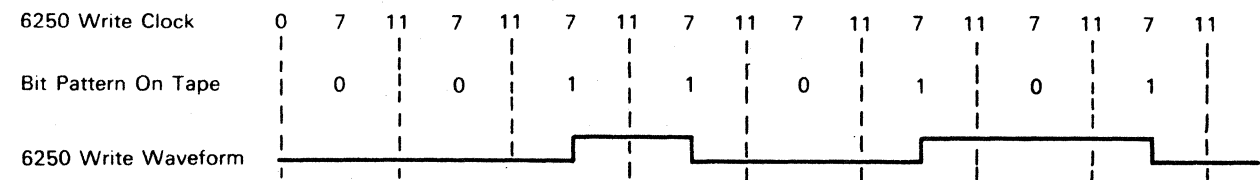
In PE operation, the write clock runs from 0 through 15 for each cycle.

Each byte is set into the write encoder. For each bit of the byte that is a one, the corresponding write trigger is "set up" at WC7. All write triggers are flipped at WC15 to write a byte on tape with flux reversals in one direction for one bits and in the opposite direction for zero bits.

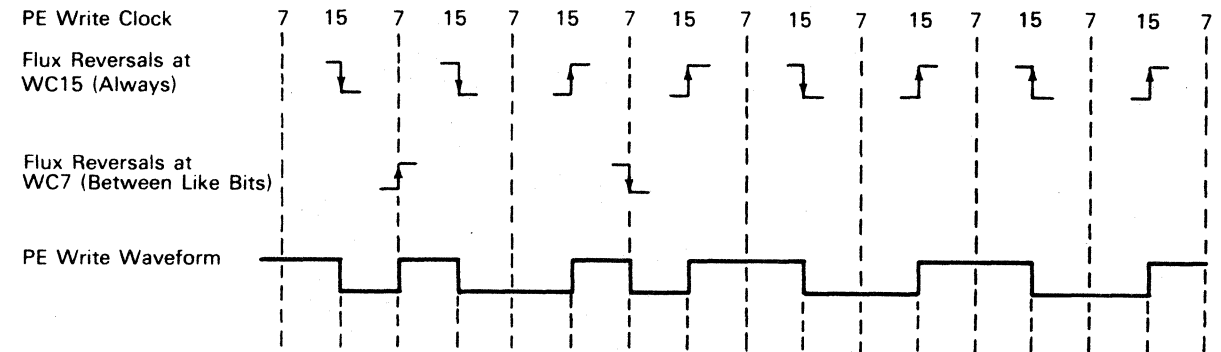
NRZI WRITE TRIGGER OPERATION

For a NRZI write operation, each byte is set into the write encoder. For each one-bit of the byte, the corresponding write trigger is flipped to write a flux reversal on tape. For zero-bits of each byte, the write trigger is not flipped, and thus, no flux reversal is written.

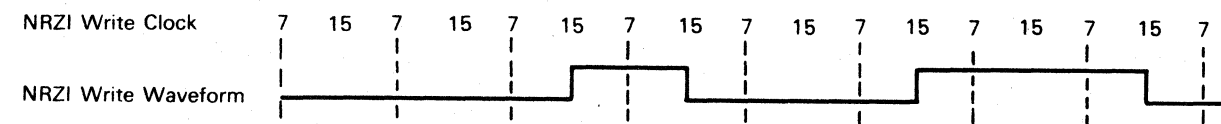
6250 bpi Write Waveform



PE Write Waveform



NRZI Write Waveform

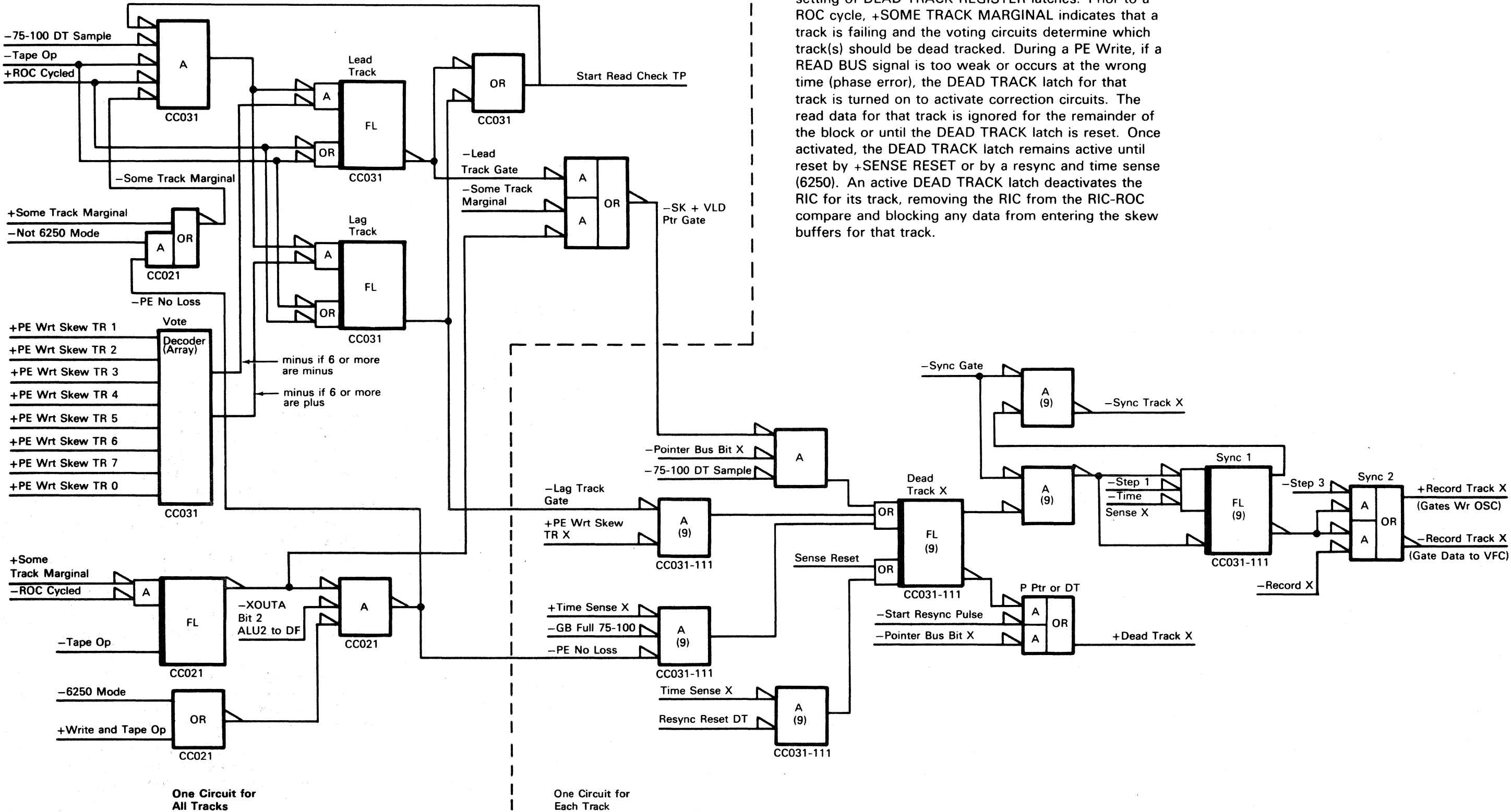


3803-2/3420

XG2500	2735995	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

DEAD TRACK REGISTER



The DEAD TRACK register contains one latch for each track. After ROC has cycled, the Pointer Bus controls setting of DEAD TRACK REGISTER latches. Prior to a ROC cycle, +SOME TRACK MARGINAL indicates that a track is failing and the voting circuits determine which track(s) should be dead tracked. During a PE Write, if a READ BUS signal is too weak or occurs at the wrong time (phase error), the DEAD TRACK latch for that track is turned on to activate correction circuits. The read data for that track is ignored for the remainder of the block or until the DEAD TRACK latch is reset. Once activated, the DEAD TRACK latch remains active until reset by +SENSE RESET or by a resync and time sense (6250). An active DEAD TRACK latch deactivates the RIC for its track, removing the RIC from the RIC-ROC compare and blocking any data from entering the skew buffers for that track.

RIC-ROC

The read section contains nine 32-position Read In Counters (RICs), one for each track, and one 32-position Read Out Counter (ROC).

A RIC specifies which skew buffer position receives the next one or zero bit for a data byte read from tape. When a bit is detected, it is placed in the skew buffer, and the RIC for that track is stepped to the next position.

The ROC selects the skew buffer position from which a byte is transferred to the group buffer.

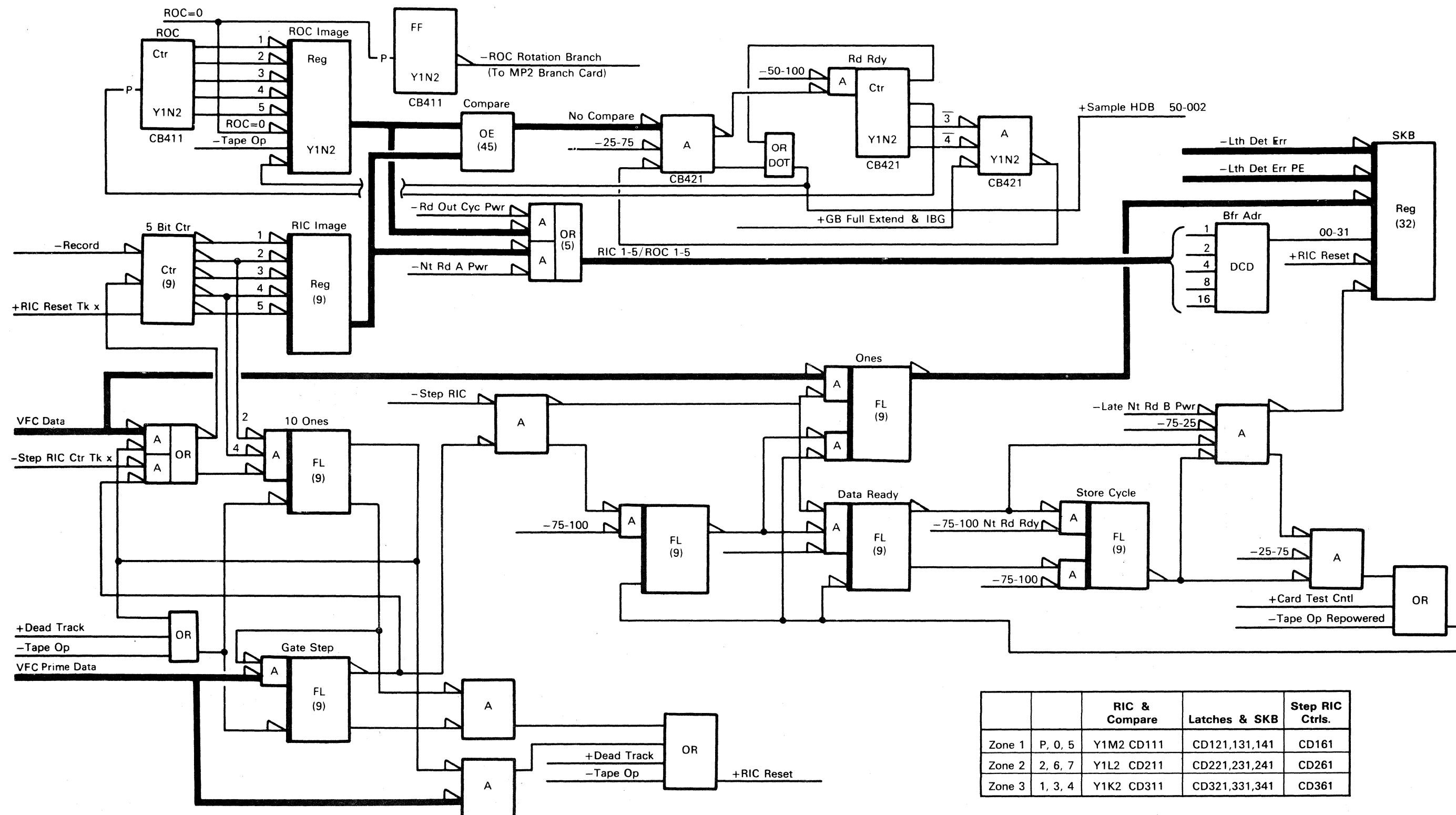
Initially, all RICs and ROC are reset. As each bit of the first data byte enters skew buffer position 0, the corresponding RIC is stepped from 0 to 1. When none of the RICs are equal to ROC, RIC-ROC NO-COMPARE is activated, indicating that all bits of the byte have entered the skew buffer. RIC-ROC NO-COMPARE gates outputs of the ROC counter to the ROC image register and steps the Read Ready Counter, which times the read out of the skew buffer.

The operation continues in this manner until GROUP BUFFER FULL or IBG becomes active to stop the read out.

3803-2/3420

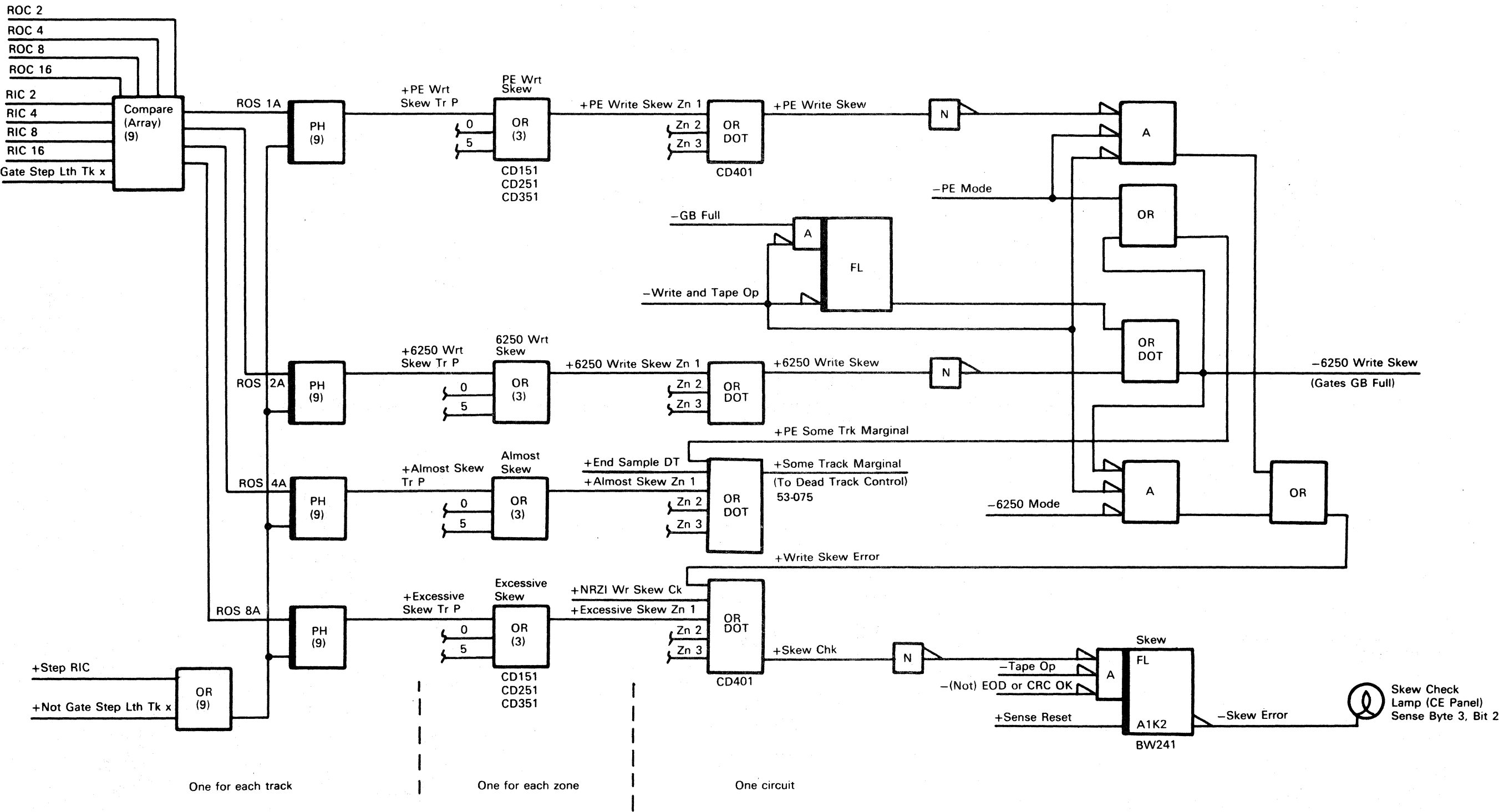
XG2600	2735996	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

## RIC-ROC



		RIC & Compare	Latches & SKB	Step RIC Ctrls.
Zone 1	P, 0, 5	Y1M2 CD111	CD121,131,141	CD161
Zone 2	2, 6, 7	Y1L2 CD211	CD221,231,241	CD261
Zone 3	1, 3, 4	Y1K2 CD311	CD321,331,341	CD361

SKREW DETECTION

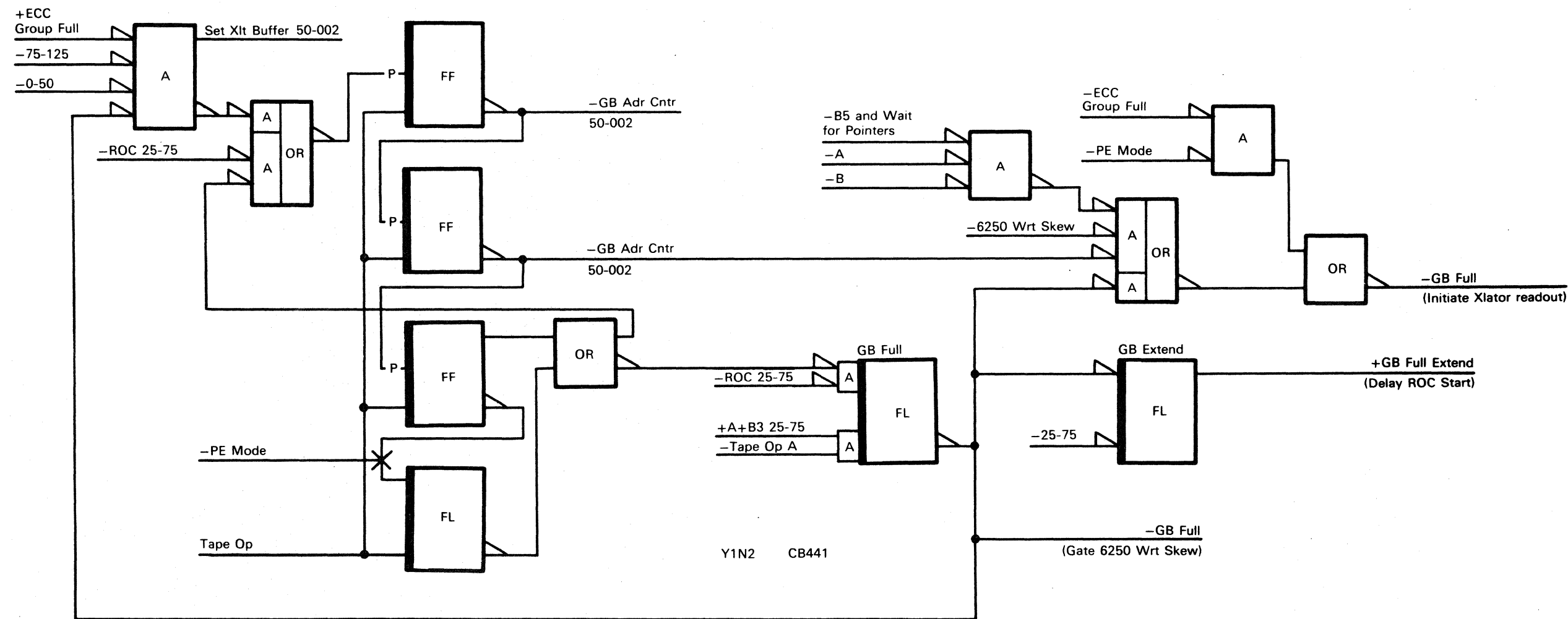




GROUP BUFFER COUNTER

Objectives:

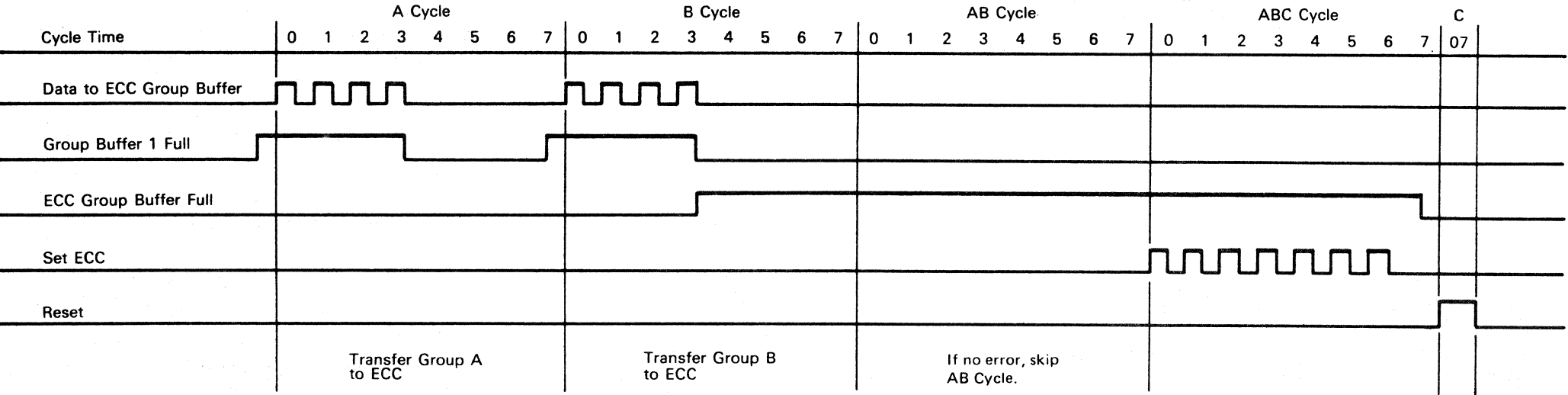
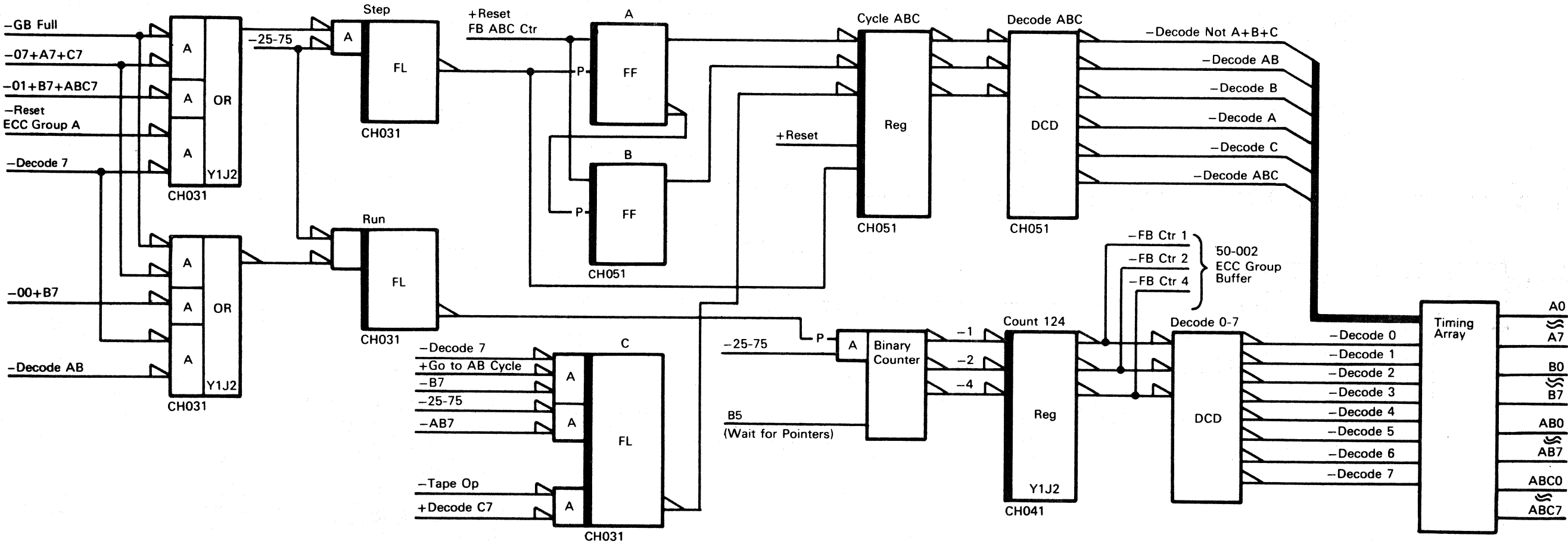
- 1. Limits skew buffer read out to one 6250 group of data (5 bytes per group).
- 2. Controls skew buffer read out in PE Mode after the first five bytes are read out to give one-byte-in and one-byte-out control.
- 3. Controls translator operation during a group buffer read out to convert five parallel 6250 bytes into four serial data bytes.
- 4. Controls translator operation to detect 6250 characters and to decode format marks.
- 5. Group buffer counter counts to five and conditions translator for read out to ECC group buffer. If ECC group buffer is full, counter stepping is inhibited.



3803-2/3420

XG2800	2735998	See EC	845958						
Seq 1 of 2	Part Number	History	1 Sep 79						

READ CYCLE CONTROLS



Clock is initialized with 00-07 only when TAPE OP becomes active.  
Format Groups and PE mode use "A" cycles only.

3803-2/3420							
XG2800	2735998	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

INITIAL SELECTION OF TAPE UNIT

DESCRIPTION

The initial selection sequence is the communication between the channel and tape control that initiates an operation.

During initial selection, the tape control obtains initial status information that indicates the availability of the selected tape unit. If the tape unit response indicates it is available, the tape control activates lines that tell the tape unit to perform a specific command. In response to the command, the tape unit furnishes additional status information that indicates its ability to perform the specified command. If the tape unit is capable of performing the command, the tape control activates MOVE to the tape unit.

The communication between the tape control and tape unit is over the device interface lines.

DEVICE INTERFACE LINES

The device interface is composed of the following lines that perform the listed functions:

**BUS OUT (9 lines):** Transmits commands, amplitude sensing levels, write data, and sense byte identification to the tape unit.

**MOVE tag:** Initiates tape motion.

**COMMAND tag:** In conjunction with BUS OUT, initiates the execution of a command.

**CONTROL tag:** In conjunction with BUS OUT, initiates the execution of a control command.

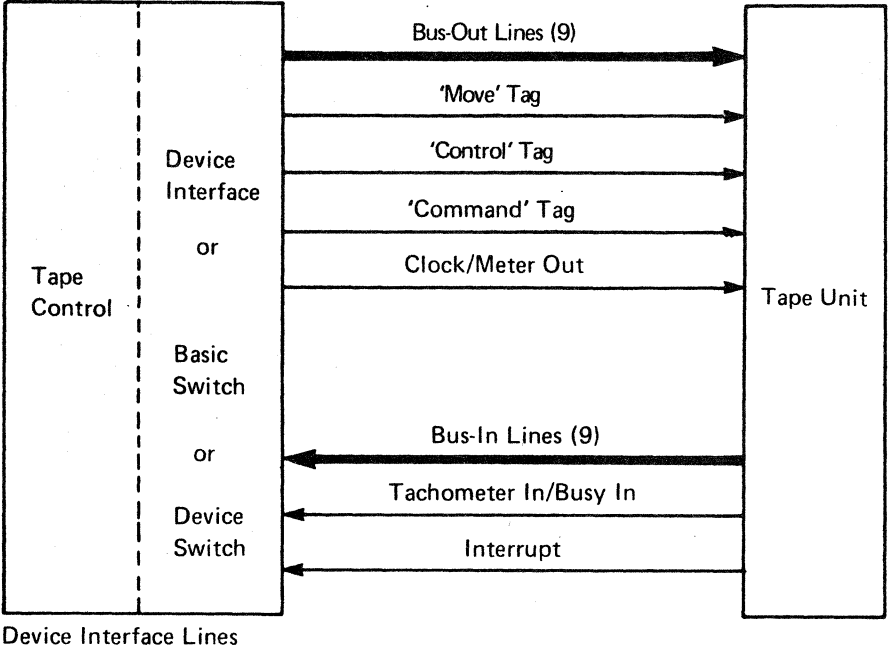
**CLOCK/METER OUT:** Causes the tape unit usage meter to run.

**BUS IN (9 lines):** Transmits status, sense information, and read data to the tape control.

**TACHOMETER IN/BUSY IN:** When no tag is active, this line indicates that the tape unit is busy. When any OUT tag is active, this line carries the capstan tachometer pulses to the tape control.

**INTERRUPT:** This line signals the tape control that one of the following unusual conditions has occurred in the tape unit.

- Load Check
- Loss of mechanical ready during a rewind
- Transition from not ready to ready status occurred
- Transition from ready to not ready status occurred while the MOVE tag was active
- BOT was sensed during a read backward operation



BUS OUT Lines

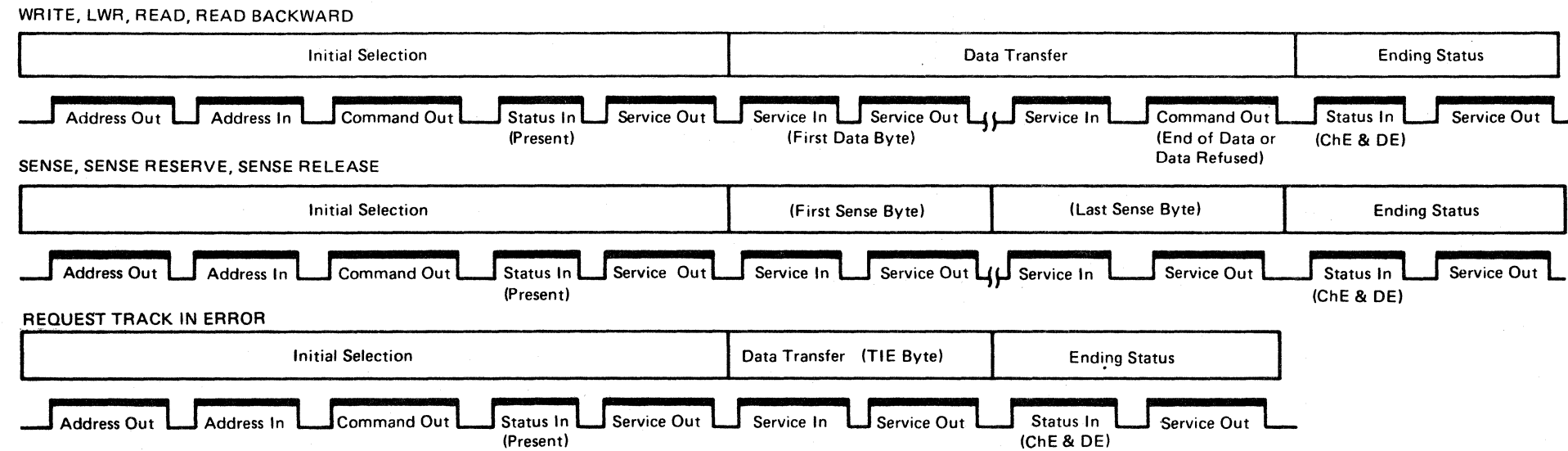
BUS OUT Bit	COMMAND Tag Active	CONTROL Tag Active
0	Backward read	Rewind Unload
1	Forward read	Not used
2	Diagnostic (LWR)	(Mod 4, 6, 8 only) Diagnostic (set high sense)
3	Pulse	NRZI or 6250 bpi mode
4	Write	(Mod 4, 6, 8 only) Diagnostic (set low sense)
5	Set Extend Stop (Mod 4, 6, 8 only)	Data security erase
6	Reset error latches	(Mod 4, 6, 8 only) Erase Status
7	Not used	Rewind

BUS IN Lines

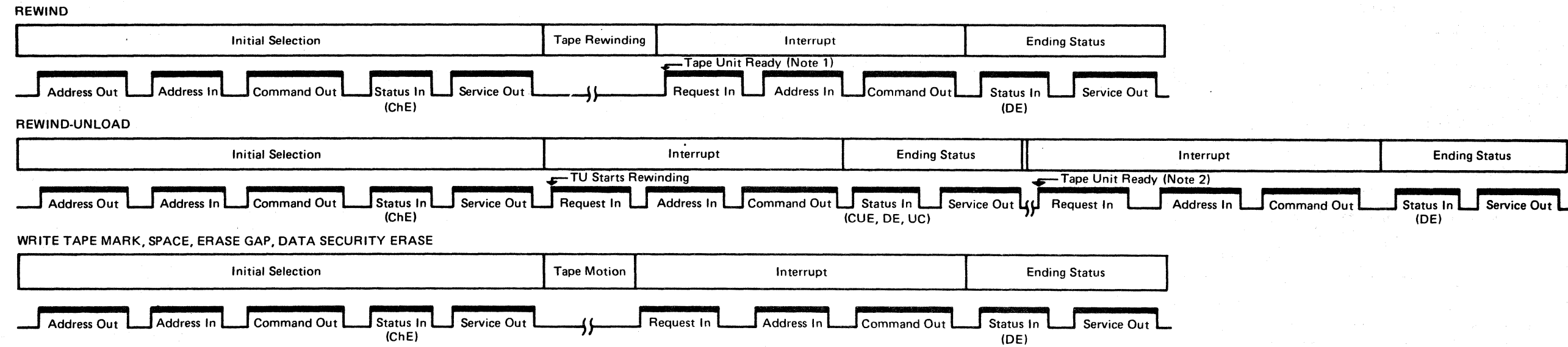
BUS IN Bit	COMMAND STATUS Byte	CONTROL STATUS Byte
0	Backward	Rewind Unload
1	Gap control	Not used
2	Diagnostic mode	(Mod 4, 6, 8 only) High Sense ON
3	(Mod 4, 6, 8 only) Opposite direction	NRZI or 6250 bpi mode
4	write status	(Mode 4, 6, 8 only) Low sense ON
5	Extended Stop (Mod 4, 6, 8 only)	Erase
6	Unit Check	(Mod 4, 6, 8 only) Erase status ON
7	(Mod 4, 6, 8 only) Positioning	Rewind

COMMAND SEQUENCE (TAG  
LINES/STATUS)

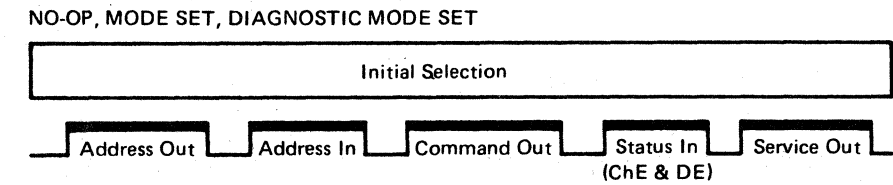
BURST COMMANDS



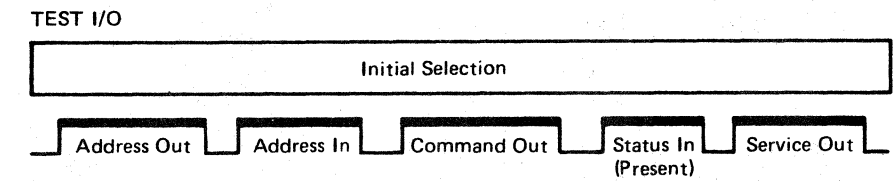
MOTION CONTROL  
COMMANDS



NON-MOTION  
CONTROL COMMANDS



INSTRUCTIONS



- Notes:
- 1. Request-in interrupt sequence initiated when 'rewinding' line goes from active to inactive state.
  - 2. Request-in interrupt sequence initiated only if operator reloads and 'readies' tape unit to generate second 'device end.'

TAPE CONTROL AND TAPE UNIT SELECTION

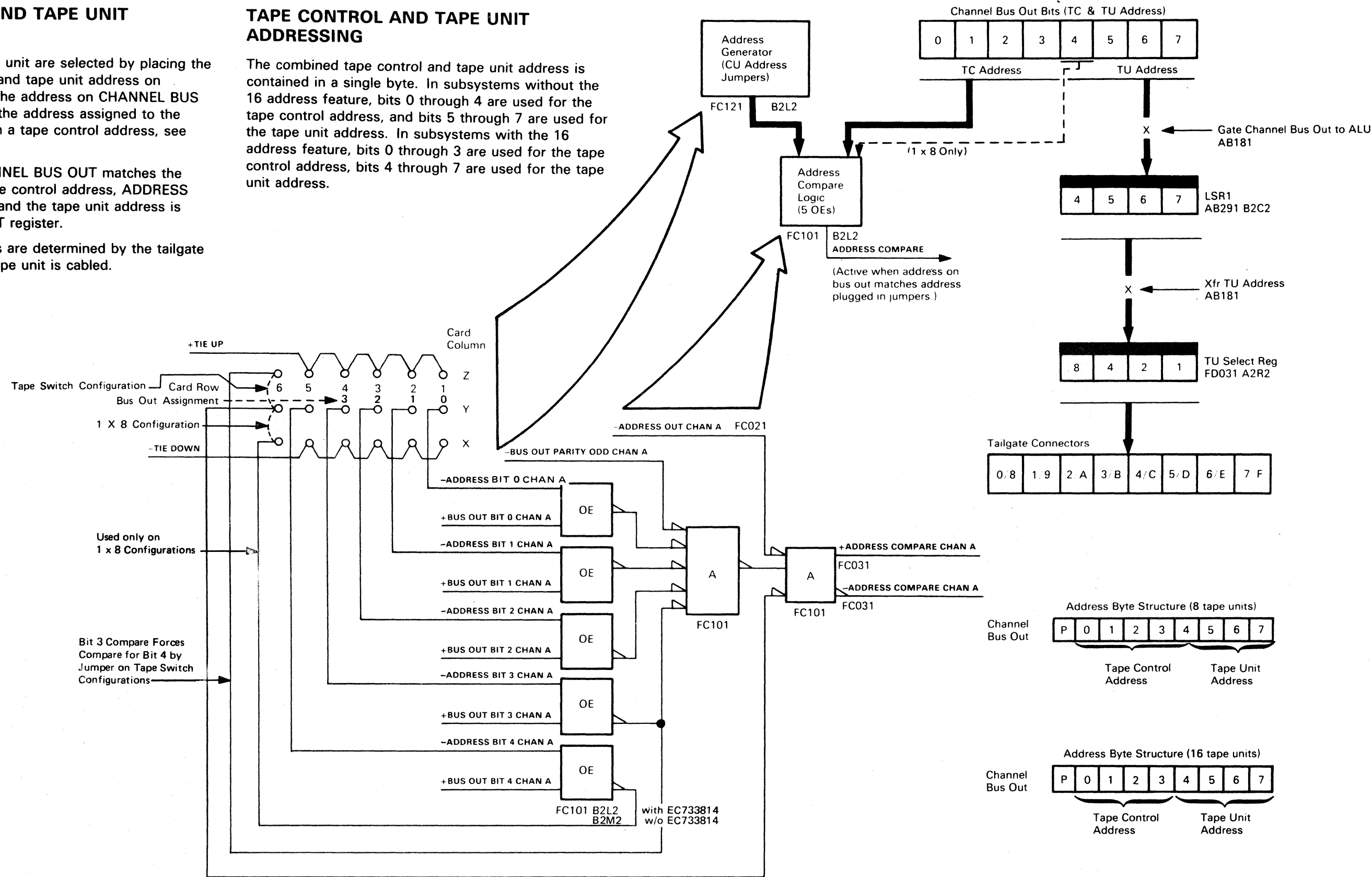
A tape control and tape unit are selected by placing the combined tape control and tape unit address on CHANNEL BUS OUT. The address on CHANNEL BUS OUT is compared with the address assigned to the tape control. (To assign a tape control address, see 90-110.)

If the address on CHANNEL BUS OUT matches the internally generated tape control address, ADDRESS COMPARE is activated and the tape unit address is gated to the TU SELECT register.

The tape unit addresses are determined by the tailgate position to which the tape unit is cabled.

TAPE CONTROL AND TAPE UNIT ADDRESSING

The combined tape control and tape unit address is contained in a single byte. In subsystems without the 16 address feature, bits 0 through 4 are used for the tape control address, and bits 5 through 7 are used for the tape unit address. In subsystems with the 16 address feature, bits 0 through 3 are used for the tape control address, bits 4 through 7 are used for the tape unit address.



TAPE UNIT SELECTION LOGIC

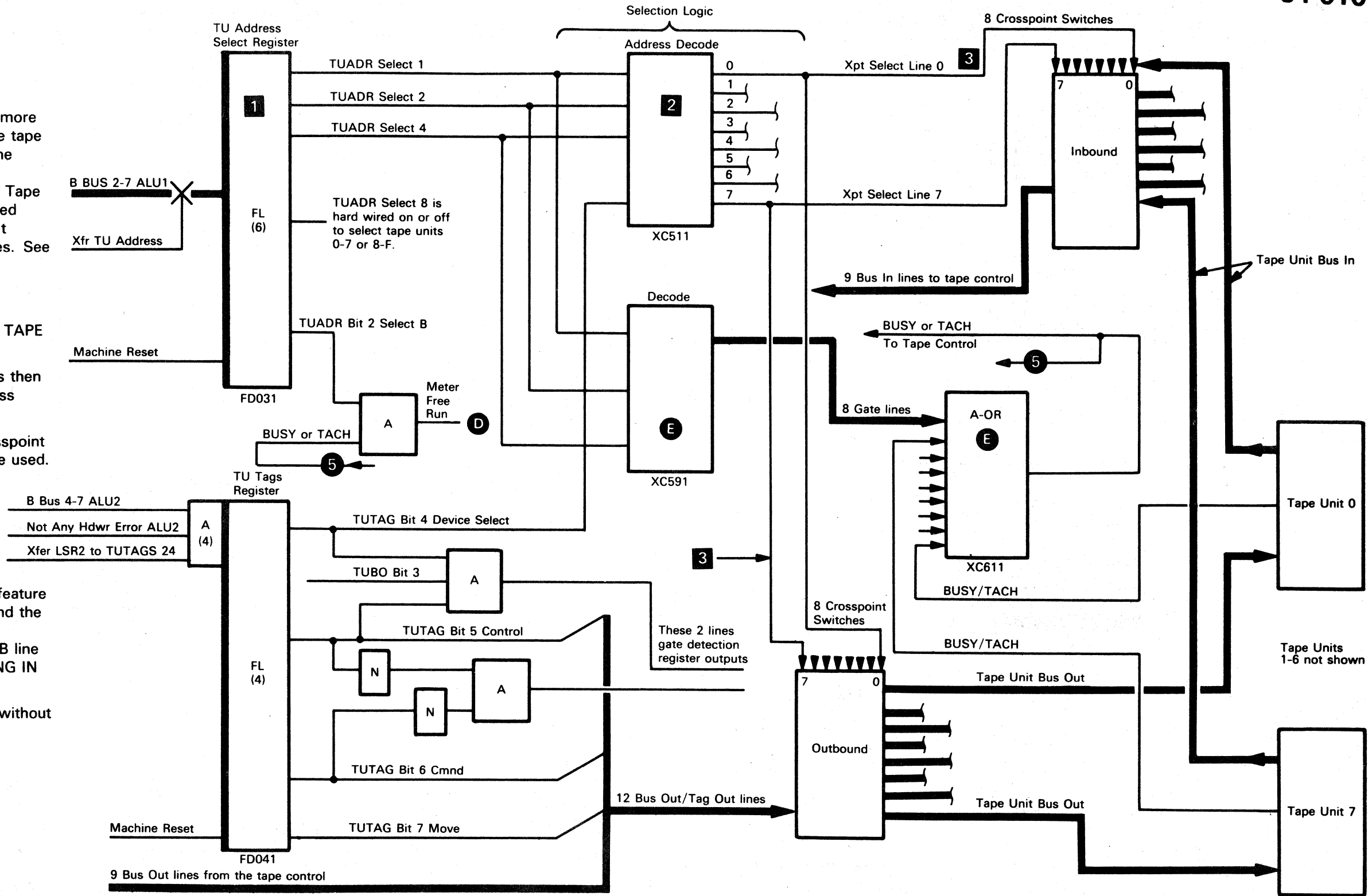
TAPE UNIT SELECTION PRIORITY

On subsystems with a Device Switching feature, more than one tape control may try to access the same tape unit at the same time. To handle this situation, the switching logic has card jumpers that establish priorities for each tape control in the subsystem. Tape controls with device switching features are shipped with device selection priorities already plugged. It should not be necessary to change these priorities. See Section 90.

Tape Unit Selection

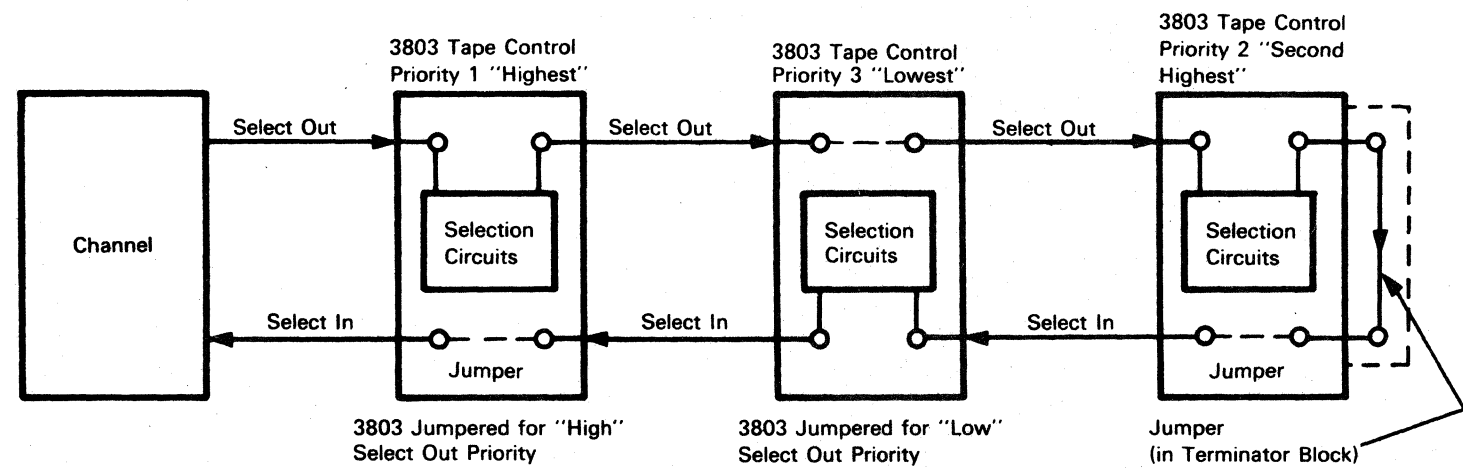
- 1 A four bit address on the B Bus is set in the TAPE UNIT ADDRESS SELECT register.
- 2 The inbound and outbound address decoders then decode ROS2's TUTAG BIT 4 and the Address Select lines.
- 3 One of eight select lines is active to the crosspoint switches to determine which tape unit will be used.

- D On machines with the Two-Channel Switch feature installed, the TUADR BIT 2 SELECT B line and the BUSY/TACH line generate METERING IN to channel B. The NOT TUADR BIT 2 SELECT B line and the BUSY/TACH line generate METERING IN to channel A.
- E This circuit interrogates a tape unit's status without selecting the tape unit.



CHANNEL PRIORITY CIRCUITS

- 'Select out' priority determines the order in which tape controls are selected if more than one tape control requires service at the same time.
  - A tape control's 'select out' priority is determined by jumpers in the tape control and by the tape control's location on the I/O interface.
  - The select signal leaves channel on the SELECT OUT line and returns to channel on the SELECT IN line if it is not 'trapped' by a tape control requiring service.
  - A tape control not requiring service propagates the select signal to the next lower priority tape control.
  - Jumpers in each tape control determine whether the tape control will respond to the SELECT OUT line ('select out priority high') or the SELECT IN line ('select out priority low').
- All units shipped from the factory are jumpered for high 'select out' priority. If it is necessary to change the priority, see 90-120.
  - Device Selection priority circuits are present in tape subsystems where a tape unit is accessed by more than one tape control. See 54-010. These circuits act as 'tie breakers' when two or more tape controls are trying to select a tape unit at the same time.
  - Additional jumpers in the switching logic of each 'host' tape control establish device selection priorities (1, 2, 3, or 4) for each tape control in a tape switching configuration.



NOTES:

54-021

3803-2/3420

XG3000	2736000	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

54-021



LOOP WRITE TO READ (LWR)

Loop write to read allows checking tape control and tape unit data and control paths without moving tape. The LWR (8B) command can be initiated from the processing unit or the CE panel. An LWR performed from the processing unit uses the same data path as a normal write operation. The following sense byte errors cannot be detected:

- Data Checks:
- Early Begin Read Back check

Early Ending Read Back check

Slow Begin Read Back check

Slow End Read Back check

Velocity During Write check
- Equipment Checks:
- No Block on Record Read Back check

No Block Detected on WTM

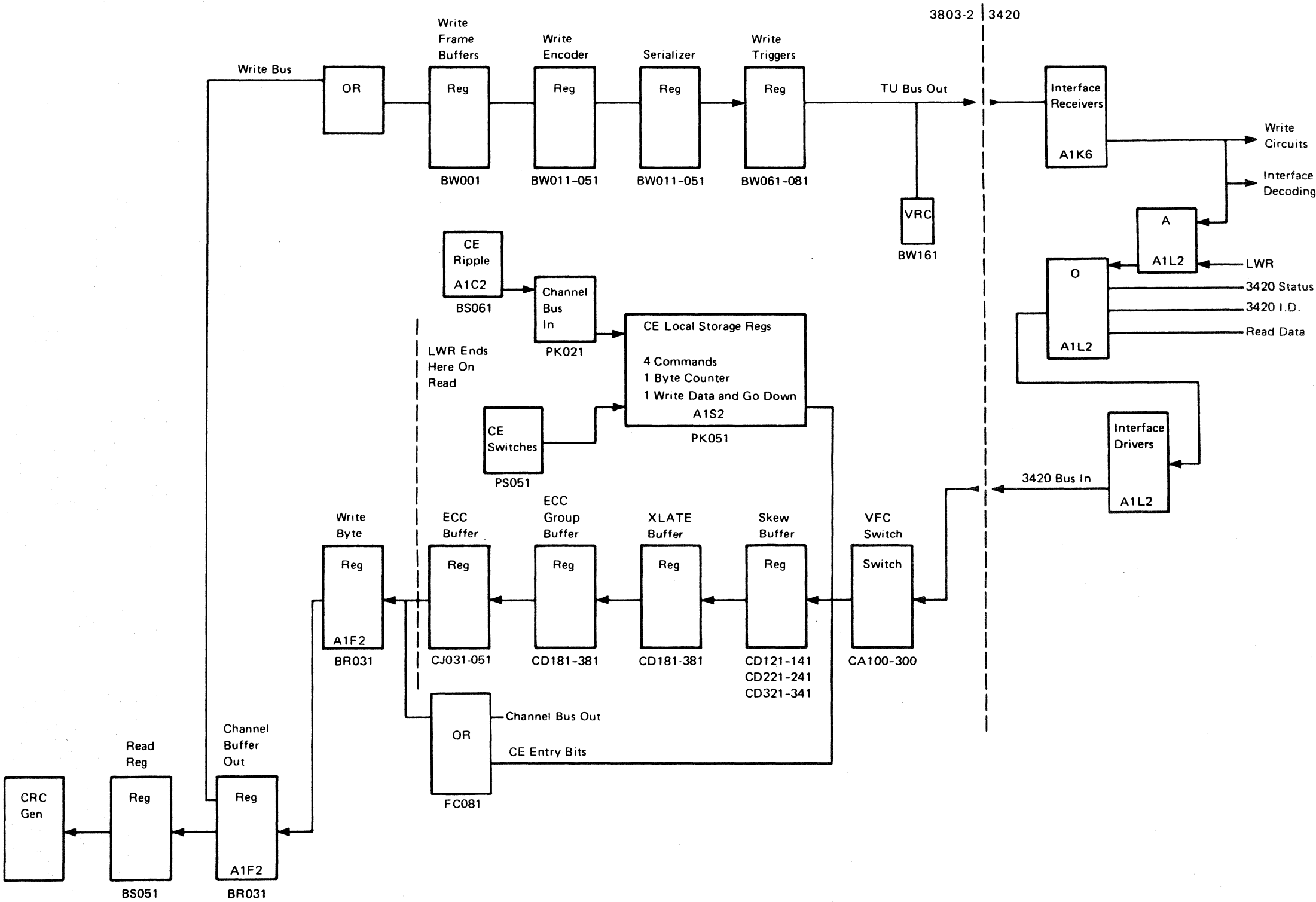
Velocity check

Tach Start failure

A loop write to read operation is initiated from the CE panel by entering the command code (8B), and it receives its data from one of two locations. A count of service responses generates a ripple pattern, which is selected by putting the Command Control switch at the Ripple position. The fixed data comes from the Write Data switches when the Command Control switch is in the Write Data position. A CE panel LWR writes continuously until it is stopped by operating the Reset switch, except when the LWR with gaps jumper is installed (A1S2G08 to ground).

LWR TAPE UNIT OPERATION

The tape control activates SET DIAGNOSTIC and the COMMAND tag. The DIAGNOSTIC MODE latch is set in the tape unit (FT104). READ/WRITE GATE (FT104) ANDs with DIAGNOSTIC MODE to activate LOOP SELECT (FT147). The tape control activates the MOVE tag and drops the COMMAND tag, then the diagnostic latch degrades Move command to prevent tape motion. LOOP SELECT active gates BUS OUT data back to tape control via the tape unit response lines.



NOTES:

55-006

3803-2/3420

XG3100	2736001	See EC	845958	847298				
Seq 2 of 2	Part Number	History	1 Sep 79	15 Aug 83				

© Copyright International Business Machines Corporation 1976, 1979, 1983

55-006

DESCRIPTION

Three types of recording techniques are used in the IBM 3803-2/3420.

- Phase encoded (PE)
- Non-return to zero IBM (NRZI)
- 6250 bpi group coded recording (GCR)

Data bytes contain a combination of one and zero bits to represent binary ones and zeros. The PE tape system uses a flux change from minus to plus to represent a one bit, and a flux change from plus to minus to represent a zero bit. (The NRZI system uses a flux change in either direction to represent a one bit and lack of a flux change to represent a zero bit.) Flux changes on tape are created by changing the direction of current through the write heads by the write triggers.

PHASE ENCODED (PE)

(See Figure 1)

- At write clock (WC) 15, flip all write triggers to write ones or zeros on tape.
- To write a PE one bit, the write register is reset. Set up write trigger by setting it at WC 7 if not already on from previous byte so that write trigger can be reset at WC 15 (complemented).
- To write a PE zero bit, reset the write trigger at WC 7 so that WC 15 turns it on.

NRZI

(See Figure 2)

Flip write trigger at WC 15 to write one bits only. Do not flip write trigger to indicate a zero bit.

6250 BPI

(See 55-008)

MODE SET 1(SEVEN-TRACK NRZI OPERATION)

Mode set 1 commands sent to seven-track tape controls establish tape unit operating mode for succeeding seven-track NRZI operation. Bits 0 and 1 control density (556/800 bpi); and bits 2, 3, and 4

control parity (odd or even), data converter (on or off) and translator (on or off) circuits in the 3803.

A mode set 1 command affects operation of all seven-track tape units attached to the 3803. Unless reset, the 3803 retains its mode setting until it receives another mode set 1 command.

Mode set 1 commands sent to a 3803 without the seven-track features are treated as no-op commands, except that sense data bytes are reset (no-op reset sense). Channel end and device end are set during initial selection. 200 bpi mode set 1 commands (hex codes 13, 23, 2B, and 33) default to 555 bpi.

MODE SET 2 (NINE-TRACK PE/NRZI OPERATION)

Mode set 2 commands sent to PE/NRZI dual density tape controls set operating mode (1600 bpi PE or 800 bpi NRZI) for succeeding write or write tape mark (WTM) operations. Mode set 2 commands sent to a 3803 without the dual density feature are treated as no-op commands, except that sense data bytes are reset (no-op reset sense). Channel end and device end are set during initial selection.

DIAGNOSTIC MODE SET

A diagnostic mode set command causes an artificial signal loss condition that checks read and write error detection circuits.

- In PE mode, whenever write data contains successive one bits in any track, writing in that track is inhibited until the last one-bit is reached.
- In nine-track NRZI mode, no bits are written in track P.
- In seven-track NRZI mode, no bits are written in track C.

A diagnostic mode set command affects only write operations for the command in which it is issued. Channel end and device end are set during initial selection.

**Note:** For additional information, see 53-070.

Figure 1. Bit Cell and PE Write Waveform

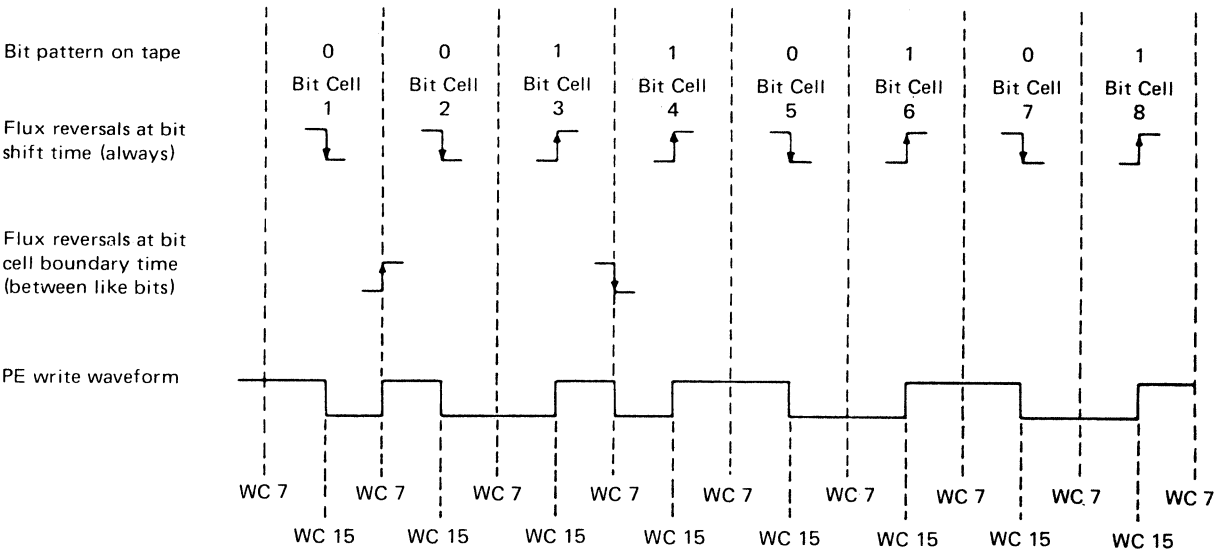
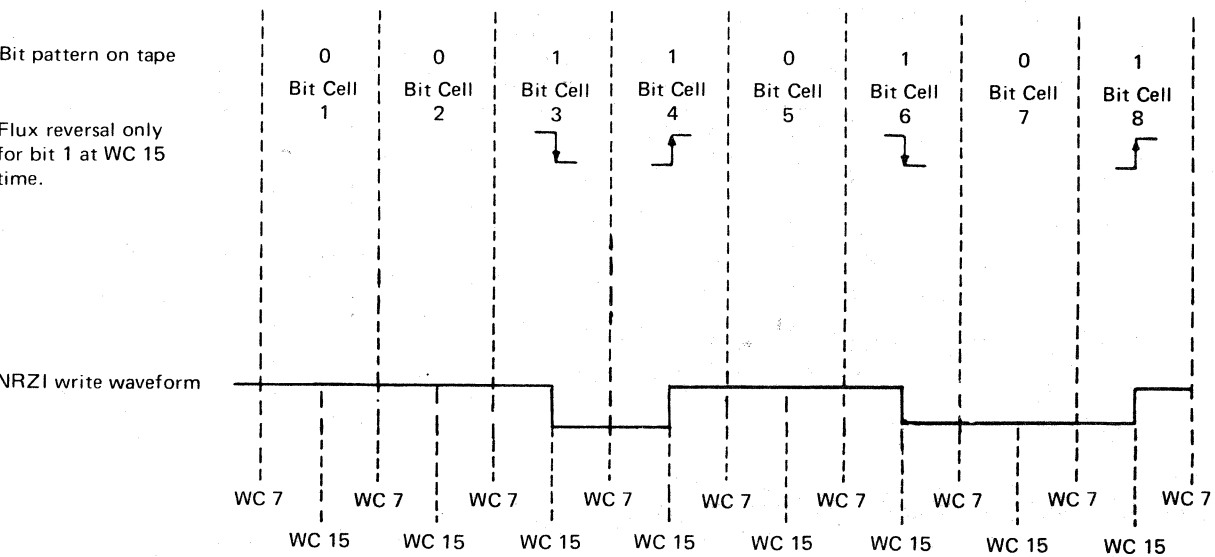


Figure 2. Bit Cell and NRZI Write Waveform



GROUP CODED RECORDING (6250 BPI)

Group coded recording (GCR) offers many advantages over previously used recording methods. This recording offers higher reliability even with existing tape libraries. Greatly expanded error correction capability has been engineered into GCR. Higher data rates and lower access times give higher throughput, reduced channel time, resulting in higher system performance. Data is compacted on tape, reducing rewind times, shortening the length of tape required for a data set, reducing the number of reels, reducing mounts and dismounts, and improving overall tape handling.

The data is recorded in blocks, or groups of characters. A block of data may be a single character or byte, or a number of bytes as determined by the programming system used. The significant improvements in the GCR mode are:

- 1. The information data is recorded at an effective density of 6250 bytes per inch (bpi) of tape.
- 2. The separation between blocks (IBG) is 0.3 inches (7,6 mm).
- 3. Simultaneous errors in any two of the nine tracks are corrected automatically.

GCR BLOCK

A GCR block consists of a preamble, data, and a postamble (see 55-009). The preamble and postamble are each 80 bytes long and serve to synchronize the read detection circuits in a manner similar to previous 1600 bpi subsystems. The data portion of the block consists of the following:

- 1. Data to be written by the 6250 bpi feature is continuously collected in seven character groups (9 bits in each character) and is held in the control unit 6250 bpi feature circuitry. (see 50-000 through 50-002 for second level logic details.) An error correction character is generated and then added to the seven characters to make an eight character data group. This data group is then divided into two subgroups of four characters each. The four bits in each of the 9 tracks are encoded into five bits. (see Figure 1a through 1e.) This matrix of bits, 9x10, is recorded on the tape (see Figure 3a on 55-010).

Reading of the tape reverses the process, with error correction occurring where needed. There are as many of these 10 bit storage groups as there are multiples of seven channel data bytes in the record block.

- 2. The remainder, or last group of the channel data bytes (zero to six bytes) is encoded with whatever pad bytes are necessary, an auxilliary check character, and the error correction code (ECC) generated from these into a 10-byte residual group. This residual data group is created for every block recorded even though no residual bytes are found in the record. The auxiliary check character verifies read and write operations.
- 3. End of data (EOD) is signaled by a unique subgroup of five bytes immediately preceding the residual group.
- 4. Following the residual group, a 8-byte cyclic redundancy check (CRC) is encoded into a ten bit group. This group, with the auxiliary check character, ensures the integrity of the read and write operation, including verifying any error corrections that may have taken place.
- 5. Interleaved into the recorded block, every 158 storage groups, is a resync burst. This burst allows the tape control to put into full operation any track(s) that have lost synchronization or were dead tracked due to tape defects. The action limits dead tracking for greater throughput.

Figure 1a.

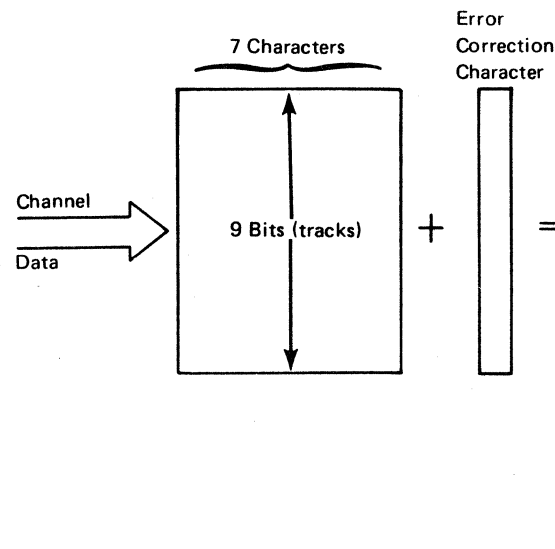


Figure 1b.

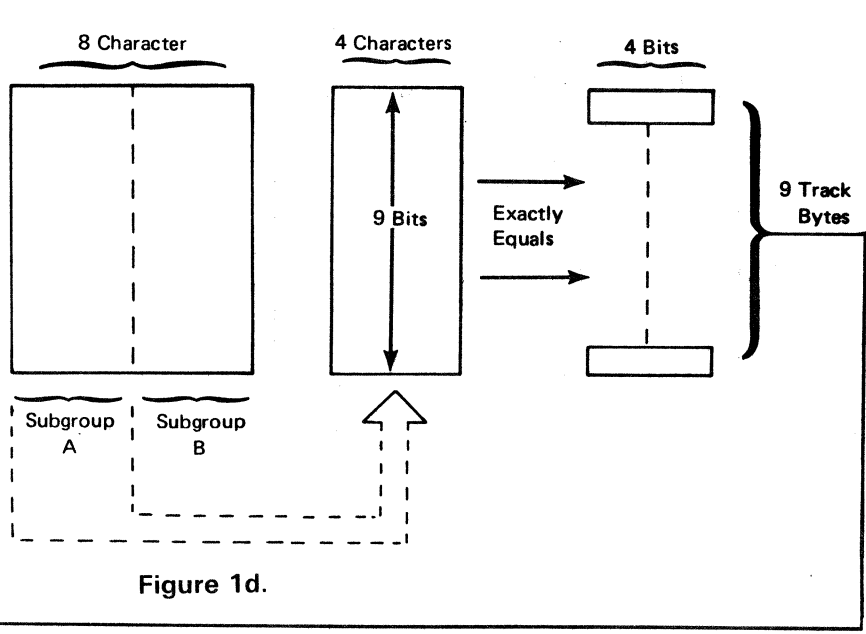


Figure 1c.

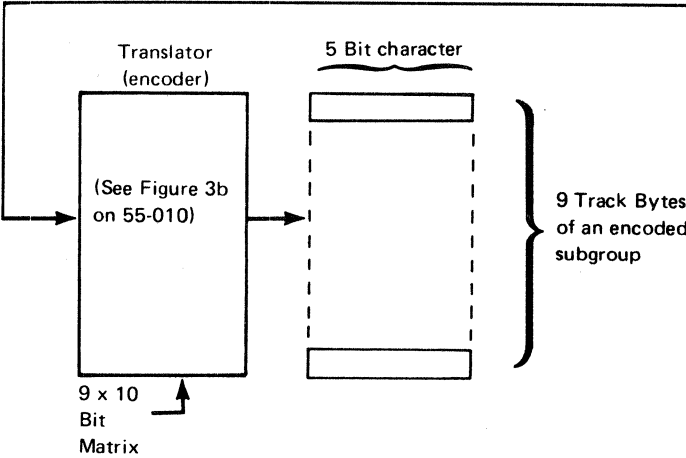


Figure 1d.

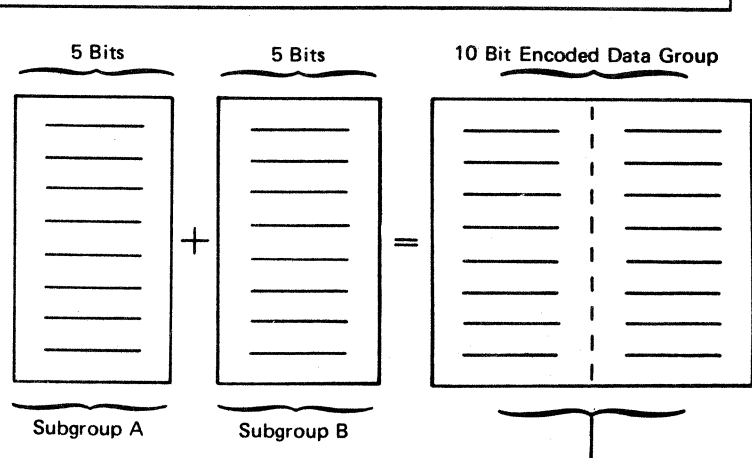
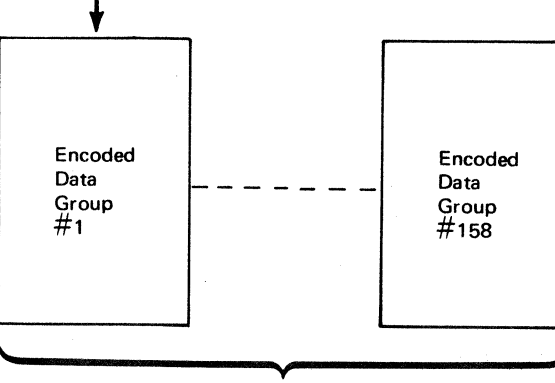


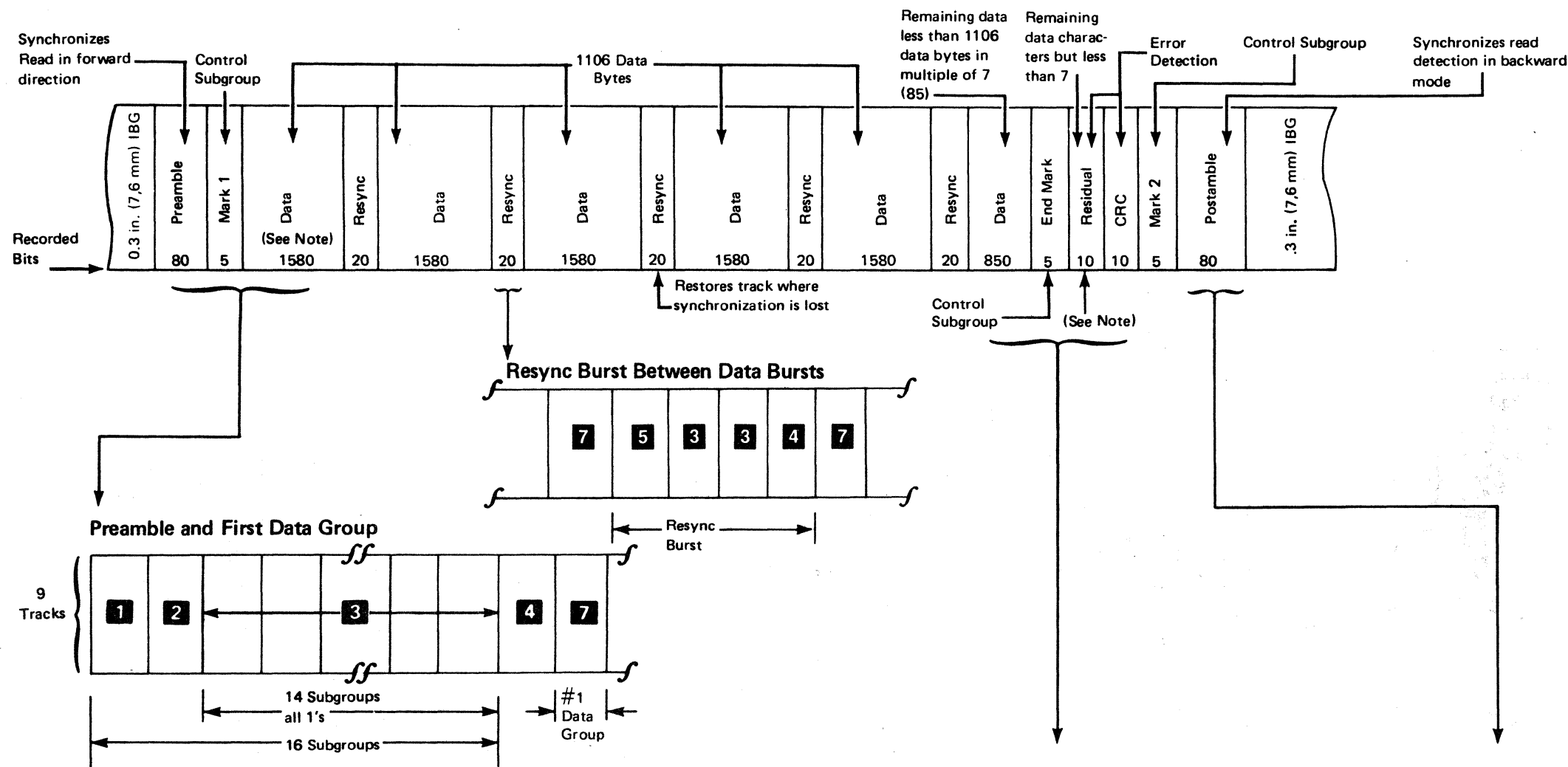
Figure 1e.



**Note:** There are 1106 bytes of channel input data in each 1580 (6250 bpi) group recorded data block written on tape.

1580 Encoded Group Recorded Data Block Written on Tape

GROUP CODED RECORDING 6250 BPI



**Note:** From first data bytes through residual bytes (9042 fci) equals 6250 bpi of customer data.

**Legend**

For all bits (tracks 1 through 9)

Key	Name	Pattern	Comments
1	Term	1 0 1 0 1	
2	Second 1	0 1 1 1 1	
3	Sync	1 1 1 1 1	
4	Mark 1	0 0 1 1 1	
5	Mark 2	1 1 1 0 0	
6	Second 2	1 1 1 1 0	
7	Data	DDDD DDDE or GGGG GGGG	
8	Residual	XXXX XXxE or HHHH HHNE	
9	CRC	BCCC CCxE	

(See 55-010 Legend 2 for data symbols.)

GROUP CODED RECORDING 6250 BPI  
(Cont'd)

6250 bpi does not relate to actual writing density on tape, but to effective data density. Actual density (9042 bpi) is greater due to the formatting and encoding. This formatting and encoding is transparent to the user. The formatting and encoding method allows reliable error correction for any two tracks simultaneously in error. Also, tracks are not immediately dequeued or dead tracks assigned when an error occurs as they were in the past. It is conceivable that a block could have errors in all nine tracks and appear to the user to be read error free as long as only two tracks have errors at any given instant.

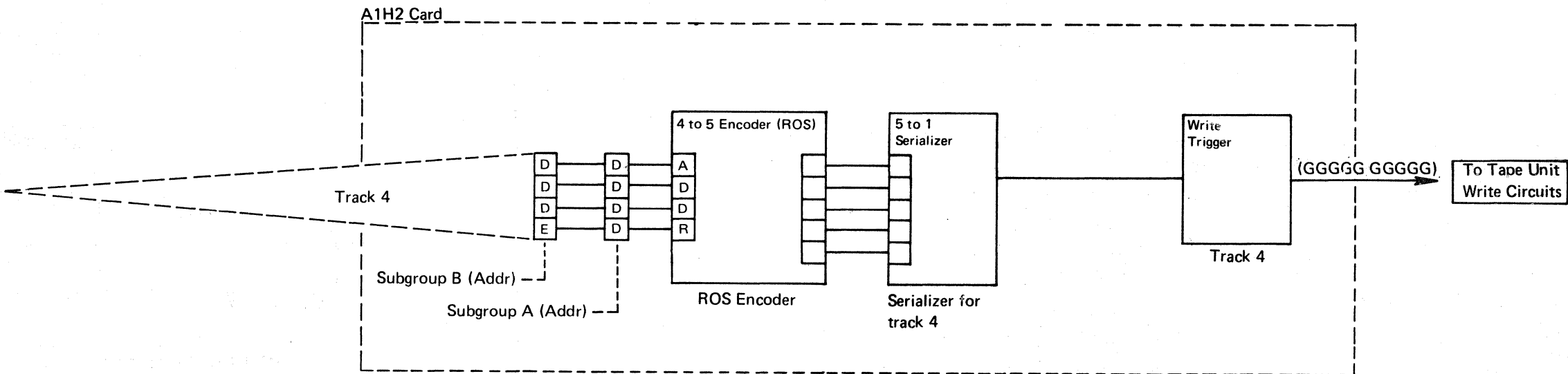
Figure 3a. Encoded Data Group

Physical Tracks	DATA GROUP		STORAGE GROUP	
	Subgroup		Subgroup	
	A	B	A	B
	DDDD	DDDD	GGGGG	GGGGG
2	DDDD	DDDD	GGGGG	GGGGG
3	DDDD	DDDD	GGGGG	GGGGG
4	DDDD	DDDD	GGGGG	GGGGG
5	DDDD	DDDD	GGGGG	GGGGG
6	DDDD	DDDD	GGGGG	GGGGG
7	DDDD	DDDD	GGGGG	GGGGG
8	DDDD	DDDD	GGGGG	GGGGG
9	DDDD	DDDD	GGGGG	GGGGG
	1234	5678	12345	678910
Group Positions				

Legend 2. Data Symbols

Symbol	Data Represented
B	CRC or Pad Characters
C	Cyclic Redundancy Check Characters
D	Channel Data Characters
E	ECC Characters
G	Encoded Group Recorded Bits
L	Last Character
N	Auxiliary CRC
X	Residual Character

Figure 3b. How 4 Bit (Address) Becomes 5 Data Bits



Note: This illustration is only one of nine such circuits.  
(See 50-001 for further details.)

COMMON START I/O (SIO) ROUTINE

55-020

This section introduces the microprogram controls used to read and write a record from load point. Addresses noted within the charts are key checkpoint addresses which perform a major function.

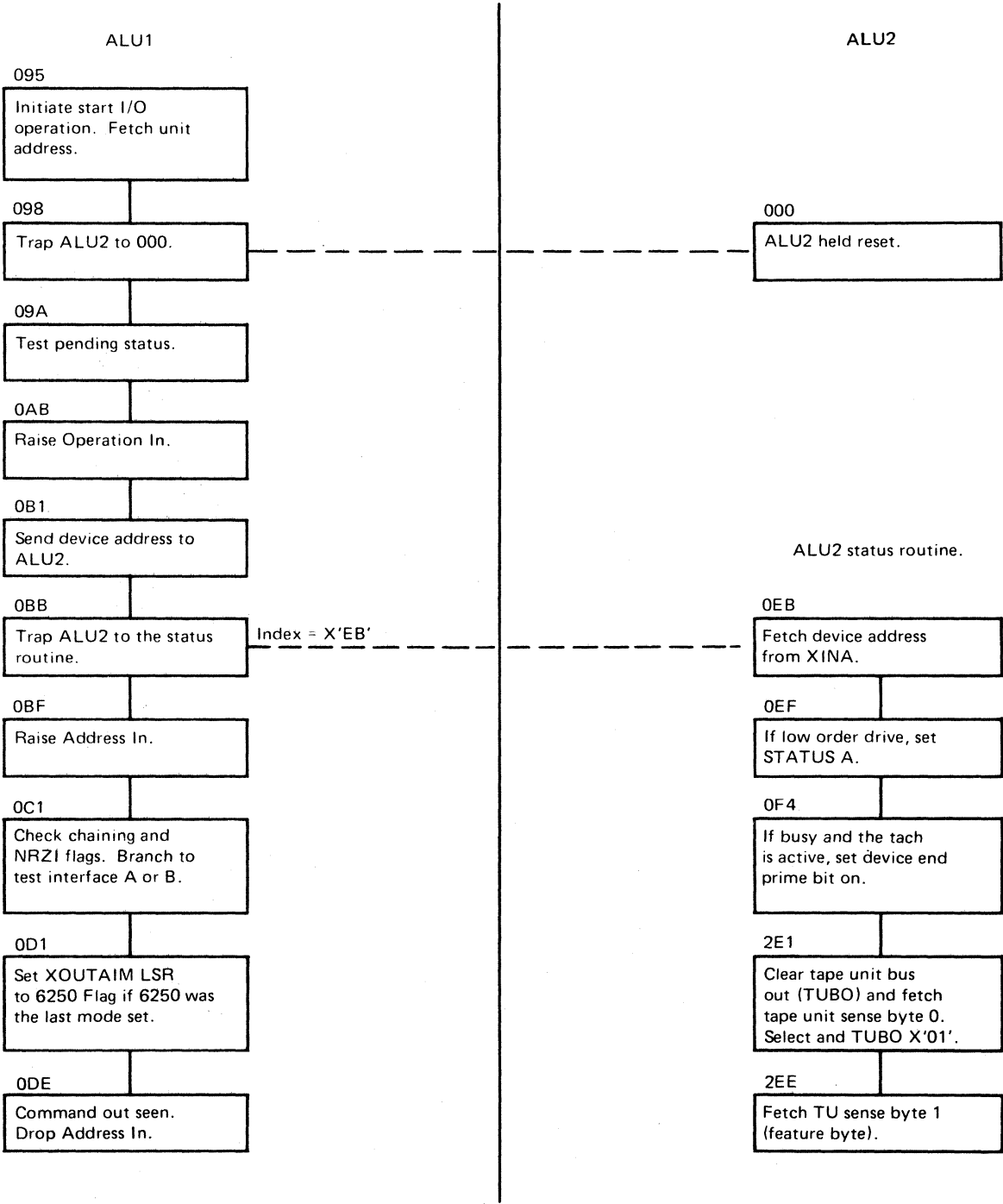
These charts provide major synchronization points within a routine, and lay out a path to check the path through the microcode. The common Start I/O routine is followed by the write operation, then the read operation from load point. The paths shown are for single, unchained operations with no exceptional conditions.

Using the compare ROS stop sync on ROS address of the CE panel (see sequence 10 on page 12-011), synchronization can be developed at various points within the operation being performed.

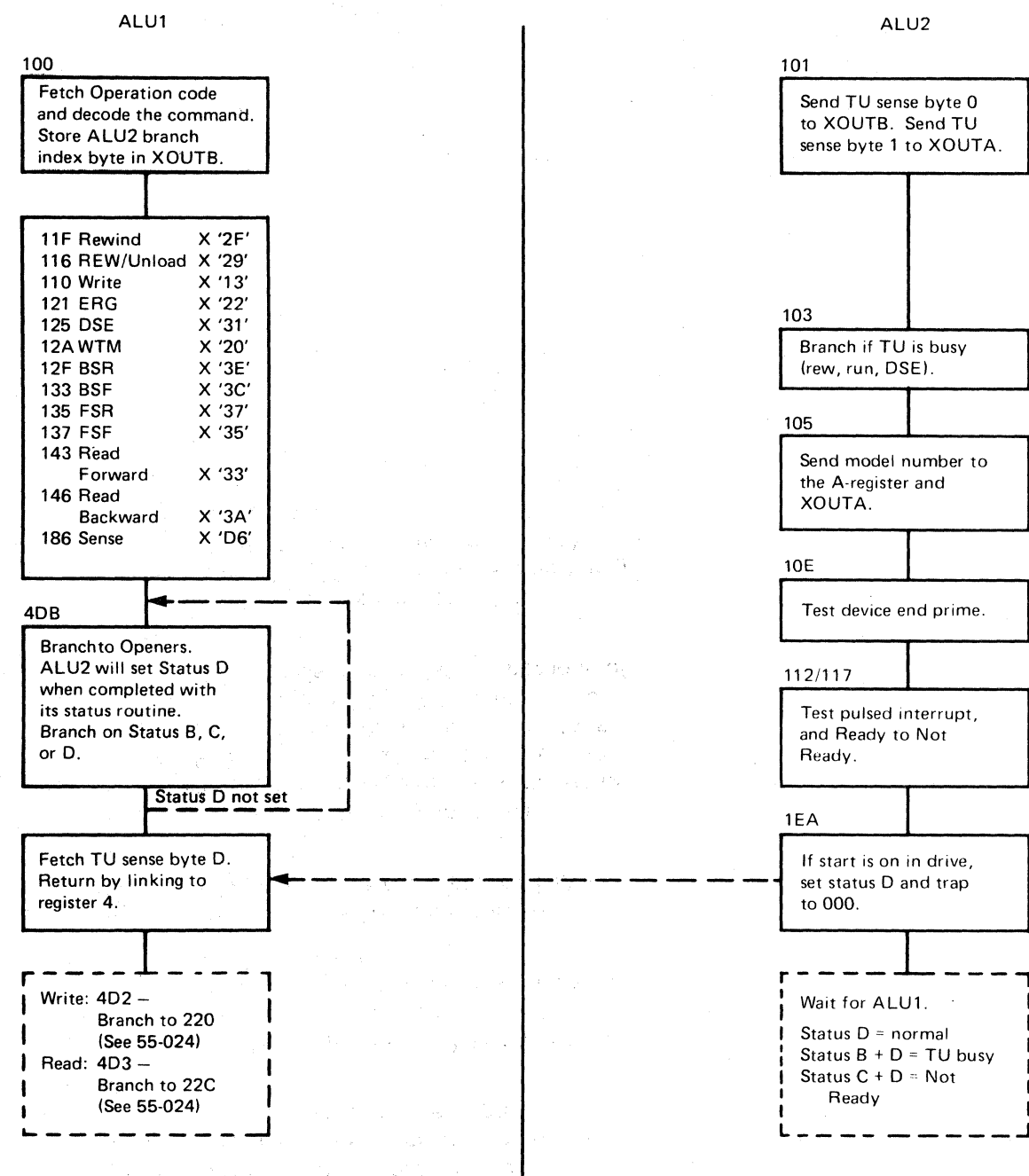
Remember that many routines are commonly used many times and will provide unstable synchronization points.

Some knowledge of basic microprogram concepts is assumed. XOUTA and XOUTB registers as well as the status registers A, B, C, and D provide response back and forth between the ALUs. ALU1 basically controls the processing unit channel, while ALU2 controls the device interface. Both ALUs control various portions of the data flow.

ALU2 is a slave to ALU1, and is controlled by a transfer command and XOUTB branch index byte being passed from ALU1 to ALU2. Response from ALU2 is by way of ALU2 status registers.



55-020





Write from load point is performed by controlling drive motion and controls with ALU2. ALU2 also sets the data flow control to write the single 1 or P track identification (ID) at load point.

ALU1 initiates the first data Service-In cycle, then relinquishes data transfer to the hardware. ALU1 also controls the write triggers for all control characters within the preamble, postamble, and resync burst.

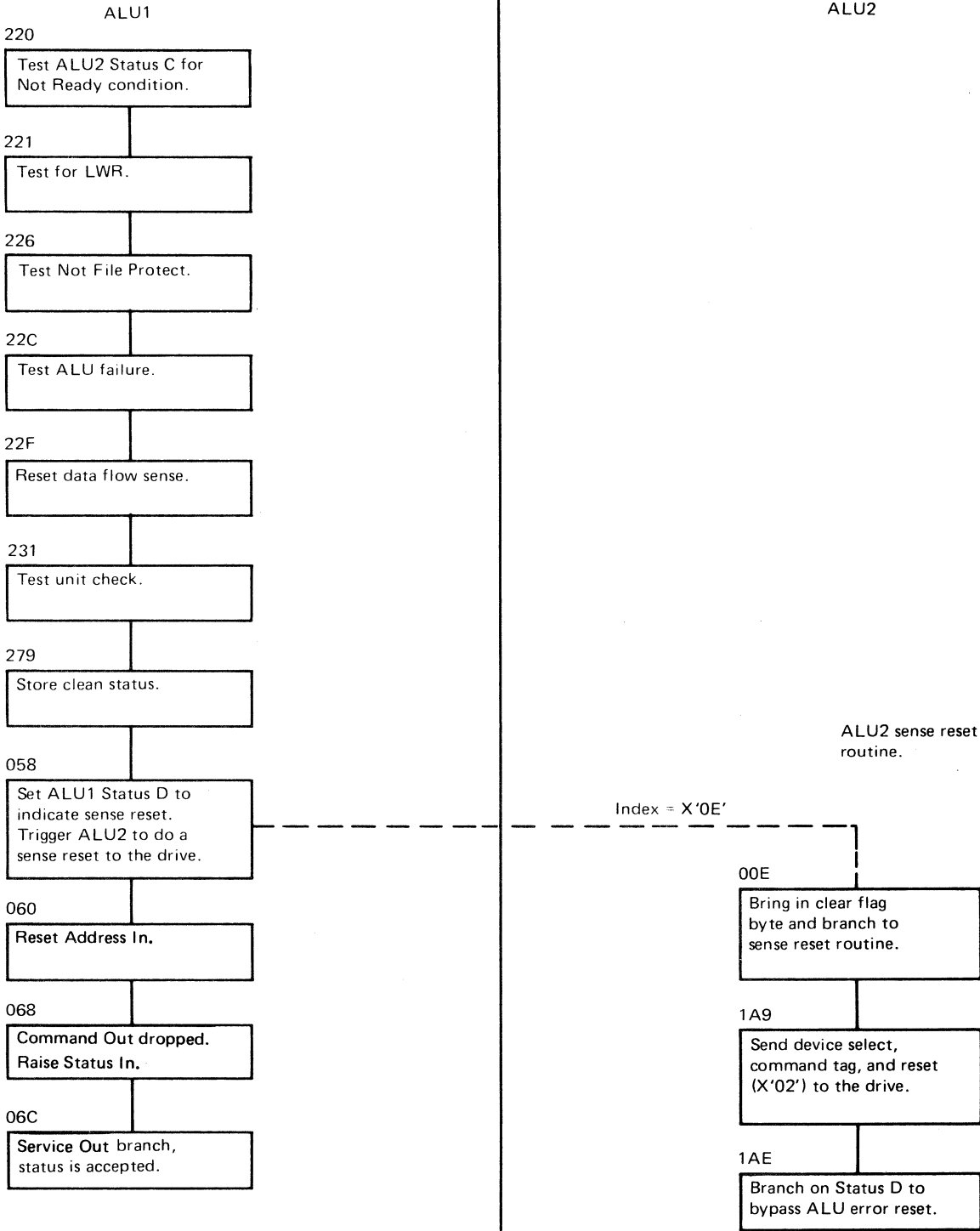
Once the data portion of the write command is entered, ALU2 monitors velocity during the tach period transitions to test for velocity change during write.

The write operation is divided into the following steps:

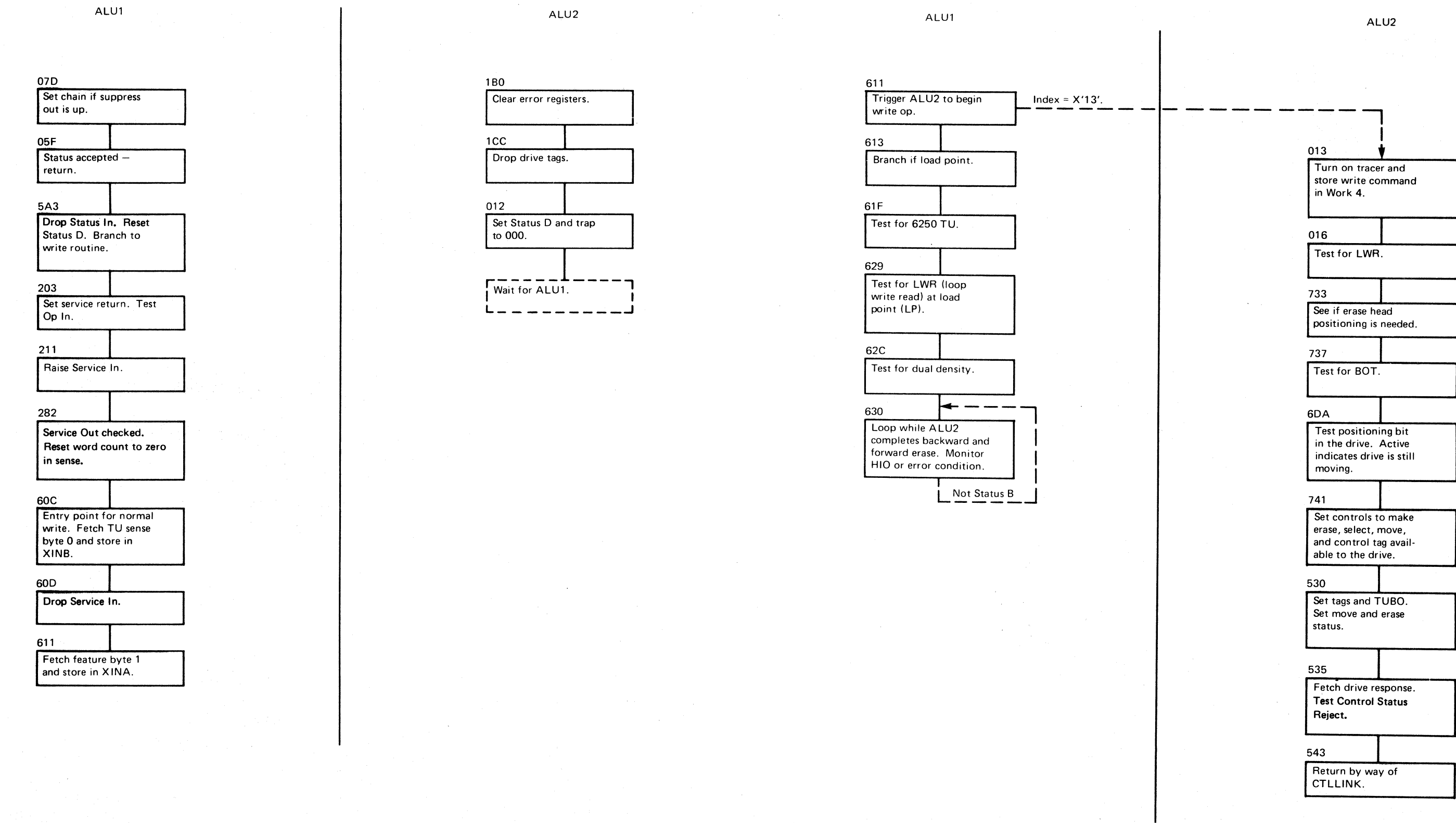
1. Trigger ALU2 to issue a sense reset to the drive. ALU1 will monitor ALU2 Status D, which indicates that ALU2 is finished with sense reset.
2. Fetch TU sense bytes 0 and 1 and test for drive status.
3. Raise Service In for one byte of data before turning control of the channel over to the data flow section.
4. ALU1 again allows ALU2 to perform the write operation.
5. Set Erase in the drive (not Write Status yet) and erase backward, then forward. (Backward 150 tachs, forward 140 tachs.)
6. Test for Tach Start fail or Velocity Error, then write 1-track ID burst.
7. Write self-adjusting gain control (SAGC) burst with the inverse Tape Mark (no zone 1) attached to the end.
8. Set SAGC circuits in the drive to perform read back check.
9. Write record preamble consisting of the following characters: 10101, 01111, seventy 1s, 00111.
10. The hardware data flow section now takes over the writing of data while ALU2 monitors the capstan tach velocity in the drive.
11. Every 1106 channel bytes (158 storage groups on tape), ALU1 intersperses a resync burst consisting of: 00111, 11111, 11111, 11100.
12. When data is complete, the hardware writes an all ones character.

13. ALU1 checks for an all ones character indicating the end of data. This allows for writing of the residual and CRC frames.
14. ALU1 then writes the postamble consisting of the following characters: 11100, seventy 1s, 11110, 10101.
15. ALU2 waits for IBG, then tests for errors. ALU2 finishes by setting Status D and trapping to 000.

WRITE FROM LOAD POINT



WRITE FROM LOAD POINT

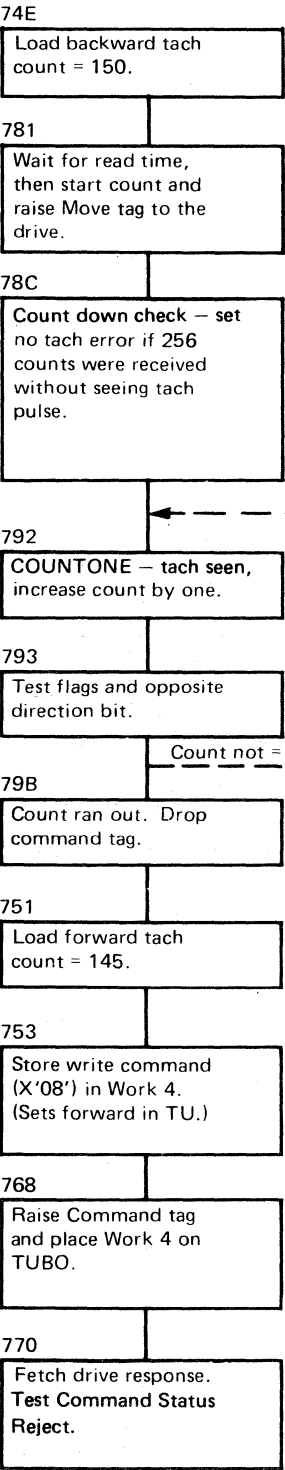


WRITE FROM LOAD POINT

ALU1

ALU1 still looping  
until ALU2 sets  
Status B.

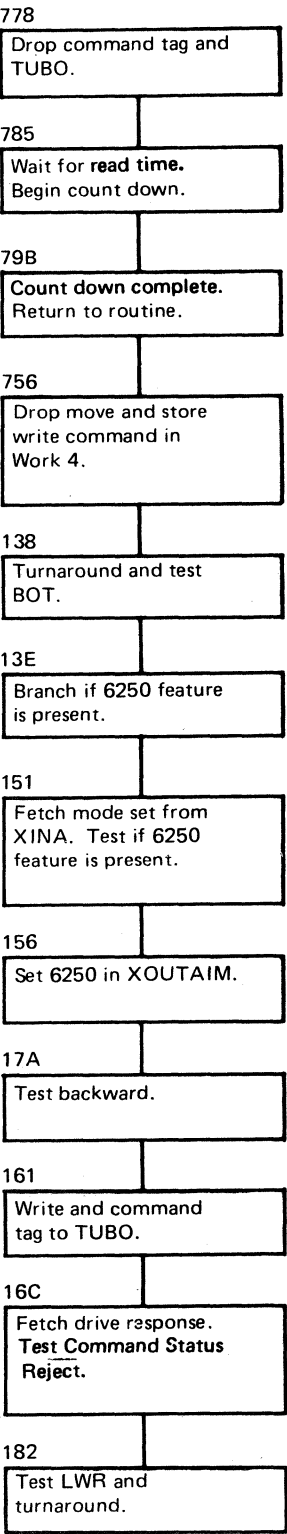
ALU2



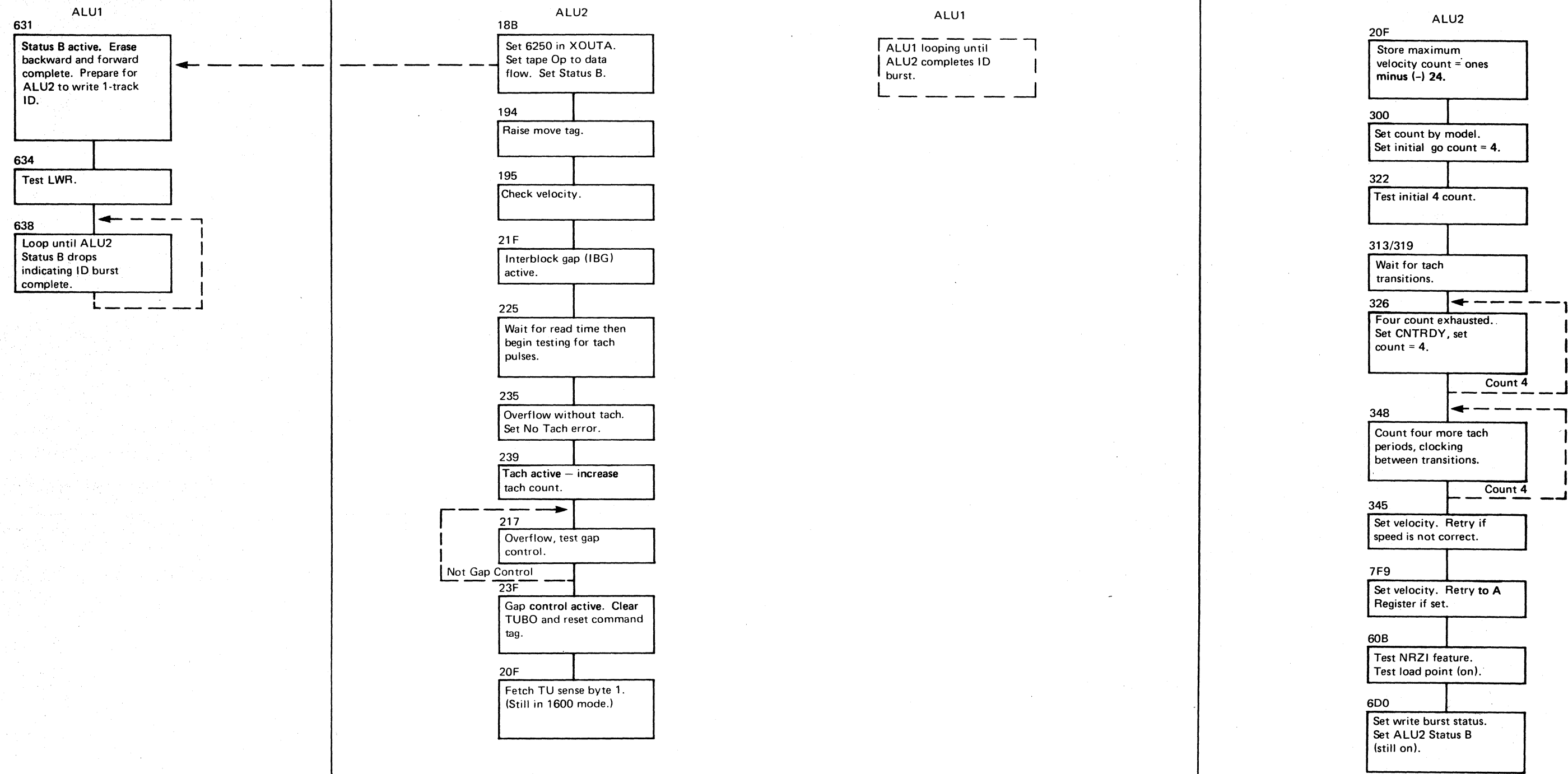
ALU1

ALU1 still looping  
until ALU2 sets  
Status B.

ALU2

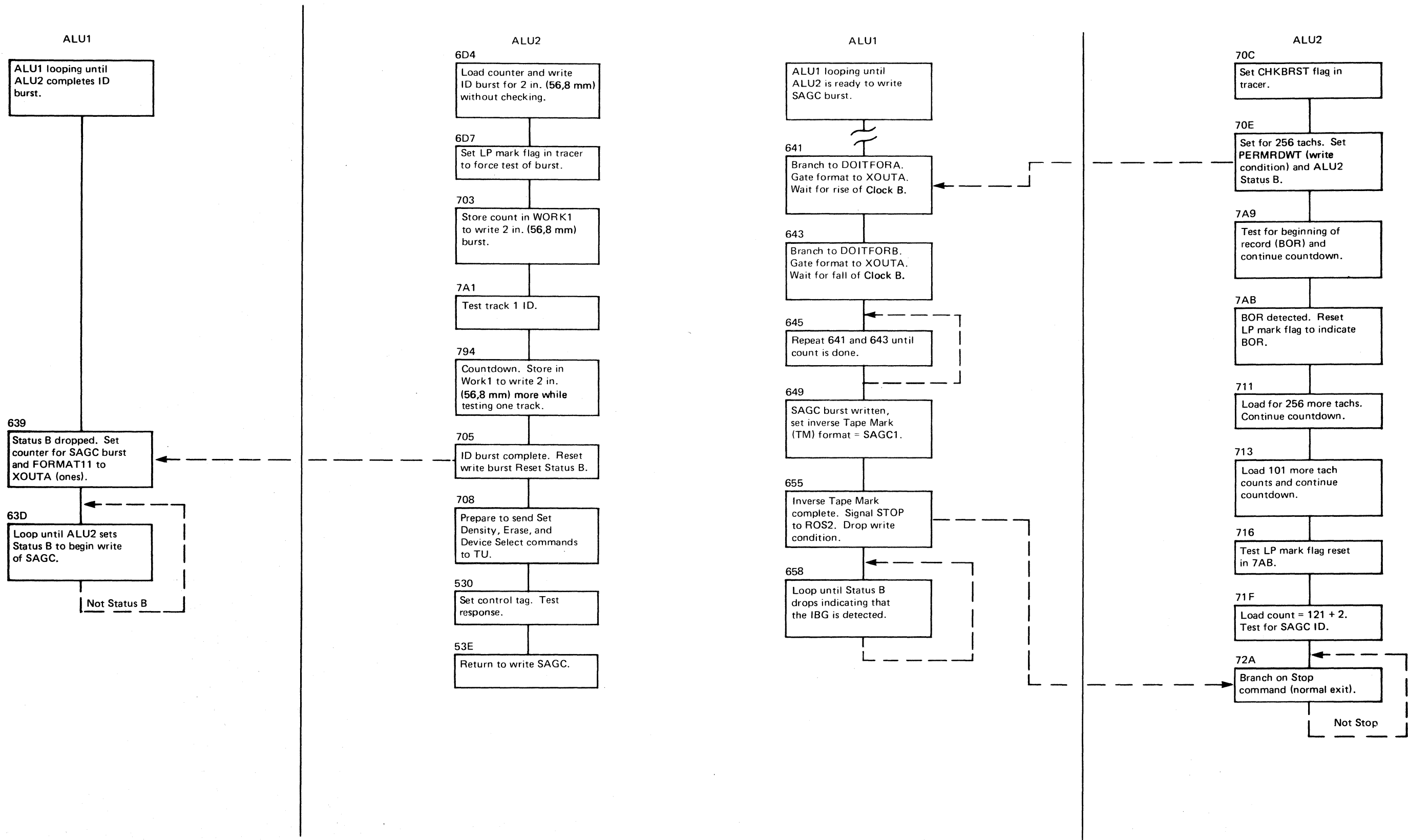


WRITE FROM LOAD POINT

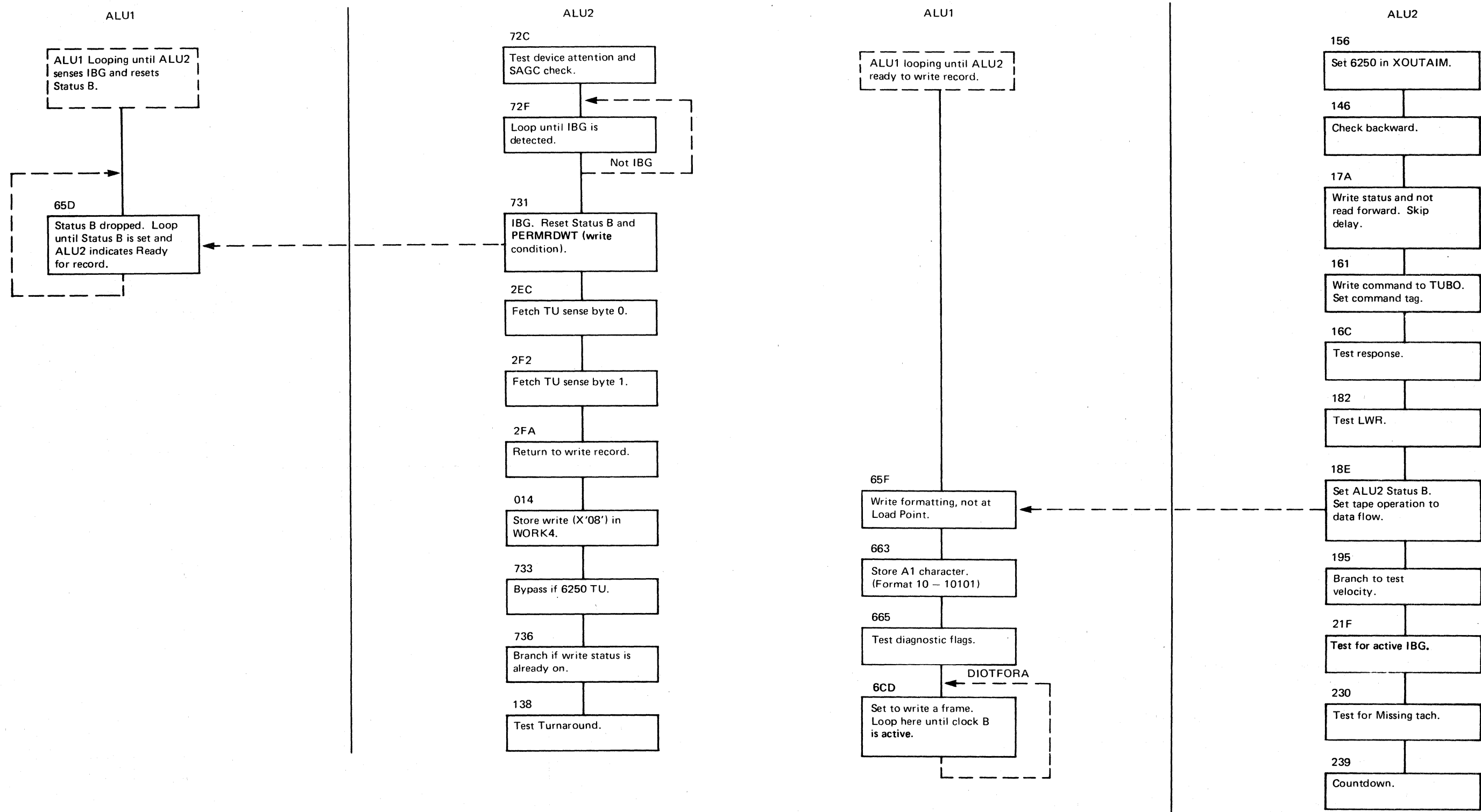


3803-2/3420							
XG3128	4169681	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

WRITE FROM LOAD POINT



WRITE FROM LOAD POINT



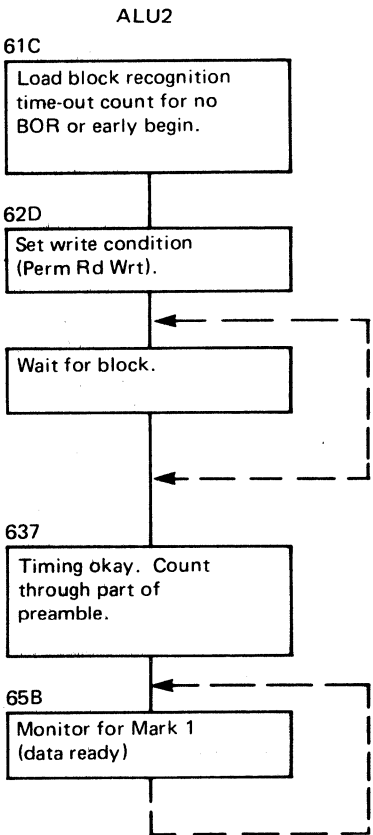
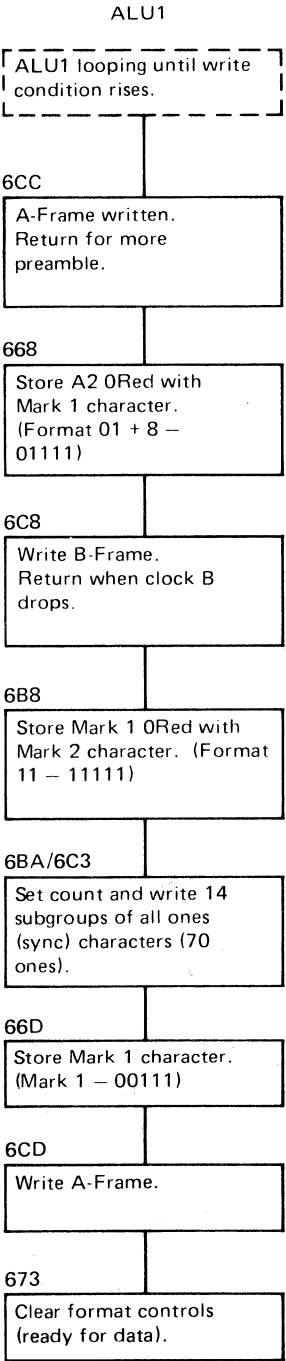
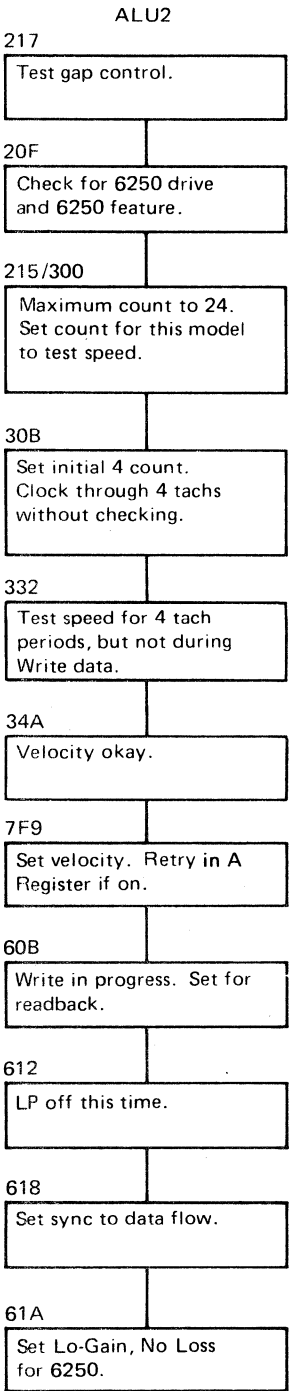
3803-2/3420

XG3132	4169682	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

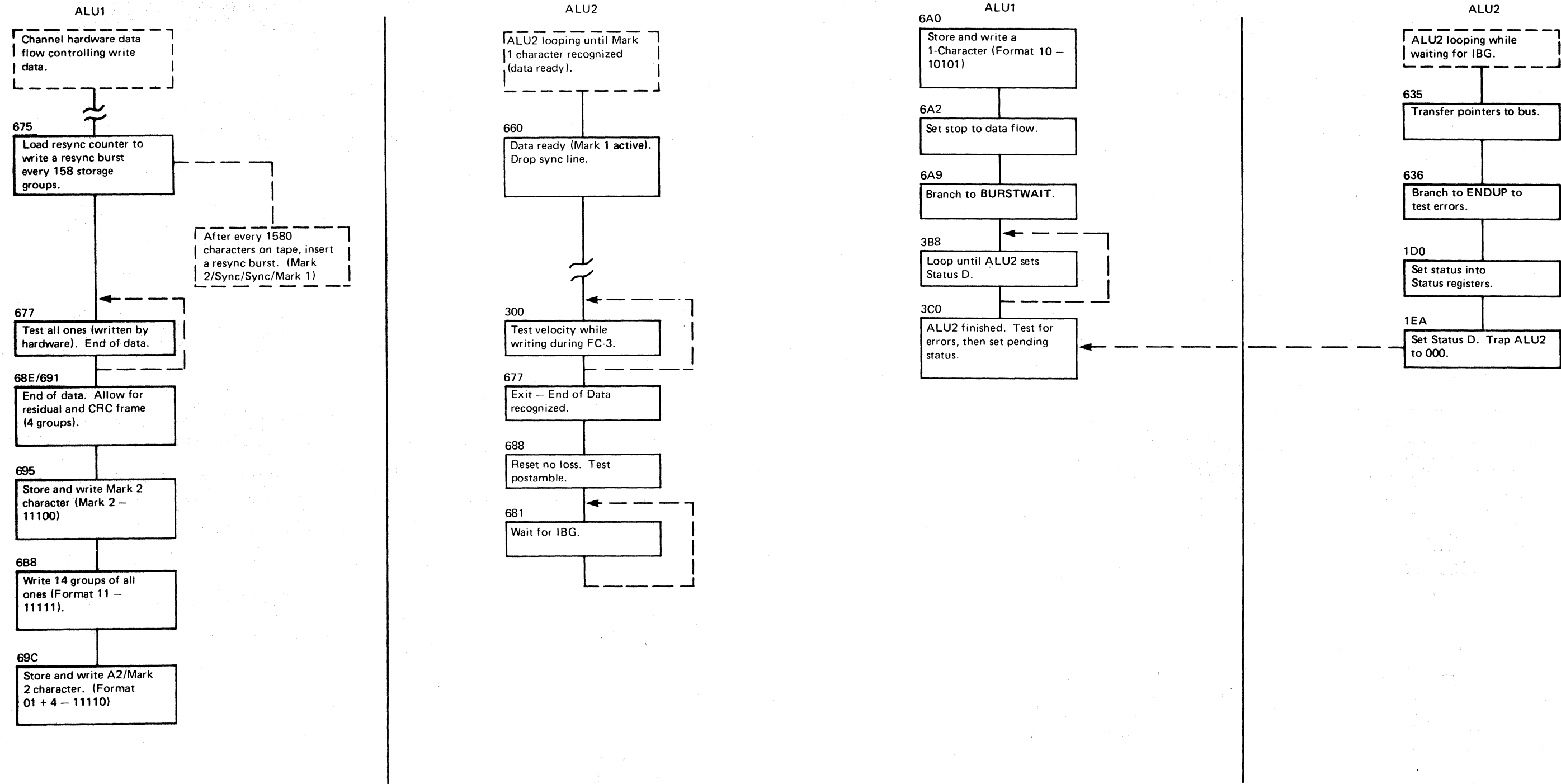
© Copyright International Business Machines Corporation 1976, 1979

WRITE FROM LOAD POINT

ALU1  
ALU1 looping until write condition rises.



WRITE FROM LOAD POINT





BRANCH TO READ FROM LOAD POINT

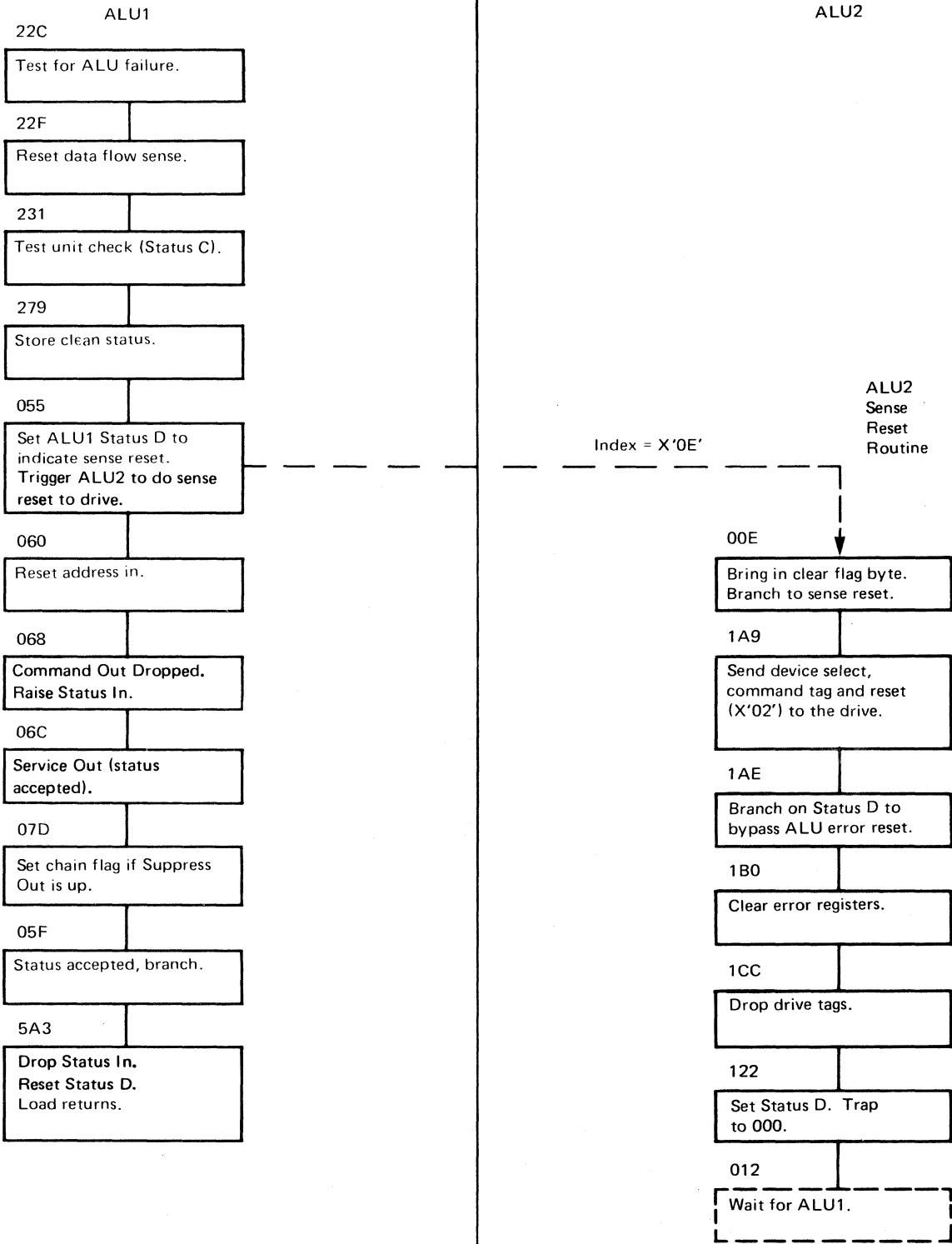
Read from load point is basically performed by ALU2 and the hardware data flow controls.

Once ALU1 has triggered ALU2 to perform sense reset to the drive, and again to initiate the read from load point, ALU1 is basically finished. ALU1 tests to be sure that the first service cycle takes place, then goes into a loop until ALU2 finishes and sets Status D.

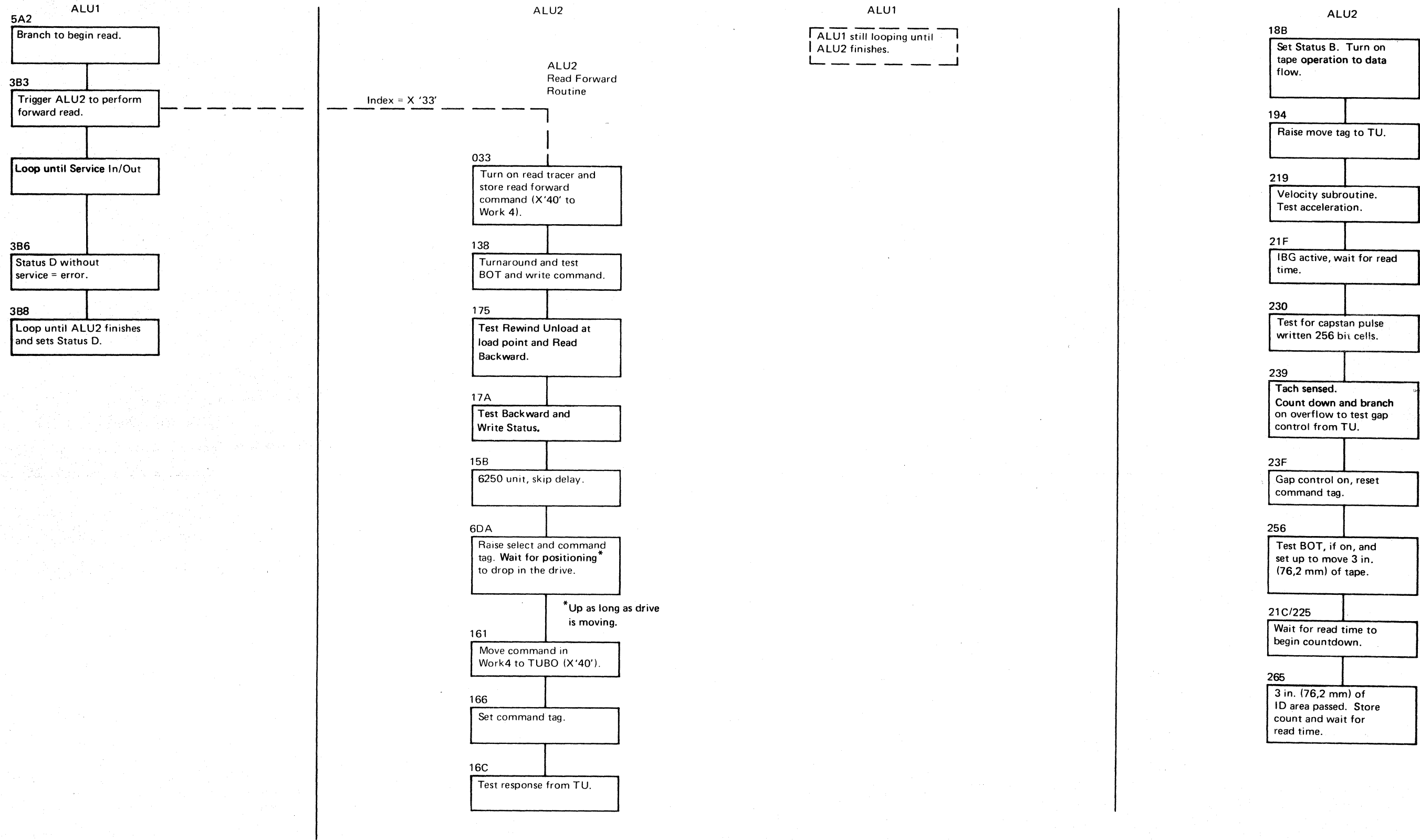
The read forward operation from load point steps follow:

- 1. ALU1 triggers ALU2 to issue a sense reset to the drive.
- 2. ALU1 triggers ALU2 to begin the read operation. If Status D from ALU2 is sensed before the first service cycle, an error is signalled.
- 3. ALU2 tests the status of the drive and checks for correct velocity.
- 4. Move 3 in. (76,2mm) of tape, then test for a 1-track envelope indicating a 6250 bpi tape.
- 5. Count through part of SAGC, then initiate read SAGC circuits in the drive.
- 6. Clock through 550 tachs, then check the Inverse Tape Mark.
- 7. When IBG is reached, fetch two bytes of drive sense and test status to this point.
- 8. Set read condition after gap control comes up again, and wait for the Mark 1 character preceding the data.
- 9. The hardware data flow now takes over until the end of data is sensed.
- 10. Test for errors. ALU2 sets Status D when finished, altering ALU1.
- 11. ALU1 compares the modulo count then branches to the status handler.

READ FROM LOAD POINT



READ FROM LOAD POINT



3803-2/3420

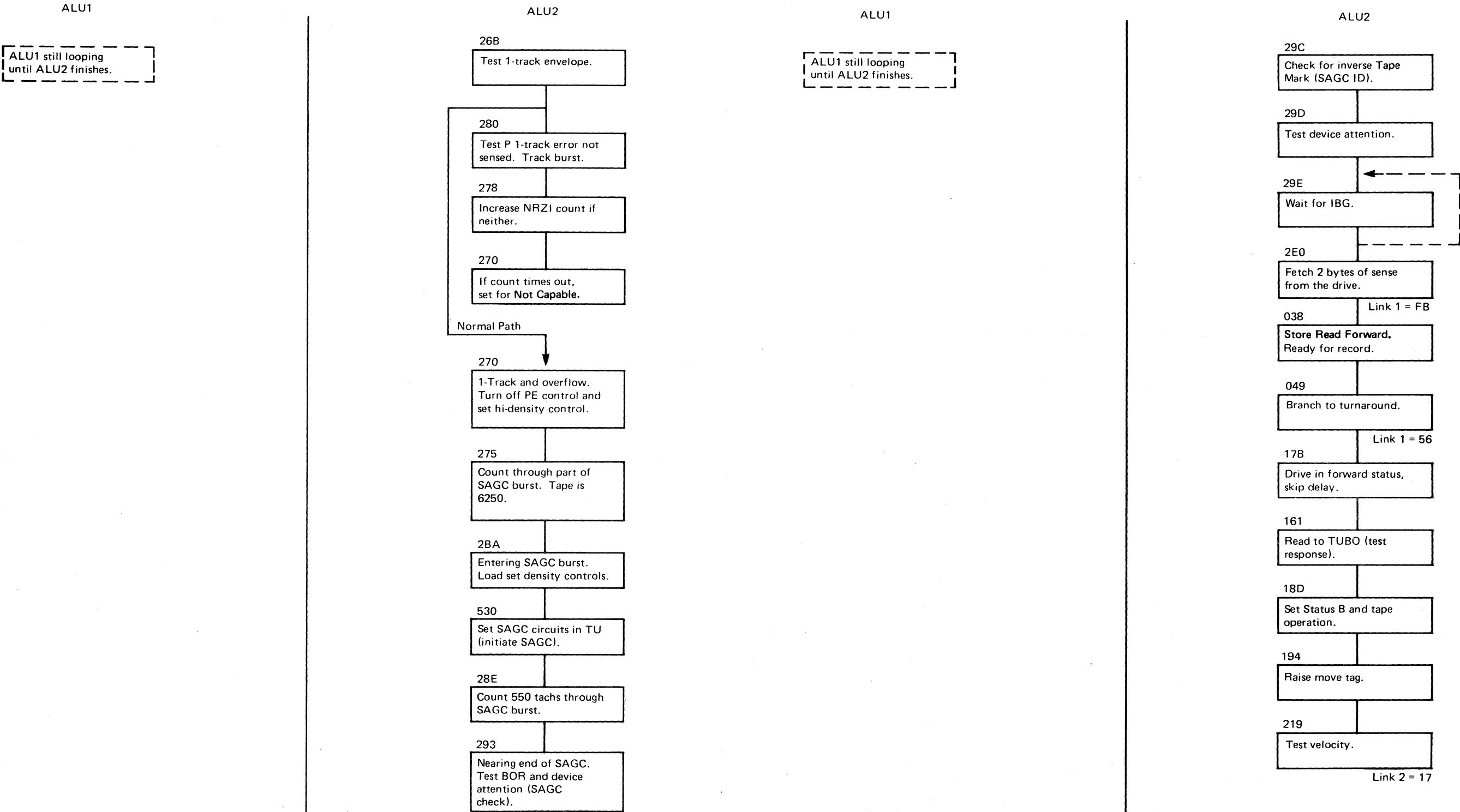
XG3140	4169684	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

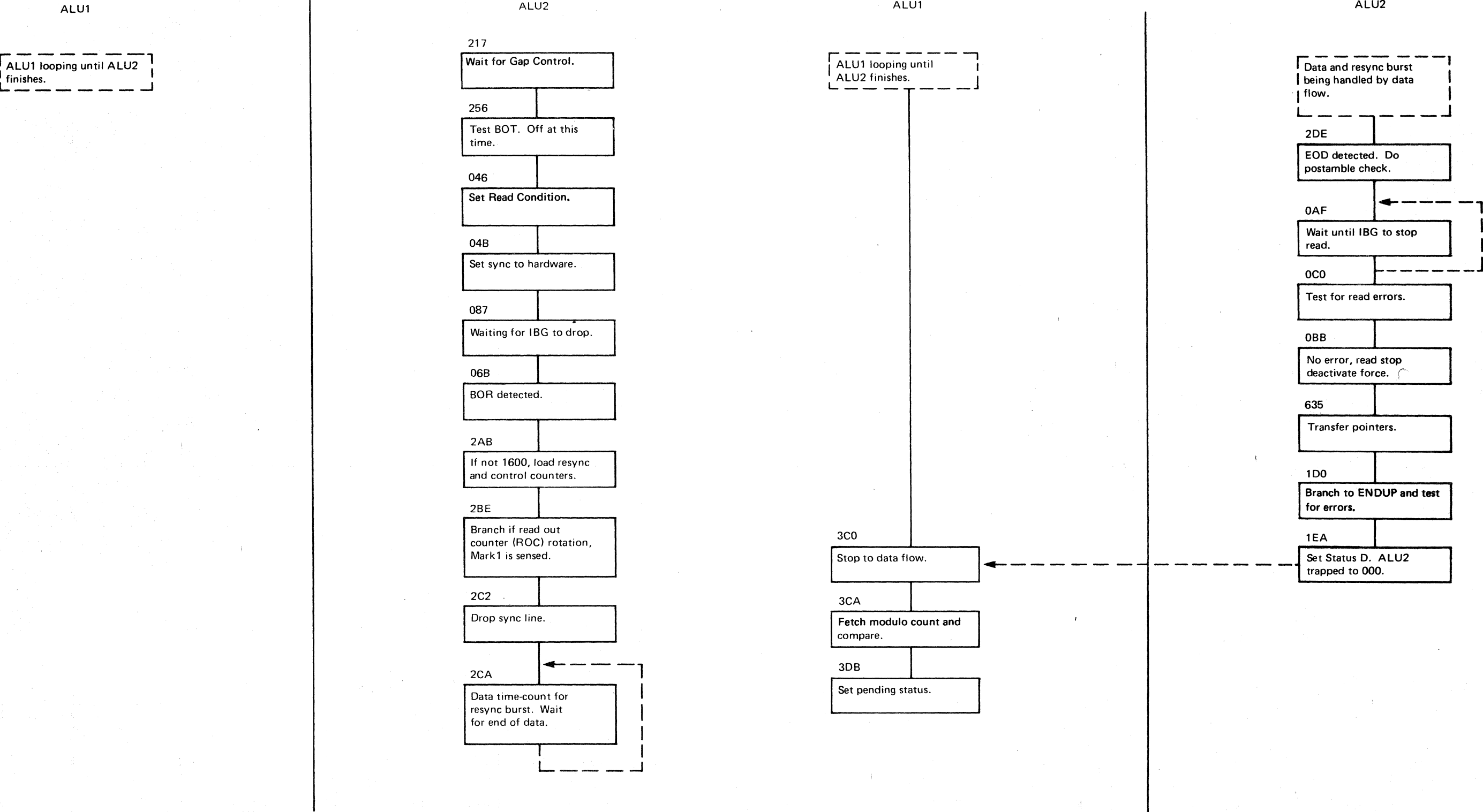
BRANCH TO READ FROM LOAD POINT (Cont'd)

55-044

READ FROM LOAD POINT

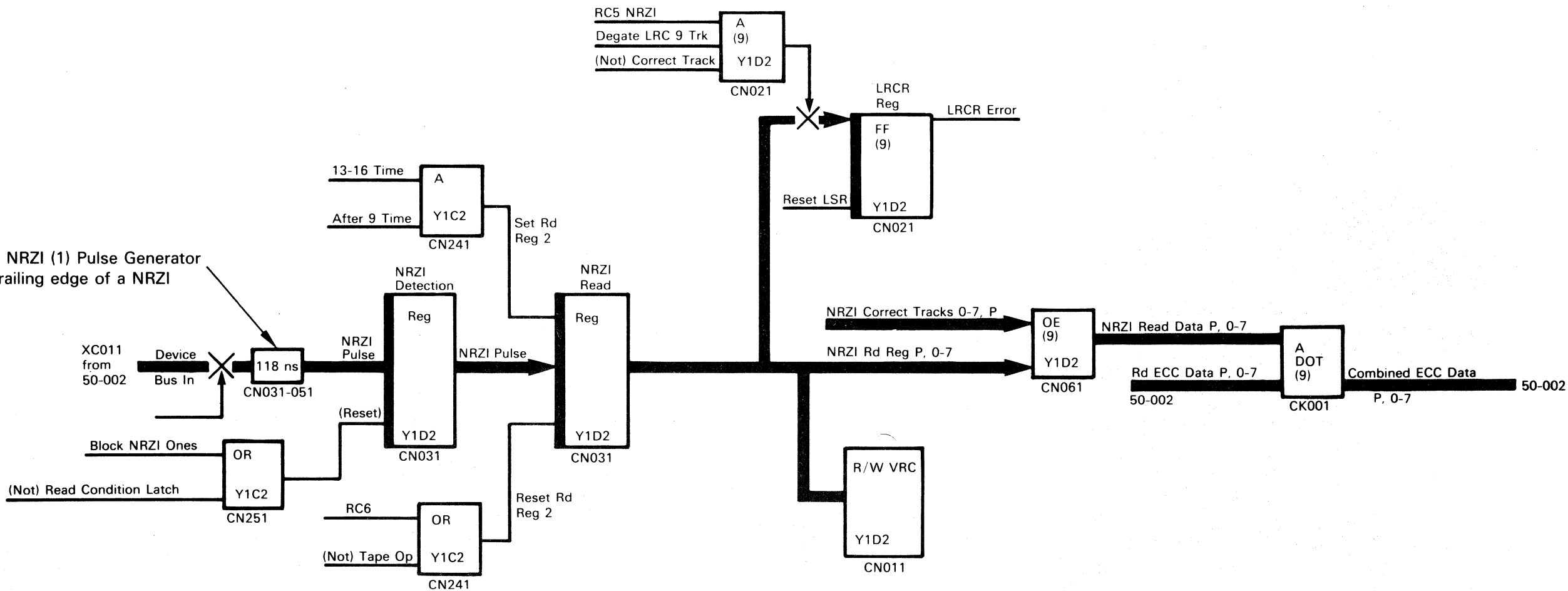


READ FROM LOAD POINT



NRZI READ DATA FLOW

**Note:** The 118 ns delay is a NRZI (1) Pulse Generator which uses the de-skewed trailing edge of a NRZI pulse from the tape unit.



WRITE TRANSLATOR (CARD A1E2)

TRANSLATOR

Some tape subsystems use a six-bit BCD code. Each character of the six-bit code can be translated to an equivalent eight-bit character for processing by 9-track tape subsystems. A translator in the tape control translates eight-bit code to six-bit code while writing, and translates six-bit code to eight-bit code while reading. The translator operates only if Microprocessor 1 XOUTA bits 2 and 4 are on at the rise of TAPE OP and Microprocessor 2 Stat bits 0 and 3 are on.

On 7-track write operations with the translator off, the tape control discards the two high-order bit positions (BUS OUT bits 0 and 1) of each byte from channel. Only the six low order data bits (plus a parity bit) are transferred to the tape unit.

On 7-track read operations with the translator off, the tape control inserts zeros in the two high order bit positions (BUS IN bits 0 and 1) of each byte when transferring it to channel.

ECBDIC AND BCD CODES

EBCDIC - 8 Bit Code															
00				01				10				11			
Bits	4567	00	01	10	11	00	01	10	11	00	01	10	11	00	01
	0000	BL	&	-	0	BL	&	-	0	>	<	±	0	>	<
	0001	A	J	/	1	A	J	/	1	A	J	/	1	A	J
	0010	B	K	S	2	B	K	S	2	B	K	S	2	B	K
	0011	C	L	T	3	C	L	T	3	C	L	T	3	C	L
	0100	D	M	U	4	D	M	U	4	D	M	U	4	D	M
	0101	E	N	V	5	E	N	V	5	E	N	V	5	E	N
	0110	F	O	W	6	F	O	W	6	F	O	W	6	F	O
	0111	G	P	X	7	G	P	X	7	G	P	X	7	G	P
	1000	H	Q	Y	8	H	Q	Y	8	H	Q	Y	8	H	Q
	1001	I	R	Z	9	I	R	Z	9	I	R	Z	9	I	R
	1010	>	<	±	0	>	<	±	0	BL	&	-	0	BL	&
	1011	.	\$	.	#	.	\$	.	#	.	\$	.	#	.	\$
	1100	◀	•	%	@	◀	•	%	@	◀	•	%	@	◀	•
	1101	(	)	WS	v	(	)	WS	v	(	)	WS	v	(	)
	1110	+	↑	=	-	+	↑	=	-	+	↑	=	-	+	↑
	1111	GM	MC	SM	TM	GM	MC	SM	TM	GM	MC	SM	TM	GM	MC
		0	1	2	3	4	5	6	7	8	9	10	11	12	13

Note 2

BCD - 6 Bit Code															
4,5,6,7				2,3				Tracks				BCD			
	8421	00	01	10	11	00	01	10	11						
	0000	BL	0	-	&	BL	0	-	&						
	0001	1	/	J	A	1	/	J	A						
	0010	2	S	K	B	2	S	K	B						
	0011	3	T	L	C	3	T	L	C						
	0100	4	U	M	D	4	U	M	D						
	0101	5	V	N	E	5	V	N	E						
	0110	6	W	O	F	6	W	O	F						
	0111	7	X	P	G	7	X	P	G						
	1000	8	Y	Q	H	8	Y	Q	H						
	1001	9	Z	R	I	9	Z	R	I						
	1010	0	±	<	>	0	±	<	>						
	1011	#	.	\$	.	#	.	\$	.						
	1100	@	%	•	◀	@	%	•	◀						
	1101	v	WS	)	(	v	WS	)	(						
	1110	=	↑	-	+	=	↑	-	+						
	1111	TM	MC	SM	GM	TM	MC	SM	GM						

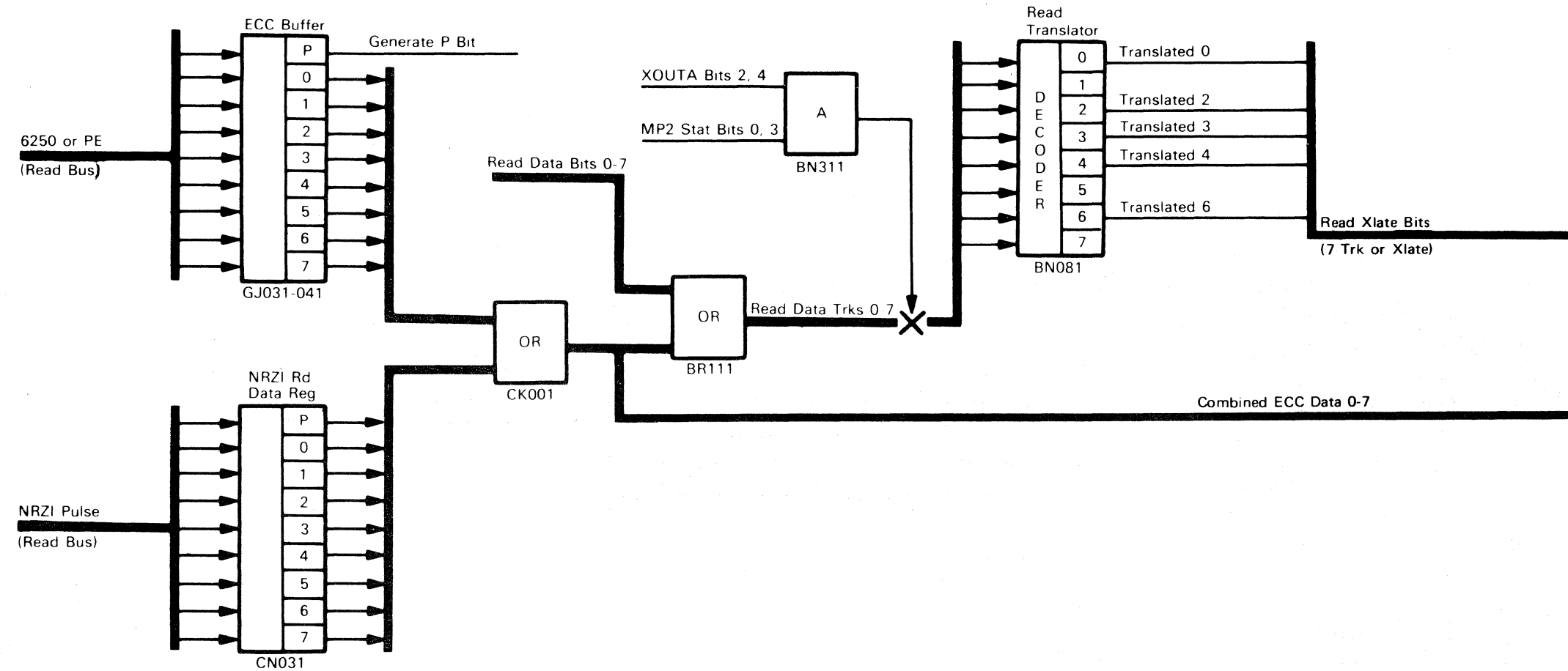
- Notes:
- [1] The graphics in these charts may not be identical to those printed by the printer or printer-keyboard. The graphics are intended as references for translating bit codes on a read or write operation.
  - [2] The write translator accepts the complete EBCDIC code and translates the bits to the BCD code. However, the read translator translates the BCD code only to the bits outlined.
  - [3] When operating in the even-parity mode, the EBCDIC blank (bl) is translated to a BCD substitute blank (bl), and the BCD substitute blank is translated to an EBCDIC blank (01000000). The odd parity blank's bit code is 000000.

3803-2/3420	XG3200	2736002	See EC	845958											
	Seq 2 of 2	Part Number	History	1 Sep 79											

READ TRANSLATOR (CARD A1E1)

Read Translator Data Flow

ANDs and ORs translate bits 0-7 to determine EBCDIC code.



## WRITE DATA CONVERTER (CARD A1E2)

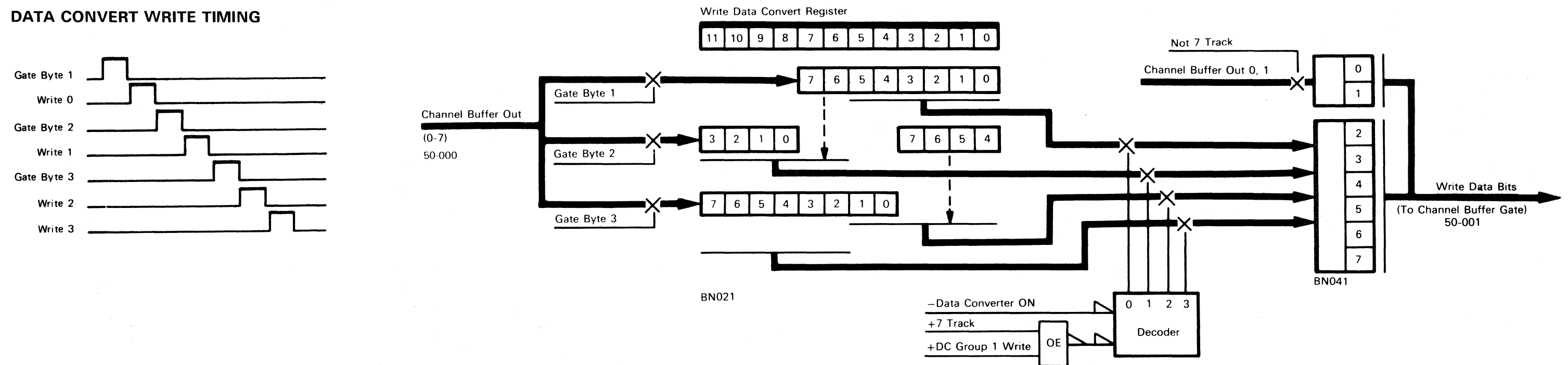
The data converter is used for 7-track write and read forward operations only.

The data converter is disabled during read backward operations, but is left on for the next write or read forward operation.

The data converter is turned on and off by a mode set command. When Microprocessor 1 XOUTA BIT 2 is on at the rise of TAPE OP (MP2, Status 0), the data converter is off. When Microprocessor 1 XOUTA BIT 2 is off at the rise of TAPE OP (MP2, Status 0), the data converter is on.

During a write operation, three 8-bit EBCDIC bytes from channel are converted to four 6-bit BCD characters for writing on tape. If the byte count is not a multiple of three, any remaining bits of the last 6-bit character are set to zero.

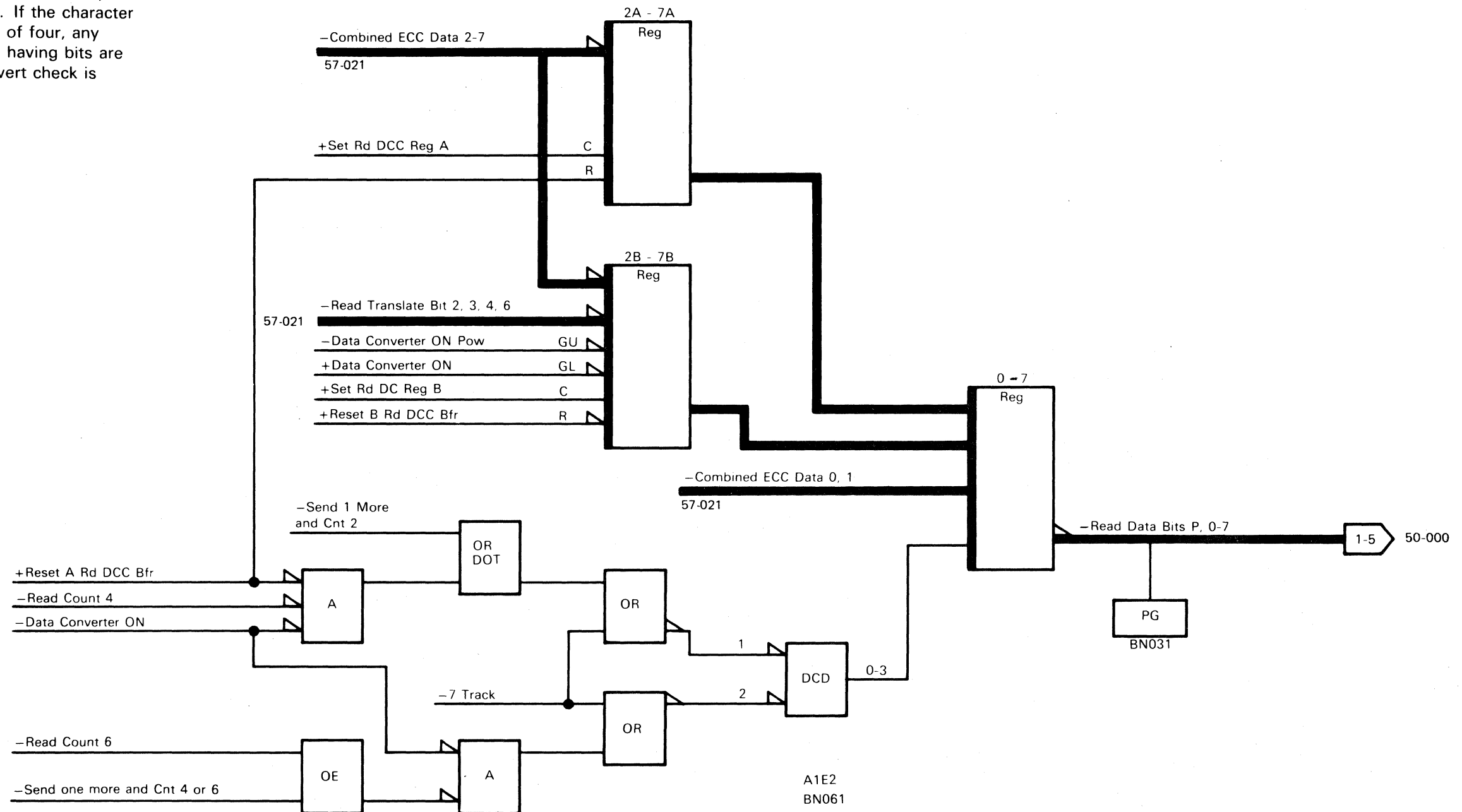
## DATA CONVERT WRITE TIMING





## READ DATA CONVERTER

During a read operation, four 6-bit characters (plus parity) from tape are converted to three 8-bit bytes (plus parity) for transfer to channel. If the character count of the block is not a multiple of four, any remaining positions in the last byte having bits are padded with zeros, and a data convert check is indicated.



NOTES:

57-027

3803-2/3420

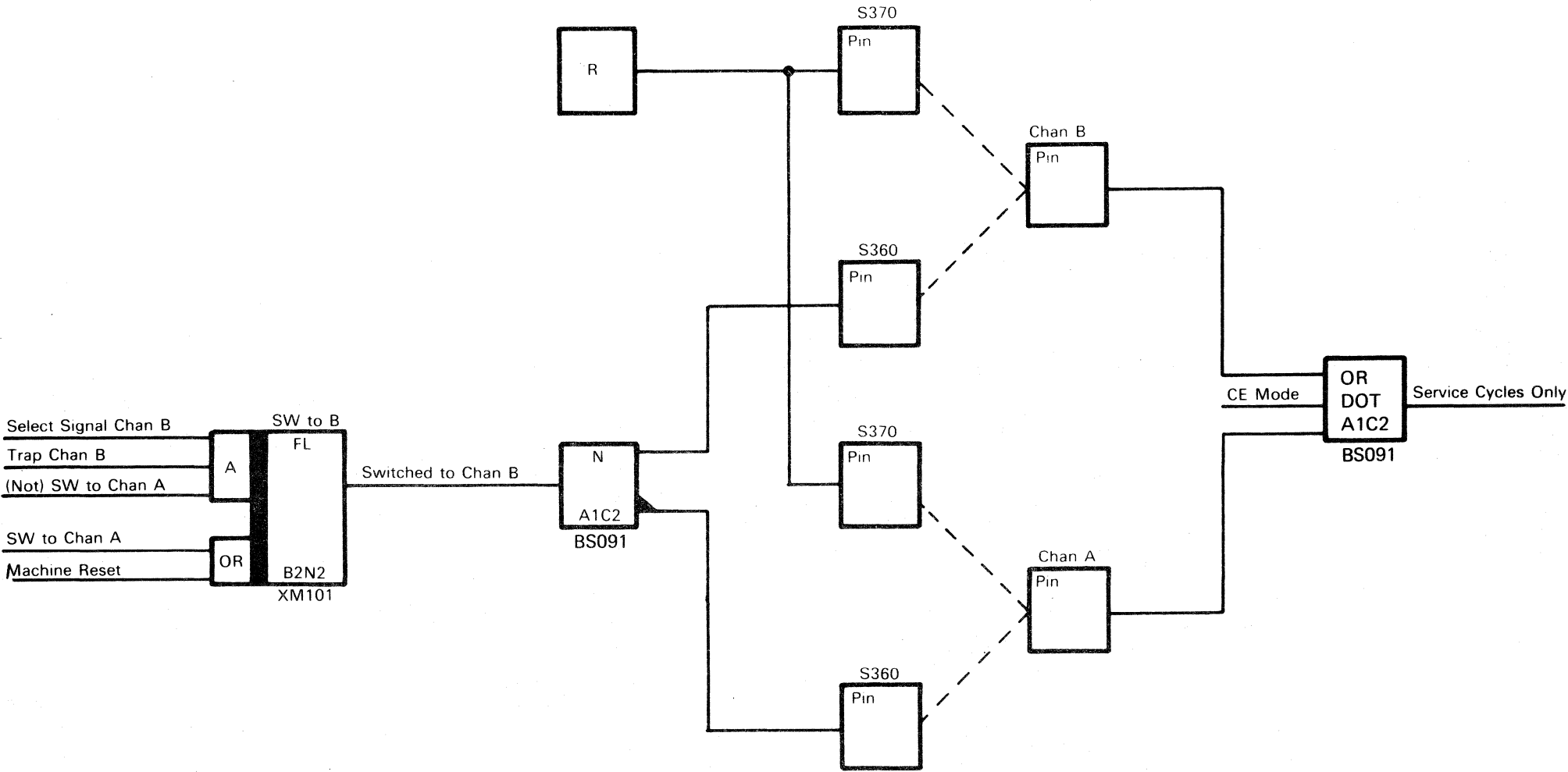
XG3400	2736004	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

57-027

OBJECTIVES

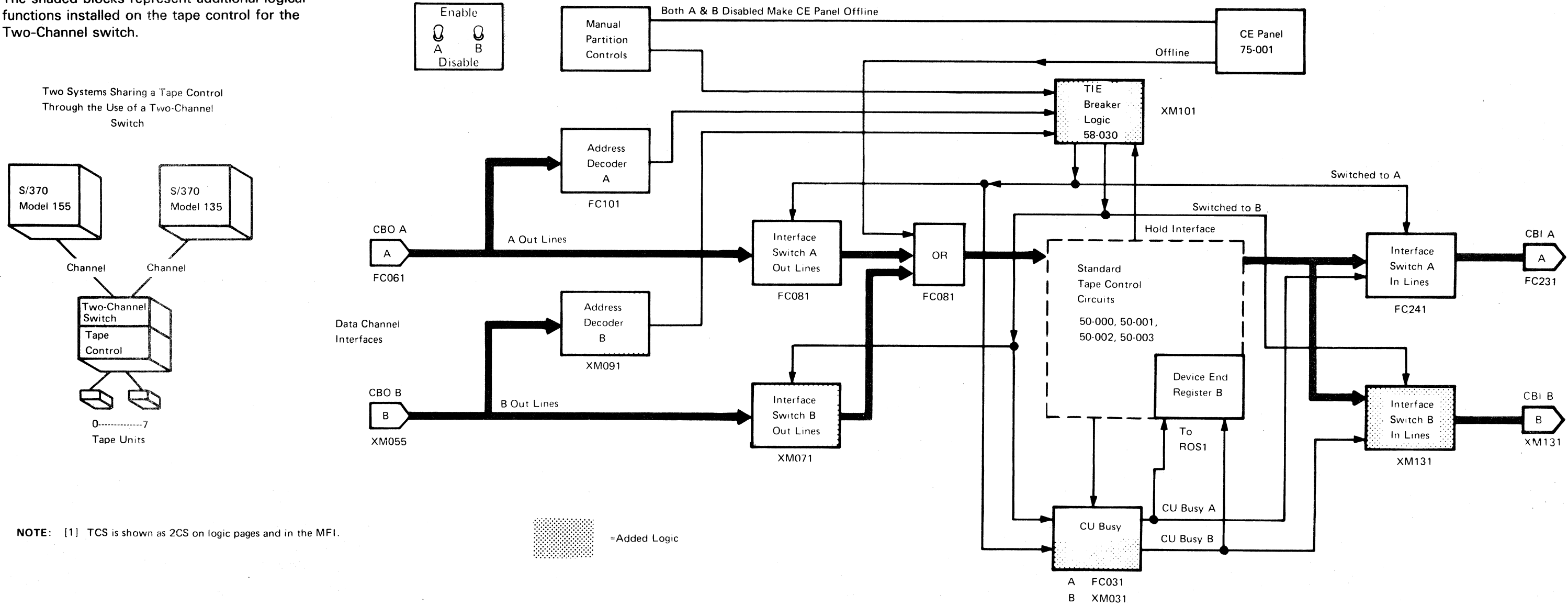
- 1. The switching circuit enables a 3803-2 to be attached to either a System/360 or a System/370.
- 2. Selection is accomplished by plugging cards to reflect system type on which the tape subsystem is installed. See installation, Page 90-130 or AA010, Sheet 2.
- 3. When plugged for S/360, a Service In/Service Out sequence is used.
- 4. When plugged for S/370, a Service In/Service Out/Data In/Data Out sequence is used.



A 3803-2 tape control with a two-channel switch (TCS) [1] operates with two channel interfaces. All 3803-2 operations can be performed on either channel interface. Channels attached to the TCS interfaces can be attached to the same system or to separate systems, allowing tape units on the tape control with the TCS feature to be shared by two channels on a single system, or by two systems. In addition to all normal operations, a tape control with this feature can execute Reserve and Release commands for program control of interface switching. The large block in the center of the diagram and the unshaded blocks represent control circuits for a standard tape control. The shaded blocks represent additional logical functions installed on the tape control for the Two-Channel switch.

Channel interface lines going into or out of the tape control pass through interface switch circuits. The circuits consist of gated drivers that connect the tape control to either channel interface (A or B). Tie-breaker logic (XM101) controls the interface switch lines so only one channel operates the subsystem, preventing one channel from interfering with the operation of the other. When neither interface is reserved or operating, the interface switch circuits are in a neutral state, and either interface can initiate an Initial Selection sequence.

Address decoders monitor the bus out lines of each interface. If the tape control address appears on the bus out lines along with an ADDRESS OUT tag, the decoders send a signal to the interface switch controls. When no interfering conditions exist, the controls connect that interface to the tape control. If the tape control is reserved or operating with the other interface, a 'short busy' sequence is sent to the interface attempting to break in. When the tape control becomes available, a Control Unit End status byte is sent to the channel that previously received the BUSY signal.



The Sense/Reserve command (F4) locks the two-channel switching circuits to one interface, so the other interface does not have access to the tape control. The Sense/Release command (D4) resets the reserved condition and allows the tape control to accept commands from either interface.

When a tape unit completes an operation, a Device End signal is sent to the channel. A tape control with the Two-Channel switch uses the second Device End LSR to ensure that the Device End is returned to the channel that initiated the operation. See Device End on 58-012.

RESETS

The Reset circuits of the two-channel switch are interlocked so a Reset from one channel cannot disrupt operations on the other channel. A Reset can be accepted only from the operating channel. Resets are further conditioned to prevent a channel from destroying information needed by the other channel.

INTERFACE SWITCH CONTROL

A tape control with a Two-Channel switch monitors addresses on two channel interfaces. When the tape control receives its own address, it tries to start an operation with the interface attempting selection. If the tape control is neither busy nor reserved, the OPERATIONAL IN latch for that interface is activated. If the tape control is busy or reserved to interface A, interface B ADDRESS OUT will be answered with a SHORT BUSY sequence, and vice versa. The interface which received SHORT BUSY will receive a CU END when the tape control is available. If the channel stacks status containing UNIT CHECK or UNIT EXCEPTION, the tape control will remain connected to that interface until status is accepted. If both interfaces attempt selection simultaneously, a tie-breaker circuit resolves the selection. See 58-030.

The purpose of interface switching circuits is to connect the tape control 'common' circuits to whichever interface is operating. To operate with an interface, output from the OPERATIONAL IN latch (FC141) gates interface drivers for the corresponding interface when OPERATIONAL IN is gated by -SWITCHED TO CHANNEL A (or B) (58-030).

The two-channel switch microprogram is entered by branching from Initial Selection (or Ending Sequence) to ensure that data is sent to or from the proper interface.

RESERVE/RELEASE OPERATION

- A Sense/Reserve command locks the tape control to an interface until a Sense/Release command or a Reset is received from that interface.
- A Sense/Release command resets the RESERVE flag to allow operation on either interface.
- A Sense/Reserve or Sense/Release command, while chained, results in Command Reject.
- After Initial Selection, operation of Sense/Reserve and Sense/Release commands are identical to a Sense command.

The Sense/Reserve and Sense/Release commands enable the tape control to remain locked to one interface. Executing a Sense/Reserve command places a tape control under exclusive control of one channel until that channel issues a Sense/Release command. A Sense/Reserve command from channel A or B activates the RESERVE flag for A or B. A Sense/Release command deactivates the RESERVE flag.

Modifier bits, in positions 0,1,2, and 3 of a Sense command byte identify the reserve and release operations. After Initial Selection, modifier bit 2 determines whether the command is a Reserve or a Release. If bit 2 is on, (command code F4) Reserve is indicated. If bit 2 is off, (command code D4) Release is indicated.

SENSE/RESERVE COMMAND [F4]

A Sense/Reserve command locks the tape control to the interface of whichever channel initiated the command.

During Command Out of a Sense/Reserve command, the current command is masked for the F4 configuration. If an (F4) command is recognized, the microprogram checks for chaining (SETRESV). If chaining is not indicated, CURFLAG (20) is set in FLAGS1 (LSR 10) to reserve the tape control. If chaining is indicated, Command Reject is set.

In a valid Sense/Reserve command, bit 2 from the CHANNEL TAGS IN (CTI) register (FC161) prevents resetting the SWITCHED TO CHANNEL A or SWITCHED TO CHANNEL B latch (58-030) and the tape control remains reserved to the operating interface.

Output of the SWITCHED TO A (or B) latch blocks interface switch circuits for the opposite interface

(58-030) until a reset or Sense/Release command is received from the operating interface.

SENSE/RELEASE COMMAND [D4]

A Sense/Release command resets the RESERVE flag to allow the tape control to operate with either interface. As in the sense/reserve operation, the Sense/Release command checks for chaining. A valid Sense/Release command leaves position 2 of the CHANNEL TAGS IN register reset so the SWITCHED TO CHANNEL A and SWITCHED TO CHANNEL B latches are reset at the end of each chain of commands.

SELECTION

Address decoders in the tape control continuously monitor both interfaces. If the correct address bits arrive on the bus out lines along with an ADDRESS OUT tag, the SELECT OUT latch is reset. CONTROL UNIT END latch OFF ANDs with a minus output from the SELECT OUT latch to generate TRAP CHANNEL A or TRAP CHANNEL B.

Assume that the tape control is idle and is addressed by channel A. The TRAP CHANNEL A line ANDs with the SELECT SIGNAL CHAN A to set the SWITCHED TO CHANNEL A (tie breaker) latch. SWITCHED TO CHANNEL A ANDs with DELAY SELECT SIGNAL CHAN A to generate INITIAL SELECTION CHAN A.

Once interface A is addressed and selected, it arms the CONTROL UNIT BUSY AND circuit in interface B. If interface B tries to use the tape control during the time interface A is locked onto the switch, the CONTROL UNIT END latch for interface B is set.

When interface A is finished operating, MP1 determines that the Two-Channel switch is installed, and MP2 checks status of the CONTROL UNIT END latches. If either CUE latch is on, MP1 presents CUE status to the interface associated with that latch. The CUE will have a random tape unit address unless presented along with Device End.

PARTITIONING

Partitioning, achieved by operating the Enable/Disable switches, restricts the accessibility of the tape control to either channel. Partitioning bypasses SELECT OUT and degates all interface functions. When both

interfaces are partitioned (both switches set to DISABLE), the tape control is offline and the CE panel controls can be used.

IMPLICIT CONNECTION

An implicit connection is one that does not depend on program intervention for release. The duration of the connection is determined by the time required for the tape control to perform a command or a chain of commands. The switch reverts to neutral on completion (at the tape control level) of the last command in a chain.

An implicit connection is extended if the channel stacks primary status. The stacked status must then be accepted by the channel to terminate the connection. If the status byte contains Unit Check, a contingent connection is made and acceptance of the status by the channel does not terminate the connection.

If the channel stacks secondary status containing Unit Exception or Unit Check, connection to that channel will be maintained until the status is accepted by the channel. If the status byte contains Unit Check, a contingent connection is made and acceptance of status by the channel does not terminate the connection.

If the channel stacks secondary status other than Unit Check or Unit Exception, the switch returns to neutral and is available to either channel. Any further attempts by the tape control to present this status to the channel that indicated STACK STATUS are controlled by SUPPRESS OUT from that channel.

CONTINGENT CONNECTION

A contingent connection is initiated when the last status byte contains Unit Check. The connection is maintained until a command other than Test I/O or NOP is received from the channel to which status was presented. Any command other than Test I/O or NOP to that tape unit clears the contingent connection if the tape unit is READY.

The purpose of the contingent connection is to ensure an available path to the tape unit and the transmission of sense data from the tape unit to the proper channel. If a Test I/O or NOP is issued by the addressed channel to a tape unit other than the one contingently connected, the tape control responds with SHORT BUSY and retains the connection.

BUSY

While the tape control is operating with one interface, a SELECT from the other interface will be answered with a SHORT BUSY signal (Bits P, 1, 3). Assume that the B interface is operating when the A interface attempts to address the tape control (58-030). The SWITCHED TO CHANNEL B latch blocks the setting of the SWITCHED TO CHANNEL A latch. However, —SELECT SIGNAL CHANNEL A is ANDed with —ADDR COMPARE CHAN A and NOT PROPAGATE SEL OUT CHAN A to reset the CHANNEL A SEL OUT latch. With the latch reset, the minus output of the off side of the latch is ANDed with —ENABLE CHAN A and OPERATIONAL IN to condition one input to the channel A CUE latch. A second conditioning input is OPERATIONAL IN, and the third is the minus output from the CU BUSY AND circuit. Thus, the CUE latch for channel A, is turned on to send CU BUSY STATUS CHAN A to the A interface.

The BUSY signal sent to channel A is a Unit Status byte with bits 1 and 3 on. Bit 3 indicates BUSY, while bit 1 (status modifier) indicates that the BUSY condition applies to the tape control. Bits P, 1, and 3 are forced onto the BUS IN lines at the same time the STATUS IN tag line is forced up. The STATUS IN latch is not turned on during this SHORT BUSY sequence.

CONTROL UNIT END

The CONTROL UNIT END latch (58-030) remains on, remembering that channel B tried to break into channel A operations. This latch also sends +CUE PENDING CHAN B to the microprogram branch-on-condition logic (AB161) to notify the B interface that a Channel End is pending. When the tape control is no longer operating with, or reserved by, interface A, the SW TO CHAN A latch turns off, —TRAP CHAN B is active, and the SELECT CHAN B line is still active to turn on the SW TO CHAN B latch.

The SW TO CHAN B latch gates the output from OPERATIONAL IN to channel B to send a Unit Status byte to channel B. The status byte will contain a CUE (bit 2) indicating the tape control is now available for other operations. A standard REQUEST-IN sequence is used to transmit the CUE status byte.

At the end of an operation, the SW TO CHAN A (or B) latch is reset unless a chain, STACK, INTERRUPT, or UNIT CHECK condition exists. OPERATIONAL IN is reset in the Burst Ending Sequence when CHANNEL TAGS IN register bit 7 is reset.

With OP IN reset, no REQUEST IN, no ADDRESS OUT, and no SELECT OUT for the tape control, the SELECT OUT latch is active. (Note that the SELECT OUT latch is turned on when the tape control is inactive.) With the SELECT OUT latch active, the plus output degates —RESPONDING TO CHAN A (or B). —RESPONDING TO CHAN A (or B) inactive resets the SW TO CHAN A (or B) latch, and the tape control is available for another selection sequence.

STACK

In some cases the channel may refuse the end status byte, this turns on a 'stack' condition. If the status byte contains Unit Check or Unit Exception, the tape control remains connected to that interface until the channel accepts the status. If the status byte contains Unit Check, the connection is maintained until a command other than NOP or Test I/O is received from the channel to which the status was presented. This procedure makes certain the channel has an opportunity to interrogate a unit check condition before the other channel disturbs the tape control. When the interface connection is maintained because of a unit check, the connection is defined as "contingent" (not part of the normal routine).

Stacking of status other than Unit Check or Unit Exception does not maintain the interface connection. The TCS will be reset to neutral, and the tape control will become available to either channel.

STACK INTERRUPT

A Halt I/O command received by the tape control before the channel accepts the ending status causes the MP1 microprogram to reset OP IN and check for two-channel operation and contingent connection. If a contingent connection is needed to prevent loss of error information, the microprogram branches to a 'Hold Interface' routine.

With no contingent connection, an interrupt cycle is initiated to present the stacked status. CONTROL UNIT BUSY will be reset (if applicable) and HOLD INTERFACE will be set if the STACK or STATUS PENDING flag is on.

DEVICE END

The purpose of Device End circuits is to signal the data channel when a tape unit has completed a task and is ready to accept a new one. On a tape control with the two-channel switch feature, separate LSRs in MP2 are used to store the Device End signal for each channel. The second Device End LSR ensures that the Device End is returned to the channel that initiated the operation.

A Device End received while the two-channel switch is in a neutral state causes the tape control to enter an interrupt status. The tape control then presents the Device End to the channel that initiated the Device End operation, if that interface has not been partitioned. Partitioning resets pending Device Ends for that interface.

An interrupt due to a Control Unit End sends Device End, including the address of that device, and Control Unit End, to the channel.

TIE BREAKER

Tie-breaker logic (XM101) on 58-010) controls the interface switch lines so only one channel operates the subsystem, preventing one channel from interfering with the operation of the other. When neither interface is reserved or operating, the interface switch circuits are in a neutral state, and either interface can initiate an Initial Selection sequence.

Address decoders monitor the bus out lines of each interface. If the tape control address appears on the bus out lines along with an ADDRESS OUT tag, the decoders send a signal to the interface switch controls. When no interfering conditions exist, the controls connect that interface to the tape control. If the tape control is reserved or operating with the other interface, a 'short busy' sequence is sent to the interface attempting to break in.

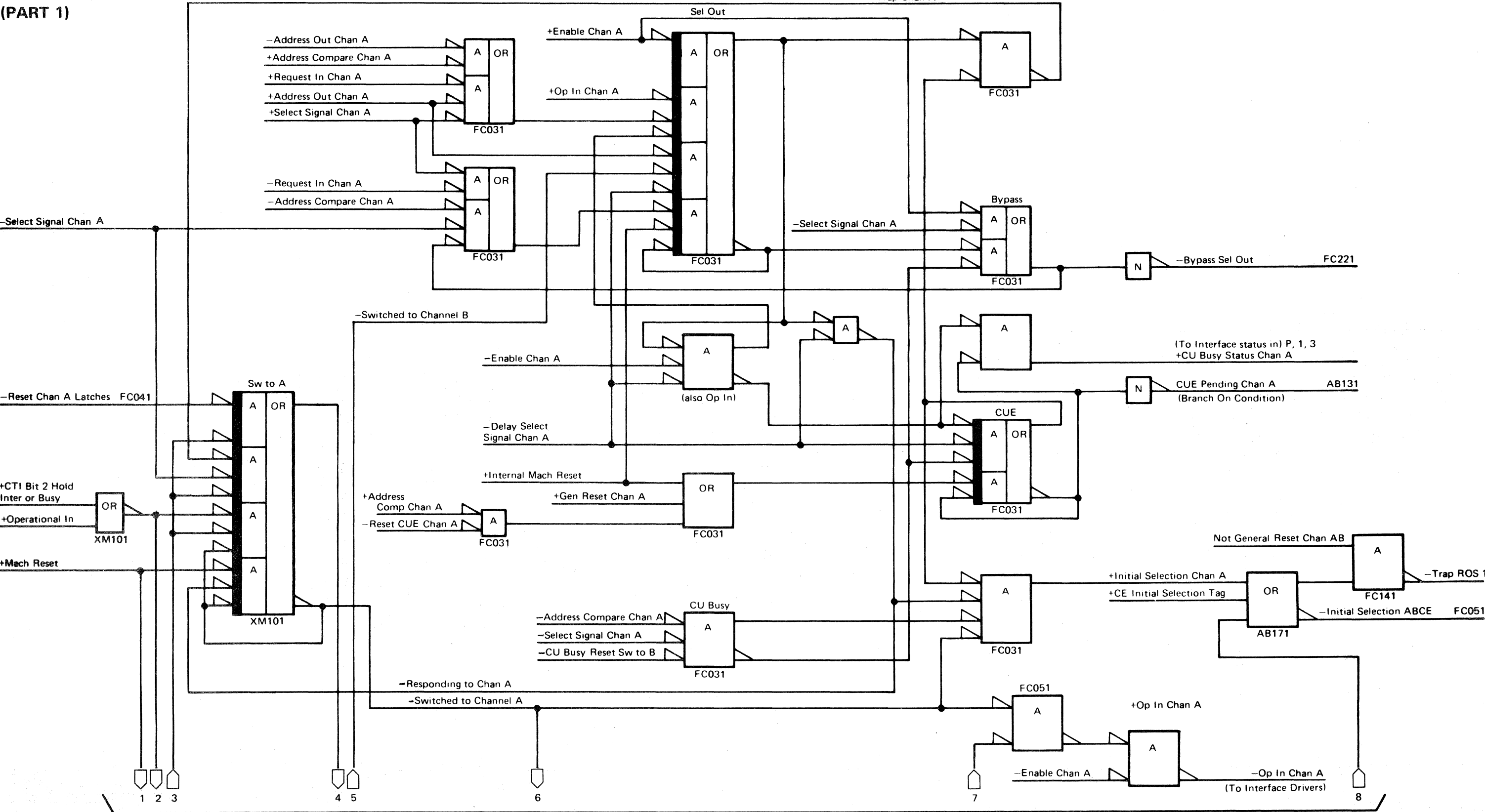
When the tape control becomes available, a Control Unit End status byte is sent to the channel that previously received the BUSY signal.

See 58-030 for schematic details.

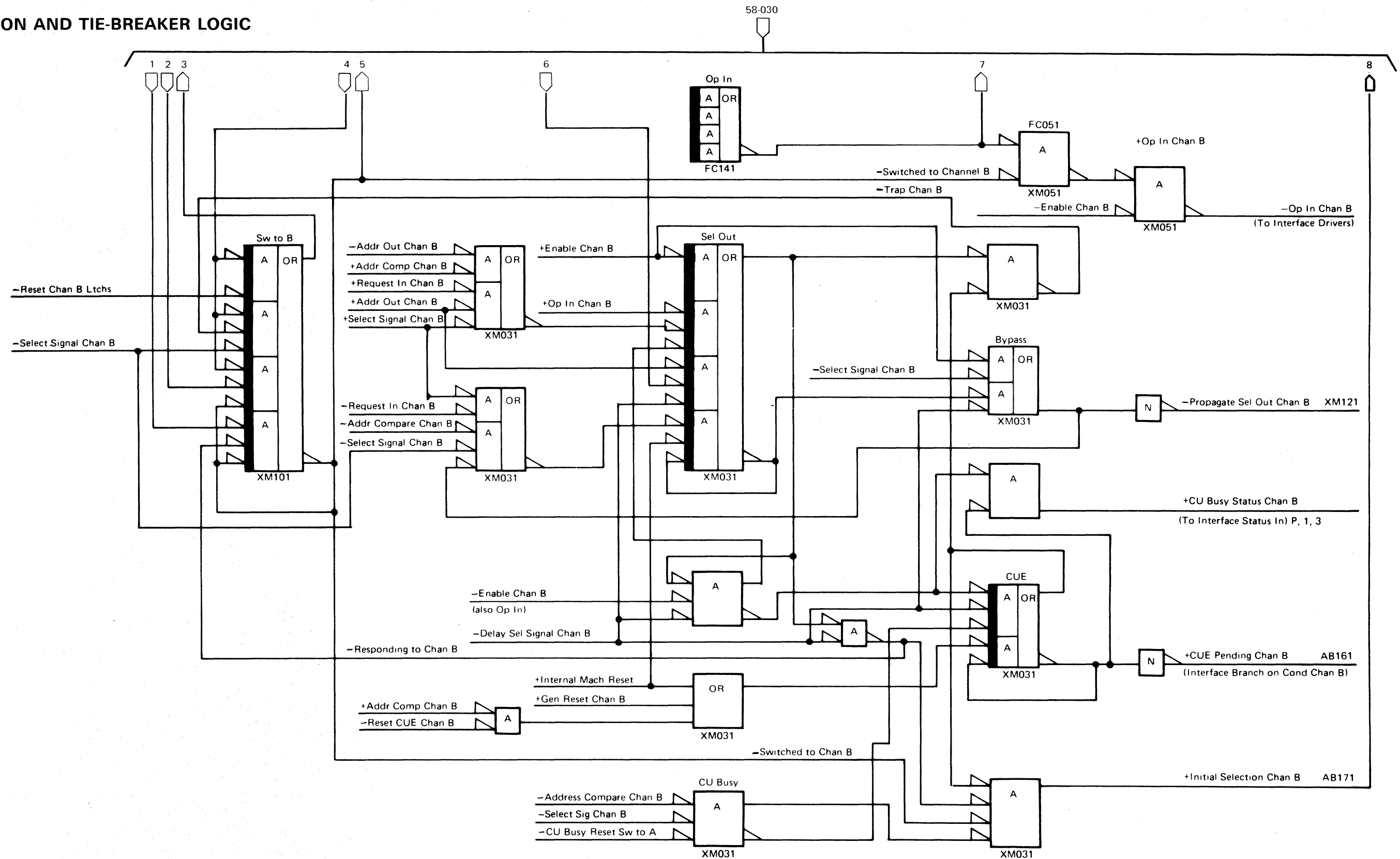
XG3600	2736006	See EC	845958	847298				
Seq 2 of 2	Part Number	History	1 Sep 79	15 Aug 83				

TCS SELECTION AND TIE-BREAKER LOGIC  
(PART 1)

Note: See 58-012 for description of circuit operation.



## TCS SELECTION AND TIE-BREAKER LOGIC (PART 2)



3803-2/3420

<b>XG3700</b> Seq 2 of 2	<b>2736007</b> Part Number	<b>See EC History</b>	<b>845958</b> 1 Sep 79					
-----------------------------	-------------------------------	-----------------------	---------------------------	--	--	--	--	--

© Copyright International Business Machines Corporation 1976, 1979



DESCRIPTION

Device switching allows access to a maximum of sixteen tape units by two, three, or four tape controls, and permits simultaneous operation of as many tape units as there are tape controls.

3803 Models 1 and 2 can be mixed in a switching configuration; however, attempting to access a 3420 Model 4, 6, or 8 through a 3803 Model 1 produces unpredictable results.

Device switching is performed via the Communicator and Device Switch features. Three Device Switch features (58-051) available with the tape subsystem are:

- 2 Control Switch used with 2x8 and 2x16 configurations
- 3 Control Switch used with 3x8 and 3x16 configurations
- 4 Control Switch used with 4x8 and 4x16 configurations

The minimum switching subsystem configuration allows two tape controls to access up to 8 tape units and is called a 2x8 configuration. The maximum configuration is 4 tape controls and 16 tape units (4x16). A non-switching configuration (1x8) is referred to as Selection Logic.

Device Switching logic is installed only in those tape controls that have attached tape units.

The location of the Device Switches depends on the configuration desired. For example: In a 2x8, 3x8, or 4x8 configuration, the switching feature is required only on the first tape control while in the 2x16, 3x16, and 4x16 configurations, the switching feature is required on Tape Controls 1 and 2 (58-051). The 2x16 configuration consists of two tape controls, each with a Communicator 1, a 2 Control Switch, and eight tape units. The tape controls may be connected to either different channels of the same system or on different systems.

Device switching logic is logically invisible (except for BUSY responses during Initial Selection and Device End interrupts, which result when tape units become available). Device switching logic is modular to allow flexibility for a variety of system configurations. Subsystem priority and device addressing are assigned by pluggable jumpers within the switch. Any tape unit may be partitioned (made unavailable) to any tape control via toggle switches on the tape control operator's panel (58-060).

2 Control Switch

The 2 Control Switch is a 2x8 configuration of hardware switching logic (58-051, 58-055). Tape Units 0 - 7 (attached to Tape Control 1) can be accessed by the Communicator in Tape Control 2 as well as the Communicator of Tape Control 1. A 2x16 configuration is obtained by installing a 2 Control Switch in both Tape Controls 1 and 2, allowing the Communicator in each tape control to access its own eight 3420s, as well as 3420s of the other tape control.

3 Control Switch

A 3x8 configuration is obtained by installing a 3 Control Switch in Tape Control 1 only and a Communicator 1 in Tape Controls 1, 2, and 3 (58-051). Tape units attach to Tape Control 1.

A 3x16 configuration is obtained by installing a 3 Control Switch in both Tape Controls 1 and 2. A third tape control must be added to the configuration. Tape Control 3 does not contain any switching hardware or attach any tape units, but does contain a Communicator.

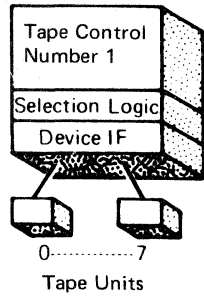
4 Control Switch

A 4x8 configuration is obtained by installing a 4 Control Switch in Tape Control 1 and a Communicator 1 in Tape Controls 2, 3, and 4 (58-051). Tape units attach to Tape Control 1.

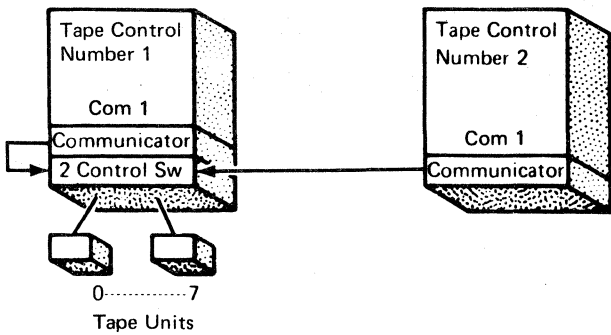
A 4x16 configuration is obtained by installing a 4 Control Switch in both Tape Controls 1 and 2. Two more tape controls must be added to the configuration. Tape Controls 3 and 4 do not contain any switching hardware or attach any tape units, but each contains a communicator.

The 3 Control Switch and the 4 Control Switch are expansions of the 2 Control Switch. They allow access to eight attached tape units by the additional Communicators.

1 x 8 Configuration

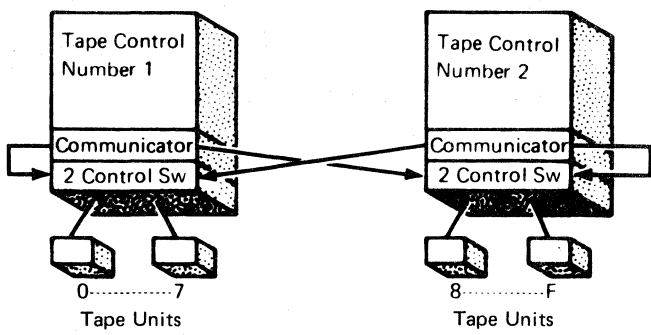


2 X 8 Configuration

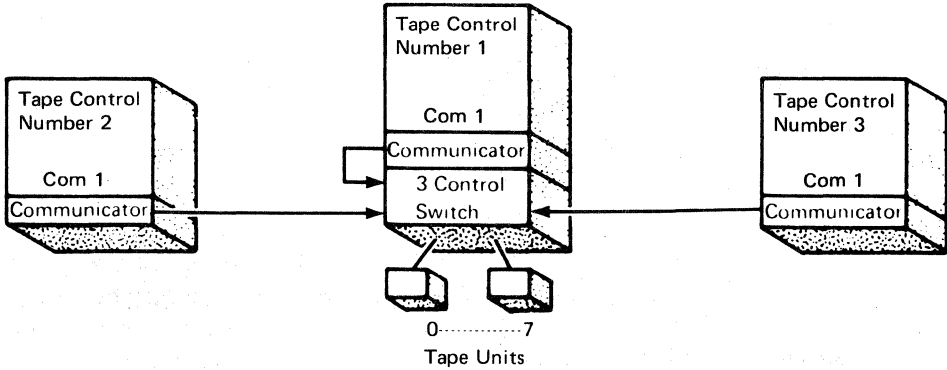


- Notes:
- [1] Maximum of 16 tape units and 4 tape controls.
  - [2] Tape units attach only to tape controls with switching features.
  - [3] Any or all control units may have two channel switch features.
  - [4] For 3420 Model 8 power requirements, see 90-180.

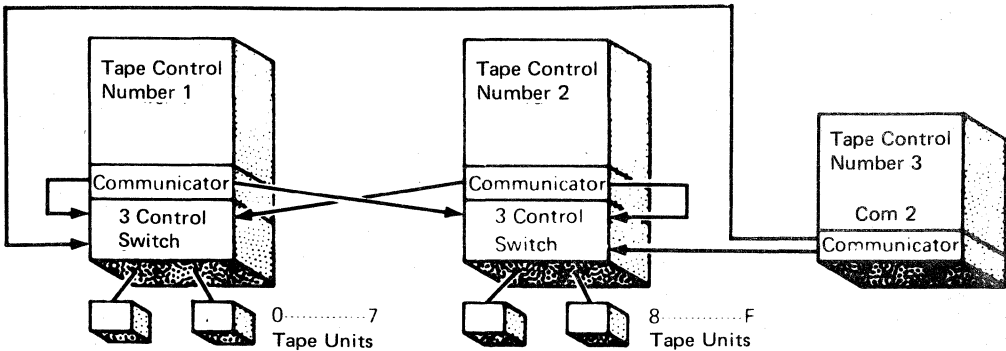
2 x 16 Configuration



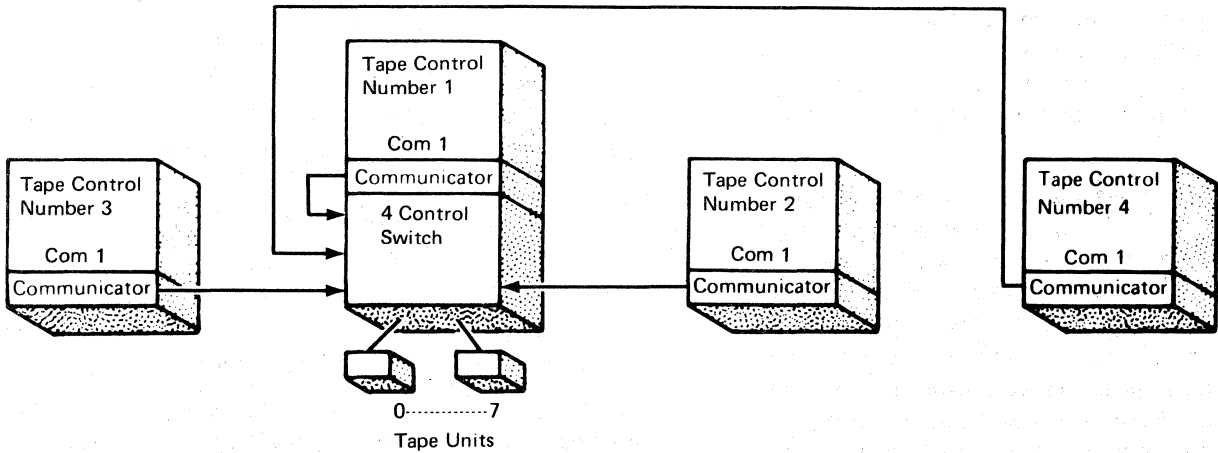
3 X 8 Configuration



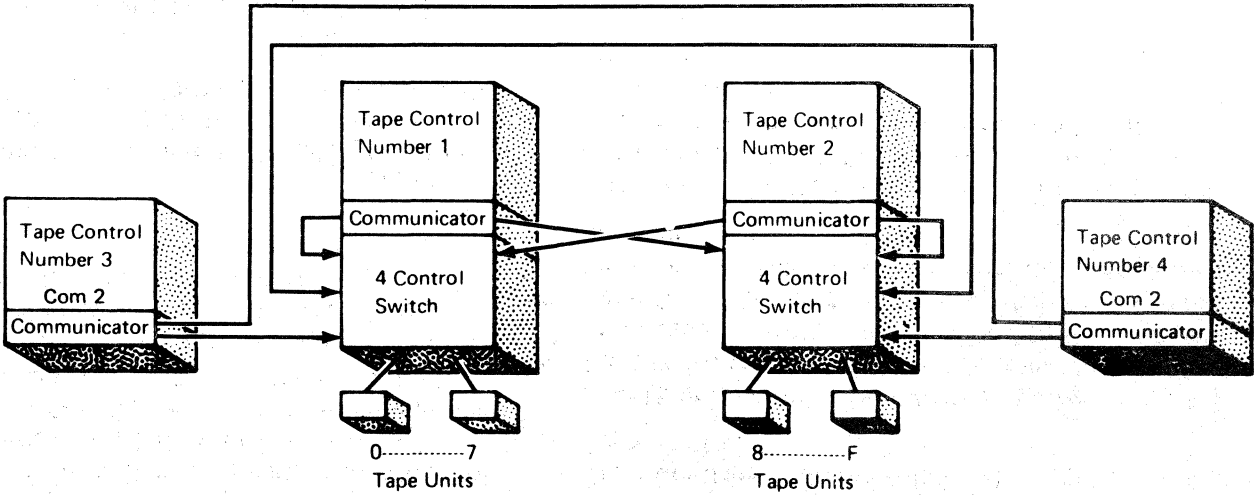
3 x 16 Configuration



4 x 8 Configuration

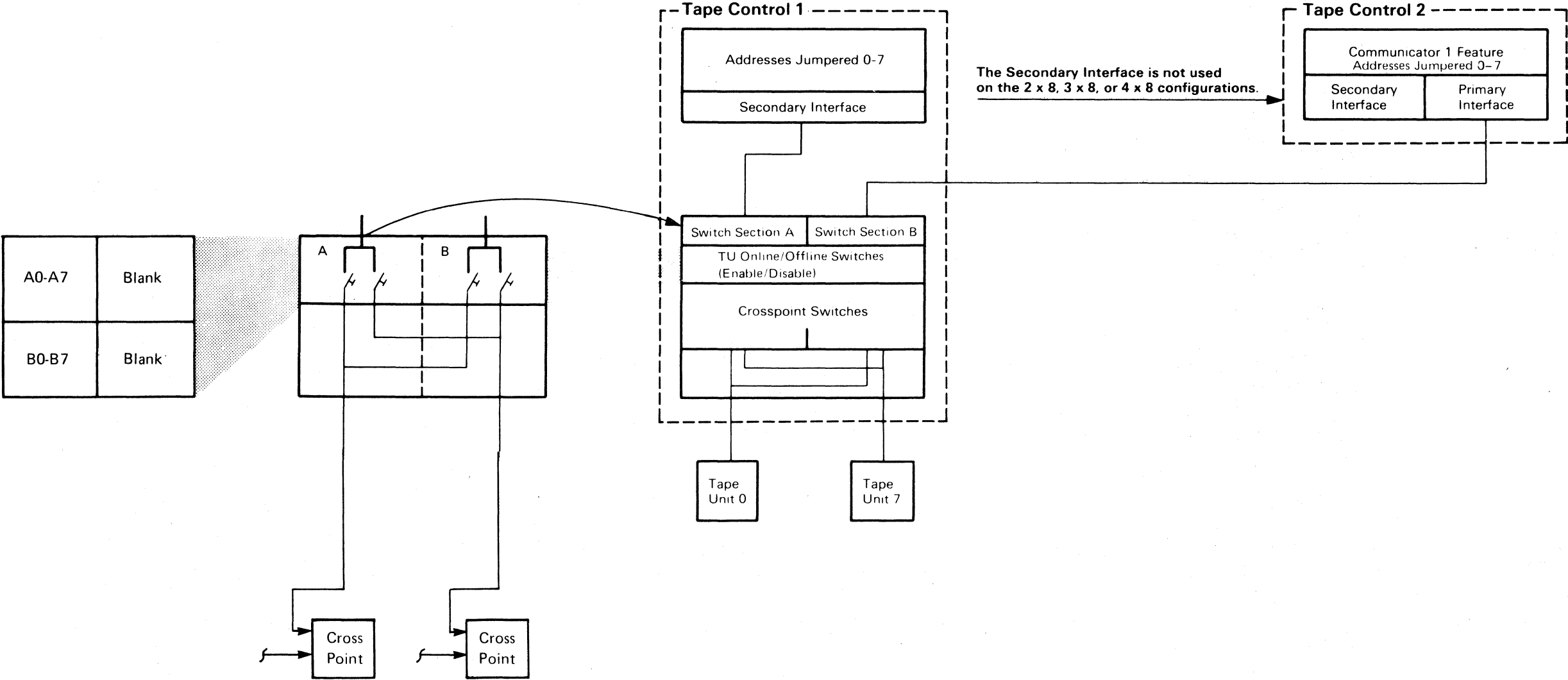


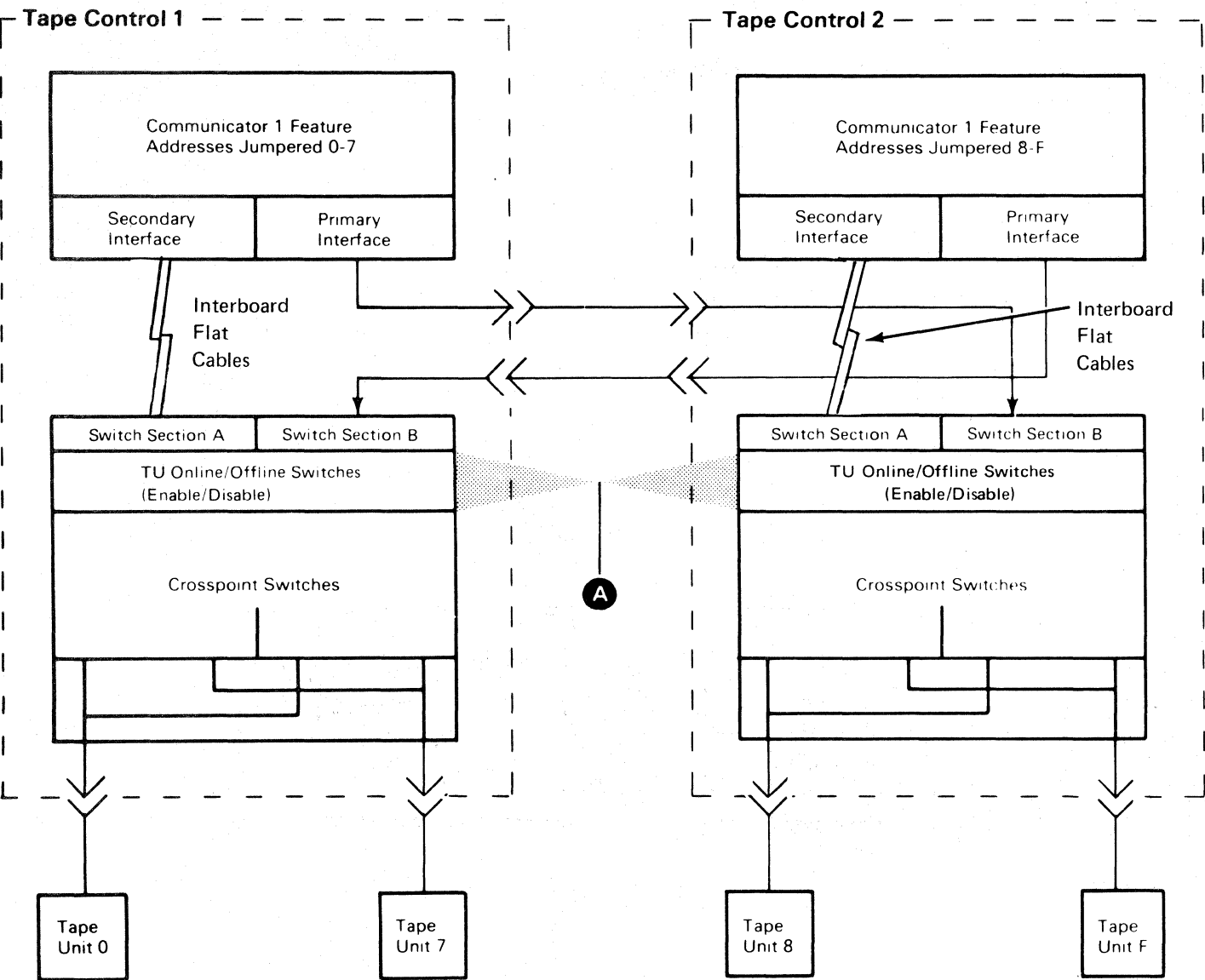
4 x 16 Configuration



OPERATOR PANEL SWITCHES (16)

Switch Section A on Tape Control 1 directs Tape Control 1's access path to Tape Units 0-7. Switch Section B on Tape Control 1 directs Tape Control 2's access path to Tape Units 0-7.





Switch section A on tape control 1 directs tape control 1's access path to tape units 0-7. Switch section B on tape control 1 directs tape control 2's access to tape units 0-7.

Tape control 2 switches are similar to tape control 1, except section A directs tape control 2's access to tape units 8-F. Section B controls the access of tape control 1 to tape units 8-F.

OPERATION

The Device Switch is controlled by lines from the tape control. Although there are necessary switching delays, data transfers, control requests, and responses, tape unit status is sent to the tape control as if the switch were not present.

**Selection:** When DEVICE SELECT (58-090) is activated, with the device address on the DEVICE SWITCH bus and the node is enabled, the switch tries to set the COMMITTED latch for the node. **Note:** A "node" is the logic circuitry required to select and assign one tape unit to a requesting tape control. If the device has already been selected by another tape control, a BUSY indication is returned to the tape control attempting selection. If the device is not busy, the COMMITTED latch is set. The latch output is then sent to the other tape control nodes for that device to prevent selection by them. At the same time the committed latch is set, the SELECT crosspoint line to that node will become active and GATE BUS OUT will be the response to the selecting tape control. The BUS OUT and BUS IN connection has now been established between the tape control and tape unit. SWITCH SELECT is not required to select a tape unit, although it is always active in 3803 subsystems.

**Committed:** Once the COMMITTED latch is set for a given node, it remains set until reset by the selecting tape control. Reset is accomplished by addressing and sending a 50 ns pulse on the SET/RESET line.

**Priority:** When two or more tape controls attempt to select a tape unit at the same time, priority of access is determined by jumpers plugged on Tape Controls 1 and 2 (58-100). See Section 90 for plugging details.

LINE DEFINITIONS (58-100)

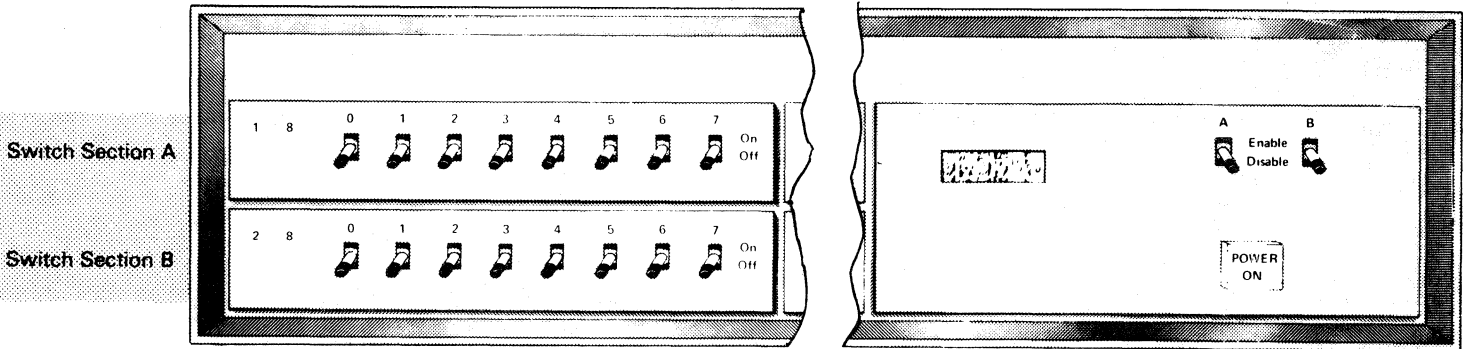
**Busy/Tach:** The BUSY/TACH line indicates the state of the device (busy or not busy) to the tape control.

**Device Operating Interface A and B (2 lines):** A device operating line is active when a committed tape unit (one for which a COMMITTED latch has been set) has its BUSY/TACH line active. The DEVICE OP INTF A line to the tape control is used for generating the METERING IN line for its channel interface. The DEVICE OP INTF B line serves the same function but is used by the second channel interface when the Two-Channel Switch feature is installed.

**Run Meter:** When the node is enabled, the RUN METER line is sent to the device for meter operation.

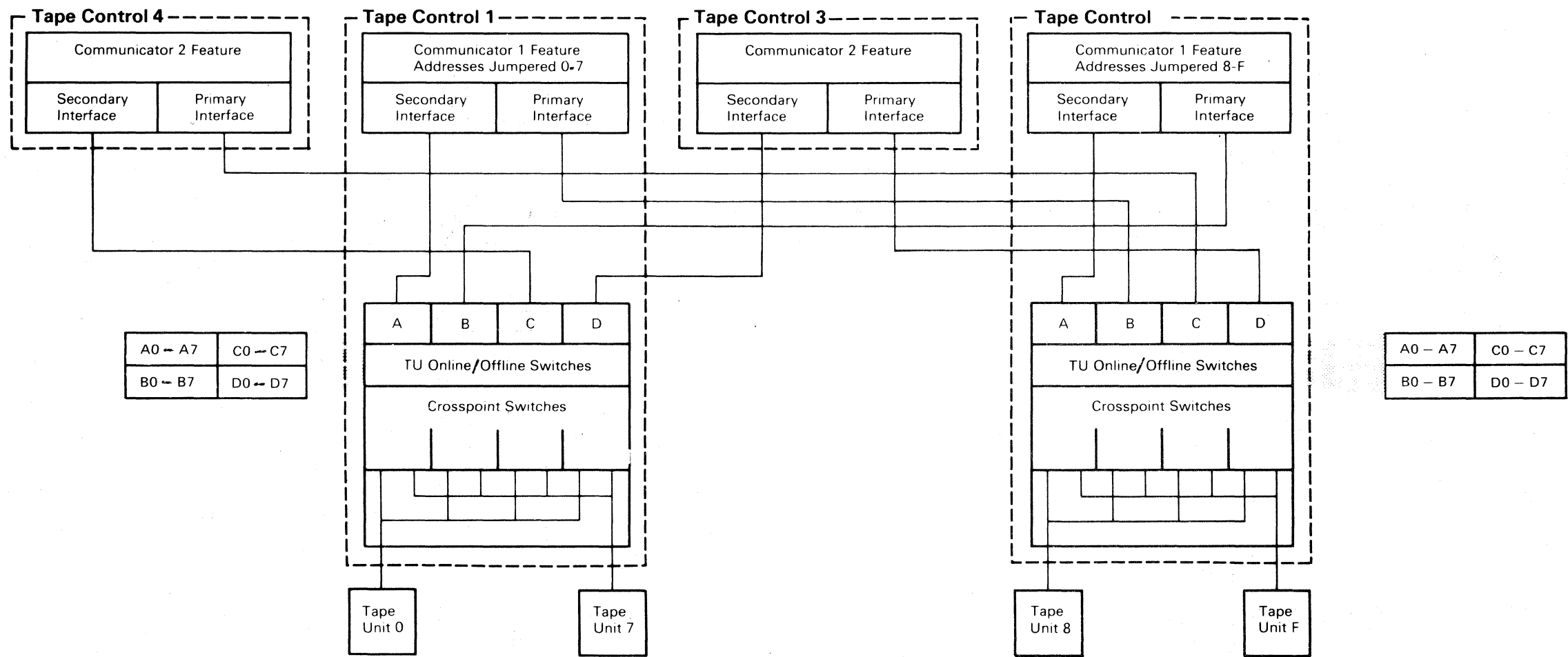
**Set/Reset:** The SET/RESET line is tied active so the ENABLE/DISABLE latch can be set to the corresponding state of the Enable/Disable switch on the operator's panel.

3803-2/3420							
XG3900	2736009	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				



Notes:

- [1] The maximum switch configuration consists of 16 tape units and 4 tape controls.
- [2] Tape units attach only to the tape controls with device switching features.
- [3] Any or all tape controls may have a Two-Channel Switch feature.



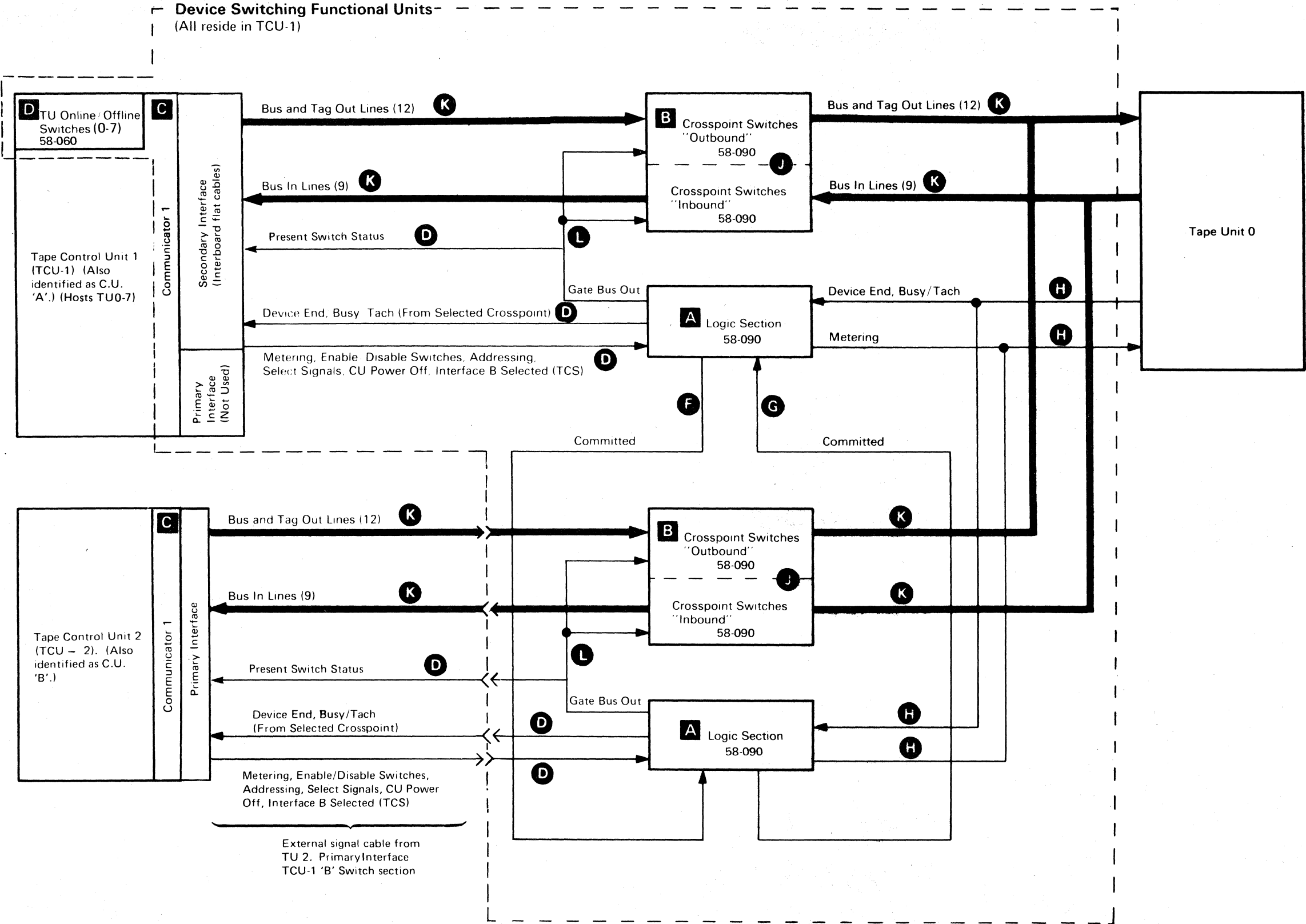
Functional Units of the Device Switch are:

- A Logic Section:** The logic section communicates with the tape control to provide status, device address, and accessing interlocks. The information exchanged establishes tape unit attachment to the tape control and presents switch status to the operating tape control or controls in the subsystem configuration.
- B Crosspoint Section:** The crosspoint section is a switch matrix capable of switching twelve inbound and twelve outbound lines. Each node (tape control/tape unit path) is controlled by the logic section.
- C Communicator:** The communicator replaces the selection logic circuits and associated device interface cabling in the basic tape control with different logic circuits and cabling to the device switches. The communicator divides the device interface into primary and secondary and controls the gating of each according to the address of the device being selected. The communicator consists of interface drivers and receivers.

The Communicator 1 feature has only one external (primary) interface. The Communicator 2 feature has two external interfaces (primary and secondary). The secondary interface connects attached tape units through Switch Section A (58-055, 58-060). The primary interface connects a 3803 that does not have tape units attached to another tape control through Switch Section B.

- D Tape Unit Online/Offline Switches:** Tape unit toggle switches (58-060, 58-100) are located on the operator's panel of each tape control having a device switch feature. These switches enable the operator to determine tape unit availability to each tape control in the configuration. In a 4x16 configuration, four tape controls can access 16 tape units so there are 64 toggle switches, 32 each on Tape Controls 1 and 2. There are no switches in Tape Controls 3 and 4.

**Note:** A, D, F, G, H, K, L refer to charts located in ALD XC-700 pages.



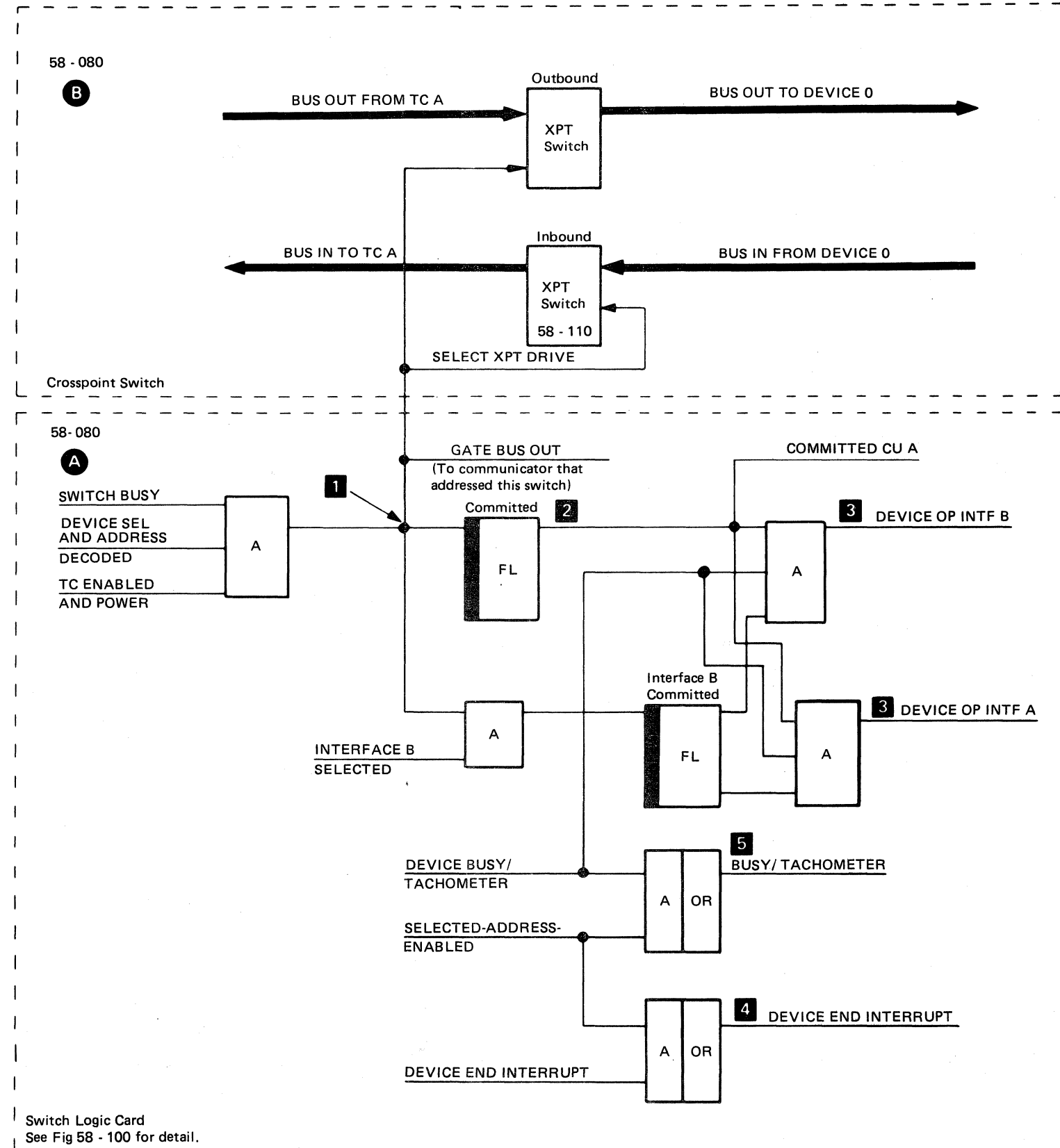
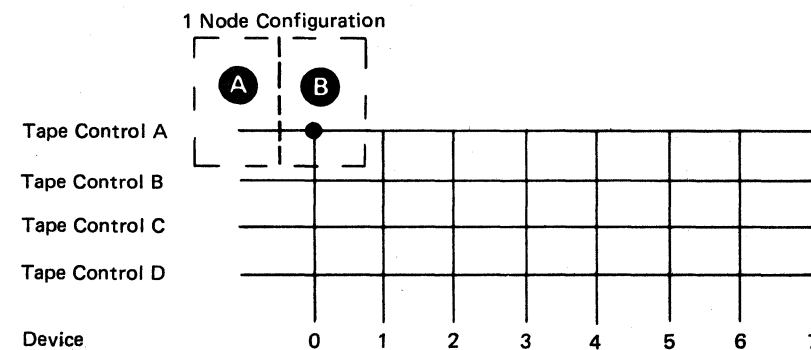
3803-2/3420

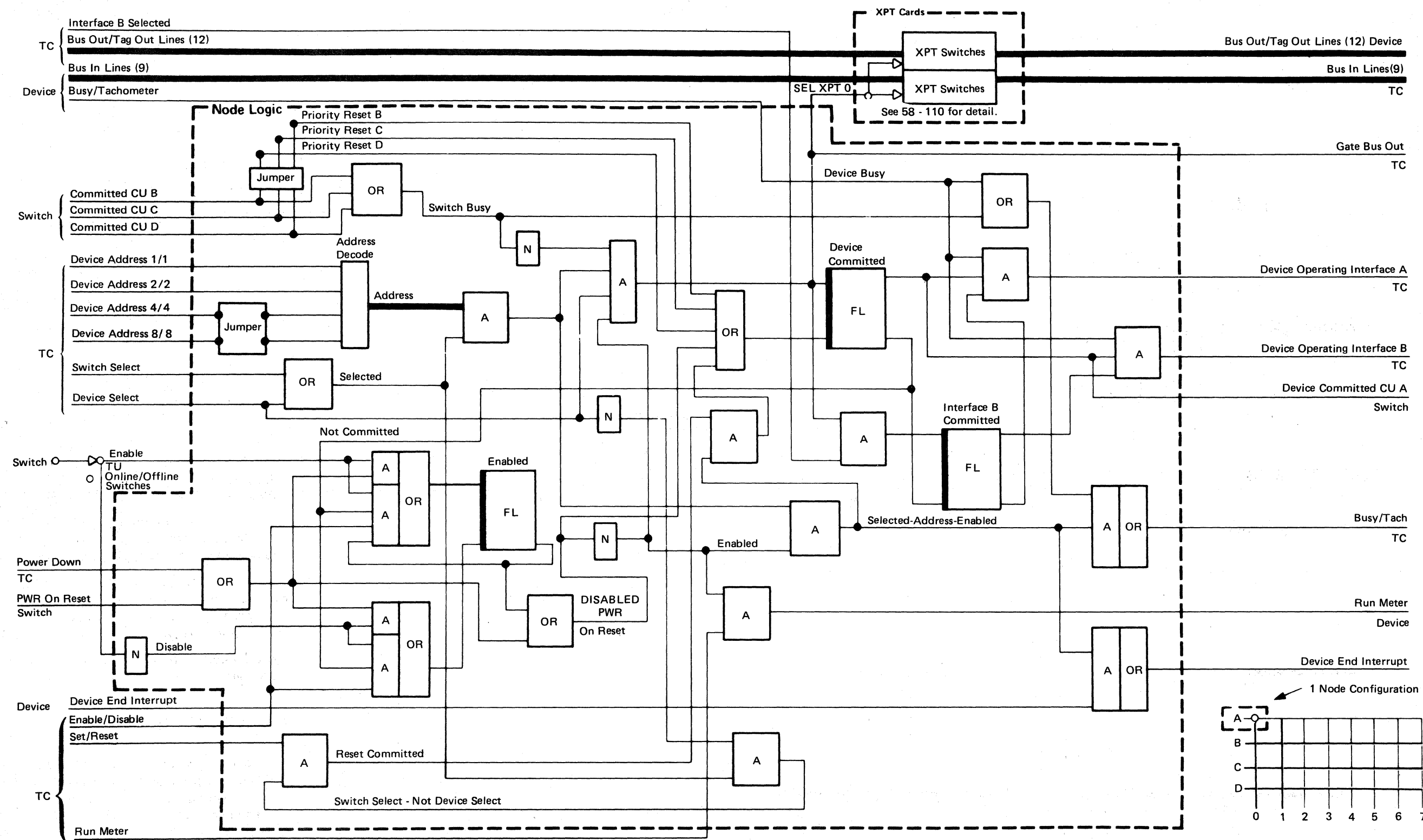
XG4000	2736010	See EC	845958						
Seq 2 of 2	Part Number	History	1 Sep 79						

Gating a control unit to device path node on or off effects switching at the device interface level.

Each node consists of parts of three logic cards. The crosspoint cards (B) contain the electronic switches needed to switch the bus in or bus out lines for a node. The switch logic card (A) contains the circuitry to control the crosspoint switch and communications to the tape controls.

- 1** The crosspoint (XPT) switches are gated by the set to the COMMITTED latch.
- 2** COMMITTED lines prevent simultaneous selection of the same device by more than one tape control.
- 3** INTERFACE COMMITTED, COMMITTED, and DEVICE BUSY are ANDed to generate DEVICE OPERATIONAL, which is sent to the tape control to develop METER IN for the channel interface.
- 4** DEVICE END INTERRUPT lines are scanned by the tape control to determine which tape unit has a DEVICE END INTERRUPT pending.
- 5** BUSY/TACH is available to the tape control when the node is selected and enabled and the DEVICE BUSY or SWITCH BUSY line is inactive.

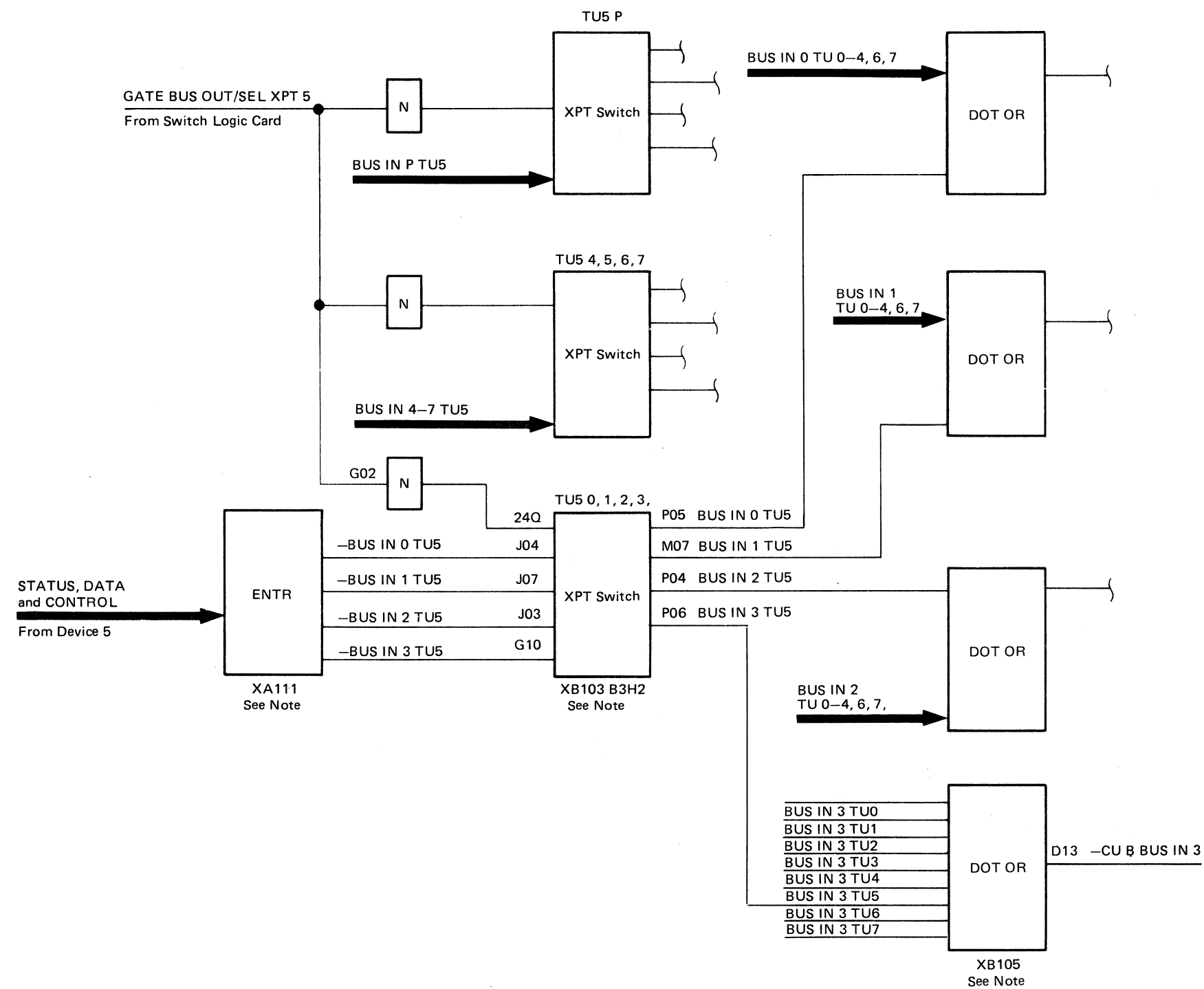




3803-2/3420							
XG4100	2736011	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

© Copyright International Business Machines Corporation 1976, 1979





Note: See ALD pages XCnnn.

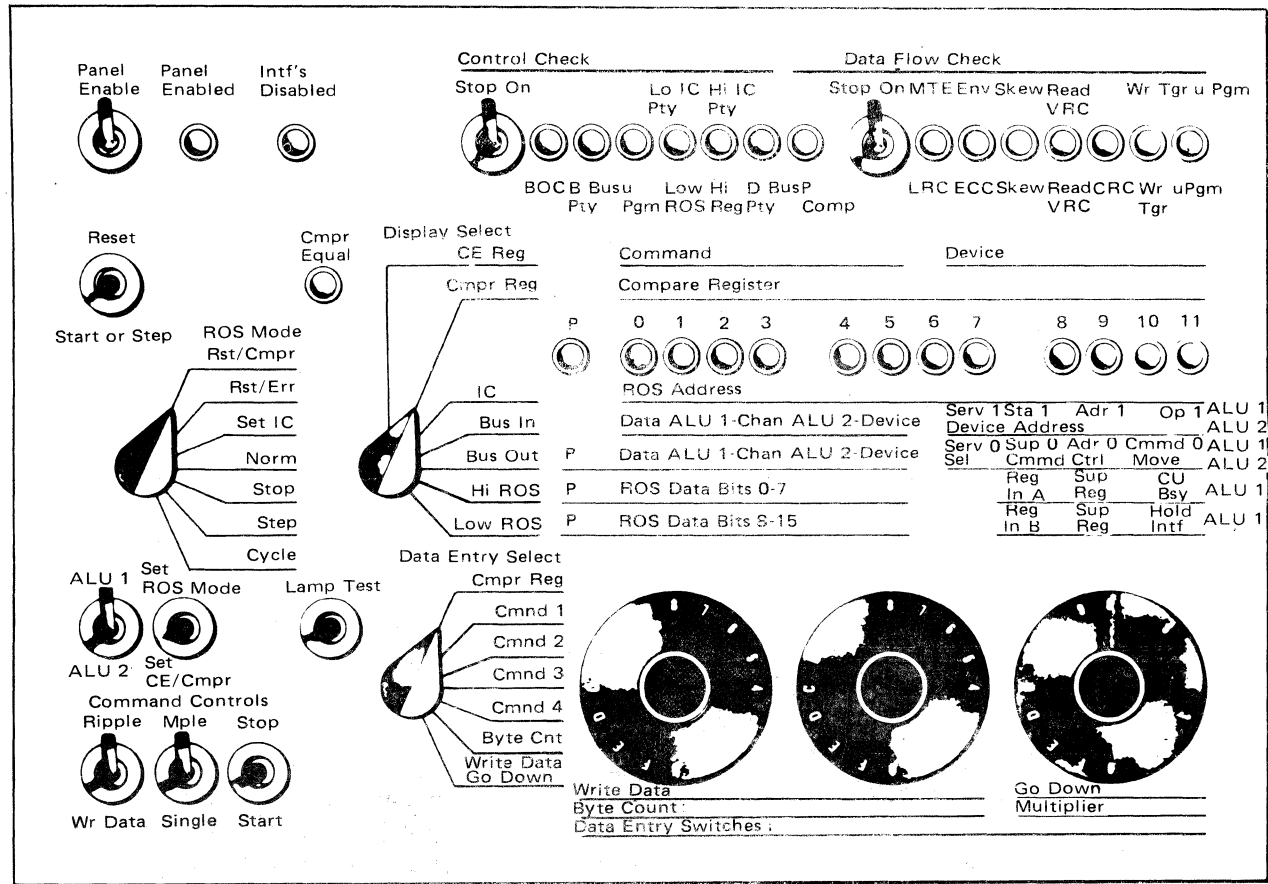
NOTES:

3803-2/3420

XG4200	2736012	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

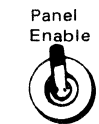
© Copyright International Business Machines Corporation 1976, 1979

3803 CE PANEL DESCRIPTION



CE PANEL SWITCHES

PANEL ENABLE (TWO-POSITION TOGGLE)



Active only if ROS is in normal mode. It may be necessary to raise the Set ROS Mode momentary switch to establish this mode. The Panel Enabled light is ON when the switch is ON.

**Note:** If the Panel Enabled light does not light, set the ROS Mode rotary switch to Norm and operate the Set ROS Mode switch (momentary).

On

Allows the CE panel functions identified by yellow lettering to be performed with the Interface Disabled light either on or off.

Allows all CE panel functions to be performed with the Interface Disabled light On.

Off

Delegates the following functions:

1. Stop On—Control Check
2. Stop On—Data Flow Check
3. Reset/Start or Step
4. ROS Mode
5. Command Control switches (3)

STOP ON-CONTROL CHECK (TWO-POSITION TOGGLE)



Active only while ROS is in Stop mode.

On

Stops both ALUs when any control check is recognized in the ALU selected by the ALU1/ALU2 switch. The exact stopping location depends on the type of error; it is usually two less than the stop address except for a BOC. Generally, microprogram-detected errors will not be recognized until a transfer hardware error (XFR HDWERR) microinstruction is executed. Most other errors will stop the ALUs when the failure occurs.

Disables the compare register equal features of the ROS Mode switch Stop position.

Off

Allows normal tape control operation.

RESET/START OR STEP (TWO-POSITION MOMENTARY TOGGLE)



Active only while the Panel Enabled light is On.

Reset (UP)

Sets both ALUs to Instruction Counter (IC) address 000 and causes a Power-on Reset Branch Condition.

Start or Step (Down)

Starts both ALUs after a stop condition, with subsequent running of the ALUs controlled by the ROS Mode switch. Also resets the Compare Equal light at any time without interlocks.

STOP ON-DATA FLOW CHECK (TWO-POSITION TOGGLE)



Active only while Interface Disabled light is On (CE Mode).

On

Stops both ALUs at the completion of a command in which a failure occurs on Unit Check condition.

Off

Normal tape control operation.

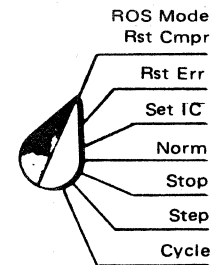
**Note:** When in CE Mode, the tape control stops on Unit Exception, regardless of switch position. To inhibit a Stop-On-Unit-Exception when tape control is in CE Mode, jumper AA1T2J12 to ground.

LAMP TEST (TWO-POSITION TOGGLE)



Allows you to test the CE panel indicator lights.

ROS MODE (SEVEN-POSITION ROTARY)



Active only while the Panel Enabled light is On. After selecting any of the seven positions of the ROS Mode switch, activate the Set ROS Mode momentary toggle switch to set the mode.

Rst/Cmpr

When the IC address of the selected ALU equals the data in the compare register, both ALUs are reset to location 000 and allowed to continue running. (The Display Select switch must be in IC position.)

Rst/Err

When a control check occurs, both ALUs are reset to location 000 and allowed to continue running.

Set IC

Allows the contents of the compare register to set IC of the ALU selected by the ALU1/ALU2 switch.

Norm

Normal running condition of both ALUs.

Stop

When the data in the compare register equals the IC address of the ALU selected by the ALU1/ALU2 switch, and the Display Select switch is in IC position, both ALUs are stopped. The instructions at the stopped addresses will not have been executed.

When the Stop On-Control Check switch is active, both ALUs are stopped only when an error occurs in the ALU selected by the ALU1/ALU2 switch.

**Note:** If compare equal stop function does not work, make sure the Control Check Stop switch is off.

Step

Operating the Start or Step momentary switch allows stepping the ALU selected by the ALU1/ALU2 switch, while the ALU not selected runs normally.

Cycle

Allows the repetitive execution of an instruction at a selected address. Step or stop at the instruction address on which you want to cycle. Set ROS Mode to Cycle and press Start or Stop.

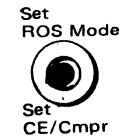
ALU1/ALU2 (TWO-POSITION TOGGLE)



Selects the ALU to be controlled by the ROS Mode switch.

Selects the ALU when the Display Select switch is set to the IC, Bus In, Bus Out, Hi ROS, or Low ROS position.

SET ROS MODE/SET CE COMPR (TWO-POSITION MOMENTARY TOGGLE)



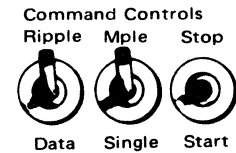
Set ROS Mode

Sets the selected ROS mode.

Set CE/Compr

Sets the data, selected by the three hex rotary switches into the register selected by the Data Entry Select switch. The Set CE/Compr switch operates without the panel enabled or the interface disabled.

COMMAND CONTROLS



Active only while the Intf's Disabled light is on.

Ripple/Wr Data

Establishes the data pattern mode for offline write commands.

Mple/Single

MPLE allows continuous cycling of the four commands entered with the Data Entry Select switch.

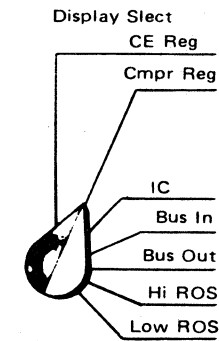
SINGLE allows single stepping of the four commands with each activation of the momentary Start switch.

Stop/Start

STOP halts the continuous cycling of the four commands when the Mple/Single switch is in the MPLE position.

START initiates the commands stored in the CE command registers.

DISPLAY SELECT (SEVEN-POSITION ROTARY)



CE Reg

- 1. Displays command/device in conjunction with Data Entry Select.
- 2. Displays Write Data/Go Down or Byte Ct/Multiplier in conjunction with Data Entry Select.

**Note:** Some stop-on-error conditions stop the CE clock, which prevents displaying the contents of the CE registers.

Cmpr Reg

Displays data currently in the compare register in indicators 0 through 11.

IC

Displays the IC address of the selected ALU in indicators 0 through 11.

Bus In

With ALU1 selected, displays Channel Bus In data in indicators 0 through 7 and In Tags in indicators 8 through 11.

With ALU2 selected, displays TU Bus In data in indicators 0 through 7 and the device address in indicators 8 through 11.

3803-2/3420							
XH0100	2736013	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

Bus Out

With ALU1 selected, displays Channel Bus Out data in 0 through 7, and outbound control or tags in 8 through 11. Parity is only assured when the microprogram activates CHANNEL BUS OUT.

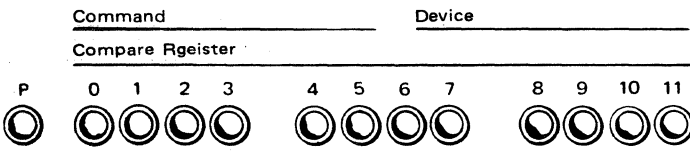
With ALU2 selected, displays TU Bus Out data in 0 through 7 and outbound controls or tags in 8 through 11.

Hi ROS

With ALU1 selected, displays ROS1 data bits 0-7 P1 in 0 through 7 and control lines in 9 through 11.

With ALU2 selected, displays ROS2 data bits 0-7 P1 in 0 through 7 only.

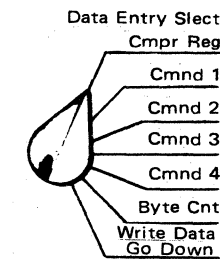
Low ROS



With ALU1 selected, displays ROS1 data bits 8-15 P2 in 0 through 7 and control lines in 9 through 11.

With ALU2 selected, displays ROS2 data bits 8-15 P2 in 0 through 7 only.

DATA ENTRY SELECT (SEVEN-POSITION ROTARY)



Cmpr Reg

Allows data in the three Data Entry switches to be entered in the compare register.

Cmnd 1, 2, 3, and 4

With the Data Entry Select switch in one of the four positions (Cmnd 1, 2, 3, or 4), a command and its associated device address (0-F) may be entered into one of the four command positions.

Byte Cnt

The three Data Entry switch positions determine the total byte count. The left and center switches count to a maximum of 256. The right, or Multiplier switch counts in multiples of 1024. Position zero of the Multiplier switch adds zero to the total of the other two switches. Position 1 would add 1024, 2 would add 2048, etc. To provide a byte count of 3140, set the left and center switches each to 4, and set the right switch to 3.

**Note:** Check to ensure you get the correct byte count.

Byte Count Dialed	Byte Count Written
00 to FE	Byte Count dialed +3
FF	2

Write Data Go Down

Write Data and Go Down determine those bits to be written and establishes the go-down time. The left and center data entry switches determine the bits to be written. For example, the Ripple/Wr Data switch in Wr Data, 8 in the left switch, and 3 in the center switch writes the following:

0	1	2	3	4	5	6	7
1	0	0	0	0	0	1	1

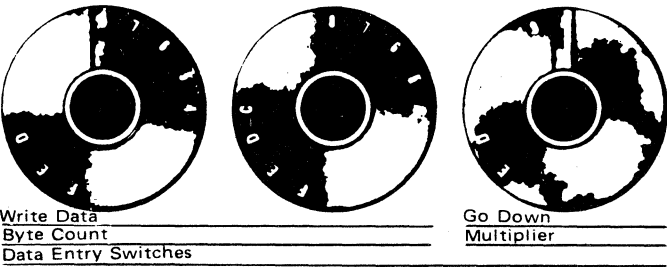
**Note:** The P bit is automatically generated when required.

The right switch determines the go-down time. Position zero gives a go-down of 6.0 milliseconds. The total range is from 6.0 milliseconds to approximately 0.5 second. Each position, 0 to F, represents approximately 26 milliseconds. A setting of 3 results in a go-down time of 6 milliseconds + (3 x 26), or approximately 84 milliseconds.

- To write continuously, jumper from AA1R2J12 to ground.
- To do an LWR with go-down time, jumper from AA1S2G08 to ground.

Data Entry

The three rotary switches are used to enter data into various registers. Set a command into the left switch and the TU address into the right switch. For example, 01A entered into the Command register indicates a write command to device A.



CE PANEL INDICATORS

INTF'S DISABLED



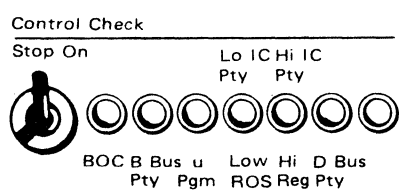
Indicates when the tape control is offline. The manual Enable/Disable switch(es) on the CU operator's panel must be in Disabled position before the lamp comes on.

CMPR EQUAL



Indicates that the data entered in the CE/Compare register equals that contained in any register selected for comparison.

CONTROL CHECK INDICATORS



BOC

Checks the 16 branch conditions not checked by the HI IC PARITY/HI ROS register circuits. (A total of 32 BOCs are checked.) If an even number of BOC groups are active, a BOC error is indicated.

B-Bus Parity

Checks the output of an LSR for odd parity on the B Bus on instructions which transfer data from ALU to an external register. If parity is even, the error is gated to the hardware error latches and CE panel indicator.

**Note:** When displaying the LSRs, B-Bus parity errors can occur because LSRs are not set to odd parity with power-on reset.

Hi IC Pty/Hi ROS Reg Pty

The circuits that set this indicator are:

- Hi IC parity check.
- Hi ROS register parity check.
- Instruction Decode error. (ROS instruction check to be sure only one ROS operation was decoded.)
- BOC Error. (Check of 16 branch conditions.)

Lo IC Pty/Low ROS Reg Pty

Checks parity of the IC (low order) and ROS register (low order). An even parity error sets the HARDWARE ERROR latch and CE panel indicator. Lo IC Parity is checked only on a BU or a successful BOC. Low ROS Parity is checked on every instruction cycle.

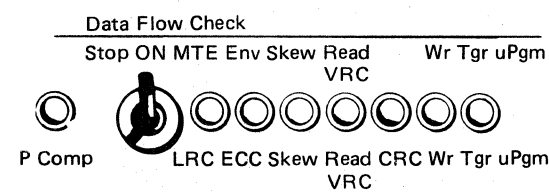
D Bus Pty

Checks the parity of information to be stored in an LSR at 100 ns time. Bits 0-8 from the D Bus are exclusive-ORed with the P bit from Bus Out. Even parity sets the D BUS PARITY ERROR latch and HARDWARE ERROR 5 latch, and lights the CE panel indicator. This error condition is only checked on a transfer of data into the ALU from an external source.

U Pgm

Monitors the selected ALU and signals an error when the ALU detects any hardware error, including checkout errors for both ALUs.

Data Flow Check Indicators



P Comp

- The P Comp indicator (also C Compare) is set by the following conditions:
- 1. When parity of the byte sent to the channel buffer on read operations is wrong.
  - 2. Buffer Overrun.
  - 3. Write Address error.
  - 4. If CHANNEL BUFFER READ IN counter gets out of step.
  - 5. Write buffers are empty when a write tape cycle occurs.

- 6. Parity does not match between the channel buffer and the write buffer outputs on write operations.
- 7. When operating in 7-track data convert mode and a count of bits before and after conversion does not match.
- 8. When operating in 7-track mode with the Data Converter off and the count of bits for each byte as it enters and leaves the register fails to compare.

MTE/LRC

- 1. Set during a 6250 bpi write operation when there are two or more error pointers:
- 2. Set during a PE operation when there are two or more error pointers.
- 3. Set during a NRZI operation when a block has an odd number of bits in any track (LRC).

ENV/ECC

- 1. Set when any track signal falls below threshold on read or write. Does not set Data Check.
- 2. Set during a PE operation when any error pointer is set or when any track falls below threshold. Sets Data Check on write only.
- 3. Set during a NRZI write operation if NRZI Register 2 has incorrect parity.

Skew

Set when vertical misalignment of bits exceeds acceptable limits. (If all bits in a byte are not received by the read circuits within a specified period, the bit has excessive "skew" and Skew Error is set.)

Skew Error is set:

- 1. During a 6250 bpi/PE read operation if RIC leads ROC by 30 bits.
- 2. During a 6250 bpi write operation if RIC leads ROC by 14 bits.
- 3. During a PE write operation if RIC leads ROC by 4 bits.
- 4. During a NRZI write operation by skew gate.

Read VRC

- 1. 6250 bpi Mode
  - a. Set during single-track error correction if a match is not found.
  - b. Set during a write operation if hardware pointer and correction code indicate different tracks.
- 2. Set during a PE operation if a parity error occurs and no track pointers are on.

CRC

Set during 6250 bpi and 9-track NRZI operations when the CRC byte calculated for a read operation does not match the CRC byte written on tape.

Wr Tgr

Set when the output of the write triggers has incorrect parity.

U Pgm

Set when ALU2 detects any microprogram error, including End Data Check on PE operations, and any error indicated in sense byte 8, bits 0-6; sense byte 9, bit 1; and sense byte 10, bits 0-7.

NOTES ON CE PANEL OPERATION

- A Start I/O command to a tape unit that has Unit Check or Busy in its initial status byte will prevent stepping to the next command. This condition can be caused by a Not Ready tape unit.
- CE command sequence hang up: when an error occurs on a 3803 with the Two-Channel Switch (TCS) feature installed, a "contingent connection" is established without Stop On Error ON. This is caused by dedicated sense data from the failing tape unit. There are three ways to proceed:
  - 1. Issue a Sense command to the same tape unit after any other type of command.
  - 2. Issue all four internal program commands, except a Test I/O or NOP, to the same tape unit. A Mode Set command can also cause a hang condition, so it may be necessary to replace this command following initial setup.
  - 3. In order to allow command cycling to multiple tape units without changing the command setup, set ROS Mode to Rst/Cmpr using IC address 302 on ALU1. This restarts both microcodes at 000 on contingent-connection conditions and performs a general reset. To eliminate the need for pressing the CE Command Start pushbutton, connect a jumper from AB2Q2S10 (General Reset FC041) to AA1T2G05 (Start Key Latch PK035).

XH0200	2736014	See EC History	845958					
Seq 2 of 2	Part Number		1 Sep 79					

TOOLS AND TEST EQUIPMENT

The tools and test equipment listed in this section are required to properly service 3420 Magnetic Tape Units and 3803 Tape Controls.

KEPT AT THE BRANCH OFFICE	
Part	Name
1848621	Stress Tape (order from Mechanicsburg)
432152	Master Signal-Level Tape (order through IRD Sales) (See Note 1.)
451064	Degausser (See Note 1.)
453522	Developing Solution
453585	*Digitec 251 Meter (Digitec 201 Meter, P/N 453046, may be used if available)
460874	Scale, 0 to 6 pounds (belt adjustment)
2515376	Capstan Prealignment Gauge
2515390	Capstan Adjustment Wrench (rear adjustments)
2515401	Reel Motor and Hub Adjustment Tools: (see 08-460)
2523723	Capstan Adjustment Wrench (front adjustments)
5861448	7-Track NRZI Threshold Adjustment Card
5861455	PE Threshold Adjustment Card
5861452	Dual Density Threshold Adjustment Card
* Trademark of United Systems Corporation	

KEPT AT THE CUSTOMER'S ACCOUNT	
Part	Name
453511	Tape Transport Cleaner Scratch tape Oscilloscope (Model 453, 454, 561, 545, 766H or equivalent)
352465	Tape Cleaning Kit
432641	Master Skew Tape (See Note 1.)
453500	Manometer, 30 inch (two needed for series connection) (See Notes 1 and 2.)
453504	Tee and Hose Assembly (See Note 2.)
453522	Tape Developing Solution
1765342	Tape Unit Tester
1846251	Shim, Right Reel Hub Alignment
1846252	Hex Wrench, Right Reel Hub
2512745	Adapter Hose (See Note 2.)
2513154	Pressure Divider (See Note 2.)
2501611	Tape Unit Cleaning Brush
2512063	Crimper (supplied by marketing representative)
2515390	Capstan Box Wrench (read adjustment capstan only)
1848621	6250 bpi Stress Tape
<b>Notes:</b>  1. Discussed in more detail in this section. 2. Not needed if pressure/vacuum gauge P/N 5495384 is available.	

MASTER TAPES

Master skew tapes and master signal-level tapes are manufactured to rigid specifications. They are the standards that are used by CEs to obtain optimum tape unit performance.

Because tape unit performance is directly affected by the accuracy of these master tapes, the following precautions should be taken:

- 1. Use master tapes only for their intended purpose.
- 2. Handle tapes with care.
- 3. Make only full-reel passes in order to have even wear throughout the length of the tape.
- 4. Identify master tapes as such and mark the reels with the letter "m," as a reminder to make full passes only.

MASTER SKEW TAPES

Master skew tapes have a density of 800 FCI and are written with one solid bit across the width of the tape. These tapes are written on a specially adapted tape unit at the Tape Test Center with accuracy held to within 0.375 usec total skew between the leading and lagging bits of a 112 ips tape unit.

The master skew tape will run off the reel when reading forward because it is written with no interblock gaps (IBGs). In order to create an IBG and save time during skew adjustments, make the following alterations to the master skew tape:

- 1. Read the master skew tape forward to the end of tape EOT reflective marker.
- 2. Install a write enable ring.
- 3. Write one record of any size beyond the EOT marker.
- 4. Remove the write enable ring.
- 5. Rewind the tape.

After the preceding one-time preparatory steps, set the tape control CE panel as follows when you use the skew tape:

- 1. Command 1-Read Forward ('02')
- 2. Command 2-Read Backward ('0C')

- 3. Command 3-Read Forward ('02')
- 4. Command 4-Read Backward ('0C')

The master skew tape will read forward to the end of the reel, read backward, and repeat the cycle. This permits checking skew from the rear of the tape unit without manipulating the controls.

MASTER SIGNAL-LEVEL TAPES

Master signal-level tapes have the ability to produce a signal to within  $\pm 2\%$  of the primary master. (A primary master, which is established as an IBM standard, is the base for instrument alignment.)

All new master signal-level tapes are checked at 3200 FCI and 800 FCI. The suffix letter "A" is added to the part number to allow field identification of 3200/800/556 FCI tapes as opposed to the former 800/556 FCI tapes. Thus, for example, a master signal-level tape checked out at both 3200 FCI and 800 FCI would have P/N 432152A.

DEGAUSSER

**Caution: The degausser will demagnetize any material such as tape, disks, etc. Power off the tape unit.**

To degauss the read/write head:

- 1. Remove magnetic tape from the tape unit. Do not place the tape on top of the tape unit.
- 2. Plug degausser into 110 Vac receptacle.
- 3. Press the pushbutton on the degausser while it is at least 1 foot (30,5 cm) away from the read/write head and move it slowly toward the head.
- 4. Hold the degausser against the front surface of the head for about 10 seconds.
- 5. Pull the degausser straight away from the head very slowly to a distance of at least 1 foot (30,5 cm) and release the pushbutton.

XH0300	2736015	See EC	845958	846627A	847298			
Seq 1 of 2	Part Number	History	1 Sep 79	3 Dec 80	15 Aug 83			

WATER MANOMETER

**Note:** The use of a 30 inch (76,20 cm) manometer or the 80 inch (203,20 cm) pressure/vacuum gauge is not dependent on the English (metric) system of measurement.

Use the requested tool by part number and name, and measure to the specified units (whether metric or English) to obtain the desired adjustment or reading.

Shown are several setups for using the water manometer, part number 453500. Part A shows a single manometer measuring a pressure of less than 30 inches (76,20 cm). Part B shows two manometers in series measuring a pressure between 30 and 60 inches (76,20 cm and 152,90 cm). Part C shows using the pressure divider and a single manometer measuring a pressure greater than 30 inches (76,20 cm).

General instructions for using the manometer are:

- 1. Remove the tee from the tee and hose assembly, and connect the hose on the line to be checked.
- 2. Set up the water manometer by opening both top valves one full turn from closed position. (Incorrect readings will occur if valves are opened too far.)

- 3. Fill the water manometer with tap water, maintaining the water level near the 0 position on the scale. Zero the manometer by sliding the scale up or down until the 0 mark lines up within 0.2 inch (5,7 mm) of the bottom of the meniscus in both columns.
- 4. Set conditions for the specific item to be checked according to the pneumatic-adjustment decal located on the transfer valve and manifold.
- 5. Read the vacuum level. (The vacuum level is the sum of the displacement of the water level in each column.)

PROCEDURES

**Note:** Take readings at bottom of meniscus.

- 1 Using a single manometer to measure a pressure of less than 30 inches (76,20 cm). Read at bottom of each meniscus and add the two readings together to get total pressure (W).  $W = 2.0 + 1.7 = 3.7$ .

- 2 Using two manometers in series to measure a pressure between 30 and 60 inches (76,30 and 152,40 cm). Read at bottom of each meniscus and add the four readings together to get total pressure (the sum of X + Y).  $X + Y = 2.0 + 1.7 + 2.0 + 1.7 = 7.4$  inches.
- 3 Using a pressure divider with a single manometer to measure a pressure of greater than 30 inches (76,30). First, measure a known pressure of less than 30 inches. Second, insert the divider and adjust the divider's adjusting screw until the manometer reading is 40% of its original reading. Third, measure the pressure of greater than 30 inches by reading at the bottom of each meniscus, adding the two readings together (to get Z), and multiplying Z by 2.5 to get pressure.  $2.5Z = 2.5(2.0 + 1.7) = 2.5(3.7) = 9.25$  inches. The maximum reading possible with this combination is 75 inches (190,50 cm).
- 4 Using a pressure/vacuum gauge to measure a pressure greater than 80 inches (203,20 cm).
  - a. Measure a known pressure less than 80 inches (203,20 cm).

- b. Insert the pressure divider between the measurement part and the gauge and adjust the divider's adjusting screw until the gauge reads 40% of its original reading.
- c. Measure the pressure greater than 80 inches (203,20 cm) and record the reading (Z).
- d. Multiply Z by 2.5 to get the total pressure.

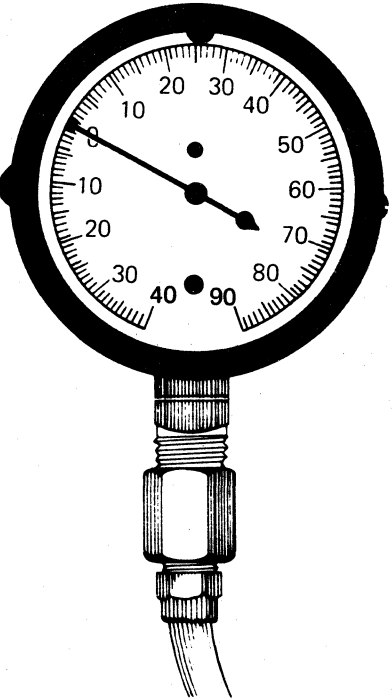
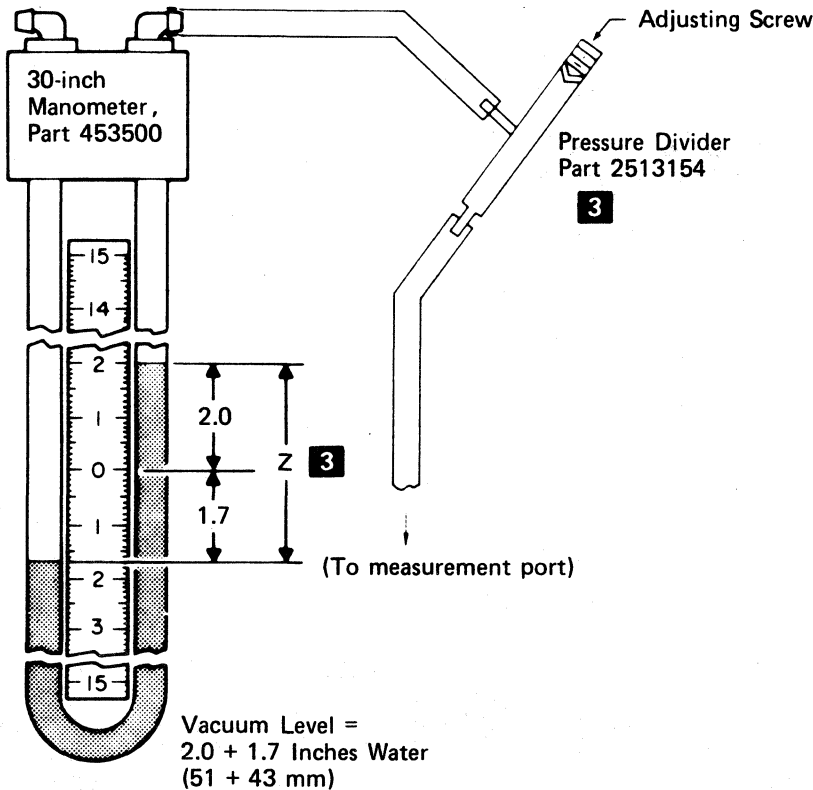
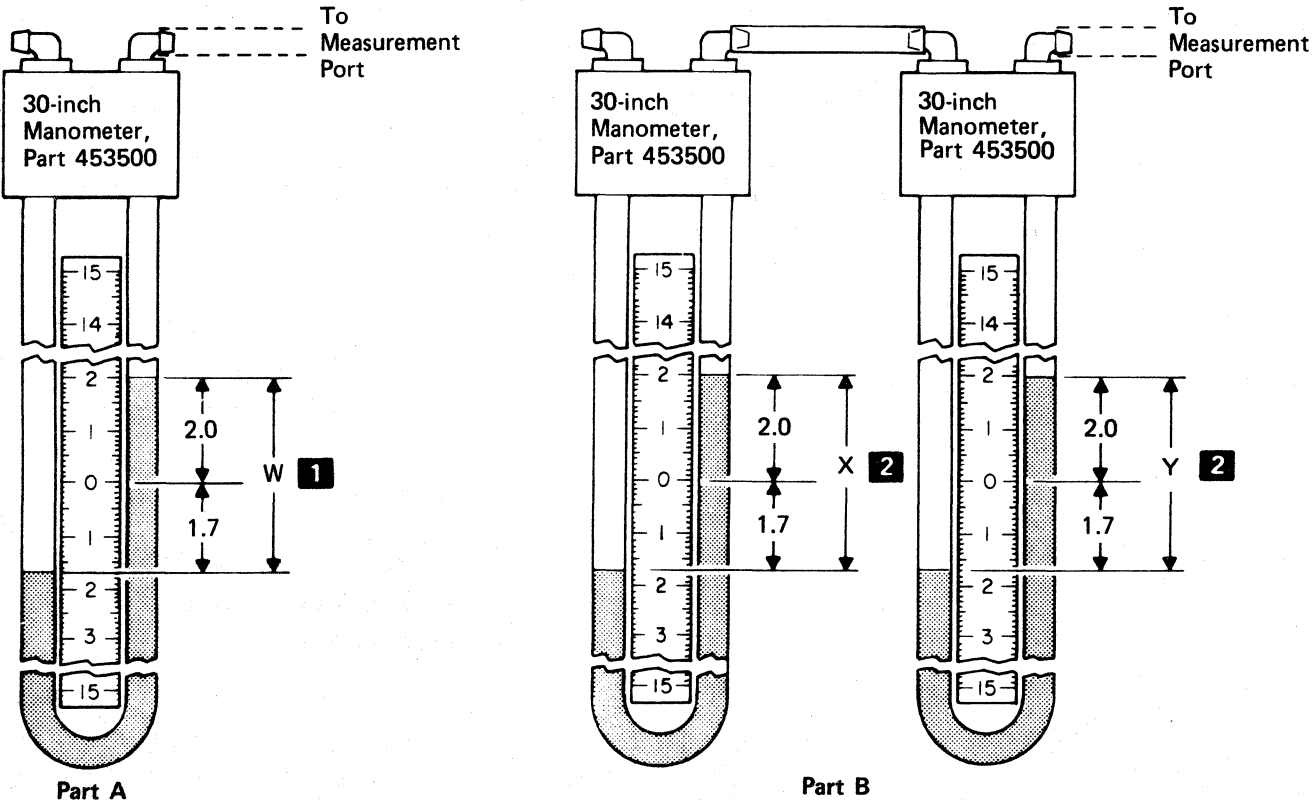
**Example:** If Z reading is 33.2,  $33.2 \times 2.5 = 83.0$  inches

PRESSURE/VACUUM GAUGE

Shown below is pressure/vacuum gauge, part 5495384. To use the gauge:

- 1. Attach the gauge hose to the fitting to be tested.
- 2. Read the dial directly in pressure or vacuum. (For measurements above 80 inches (203,20 cm), add 1 inch (2,54 cm) to the reading for each 1/16 inch (1,59 mm) of pointer travel beyond the end of the scale.)

**Caution:** Disconnect from test point before loading or unloading tape unit to prevent damage or miscalibration of gauge.



3803-2/3420	XH0300	2736015	See EC History	845958	846627A	847298			
Seq 2 of 2	Seq 2 of 2	Part Number		1 Sep 79	3 Dec 80	15 Aug 83			



3420 FIELD TESTER

Caution: Use extreme care when attaching the field tester because an error can damage the tape unit, the tester, or both. Be sure to use only the 3420 field tester, part 1765342, when doing offline maintenance on 3420 tape units. Do not use the 2420 Field Tester. When testing Models 4, 6, and 8, a field tester at EC level 734316 must be used. A temporary jumper must be installed from K2P02 to M2D06 for 6250 operation.

When operated with the field tester, the tape unit loads and unloads tape, reads, writes, and moves tape forward or backward.

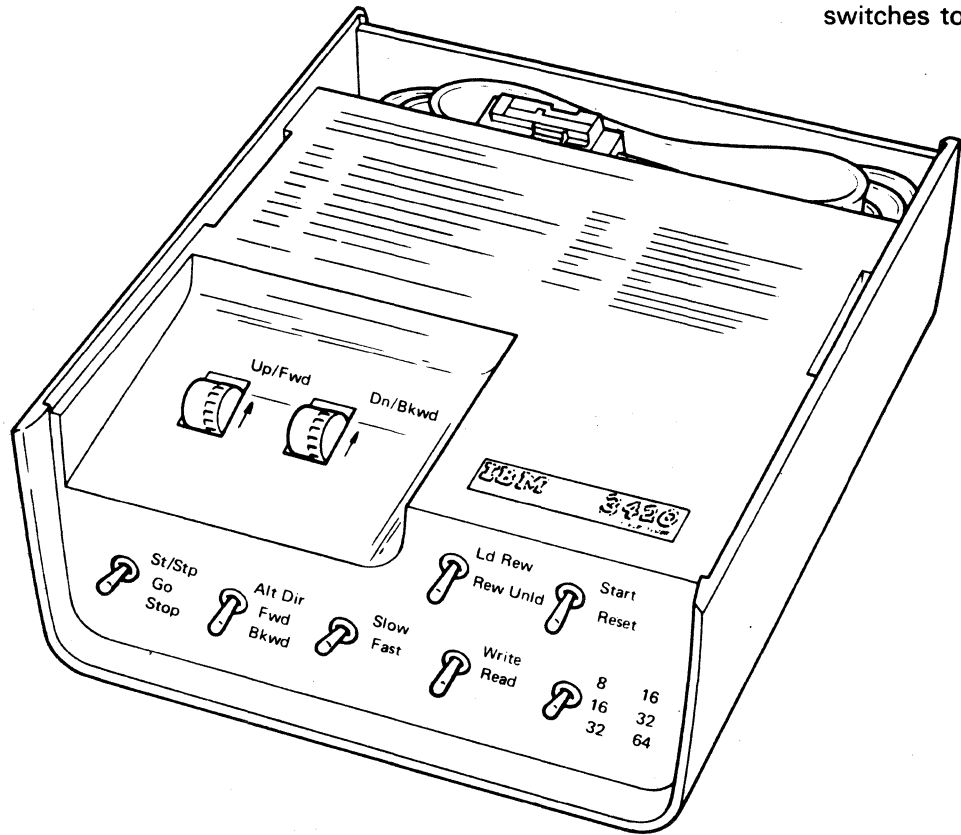
To test several tape units simultaneously, use the manual controls on the tape control CE panel.

To use the field tester:

- 1. Unload the tape unit.
- 2. Switch the unit off line at the logic gate. To ensure that the on-off line switch circuitry is operating correctly, monitor the - interface disable and + int dis or - off lines. Refer to page FT910 of the 3420 ALDS. Check the following levels for proper operation of the on-off line switch circuits.

Position of On-Offline SW	A1L6D04	A1L6B03
Online	+6v	-4v
Offline	Gnd	Gnd

- 3. With the arrow on the cable pointing up, plug the tester into the wiring side of the logic gate at location A1N5. Another way to be sure the cable is plugged correctly is to make sure the notches on the cable connector are toward the center of the logic gate. Select, on the tape unit operator's panel, comes on when the Read/Write switch is in the READ position, or in the WRITE position with the MOVE tag active. You can now use the tester switches to load and Ready the tape unit.



Caution: The field tester can cause tape dump and damage under the following conditions:

- 1. When moving tape with field tester, the direction switch position is changed before activating "Stop".
- 2. When attached to a tape unit and set to "Fwd" and either "St/Stop" or "Go", the tape unit is loaded and goes to Load Point and becomes Ready. If RESET on the tape unit console is activated and the tape unit does not dump tape, and then Reset is followed by activating UNLOAD, the tape will run off the end of the reel.
- 3. When using "Alt Dir", RESET is activated on the tape unit.

Conditions 1, 2, and 3 above can be eliminated by always putting the tester in "Stop" before doing any other operation.

The switches on the tester operate the tape unit by remote control as follows:

Start/Reset

Operates the same as the control on the tape unit operator's panel. Start makes the unit ready. Reset resets the unit.

Ld Rew/Rew Unld

Ld Rew loads tape if none is loaded, and rewinds tape to load point if tape was loaded but is not at load point. Rew Unld rewinds tape from any position, unloads the unit, closes the cartridge if one is used, and lowers the power window.

Up/Fwd

Up/Fwd controls either the time the MOVE line is active during a start/stop operation, or the duration of forward motion in an alternate-direction operation.

Dn/Bkwd

Dn/Bkwd controls either the time the MOVE line is inactive during a start/stop operation, or the duration of backward motion in an alternate-direction operation.

St/Stop/Go/Stop

St/Stop causes interruptions in tape motion. Use the Up/Fwd control and Slow/Fast switch to adjust go-up

time. Use the Dn/Bkwd control and Slow/Fast switch to adjust go-down time. Go ensures continuous tape movement. Use the Alt Dir/Fwd/Bkwd switch to control direction. Stp halts tape motion.

Alt Dir/Fwd/Bkwd

St/Stp/Go/Stop switch must be at Go to enable this switch. Alt Dir is active in read status only; it moves tape alternately forward and backward. Use Up/Fwd control and Slow/Fast switch to adjust duration of forward movement. Use Dn/Bkwd control and Slow/Fast switch to adjust duration of backward movement. Fwd causes forward tape motion. Bkwd causes backward tape motion.

Slow/Fast

This is a range switch for the Up/Fwd and Dn/Bkwd controls. Slow extends the go-up/down timing range to approximately 3.0 seconds. Fast decreases the go-up/down timing range to approximately 7.0 ms.

Write/Read

Write causes the tape unit to write with gaps. Each time the tape unit writes, as in a start/stop operation, it generates a PE gap of 0.528 inch (13,4 mm) and a GCR gap of 0.275 inch (7,0 mm). Read causes continuous reading.

8/16/32 (Models 3, 5, 7) See Note

This switch controls the frequency of the tester's write oscillator. The three positions result in write frequencies of 800 fci (NRZI), and 1600 and 3200 fci (PE), respectively.

16/32/64 (Model 4, 6, 8) See Note

When a field tester at EC level 734316 is used on 3420 Models 4, 6, and 8 with the provided jumper installed, these switch positions represent 1600, 3200, and 6400 fci as the label shows. Frequencies generated by the tester are for practical offline test only. Do not confuse these tester frequencies with normal online recording densities.

Note: The back panel wiring on cable position A1N5 on Models 4, 6, and 8 is such that the frequency of the tester is doubled.

NOTES:

80-030

3803-2/3420

XH0400	2736016	See EC	845958	846627A	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	3 Dec 80	15 Aug 83			

© Copyright International Business Machines Corporation 1976, 1979, 1980, 1983

80-030

GENERAL CLEANING INSTRUCTIONS

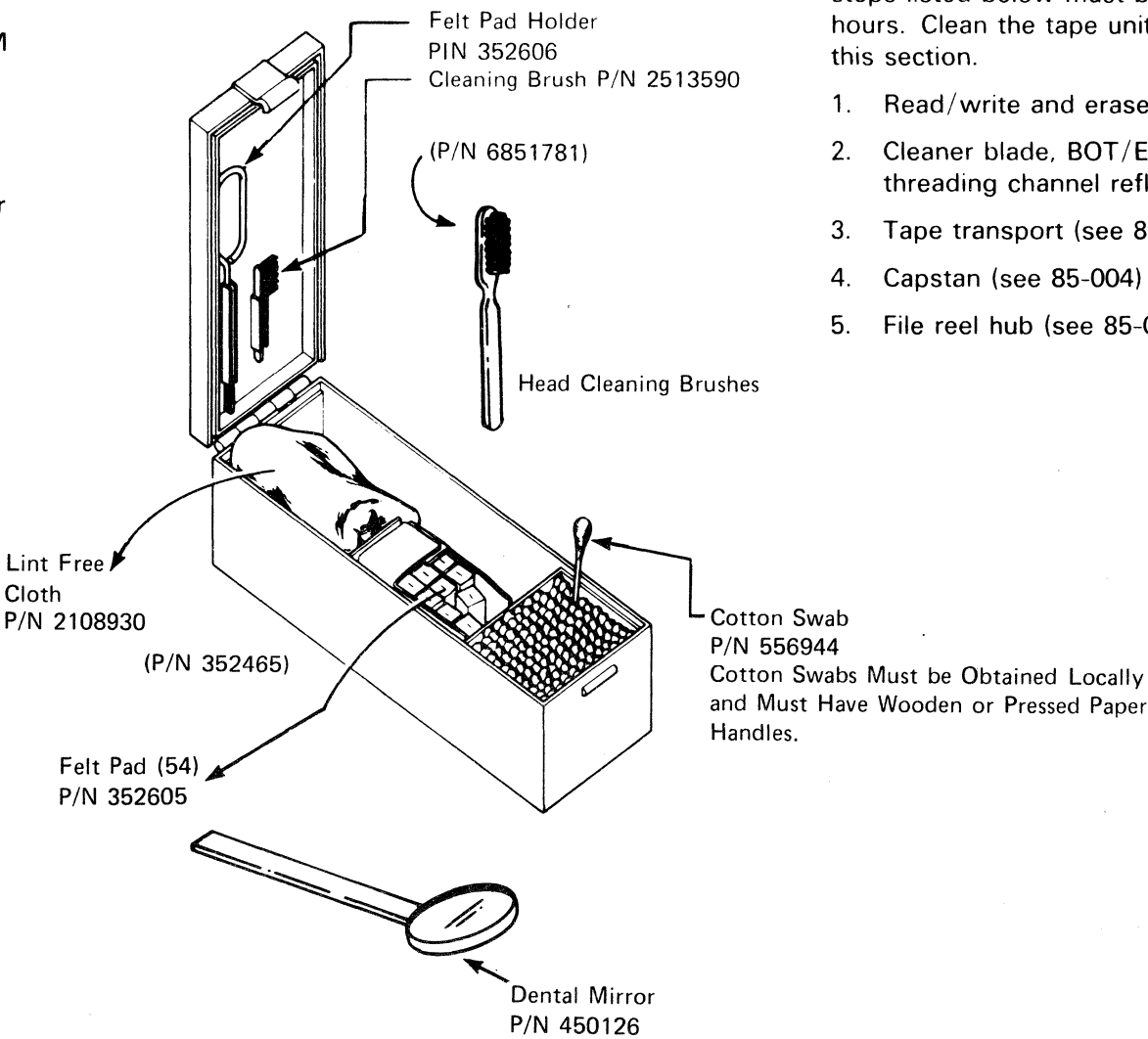
This procedure makes all previous 3420 tape unit cleaning procedures obsolete.

Items used by this procedure are contained in the IBM Tape Cleaning Kit, part number 352465 (see Figure 1).

Use IBM tape transport cleaner, part 8493001. Performance results cannot be guaranteed when other chemical formulations are used. Other chemical formulations have not been tested by IBM, and their use may impair performance or cause damage to the tape unit or tape.

**DANGER**  
When using tape cleaner, do not get it on skin or clothing. Follow the instructions on the container. Do not use metal instruments to clean any part of the tape unit.

Figure 1. IBM Tape Cleaning Kit



DAILY CLEANING PROCEDURE

To promote reliable tape unit performance, all of the steps listed below must be performed every eight hours. Clean the tape unit in the sequence presented in this section.

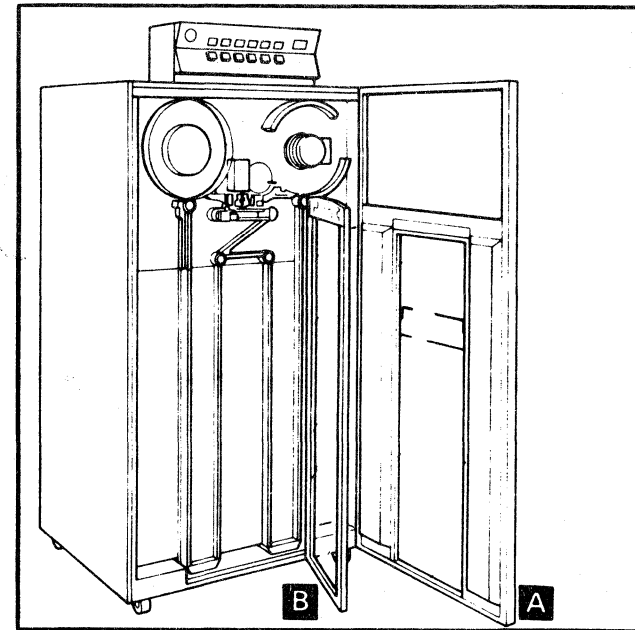
1. Read/write and erase heads (see 85-001)
2. Cleaner blade, BOT/EOT block, rewind plunger, and threading channel reflector (see 85-002)
3. Tape transport (see 85-003)
4. Capstan (see 85-004)
5. File reel hub (see 85-004)

3803-1,2,3/3420							
XH0500	2736017	See EC	845958	846927	847298		
Seq 1 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83		

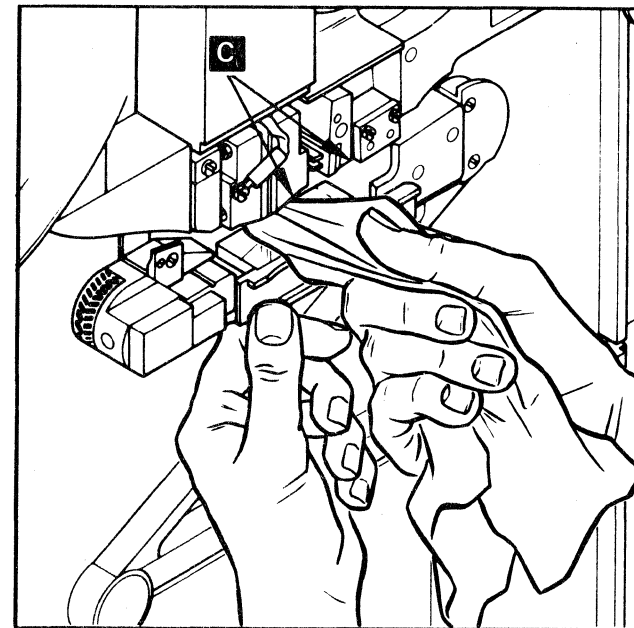
TAPE UNIT CLEANING PROCEDURE FOR  
3420 MODELS 3 THROUGH 8

## 1. R/W AND ERASE HEADS

- 1.1 Unload tape and remove from tape unit.  
1.2 Open outer **A** and inner **B** doors.



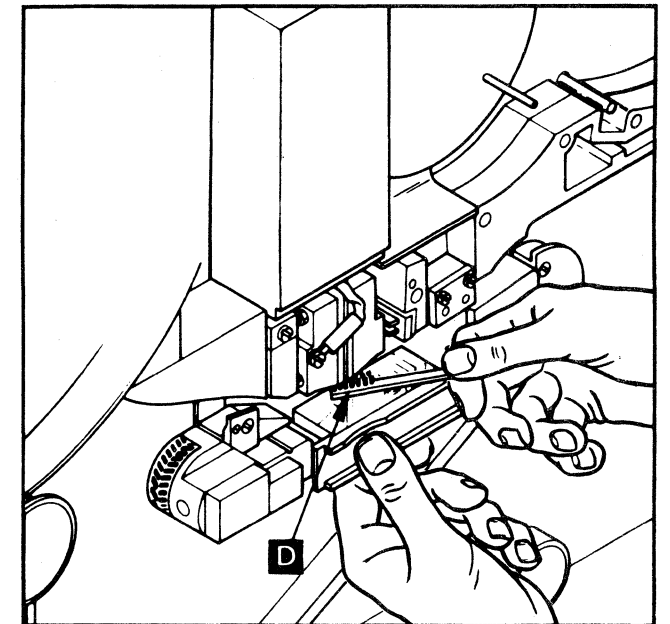
- 1.3 Dampen clean area of lint-free cloth with tape cleaner.  
1.4 When cleaning Models 3, 5, and 7, hold the inspection mirror down, use dampened cloth to clean the R/W and erase heads **C** using a circular motion.  
1.5 When cleaning Models 4, 6, and 8, hold autocleaner in and clean the R/W and erase heads **C** with a dampened cloth using a circular motion. To reach the inside tracks, wrap the dampened cloth around a cotton swab.  
1.6 Repeat steps 1.3 and 1.4 or 1.5 until cloth remains clean.



- 1.7 Use inspection mirror for Models 3, 5, and 7 or dental mirror for Models 4, 6, and 8, to carefully inspect heads. (Clean mirror with dry cloth, if dirty.) If heads do not look clean, perform step 1.8, otherwise wipe heads with dry clean cloth and go to step 2.

## To remove stubborn residue from heads—

- 1.8 Use either style head cleaning brush dampened with tape cleaner to remove residue **D** and then return to step 1.3.



3803-1,2,3/3420

XH0500	2736017	See EC	845958	846927	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			

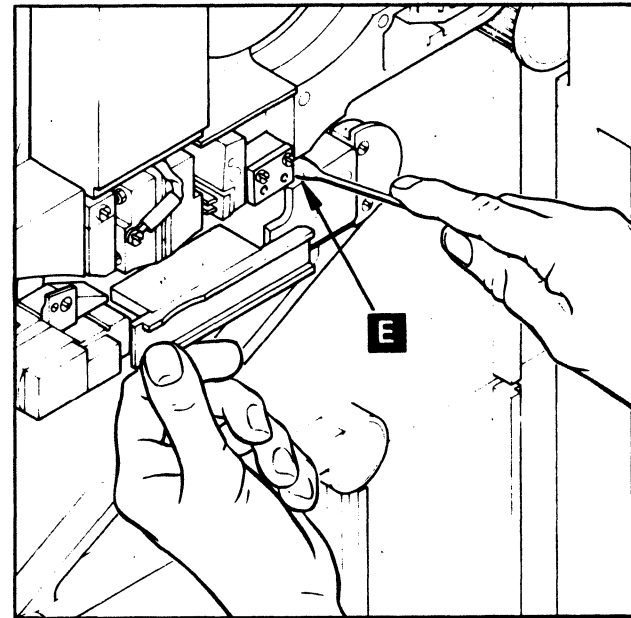
© Copyright International Business Machines Corporation 1976, 1979, 1980, 1983

# TAPE UNIT CLEANING PROCEDURE FOR 3420 MODELS 3 THROUGH 8

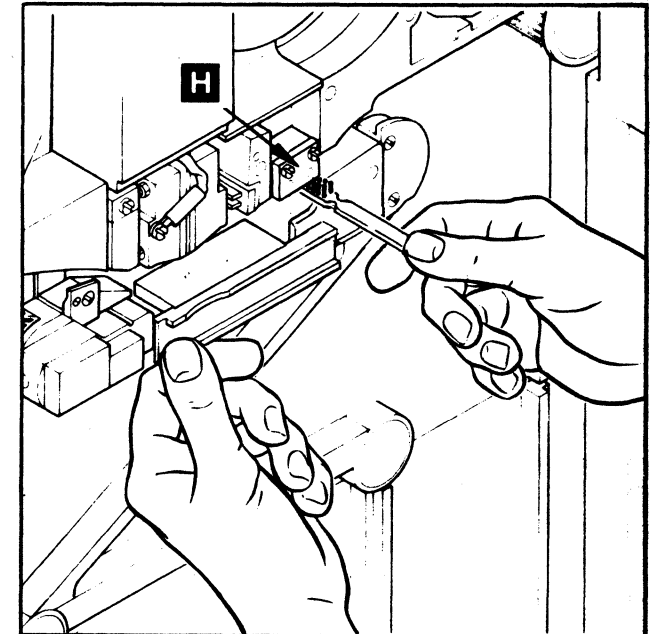
## 2. CLEANER BLADE, BOT/EOT BLOCK, REWIND PLUNGER, AND THREADING CHANNEL REFLECTOR

2.1 Hold the inspection mirror down, or the autocleaner in, when cleaning. Use a cotton swab dampened with tape cleaner to clean the following items.

### 2.1.1 BOT/EOT block **E**

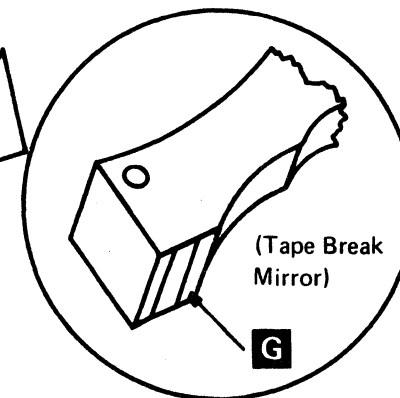
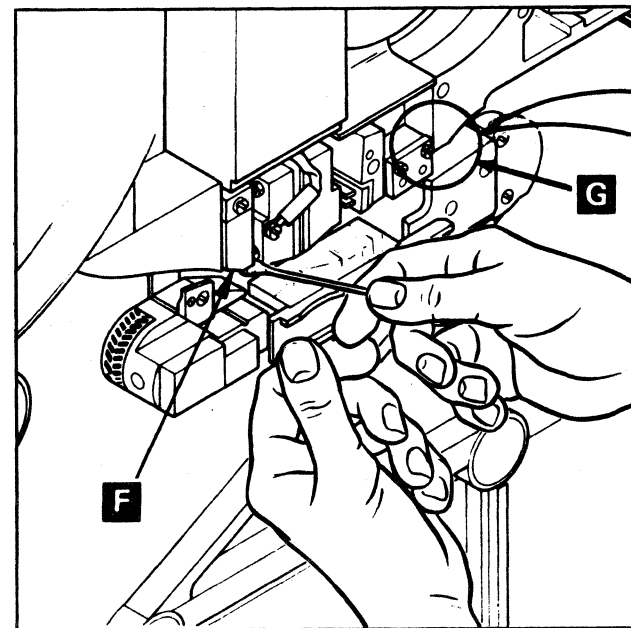


2.2 Use the head cleaning brush (P/N 6851781) dampened with tape cleaner to clean the cleaner block **H**. Wipe with cloth.



### 2.1.2 Rewind plunger/filler block **F**

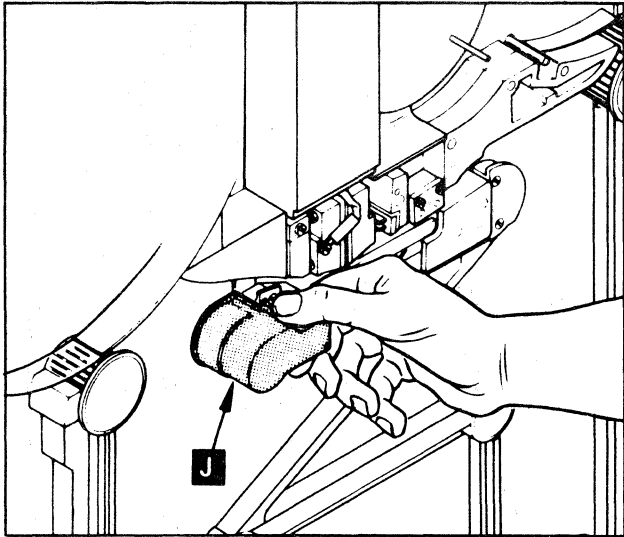
### 2.1.3 Threading channel reflector **G**



TAPE UNIT CLEANING PROCEDURE FOR  
3240 MODELS 3 THROUGH 8

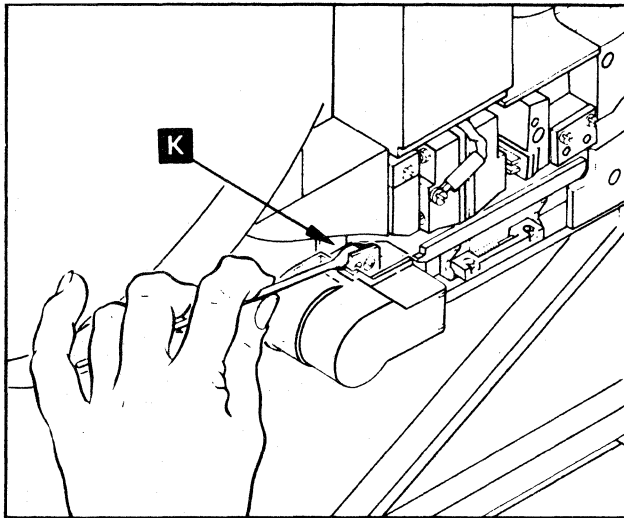
3. TAPE TRANSPORT

3.1 Install capstan cover **J**.

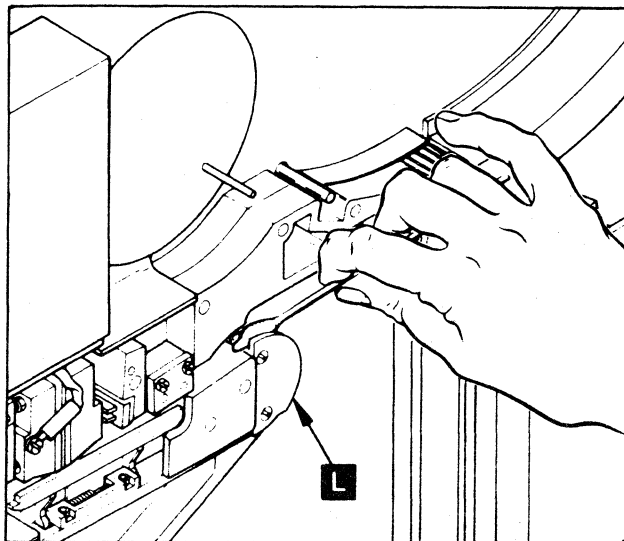


3.2 Dampen cotton swab with tape cleaner and clean the following:

3.2.1 Front and back guides **K**.



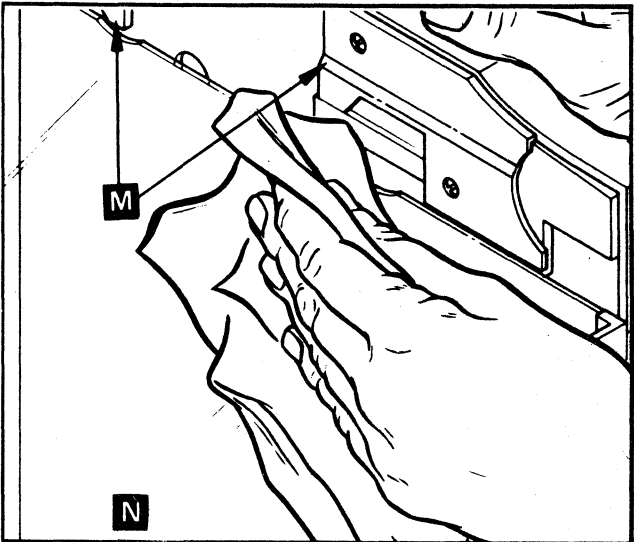
3.2.2 D-bearing **L**.



3.3 Use a lint-free cloth dampened with tape cleaner to clean the following:

3.3.1 Threading plates **M**.

3.3.2 Back of inner door **N**.



3.3.3 Back wall **P** and sides **Q** of vacuum columns

3.3.4 Air bearings **R**. **Note:** If residue remains in vacuum column corners, perform steps 3.3.5 and 3.3.6, otherwise go to step 3.4.

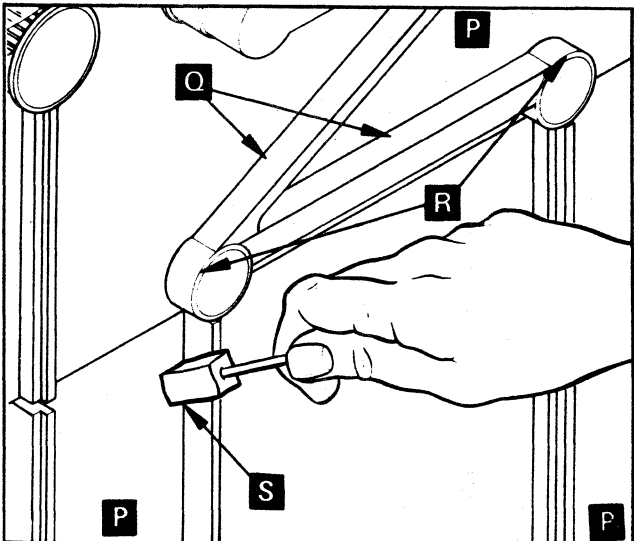
**To remove stubborn residue in corners of vacuum columns—**

3.3.5 Put clean felt pad on handle making sure the handle does not go through the end of pad.

3.3.6 Dampen felt pad with tape cleaner and clean vacuum column corners as shown **S**. Make sure no contact is made with capstan cover and/or capstan.

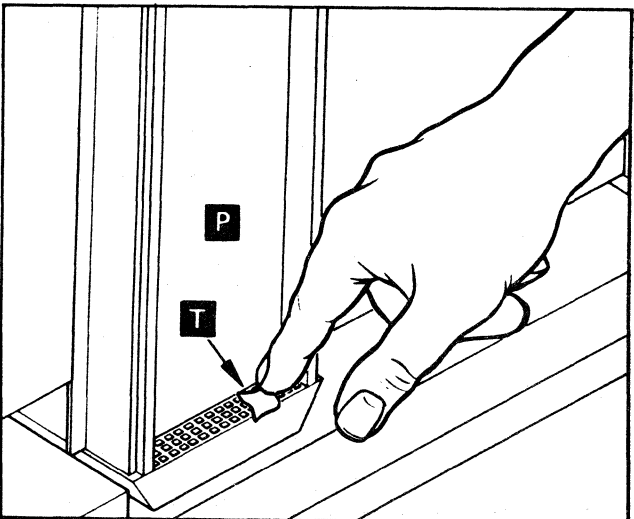
**Caution:** You may need to use water to remove residue left in the vacuum columns by some tapes. Do not get water on any other part of the machine. Water will damage the capstan.

3.3.7 Use a lint-free cloth dampened with tape cleaner to remove any residue left by the felt pad.



3.4 Check bottom of vacuum columns **T** for bits of tape and remove if present.

3.5 Remove capstan cover and replace in storage area.



3803-1,2,3/3420

XH0600	2736018	See EC	845958	847298				
Seq 2 of 2	Part Number	History	1 Sep 79	15 Aug 83				

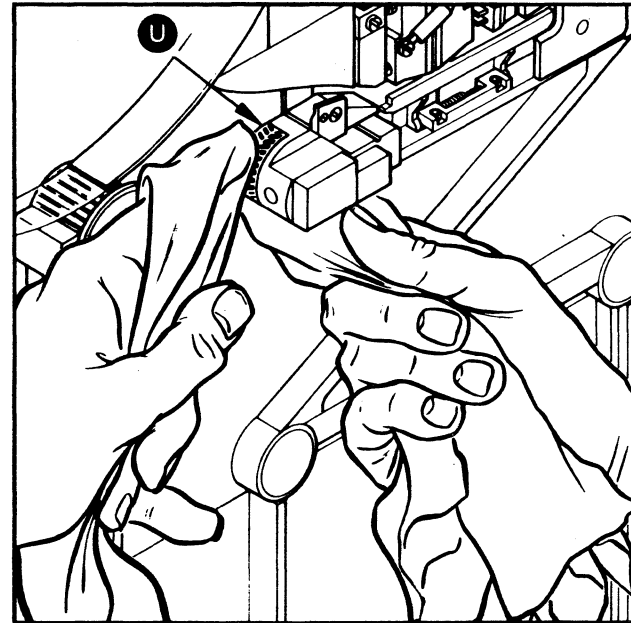
© Copyright International Business Machines Corporation 1976, 1979, 1983

**TAPE UNIT CLEANING PROCEDURE FOR  
3420 MODELS 3 THROUGH 8****4. CAPSTAN CLEANING—NORMAL  
PROCEDURE**

This procedure must be done at regular intervals by the customer. Tape will slip on a dirty capstan while accelerating.

**Caution:** Any capstans not kept free of glaze will eventually build a deposit that cannot be removed by a reasonable amount of scrubbing.

- 4.1 Wrap a clean, dry cloth around one index finger and a lint-free cloth dampened with tape cleaner around the other index finger.
- 4.2 Vigorously wipe the capstan rubber with the dampened cloth (without bending the capstan) while rotating the capstan with the dry-cloth-covered finger **U**.
- 4.3 Continue this procedure until the capstan has a definite dull rubber finish. Any glaze must be removed in order to operate reliably.
- 4.4 If the glaze cannot be removed, follow the special Glazed Capstan Cleaning procedure on page 08-700.

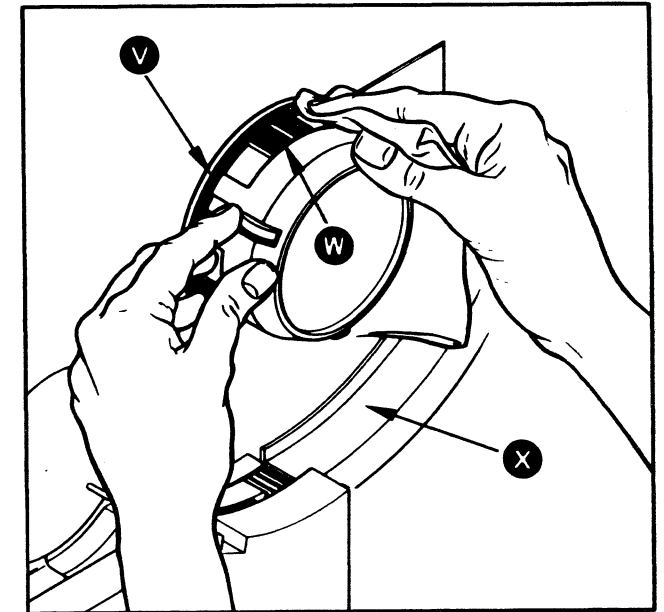
**5. FILE REEL HUB**

5.1 With a lint-free cloth dampened with tape cleaner, use a light pressure to clean the following:

- 5.1.1 Back rubber flange **V**.
- 5.1.2 Rubber ring **W** or rubber pads on some models.

**6. CARTRIDGE RESTRAINT**

- 6.1 Use a lint free cloth to clean lower restraint **X**. This metal is porous and the air flow can be restricted by using fluids or abrasive material during cleaning.



3803-1,2,3/3420

XH0700	2736019	See EC	845958	846927	847298			
Seq 1 of 2	Part Number	History	1 Sep 79	20 Jun 80	Aug 15 83			

© Copyright International Business Machines Corporation 1976, 1979, 1980, 1983

3803/3420 PREVENTIVE MAINTENANCE SCHEDULE

3420 Tape Unit

Code		Location Operation	Frequency	Action
U	R			
0		Door Slide and Stop Pin	4 months	Lubricate the door slide and the stop pin with IBM #17.
		General Cleaning	4 months	1. Clean front deck and base. 2. Remove tape cleaner block and clean with tape cleaner. 3. Remove air bearing (D bearing) next to EOT/BOT block and clean. Inspect guide behind bearing and replace if grooved. 4. Clean NRZI guides. 5. Clean EOT/BOT channel mirror. 6. Clean the fiber optic lamp. Use a tissue lightly moistened with water.  <b>Caution: Allow lamp to cool before cleaning.</b>  Remove the manifold and fiber bundles to provide access to the lamp. Replace the lamp (08-620) if it is not clear. <b>Note:</b> Cleaning or replacement of the fiber optic lamp may require the readjustment of the EOT/BOT and capstan squaring.
		Capstan Tach Squaring Circuit	4 months	Check and adjust Capstan Squaring. See 08-120 or 08-130. Ensure capstan is free from dents and does not bind.
		Capstan Tracking	4 months	Check and adjust Capstan Tracking. See 08-000.
		EOT/BOT	4 months	Check and adjust EOT/BOT. See 08-580.

Code		Location Operation	Frequency	Action
U	R			
		File Protect Pin	4 months	1. Push plunger in, check for binds. 2. Check that plunger extends in front of the right hub flange. 3. Replace unit if any checks produce unsatisfactory results.
		Power Window Safety Bail	4 months	Check for the correct operation of the power window safety bail. If incorrect, tighten the setscrew in the safety bail terminator, and adjust the safety bail switch assembly (see 08-000).
2		Parts Replacement	12 months	Order one of the following B/Ms for required parts. B/M 8492273 Puralator type filter B/M 8492274 Cuno type filter
		Tape Cleaner Block	12 months	Replace the tape cleaner block. Supplied with parts replacement B/M.
		Pneumatic Supply	12 months	Check pneumatic supply belts.
		Input Filter	12 months	Replace filter element of the pressure pump input filter. Supplied with parts replacement B/M. Check for Puralator or Cuno type.
		Cooling Filter	12 months	Clean cooling air filter or replace as necessary.
		Air Bearing Cleaning	12 months	1. Remove bearings. 2. Brush each bearing to remove oxide deposits. 3. Install new decorative covers on air bearing. Supplied with parts replacement B/M.
		Vacuum Column Door Foam	12 months	Inspect foam in front of vacuum door glass. See 08-690. If foam replacement is required, order B/M 4469244
		DC Voltage	12 months	Check the dc voltages. (08-570)

Code		Location Operation	Frequency	Action
U	R			
		EOT/BOT	12 months	Remove EOT/BOT by removing the two screws and gently move block forward being careful not to damage the fiber bundles if present. Clean EOT/BOT with a cotton swab dampened with tape cleaner. Replace EOT/BOT block.
		Capstan Motor Mod-8	12 months	Clean screens on back of motor with vacuum cleaner.
		Radius Sense	12 months	Clean the ends of the fiber optic bundle if present with a damp cloth, see 08-610 for removal. Apply a felt pad to the handle and lightly dampen with tape cleaning fluid. Hold pad to the inside front of left reel flange and spin by hand. This will clean the reflective strips located inside the left reel.
		Reel Tach	12 months	Check reel tachs for glaze. Replace reel tachs if glazed.
		Glass Bead Tape	12 months	Inspect glass bead tape on stubby bar and in vacuum columns. See note. Ensure that stubby bars are not loose and have proper clearance. See 08-000.
		High Speed Rewind Plunger	12 months	Check operation of the High Speed Rewind Plunger. (08-000) Models 3, 5, and 7 only.
		Autocleaner Check	12 months	1. Check operation of autocleaner by marking the ribbon and observing ribbon movement. The ribbon should move from bottom to top. 2. Check the supply of autocleaner ribbon. Order a new autocleaner cartridge when approximately 3/4 inches of ribbon is visible through the cartridge window. Models 4, 6, and 8 only.
		Preamps	12 months	Check and adjust preamps (08-290 or 08-300).

Code		Location Operation	Frequency	Action
U	R			
3		Output Filter	36 months	Replace with P/N 2524998.
4		Vacuum Tubing	60 months	Replace vacuum tubing (order B/M 4416409).
		Pressure Tubing	60 months	Replace pneumatic pressure tubing (order B/M 4416408).
		Vacuum Pressure Switches	60 months	Right switch plate - with seven holes - B/M 6851766 - with five holes, one switch top, three grouped center, one at bottom - B/M 6851768 two switches top, three at bottom - B/M 6851764  Left switch plate - with five holes, three switches top, two at bottom - B/M 6851765 -all other configurations - B/M 6851767  Tape transport switches Model 3,5,7 - B/M 6851770 Model 4,6,7 - B/M 6851771

**Note:**  
Inspect the glass bead surface of the stubby bars and vacuum columns.  
Replace if the glass bead is nicked, scratched, burred or has an area obviously worn to the touch. (If not obviously worn, do not replace).  
Run finger on the glass bead surface at the bottom of the vacuum column. This is a good glass bead surface and may be used as a reference.  
A worn glass bead surface will cause tape motion problems.

3803 Control Unit

Code		Location Operation	Frequency	Action
U	R			
0		Air Filter	2 months	Check cooling air filter for restriction of air flow. Clean or replace as required.
2		dc Voltage	6 months	Check dc voltages. Adjust as required to the levels specified on decals.

3803-1,2,3/3420

XH0700	2736019	See EC	845958	846927	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			



INTRODUCTION

This section contains installation instructions for the IBM 3803 Model 2/3420 Magnetic Tape Subsystem. Companion publications pertaining to this product are:

- 1. 3803 Model 2/3420 Subsystem Description, GA32-0021
- 2. 3420 Model 4, 6 and 8 Parts Catalog, S132-0007
- 3. 3803 Models 1 and 2 Parts Catalog, S132-0004
- 4. 3420 Operator's Guide Card, S232-0003
- 5. 3803/3420 OLT Users Guide

**Safety Note:** Ensure your own safety by using caution at all times and by being aware of potentially dangerous areas of the machine. Read and follow the safety suggestions in Form 229-1264, a pocket-sized card issued to all customer engineers and reprinted at the front of this manual.

**Caution:** No portion of this procedure is to be omitted. Perform all steps including checks and adjustments.

INSTRUCTIONS

Perform the following basic steps for each 3803 Model 2/3420 installation, regardless of the subsystem configuration:

- 1. Refer to the checklist on 90-020 and initial each box when an installation procedure is completed.
- 2. Complete the configuration worksheet on 90-040. Refer to the instructions on 90-030.
- 3. Unpack units. (See Unpacking Instructions on this page.)

**Note:** Before moving 3420 tape units into place, be sure to remove packing tape from the air flow mercury switch and install the front kickplate. Check ESD grounding. See 90-190, F7 and F8 before moving machines into place.

- 4. Remove the wire seal from the 3803 and 3420's, 90-180, only at this time.
- 5. Install four caster locks.
- 6. Install front and both side kickplates. See 90-090.
- 7. Install rear kickplate. See 90-090.
- 8. Install and plug cables. See 90-050 through 90-080.

**Note:** The tag and bus cable pairs must be of equal length. Paired cables of unequal length cause timing errors resulting in hard-to-diagnose subsystem problems.

- 9. Plug address/feature/priority card jumpers to match configuration requirements, see 90-110.

**Note:** Check the factory-installed items such as card jumpering, and all card and cable seating. Particularly check the write head and read head card seating.

- 10. Rework the 3420 Field Tester, see 90-170.

**Note:** Make sure customer's power matches subsystem requirements. Check for correct blower and motor rotation.

- 11. Perform power supply checks and note special tape unit power supply requirements, see 90-180.

- 12. Perform all checks and adjustments on 90-190.
- 13. Run system diagnostics on 90-200. (Refer to User's Guide.)
- 14. If any Emulator is run on a S/360, install jumper, see 90-200.
- 15. Generate a read only tape, on 90-200.

**Note:** It is possible to combine 3803 Models 1 and 2 in one subsystem. Be sure your customer understands that a 3803 Model 1 tape control cannot address any 3420 Models 4, 6, or 8 tape units.

UNPACKING INSTRUCTIONS

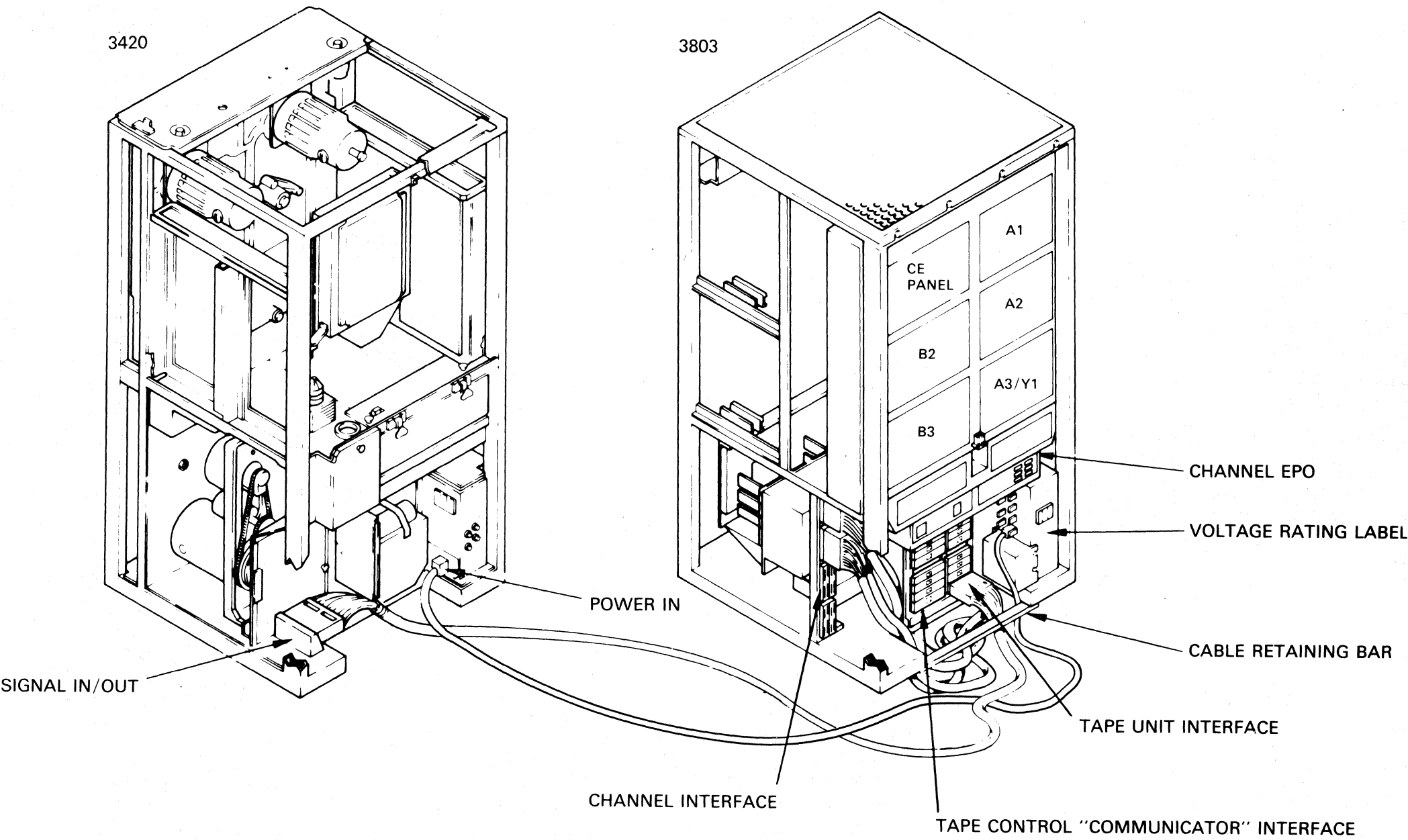
Unpack tape control and tape units.

Refer to Unpacking Instructions, which are in a plastic envelope attached to each unit. Move discarded packing material away from work area. File Unpacking Instructions for future reference if tape subsystem is to be moved.

CHANNEL ATTACHMENT

The 3803 Model 2 at 6250 bpi will attach to these systems via the indicated channels:

System	3420-8	3420-6	3420-4
370/195	2860/2880	2860/2880	2860/2880
370/168	2860/2880	2860/2880	2860/2880
370/165-2	2860/2880	2860/2880	2860/2880
370/165	2860/2880	2860/2880	2860/2880
370/158	BKMPX	BKMPX	BKMPX
370/155-2	BKMPX	BKMPX	BKMPX
370/155	BKMPX	BKMPX	BKMPX
370/145	SEL	SEL	SEL
370/135	SEL	SEL	SEL
360/195	2860/2880	2860/2880	2860/2880
360/91	2860	2860	2860
360/85	2860/2880	2860/2880	2860/2880
360/75	2860	2860	2860
360/65-67	2860	2860	2860
360/50	N/A	N/A	SEL



3803-2/3420

XJ0100	2736020	See EC	845958	846927				
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80				

© Copyright International Business Machines Corporation 1976, 1979, 1980

INSTALLATION CHECKLIST

3803-2 TAPE CONTROL

Installation Procedure	Reference Page	Initial Box When Completed
Configuration Worksheet	90-030	
Unpacking	90-000	
Cables	90-060 90-070 90-080	
Cable Retaining Bar	90-060	
Kickplates	90-090	
Address/Priority/Feature Plugging	90-110	
Card and Cable Seating	90-000	
Operator's Panel Labels	90-160	
Wire Seal Removal	90-180	
Check Capacitor Mounting Screws	90-180	
Power Supply Checks	90-180	
ESD Check and Adjustment	90-190	
System Diagnostics	90-200	
Emulator (If applicable)	90-200	
Generate READ ONLY Tape	90-200	

3420 TAPE UNIT

Installation Procedure	Reference Page	Initial Each Box When Completed							
		0/8	1/9	2/A	3/B	4/C	5/D	6/E	7/F
Unpacking	90-000								
Cables	90-060 90-070								
Caster Locks	90-000								
Kickplates	90-090 90-100								
Field Tester Conversion	90-170								
Wire Seal Removal	90-180								
Power Supply Checks	90-180								
Checks and Adjustments	90-190								
System Diagnostics	90-200								

CONFIGURATION WORKSHEET  
INSTRUCTIONS

Complete the configuration worksheet on Page 90-040 for your installation. Check customer requirements before configuring each system. When installation is completed, place worksheet in the front of subsystem ALDs and keep as a subsystem cabling history.

Complete all applicable blocks in the worksheet for each 3803 tape control:

- 1 Indicate each 3803 serial number in decimal.
- 2 Indicate processing unit/Channel identity and cable numbers.
- 3 Assign an address to each 3803 tape control in hex (bits 0-4, Example: 18X/3BX).
- 4 Assign "Select Out" priority ("high"/"low") for each interface by checking applicable box.
- 5 Indicate features installed on each 3803 tape control.
- 6 Assign 3420 addresses to each 3803. Check the 0-7 (low order) block on one "host" 3803, and the 8-F (high order) block on the other "host" 3803.
- 7 Draw in cabling for your configuration and insert cable key numbers.

3803-2/3420

XJ0200	2736021	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

CONFIGURATION WORKSHEET

2

I/O Interface Chan A  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_  
-----  
I/O Interface Chan B  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_

1

3803 Serial Number \_\_\_\_\_  
(Decimal)

3

3803 Addresses \_\_\_\_\_  
(Hex)

4

Select Out Priority  

High

Low

5

Features Yes No  
Device Switch ☐ ☐  
7-Track NRZI ☐ ☐  
Dual Density ☐ ☐  
Two-Channel Switch ☐ ☐

6

Secondary TU Interface  
TU Addresses  

(0-7) or (8-F)

7

I/O TAILGATE  

D

B

T

6

Primary TU Interface  
(Communicator 1)  
TU Addresses  

(0-7) or (8-F)

Tape Units

2

I/O Interface Chan A  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_  
-----  
I/O Interface Chan B  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_

1

3803 Serial Number \_\_\_\_\_  
(Decimal)

3

3803 Addresses \_\_\_\_\_  
(Hex)

4

Select Out Priority  

High

Low

5

Features Yes No  
Device Switch ☐ ☐  
9-Track NRZI ☐ ☐  
7 & 9 Track ☐ ☐  
Two-Channel Switch ☐ ☐

6

Secondary TU Interface  
(Communicator 1)  
TU Addresses  

(0-7) or (8-F)

7

Primary TU Interface  
(Communicator 1 or 2)  
TU Addresses  

(0-7) or (8-F)

6

I/O TAILGATE

Tape Units

Note: Symbols A through D refer to control switch paths A through D of the device switching feature.  
(See Section 58 for further information on this feature.)

2

I/O Interface Chan A  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_  
-----  
I/O Interface Chan B  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_

1

3803 Serial Number \_\_\_\_\_  
(Decimal)

3

3803 Addresses \_\_\_\_\_  
(Hex)

4

Select Out Priority  

High

Low

5

Features Yes No  
Device Switch ☐ ☐  
9-Track NRZI ☐ ☐  
7 & 9 Track ☐ ☐  
Two-Channel Switch ☐ ☐

6

Primary Interface  
(Communicator 1)  
TU Addresses  

(0-7) or (8-F)

7

I/O TAILGATE  

D

B

T

6

Secondary TU Interface  
TU Addresses  

(0-7) or (8-F)

Tape Units

2

I/O Interface Chan A  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_  
-----  
I/O Interface Chan B  
CPU Ident. \_\_\_\_\_  
Cable No. \_\_\_\_\_

1

3803 Serial Number \_\_\_\_\_  
(Decimal)

3

3803 Addresses \_\_\_\_\_  
(Hex)

4

Select Out Priority  

High

Low

5

Features Yes No  
Device Switch ☐ ☐  
9-Track NRZI ☐ ☐  
7 & 9 Track ☐ ☐  
Two-Channel Switch ☐ ☐

6

Primary TU Interface  
(Communicator 1 or 2)  
TU Addresses  

(0-7) or (8-F)

7

Secondary TU Interface  
(Communicator 2)  
TU Addresses  

0-7, 8-F

6

I/O TAILGATE

Tape Units

3803-2/3420

XJ0300	2736022	See EC History	845958	847298				
Seq 1 of 2	Part Number		1 Sep 79	15 Aug 83				

© Copyright International Business Machines Corporation 1976, 1979, 1983

90-040

SECTION A: DEVICE SWITCHING  
FEATURE

A-1 Tape subsystem configuration flexibility is provided by field-installable switching features that allow up to 16 tape units to be switched between four tape controls. The three device switching features available with the tape subsystem are:

- 2 Control Switch (2 X 8 or 2 X 16 configuration, see Figures 1 and 4 on page 90-051)
- 3 Control Switch (3 X 8 or 3 X 16 configuration, see Figures 2 and 3 on page 90-051)
- 4 Control Switch (4 X 8 or 4 X 16 configuration, see Figures 5 and 6 on page 90-052)

A 3803 must have a Communicator installed in order to be switched. The Communicator sends tape unit selection and device interface signals to one of two device switches, depending on whether tape units 0 through 7 or 8 through F are being addressed. The location of the device switches depends on the configuration desired. For example: In a 2, 3, or 4 X 8 configuration, the switching feature is required only on the first 3803.

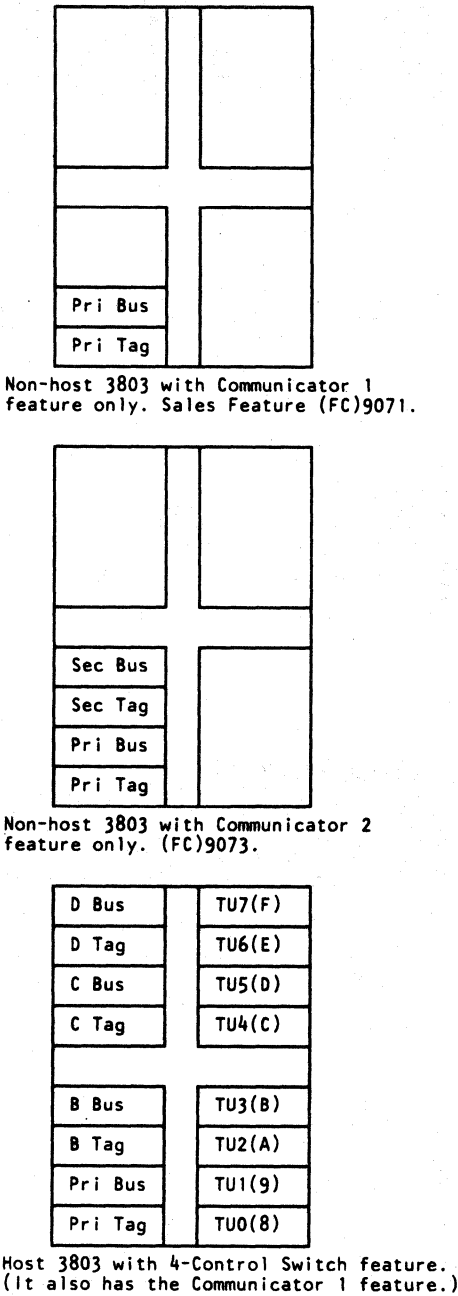
The Communicator is installed by removing the selection logic circuits and the associated device interface cabling in the basic 3803. Different logic circuitry and cables to the device switches are then installed.

Using a combination of the Communicator and the 2, 3, or 4 Control Switch, two, three, or four interconnected tape controls can address a maximum of 16 tape units. Figures 1 through 6 show some possible switching configurations and cabling.

Note:

- [1] The dark gray end of the signal cable is indicated by the arrow tip. (See Figure 1, 90-060.)

Figure 7. Cable Connectors



3803-2/3420							
XJ0300	2736022	See EC	845958	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	15 Aug 83			

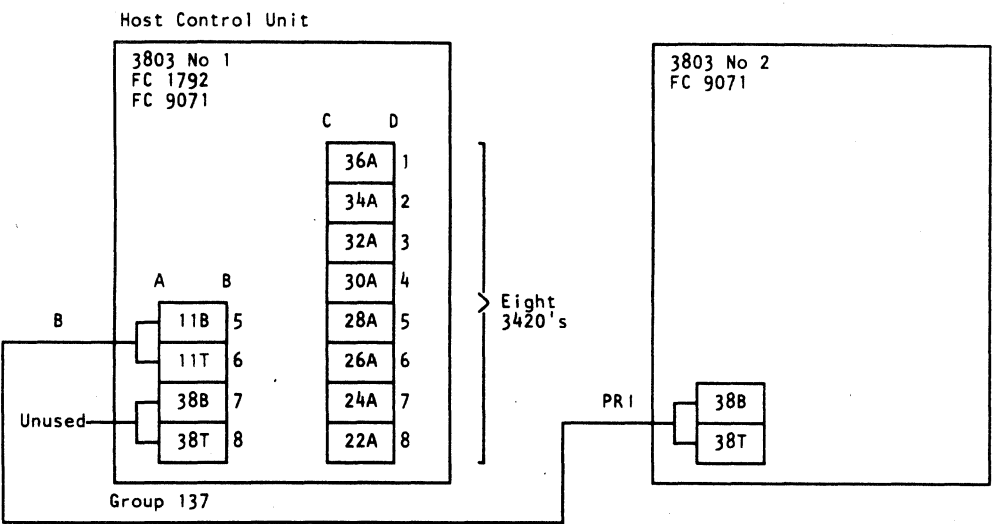


Figure 1. 2 x 8 Switch Option

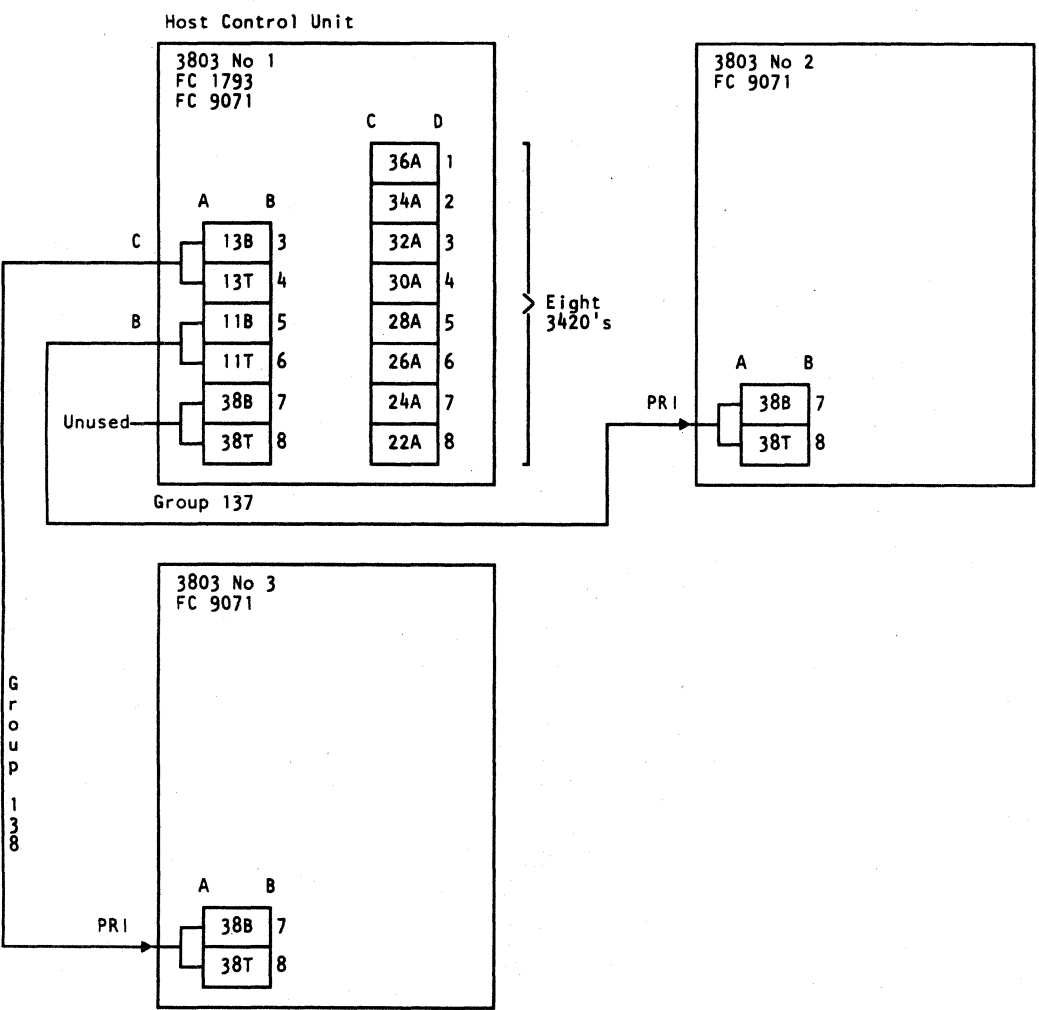


Figure 2. 3 x 8 Switch Option

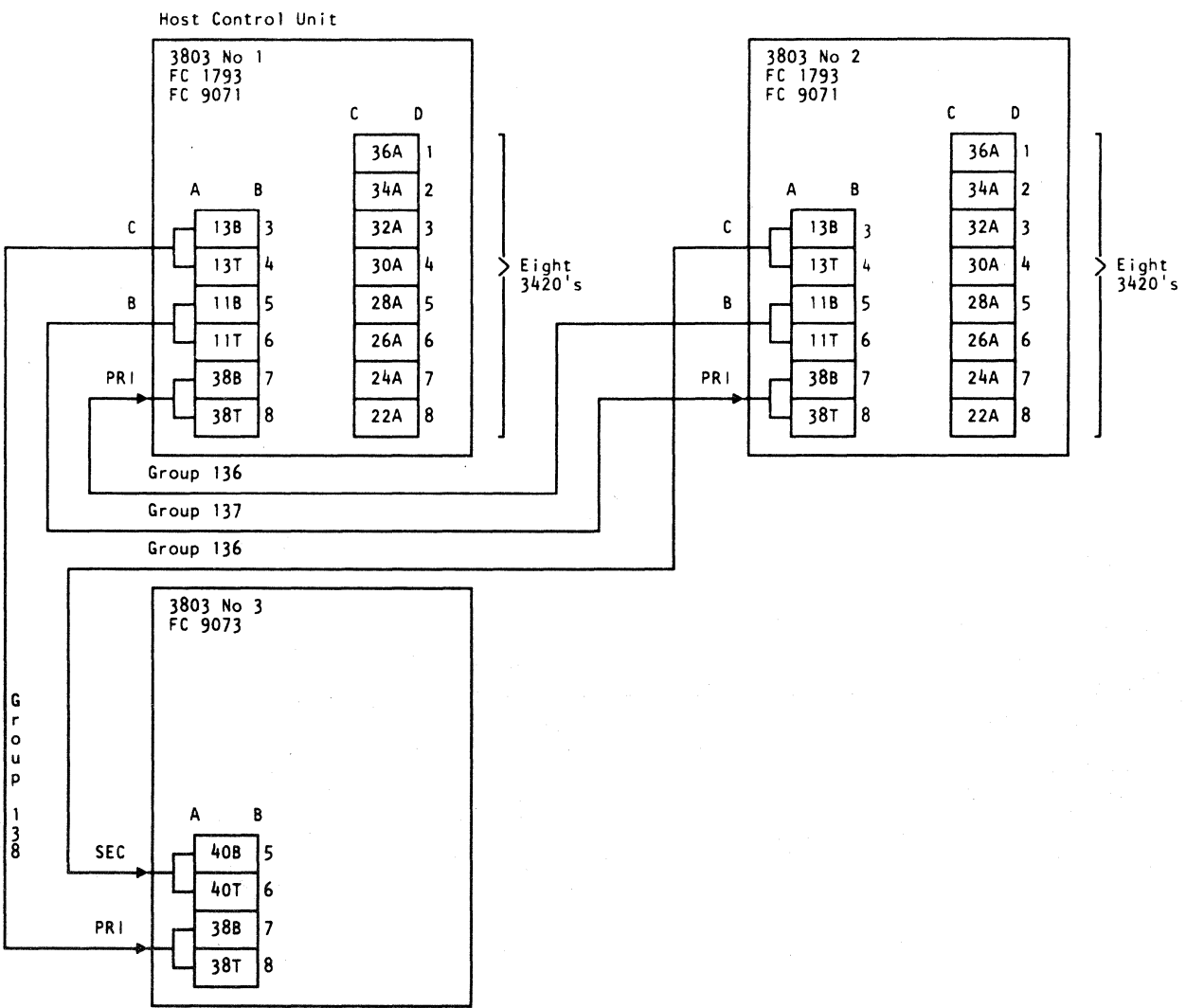


Figure 3. 3 x 16 Switch Option

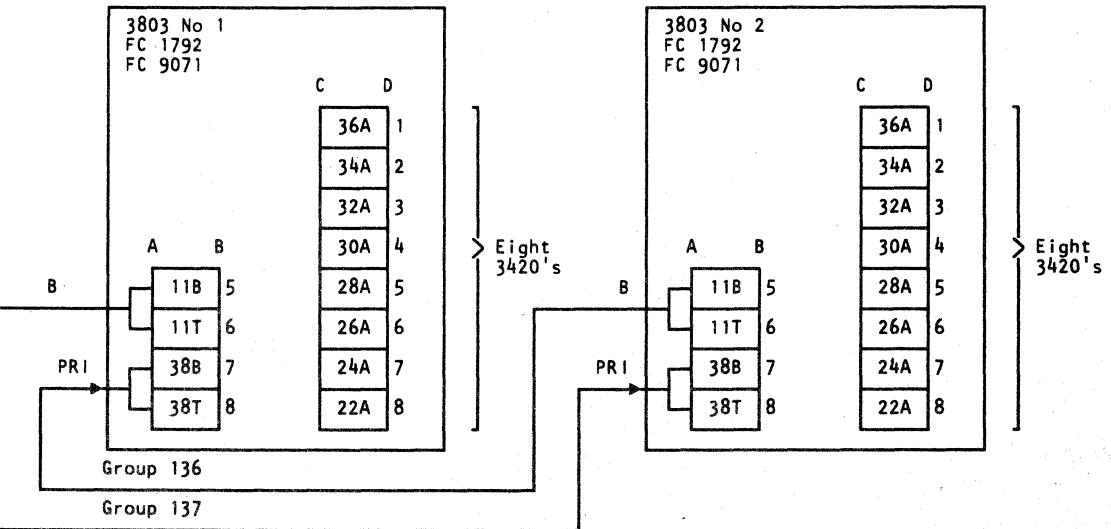


Figure 4. 2 x 16 Switch Option

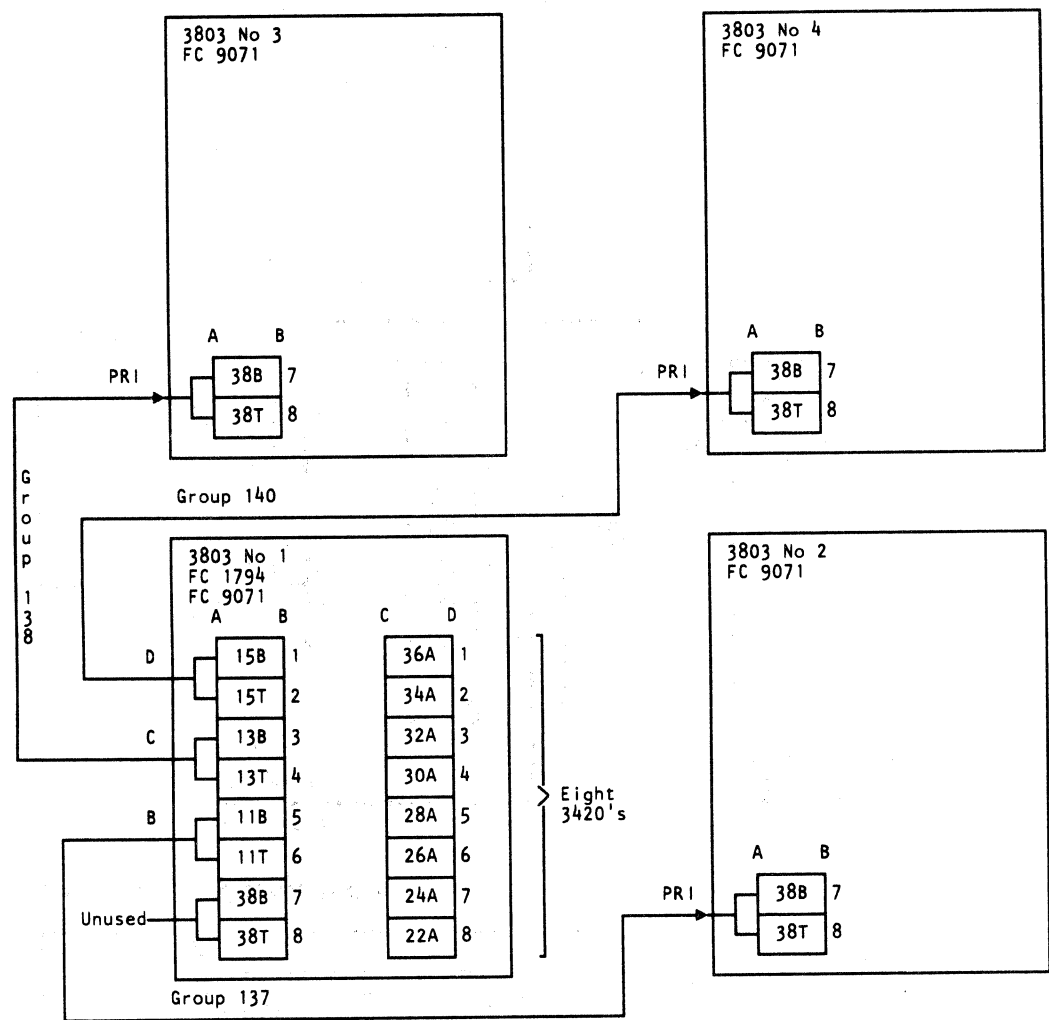


Figure 5. 4 x 8 Switch Option

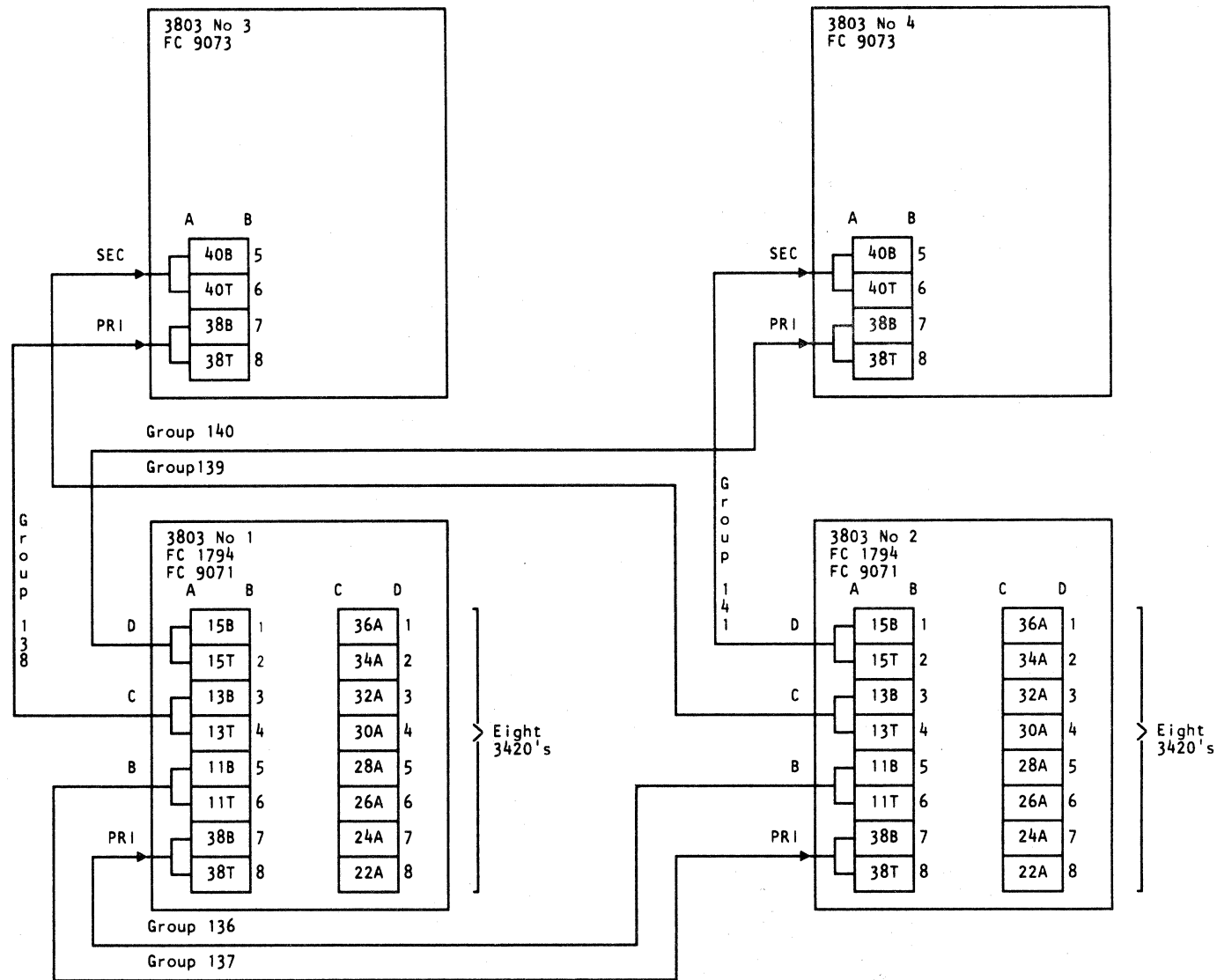


Figure 6. 4 x 16 Switch Option



## SECTION B. SUBSYSTEM CABLING

**B-1** Unpack the interface and power cables and lay in place.

Refer to the "Key Number" or "Connector ID" and "X-Length" shown on each interface cable label when placing cables (see Figure 3).

Refer to power cable connector (see Figure 2) to ensure that power cables will be located correctly.

**Caution:** Ensure that the color scheme on the connectors is followed.

**B-2** Plug Cables and Terminators:

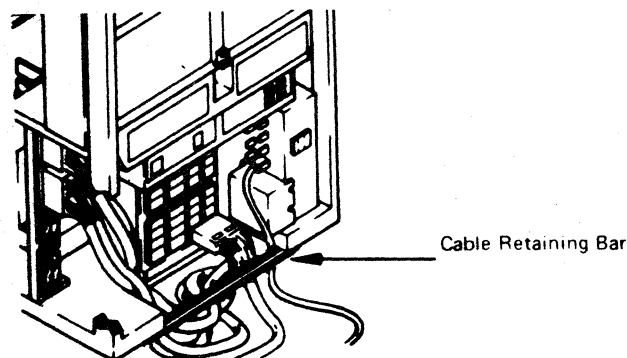
a. Plug cables at tape control and tape units. Each tape unit's address is determined by the position on the tape control interface panel to which its signal cable is connected.

**Caution:** Do not connect 3803 power cable to customer's receptacle at this time.

b. Insert terminators in "outgoing" cable positions in subsystems where "outgoing" cables 132 and 133 are not used.

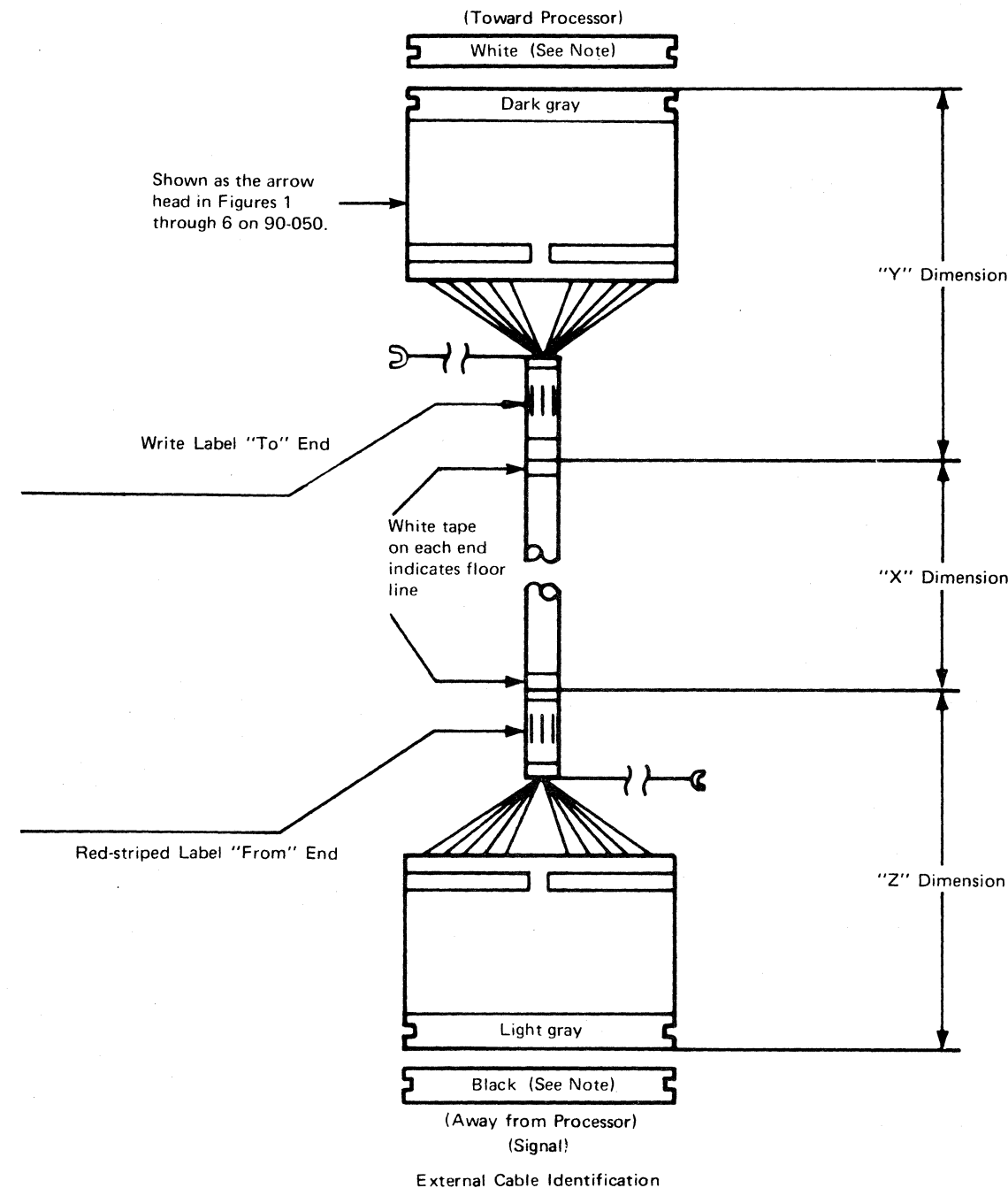
c. Install cable retaining bars when cabling is complete.

**B-3** Observe 'from' and 'to' designations given in Figure 1, Page 90-070. Red or red-striped labels indicate 'from' end of cables; white labels indicate 'to' ends of cables.



Cable Retaining Bar

Figure 1. Signal Cable



**Note:** On chrome plated tape unit signal cable connectors, observe the color at the center screw hole.

Figure 2. Power Cable

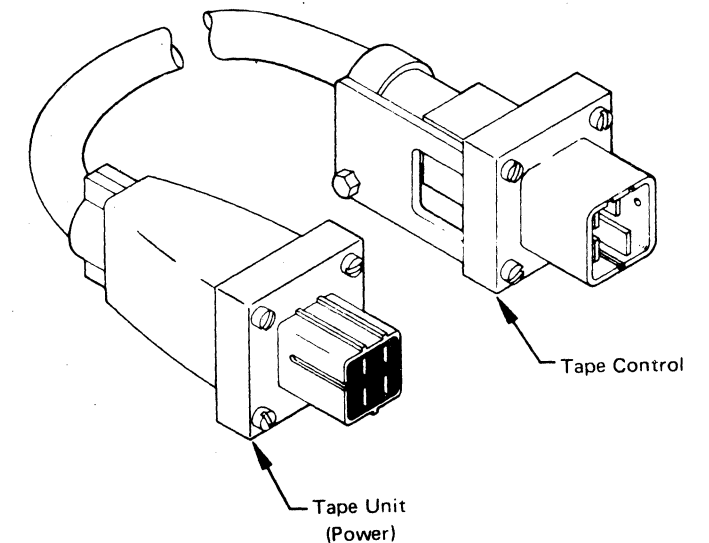


Figure 3. Dimension Explanation

"X" Dimension = Distance Between Cable Entry Holes in Floor

"Y" & "Z" Dimension = Distance Above the Floor from the Entry Hole to the Connection within the Machine

Total length = sum of X, Y, and Z dimensions.

SUBSYSTEM INSTALLATION (Cont'd)

SECTION B. SUBSYSTEM CABLING (Cont'd)

Figure 1. External Cables

Note: Cables are identified by either key number or connector ID.

Group No.	Conn. ID	Plug Location	Cable Group	Key No.	Cable P/N	From	To	Notes
-	-	-	129	129A 129B	2281630 2523073	3420 Signal 60 Hz 3420 Power 60 Hz	3803	4, 5, 7
3920	1B (Chan A) 3B (Chan B) 1T (Chan A) 3T (Chan B)	01S-A1A1 01S-A1A5 01S-A1A3 01S-A1A7	130	130 B 130 T	5353920 5353920	3803	Multiplexor Channel	1, 9
3920	1B (Chan A) 3B (Chan B) 1T (Chan A) 3T (Chan B)	01S-A1A1 01S-A1A5 01S-A1A3 01S-A1A7	131	131 B 131 T	5353920 5353920	3803	Selector Channel	1, 9
-	2B (Chan A) 4B (Chan B) 2T (Chan A) 4T (Chan B)	01S-A1B1 01S-A1B5 01S-A1B3 01S-A1B7	132	132B 132T	5353920 5353920	3803	Control Unit	1, 9
-	2B (Chan A) 4B (Chan B) 2T (Chan A) 4T (Chan B)	01S-A1B1 01S-A1B5 01S-A1B3 01S-A1B7	133	133B 133T	5353920 5353920	3803	Channel-Channel Adapter	1, 3, 9
1178	5A (Chan A) 7A (Chan B)	J11 J13	134	134A	5351178	3803	Channel EPO	2
1178	9A	01U-A1	135	135A	5351178	3803	2065/2167	8
6456	11B 11T	01T-A1A5 01T-A1A6	136	136B 136T	5466456 5466456	3803 No. 2	3803 No. 1	4
6456	11B 11T	01T-A1A5 01T-A1A6	137	137B 137T	5466456 5466456	3803 No. 1	3803 No. 2	4
6456	13B 13T	01T-A1A3 01T-A1A4	138	138B 138T	5466456 5466456	3803 No. 1	3803 No. 3	4
6556	13B 13T	01T-A1A3 01T-A1A4	139	139B 139T	5466456 5466456	3803 No. 2	3803 No. 3	4
6556	15B 15T	01T-A1A1 01T-A1A2	140	140B 140T	5466456 5466456	3803 No. 1	3803 No. 4	4
6556	15B 15T	01T-A1A1 01T-A1A2	141	141B 141T	5466456 5466456	3803 No. 2	3803 No. 4	4
-	-	-	142 or 129	142A 142B	2281630 2521595	3420 Signal 50 Hz 3420 Power 50 Hz	3803	4, 5, 6, 7
143	1A	Signal	143 or (143)	143A	2281630	3420 Signal 60 Hz	3803	4, 6, 7
144	3A	Power	144 or (144)	144A	2523073	3420 Power 60 Hz	3803	6, 7
145	3A	Power	-	-	2521595	3420 Power 50 Hz	3803	6, 7

Figure 2. Channel Cable Maximum Length for 6250 bpi.

System	From 3803-2 With	To Channel	Length - Feet (Meters)
S/360	3420-8	2860 2880	72 (22,0) 119 (36,3)
S/370	3420-8	2860 Mod 135	72 (22,0)
		Mod 155 Mod 155-2 Mod 158	103 (31,4)
		Mod 145 2880	119 (36,3)
4331	3420-6/8	None	N/A
	3420-4	BYTEMPX*	103 (31,4)
All Other Systems	3420-8	BKMPX*	119 (36,3)

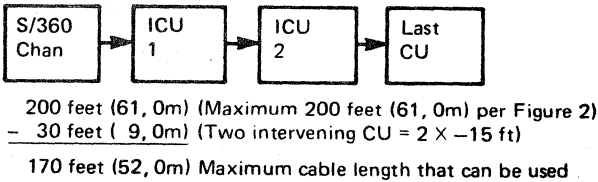
\* Tape operations allowed only when all other byte channel devices are quiescent.

Notes:

- [ 1 ] To attach eight or less tape controls to one channel, the last tape control must be attached to the channel with a sum of no more than 200 feet (61,0m) of cable. If the tape control is attached to a 3420-6, subtract 15 feet (4,5m) for each intervening control unit between the channel and the last tape control. If the tape control is attached to a 3420-8, subtract 20 feet (6,1m) for each intervening control unit between the channel and the last tape control (see Note 10). For cable length limitations when attaching a 3803-2 at 6250 BPI, see Figure 2.
- [ 2 ] Sequence and Control (EPO).
- [ 3 ] Channel to channel adapter (Sales Feature 1850).
- [ 4 ] Total cable length from a 3420 tape unit to the most remote 3803 tape control must not exceed 120 feet (36,6m). (Group 129 or 142, or 143, plus group 136-141.)
- [ 5 ] Includes both signal and power cable. A maximum of eight 3420 tape units can be connected to each 3803 Tape Control 1 and 2. Tape units cannot be connected to tape control 3 and 4 for power requirements unless they are used with cable group 144.
- [ 6 ] Parenthesis indicates cables to be used in World Trade countries for 60 Hz machines.

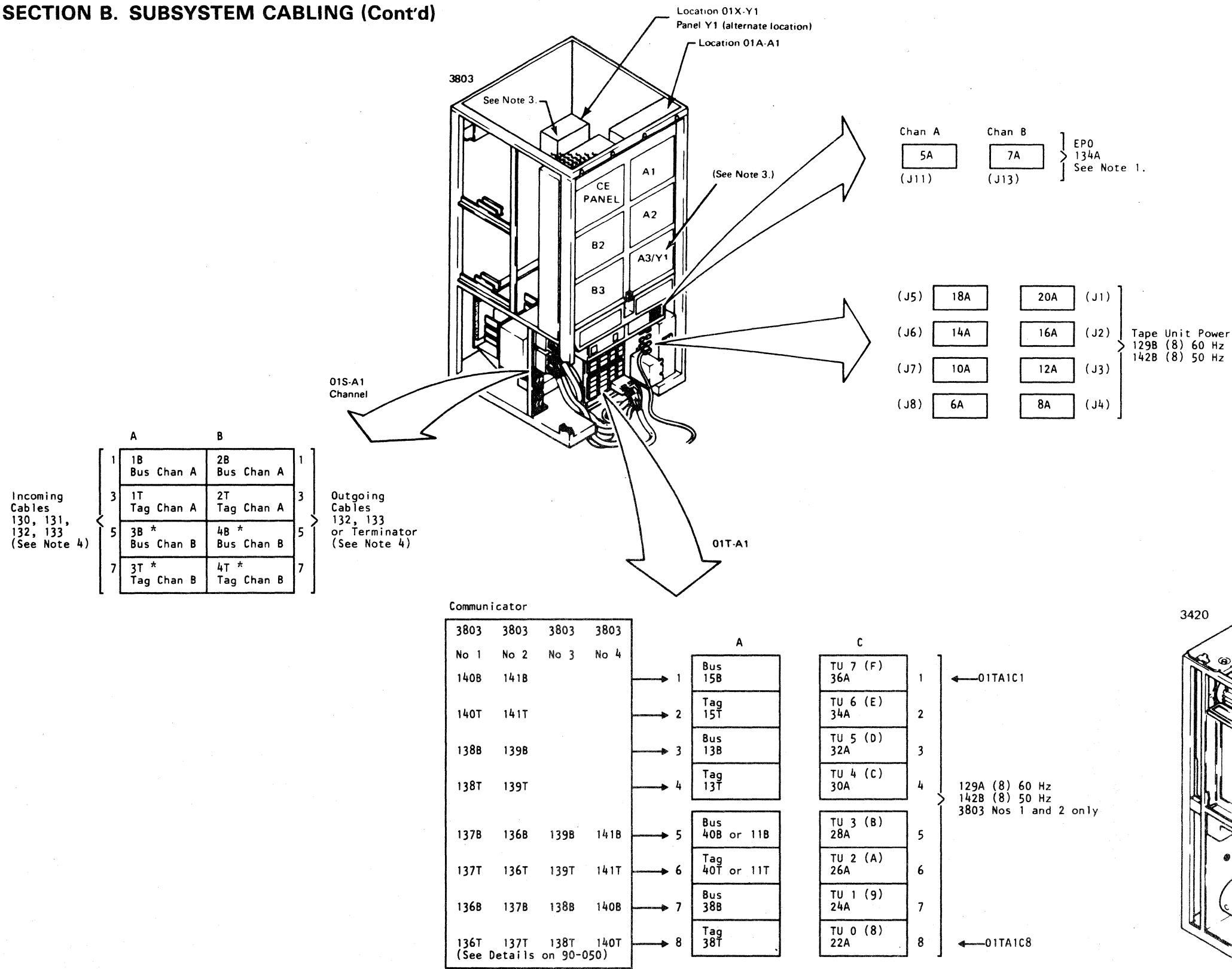
- [ 7 ] When the number of 3420s to be connected to a 3803 Model 2 exceeds the limitations of power (60 Hz), each extra 3420 tape unit may be supplied power by another 3803 tape control using cable group 144. Cable group 143 is available to signal attach tape units using cable group 144. With SF9001 installed, the 3803 Model 2 may power a total of eight 3420s (any model).
- [ 8 ] For use with remote channel switch special feature.
- [ 9 ] Part number 5466456 (24 Signal) may be substituted for 5353920 (20 Signal) for cable group numbers 130, 131, 132 and 133.
- [ 10 ] Terminators are required when the 3803 is the last control unit in a chain or the only control unit on the channel. Use either 5440649 (20 position) or 2282675 (24 position) bus terminators and either 5808324 (20 position) or 2282676 (24 position) tag terminators as determined by the number of signal lines per cable.

Example:



3803-2/3420							
XJ0400	2736023	See EC History	845958	846927	857298		
Seq 2 of 2	Part Number		1 Sep 79	20 Jun 80	15 Aug 83		

SECTION B. SUBSYSTEM CABLING (Cont'd)



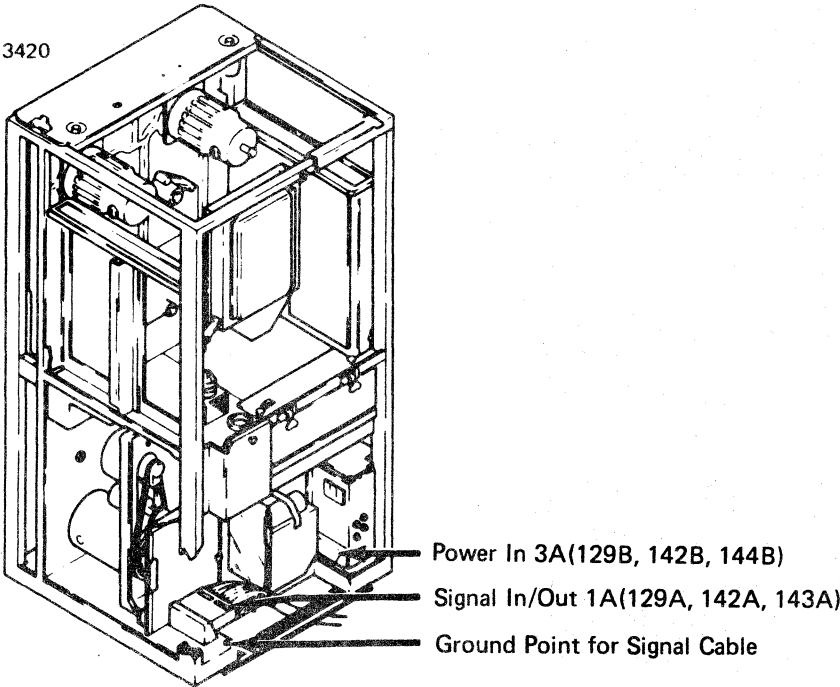
Caution: Refer to ALD AA005 Feature Plug List before installing a replacement logic board.

Notes:

Two-channel switch diagnostics AD through AG can only be run when both channel interfaces are cabled to the same central processing unit. If it is necessary to run diagnostics AD through AG during initial checkout, plan temporary cabling to meet this requirement.

- [1] Both EPO cables must be plugged if the two channel switch feature is installed, and the two channels are not on the same processing unit or not on the same channel frame. Remove any temporary jumper plugs.
- [2] For cable, part 5466456 (48 pin), use terminator, part 2282675 (bus) and 2282676 (tag).  
For cable, part 5353920 (40 pin), use terminator, part 5440649 (bus) and 5440650 (tag).
- [3] Panel Y1 is located in position 01A-A3 unless the 3803-2 has optional features installed. On feature machines, panel Y1 is located in position 01X-Y.
- [4] For cable group number, key number, part number, to and from relationship, see Figure 1 on 90-070.

\* Cables plugged when the two-channel switch feature is present.



3803-2/3420					
XJ0500	2736024	See EC	845958	846927	847298
Seq 1 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83

SECTION C. KICKPLATES

C-1 Install 3803 front and rear kickplates and 3420 rear kickplates as shown in Figure 1.

- 1. Attach pins, nuts, and retaining clips to front and rear frame members of the 3803 and rear frame member of each 3420 as shown in Figure 1.
- 2. Mount kickplates by pushing brackets onto pins. Clips must be positioned below lower flange of brackets.
- Note:** Leave 3420 rear kickplates off until cabling is complete.
- 3. Turn nuts on pins to level kickplates.
- 4. If necessary, realign 3803 covers after kickplate installation.

Figure 1. 3803 (Front and Rear Kickplates)  
3420 (Rear Kickplates)

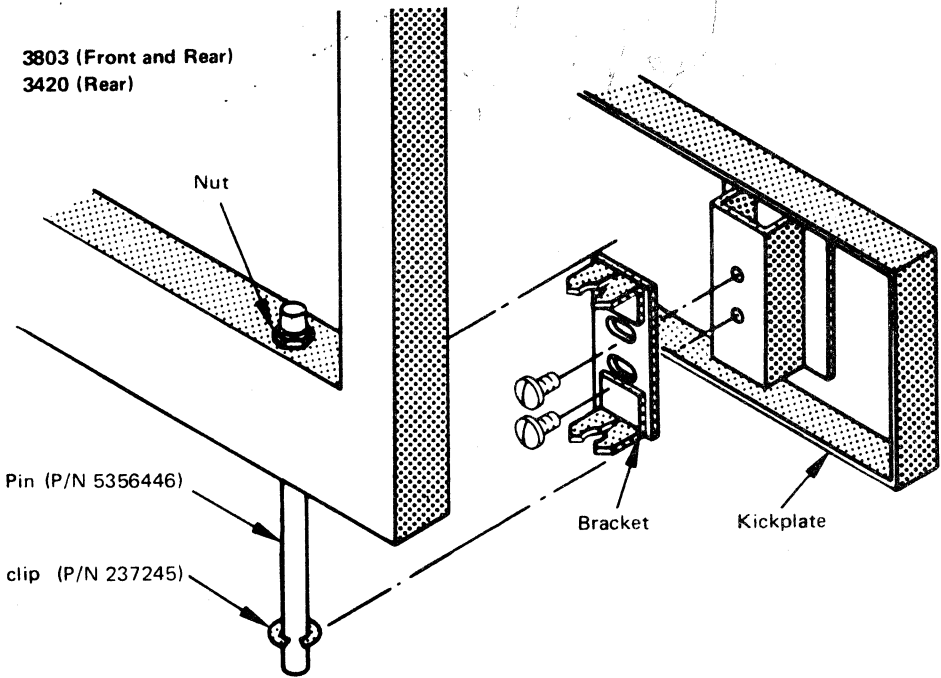
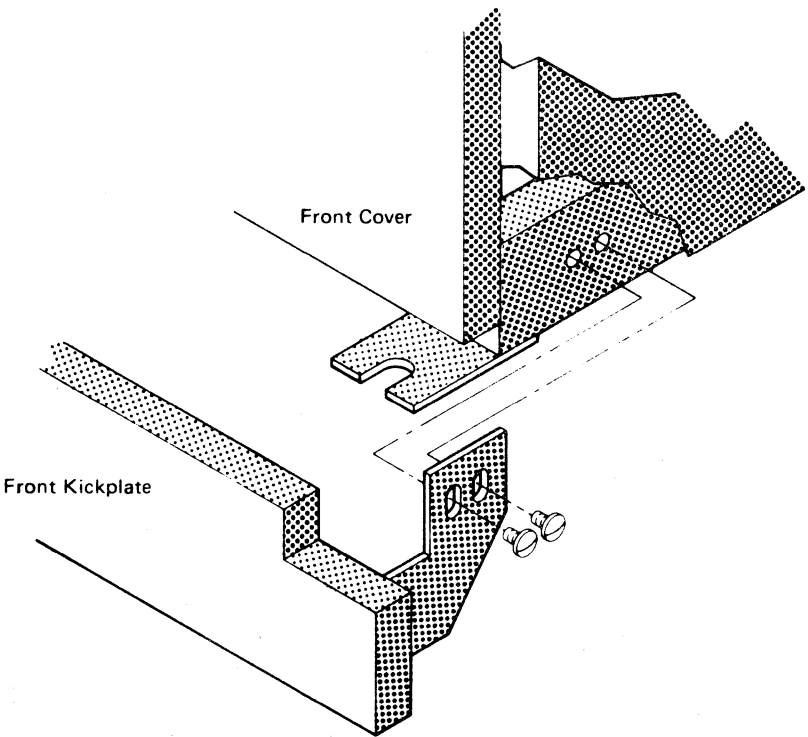


Figure 2. 3420 (Front Kickplates)

C-2 Install 3420 front kickplates as shown in Figure 2.

- 1. Install front kickplates before moving tape units into place.
- 2. Elongated holes in the bracket allow kickplate to be leveled and adjusted to clear the front cover.



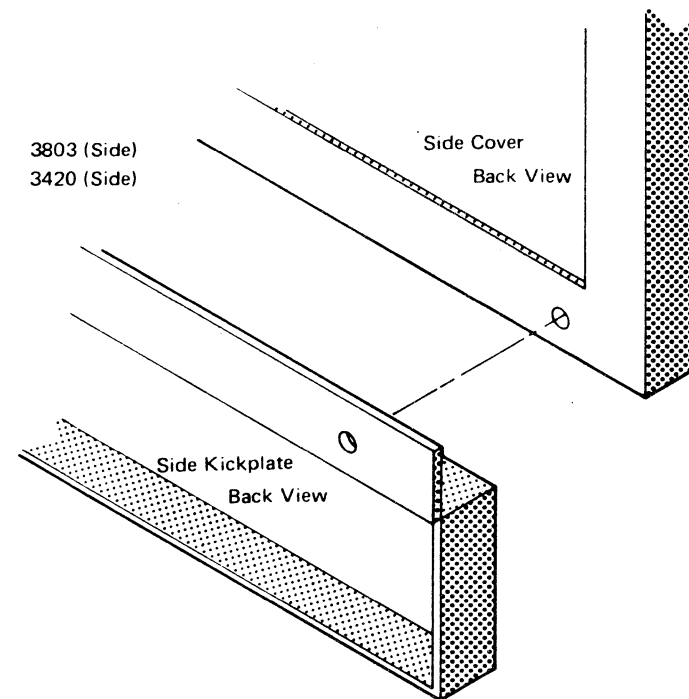
3803-2/3420							
XJ0500	2738024	See EC	845958	846927	847298		
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83		

**SECTION C. KICKPLATES (Cont'd)**

**C-3** Install 3803 and 3420 side kickplates as shown in Figure 3.

1. Install side kickplates only on the machines at each end of a group. Use screw P/N 731629.
2. Open or remove covers to attach kickplates. Use 12-inch (305 mm) kickplate, part 2501286 (notched corner), on cover adjacent to tape unit power door hinge. Use 13 1/8-inch (333 mm) kickplate, part 5356406, on remaining side covers for 3420 tape units and 3803 tape controls.

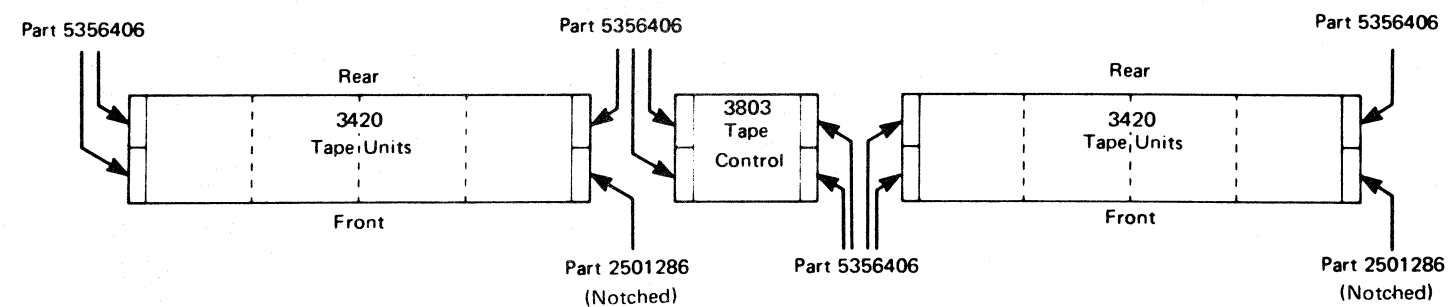
Figure 3. 3803, 3420 Side Kickplates

**C-4 Typical Subsystem Configuration**

Sufficient side kickplates, parts 2501286 and 5356406, are shipped for the configuration shown in Figure 4. Kickplates are not provided for installation between adjacent tape units. Order additional side kickplates by MES, if needed for other configurations.

**C-5** Install caster locks (4each), P/N 280336.

Figure 4. Subsystem Configuration

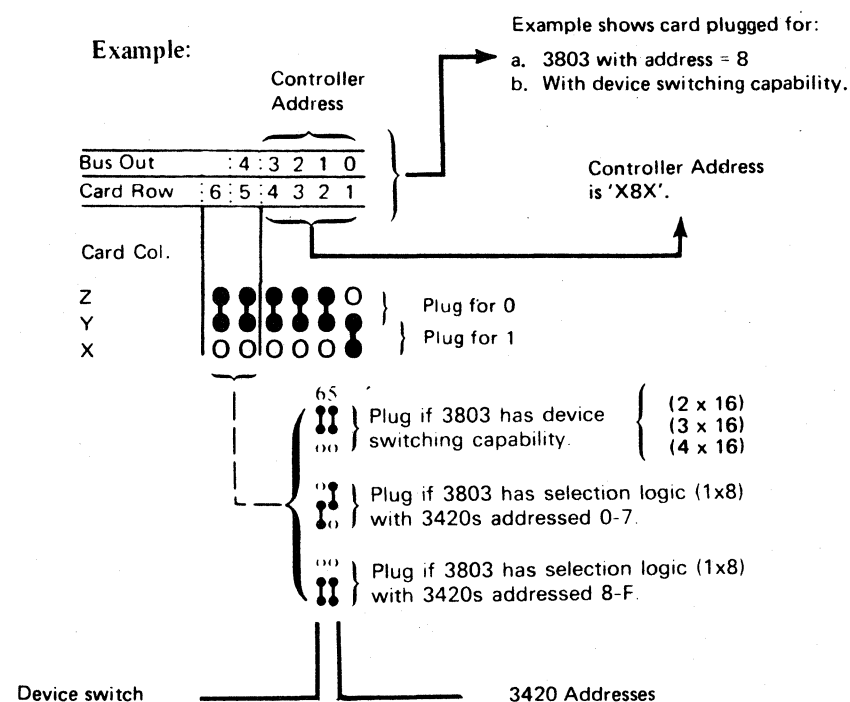
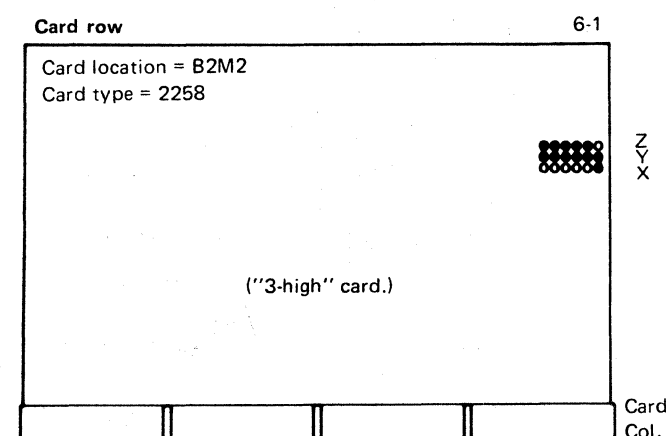


3803-2/3420

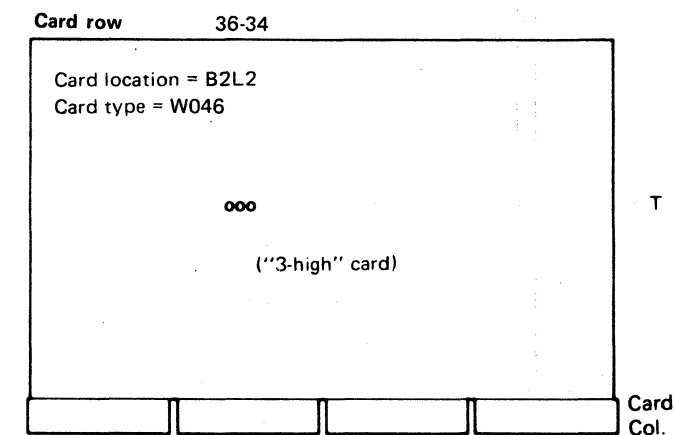
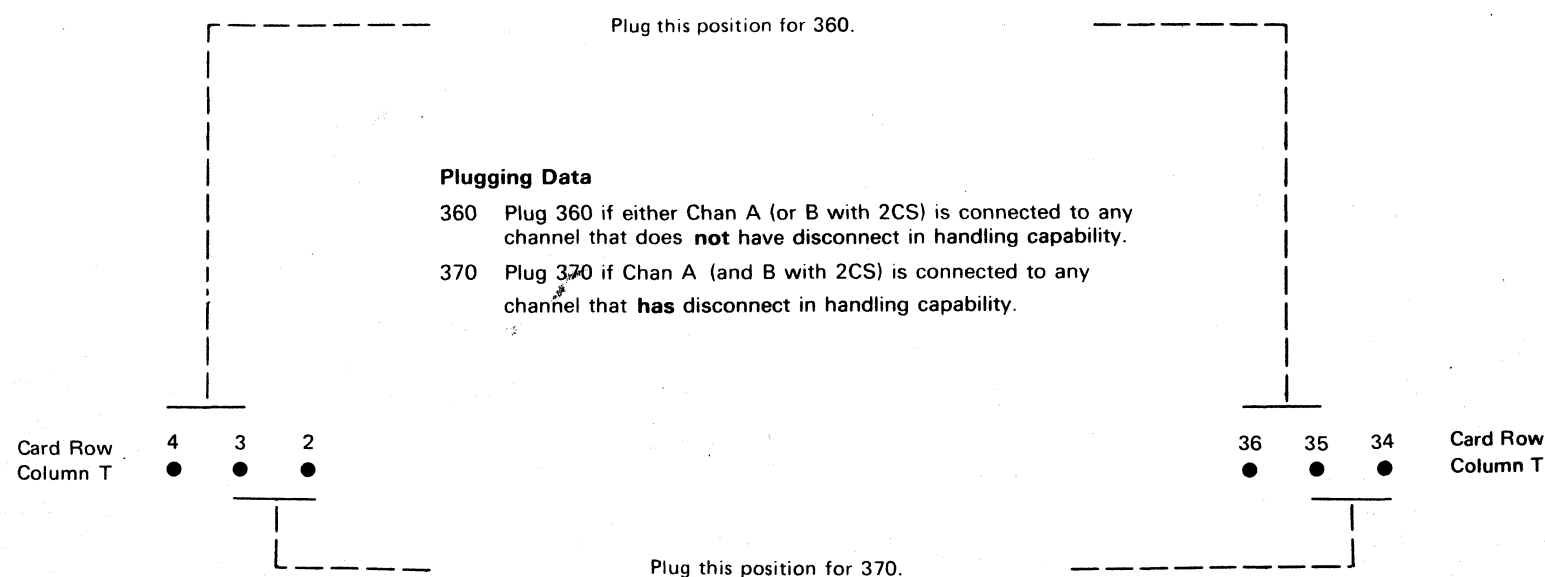
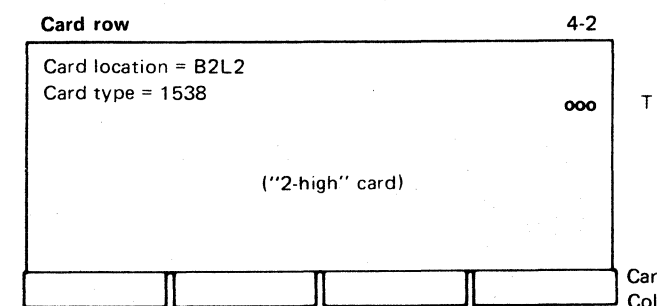
XJ0600	2736025	See EC	845958	846927	847298			
Seq 1 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			

© Copyright International Business Machines Corporation 1976, 1979, 1980, 1983

D-1 3803 Address (Channel "A"): Verify factory plugging.



Card row	4-2
Card location = B2L2	
Card type = 1538	



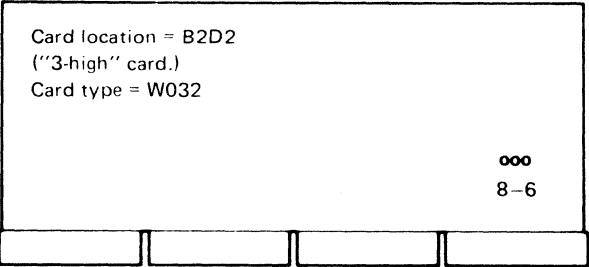
SECTION D. TAPE CONTROL ADDRESS/  
FEATURE/PRIORITY CARD PLUGGING  
(Cont'd)

D-3 Select Out Priority:

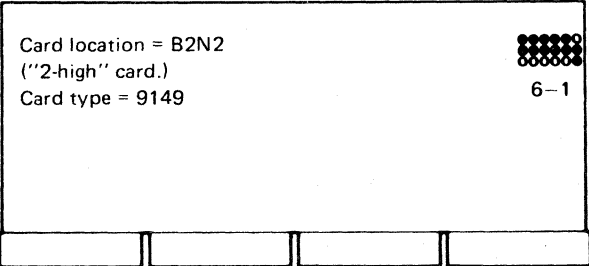
Tape controls are factory-wired to respond to a select out signal (high priority). If ("low priority") is desired, change the B2 panel wiring to convert a 3803 tape control to respond to a select in signal. Refer to wiring charts below for rework.

'High' Priority (3803 Responds to 'Select Out')		'Low' Priority (3803 Responds to 'Select In')	
Channel A (FC281)			
From	To	From	To
V4D09 T4B08 S2P11	S2P09 V4B08 T4D09	V4D09 T4B08 S2P11	T4D09 S2P09 V4B08
Channel B (XM181)			
From	To	From	To
U6C02 U4B08 R2P11	R2P09 U6B04 U4D09	U6C02 U4B08 R2P11	U4D09 R2P09 U6B04

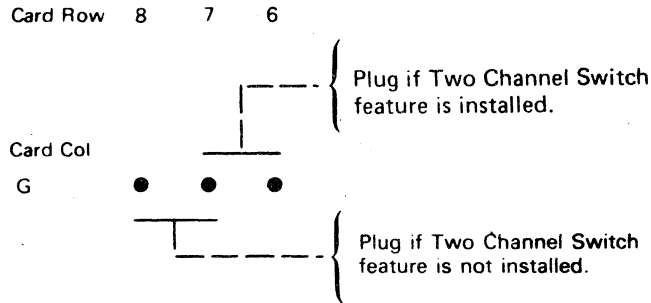
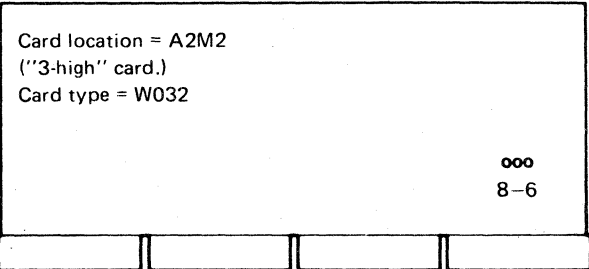
- D-4 Features (when applicable to your machine):
- a. Two Channel Switch Feature: Verify factory plugging.



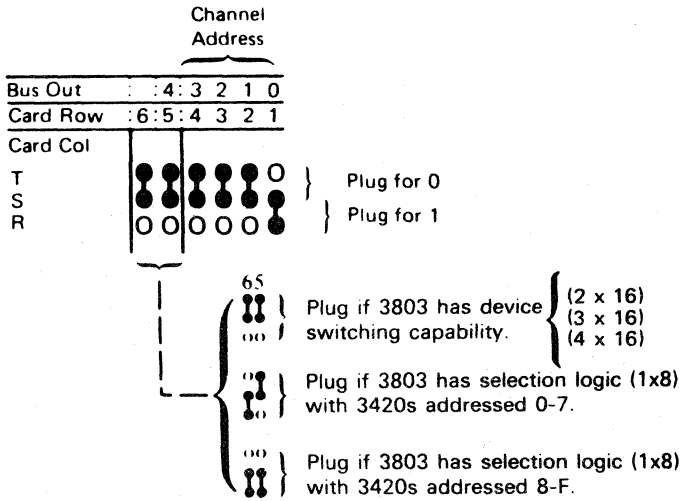
- b. Two-channel switch feature (3803 Address Channel "B"): Verify factory plugging.



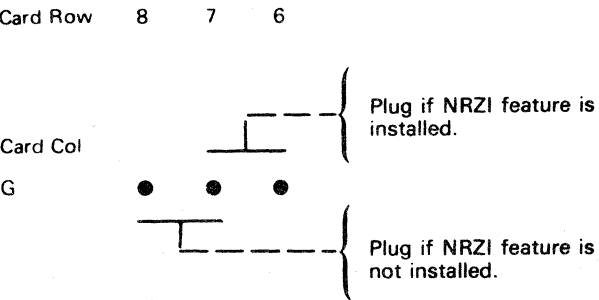
- c. NRZI Feature: Verify factory plugging.



Example:



Example shows card plugged for:  
a. 3803 with address = 8.  
b. With device switching capability.

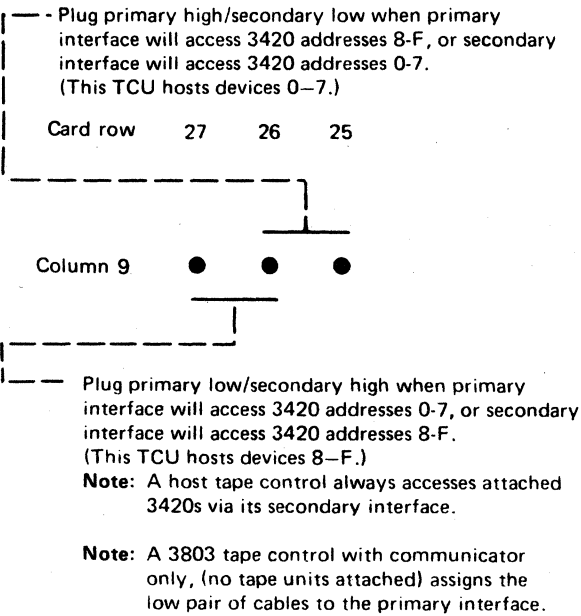
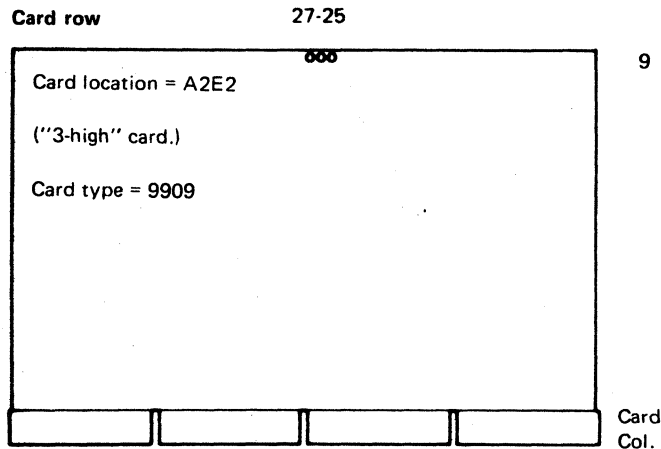


3803-2/3420		XJ0700		2736026		See EC History		845958		846927		847298					
Seq 1 of 2		Part Number		1 Sep 79		20 Jun 80		15 Aug 83									

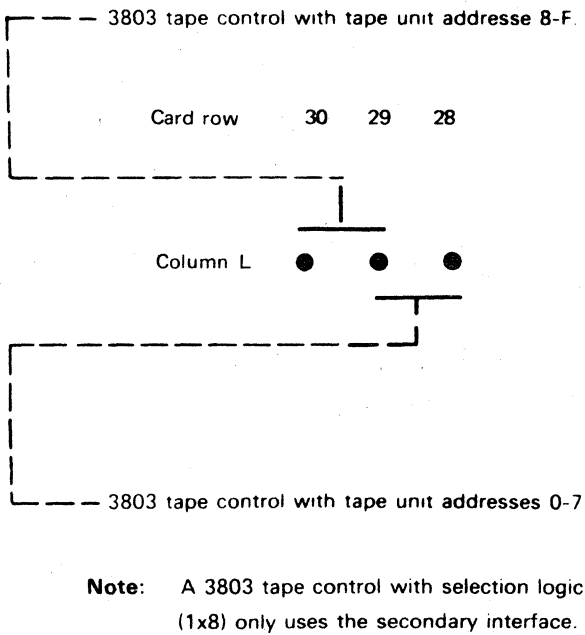
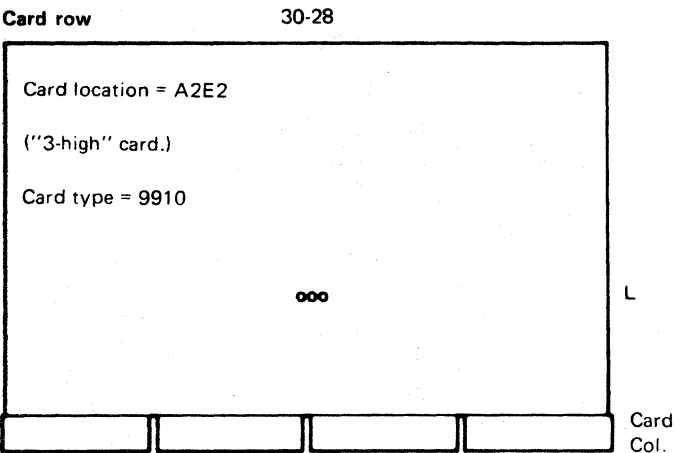
SECTION D. TAPE CONTROL  
ADDRESS/FEATURE/PRIORITY CARD  
PLUGGING (Cont'd)

D-5 Primary/Secondary Tape Unit Interface Control:

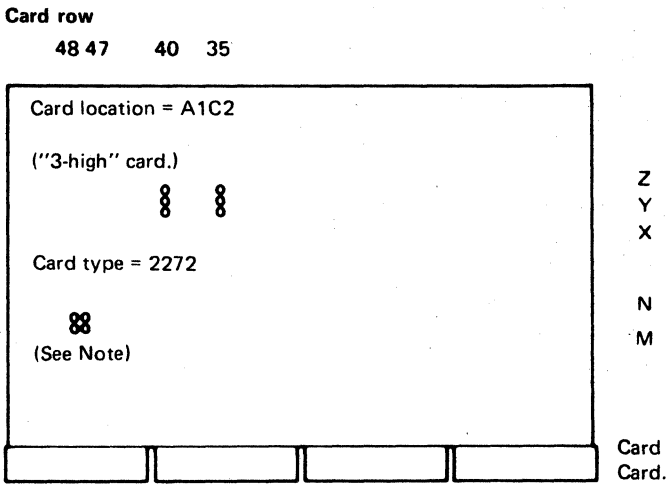
a. With device switching capability.



b. With selection logic (1x8).

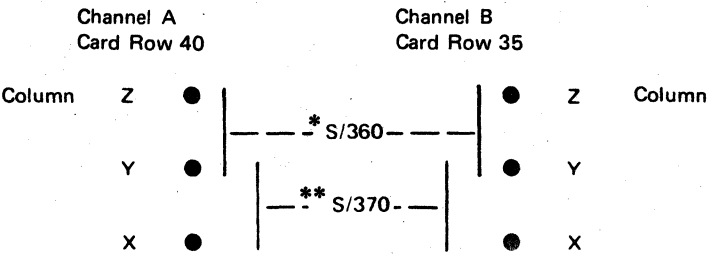


D-6 a. Data In Handling: S/360 or S/370.



Note: Data Flow Check asymmetry. Do not change jumpers unless card is replaced. This is a factory adjustment only.

b. If you have Selection Logic (2x8), go to step D-9 on page 90-160, if device entry, else go to 90-180.  
If you have 2x, 3x or 4x switch, proceed to step D-7 on page 90-140.



Plug each channel independently as follows:\*

\*360 Plug 360 if the attached channel does not have data in/data out capability.

\*\*370 Plug 370 if the attached channel has data in/data out capability.

If attached to a 2880 channel, bus out checks may occur if channel timings are not optimized. The 2880 must be at EC718040 level or higher.

\*W/O 2CS—Channel B may be plugged to 360 or 370 since it is not used.

3803-2/3420

XJ0700	2736026	See EC	845958	846927	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			

© Copyright International Business Machines Corporation 1976, 1979, 1980, 1983

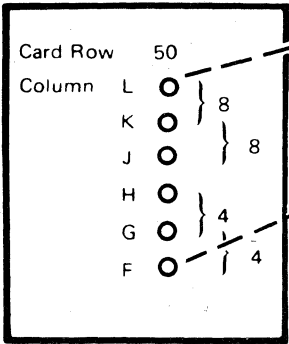


SECTION D. TAPE CONTROL  
ADDRESS/FEATURE/PRIORITY CARD  
PLUGGING (Cont'd)

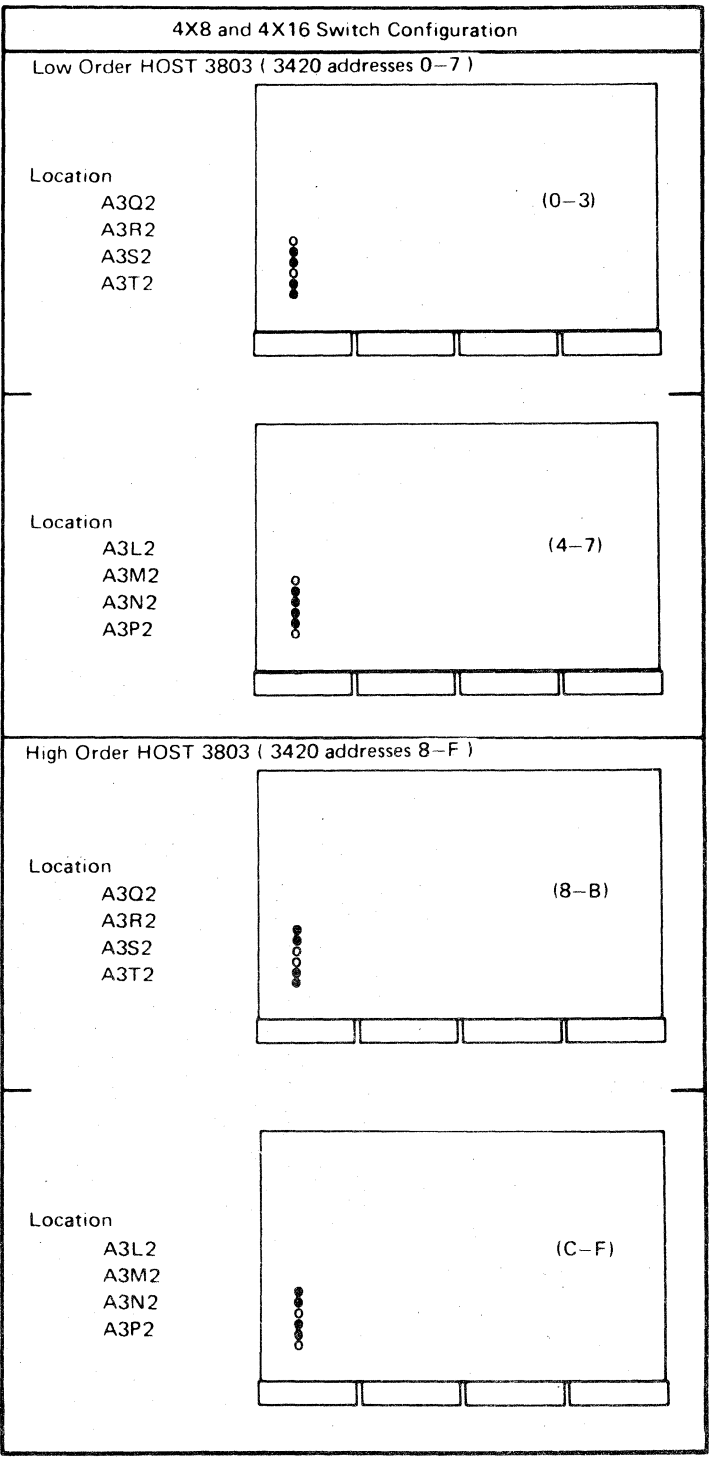
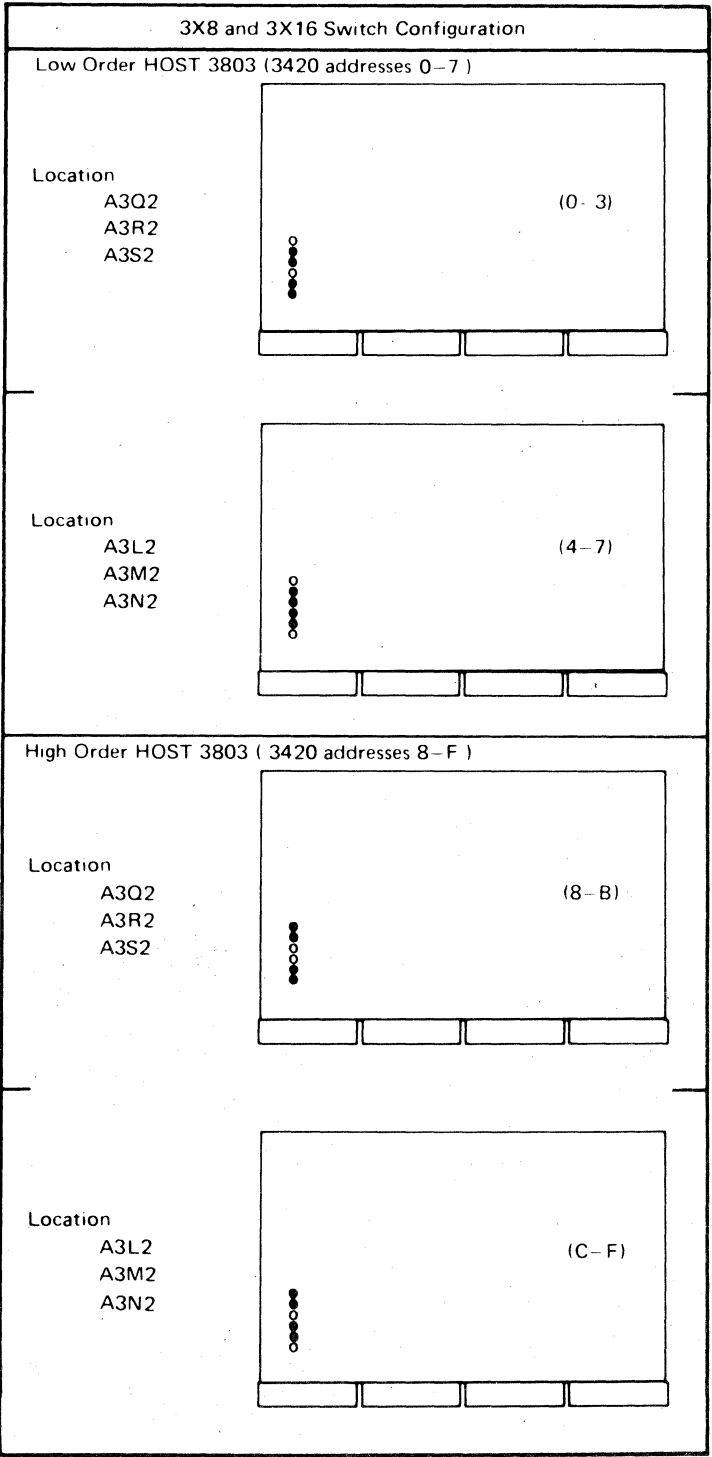
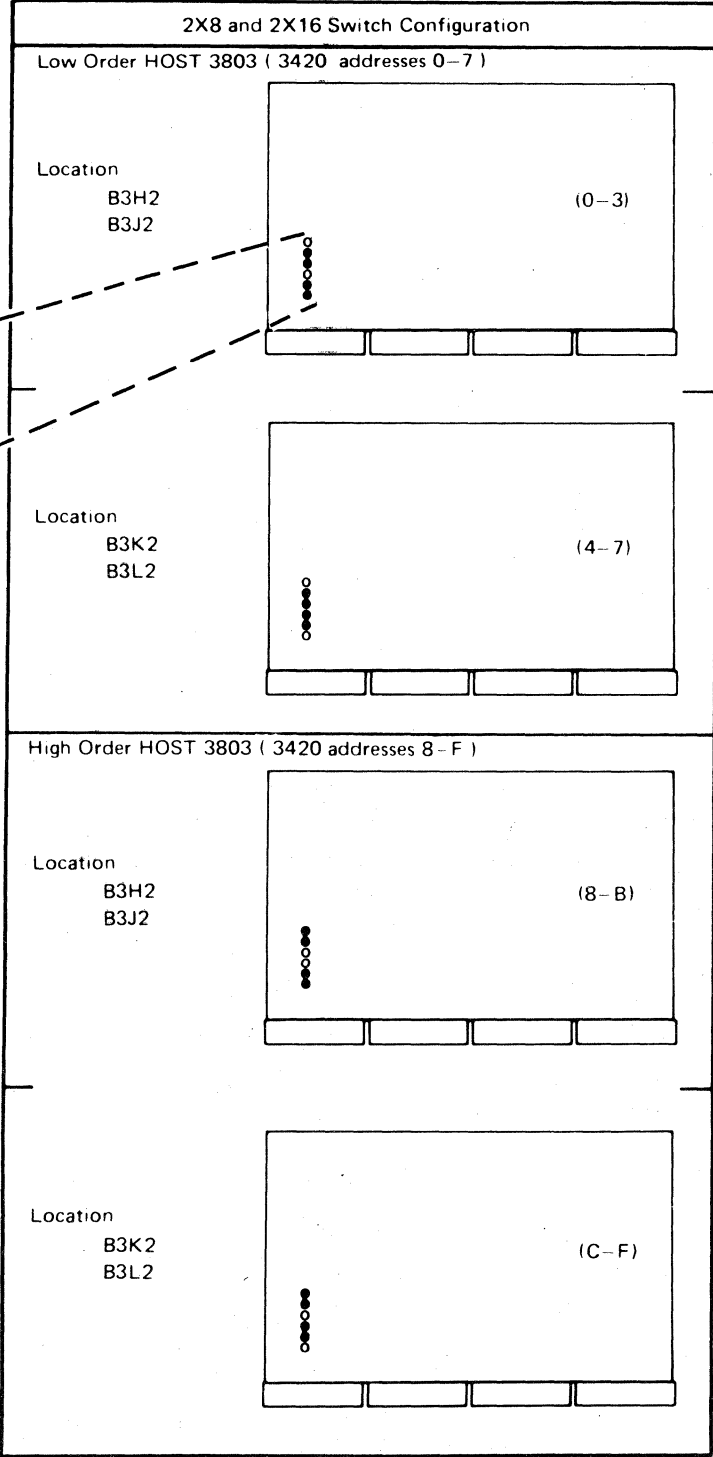
D-7 Tape Switching Feature Address Control: Change or verify jumper plugging of host 3803 tape controls only.

1. For installations with less than a full complement of 3420 tape units (for example, 2x12), plug all cards present as if the non-existent tape units had addresses assigned to them.

Jumper cable locations for switch cards:



2. As each switch card is pulled, refer to the chart on Page 90-150 and verify that device selection priority assignments are correct.



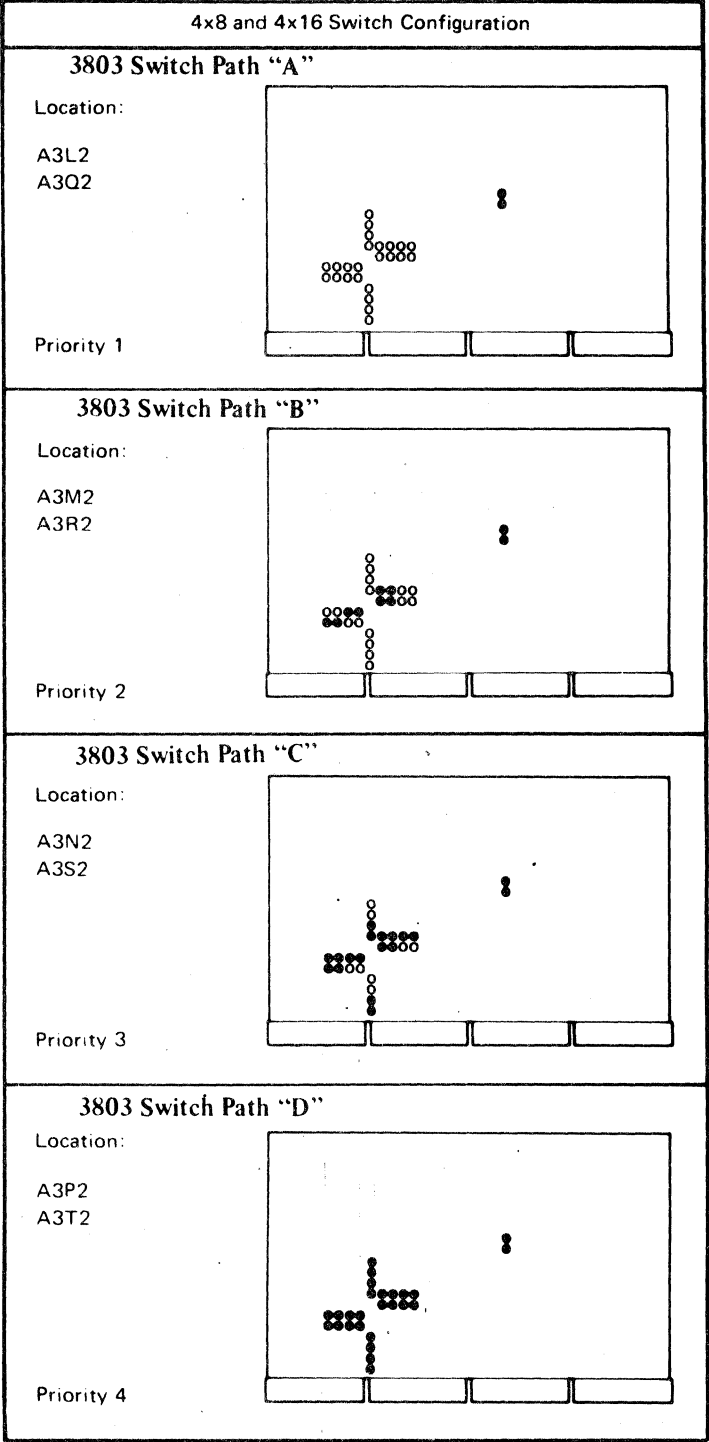
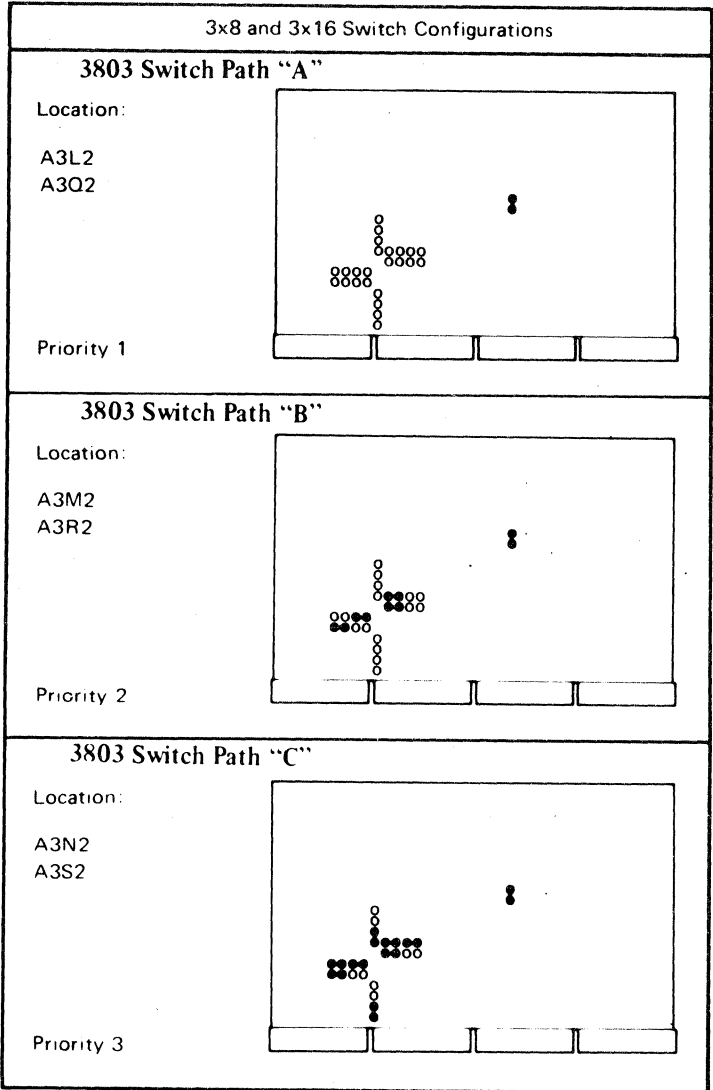
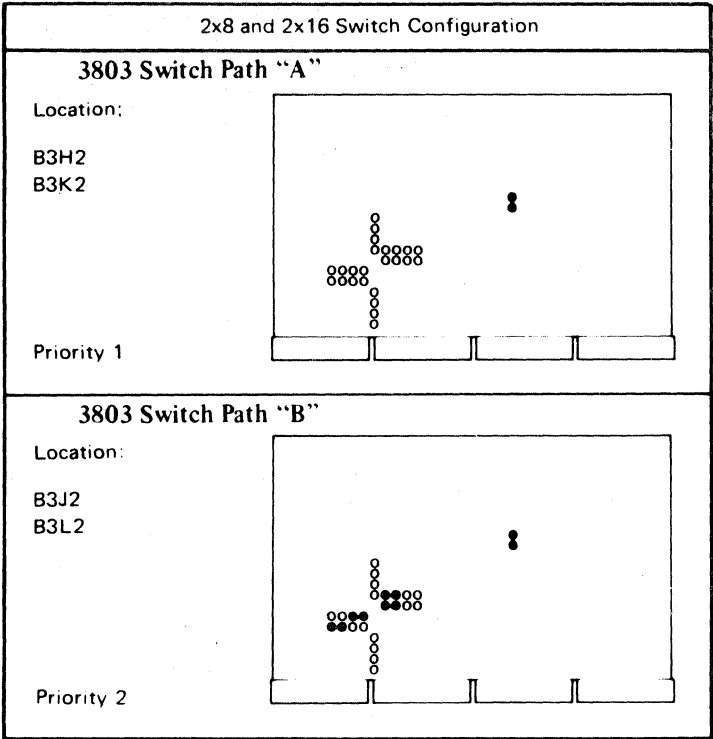
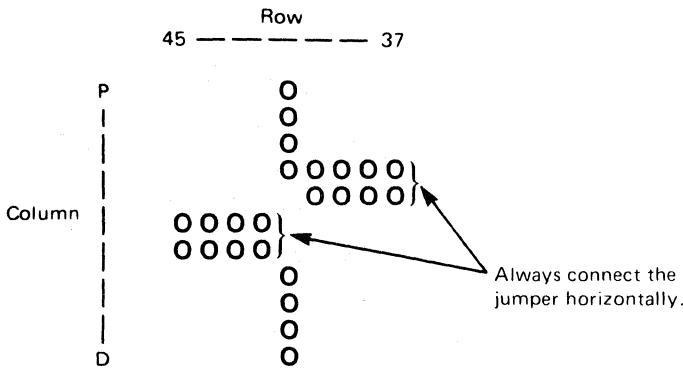
SECTION D. TAPE CONTROL  
ADDRESS/FEATURE/PRIORITY CARD  
PLUGGING (Cont'd)

D-8 Device Selection Priority Assignments: Verify that factory plugging of priority jumpers on the switch cards is correct.

Plugging Rules:

- 1. A priority must be assigned to each set of cards.
- 2. No duplication of priority should exist between sets of cards in one 3803 tape control.
- 3. All cards must have T23-U23 connected by a jumper wire.
- 4. Factory plugging for these cards should be as shown, and should not have to be changed for any installation.
- 5. This plugging establishes priority; if two 3803s try to access the same 3420 tape unit simultaneously, the 3803 with the least number of jumpers will take control.

Connect a jumper cable to locations for switch cards as shown below:



3803-2/3420

XJ0800	2736027	See EC	845958					
Seq 2 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

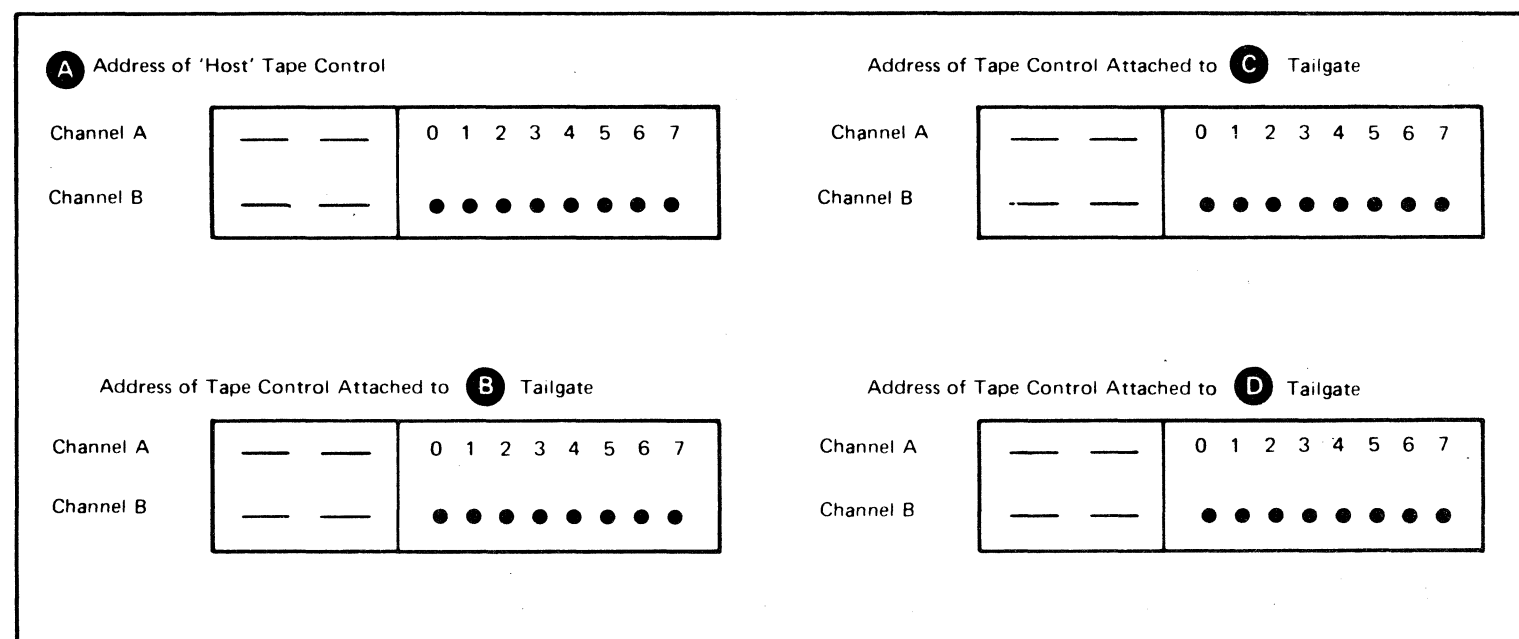
# SECTION D. TAPE CONTROL ADDRESS/FEATURE/PRIORITY CARD PLUGGING (Cont'd)

D-9 Apply labels to tape control operator's panel as shown.

## a. Operator's Panel Labels

For the 3803 that "hosts" tape units 0-7:

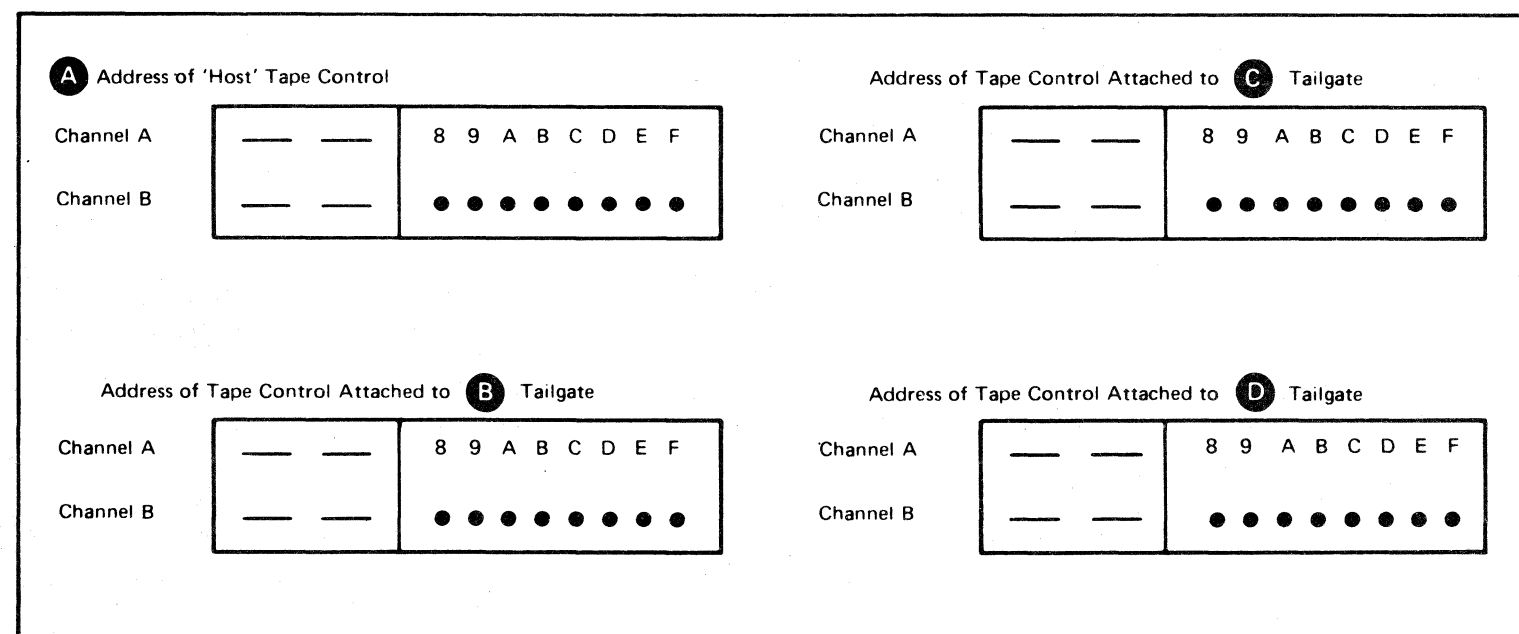
1. Use labels furnished to indicate addresses of tape control associated with each group of operator panel switches.
2. Apply 3420 address labels 0-7 above each group of switches as shown.



## b. Operator's Panel Labels

For the 3803 that "hosts" tape units 8-F:

1. Use labels furnished to indicate tape control addresses associated with each group of operator panel switches.
2. Apply 3420 address labels 8-F above each group of switches as shown.



**Note:** Symbols **A** through **D** refer to control switch paths A through D of the device switching feature.

3803-2/3420

XJ0900	2736028	See EC	845958					
Seq 1 of 2	Part Number	History	1 Sep 79					

© Copyright International Business Machines Corporation 1976, 1979

FIELD TESTER CONVERSION

Do the following rework to make the field tester compatible with 3420 Models 4, 6, and 8. The new EC Level is 734316. (The field tester remains compatible to 3420 Models 3, 5, and 7.)

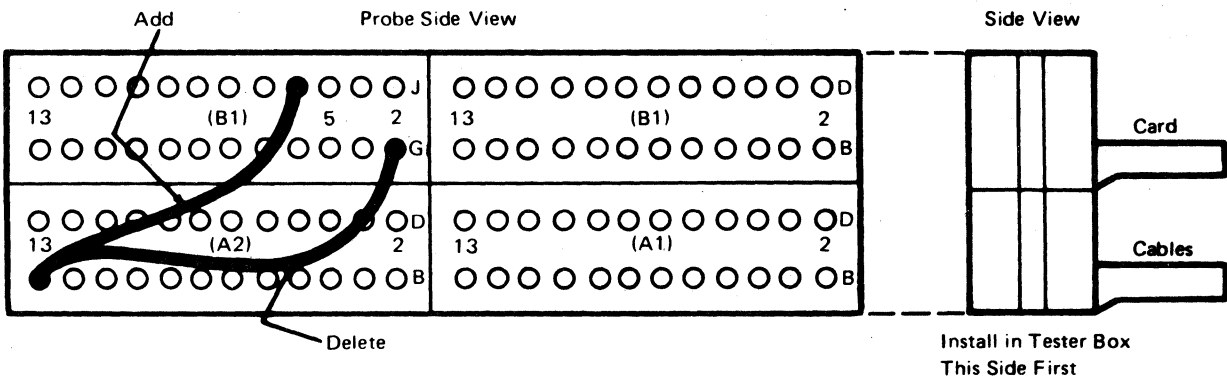
- Remove the four screws from the bottom of the tester. Then remove the cover. Check the probe side of the card/connector socket block:
  - If connections are made by means of a printed circuit card, replace the cover and four retaining screws, then skip to step 7.
  - If connections are made by means of wire wrapping, proceed to step 2.
- Remove the logic card, unplug the signal cables, and slide the connector block out.
- Delete yellow wire from B1G02 to A2B13.
- Add #30 gauge SLT wire from B1J05 to A2B13.
- Reassemble the tester: slide the connector block into the tester, plug the cables, and install the logic card.
- Replace the cover and the four retaining screws.
- Install label, part 1845758, to the right of the data rate switch (8, 16, 32) as shown.
- Install label, part 1845760, over the existing instructions (1-3) on top of the tester.
- Before** converting a Model 3, 5, or 7 tape unit to a Model 4, 6, or 8, take the tape unit offline. Then connect the field tester.

**Note:** Simulate a Model 4, 6, or 8 by grounding N5B02 on the tape unit.
- Mount and load a CE work tape. Then set the field tester to WRITE CONTINUOUS. See 80-020.
- Scope test point A1H1B11 (–WRITE DATA TRACK P), at the tape unit. Observe a full write cycle period and compare to the chart below. Make sure the data rate switch is set correctly for the tape unit model being used.

**Note:** Times are nominal and are given in microseconds. Tolerance is ±5%.

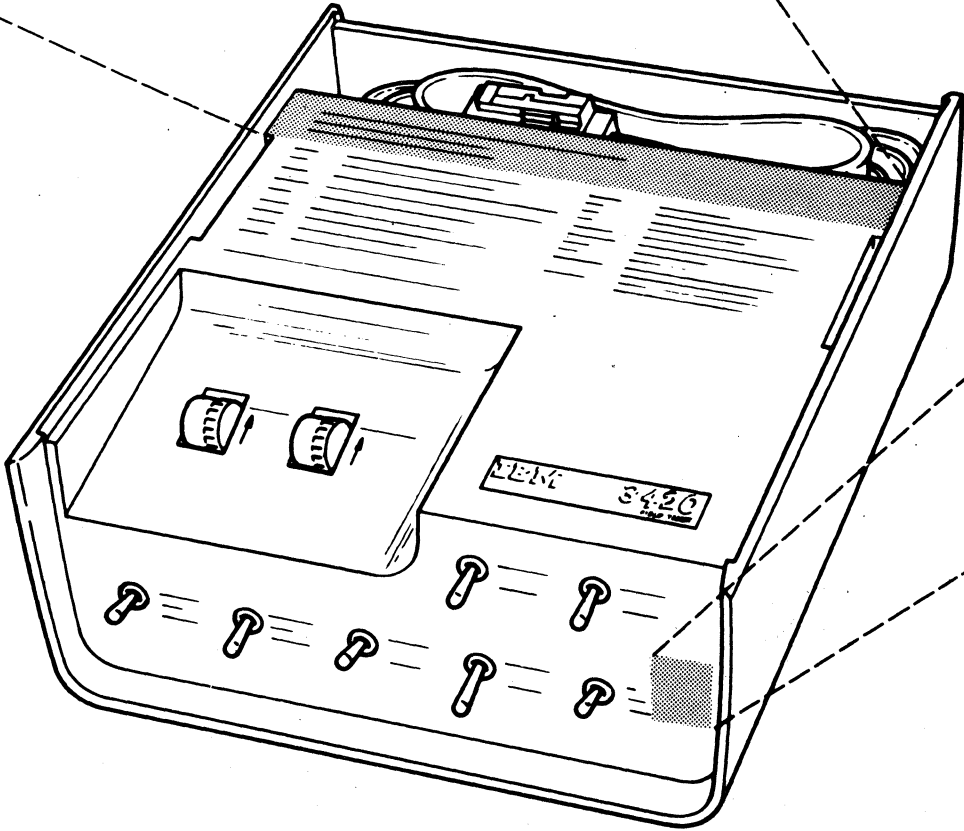
Model	Data Rate Switch Position			
	8	16	32	64
3	32.8	16.4	8.2	—
4	—	16.4	8.2	4.1
5	20.0	10.0	5.0	—
6	—	10.0	5.0	2.5
7	12.4	6.2	3.1	—
8	—	6.2	3.1	1.6

**Note:** Take any 3420 tape unit Incident Report (IR) and code your time, using Service Code 33, ECA #991.



- Unload drive before plugging or unplugging tester.
- Place tape unit in off-line status.
- Connect at A1N5, wiring side.
- Jumper K2P02-M2D06 for 6250 operation.

8



7

MOD. 4,6,8		
1600	6250	
16	16	
32	32	
N/A	64	

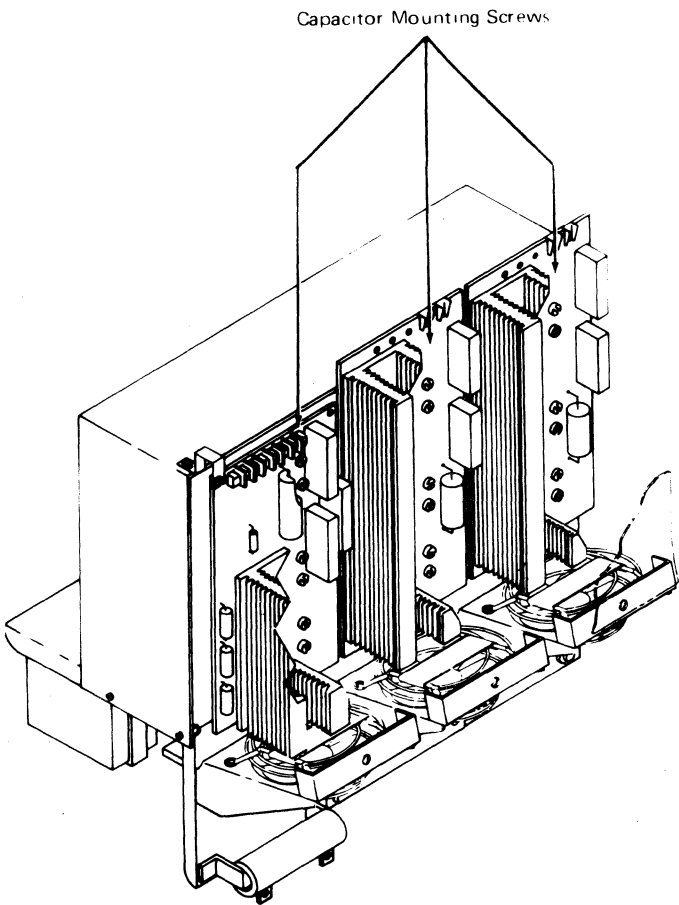
3803-2/3420

XJ0900	2736028	See EC	845958				
Seq 2 of 2	Part Number	History	1 Sep 79				

© Copyright International Business Machines Corporation 1976, 1979

SECTION E. POWER SUPPLY CHECKS

- E-1 Remove the wire seal from the 3420 tape unit J1 power connector, and the wire seal from around the 3803 Model 2 power plug.
- E-2 With power off, check the 18 filter capacitor mounting screws on the 3803 Model 2 tape control's +6v and -4v power supplies. If loose, tighten the screws being careful not to over-torque and damage the power board. Also, check all other power supply screws and connections. (See 08-575.)



- E-3 With power off, check that the customer's supply voltage matches that shown on the voltage rating label.
- Note:** To connect a 3803 tape control for operation at a different input voltage, refer to

3803 logic page YF010 (60 Hz) or YF015 (50 Hz).

See Page 08-570 to determine if each tape unit has a modified power supply. Then, refer to logic pages listed for the connections to be changed:

Frequency	Logic Pages Affected
(Model 3, 5, 7)	
60 Hz	YB010*, YB020#, YB030#
50 Hz	YB015*, YB025#, YB035#
(Model 4, 6, 8)	
60 Hz	Yf010*, YF020#, YF030#
50 Hz	YF015*, YF025#, YF035#
* For tape units with "Modified" power supplies.	
# For all tape units.	

- E-4 Customer Power Phasing
- Check three-phase ac power receptacles to ensure proper motor rotation in each unit. Any improper phasing must be corrected before power is applied to the subsystem.
- E-5 With power on, check that all blowers and motors operate correctly.
- a. Incorrect phasing of input voltage causes the tape unit pneumatic supply motor to turn backward, preventing the tape unit from loading.
  - b. The cooling fan assembly blower motor in the tape unit will run backwards. Remove filter from machine and observe the direction of the fan as power is dropped. Fan should turn clockwise when viewed from below. (See arrow.)
- Note:** All blowers in the tape control are single phase.
- E-6 Mount and load a tape. Using a Digital Voltmeter, part 453585, 453046, or equivalent, check that the +6 volt and -4 volt power supplies are within the tolerances listed:

3420 Tape Unit Models 3, 5, and 7:		
Test Point	Tolerance (Note 1)	
-6v	A1G1E09-A1G2D08	±0.1v
-4.05v	A1N3D02-A1N3D08	±0.05v
3420 Tape Unit models 4, 6, and 8:		
Test Point	Tolerance (Note 1)	
+6v	A1G2B11-A1G2D08	±0.1v
-4.05v	A1H1C09-A1G2D08	±0.05v
<b>Note 1:</b> Ripple specifications for -4v and +6v are 24 mv peak-to-peak. Measure at power supply. Refer to DC Logic page for your machine for TB locations. (YB020, YB025 or YF020, YF025)		
3803 Tape Control		
Test Point	Tolerance (Note 2)	
+6v	B2S2M11-B2S2D08	±0.01v
-4.0v	A2T4B06-A2T4D08	±0.01v
<b>Note 2:</b> Ripple specification for -4v is 80 mv peak-to-peak and for -6v is 10 mv peak-to-peak. Measure at power supply.		
<b>Caution:</b> A ground loop has been purposely installed in the 3803 tape control for electro-static discharge (ESD) control. The installed ground loop is in the tape signal tail gate connector, and must be disassembled to check for other ground loops. The tape control is checked at the factory for ground loops.		

Special Power Requirements—3420 Model 8, 60 Hz Only

In certain 1x8 or 2x16 - 3420 configurations, which include the 3420 Model 8, a single 3803 cannot supply the power necessary for the operation of the subsystem without a special power feature. The table below shows the maximum number of tape units that may be powered from one 3803 without this special feature.

Number of 3420 Model 8's	Number of 3420 Model 7's	Number of 3420 Model 3-6
6	0	0
5	1	0
5	0	2
4	2	1
4	1	2
4	0	3
3	4	0
3	3	1
3	2	2
3	1	4
3	0	5
2	5	0
2	4	2
2	3	3
2	2	4
2	1	5
2	0	6
1	*	*

\* If only one 3420 Model 8, then any combination of seven additional tape units is permissible.

If your customer's requirement exceeds the table, you must order SF9001 for the 3803(s). (For example, if he needs more than six Model 8s or two Model 8s and six Model 7s on a single 3803).

In all cases where this power supply feature is ordered, the customer must install a 100 Amp power source.

SECTION F. CHECKS AND ADJUSTMENTS

**Note:** Make sure the write head card is seated properly before continuing.

This section outlines checks, adjustments, and tests to ensure that the tape units and tape controls operate normally when the subsystem is turned over to the customer. See "Checks, Adjustments, Removals, and Replacements" sections of this manual for details.

F-1 Altitude Vacuum Level Setting—3420

Using a water manometer with a pressure divider; or a pressure/vacuum gauge, part 5495384, measure the vacuum according to the decal on the transfer valve. If incorrect:

- a. 3420 Models 3 through 7:  
Check that the vacuum pump belt and transfer valve plug are set as shown in 08-410.
- b. 3420 Model 8 only:  
Adjust vacuum line restrictor to obtain vacuum shown in 08-410.

F-2 Regulator Air Pressure—3420

Check/adjust pressure as shown in 08-405.

F-3 Capstan—3420

**Caution:** Allow fiber optics lamp to warm up 20 to 30 minutes before making adjustments.

Do capstan tach adjustment. See 08-130 for models 3, 5, 7 or 08-120 for models 4, 6, 8.

F-4 Mechanical Skew—3420

- a. Visually check tracking before adjusting the skew plate. Perform procedure on page 08-150 or 08-160.
- b. Check that mechanical skew meets the specifications given in 08-170 (1600 and 6250 bpi) or 08-180 (NRZI).

F-5 BOT/EOT—3420

**Caution:** Allow fiber optics lamp to warm up 20 to 30 minutes before making the adjustments.

Verify BOT/EOT adjustment. See 08-580.

F-6 Autocleaner Tape Direction—3420

**Caution:** Do not check autocleaner until tape unit has been positioned online, and just prior to returning machine to customer.

Check that autocleaner tape moves from bottom to top by marking tape and observing direction. See 08-380, "Autocleaner Operational Check".

F-7 ESD Grounding—3420 and 3803

Check that each door strike and roller assembly is adjusted correctly to ensure sufficient electro-static discharge (ESD) grounding.

- 3420 lower rear door (1).
- 3803 upper and lower on the front and rear doors (4).

This adjustment is accomplished as follows:

- a. With the screws loose, adjust the roller assembly so the door roller will latch on the strike plate.
- b. If necessary, adjust the plate mounted between the strike and frame to ensure proper grounding between the plate and finger stock assembly.

**Note:** Check that the door latching adjustment is still correct.

F-8 ESD Grounding—3803

- a. Check the adjustment of the ESD plates on both the left and right sides. Be sure the plates are installed with the hem toward the inside of the machine.

**Caution:** Be sure that the plates are not adjusted to bow too much because the plates will reverse bow when the door is closed and lose proper grounding.

- b. If necessary, adjust the plates so that each one bows out sufficiently to make contact with the hat section of the side cover.
- c. Check the side door latch for a firm latching and adjust, if necessary.

F-9 Data Flow Clock Asymmetry Adjustment—3803

If the A1C2 card is replaced in the 3803, see ALD AA010 sheet 2 of 3, for adjustment procedure. (Originally factory adjusted.)

3803-2/3420

XJ1000	2736029	See EC	845958	846927				
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80				

SECTION G. SYSTEM DIAGNOSTICS

**Note:** Make sure the write head card is seated properly before continuing.

**G-1** Run 3420 OLTs A-K, M-X and AB through AG. (AB) through AG must be run under OLTSEP. AB is a diagnostic for 3803s with a device switching feature. AD through AG are optional for 3803s with the two-channel switch feature. (You must have a "dedicated" system to run diagnostics AB through AG.)

**Note:** OLT section 3420L will run only under sense switch setting (3420L/EXT=9). Verify PE clipping levels on machines with PE feature.

**G-2** Verify serial numbers, EC levels, and features from the diagnostic printout.

- a. If the tape control information is incorrect, see plugging chart on 90-210, or AA010 in the 3803 ALDs.
- b. If the tape unit information is incorrect, see plugging chart on 90-210, and 90-212 or A6106 in the 3420 ALDs.

**G-3** When the diagnostics have run error free, generate and save for future use a **read only** tape in 6250 bpi mode.

- a. Enter the following as shown:  
r 01,'DEVICE/3420A-G/fe,ext=z/'
- b. To ensure that a good tape has been generated, the program must run without error. When a good tape has been generated, remove the write enable ring.
- c. Mark this reel **6250 bpi READ ONLY** and save for diagnostic use with Section 00-010 of the MLMs.

**Note:** The CE should retain the output from Sections "V" and "W" of the OLTs which will give a printed table listing of all tape unit performance measurements.

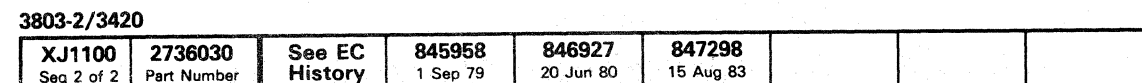
**EMULATOR:** (If applicable to your machine.)

If the 3803 is attached to a System/360 on which any emulator is run, install a jumper on each tape unit to disable LOAD FAIL IRPT:

- 3420-3, 5, and 7, between A1H2U12 and A1H2U08
- 3420-4, 6, and 8, between A1M2U12 and A1M2U08

**G-4** Tape Control Serial Number/EC Level/Feature Code: Verify from diagnostic printout that factory plugging is correct when diagnostics are run.

Plugging example: tape control serial number is 10430, with 9-track feature.





**G-5** Tape Unit Serial Number/Model Number/EC Level/ Feature Code: Verify from diagnostic printout that factory plugging is correct on all tape units when diagnostics are run (3420) ALD A6106.

Tape Model	Alpha
Model 3	A, B, P
Model 5	C, D, Q
Model 7	E, F, R
Model 4	G, H, S
Model 6	J, K, T
Model 8	M, N, U

Plugging example: Wired for EC734801 and feature code 6250/1600 bpi.

Plugging example: Wired for model 4.

Original model number (Models 4,6, and 8) (See Notes)

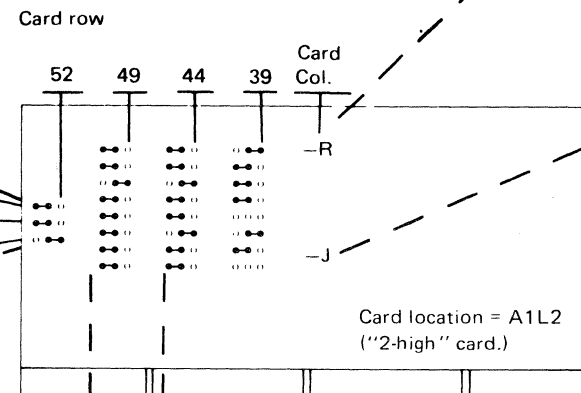
Original Model No.	Card Col.	Card row		
		54	53	52
L M N — Card Col.	N M L			O
0 1 0 — Model 3				O
0 1 1 — Model 4		O		
1 0 0 — Model 5				
1 0 1 — Model 6				
1 1 0 — Model 7				
1 1 1 — Model 8				

When plugged, the columns will become either a one (1) or a zero (0).

90-99XXX machines plug for  
model of tape unit.

**Notes:**

- [1] The original model number is the high-order digit or alpha character in the serial number, and is not changed with model conversion. See table to convert alpha to model type.
- [2] For tape units with a high order digit in the serial number, other than 3 through 8; the diagnostic will print the original model number as the high order digit of the serial number.



EC Level/Feature Code			Card Col.	Purpose
41	40	39		
O	●	●	R	EC Level N P Q R Card Col. (Ref.) 1 1 1 1 = EC No. 734776 0 0 0 1 = EC No. 734801 0 0 0 0 = EC No. 735810 or higher
●	●	O	Q	
●	●	O	P	
●	●	O	N	
O	O	O		Feature Code K L = Card Column (Ref.) 0 0 = Basic Densities 6250 only 0 1 = 6250/1600 bpi
O	●	●	L	
●	●	O	K	

When plugged, the columns will become either a one (1) or a zero (0).

Tape Unit Serial Number					
Card row			Example Values	Plug Valve	Card Col.
46	45	44			
			4	1	R
				2	Q
			32	4	P
				8	N
			1024	16	M
				32	L
			1060	64	K
				128	J
Card row				Plug Value	Card Col.
51	50	49	1024	256	R
				512	Q
			1060	1024	P
				2048	N
			1060	4096	M
				8192	L
			1060	16384	K
				32768	J
Card row					

To plug serial number:  
Plug pins to equal the  
last four digits of the  
serial number using  
chart at left.

Plugging example:  
Tape unit serial  
number is 81060.

Plug positions  
to give a sum  
of 1060.

<b>XJ1102</b> Seq 1 of 2	<b>4169688</b> Part Number	<b>See EC History</b>	<b>845958</b> 1 Sep 79	<b>846927</b> 20 Jun 80				
-----------------------------	-------------------------------	-----------------------	---------------------------	----------------------------	--	--	--	--

NOTES:

90-213

3803-2/3420

XJ1102	4169688	See EC	845958	846927				
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80				

© Copyright International Business Machines Corporation 1976, 1979, 1980

90-213

A

Abends-Theory 00-035  
A/B Read and Sequencing Register 53-055  
A Register 52-035  
AC Power Supply (see Power Supplies)  
Acceptable Waveforms (Read Card Test Points) 5B-004  
Access Times, Read/Write (Subsystem Characteristics) 40-002  
Acronyms and Abbreviations PLAN 2  
Active/Inactive/Pulsing/Switched Line Levels 00-003  
Adapter Hose (CE Tool) 80-000  
ADD/ADDM, Arithmetic (ALU Operation) 52-065  
Additional Stopping Distance After Go Extend 6A-140, 6B-205  
Address Out Active (MAP) 13-300  
Address Out Inactive (MAP) 13-360  
Address/Feature/Priority Card Plugging (Installation) 90-110  
Address Decoders, Control Unit 58-010  
Addressing  
  Concepts 40-003  
  Tape Control and Tape Unit 54-005  
Adjustment  
  Altitude Vacuum Level 08-410, 90-190  
  AMP Sensor (NRZI-Model 3, 5, 7) 08-300  
  Amp Sensor (PE Only-Model 3, 5, 7) 08-290  
  Amplitude (Model 4, 6, 8) 08-310  
  Autocleaner 08-382, 5B-110  
  BOT/EOT, Fiber Optic 08-580  
  BOT/EOT Voltage 08-575  
  Capstan To Stubby Bar Clearance (All Models) 08-080  
  Capstan Tachometer (Model 3, 5, 7) 08-130  
  Capstan Tachometer (Model 4, 6, 8) 08-120  
  Cartridge Motor 08-535  
  Data Flow Clock Asymmetry 90-190  
  DC Power Supply 08-570  
  Dual Density Threshold Adjustment Card 80-000  
  Electrical Skew (NRZI Feature) 08-200  
  ESD Grounding (3420/3803) 90-190  
  Head Mirror Stop (Model 3, 5, 7) 08-350  
  Left Reel Hub and Motor 80-560  
  Mechanical Skew (NRZI Feature) 08-180  
  Mechanical Skew (1600 and 6250 BPI) 08-170  
  Power Window Safety Bail 08-640  
  Read Amplitude (Model 4, 6, 8) 08-310  
  Read Electrical Skew (NRZI Feature) 08-190  
  Type 2272 MST Card 17-800  
  Vacuum Column Door 08-680  
  Vacuum Column Door Glass 08-690  
  Write Electrical Skew (NRZI Feature) 08-200  
Pneumatics  
  Pressure Level (All Models) 08-420  
  Supply Flat Belt (Type 4) 08-442  
Power Window Motor, Rack and Switch 08-640  
Rack and Limit Switch 08-650  
Read Amplitude (Models 4, 6, 8) 08-310  
Read Electrical Skew (NRZI) 08-190  
Right Reel Hub 08-500  
Safety Bail 08-640  
Tape Unit Stubby Bar 08-080  
Write Electrical Skew (NRZI) 08-200  
7-Track NRZI Threshold Adjustment Card 08-000  
Air Bearings, MAP 4A-160, 4B-160

Air Pressure Check, Regulator 08-405, 90-190  
Airflow and Voltage Monitoring System 1A-000, 1B-000  
Alignments  
  Capstan  
    Dynamic (Non-90,000 series) 08-150  
    Dynamic (90,000 series) 08-160,  
      Marks 08-064  
    Static (Non-90,000 Series) 08-060  
    Static (With Round Supports) 08-068  
    Static (With Square Support Without Zero Marks) 08-062  
  Power Window 08-640  
  Alternate Flip Flop 53-040  
ALU ((Arithmetic Logical Unit) Microprocessor))  
  Operations  
    Arithmetic Add: ADD/ADDM (Hex Code A or B) 52-065  
    Branch On Condition: BOC (Hex Code 2 or 3) 52-085  
    Branch to Read from Load Point 55-040  
    Branch to Write from Load Point 55-024  
    Branch Unconditional: BU (Hex Code 6) 52-090  
    Common Start I/O Routine 55-020  
    Logical AND: AND/ANDM (Hex Code C or D) 52-070  
    Logical Exclusive OR: XO/XOM (Hex Code E or F) 52-075  
    Logical OR: OR/ORM (Hex Code 8 or 9) 52-075  
    Store Logic: STO (Hex Code 0 or 1) 52-095  
    Transfer Logic: XFR (Hex Code 4 or 5) 52-100  
  ALU1  
    Charts 1 to 7 13-091  
    Fails to Trap to 000 (MAP) 13-400  
    Failure to Reset CTI (MAP) 13-210  
    Hangs at 000 (MAP) 13-010  
    Hangs on ALU2 Failure (MAP) 13-410  
    Loop (MAP) 13-530, 13-540  
    Loop, TCS (MAP) 13-080  
    Microprogram Detected Error (Sense Byte 11, Bit 4) (MAP) 16-060  
    Op In Wait (MAP) 13-250  
    Power-On Reset (MAP) 13-090  
    Reset Failure (MAP) 13-200  
    Waiting for ALU2 to Complete a Sequence (MAP) 13-420  
    Waiting for ALU2 to Drop STATB (MAP) 13-460, 13-470  
    Waiting for ALU2 STATB Indication (MAP) 13-450  
    Waiting for ALU2 STATD Indication (MAP) 13-440  
  ALU Cannot Exit or Loop (MAP) 13-370  
  ALU1 or ALU2 Hangs (Chart) 13-005  
  ALU1 or ALU2 Hangs (MAP) 13-000  
  ALU1/ALU2 (Two Position Switch) 75-002  
  ALU2  
    Analyzing Microprogram Errors 16-131  
    Microprogram Detected Error (Sense Byte 12, Bit 4) 16-130  
    Microprogram Error (Table) 16-130  
    Power-On Reset Charts 1 to 7 13-194  
    Power-On Reset (MAP) 13-190

Trap Failure (MAP) 13-260  
B Bus Parity Error ALU1 16-030  
B Bus Parity Error ALU2 16-100  
Branch On Condition (BOC) Error  
  ALU1 16-050  
  ALU2 16-120  
Bus In Register, Channel 52-040  
Bus Out Register, Tape Unit 52-045  
Card Interchanging List 16-001  
Channel Bus In (CBI) Register 52-040  
Channel Tags In (CTI) Register 52-040  
Communication Between Microprocessors (Description) 52-030  
Crossover (XOUTA/XOUTB) Registers 52-025  
D Bus Parity Error ALU2 16-110  
D Registers 52-060  
Diagnose, Loop, and Scoping Procedures 16-000  
General Reference Information 16-000  
High-Order ROS Registers 52-035  
High ROS/IC Parity Error On a Branch Instruction  
  ALU1 16-020  
  ALU2 16-090  
How to Determine the Failing Address 16-000  
How to Make the ALU Loop on an Error 16-000  
Linking Microprogram Routines (Description) 52-030  
Listings, Microprocessor (Description) 52-030  
Local Storage Register (LSR) 52-015  
Low-Order ROS Registers 52-035  
Low ROS/IC Parity Error On a Branch Instruction  
  ALU1 16-010  
  ALU2 16-080  
Microprocessor  
  Clocks 52-005  
  Instructions (see ALU Operation)  
  Listings (Description) 52-030  
  (MP1/MP2) Schematic 50-003  
  Microprogram Transfer Decodes 52-101  
  MIST or TCS Register (MP1) 52-060  
  MP1 Special Register (Hardware Errors) 52-060  
  MP2 Special Register (TU Bus In) 52-060  
  Parity Error ALU1 16-040  
  ROS 1 Trap Conditions 50-011  
  Second Level Diagram, ROS 1 Trap Conditions 50-010  
  Short Cycle XFR Example (Timing Chart) 16-001  
  Stat Registers 52-015  
  Stop Address-FRU List ALU1 16-060  
  Stop Address-FRU List ALU2 16-130  
  Tags In Register, Channel 52-040  
  Tape Unit Bus Out (TUBO) Register 52-045  
  TCS or MIST Register (MP1) 52-060  
  XOUTA/XOUTB (Crossover) Registers 52-025  
Amplitude-Setting Sequence 5B-120  
Analysis of Damaged Tape Errors 00-012  
Analysis of IBG in Developed Tape 00-013  
Analyzing Microprogram Errors 16-131  
AND, Logical (ALU Operation) 52-070  
Arithmetic Add (ALU Operation) 52-065  
Array Patching, Patch Card 52-103  
Asymmetry Adjustment, Clock 17-800  
Attachment, Channel (Chart) 90-010  
Autocleaner  
  Adjustment 08-382

Erase Head 5B-110  
Operation 08-360  
Operational Check 08-380  
Removal/Replacement 08-370  
Solenoid 4B-160  
Write Card Circuits 5B-110  
Automated Logic Diagram (ALDs) 00-002  
Automatic Threading (Concept) 40-001

B

B Bus  
  B Bus 0-7 ALU1 Test Points (Table) 16-030  
  Parity Error ALU1 (MAP) 16-030  
  Parity Error ALU2 (MAP) 16-100  
  Parity Indicator 75-003  
Backhitch 6B-230  
Backspace Block Command 40-007  
Backspace File Command 40-007  
Backspace Operation 6B-230  
Backward  
  No Response or Tape Moves Backward 3A-100  
  Tape Fails to Go Backward 3A-130, 3B-130  
Bad Sense Data After a Rewind from OLTs (MAP) 15-140  
Basic Recording Techniques (PE, NRZI, 6250) Description 55-007  
Basic Subsystem (Concepts) 40-001  
BCDIC-EBCDIC Conversion Chart (7-Track Operation) 57-020  
Bit Cell and PE Waveform 55-007  
Bit Cell and NRZI Waveform 55-007  
Bit Packing and Scoping Procedure 5A-115, 5B-025  
Bit Usage Chart, MP1 XOUTA Register 52-025  
Block Diagram, Device Switching (2x8 Switch) 18-012  
Block Diagram, Device Switching (3x8 or 4x8 Switch) 18-013  
BOC Indicator 75-003  
BOT/EOT  
  Phototransistor 2A-010  
  Load Check Prior to BOT Sense 2A-150, 2B-150  
  Tape Does Not Go Backward or Does Not Stop at BOT 2A-190  
  Tape Moves Backward Off Left Reel 2B-190  
  Tape Unwinds Off Right Reel or TI Light Stays On 3A-150  
  Tape Won't Thread, Load, and Return to BOT Correctly 6B-100  
  Voltage Checks and Adjustments 08-580  
BOT/EOT, Fiber Optics  
  Block Removal/Replacement 08-590  
  LED BOT/EOT Window Removal/Replacement 08-590  
  LED BOT/EOT Voltage Checks/Adjustments 08-580  
Branch  
  Condition Error ALU1 (MAP) 16-050  
  MP1 Condition (Table) 52-086  
  MP2 Conditions (Table) 52-087  
  On Condition (ALU Operation) 52-085  
  On Condition Error ALU2 (MAP) 16-120

3803-2/3420

XK0100	2736031	See EC	845958	846927	847298			
Seq 1 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			

Unconditional (ALU Operation) 52-090  
To Write From Load Point 55-024  
To Read From Load Point 55-040  
Buffer Write Cycle 53-040  
Buffers, LSR 52-015  
Burst Commands 40-005  
Bus In Register, Channel 52-040  
Bus In/Bus Out Interface Lines 07-000, 54-000  
Bus Out Checks (MAP) 15-030  
Bus Out Register, Tape Unit 52-045  
Busy (TCS Feature) 58-012  
Busy/Tach Lines Test Points (Table) 16-171  
Byte Counter 53-025

C

C Compare or P Compare Circuit Logic 17-017  
C Compare or P Compare Errors 17-010  
C Compare or P Compare Errors (Timing Chart) 17-014  
Cable and Terminator Plugging 90-080  
Cable Retaining Bar 90-060  
Cables 90-060  
Cabling, Subsystem 90-060  
Capstan  
Adjusters 08-060  
Adjustment Wrench (CE Tool) 80-000  
Box Wrench (CE Tool) 80-000  
Capstan To Stubby Bar Clearance 08-080  
Drive System 6A-120, 6B-200  
Dynamic Alignment Tracking (90,00 Series) 08-160  
Dynamic Alignment Tracking (Non-90,00 Series) 08-150  
Glazed Cleaning Procedure 08-700  
Major Elements of Capstan Control logic 6B-205  
Motion Checks (Motion Appears Normal) 6B-020  
Motion Control 6A-000  
Motion Failure Symptoms 6B-000, 6B-140  
Motor and Controls 6A-120, 6B-200  
Motor Proportional Drive Control 6B-215  
Motor Status 3A-030, 3B-030  
Motor Waveforms 6A-002  
Normal Cleaning Procedure 85-004  
Pulse Generator 6A-120, 6B-200  
Start Capstan Motion (Write Operation 200 IPS) 6B-220  
Capstan Assembly  
Field Repair, Dented Capstans (Non-90,000 Series TU) 08-020  
Field Repair, Dented Capstans (90,000 Series TU) 08-030  
Removal (Non-90,000 Series Tape Units) 08-020  
Removal (90,000 Series Tape Units) 08-030  
Replacement (Non-90,000 Series Tape Units) 08-040  
Replacement (90,00 Series Tape Units) 08-050  
Starts Turning When Power is Turned On (Second Level) 6B-140  
Static Alignment (Square Support With Zero Marks) 08-064  
Static Alignment (Square Support Without Zero Marks) 08-062  
Static Alignment (With Round Supports) 08-068  
Capstan Tachometer  
Check/Adustment (Models 3, 5, and 7) 08-130

Check/Adjustment (Models 4, 6, and 8) 08-120  
Cleaning 08-140  
Cleaning Kit 85-000  
Cleaning Procedure, Special Glazed 08-700  
Control Circuits, Capstan 6A-120, 6B-200  
Drive System 6A-120, 6B-200  
Dynamic Alignment (Non-90,000 Series Tape Units) 08-150  
Dynamic Alignment (90,000 Series Tape Units) 08-160  
Extended Go 6A-140, 6B-205  
Gray Code Counter (GCC) 6B-205  
IBG Counter Circuits 6A-130, 6B-205  
Major Elements of Capstan Control Logic 6B-205  
Motion Checks (Capstan Motion Appears Normal) 6B-020  
Motion Control Problems 6A-000  
Motion Failure Problems 6B-000  
Motor and Controls 6A-120, 6B-200  
Motor Proportional Drive Control Circuit 6B-215  
Motor Waveforms 6A-002, 6B-002  
Polarity Hold Drive (PHD) Register 6B-205  
Proportional Drive Counter (PDC) 6B-205  
Pulse Generation 6A-120, 6B-200  
Quarter Tach Pulses 6B-205  
Read Only Storage (ROS) 6B-205  
Start Capstan Motion 6B-220  
Starts Turning When Power is Turned On 6B-140  
Static Alignment  
(With Round Supports) 08-068  
(90,000 Series, With Zero Marks) 08-062  
(90,000 Series, Without Zero Marks) 08-064  
Tach Period Counter (TPC) 6B-205  
Tape Unit Loads But Capstan Motion is Faulty 6B-110  
TU Stubby Bar Clearance Adjustment 08-080  
TU Won't Thread, Load and Return to BOT Correctly 6B-100  
Won't Start Rewind to LP After Tape Load 2B-175  
6 MHz Oscillator and GCC 6B-205  
Capstan Prealignment Gauge (CE Tools) 80-000  
Card/Board Function Layout  
(3420) 19-010  
(3803-2) 19-000  
Card Isolation Technique PLAN 1  
Card Plugging (Installation) 90-110  
Card Plugging, Tape Control Logic Panel 19-000  
Cartridge  
Does Not Open 2A-100, 2B-100  
Opener Does Not Close 4A-150, 4B-150  
Optional (Concept) 40-001  
Motor Replacement/Adjustment 08-535  
Restraint Pressure Check 08-536  
Restraint Removal/Replacement 08-540  
CE Initial Entry Flow Chart START 1  
CE Panel  
Description 75-001  
Failures 12-020  
Operation Contents (MAP) 12-010  
Switches 75-001  
Channel  
Attachment (Chart) 90-010  
Buffer Controls 53-030  
Buffer Logic 50-000  
Bus In 53-055  
Bus In Register 52-040

Bus In/Out Checking (MAP) 13-380  
Initial Selection 54-000  
Interface Problems, Tape Control 18-040  
Priority Circuits 54-020  
Status Word Bits (Table) 15-080  
Tags In Register 52-040  
Test Points (Table) 17-021  
Write Byte Register 53-045  
Characteristics, 3420 Subsystem 40-002  
Chart  
ALU1 1 to 7 13-091  
ALU2 Power On Reset 13-194  
Branch Conditions 16-050  
Cards and Cables, Device Switching  
Troubleshooting Procedure 18-028  
Dropping Ready and Thread and Load Failure 2A-000  
Features Chart (Sense Byte 6) 17-220  
Mode Chart (Sense Byte 6) 17-110, 17-220  
Read/Write Vertical Redundancy Check 17-170  
Reference 18-029  
Skew Error Test Points 17-162  
Tape Control To/From Device 18-005  
Tape Unit Control Lines 16-213  
1x8 Selection 18-001, 18-005  
Checks  
Autocleaner Operational 08-380  
BOT/EOT Voltage 08-580  
Capstan Tachometer  
(Model 4, 6, 8) 08-120  
(Model 3, 5, 7) 08-130  
Capstan and Tracking 08-010  
Cartridge Restraint Pressure 08-536  
Cleaner Blade Gauss 08-390  
Column Vacuum Level 08-400  
DC Power Supply 08-570  
Erase Head Polarity and Erasure 08-320  
ESD Grounding (3420/3803) 90-190  
Feedthrough 08-330  
File Protect Mechanism 08-340  
Mechanical Skew  
1600 and 6250 08-170  
NRZI Feature 08-180  
Pneumatic Pressure Vacuum 08-400  
Power Supply 90-180, 08-570  
Read/Write Head Resistance (Model 4, 6, 8) 08-280  
Regulator Air Pressure 08-405, 90-190  
Tape Guide (NRZI Feature) 08-230  
Tape Unit Grounding 08-600  
Threading Vacuum 08-400  
Transfer Valve Plug 08-410  
Vacuum Column Switch 08-450  
Vacuum Pump Belt 08-410  
Check Register, Write 53-045  
Checking, Read Back (Concept) 40-001  
Cleaner Blade Gauss Check 08-390  
Cleaning Procedures (see Preventive Maintenance)  
Clock  
Asymmetry Adjustment 17-800  
Chart 53-015  
Check (MAP) 17-800  
Control Logic, Microprocessor 52-005  
Write (Table) 53-020

Clocks/Oscillators/Counters  
Byte Counter 53-025  
CRIC-CROC Address Counters 53-035  
Data Flow Clock 53-015  
Group Buffer Counter 53-090  
Master Clock 53-005  
Microsecond Frequency 53-005  
Oscillator Gating 53-005  
Read Clock Stepping Pulses 53-005  
Read/Write Clocks and Counters (Table) 53-010  
Write Clock and Write Counter 53-020  
Column Vacuum Check 08-400  
Command Controls Switches (CE Panel) 75-002  
Command or Control Status Reject 16-160, 6A-160  
Command Out Inactive During Reset or Power On Reset (MAP) 13-330  
Command Out Tag Active (MAP) 13-290  
Command Reject (MAP) 15-020,  
Command Select Sequencer and Decoder 12-026  
Command Sequence (MAP) 13-050  
Command Status Reject (MAP) 16-160  
Commands and Instructions  
Burst Commands 40-005  
I/O Instructions 40-009  
Motion Control Commands 40-007  
Non-Motion Control Commands 40-008  
Common Start I/O (SIO) Routine 55-020  
Communication Between Microprocessors (Description) 52-030  
Communicator Feature, Device Switch 18-010  
Communicator (2X8 Switching) 58-080  
Compare Equal Indicator (CE Panel) 75-003  
Compare Errors, P Compare or C Compare 17-010  
Compare Errors, P Compare or C Compare (Timing Chart) 17-014  
Concepts, 3803-2/3420 40-003  
Configuration Worksheet Instructions 90-030  
Configurations, Subsystem (Concepts) 40-003, 90-100  
Contingent Connection (TCS Feature) 58-012  
Control Burst 40-002  
Control Check Indicators (CE Panel) 75-003  
Control Status Reject (MAP) 16-210  
Control Unit (see Tape Control)  
Common Start I/O (SIO) 55-020  
Sense and Status Byte Table 00-005  
Control Unit End (TCS Feature) 58-012  
Conversion, Field Tester 90-170  
Conversion Table, Sense Byte to Bit 14-005  
Cooling Fan Assembly Removal/Replacement 08-630  
Cooling System (see Voltage and Airflow Monitoring System)  
Counter (IC), Microprocessor 1 Flow Logic 52-010  
Counters (see Clocks/Oscillators/Counters)

3803-2/3420

XK0100	2736031	See EC	845958	846927	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			

CRC  
Error, NRZI 17-590  
Error, 6250 BPI/PE 17-540  
Generation 53-0678  
Generators 53-065  
Indicator 75-004  
Timing Chart 17-544  
CRIC/CROC Address Registers 53-035  
Crimper Procedure, Tape (CE Tool) 80-000, 2A-015, 2B-006  
Cross Reference, Pins to Logic (3803-2) 20-000  
Cross Reference 3803-2, Pins To Logic (Logic) 17-166  
Crossover (XOUTA/XOUTB) Registers 52-025  
Crosspoint Section (2X8 Switching) 58-080  
Crosspoint Switch, Inbound 58-110  
Crystal Oscillators, Basic Timing 53-005  
CUE Reset on Interface B (MAP) 13-500  
Current Generator 58-110  
Cyclic Redundancy Checks (see CRC) (MAP) 17-540  
Generation CRC A, B, C, D 53-066  
During Read Back Check of Write Operations 53-067  
During 9-Track Read Backward Operations 53-067  
During 9-Track Read Forward Operations 53-067  
During 9-Track Write Operations 53-067  
Read CRC Generator 53-065  
Write CRC Generator 53-065  
  
D  
  
D-Bearing Removal and Replacement (NRZI Feature) 08-210  
D Bus  
Parity Error  
ALU1 (MAP) 16-040  
ALU2 (MAP) 16-110  
Parity Indicator 75-004  
D Registers 52-060  
Data  
Converter Check (MAP) 15-070  
Entry Select Switch (CE Panel) 75-003  
Exchange on Device Interface During a Write Operation 5A-130, 5B-130  
Data Flow and Control  
ALU Schematic 50-003  
Check Indicators 75-004  
Clock 53-015  
Clock Asymmetry Adjustment (Installation) 90-190  
Exchange on Device Interface During Write Operation 5A-130, 5B-130  
Intermittent Permanent Data Checks  
Bit Packing 5A-115, 5B-025  
Forward to Backward Ratio 5B-020  
Noise or Bit In IBG 5A-115, 5B-025  
Signal Dropout 5A-110, 5B-020  
Tape Edge Damage 5A-110, 5B-030  
Tape Slipping 5B-020  
Tape Stretch 5A-115, 5B-020  
Read Data Flow Logic 50-002  
Read Translator 7-Track 57-020  
Read/Write Flow Logic 50-002

Write Data Flow Logic 50-001  
Write Translator 7-Track 57-021  
7-Track Read Schematic 57-006  
Security Erase Command 40-007  
Security Erase Procedure Offline 12-013  
Data Flow Check Indicators (CE Panel) 75-004  
Data In 53-040  
Data Rates (3420 Subsystem Characteristics) 40-002  
DC Power Supply (see Power Supplies)  
DC71 Patch Card General Description 52-103  
Dead Track Register 53-075  
Degausser (CE Tool) 80-000  
Degaussing, Cleaner Blade 08-390  
Degaussing, Read/Write Head 08-280  
Density Feature Combinations (Table) 40-004  
Description  
Group Coded Recording 55-003  
Phase Encoded (PE) 55-007  
NRZI 55-007  
6250 BPI 55-007  
Detection Register 53-005  
Determine the Failing Instruction Address Procedure, Microprocessor 16-000  
Developing Solution (CE Tool) 80-000  
Develop Tape 00-011  
Device  
Bus In x to DF Test Points (Table) 17-312  
Selection Priority 54-020  
Switching Feature (Description) 58-050, 90-050  
Block Diagram For 2x8 Switch 18-012  
Block Diagram For 3x8 or 4x8 Switch 18-013  
Failure Modes 18-010  
Feature (Logic) 18-010  
Inbound Crosspoint Switch 58-110  
Line Definitions 58-060  
Operation 58-060  
Rules and Definitions 18-011  
Switch Node 58-090, 90-050  
Tape Subsystem Cabling 18-011  
Interface  
Data Exchange on Device Interface During Write Operation 5A-130, 5B-130  
Lines 07-000, 54-000  
Device End (TCS Feature) 58-012  
Device to SDI Logic Lines 18-030, 18-032  
Diagnostic Mode Set Command 40-008, 55-007  
Diagnostics, System (Installation) 90-200  
Diagram  
Autocleaner Operation 08-360  
Byte Count or Go Down 12-028  
CE Entry 12-027  
Channel Priority 54-020  
Configuration Worksheet, Subsystem Installation 90-040  
Device Interface 07-000  
Device Interface During a Write Operation 5A-130, 5B-130  
Device Interface During Read Forward Operation 5A-140, 5B-140  
Device Switching  
Configuration 58-051, 18-011  
Feature 18-010  
Most Probable Cause Analysis 18-015  
1x8 Selection Logic 18-000  
2X8 Switch Logic 58-055, 18-012

2X8 Switching Functional Units 58-080  
2X16 Switch Logic 58-055  
2x16 Switch Logic 58-060  
3X8 or 4X8 Switch Logic 18-013  
4X16 Switch Logic 58-070  
Display Select Switch and Compare 12-023  
Group Coded Recording (6250 BPI) 55-008  
IBG Generation 6A-150, 6B-210  
Initial Selection 54-000  
Map Formats 00-001  
Pneumatic System, Thread Status (Active and Inactive) 4A-161, 4B-161  
Reel and Capstan Operation During Rewind 3A-030, 3B-030  
Set and Display CE Register 12-021  
Set and Display Compare Register 12-022  
System Diagnostics 90-210  
Troubleshooting Procedure (MAP) 18-020  
Write Head Driver Card 08-270  
Digital to Analog Converter (DAC) Waveforms (Model 4, 6, and 8) 6B-010, 6B-011, 6B-012  
Digitec 251 Meter (CE Tool) 80-000  
Display LSR Contents (How To) 12-013  
Display Select Switch (CE Panel) 75-002  
Drive (see Tape Unit)  
Drop Ready Problems, Intermittent 00-005  
Dropping or Picking Records 15-200  
Dropping Ready and Thread and Load Failure Symptoms Chart 2A-000, 2B-000  
Dual Density Threshold Adjustment Card 80-000  
Dynamic Reversal (MAP) 16-200

E

Early Begin Readback Check (MAP) 17-100  
Easy Load Cartridge (Concept) 40-001  
EBCDIC/BCDIC Conversion Chart 57-020  
ECC/CRC Scope points (Table) 17-075  
ECC/ENV Indicator 75-004  
Edge Damage, Tape 5B-030  
Emulator Jumper 90-200  
Enable Switch 75-001  
Enable/Disable Switch (Concepts) 40-003  
Encoded Data Group (GCR) 55-010  
End Data Check  
MAP 17-530  
Logic 17-531  
End Of Call 00-030  
Engineering Changes Which Affect MAPs 00-000  
Entry Select Switch, Data 75-003  
ENV/ECC Indicator 75-004  
Envelope  
Check Circuit Logic 17-315  
Check Without Skew Error (MAP) 17-220  
Circuits 5A-100, 5B-100  
Failure, Runaway, or Read/Write Problems 5A-000, 5B-000  
EOT/BOT (see BOT/EOT)  
Equipment Checks 16-000  
Erase  
Full Width Erasure (Concept) 40-001  
Gap Command 40-007  
Head 5B-110

Head Current 40-007  
Head Polarity and Erasure Checks 08-320  
Head Removal and Replacement 08-250  
Error Analysis (see MAPs, Tape Control)  
Error Analysis Flow Chart, Permanent Read/Write 00-011  
Error Correction Sense Analysis (MAP) 21-000  
Example of Typical Flow Through MAPs 00-003  
Excursions (Wide) in Left Column During HS Rewind 3A-160, 3B-160  
Extended Go 6B-205  
Extra or Missing Interrupts (A2 Panel) 18-050

F

Failure Follows Tape Unit 00-040  
Failure Modes, Device Switch Feature 18-010  
Features  
Card Plugging 90-110  
Chart for Sense Byte 6 17-220  
Density Feature Combinations (Table) 40-004  
Device Switching  
Cabling Instructions 90-060  
Line Definitions 58-060  
Node Logic 58-090  
Node Schematic 58-080  
Operation 58-060  
Theory 58-050  
2 X 8 Switch Functions (Concepts) 58-080  
2 X 8 Switch Logic 5B-005  
2 X 16 Switch Logic 58-060  
4 X 16 Switch Logic 58-070  
Nine-Track NRZI 40-004  
Seven-Track NRZI  
EBCDIC-BCDIC Conversion Chart 57-020  
Read Data Convert Data Flow Schematic 57-026  
Read Translator Data Flow Schematic 57-022  
Seven-Track Read Data Flow Schematic 57-006  
Seven-Track Write Data Flow Schematic 57-005  
Write Data Convert Data Flow Schematic 57-025  
Write Translator Data Flow Schematic 57-020  
Switching Configurations (Figure) 58-051  
Two Channel Switch (TCS) 58-010  
Busy 58-012  
Contingent Connection 58-012  
Control Unit End 58-012  
Device End 58-012  
Implicit Connection 58-011  
Interface Switch Control 58-011  
Partitioning 58-011  
Reserve/Release Operation 58-011  
Resets 58-011  
Selection 58-011  
Sense Release Command 58-011  
Sense Reserve Command 58-011  
Stack 58-012  
Stack Interrupt 58-012  
Theory 58-010  
Tie Breaker 58-012  
2 Control Switch (Concepts) 58-050  
3 Control Switch (Concepts) 58-050  
4 Control Switch (Concepts) 58-050  
Feedthrough Check 08-330

3803-2/3420

XK0200	2736032	See EC	845958	846927	847298			
Seq 1 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			



Fiber Optics  
BOT/EOT Voltage Checks/Adjustments 08-580  
Bundle Removal/Replacement 08-610  
Lamp Removal/Replacement/Cleaning 08-620  
LED BOT/EOT Block Removal/Replacement 08-590  
LED BOT/EOT Voltage Checks/Adjustments 08-580  
LED BOT/EOT Window Removal/Replacement 08-590  
Field Feedback Problem Fixes 00-050  
Field Replaceable Units (FRUs) PLAN 1  
Field Tester  
Accuracy Check 08-290, 08-300, 08-315  
Conversion 90-170  
3420 80-020  
File Protect Indicator Off (MAP) 1A-000, 1B-000  
File Protect Mechanism Check 08-340  
File Protection (Concept) 40-001  
Flag Bytes 1 and 2 (Tables) 40-006  
Flat Belt Replacement, Pneumatic Supply 08-442  
Flow Charts  
Branch To Read From Load Point 55-040  
Branch To Write From Load Point 55-024  
Common Start I/O Routine 55-020  
Read From Load Point 55-040  
Selection and Priority 54-005  
Write From Load Point 55-024  
Flow Through MAPs, Typical (Example) 00-003  
Format Character Trk x (Table) 17-075  
Format, Data (see Recording Methods/Formats)  
Format of MAPs 00-001  
Format, Microprocessor Instruction 52-030  
Forward Creep During Rewrite (Model 4, 6, 8) 6B-230  
Forward Space Block (FSB) Command 40-007  
Forward Space File (FSF) Command 40-007  
Forward Start Times (Subsystem Characteristics) 40-002  
Four Control Switch (Concepts) 58-050  
Full-Width Erasure (Concept) 40-001  
Function Layout, Card/Board 3420 19-010  
3803-2 19-000  
Functions, MP1 and MP2 52-030  
  
G  
Gating, Oscillator 53-005  
General Cleaning Instructions 85-000  
General Information 07-000  
General Reference Information, Microprocessor 16-000  
General Reset 50-011  
Generators, CRC 53-065  
Generation, CRC 53-067  
Generation, IBG 6A-150  
Glazed Capstan Cleaning Procedure 08-700  
Glossary of Terms PLAN 5  
Go Extend  
Additional Stopping Distances After 6A-140, 6B-205  
Go Extensions in Quarter Tach Pulses 6B-205  
IBG Counts Models 3, 5, and 7 6A-140

Gray Code Counter (GCC) 6B-205  
Ground Check, Tape Unit 08-600  
Group Buffer Control 53-025  
Group Buffer Counter 53-090  
Group Coded Recording (GCR) 6250 BPI 55-008  
GCR, 5260 BPI (Concepts) 40-002  
GCR Block 55-008  
  
H  
Halt I/O Instruction 40-009  
Hardware Errors (MP1 Special Register) 52-060  
Hardware Pointers 17-602  
Head, Erase 5B-110  
Head Mirror Stop Adjustment (Models 3, 5, and 7) 08-350  
Hex Wrench, Right Reel Hub (CE Tool) 80-000  
Hi IC Pty/Hi ROS Reg Pty Indicator (CE Panel) 75-003  
High-Order ROS Registers 52-035, 16-020  
High ROS/IC Parity Error on A Branch Condition  
ALU1 (MAP) 16-020  
ALU2 (MAP) 16-090  
High-Speed Rewind (see Rewind Operation)  
High-Speed Rewind Solenoid Check 08-405  
How To  
CE Initial Entry Flow Chart Start 1  
Determine the Failing Instruction Address 16-000  
Develop Tape 00-011  
Locate Information PLAN 1  
Make the ALU Loop on an Error 16-000  
Operate CE Panel 12-000  
Use MAPs 00-000, PLAN 1  
Use Section 18-xxx 18-010  
  
I  
IBG Counter 2A-010  
IBG Detected on Write (MAP) 17-080  
IBM Easy Load Cartridge 40-001  
ID Burst 40-002  
ID Burst Check (MAP) 17-050  
Implicit Connection (TCS Feature) 58-011  
Inactive/Active/Pulsing/Switched Line Levels 00-003  
Inbound Crosspoint Switch Schematic (Device Switch Feature) 58-110  
Indicators, CE Panel 75-003  
Inhibit Preamble/Postamble 40-005  
Initial Entry Flow Chart, CE Start 1  
Initial Selection Description 54-000  
Initial Selection  
AB CE 50-011  
Bus In/Bus Out Lines 54-000  
Device Interface Lines 07-000  
Tape Unit 07-000, 54-000  
Initiating a Rewind 3A-010, 3B-010  
Initiating Tape Motion 07-010  
Installation  
Address/Feature/Priority Plugging (see Card Plugging)  
Cable and Terminator Plugging 90-060  
Cable Retaining Bar 90-060  
Cabling, Subsystem (Chart) 90-070  
Card Plugging

Address, Tape Control 90-110  
Data In Handling 90-130  
Device Selection Priority Assignments (Chart) 90-150  
Device Switching Feature 90-110  
Device Switching Feature, Address Control (Chart) 90-140  
Disconnect In Handling 90-110  
NRZI Feature 90-120  
Primary/Secondary TU Interface Control (With Device Switch) 90-130  
Primary/Secondary TU Interface Control (With 1x8) 90-130  
Priority Assignments, Device Selection (Chart) 90-150  
Select Out Priority 90-120  
Serial No/EC Level/Feature Code (Tape Control) 90-210  
Serial No/Model No/EC Level/Feature Code (Tape Unit) 90-212  
Tape Control Address 90-110  
Tape Switching Feature, Address Control (Chart) 90-140  
Two Channel Switch Feature 90-120  
3803 Address 90-110  
Checklist 90-020  
Checks and Adjustments (Installation)  
Air Bearing Pressure, 3420 90-190  
Altitude Vacuum Level Setting, 3420 90-190  
Autocleaner 90-190  
BOT/EOT Check 90-190  
Capstan Check 90-190  
Data Flow Clock Asymmetry Adjustment, 3803 90-190  
ESD Grounding 90-190  
Mechanical Skew, 3420 90-190  
Configuration Worksheet (Instructions) 90-030, 90-040  
Device Switch Cabling 90-050  
Emulator Jumper 90-200  
Field Tester Conversion 90-170  
Installation Checklist 90-020  
Instructions, Subsystem Installation 90-000  
I/O Interface 40-003  
Kickplates 90-090, 90-100  
Operator Panel Labels, Tape Control 90-160  
Plugging, Cables and Terminators 90-060  
Power Requirements, Special-3420 Model 8 90-180  
Power Supply Checks  
Procedures 90-020  
Special Power Requirements-3420 Model 8 90-180  
Subsystem Cabling (Chart) 90-070  
System Diagnostics 90-200  
Terminator and Cable Plugging 90-060  
Instructions (see Commands and Instructions)  
Instruction Counter, Microprocessor 1 52-010  
Interblock Gap (IBG)  
Counter Logic 6A-130, 6B-205  
Detected on Write 17-080  
Generation 6A-150, 6B-210  
Go Extend IBG Counts (Model 3, 5, 7) 6A-140  
Noise or Bit In 5A-115, 5B-025

Passing Times (3420 Subsystem Characteristics) 40-002  
Subsystem Characteristics 40-002  
Timing Chart (Model 5) 6A-150  
Interface Disabled Indicator (CE Panel) 75-003  
Interface Switch Control (TCS Feature) 58-011  
Intermittent Drop Ready Problems 2A-005, 2B-005, 07-010  
Interrupt 54-000  
Interrupts, Extra or Missing (A2 Panel) 18-050  
Intervention Required (MAP) 15-010  
Introduction to Maintenance Philosophy PLAN 1  
Introduction, Subsystem Installation 90-000  
I/O Instructions (see Commands and Instructions) 40-009  
I/O Pins (3 Bit Code) 12-023, 12-024  
  
K  
Kickplates, Installation 90-090, 90-100  
  
L  
Lamp, Skew Check 53-085  
Lamp Test Switch (CE Panel) 75-002  
Latch, Reel (see Right Reel Latch)  
Left Movable Guide and Retractor Removal and Replacement (NRZI Feature) 08-220  
Left or Right Vacuum Column Problems 2A-170, 2B-170, 3A-110, 3B-110  
Left Reel  
Does Not Turn Clockwise at Threading Speed 2A-110, 2B-110  
Hub and Motor Removal/Replacement/Adjustment 80-560  
Logic 3A-030, 3B-030  
Motor Speed, Voltages 3A-020, 3B-020  
Right or Left Reel Won't Load Tape Into Column 2B-180  
Tape Rewinds Off Left Reel 3B-180  
Theory, Rewind and Timing Chart 3A-010, 3B-010  
Left Threading Channel 08-230  
Legend and Symbols PLAN 4  
Light Source Removal/Replacement 08-620  
Lights/Indicators (see Maintenance Procedures)  
CE Panel 75-001  
File Protect Indicator Off 1A-000, 1B-000  
Load Check Prior to BOT Sense 2A-150, 2B-150  
Power Check Indicator On 1A-000, 1B-000  
Ready Lamp Does Not Turn Off 4A-100, 4B-100  
Ready Lamp Does Not Turn On 2A-210, 2B-210  
TI Lamp Stays On 3A-150, 3B-150  
Line Definitions, Device Switching Feature 58-060  
Line Levels - Active/Inactive/Pulsing/Switched 00-003  
Line Names for Reference to ALD XC70x (Table) 18-020  
Linking Microprogram Routines (Description) 52-030  
Listings, Microprocessor 52-030  
Lo IC Pty/Low ROS Reg Pty Indicator 75-003  
Load Check 2A-000, 2B-000

3803-2/3420

XK0200	2736032	See EC	845958	846927	847298			
Seq 2 of 2	Part Number	History	1 Sep 79	20 Jun 80	15 Aug 83			

© Copyright International Business Machines Corporation 1976, 1979, 1980, 1983

Load Failure Symptoms (MAP) 2A-000, 2B-000	Envelope Check 17-315	(Forward or Backward 3A-140, 3B-140	Schedule 85-005
Load Check Prior to BOT Sense 2A-150, 2B-150	Group Buffer Counter 53-090	Tape Does Not Wind Completely Onto Right	Tape Unit Cleaning Procedure 85-001
Loading Tape in Columns 2B-175	Inbound Crosspoint Switch 58-110	Reel or Reels Do Not Stop 4A-130, 4B-130.	Maintenance Philosophy, Introduction PLAN 1
Load Operation, Approximate Time (3420 Subsystem Characteristics) 40-002	High-Order ROS Register 52-035	Tape Fails To Go Backward 3A-130, 3B-130	Major Elements of Capstan Control Logic 6B-205
Load Test, Minireel 08-800	Left Reel Does Not Turn Clockwise at Threading Speed 2A-111, 2B-111	Tape Goes Forward After Loading Into Vacuum Columns 2A-200, 2B-200	Make the ALU Loop on an Error (Procedure) 16-000
Local Storage Register (LSR)	Left or Right Vacuum Column Problems 2A-170, 2B-170, 3A-110, 3B-110	Tape Moves Backward Off Left Reel, or Tape Unit Performs a Normal Unload	MAPs
Displaying Contents 12-013	Load Check Prior To BOT Sense 2A-150, 2B-150	Rewind During Load Operation 2B-190	Address Out Tag Active 13-300
Operation 52-015	Logical AND 52-070	Tape Pulls Out, Dumps, or Has Wide Excursions in Left Column During High Speed Rewind 3A-160, 3B-160	ALU Cannot Exit or Loop 13-370
Locating Information PLAN 1	Logical Exclusive OR 52-080	Tape Threads Into Threading Channel and Stops 2A-140, 2B-140	ALU1
Locations	Logical OR 52-075	Tape Threads Into Right Column 2B-130	Cannot Transfer 13-130
Control Unit	Loop-Write-To-Read (LWR) 55-005	Tape Unit Bus Out (TUBO) Register 52-045	Fails to Trap to 000 13-400
Tape Unit	Low-Order ROS Register 52-035	Tape Unit Selection Priority 54-010	Failure to Reset CTI 13-210
Air Bearing Switch 2B-160	Microprocessor Clocks Control 52-005	Tape Unwinds Off Right Reel 3A-150, 3B-150	Hangs at 000 13-010
BOT/EOT Block 3A-150, 3B-150	MP1 IC (Instruction Counter) 52-010	TCS Selection and Tie Breaker 58-030	Hangs on ALU2 Failure 13-410
Cartridge Motor 4B-150	MP1/MP2 Circuits 50-003	Transfer 52-100	Loop 13-530, 13-540
Cartridge Open Switch 4B-150	MP1/MP2 Special registers 52-060	Transfer Valve Does Not Pick or Pneumatic Motor Not Running 2A-130	Loop, TCS 13-080
Cartridge Opener Control Card 4B-150	MP1/MP2 STAT Registers 52-015	Two-Channel Switch 58-010	Microprogram Detected Error (Sense Byte 11, Bit 4) 16-060
CP3 2A-130, 2B-130	MIST or TCS Register 52-060	Two-Channel Switch and Tie Breaker 58-030	Op In Wait 13-250
Fiber Optic 2B-150	Multi-Track Error (Logic) 17-112	Unload Rewind Pushbutton (No Response) 4A-110, 4B-110	Power On Reset 13-090
Fuses 1A-000, 1B-000	No Response or Tape Moves Backward 3A-100, 3B-100	Write 53-070	Reset Failure 13-200
Manual Status Control (MSC) Card 4B-110	NRZI Read Data Flow 57-006	Clock and Write Counter 53-020	Waiting 13-110, 13-140, 13-170
Pneumatic Contactor 2A-130, 2B-130	Oscillator Gating 53-005	Data Converter 57-025	Waiting for ALU2 to Complete a Sequence 13-420
Pneumatic Supply 2A-210, 2B-210	Overrun 15-042	Data Flow 50-001	Waiting for ALU2 to Drop STATB 13-460, 13-470
Power Interface Board B1 1A-003, 1B-001	P or C Compare 17-017	Group Buffer Control 53-025	Waiting for ALU2 STATB Indication 13-450
Power Window PCB 2A-210, 2B-210	Power Window Does Not Go Down 4A-140, 4B-140	Write Head, Erase Head, and Write Card 5B-110	Waiting for ALU2 STATD Indication 13-440
Power Window Switches 4B-140	Proportional Drive Control 6B-215	Service Controls 53-040	Waiting for End of Data (EOD) on Write 13-520
Reel Motor Power Board 2A-140, 2B-140	Read Cycle Controls 53-095	Translator 57-020	ALU1 or ALU2 Hangs 13-300
Reel Tachometers 3A-170, 3B-170	Read Data Converter 57-026	Triggers 53-070	ALU2
Reels Loaded Switch 4A-140, 4B-140	Read Data Flow 50-002	Trigger VRC 17-026	Power On Reset 13-190
Regulator Cards 1A-002, 1B-002	Read Head and Read Card 5B-120	2x8 Switching Functional Units 58-080	Trap Failure 13-260
SCRA 2B-160	Read Sequencing and A/B Registers 53-055	Logic Panel Removal/Replacement (3803/3420) 08-630	B Bus Parity Error (ALU1) 16-030
TB-1, 2, and 3 1A-002, 1B-002	Read Translator 57-021	Logic, Pins, Cross Reference List 20-000	B Bus Parity Error (ALU2) 16-100
Transfer Valve Solenoid 2A-130, 2B-130	Read/Write Flow 50-000	Logic Section (2X8 Switching) 58-080	Bad Sense After a Rewind from OLTs 15-140
Y1 Panel Location 90-080	Read/Write VRC Circuit 17-179	Logical AND (ALU Operation) 52-070	Branch Condition Error ALU1 16-050
Lock ROS 1 IC 50-011	Ready Lamp Does Not Turn Off 4A-100, 4B-100	Logical Exclusive OR (ALU Operation) 52-080	Branch On Condition Error (ALU2) 16-120
Logic	Ready Lamp Does Not Turn On/Window Does Not Close 2A-210, 2B-210	Logical OR (ALU Operation) 52-075	Bus Out Checks 15-030
A Register 52-035	Reel and Capstan Operation during Rewind 3A-030, 3B-030	Long Cycle BOC or BU Example (Timing Chart) 16-001	Capstan Motion Control 6A-000, 6B-000
Arithmetic Add 52-065	Reel Drive System 3b-020	Loop, ALU1 (MAP) 13-530, 13-540	CE Panel Operation 12-010
Branch On Condition 52-085	RIC/ROC 53-081	Loop Write-to-Read (LWR) Command 40-006, 55-005	Channel Bus In/Out Checking 13-380
Branch Unconditional 52-090	Right or Left Reel Fails To Load Tape Into Column 2B-180	Tape Unit Operation 55-005	Clock Check 17-800
Byte Count or Go Down 12-028	Right Reel Does Not Turn Clockwise at Threading Speed 2A-120, 2B-120	Low-Order ROS Registers 52-035, 16-010	Command or Control Status Reject 6A-160
Capstan Control, Pulse Generator, and Motor Controls 6A-120, 6B-200	ROS/LSR 52-015	Low ROS/IC Parity Error on a Branch Condition (ALU2) (MAP) 16-080	Command Out Inactive During Reset or Power On Reset 13-330
Capstan Fails To Start a Rewind To Load Point Operation After Loading Tape into Columns 2B-175	ROS Mode Switch and Gates 12-024	Low ROS/IC Parity Error on a Branch Instruction (ALU1) (MAP) 16-010	Command Out Reject 15-020
Cartridge Does Not Open 2A-100, 2B-100	Skew Detection 53-085	Low Speed Rewind 3A-010, 3B-010	Command Out Tag Active
Cartridge Opener Does Not Close 4A-150, 4B-150	System 360/370 Switching (Data In Handling) 58-005	LWR Tape Unit Operation 55-005	Command Sequence 13-050
CE Entry 12-027	Tape Does Not Enter or Stay in High Speed Rewind or Rewinds To BOT at High Speed 3A-170, 3B-170		Command Status Reject 16-160
Channel Buffer Controls 53-030	Store 52-095		Control Status Reject 16-200
Channel Tags In and Channel Tags Out Register 52-040	Tape Does Not Go Backward or Does Not Stop at BOT 2A-190		CUE Reset on Interface B 13-500
Channel Write Byte, Write Check, and Pointer Registers 53-045	Tape Does Not Load Into Either Column 2A-160, 2B-160		Cyclic Redundancy Checks 17-540
Command Select Sequencer and Decoder 12-026	Tape Does Not Pull Out of Columns Properly During Unload Rewind 4A-120, 4B-120		D Bus Parity Error
CRC Generators 53-065	Tape Does Not Stop or Tape Runaway		ALU1 16-040
D Register 52-060			ALU2 16-110
Data Flow Clock 53-015			
Dead Track 53-075			
Device Switch Node 58-090			
Device Switching 58-050			
End Data Check 17-531			
Envelope and Read/Write			
Model 3, 5, 7 5A-100			
Model 4, 6, 8 5B-100			

3803-2/3420

XK0300	2736033	See EC	845958	847298				
Seq 1 of 2	Part Number	History	1 Sep 79	15 Aug 83				

Data Converter Check 15-070  
Device Switching Feature  
Most Probable Cause Analysis 18-015  
Troubleshooting Procedure 18-020  
Dropping Ready and Thread and Load  
Failure Symptoms 2A-000, 2B-000  
Dynamic Reversal 16-200  
Early Begin Readback Check 17-100  
End Data Check 17-530  
End Of Call 00-030  
Envelope Check Without Skew Error 17-220  
Envelope Failure, Runaway, or Read/Write Problems 5A-000, 5B-000  
Error Correction Sense Analysis 21-000  
File Protect Indicator Off or Power Check Indicator On 1A-000, 1B-000  
Formats 00-001  
High ROS/IC Register Parity Branch Condition  
ALU1 16-020  
ALU2 16-090  
How to Use 00-000  
IBG Detected on Write 17-080  
ID Burst Check 17-050  
Intervention Required 15-010  
LRCR Errors, Sense Byte 3, Bits 0, 1, or 4 17-310  
Low ROS/IC Parity Error on a Branch Condition (ALU2) 16-080  
Low ROS/IC Parity Error on a Branch Instruction (ALU1) 16-010  
MTE Without Envelope Check 17-110  
No Block Detected on Write/Write Tape Mark (WTM) 16-190  
Noise Detection 17-370  
Not Capable 15-060  
NRZI Cyclic Redundancy Check (CRC) 17-590  
Offline Duplication of Online Failures 12-000  
Overrun 15-040  
P Compare or C Compare Errors 17-010  
Partial Record (Sense Byte 5, Bit 5) 17-410  
PE or NRZI and GCR Velocity Checks/Changes 16-180  
Permanent Data Checks 5A-105, 5B-002  
Picking/Dropping Records 15-200  
Pointer System 17-602  
Postamble Error 17-190  
Read/Write Vertical Redundancy Check (VRC) 17-168  
Sense All Zeros 15-080  
Sense Analysis 14-000  
Service Out Tag Active 13-280  
Single Tape Unit Problems 00-040  
SIO Trap Failures 13-320  
Slow End Readback Check 17-150  
Start Read Check 17-070  
Suppress Out Active 13-310  
Suppress Out Inactive During Reset or Power On Reset 13-340  
TACH Start Failure (Sense Byte 10, Bit 5) 16-170  
TACH Velocity Error 13-510  
Tape Control Metering Problems 18-060  
Tape Control Power Supply 11-000  
Tape Motion and Rewind Symptoms 3A-000, 3B-000  
Tape Unit Loads but Capstan Motion is

Faulty 6B-110  
Tape Unit Wont Thread, Load, and Return to BOT Properly 6B-101  
Unit Check Without Supporting Sense or Unexpected Sense 15-100  
Unload Failure Symptoms 4A-000, 4B-000  
Write Current Failure or Tape Unit Check 15-090  
Write Tape Mark (WTM) Check 17-180  
Write Trigger Vertical Redundancy Check (VRC) Error 17-020  
XOUTA Register Not Functioning 13-430  
1x8 Selection Logic 18-000  
301 Trap Address, TCS or Device Switching Without TCS 13-240  
3420/3803 Symptom Index 00-010  
3803 Status Pending 13-220  
6250 Error Correction 17-600  
Markers, BOT/EOT 40-007  
Master Clock 53-005  
Master Signal Level Tapes (CE Tool) 80-000  
Master Skew Tapes (CE Tools) 80-000  
Mechanical Skew (Installation) 90-190  
Mechanical Skew Check/Adjustment, NRZI Featured Units 08-180  
Mechanical Skew Check/Adjustment, 1600 and 6250 BPI Units 08-170  
Meter, Torque  
Metering (Concepts) 40-003  
Metering Problems, Tape Control 18-060  
Microprocessor (see also ALU)  
Card Interchange List 16-001  
Clock Control Logic 52-005  
Communication Between ALU1 and ALU2 (Description) 52-030  
Diagnose, Loop, and Scoping Procedures 16-000  
Functions (Description) 52-030  
Instruction Counter Logic 52-010  
Instruction Format 52-030  
Listings (Description) 52-030  
Stat Registers 52-015  
Microprogram Address, Used in MAPs (Description) 00-003  
Microprogram Detected Error, ALU1 (MAP) 16-060  
Microprogram Error, ALU2 (Table) 16-130  
Microprogram Error Labels (Table) 16-060  
Microprogram Errors, Analyzing (Table) 16-131  
Microprogram Flowcharts  
Branch to Read From Load Point 55-040  
Branch to Write From Load Point 55-024  
Common Start I/O Routine 55-020  
Microprogram Indicators 75-004  
Microsecond Frequency 53-005  
Minireel Load Test 08-800  
Missing or Extra Interrupts 18-050  
MIST or TCS Register (MP1) 52-035, 52-060  
MLM Tab Placement by Volume PLAN 7  
Mode Chart for Sense Byte 6 17-220  
Mode Set Command Table 40-008  
Mode Set 1 (7-Track NRZI) Operation 55-007  
Mode Set 2 (9-Track PE/NRZI) Operation 55-007  
Modified Power Supply, 3420 1A-002  
Motion Control Commands 40-007  
Motion Control Commands (Table) 40-005  
Motion Problems, Tape (Stubby Column Loops) 6A-010  
Motion Tester (see Field Tester)

Mple/Single Switch (CE Panel) 75-002  
MP1 (see ALU)  
A-Register 52-035  
Branch Conditions (Table) 52-086  
Clock Control Logic 52-005  
Clock Timing Charts 52-005  
Functional Description 52-030  
High-Order ROS Registers 52-035  
Instruction Counter Logic 52-025  
Low-Order ROS Registers 52-035  
Schematic 50-003  
Special Register (Hardware Errors) 52-060  
Stat Registers 52-015  
Transfer Decodes (Table) 52-101  
XOUTA Register Bit Usage 52-025  
MP2 (see ALU)  
A-Register 52-035  
Branch Conditions (Table) 52-087  
Functional Description 52-030  
High-Order ROS Registers 52-035  
Instructional Counter Logic 52-030  
Low-Order ROS Registers 52-035  
Schematic 50-003  
Special Register (TU Bus In) 52-040  
Stat Registers 52-015  
Transfer Decodes (Table) 52-101  
XOUTA Register Bit Usage 52-025  
Multi-Track Error (MTE)  
Logic 17-112  
MTE/LRC Indicator 75-004  
Without Envelope Check (MAP) 17-110

N

9-Track NRZI (Concepts) 40-002  
9-Track NRZI Feature (Tape Control) 40-004  
No Block Detected on Write/Write Tape Mark (WTM) 16-190  
No-Operation (NOP) Command 40-008  
No Response or Tape Moves Backward 3A-100, 3B-100  
No Response When Rewind/Unload Button is Pressed 4A-110, 4B-110  
Noise Detection (MAP) 17-370  
Noise or Bits in the Interblock Gap 5A-115, 5B-025  
Non-Motion Control Commands 40-008  
Non-Motion Control Commands (Table) 40-005  
Not Capable (MAP) 15-060  
Not Capable Conditions (Table) 15-064  
NRZI  
Cyclic Redundancy Check (CRC) (MAP) 17-590  
Hi-Clip VRC (Write Only) 17-310  
Read Data Bit x Test Points (Table) 17-590  
Read Data Flow 57-006  
R/W VRC, Hi Clip VRC, LRC Error 17-314  
7-Track (Concepts) 40-002  
9-Track (Concepts) 40-002

O

Offline Duplication of Online Failures (MAP) 12-001  
OLT Error Messages Analysis 21-000  
OLT-3420 F, G, H, Error Sense Analysis 21-000  
One and Two Track 6250 Error Correction 17-600  
Online and Offline Status (Concepts) 40-003

Operation, Autocleaner 08-360  
Operational Check, Autocleaner 08-380  
Operations, ALU  
Arithmetic Add: ADD/ADDM (Hex Code A or B) 52-065  
Branch On Condition: BOC (Hex Code 2 or 3) 52-085  
Branch to Read from Load Point 55-040  
Branch to Write from Load Point 55-024  
Branch Unconditional: BU (Hex Code 6) 52-090  
Common Start I/O Routine 55-020  
Logical AND: AND/ANDM (Hex Code C or D) 52-070  
Logical Exclusive OR: XO/XOM (Hex Code E or F) 52-075  
Logical OR: OR/ORM (Hex Code 8 or 9) 52-075  
Store Logic: STO (Hex Code 0 or 1) 52-095  
Transfer Logic: XFR (Hex Code 4 or 5) 52-100  
Operator Panel Switches (2X8 Switch Logic) 58-055  
Optional Tape Cartridge (Concept) 40-001  
ORC Byte 53-045  
Organization of Publication PLAN 6  
Oscillator Gating 53-005  
Oscillators (see Clocks/Oscillators/Counters)  
Other (Related) Subsystem Documents PLAN 1  
Overrun  
Error 53-040  
MAP 15-040  
PE and 6250 BPI (Timing Chart) 15-041

P

P Compare Error Test Points (Table) 17-013  
P Comp Indicator (CE Panel) 75-004  
P Compare or C Compare (Logic) 17-017  
P Compare or C Compare Errors (MAP) 17-010  
Panel, CE 75-001  
Panel Enable Switch 75-001  
Parity Error, B Bus, ALU1 16-030  
Parity Error, B Bus, ALU2 16-100  
Parity Indicator 75-003  
Partial Record (MAP) 17-410  
Partitioning (TCS Feature) 58-011  
Passing Times per Byte (3420 Subsystem Characteristics) 40-002  
Passing Times, IBG (Subsystem Characteristics) 40-002  
Patch Card  
ALU1/ALU2 Card Location 52-104  
General Description 52-103  
Card Plugging Layout 52-104  
PE or NRZI and GCR Velocity Checks/Changes (MAP) 16-180  
PE Threshold Adjustment Card 80-000  
PE, 1600 BPI (Concepts) 40-002  
PE/6250 BPI CRC 17-540  
Permanent Data Checks (MAP) 5A-105, 5B-002  
Permanent Read Error Scoping Offline 00-013  
Permanent Read Error Scoping Online 00-014  
Permanent Read/Write Error Analysis  
Flow Chart 00-011

3803-2/3420

XK0300	2736033	See EC	845958	847298				
Seq 2 of 2	Part Number	History	1 Sep 79	15 Aug 83				



Permit Flip Latch 53-040  
Persistent Pointers 17-602  
Phase Encoded (PE) 55-007  
Phase Pointers (Table) 08-250  
Phasing Check (Installation) 90-180  
Phasing, Power 90-180  
Photo Cell, Radius Sensor 08-610  
Picking/Dropping Records (MAP) 15-200  
Pins to Logic, Cross Reference List (3803-2) 20-000  
Plugging, Cables and Terminators 90-060  
Plugging, Reverse High Power Drive Current To Capstan (Model 7 Only) 6A-140  
Plugging, Write Head Card (Model 4, 6, 8) 08-270  
Pneumatic System  
Imbalance or Leaks Check 6A-010, 6B-150  
Motor Does Not Turn Off 4A-160, 4B-160  
Motor Not Running or Transfer Valve Not Picked 2A-130, 2B-130  
Motor Stepped Pulley Alignment (Type 3 Supply) 08-434  
Pressure Level Adjustment (All Models) 08-420  
Pressure/Vacuum Checks 08-400  
Procedure to Check for Imbalance or Leaks 6A-010  
Regulator Air Pressure Check 08-405  
Supply Flat Belt Replacement/Adjustment 08-442  
Supply Pulley Removal/Replacement 08-430  
System, Description  
Air Bearing 4A-160, 4B-160  
Flow Diagram 4A-161, 4B-161  
Pneumatic Switches 4A-160, 4B-160  
Three-Way Valve 4A-160, 4B-160  
Transfer Valve 4A-160, 4B-160  
Transfer Valve Leakage Test 08-400  
Transfer Valve Not Picked 2A-130  
Pointer System  
MAP 17-602  
Pointer Register (Second Level) 53-045  
Probe List (Table) 17-701  
Timing Chart 17-702  
Polarity Hold Drive (PHD) Register 6B-205  
Possible 3420/3803 Problem Fix 00-050  
Postamble Error (MAP) 17-190  
Power  
Cable 90-060  
Check Indicator On 1A-000, 1B-000  
Supply Checks (Installation) 90-180  
Power-On Checks (Installation) 90-180  
Power-On/Off Sequencing (Concepts) 40-003  
Power On Reset 50-011  
Reel Motor Voltages, Speed 3A-020, 3B-020  
Requirements, Special-3420 Model 8 (Table) 90-180  
Power Supplies  
DC Checks/Adjustments 08-570  
DC Test Points (3803/3420 Tables) 08-570  
Modified 1A-002  
Printed Circuit Board Removal/Replacement (3803 Model 2 Only) 08-575  
TCU Power Supply Failure Analysis 11-000  
Unmodified 1A-000, 1B-002  
3420 1A-000, 1B-000  
3420 Power Interface Board, B1 1A-003, 1B-001  
Power Window  
Alignment 08-640  
Does Not Go Down 4A-140, 4B-140

Glass Removal/Replacement 08-670  
Rack, Switch Adjustment 08-650  
Safety Bail Adjustment 08-640  
Safety Bail Cable Removal/Replacement 08-660  
Preamps (see Adjustment)  
Pressure, Air (see Pneumatic System)  
Pressure Divider (CE Tool) 80-000  
Pressure Test, Right Reel Latch  
Rear Housing 08-520  
Pressure/Vacuum Gauge 80-010  
Preventive Maintenance  
Fiber Optic Lamp Cleaning Procedure 08-260  
General 85-000  
Schedule 85-005  
Tape Unit Cleaning Procedure 85-001  
Priority, Select Out 90-120  
Priority (2X16 Switch Logic) 58-060  
Procedures  
Capstan Motion Checks (Motion Appears Normal) 6B-020  
Check for Tape Drag 6A-010  
Diagnosing CE Panel Failure 12-020  
Displaying Sense Information from CE Panel 12-012  
Locating a Failing Command 12-010  
Offline Duplication of Failures 12-000  
Priority Circuits 54-020  
Priority (see Selection and Priority)  
Problems, Intermittent Drop Ready 2A-005  
Proportional Drive Control, Capstan Motor (Second Level) 6B-215  
Proportional Drive Counter (PDC) 6B-205  
Protection, File (Concept) 40-001  
Pulse Generator, Capstan 6A-120  
Pushbuttons (see CE Panel Switches)

Q

Quick Fix Index, 3803-2 Subsystem 00-009

R

Radius Sensor Photo Cell 08-610  
Read  
Acceptable Waveforms (Read Card Test Points) 5B-004  
Access Times (3420 Subsystem Characteristics) 40-002  
Amplitude Adjustment (Model 4, 6, and 8) 08-310  
Back Checking (Concept) 40-001  
Backspace Operation 6B-230  
Backward Command 40-005  
Backward Operation 5A-140, 5B-140  
Card Reference Generator 5B-120  
Cycle Controls 53-095  
Data Converter Data Flow Logic 57-026  
Data Flow Logic 50-002  
Data Flow Logic, NRZI 57-006  
Errors, Permanent (see Permanent Read Error Analysis)  
Forward to Backward Ratio Test (All Models) 08-240, 5B-020  
Forward to Backward Ratio Test (Models 3, 5, 7) 5A-110

Forward Command 40-005  
Forward Operation 5A-140, 5B-140  
Head and Read Card Circuits 5B-120  
Noise or Bits in the Interblock Gap 5A-115  
Operation 5B-140  
Register, A/B 53-055  
Translator Data Flow Logic 57-021  
VRC Indicator 75-004  
6250 Service Requirements 50-030  
Read Card Reference Generator 5B-120  
Read Card Test Points (Table) 08-310  
Read Electrical Skew Adjustment (NRZI Feature) 08-190  
Read Head and Read Card Logic 5B-120  
Read Only Storage (ROS) 6B-205  
Read Only Tape Generation 90-200  
Read Sequencing Circuits 53-055  
Read/Write  
Clocks and Counters (Table) 53-010  
Clocks/Oscillators 53-005  
CRC A, B, C, D 53-066  
CRC Generators 53-065  
Cyclic Redundancy Check Generation and Use 53-067  
Data Flow Clock 53-015  
Data Flow Logic 50-000, 50-001, 50-002  
Envelope Failure, Runaway, or Read/Write Problems 5A-000, 5B-000  
Head Degaussing and Resistance Check (Models 4, 6, and 8) 08-280  
Head Resistance Check Procedure 5B-001  
Intermittent Permanent Data Checks  
Bit Packing 5A-115, 5B-025  
Forward to Backward Ratio 5A-110, 5B-020  
Noise or Bit In IBG 5A-115, 5B-025  
Signal Dropout 5A-110, 5B-020  
Tape Edge Damage 5A-110, 5B-030  
Tape Slipping 5B-020  
Tape Stretch 5A-115, 5B-020  
Logic Circuits 5A-100, 5B-100  
Problems 5A-000, 5B-000  
Self Adjusting Gain Control (SAGC) 5B-120  
Skew Detection 53-085  
Vertical Redundancy Check (VRC) (Logic) 17-179  
Vertical Redundancy Check (VRC) (MAP) (Chart) 17-168, 17-170  
Vertical Redundancy Check (VRC) (Timing Charts) 17-172  
VRC Circuit (Logic) 17-179  
Write Clock and Write Counter 53-020  
Write Head Card Plugging (Models 4, 6, and 8) 08-270  
Write Service Controls 53-040  
Zero Threshold 5B-120  
Ready Lamp Does Not Turn Off 4A-100, 4B-100  
Ready Lamp Does Not Turn On/Window Does Not Close 1A-210, 2B-210  
Ready Symptoms Failure Chart 2A-000  
Recording Methods/Formats  
Concepts 40-002  
Description 55-007  
Interblock Gap (IBG) 40-002  
Magnetic Tape and Reels (Concepts) 40-002  
Nine-Track NRZI (Concepts) 40-002  
PE (1600 BPI) Concepts 40-002

7-Track NRZI (Concepts) 40-002  
6250 BPI (Concepts) 40-002  
6250 BPI Error Correction (Concepts) 40-002  
Reel  
Alignment Tool Preparation Kit 08-460  
Alignment Tool Modification/Zeroing 08-465  
And Capstan Operations During Rewind 3A-030, 3B-030  
Left Reel Does Not Turn Clockwise at Threading Speed 2A-110, 2B-110  
Motors and Drivers 3A-020, 3B-020  
Reel and Capstan Operations During Rewind 3A-030, 3B-030  
Reel Does Not Stop 4A-130, 4B-130  
Reel Motor and Hub Adjustment (CE Tools) 80-000  
Reel Tachometers 3A-030, 3B-030  
Rewind Operation and Timing Chart 3A-010, 3B-010  
Right or Left Reel Won't Load Tape into Column 2B-180  
Right Reel Does Not Stop 4A-130, 4B-130  
Right Reel Does Not Turn Clockwise at Correct Speed 2A-120, 2B-120  
Right Reel Latch Rear Housing Pressure Check 08-520  
Stabilization 3A-020, 3B-020  
Tachometer Removal/Replacement 08-550  
Tachometers, During Rewind 3A-030, 3B-020, 3B-030  
Tape Does Not Wind Completely Onto Right Reel 4A-130, 4B-130  
Tape Fails to Go Backward 3A-130, 3B-130  
Tape Unwinds Off Right Reel or TI Light Stays On 3A-150, 3B-150  
Reference Charts, Device Switching Feature 18-029  
Registers  
A/B 53-055  
Channel Tags and Bus In 52-040  
Channel Write Byte 53-045  
Crossovers 52-025  
D 52-060  
Dead Track 53-075  
High and Low-Order ROS 52-035  
Local Storage 52-015  
MIST and TCS 52-060  
MP1 and MP2 52-060  
MP1/MP2 STAT 52-015  
Pointer 53-045  
ROS/LSR 52-015  
Tape Unit Bus Out 52-045  
Write Check 53-045  
Regulator Air Pressure Checks/Adjustments 90-190, 08-405

3803-2/3420

XK0400	2736034	See EC	845958	847298			
Seq 1 of 2	Part Number	History	1 Sep 79	15 Aug 83			

Removals and Replacements  
Air Bearings (D) 08-210  
Autocleaner 08-370  
Capstan Assembly (Non-90,000 Series) 08-020, 08-040  
Capstan Assembly (90,000 series) 08-030, 08-050  
Capstan Tachometer (Model 3, 5, 7) 08-110  
Capstan Tachometer (Model 4, 6) 08-090  
Cartridge Restraint 08-540  
Cooling Fan 08-630  
D-Bearing 08-210  
Erase Head 08-250  
Fiber Optics  
BOT/EOT Block 08-590  
Bundle 08-610  
Lamp 08-620  
LED BOT/EOT Block 08-590  
LED BOT/EOT Window 08-590  
Left Movable Guide and Retractor (NRZI Feature) 08-220  
Left Reel Hub and Motor 08-560  
Logic Panel (3420/3803) 08-630  
Pneumatic Supply Flat Belt 08-442  
Power Circuit Board (PCB) 08-575  
Power Circuit Board (3803 Model 2 only) 08-575  
Power Window Glass 08-670  
Power Window Safety Bail Cable 08-660  
Printed Circuit Board (3803 Model 2 Only) 08-575  
Read/Write Head Card 08-260  
Read/Write or Erase Head 08-250  
Reel Tachometer 08-550  
Right Rear Movable Guide and Retractor 08-210  
Right Reel-Latch Rear Housing 08-470  
Right Reel Motor 08-530  
Right Reel Hub 08-480  
Right Reel Hub Individual Parts 08-490  
Vacuum Column Door Glass 08-690  
Replacement  
Cartridge Motor 08-535  
Pneumatic Supply Flat Belt (Type 4) 08-442  
Pneumatic Supply Pulley (All Types of Pneumatic Supplies) 08-430  
Right Reel Hub 08-500  
Right Reel Hub Individual Parts 08-490  
Right Reel-Latch Rear Housing 08-510  
Vacuum Column Door 08-680  
Request In Interrupt 54-001  
Request Track-In-Error Command 40-006  
Reserve/Release Operation (TCS Feature) 58-011  
Reset/Start or Step Switch (CE panel) 75-001  
Resets (TCS Feature) 58-011  
Resources PLAN 1  
Response Chart 40-008  
Rewind (REW)  
Command 40-007  
Concept 40-001  
Operation and Timing Chart 3A-010, 3B-010  
Problems 3A-000, 3B-000  
Capstan Won't Rewind to LP After Loading Tape 3B-175  
No Response or Tape Moves Backward 3A-100, 3B-100  
Tape Does Not Enter or Stay in Hi Speed Rewind 3A-170, 3B-170  
Tape Does Not Stop or Tape Runaway (Forward

or Backward) 3A-140, 3B-140  
Tape Fails to Go Backward 3A-130, 3B-130  
Tape Pulls Out Of or Dumps During High Speed Rew 3B-160  
Tape Rewinds Off Left Reel 3B-180  
Tape Rewinds to Beginning of Tape at High Speed 3A-170  
Tape Stays in High Speed Rewind Status to Load Point 3B-180  
Tape Unwinds off Right Reel 3A-150, 3B-150  
Unload/Rewind Pushbutton (No Response) 4A-110, 4B-110  
Wide Execursions in Left Column During High Speed Rewind 3A-160, 3B-160  
Rewind Times (Subsystem Characteristics) 40-002  
Rewind/Unload (RUN)  
Command 40-007  
Concepts 40-001  
Unload Operation With Cartridge 4A-000, 4B-000  
Unload Operation Without Cartridge 4A-000, 4B-000  
Problems 4A-000, 4B-000  
Cartridge Opener Does Not Close 4A-150, 4B-150  
No Response When Rewind/Unload Button is Pressed 4A-110, 4B-110  
Power Window Does Not Go Down 4A-140, 4B-140  
Reels Do Not Stop 4A-130, 4B-130  
Tape Does Not Pull Out of Columns Properly During Unload Rewind 4A-120, 4B-120  
Tape Does Not Wind Completely onto Right Reel or Reels Does Not Stop 4A-130, 4B-130  
Tape Moves Backward Off Left Reel 2B-190  
Tape Unit Performs a Normal Unload Rewind During a Load Operation 2B-190  
Unload Rewind Pushbutton (No Response) 4A-110, 4B-110  
Rewind/Unload Times (Subsystem Characteristics) 40-002  
RIC/ROC 53-080  
Right Reel  
Does Not Turn Clockwise at Correct Speed 2A-120, 2B-120  
Hub Individual Parts Replacement 08-490  
Hub Removal 08-480  
Hub Replacement/Adjustment 08-500  
Latch  
Rear Housing Pressure Test 08-520  
Rear Housing Removal 08-470  
Rear Housing Replacement 08-510  
Logic 3A-030, 3B-030  
Motor Removal/Replacement 08-530  
Motor Speed, Voltages 3A-020, 3B-020  
Reels Do Not Stop 4A-130, 4B-130  
Right or Left Reel Won't Load Tape into Column 2B-180  
Tape Does Not Wind Completely onto Right Reel 4A-130, 4B-130  
Tape Unwinds Off Right Reel or TI Light Stays On 4A-150, 3B-150  
Theory, Rewind and Timing Chart 3A-010, 3B-010  
Won't Load Tape into Column 2B-180  
Right Threading Channel 08-230  
Ripple/Wr Data Switch (CE Panel) 75-002  
ROS Bit P1, 0-7 Test Points (Table) 16-020

ROS Bit P2, 8-15 Test Points (Table) 16-010  
ROS Mode Switch (CE Panel) 75-002  
ROS Patch Card (Plugging) 80-030  
ROS 1 Trap Conditions Logic 50-010  
Routines, Linking Microprogram 52-030  
Rules and Definitions, Device Switching 18-011  
Runaway  
Envelope Failure, Runaway, or R/W Problems 5A-000, 5B-000  
Tape Does Not Stop or Tape Runaway (FWD/BKWD) 3A-140, 3B-140  
  
S  
  
Safety Section  
SAGC (Self-Adjusting Gain Control)  
Check 16-220  
Theory 5B-120  
Scale (CE Tool) 80-000  
Schematics  
IBG Counter (Model 3, 5, 7) 6A-130  
Microprocessor (MP1, MP2) Flow 50-003  
Read/Write Flow 50-000, 50-001, 50-002  
ROS 1 Trap Conditions 50-010  
Scoping Permanent Errors  
Offline 00-013  
Online 00-014  
Select In/Select Out 54-020  
Select Out Priority (Table) 90-120  
Selection, Tape Control and Tape Unit 54-005  
Selection (TCS Feature) 58-011  
Selection and Priority 54-010  
Selective Reset 50-011  
Self-Adjusting Gain Control and Zero Threshold 5B-120  
Logic 1x8 18-000  
Priority Circuits 54-020  
Tape Control and Tape Unit Addressing 54-005  
Tape Control and Tape Unit Selection 54-005  
Tape Unit Selection 54-010  
Sense  
Analysis (MAP) 14-000  
Analysis, Error Correction (MAP) 21-000  
Bytes 0-23  
Bits not Defined in MAPs 00-006  
Tables 00-005  
Mask for Sense Data After Rewind 15-140  
Subsystem Quick Fix Index, Sense Byte Analysis 00-009  
Tape Unit Sense Bytes (Table) 00-005  
Sense All Zeros (MAP) 15-080  
Sense Byte to Bit Conversion (Table) 14-005  
Sense Byte 3, Bit 4 17-315  
Sense Byte 5, Bit 5 17-410  
Sense Command 40-005  
Sense Data Equals All Zeros 15-080  
Sense Release Command (TCS Feature) 40-006, 58-011  
Sense Reserve Command (TCS Feature) 40-005, 58-011  
Sensor Adjustment, AMP  
(NRZI-Model 3, 5, 7) 08-300  
Sensor Adjustment, AMP

(PE Only-Model 3, 5, 7) 08-290  
Sequence Chart, Forward Creep During Rewrite 6B-230  
Sequencing, Power On/Off (Concepts) 40-003  
Service Controls, Write 53-040  
Service In/Service Out 58-005  
Service Out Inactive During Reset or Power-On-Reset (MAP) 13-350  
Service Out Tag Active (MAP) 13-280  
Service Requirements  
6250 Read 50-030  
6250 Write 50-020  
Set Diagnose Command 40-006  
Set ROS Mode/Set CE Compr Switch (CE Panel) 75-002  
Seven-Track NRZI Recording (Concepts) 40-002  
Shim (CE Tool) 80-000  
Short Cycle XFR Example (Timing Chart) 16-001  
Short Gap (with Tape Damage) 00-012  
Signal Dropout 5A-110, 5B-020  
SIO Trap Failures (MAP) 13-320  
Single Tape Unit Problems Chart 00-040  
Skew  
Buffers 53-075  
Detection 53-085  
Error 17-166  
Error Circuit Description 17-166  
Errors, Test Point Chart (Table) 17-162  
Error Timing Chart 17-163  
Group Buffer Counter 53-090  
Indicator (CE Panel) 75-004  
RIC Equals ROC (MAP) 17-160  
Test Points, Skew Errors (Chart) 17-162  
Slippage, Tape 5B-020  
Slow End Readback Check (MAP) 17-150  
Solenoid Check, High-Speed Rewind 08-405  
Space Block Commands (Description) 40-007  
Space File Commands (Description) 40-007  
Special Power Requirements-3420 Model 8 (Table) 90-180  
Special Register, MP1 (Hardware Errors) 52-060  
Special Register, MP2 (TU Bus In) 52-060  
Stack Interrupt (TCS Feature) 58-012  
Stack/Stack Interrupt (TCS Feature) 58-012  
Standard Voltages, Definition of 00-003  
Start Capstan Motion 6B-220  
Start I/O (SIO) Routine, Common 55-020  
Start Problem Analysis START 1  
Start Read Check (MAP) 17-070  
Start Times, Forward (Subsystem Characteristics) 40-002  
Stat Registers 52-015  
Status Byte Chart 00-005  
Status Reject, Command or Control 6A-160  
Stop Address-FRU List (Table) 16-060  
Stop On Control Check Switch (CE Panel) 75-001  
Stop On Data Flow Check Switch (CE Panel) 75-001  
Stop/Start Switch (CE Panel) 75-002  
Store (ALU Operation) 52-095

3803-2/3420

XK0400	2736034	See EC	845958	847298				
Seq 2 of 2	Part Number	History	1 Sep 79	15 Aug 83				

Subsystem  
Address/Feature/Priority Card Plugging 90-110  
Cabling 90-060  
Channel Cable Maximum Length for  
6250 BPI (Table) 90-070  
Channel Attachment (Table) 90-010  
Concepts 40-002  
Configuration 90-100  
Configuration Worksheet Instructions 90-030  
Device Switching 90-050  
Error Correcting/Detecting Code 40-002  
External Cables (Table) 90-070  
Field Tester Conversion 90-170  
Installation Checklist (3803-2/3420) 90-020  
Installation (Introduction/Instructions) 90-000  
Kickplates 90-100  
Power Cable 90-060  
Power Supply Checks 90-180  
Quick Fix Index, 3803-2 00-009  
Recording Method 40-002  
Unpacking Instructions 90-000  
3803/3420 Configurations 40-003  
Suppress Out Active (MAP) 13-310  
Suppress Out Inactive During Reset or  
Power-On-Reset (MAP) 13-340  
Switches  
Cartridge Open and Closed 2A-100, 2B-100  
CE Panel 75-001  
Vacuum Column 08-450  
Switching Configuration, Device 58-050  
Symbols and Legend PLAN 4  
Symptoms  
Capstan Motion Failure 6B-000  
Dropping Ready and Thread and Load Failure  
2A-000, 2B-000  
Failure Follows Tape Unit 00-040  
Index, 3420/3803 00-010  
Unload 4A-000, 4B-000  
Tape Motion and Rewind Chart 3A-000, 3B-000  
3803/3420 Index 00-010  
System Diagnostics (Installation) 90-200  
System/360/370 Switching 58-005

T

TACH Period Counter (TPC) 6B-205  
TACH Start Failure (Sense Byte 10, Bit 5)  
(MAP) 16-170  
TACH Velocity Error (MAP) 13-510  
Tachometer, Capstan (Model 3, 5, 7) 08-130  
Tachometer, Capstan (Model 4, 6, 8) 08-120  
Tachometer, Reel 3B-020, 3B-030  
Tags In Register, Channel 52-040  
Tape Cleaning Kit (CE Tool) 80-000  
Tape Cleaner (see Autocleaner)  
Tape Control (TCU)  
Addressing 40-003  
Address Decoders 58-010  
Address/Feature/Priority Card 90-110  
Branch To Read From Load Point 55-040  
Branch To Write From Load Point 55-024  
Channel Interface Problems (Table) 18-040  
Common Start I/O (SIO) 55-020  
Concepts 40-003  
Configurations (Concepts) 40-003

Contingent Connection (TCS Feature) 58-012  
Control Unit End (TCS Feature) 58-012  
Density Feature Configurations 40-004  
Device End (TCS Feature) 58-012  
Device Switching Feature 54-010  
Enable/Disable Switch 40-003  
Group Coded Recording (GCR) 55-008  
Interface Switch Control 58-011  
Logic Panel Card Plugging 19-000  
Logic Panel Removal/Replacement 08-630  
Loop-Write-To-Read (LWR) 55-005  
MAPs (see MAPs)  
Metering 40-003  
Metering Problems (MAP) 18-060  
Online and Offline Status 40-003  
Power On/Off Sequencing (Concepts) 40-003  
Registers 52-060  
Channel Tags and Bus In 52-040  
Crossovers 52-025  
D 52-060  
High and Low-Order ROS 52-035  
Local Storage 52-015  
MP1 and MP2 52-060  
MP1/MP2 STAT 52-015  
ROS/LSR 52-015  
Tape Unit Bus Out 52-045  
Resets (TCS Feature) 58-011  
SDI Logic! (Table) 18-030, 18-032  
Selection and Addressing 54-005  
Sense Byte Bits Not Defined in MAPs 00-007  
Sense Byte Chart 00-005  
Sequencing, Power On/Off 40-003  
Stack Interrupt (TCS Feature) 58-012  
Status Byte Chart 00-005  
Tie Breaker Logic 58-010  
Timing, Read Cycle Controls 53-095  
Tape Control To/From Device (Chart) 18-005  
Tape Crimper Procedure 2A-015, 2B-006  
Tape Damage  
Analysis of IBG in Developed Tape 00-013  
At End of Block (Block Appears Short) 00-012  
Consists of Small Spot or Oxide Void (1 or  
More Tracks) 00-012  
Edge Damage 5B-030  
In Beginning Zeros Burst (PE Only) 00-012  
In Ending Zeros Burst (PE Only) 00-012  
In Erased Gap Area 00-012  
In Middle of Data 00-012  
Scope  
Offline 00-013  
Online 00-014  
Short Gap 00-012  
Tape Developing Procedure 00-011  
Tape Guide Check (NRZI-Featured Units) 08-230  
Tape Slippage 5B-020  
Tape Speed (3420 Characteristics) 40-002  
Tape Subsystem Cabling, Device Switch  
Feature 18-011  
Tape Transport Cleaner (CE Tool) 80-000  
Tape Unit  
Autocleaner Operation 40-001, 5B-110,  
08-360  
Bus In Test Points (Table) 17-312  
Bus Out Test Points (Table) 17-312  
Characteristics Table 40-002  
Commands 40-006

Commands and Command Status Byte (Table)  
16-164  
Control Lines Charts 16-213  
Double Track Errors 40-002  
EC Level 90-210  
Erase Head 5B-110  
Feature Code 90-210  
Full Width Erasure 40-001  
General and Daily Cleaning 85-000  
Ground Check 08-600  
Head-Mirror Stop Adjustment (Model 3, 5, 7)  
08-350  
IBG Counter (Model 3, 5, 7) 6A-130  
Initial Selection 54-000  
Initiating Tape Motion 07-010  
Interchangeability Problems 40-001  
Logic Panel Card Plugging (Models 3, 5, and 7)  
19-010  
Logic Panel Card Plugging (Models 4, 6, and 8)  
19-011  
Logic Panel Removal/Replacement 08-630  
Loop-Write-To-Read 55-005  
Model Number 90-212  
Online/Offline Switches (2X8 Switching)  
58-080  
Power Supplies 1A-000, 1B-000  
Problems, Single Unit 00-040  
Selection and Addressing 54-005  
Selection Priority 54-010  
Sense Byte Chart 00-005  
Serial Number 90-210  
Single Direct-Drive Capstan 40-001  
Single Track Errors 40-002  
Speed (Subsystem Characteristics) 40-002  
Tape Developing Analysis 00-011  
Tape Guide Check (NRZI Feature) 08-230  
Track Pointers 40-002  
Two-Gap Read/Write Head 40-001  
Tape Unit Problems  
Bit Packing 5A-115, 5B-025  
Capstan Starts Turning When Power is Turned  
On (Second Level) 6B-140  
Dropping Ready and Thread and Load Failure  
Symptoms 2A-000, 2B-000  
Capstan Fails to Start a Rewind to Load  
Point After Loading Tape into Columns 2B-175  
Cartridge Does Not Open 2A-100, 2B-100  
Intermittent Drop Ready 2A-005, 2B-005  
Left or Right Vacuum Column Problems  
2A-170, 2B-170  
Left Reel Does Not Turn Clockwise at  
Threading Speed 2A-110, 2B-110  
Load Check Prior to BOT Sense 2A-150,  
2B-150  
Ready Lamp Does Not Turn On/Window  
Does Not Close 2A-210, 2B-210  
Right or Left Reel Fails to Load Tape  
into Columns 2B-180  
Right Reel Does Not Turn Clockwise at  
Threading Speed 2A-120, 2B-120  
Tape Does Not Go Backward or Does  
Not Stop at BOT 2A-190  
Tape Does Not Load into Either Column  
2A-160, 2B-160

Tape Goes Forward After Loading into  
Vacuum Columns 2A-200, 2B-200  
Tape Motion Problems (Stubby Column  
Loops) 6A-010  
Tape Moves Backward Off Left Reel, or Tape  
Unit Performs a Normal Unload Rewind During  
a Load Operation 2B-190  
Tape Starts into Threading Channel and  
Stops 2A-140, 2B-140  
Tape Threads into Right Column 2A-130,  
2B-130  
Forward to Backward Ratio 5A-110, 5B-020  
Intermittent Drop Ready 07-010  
Noise or Bit in IBG 5A-115, 5B-025  
Permanent Data Checks (MAP) 5A-105, 5B-002  
Signal Dropout 5A-110, 5B-020  
Tape Drag Check 6A-010, 6B-150  
Tape Edge Damage 5A-110, 5B-030  
Tape Motion Symptoms 3A-000, 3B-000  
Left or Right Vacuum Column-Tape Pulls Out,  
Bobbles, Bottoms 3A-110, 3B-110  
No Response or Tape Moves Backward  
3A-100, 3B-100  
Tape Does Not Enter or Stay in High Speed  
Rewind or Rewinds to BOT at High Speed  
3A-170, 3B-170  
Tape Does Not Stop or Tape Runaway (Forward/  
Backward) 3A-140, 3B-140  
Tape Fails to go Backward 3A-130, 3B-130  
Tape Has Wide Excursions in Left Column  
During High Speed Rewind 3A-160, 3B-160  
Tape Pulls Out or Dumps in Left Column  
During HS Rew 3A-160, 3B-160  
Tape Rewinds to Beginning-Of-Tape (BOT) at  
High Speed 3A-170, 3B-170  
Tape Unwinds Off Right Reel 3A-150, 3B-150  
Tape Slipping 5B-020  
Tape Stretch 5A-115, 5B-020  
Tape Unit Check (MAP) 15-090  
Tape Unit Loads but Capstan Motion is Faulty  
(MAP) 6B-110  
Tape Wont Thread, Load, and Return to BOT  
Properly (MAP) 6B-100  
Unload Failure Symptoms  
Cartridge Opener Does Not Close 4A-150,  
4B-150  
Pneumatic Motor Does Not Turn Off 4A-160,  
4B-160  
Power Window Does Not Go Down 4A-140,  
4B-140  
Ready Lamp Does Not Turn On 4A-100, 4B-100  
Tape Does Not Pull Out of Columns Properly  
During Unload Rewind 4A-120, 4B-120  
Tape Does Not Wind Completely Onto Right  
Reel or Reels Do Not Stop 4A-130, 4B-130  
Unload Rewind Pushbutton (No Response)  
4A-110, 4B-110  
TB-1, TB2, and TB3 Diagram 1A-002  
TCS (see Two Channel Switch)  
TCU (see Tape Control)  
Technique, Card Isolation PLAN 1  
Tee and Hose Assembly (CE Tool) 80-000  
Terminator and Cable Plugging 90-060  
Terminology Notes PLAN 1

Test I/O Instruction 40-009  
Test Points, Channel Buffer/Write Bus (Table) 17-021  
Test Points (Read Card) 5B-004  
Tester, CE (see Field Tester)  
Theory (see Tape Unit or Tape Control Unit)  
Theory (TCS Feature) 5B-010  
Theory of Operation  
    Additional Stopping Distances After Go  
    Extend 6A-140  
    Air Bearings 4A-160, 4B-160  
    Airflow and Voltage Monitoring System  
    1A-000, 1B-000  
    Backspace 6B-230  
    Capstan Control Circuits 6A-120, 6B-020  
    Capstan Drive System 6A-120, 6B-200  
    Capstan Motion Checks 6A-000, 6B-000  
    Capstan Motor and Controls 6A-120, 6B-020  
    Capstan Pulse Generation 6A-120, 6B-200  
    Cartridge Opener Does Not Close 4A-150, 4B-150  
    Data Exchange on DEVI During Write  
    Operation 5A-130, 5B-130  
    Erase Head (Schematic) 5B-110  
    Extended Go 6B-205  
    Go Extend IBG Counts 6A-140  
    Go Extensions in Quarter TACH Pulses 6B-205  
    IBG Counter Circuits 6A-130, 6B-205  
    IBG Generation 6A-150, 6B-210  
    Left or Right Vacuum Column Problems 3A-110,  
    3B-110  
    Left Reel Does Not Turn Clockwise at Threading  
    Speed 2A-110, 2B-110  
    Load Check Prior to BOT Sense 2B-150  
    Major Elements of Capstan Control Logic 6B-205  
    Plugging (Model 7 Only) 6A-140  
    Pneumatic System (flow diagram) 4A-160  
    Pneumatic Switches 4A-160, 4B-160  
    Polarity Hold Drive (PHD) Register 6B-205  
    Power Check 1A-000, 1B-000  
    Power Supplies 1A-000, 1B-000  
    Proportional Drive Counter (PDC) 6B-205  
    Read Backward Operation 5A-140, 5B-140  
    Read Card and Read Card Circuits 5B-120  
    Read Card Reference Generator 5B-120  
    Read Forward Operation 5A-140, 5B-140  
    Read Only Storage (ROS) 6B-205  
    Reel and Capstan Operations During Rewind  
    3A-030, 3B-030  
    Reel Drive System Schematic 3A-020, 3B-020  
    Reel Motors and Drivers 3A-020, 3B-020  
    Reel Stabilization 3A-020, 3B-020  
    Reel Tachometers 3B-020, 3B-030  
    Reel Tachometers, During Rewind 3A-030, 3B-030  
    Reset/Start or Stop Switch 75-001  
    Rewind Operation 3A-010, 3B-010  
    Self Adjusting Gain Control (SAGC) 5B-120  
    TACH Period Counter (TPC) 6B-205  
    Three-Way Valve 4A-160, 4B-160  
    Transfer Valve 4A-160, 4B-160  
    Unload Operation with Cartridge 4A-000,  
    4B-000  
    Unload Operation without Cartridge 4A-000,  
    4B-000  
    Write Head, Erase head, and Write Card  
    (Schematic) 5B-110  
    Zero Threshold 5B-120  
    6 MHz Oscillator and GCC 6B-205

3420 Power Supplies 1A-000  
Thread and Load Operations 2A-010, 2B-020  
Thread, Load  
    Check Points 2A-020, 2B-030  
    Checking with Cartridge (Timing  
    Chart) 2A-010, 2B-020  
    Checking without Cartridge (Differences)  
    2A-020, 2B-030  
    Failure Symptoms 2A-000, 2B-000  
    Left Reel Turns Too Fast 2A-110, 2B-110  
    Operations  
    Cartridge Does Not Not Open 2A-100, 2B-100  
    Left or Right Vacuum Column Problems 2A-170,  
    2B-170, 3A-110, 3B-110  
    Left Reel Does Not Turn Clockwise at  
    Threading Speed 2A-110, 2B-110  
    Load Check Prior to BOT Sense 2A-150,  
    2B-150  
    Motor Not Running or Transfer Valve Not Picked  
    2A-130, 2B-130  
    Ready Light Does Not Turn On 2A-210, 2B-210  
    Right Reel Does Not Turn Clockwise at Correct  
    Speed 2A-120, 2B-120  
    Tape Does Not Go Backward or Does Not Stop at  
    BOT 2A-190  
    Tape Does Not Load into Either Column 2A-160,  
    2B-160  
    Tape Enters Threading Channel and Stops 2A-140,  
    2B-140  
    Tape Goes Forward after Loading into Vacuum  
    Columns 2A-200, 2B-200  
    Tape Unit Won't Thread, Load, and Return  
    to BOT Correctly 6B-100  
    Time Required in Execute (Subsystem  
    Characteristics) 40-002  
    Regulator Air Pressure Check 08-400  
    Threading Vacuum Check 08-400  
    Transfer Valve Leakage Test 08-400  
    Thread Load Checking With Cartridge 2A-020, 2B-030  
    Thread Load Without Cartridge (Differences) 2A-020  
    Thread Status Active and Inactive 4A-161, 4B-161  
    Threading Failure Symptoms Chart 2A-000, 2B-000  
    Three Control Switch Feature (Concepts) 58-050  
    Three-Way Valve 4A-160, 4B-160  
    TIE Breaker (with TCS Feature) 58-012, 50-030  
    TIE (Request Track-in-Error Command) 40-006  
    Timing Chart  
    Bit Cell and PE and NRZI Write  
    Waveform 55-007  
    Branch Unconditional 52-090  
    Byte Count or Go Down 12-028  
    CE Entry 12-027  
    Clock 17-800  
    Command Select Sequencer and Decoder 12-026  
    Command Sequence (Tag Lines/Status) 54-001  
    Cyclic Redundancy Check (CRC) 17-544,  
    17-545, 17-546  
    Data Convert Write Timing 57-025  
    Go Extend IBG 6A-140  
    IBG Generation 6B-210  
    Long Cycle (BOC or BU) 16-001  
    Microprocessor Clocks Control 52-005  
    NRZI R/W VRC, Hi Clip VRC, LRC Errors 17-314  
    Overrun 15-041  
    PE 17-176  
    PE Mode 17-016, 17-025, 17-111

PE Write 17-165  
Plugging Reverse High Power Current  
(Model 7 Only) 6A-140  
Pointer System, PE 17-705  
Pointer System, 6250 17-702  
Read Cycle Controls 53-095  
Read Electrical Skew 08-190  
Rewind 3A-010, 3B-010  
Set and Display CE Register 12-021  
Set and Display Compare Register 12-022  
Short Cycle (XFR) Example 16-001  
Start Capstan Motion (Write Operation  
200 IPS) 6B-220  
Store 52-095  
Thread and Load 2B-020  
Thread Load Checking With Cartridge 2A-020,  
2B-030  
Thread Load With Cartridge 2A-010  
Transfer 52-100  
Write Electrical Skew (NRZI Feature) 08-200  
6250 BPI Mode 17-014, 17-015,  
6250 Multi-Track Error (MTE) 17-111  
6250, PE, and NRZI Waveform 53-070  
6250 Read Service Requirements 50-030  
6250 Write 17-172  
6250 Write (RIC/ROC) 17-163  
6250 Write Service Requirements 50-020  
6250 Write Trigger VRC 17-022  
7-Track 17-313  
Timing Charts, Used in MAPs (Description) 00-003  
Tools and Test Equipment 80-000  
Transfer (ALU Operation) 52-100  
Transfer Decodes, Microprogram (MP1 and MP2) 52-101  
Transfer Valve  
    Not Picked or Pneumatic Motor Not Running  
    2A-130, 2B-130  
    Leakage Test 08-400  
Translation  
    Write Translator 7-Track 57-020  
    Read Translator 7-Track 57-021  
Translator, Write 57-020  
Transport Cleaning Procedure 85-001  
Transport Concepts 40-001  
Transport, Tape (Concept) 40-001  
Trap Channel A/B (TCS Feature) 58-011  
Trap Condition Schematic, ROS 1 50-010  
Troubleshooting Procedure, Device  
    Switching (MAP) 18-020  
TU (see Tape Unit)  
TU Bus In (MP2 Special Register) 52-060  
TU Control Lines and Control Status Byte  
    Response (Table) 16-213  
TUBI Test Points (Table) 17-312  
TUBO Test Points (Table) 17-312  
Two Channel Switch (TCS) Feature 58-010  
    TCS or MIST Register (MP1) 52-060  
Two Control Switch Feature (Concepts) 58-050  
Type 2272 MST Card Adjustment 17-800  
Typical Flow Through MAPs (Example) 00-002

U  
U Pgm Indicators 75-004  
Unit Check Without Supporting Sense  
or Unexpected Sense (MAP) 15-100  
Unload Operation With/Without Cartridge  
4A-000, 4B-000  
Unload Operations (see Rewind/Unload Operation)  
Unmodified Power Supply, 3420 1A-000, 1B-002  
Unpacking Instructions, Subsystem Installation 90-000

V  
Vacuum Column  
    Balance 08-800  
    Door Glass Removal/Replacement/Adjustment  
    08-690  
    Door Replacement/Adjustment 08-680  
    Left or Right Vacuum Column Problems 2A-170,  
    2B-170, 3A-110, 3B-110  
    Switch Check 08-450  
    Tape Bobbles Vacuum Columns 3A-110, 3B-110  
    Tape Bottoms in Vacuum Columns 3A-110,  
    3B-110  
    Tape Does Not Load into Either Column 2A-160,  
    2B-160  
    Tape Exhibits Abnormal Motion Symptoms 3A-110,  
    3B-110  
    Tape Goes Forward After Loading into Vacuum  
    Columns 2A-200, 2B-200  
    Tape Pulls Out of Vacuum Columns 3A-110,  
    3B-110  
    Wide Excursions in Left Column During  
    High Speed Rewind 3A-160, 3B-160  
Vacuum Chart ((Inches of Water) All Models) 08-405  
Vacuum Level Adjustment, Altitude 08-410  
Vacuum/Pressure Gauge (Setup) 80-010  
Valid Pointers 17-602  
Variable Go-Down Time 40-006  
Velocity Check, Velocity Change During Write 16-180  
Voltage and Airflow Monitoring System 1A-000, 1B-000  
Voltage Levels (Limits) 00-003  
Voltages, Standard (Definition Of) 00-003  
VRC Error, Write Trigger 17-020  
VRC, Write Trigger Circuit Description 17-026

W  
Water Manometer (Procedures) 80-010  
Waveforms (Read Forward and Backward Ratio Test)  
5A-110, 5B-020  
Wide Excursions in Left Column During High Speed  
Rewind 3A-160, 3B-160  
Window (see Power Window)  
Word Count Zero (MAP) 15-050

3803-2/3420

XK0500	6851776	847298						
Seq 2 of 2	Part Number	15 Aug 83						



Write  
Access Times (Subsystem Characteristics) 40-002  
Byte Counter 53-025  
Byte Register, Channel 53-045  
Check Register 53-045  
Clock and Write Counter 53-020  
Command 40-005  
Data Converter Logic 57-025  
Data Exchange on Device Interface During Write  
Operation 5A-130, 5B-130  
Data Flow Logic 50-000, 50-001  
Electrical Skew Adjustment (NRZI Feature) 08-200  
Enable Ring (see File Protection-Concepts)  
Forward Creep During Write 6B-230  
Group Buffer Control 53-025  
Head Card Plugging (Models 4, 6, and 8) 08-270  
Service Controls 53-040  
Tape Mark (WTM) Check (MAP) 17-180  
Tape Mark Command 40-007  
Translator, 7-Track Logic 57-020  
Trigger Operation, 6250, NRZI, and PE 53-070  
Write Trigger Indicator 75-004  
Write Trigger Vertical Redundancy Check (VRC)  
Logic 17-026  
Error (MAP) 17-020  
Error, 6250 BPI (Timing Chart) 17-022  
Write Current Failure or Tape Unit Check (MAP)  
15-090  
Write Head, Erase Head, and Write Card  
Circuits 5B-110  
6250 Write Operation (MAP) 13-480  
6250 Service Requirements 50-020

X

XOUTA Register Not Functioning (MAP) 13-430  
XLOUTA/XOUTB (Crossover) Registers 52-025

Y

Y1 Panel Location 90-080

Z

Zero Threshold 5B-120

NUMERIC

1 and 2 Track 6250 Error Correction 17-600  
301 Trap Address, TCS or Device Switching  
Without TCS (MAP) 13-240  
360/370 Switching Logic 58-005  
1600 BPI (Concepts) 40-002  
3420  
Airflow and Voltage Monitoring System  
1A-000, 1B-000  
Altitude Vacuum Level Adjustment 08-410  
Daily and General Cleaning Instructions 85-000  
Dropping Ready, Thread, and Load Failure  
Symptoms 2A-000, 2B-000  
Field Tester Accuracy Check 08-290,  
08-300, 08-315  
Field Tester Procedure 80-020

Installation Checklist 90-020  
Models 3-8 Cleaning Procedure 85-001  
Model 8-Special Power Requirements 90-180  
Modified Power Interface Board (B1) 1A-003  
Modified Power Supply 1A-002  
Preventative Maintenance Schedule 85-005  
Read Amplitude Adjustment 08-310  
SAGC Checks 08-315  
Tape Speed (3420 Subsystem Characteristics)  
40-002  
Unmodified Power Supply 1A-000  
3803  
CE Panel Description 75-001  
Installation Checklist 90-020  
3803/3420 Magnetic Tape Subsystem 40-001  
Basic Sense Data 40-001  
Command Set 40-001  
Cross-Reference, Pins To Logic 17-166  
Features (Concepts) 40-004  
Logic Panel Removal/Replacement 08-630  
Preventative Maintenance Schedule 85-005  
Status Pending 13-220  
Status Response 40-001  
Symptom Index 00-010  
Tape Control (Concepts) 40-003  
6250 Write Operation (MAP) 13-480  
PE Mode Timing Chart 17-016  
1x8 Selection Logic (MAP) 18-000  
2 Control Switch (Concepts) 58-050  
2x8 Switch Logic 58-055  
2x8 Switching Functional Units 58-080  
2x16 Switch Logic 58-060  
3 Control Switch (Concepts) 58-050  
4 Control Switch (Concepts) 58-050  
4x16 Switch Logic 58-070  
6 MHz Oscillator and Gray Code Counter 6B-205  
6250 BPI  
(Concepts) 40-002  
Error Correction (Concepts) 40-002  
Mode Timing Chart 17-014, 17-015  
PE CRC 17-540  
6250 Error Correction (MAP) 17-600  
6250 Read Service Requirements 50-030  
6250 Stress Tape (CE Tool) 80-000  
6250 Write Service Requirements 50-020  
7-Track NRZI Threshold Adjustment Card 80-000  
7-Track Timing Chart 17-313  
7 or 9 Track LRC 17-310  
7 and 9 Track NRZI 40-004  
9-Track CRC Generation During Read and Write 53-067

3803-2/3420

XK0600	6851777	847298						
Seq 1 of 2	Part Number	15 Aug 83						

3803-2/3420

XK0600	6851777	847298						
Seq 2 of 2	Part Number	15 Aug 83						

© Copyright International Business Machines Corporation 1983