3600/3800 Tape Subsystem

Product Description Manual

ET 050-0 1982

Storage Technology Corporation

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This publication was prepared by Storage Technology Corporation, Technical Publications, MD:3K,2270 South 88th Street, Louisville, Colorado 80028.

This document contains a product description of the STC 3600/3800 Tape Subsystem. This includes basic machine specifications, operation explanation and support documentation necessary to connect the STC 3600/3800 Tape Subsystem to an IBM* 360/370 CPU. The subsystem is composed of STC's 3600 Tape Units, capable of data storage at 1600 or 6250 bits per inch, and the STC 3800-IV Tape Control Unit. The material in this document is intended for use by STC customers.

Additional copies of this document may be obtained through the local STC branch office.

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FIGURES

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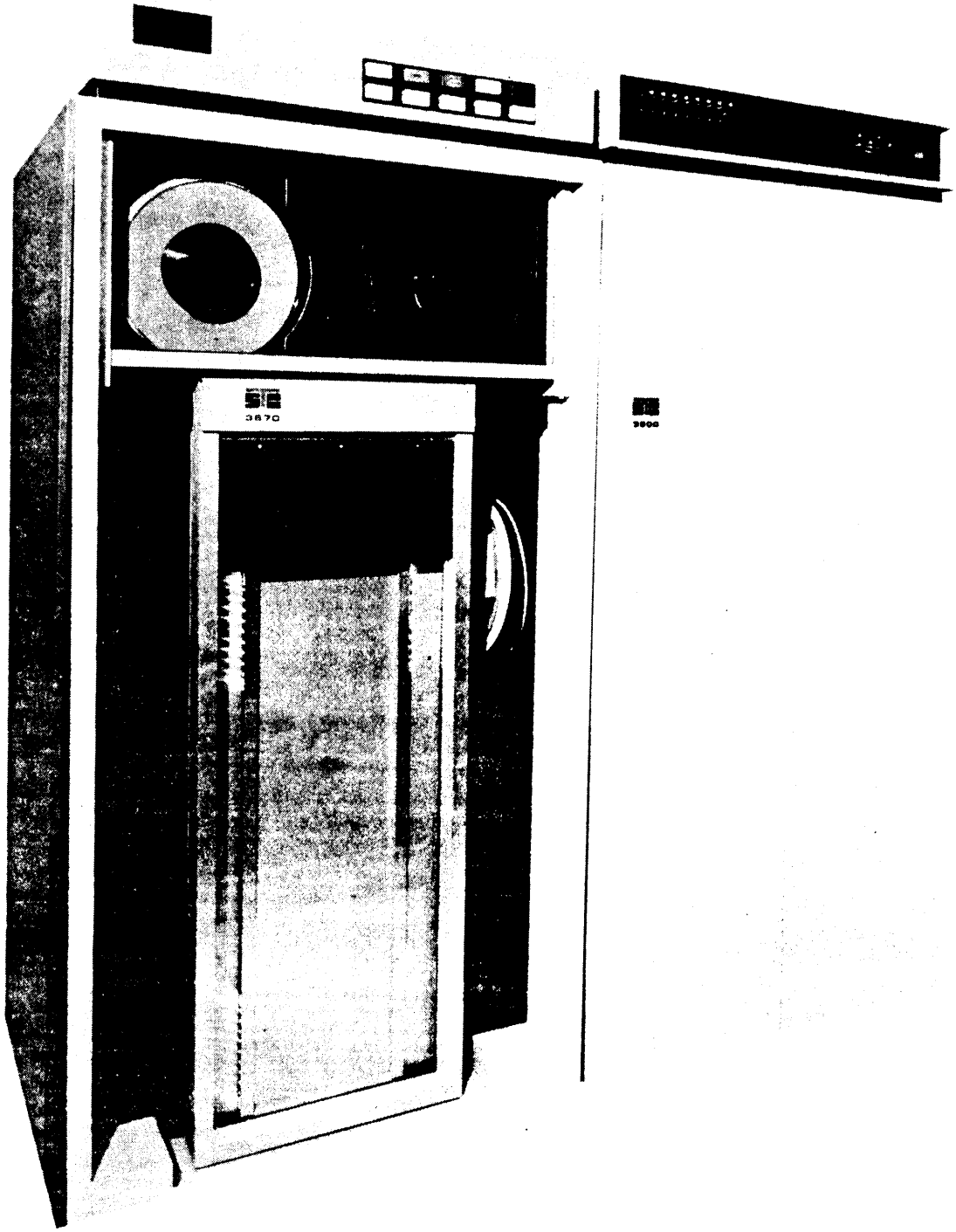
The STC 3600/3800 Tape Subsystem is designed to provide 6250 bits per inch (BPI) capability compatible with the IBM Group Coded Recording (GCR) format. The subsystem is comprised of a 3800-IV Tape Control Unit (TCU) and at least one 3600 model tape unit.

The subsystem control unit, the 3800-IV, operates at either 6250 or 1600 BPI. Optional features permit operation at 800, 556 and 200 BPI. Tape units are attached to, and powered from, the tape control unit, with the subsystem attached to the system by a standard IBM System 360 or System 370 channel interface. See Planning Considerations for appropriate system attachment.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CHAPTER 1

3800-IV TAPE CONTROL UNIT

GENERAL

The 3800-IV Tape Control Unit (TCU) contains the logic required to operate the STC 3600 and 3400 series tape units. The basic TCU can perform tape operations at 6250 or 1600 BPI. General specifications for the 3800-IV Tape Control Unit are listed in Table 1.

Table 1. General Specifications, 3800-IV TCU

POWER REQUIREMENTS	
Primary Power	208/230 VAC + 10%, 3 phase 4 wire, 60HZ + 1%. Standard supply is 60 amp, with an optional 100 amp supply available for certain configurations.
KVA	1.7
ENVIRONMENTAL	
Operating Temperature range (Room Ambient)	
Minimum	60 degrees F
Masimum	90 degrees F
Humidity Range	
Minimum	20 percent
Maximum	80 percent
Heat Dissipation	4600 BTU
Air Requirement	500 CFM
PHYSICAL DIMENSIONS	
Height	66 inches
Length	30 inches
Width	30 inches

During 6250 BPI write operations, data is assembled in data groups, translated, formatted into storage groups and recorded. The TCU will, at specified intervals, insert control characters for error correction, record detection, data verification and read circuit resynchronization. A complete read-back check of the write data is performed to verify proper recording.

The 6250 BPI read operations convert GCR data to standard hexidecimal characters, which are then transmitted serially across the channel interface. Correctable errors are determined and corrected in flight.

Control commands are included for rewinding, unloading, spacing, erasing, tape marking, status recording and diagnostic assistance.

FEATURES

The features available on the 3800-IV Tape Control Unit are:

- Nine-Track NRZI

  Nine-Track NRZI is comparable to the Nine-Track feature of the 3800-III, with tapes written and read in 800 BPI NRZI. For proper operation, a 3430, 3450 or 3470 Tape Unit with Dual Density is required.

- Seven-Track NRZI

  The Seven-Track NRZI feature for the 3800-IV compares with the Seven-Track feature of the STC 3800-III TCU. Seven-Track operation can be at 800, 556 or 200 BPI on a seven-track 3430, 3450 or 3470 Tape Unit.

  The Seven-Track feature also includes the data convert and data translate functions. Data convert causes four tape characters (24 bits) to be written for every three hexidecimal characters (24 bits) transmitted across the channel. Data translate causes the translation of each hexidecimal character to a six-bit binary character. There are 64 possible character combinations in translate mode.

PROGRAMMING NOTE

Data convert, data translate, density and parity functions are activated by Mode Set 1 commands. Mode Set 1 commands can be used at any time, therefore they must be issued under strict control. Improper use may result in tapes being written at various densities, parities, etc., settings within the same tape. Use of data convert reduces operating data rate by 25 percent.

- Two-Channel Switch

The addition of this feature permits a second channel to access the 3800-IV. The two channels may be from the same or seperate CPU's and use of the Two-Channel Switch can be under manual or program control.

- Tape Switch

This feature permits from two to four tape control units to access any one of sixteen tape drives. The Tape Switch feature allows tape units to be dynamically switched among the control units. Any or all units may be rendered inaccessible to a given control unit, or control units, by switches located on the TCU operator panel. Figure 1 illustrates the possible combinations that may be obtained using the Tape Switch features.

Those TCU's marked "Switch" contain the 2x, 3x or 4x switching feature. The "Remotes" contain communication paths to the switching circuitry and therefore do not need the switch feature. In a 4x configuration, if four drives are selected via four different control units, data may be transmitted simultaneously on all four paths.

TCU OPERATOR PANEL

The TCU operator panel contains the switches which control the Two-Channel Switch and Tape Switch functions. Two-channel access to the tape control unit is provided by the Two-Channel Switch feature. On a control unit equipped with Two-Channel Switch, access to a channel is controlled by the switches as shown by the following:

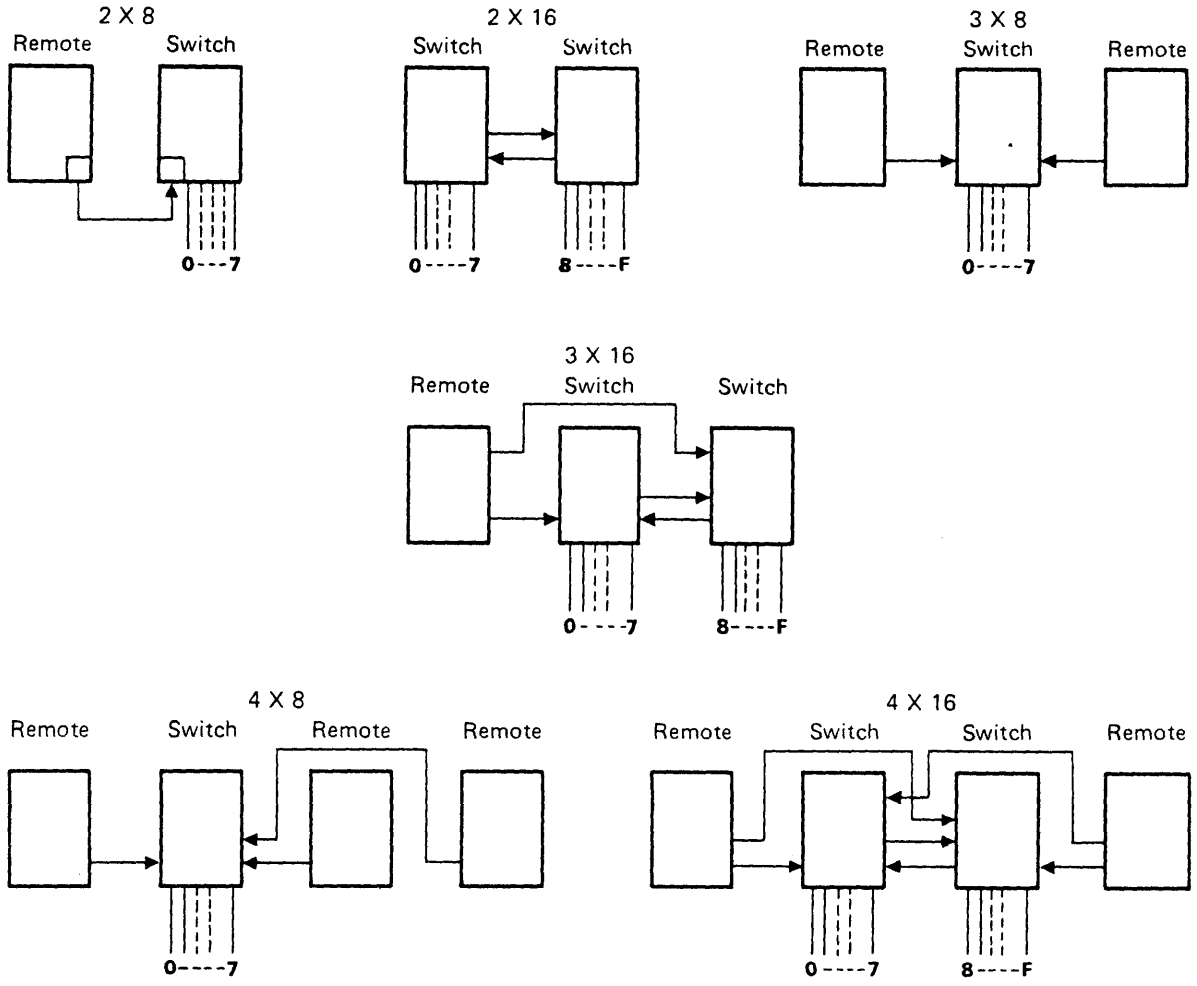

Figure 1. Tape Switch Combinations

Switch A	Switch B	Result
ON	ON	Control unit has access to both channels.
ON	OFF	Control unit has access to Channel A, no access to Channel B.
OFF	ON	Control unit has access to Channel B, with no access to Channel a.
OFF	OFF	Control unit has no channel access.

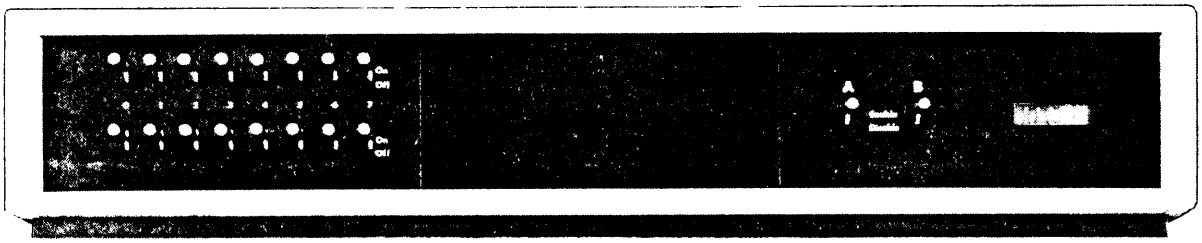

Figure 2. TCU Operator Panel

Each Tape Switch control is used to enable or disable a specific control unit path to one tape unit. The switches are in groups of eight (for operation with eight tape units). The number of groups is dependent upon whether the feature is 2x, 3x, or 4x. The down position is the disable setting.

The Usage Meter, located on the operator panel, is activated by the metering-out line from the channel.

TCU FE PANEL

The FE panel, located behind the front covers, contains various maintenance controls, error indicators, register displays and operational indicators. It permits the Field Engineer to perform commands on any or all units within the subsystem. Commands initiated from the FE panel may be run concurrently with channel programs, providing the addressed drive has been placed offline.

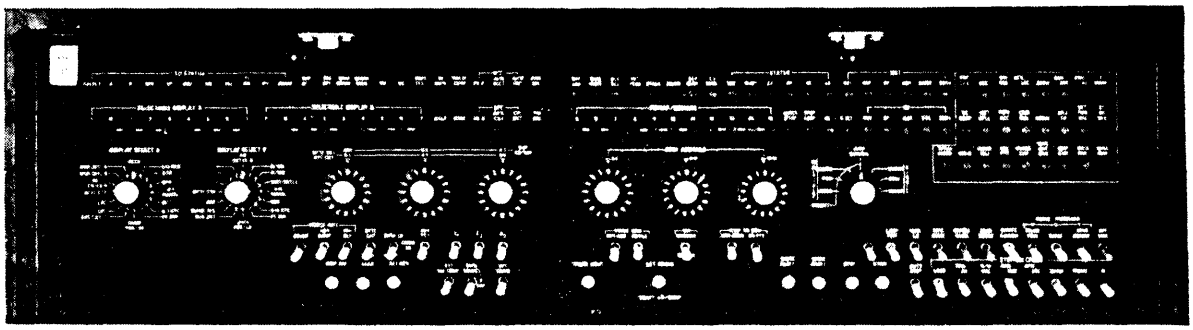

Figure 3. TCU FE Panel

Additional controls allow specific maintenance programs to execute in run mode or single-step mode. The Write Tape Mark switch allows a Field Engineer to write tape marks and rewind the tape from the control unit.

CHAPTER 2

3600 TAPE UNITS

GENERAL

The 3600 tape units are attached to the 3800-IV Tape Control Units in configurations of from one to sixteen. Tape unit models may be intermixed within the same string, provided that the TCU's are properly featured. STC's 3400 series tape units may also be intermixed with 3600 series tape units in the subsystem. Each TCU has power and signal connections for eight tape units. The address of the individual tape unit is determined by the port to which the tape unit signal cable is attached and by pluggable jumpers within the control unit.

The four models of 3600 tape units available are all self-loading, single capstan units. To determine model characteristics refer to Table 2, 3600 Tape Unit Specifications. The STC tape unit models and their IBM equivalents are:

STC	IBM
3630	3420-4
3650	3420-6
3670	3420-8

TAPE UNIT FEATURES

The features that are standard on all 3600 model tape units are:

- Self Loading — Tapes mounted in the file reel position will be automatically threaded to the machine reel, then loaded in the columns and the beginning-of-tape (BOT) marker brought to ready position.

Table 2. Tape Unit Specifications

MODELS	3630	3650	3670
Speed (IPS)	75	125	200
Density (BPI)	6250/1600	6250/1600	6250/1600
Data Rate (KB)			
6250	470	780	1250
1600	120	200	320
Write Acess (MS)			
6250	2.1	1.5	.95
1600	3.0	2.0	1.28
Read Access (MS)			
6250	2.3	1.6	1.1
1600	4.0	2.6	1.65
Rewind (sec)	55	55	45
Weight (lbs)	1000	1000	1000
Dimensions (inches)	30x30x66	30x30x66	30x30x66

Load to Ready Time	9 seconds for 10' 5" leader
Unload Time	9 seconds for 10' 5" leader
Velocity (Steady State)	+3 percent
Interface	42 line
Power Requirements	
Primary Voltage	208/230 Vac + 10% 60 Hz + Hz 3 Phase Powered from TCU
Secondary Voltages	+ 15, -15, + 10, -10 -23, -46, + 5 DC
Environment	
Operating Temperature Range	Minimum - 60 degrees F Maximum - 90 degrees F
Operating Humidity Range	Minimum - 20 percent Maximum - 80 percent

Table 2. Tape Unit Specifications (Cont.)

MODEL NUMBER	KVA		PF*		KW		BTU/HR	
	OP	RDY	OP	RDY	OP	RDY	OP	RDY
3430	2.0	1.7	.80	.76	1.6	1.3	5500	4400
3440	2.0	1.7	.80	.76	1.6	1.3	5500	4400
3450	2.0	1.7	.80	.76	1.6	1.3	5500	4400
3470	2.5	1.7	.80	.76	2.0	1.3	6800	4400
3480	2.7	1.95	.80	.76	2.2	1.5	7500	5000
3800-III	1.5	1.5	.80	.80	1.2	1.2	4100	4100
3630E	1.8	1.6	.80	.76	1.45	1.2	4900	4100
3650E	1.8	1.6	.80	.76	1.45	1.2	4900	4100
3650G	2.5	2.0	.80	.76	2.0	1.6	6800	5500
3670G	2.75	2.1	.80	.76	2.2	1.6	7400	5400
3800-IV	1.7	1.7	.80	.80	1.35	1.35	4600	4600
3670E	2.5	2.0/**	.80	.76	2.0	1.6	7200	5200/***

*Power Factor, Inductive Load

** Idle Mode: 0.75KVA

*** Idle Mode: 2250 BTU/HR

- Automatic Reel Hub — Operator action is not necessary to secure the file reel to the reel hub. The reel hub is automatically activated by pressing the LOAD/REWIND pushbutton on the operator panel.

- Capstan — All in-column tape motion is controlled by a single capstan. Contact between tape and capstan is restricted to the non-oxide surface, thereby minimizing recording surface damage.

- Tape Storage Pocket — The pocket is located to the right of the vacuum column door and provides storage for two cartridges or three open reels.

- Power Window — Window operation is automatic during load and unload operations. The window may be opened at any time by putting the tape unit in the not ready condition and pressing the HUB/WINDOW-UP pushbutton.

DATA DENSITY OPTION

Any 3600 model tape unit can be equipped to perform either 1600 or 6250 BPI operations. Mode sets for 6250 or 1600 BPI are effective only at load point, to guarantee proper density setting. Tape is

written with 0.6 inch gaps in the 1600 BPI mode and with 0.3 inch gaps in the 6250 BPI mode.

OPERATOR PANEL

The operator panel is located at the top-front of each tape unit. It contains a row of indicators above a row of pushbutton switches. The indicators provide information on the tape unit mode of operation and status. The pushbuttons manually operate the tape unit.

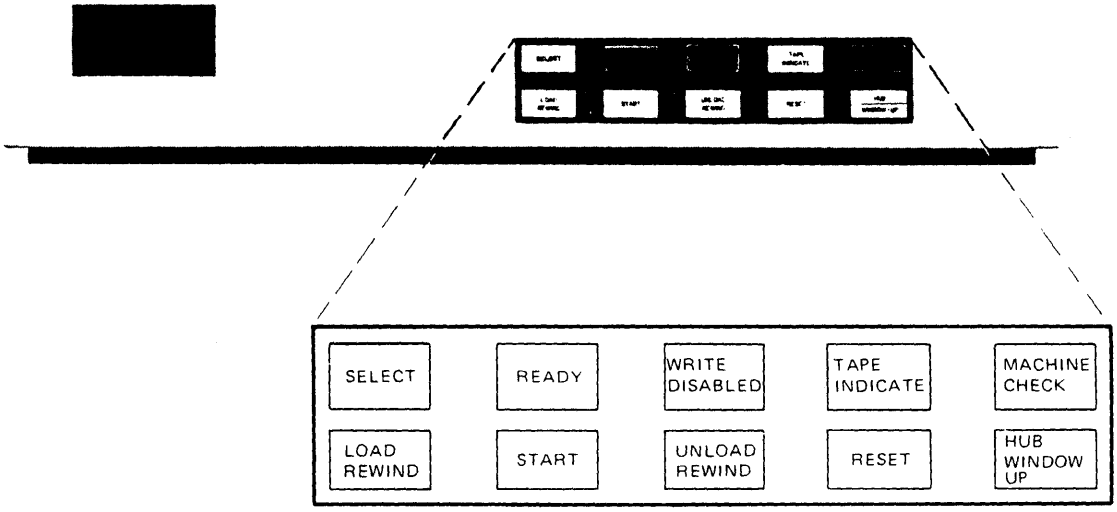

Figure 4. Tape Unit Operator Panel

The operator panel indicators and the messages they provide are:

- SELECT — Tape unit is selected for use by the control unit.
- READY — Tape unit is loaded and ready to accept commands from the control unit.
- WRITE DISABLED — Writing is prohibited by the file protect circuitry.
- TAPE INDICATE — End-of-tape sensor has detected the end-of-tape reflective marker.

- MACHINE CHECK — Flashes to indicate an operator correctable failure or a machine malfunction requiring field engineering intervention.

There are five pushbutton switches on the operator panel. Of these, only RESET will function when the tape unit READY indicator is lit. The pushbutton switches and functions are:

- LOAD/REWIND — Initiates tape load sequence or, when tape is away from load point, causes rewind to load point.

- START — Places the tape unit in ready state making it capable of performing control unit commands.

- UNLOAD/REWIND — Causes the tape unit to remove tape from the columns and rewind it onto the file reel - if tape is at load point. When the tape unit is loaded and away from load point, it causes tape to rewind and unload.

- RESET — Cancels tape unit ready status and resets machine check indications.

- HUB/WINDOW-UP — If the window is up, the hub releases when HUB/WINDOW-UP is pressed. If the tape unit is not in ready status and the window is down, the window opens.

OPERATING PROCEDURES

The pushbuttons on the operator panel may be used in various sequences to accomplish desired operations. The common operating procedures are:

- Tape Mounting - Cartridge

1. Place the cartridge on the file reel hub, matching the cartridge alignment ribs with the cutouts in the upper restraint and right threading channel.

2. Press LOAD/REWIND. The window will close, the cartridge will open and the file reel will turn clockwise, starting tape into the right threading channel. If tape should not reach the machine reel in the prescribed amount of time, the tape will be rewound into the cartridge and a second loading sequence initiated automatically. (A second load failure will cause the MACHINE CHECK indicator to flash.)

3. Press START. The READY indicator lights when tape reaches load point.

- Tape Mounting - Open Reel

1. Place the file reel on the reel hub, pushing the reel to the rear of the machine until the reel toggles snap into an upright position.

2. Turn the reel until leader hangs freely between the three and six o'clock position.

3. Press LOAD/REWIND.

4. Press START. The READY indicator lights when tape reaches load point.

- Unload

1. Press RESET.

2. Press UNLOAD/REWIND.

3. At completion of the unload operation, the window will open and the file reel will release automatically.

- Rewind

1. Press RESET.

2. Press LOAD/REWIND. Tape will rewind at high speed to load point.

- Window Operation

1. Press RESET.

2. Press HUB/WINDOW-UP. The window will now open, permitting access to head area.

3. With window open, a second pressing of the HUB/WINDOW-UP pushbutton will release the file reel (if tape is removed from threading channel).

NOTE

The window cannot be opened with the tape unit in ready status.

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CHAPTER 3

DIAGNOSTICS

Diagnostics can be run on the 3600/3800 Tape Subsystem using any of the following:

- A Field Tester.
- The FE Buffer.
- SPAR.
- Online tests.
- Standalone Diagnostics.

The field tester provides a means of checking and exercising an individual tape unit without affecting the other units in the subsystem. The tape unit to be tested must first be made unavailable via system software. It is then mechanically taken offline by a switch on the tape unit and the field tester is connected in place of the TCU.

With the tape unit switched offline but still cabled to the TCU, Channel Command Words (CCW's) may be entered into the FE buffer. The TCU is then timeshared between the channel and the remainder of the tape units. Between channel operations, commands can be directed to

the offline tape unit from the FE buffer. If the TCU is switched offline, the entire subsystem is unavailable to the channel and can then be operated independently.

The Subsystem Program For Analysis And Repair (SPAR) is an STC patented diagnostic approach operated by the microprogram, a 128-1/2 word memory and an outboard diagnostic tape. SPAR can operate either offline or online. Diagnostics read into the memory share TCU time inline with on-going operations. All tape units within the subsystem can be tested from any TCU within the subsystem. SPAR priority is lower than a channel command, so any SPAR routine must wait until the channel command is executed before proceeding. (There is also a preset delay after completion of a command that allows the channel to re-address the tape unit, instead of immediatley beginning a SPAR routine.) Once a SPAR routine is loading or executing, channel requests are terminated with a control unit busy indication. The channel request is honored upon completion of the active SPAR routine.

Online Tests are invoked by the Online Test Executive Program (OLTEP) and operate inline with other operations. The Online Tests verify system/channel/subsystem operation and operate in a partition as a problem program. Online Test results can be posted to any hard copy or display unit designated by the SYSGEN process.

The Standalone diagnostics provide more exhaustive tests at the system level than the Online Tests. Standalones require exclusive use of the entire data processing system. They are provided on tape and are initiated through standard IPL procedures.

CHAPTER 4

SUBSYSTEM COMMANDS

Subsystem commands are divided into three categories - Burst commands, Motion Control commands and Non-Motion Control commands. The Burst commands tansfer data across the channel interface. Execution of Burst commands requires total channel dedication with no interleaving of data allowed. The Burst commands that are executed by the subsystem are:

- Write

  The Write command records data on tape in the mode and at the density prescribed by the TCU. Channel End and Device End are presented to the channel at the completion of the write operation.

  Hexidecimal code: 01.

- Read Forward

  The tape unit is set in forward status by the Read Forward command. Previously recorded data is read and passed on to the channel via the TCU. The read operation continues until an interblock gap is sensed. Channel end and Device End are presented to the channel at the completion of the read operation. It a tape mark is sensed, Unit End is also posted.

  Hexicecimal code: 02.

- Read Backward

The Read Backward command sets the tape unit to backward read status, which is identical to forward read status. Channel End and Device End are presented to the channel at the completion of the read operation. The tape unit remains in backward status upon completion of the operation. Data Convert Seven-Track cannot be used when a Read Backward command is issued. If Read Backward is issued at load point, it causes a Unit Check.

Hexidecimal code: 0C.

- Sense

The Sense command transfers up to 24 sense bytes from the TCU to the channel. The actual number of bytes transferred depends on the Channel Command Word byte count. Channel End and Device End are presented to the channel at the completion of the sense operation.

Hexidecimal code: 04.

- Sense Reserve

Sense Reserve reserves the addressed TCU for exclusive use by the addressing channel. The TCU remains reserved until released by a Sense Release command or by a system reset. The Sense Reserve command operates only on TCU's equipped with Programmable 2-Channel Switch feature and is not supported by any IBM operating system. Channel End and Device End are presented to the channel at the completion of the operation. An attempt to select the reserved TCU by another channel will cause Control Unit End to be posted to the attempting channel.

Hexidecimal code: F4.

- Sense Release

The Sense Release command clears the reserved bit set by the Sense Reserve command. It must be issued by the same channel that originally reserved the TCU. The Sense Release command operates only on TCU's equippied with the Programmable 2-Channel

Switch feature and is not supported by any IBM operating system. Channel End and Device End are presented to the channel at the completion of the operation.

Hexidecimal code: D4.

- Request Track-in-Error

Request Track-in-Error transmits one byte from the channel back to the TCU and is normally issued for diagnostic reasons. The transferred byte is sense byte 2, which was saved following a nine-track NRZI Read, Read Backward, Write or Loop Write-to-Read command. After the nine-track read operation, it conditions the TCU for a corrective read. Channel End and Device End are presented to the channel at the completion of the operation. It is treated as a No-Operation after a PE or GCR operation.

Hexidecimal code: 1B.

- Loop Write-to-Read

The Loop Write-to-Read command is a write type command that is normally issued for diagnostic reasons. All read/write circuitry within the TCU and the tape unit is checked. No tape motion occurs and the tape unit need only be in the ready state. In GCR or PE mode, Loop Write-to-Read writes and error checks the record. When in the NRZI mode, Write Trigger VRC is checked. If tape is at load point, the tape unit operates at 1600 BPI in a 3400 model and at 6250 BPI in a 3600 model. When tape is away from load point, Loop Write-to-Read operates at the current operating mode.

Hexidecimal code: 8B.

- Set Diagnose

Set Diagnose provides FE buffer chaining control to allow the TCU to execute successive commands without channel interruption. The TCU presents Busy to the channel unitl a Test I/O command resets the buffer chaining control.

Hexidecimal code: 4B.

Motion Control commands move tape but do not transfer data across the channel interface. The Motion Control commands executed by the subsystem are:

- Rewind

  The Rewind command conditions a tape unit to rewind to load point. Channel End is presented to the channel in initial status. In final status Device End is presented by interrupt.

  Hexidecimal code: 07.

- Rewind/Unload

  The Rewind/Unload command conditions a tape unit to rewind to load point, remove tape from the columns, rewind all tape onto the file reel, close the cartridge and open the power window. Channel End is presented to the channel in initial status. After the command is accepted at the tape unit, Control Unit End, Device End and Unit Check are presented. Upon completion of the command or when a new tape is loaded, the tape unit is made ready. The change from not ready to ready causes Device End to be presented by interrupt.

  Hexidecimal code: 0F.

- Erase Gap

  The Erase Gap command moves tape forward and applies steady-state write and erase current to erase tape. In GCR mode the erased gap is 3.75 inches. The PE and 800 BPI NRZI have a 4.2 inch gap, while the Seven-Track gap length is 4.5 inches. Channel End is presented to the channel in initial status. Upon completion of the command, Device End is presented by interrupt. Unit Exception will be presented with Device End if the end of tape is detected during execution of the command.

  Hexidecimal code: 17.

- Write Tape Mark

The Write Tape Mark command moves tape forward, erasing tape for the distance described under Erase Gap. It then writes a special chartacter, called a tape mark, which is normally used to delineate groups of related records. Channel End is presented in initial status and Device End is presented by interrupt upon completion of the operation.

Hexidecimal code: 1F.

- Backspace Block

The Backspace Block command moves tape backward to the next interblock gap. No data is transferred and completion of the command leaves the tape unit in backward status. Channel End is presented to the channel in initial status. Device End is presented by interrupt upon completion of the operation. If load point is detected during the operation, Device End and Unit Check are presented. Detecting a tape mark during execution sets Unit Exception and Device End.

Hexidecimal code: 27.

- Backspace File

Backspace File moves tape backward until a tape mark or load point is sensed. Channel End is presented to the channel in initial status. Upon completion, Device End is presented by interrupt (Unit Exception is not presented).

Hexidecimal code: 2F.

- Forward Space Block

The Forward Space Block command moves tape forward to the next interblock gap. Channel End is presented in initial status and Device End is presented by interrupt upon completion of the operation. Detection of a tape mark sets Unit Exception and Device End.

Hexidecimal code: 37.

- Forward Space File

  Forward Space File moves tape forward until a tape mark is detected. Channel End is presented to the channel in initial status. Device End is presented by interrupt upon completion of the operation (Unit Exception is not presented).

  Hexidecimal code: 3F.

- Data Security Erase

  The Data Security Erase command erases tape to the end of the file. Data Security Erase is not supported by the IBM operating system. Channel End is presented to the channel in initial status and Device End is presented by interrupt upon completion of the operation.

  Hexidecimal code: 97.

Non-Motion Control commands do not transfer data to the end of the file. Data Security Erase is not supported by the IBM operating system. Channel End is presented to the channel in initial status and Device End is presented by interrupt upon completion of the operation.

- No-Operation

  The No-Operation command performs no function witthin the tape subsystem. It is normally used in Channel Command Word chains to allow the addition of more Channel Command Words at a later time. Channel End and Device End are presented in initital status.

  Hexidecimal code: 03.

- Mode Set 1

  Mode Set 1 establishes the operating mode for seven-track operations. It also establishes the density, parity, data convert and translate functions. Channel End and Device End are presented in initial status. The TCU retains the mode set until a new Mode Set 1 command is issued. See Table 3 for the exact mode sets.

- Mode Set 2

  Mode Set 2 establishes the operating density for GCR, PE and nine-track NRZI operations. Channel End and Device End are presented in initial status. The TCU retains the mode set until a new Mode Set 2 command is issued. See Table 3 for exact mode sets.

- Diagnostic Mode Set

  The Diagnostic Mode set command conditions the write path to allow the writing of bad data blocks on the tape. its purpose is to ensure that certain error detection circuits are capable of detecting the improperly written blocks as they are read. A Diagnostic Mode Set is valid only for the command chain in which it is issued. Its effect on the write circuitry differs depending on the recording mode.

  Hexidecimal code: 0B.

Table 3. Mode Set Commands

Set Density			Parity		Data Converter		Translator		COMMAND
200	556	800	Odd	Even	On	Off	On	Off	
MODE SET 1 (SEVEN-TRACK)									
●			●		●			●	13
●				●		●		●	23
●				●		●	●		2B
●			●			●		●	33
●			●			●	●		3B
	●		●		●			●	53
	●			●		●		●	63
	●			●		●	●		6B
	●		●			●		●	73
	●		●			●	●		7B
		●	●		●			●	93
		●		●		●		●	A3
		●		●		●	●		AB
		●	●			●		●	B3
		●	●			●	●		BB
MODE SET 2 (NINE-TRACK)									
800	1600	6250							
		●							D3
	●								C3
●									CB

CHAPTER 5

STATUS BYTE DATA

The Status Byte is presented to the channel during initial selection and at the completion of a channel initiated operation. Each bit within the status byte represents a particular condition, relative to the control unit and addressed drive. Table 4 lists the status bits, their designations and their functions.

Table 4. STATUS BITS

Bit	Designation	Function
0	Attention	Not used in tape subsystems.
1	Status Modifer	Status Modifer is used with bit 3 to indicate control unit busy. Bits 1 and 3 are set in initial status if the control unit is already in operation. This condition is referred to as "short busy".
2	Control Unit End	Control Unit end is posted:

Bit	Designation	Function
		• Upon completion, at the TCU level, of every operation during which a control unit busy was posted. • Upon completion of an operation which had Channel End in initial status and during which a Unit Check or Unit Exception was detected.
3	Busy	Busy is indicated if a command is attempted on a TCU or tape unit that contains a pending interrupt condition. Busy is set when: • A selected tape unit is rewinding or switched and no status is stacked. • Any command, other than Test I/O is issued and status is stacked. • Any command, other than Test I/O, is issued and the TCU has a Control Unit End or the tape unit has a Device End or Unit Check interrupt outstanding.
4	Channel End	Channel End indicates the channel is no longer required. Channel End is posted during initial status for Motion Control commands and during final status for Burst commands.

Bit	Designation	Function
5	Device End	Device End indicates that an operation has been completed at the tape unit level. It is posted: • When the tape reaches load point after a rewind operation. • When tape indicate is sensed during a data security erase. • When a tape unit is made ready after rewind/unload is completed. • When a Motion Control command is completed. • When a tape unit becomes available after an attempt was made to select it during a busy period. • With Channel End at the completion of Burst and Non-Motion Control commands. • With Unit Check when a tape unit becomes not ready during an operation that requires ready to remain active. • On the first initial selection after the tape unit becomes ready.

Bit	Designation	Function
6	Unit Check	Indicates an unusual condition. The conditions that caused the Unit Check are stored in the tape control unit and can be interrrogated by a Sense command. Unit check is posted when: • Any sense byte 0 condition occurs. • Rewind/Unload is issued and the tape begins rewinding. • Read Backward, Backspace Block or Backspace File is initiated at or into load point. • The Noise bit sets (bits 0, sense byte 1). • Not Capable sets (bit 7, sense byte 1). • ID Burst Check sets (bit 3, sense byte 5).
7	Unit Exception	Unit exception is posted: • When tape indicate is sensed during a write, write tape mark or erase gap operation. • When a tape mark is sensed during a read, read backward, forward space block or backspace block operation.

Bit	Designation	Function
		Tape indicate, when set during a write, write tape mark, or erase gap operation, remains on until the end-of-tape marker is moved backward past the tape indicate photocell or until Rewind or Rewind/Unload is issued.

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CHAPTER 6

SENSE BYTE DATA

The 3800-IV supplies 24 bytes of sense data to the channel when instructed by a Sense (04) command. The sense bytes supplement the status byte. They contain information on errors and various status conditons of the tape subsystem.

The sense byte indicators are reset by any command other than Sense, Test I/O or No-Operation. A general reset resets all sense information. Table 5 provides definitions of the sense bytes for all three recording modes.

Table 5. SENSE BYTE DATA

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
0	0	Command Reject	GCR PE NRZI	Command Reject is set: • When a Write, Write Tape Mark, or Erase command is issued to a file-protected tape unit.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				• For an invalid command. • For a Data Security Erase command not chained to an Erase command or issued to a tape unit positioned at EOT. • If a Sense Reserve or Sense Release command is issued: a. To a control unit that does not have two-channel switch. b. Other than the first command in a chain.
	1	Intervention Required	GCR PE NRZI	Intervention Required is set whenever the addressed tape unit is not ready or is nonexistant (not TU Status A).
	2	Bus Out Check	GCR PE NRZI	Bus Out Check is set whenever Bus Out has incorrect (even) parity during a command or data byte transfer.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	3	Equipment Check	GCR	Equipment Check, indicating an Check equipment fault, is set by: • Byte 4 - bit 1 (Reject TU). • Byte 11 - bit 4 (Memory Parity Error). • Byte 10 - bit 0 (Command Status Reject) bit 3 (Record Not Detected) bit 5 (Tach Start Fail) bit 7 (Velocity Check) • Byte 5 - Bit 2 (Write Tape Mark check) because tape mark does not meet the minimum conditons required. • No Bor detected in GCR 10.
			PE	Items 1 through 4 are the same as GCR. Item 5 does not apply.
			NRZI	Items 1 through 3 are the same as GCR. Items 4 and 5 do not apply.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	4	Data Check	GCR	Data Check is set by: • Byte 1 - bit 0 (Noise). • Byte 3 - bit 0 (R/W VRC). bit 2 (Skew), bit 3 (EDC/CRC) or bit 7 (C/P Compare). • Byte 4 - bit 3 (Write Trigger VRC). • Byte 5 - bit 2 (WTM check) or bit 5 (Partial Record). • Byte 8 - bit 0 (IBG Detected). • Byte 9 - bit 1 (velocity Change) or bit 3 (CRC III).
			PE	Data Check is set by: • Byte 1 - bit 0 (Noise). • Byte 3 - bit 0 (R/W VRC),

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				bit 1 (MTE/LRC), bit 2 (Skew), bit 3 (END/CRC), bit 4 (ENV/ECC), or bit 7 (C/P Compare).
				• Byte 4 - bit 3 (Write Trigger VRC).
				• Byte 5 - bit 2 (WTM Check), bit 5 (Partial Record), or bit 6 (Postamble Error).
				• Byte 8 - bit 0 (IBG Detected)
				• Byte 9 - bit 1 (Velocity Change) or bit 3 (CRC III).
			NRZI	Data Check is set by:
				• Byte 3 - bit 0 (R/W VRC), bit 1 (MTE/LKC),

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				bit 2 (Skew), bit 3 (EDC/CRC), bit 4 (ENV/ECC), or bit 7 (C/P Compare). • Byte 4 - bit 3 (Write Trigger VRC). • Byte 5 - bit 2 (WTM Check). • Byte 9 - bit 1 (Velocity Change).
	5	Overrun	GCR PE NRZI	Overrun is set when the channel cannot supply data to the control unit fast enough during a write operation, or take data fast enough during a read or read backward operation. If data check is set, overrun is suppressed. The write operation is terminated and tape motion is stopped. No further data requests channel occur. For a read operation, data transfer is terminated and tape motion continues until an Interblock Gap is detected.
	6	Word Count Zero	GCR PE NRZI	Word Count Zero is set:

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				• When COMMAND OUT responds to the first SERVICE IN of a write operation. • When a Halt is received before any data byte is transferred during a read or write operation.
	7	Data Converter Check	GCR PE NRZI	Not applicable. Data Converter Check is set, when operating in the data converter mode, to indicate that the last byte sent to the channel was padded with zeros.
1	0	Noise	GCR PE	Noise is set when: • No data is transferred during a read or read backward operation. • Data is detected during the erase portion of a write-tape-mark operation. • Data is detected during an erase gap operation. • When a data check occurs during a read or read backward operation. Noise sets a data check condition.
			NRZI	Noise is set when:

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				• No data is transferred during a read or read backward operation. • Data is detected during an Erase Gap operation. • Data is detected during the erase portion of a write-tape-mark operation. Noise sets a data check condition.
	1	TU Status A	GCR PE NRZI	TU Status A is set when an addressed tape unit is selected, ready and not busy.
	2	TU Status B	GCR PE NRZI	TU Status B is set when an addressed tape unit is not ready. TU 'A' TU 'B' 0 0 Non-existent 0 1 Not ready 1 0 Ready and not rewinding 1 1 Ready and rewinding or switched
	3	Seven-Track	GCR PE	Not applicable.
			NRZI	Seven-Track is set when the selected tape unit has the Seven-Track feature.
	4	Load Point	GCR PE NRZI	Load Point is set when the selected tape unit is at beginning of tape.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	5	Write Status	GCR PE NRZI	Write Status is set when the selected tape unit is conditioned to write.
	6	FILE Protected	GCR PE NRZI	File Protected is set when the selected tape unit is conditioned not to write.
	7	Not Capable	GCR PE NRZI	Not Capable is set: • When departing load point with a read command and the tape unit or control unit feature is not compatible with the tape format. Command Unit End, Device End and Unit Check are presented in the status byte. • During a write operation when the density in the tape unit and the capability of the control unit are not compatible.
2	0 ↓ 7	TIE	GCR PE	This byte contains the track-in-error (TIE) indicator bits which set for any track containing an error and is 'dead tracked'. If a R/W VRC is indicated, the track-in-error information may not be valid.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
			NRZI	This byte contains the track-in-error (TIE) indicator bits that are set at the end of a Read, Read Backward, Write or Loop Write-to-Read command. A single bit and data check indicate the track in error. Bits 5, 6 and 7 with data check indicate an uncorrectable error. Bits 6 and 7, without data check, indicate normal operation.
3	0	R/W VRC	GCR	R/W VRC occurs when in the error correction mode and the track(s) cannot be found.
			PE	R/W VRC occurs when there is a VRC error without a dead track or a phase error.
			NRZI	R/W VRC occurs when a VRC occurred during read or read backward or a missing byte is detected.
	1	LRC/MTE	GCR PE	LRC/MTE sets when: • Multiple tracks in error are detected. • Sense Byte 9 - bit 1 (velocity change).
			NRZI	LRC/MTE sets when an LRC error occurs during read, read backward, write or write-tape-mark.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	2	Skew Error	GCR	Skew Error sets when excessive skew is detected during a read, read backward or write operation. Set if a track fails to start. It indicates an error if bit spacing within a byte is greater than 14 bit-cell times.
			PE	Skew Error is the same as GCR Mode, except that bit spacing within a byte greater than 2.7 bit-cell times causes the error.
			NRZI	Skew Error sets when excessive skew is detected dur ing a write operation (25% of normal bit-cell time).
	3	EDC/CRC	GCR PE	EDC/CRC sets during read or read backward when the sync burst following a data block is not properly recognized before the actual end of data. It sets if an interblock gap is detected before the end of data during a read operation.
			NRZI	EDC/CRC sets when, during read or read backward, a CRC Register error occurs.
	4	ENV/ECC	GCR	ENV/ECC sets when any track falls below the threshold during a read or write operation.
			PE	ENV/ECC sets when there is a phase error or any track falls below the threshold during a read or write operation.
			NRZI	ENV/ECC sets when a byte with incorrect parity is detected during a write or write-tape-mark operation.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	5	1600 in TU	GCR PE	1600 in TU sets when the tape unit is in PE Mode.
			NRZI	Not applicable.
	6	Backward	GCR PE NRZI	Backward sets when the tape unit is in backward status.
	7	CP/COMPARE	GCR PE	CP/COMPARE sets when hardware detects an internal parity error.
			NRZI	C/P Compare sets in seven-track NRZI if correct parity (odd or even) is not maintained by the TCU.
4	0	(Not used)		Always zero
	1	Reject Tape Unit	GCR PE NRZI	Reject Tape Unit is set: • If the selected tape unit drops ready during execution of a tape motion command. • If change is read status occurs. • By Byte 10 - bit 0 (Command Status Reject). • By Byte 10 - bit 3 (recording Not Detected). • By Byte 10 - bit 5 (Tach Start Failure). • If Write Inhibit is not active when Go raises. • If Write Inhibit fails to drop within 45 microseconds after GO is raised.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				• If no interblock gap is found after the GCR identification burst.
	2	Tape Indicate	GCR PE NRZI	Tape Indicate is set when the end of tape marker is sensed during a forward tape operation.
	3	Write Trigger VRC	GCR PE NRZI	Write Trigger VRC is set if the byte written by the write triggers has incorrect parity.
	4	(Not used)		Always zero
	5	LWR	GCR PE NRZI	LWR is set when the last command was a Loop Write-to-Read.
	6	TU Check	GCR NRZI	TU Check sets when Unit Check Is set tape unit sense. Unit Check is set by sense byte 6 bit or sense byte 7 - bits 1-7.
			PE	Not applicable.
	7	RPQ	GCR PE NRZI	Reserved for RPQ.
5	0	(Not used)		Always zero
	1	New Subsystem	GCR PE NRZI	Always one.
	2	WTM Check	GCR PE NRZI	WTM Check is set when a tape mark is not written properly. It can be recognized if Data Check (byte 0 - bit 4) and

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
				Envelop Check (byte 3 - bit 4) occur together without an Equipment Check (byte 0 - bit 4).
	3	ID Burst Check	GCR	ID Burst Check sets if the identification burst is not written correctly off load point.
			PE NRZI	Not applicable.
	4	Start Read Check	GCR PE NRZI	Not applicable.
	5	Partial Record	GCR PE	Partial Record sets when the interblock gap appears before end of data is recognized.
			NRZI	Not applicable.
	6	Postamble Error	GCR PE NRZI	Postamble Error sets when the postamble is too long for a read or read backward operation.
	7	RPQ 9MD	GCR PE NRZI	The RPQ bit gated jumper determines how the RPQ bit is set in sense byte 5, bit 7. If the jumper is installed, the RPQ bit is gated into the sense byte only during NRZI mode. If the jumper is removed, the RPQ bit is always present in the sense byte.
6	0	7-Track TU	GCR PE	Not applicable.
			NRZI	7-Track TU sets when the selected tape unit is a seven-track model.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	1	Write Current Fail	GCR PE	Write Current Fail sets when current is flowing in the erase head and the tape unit is in read status.
			NRZI	Always zero.
	2	Dual Density Tape Unit	GCR PE	Dual Density Tape Unit sets when the selected TU is capable of both 6250 and 1600 BPI operation.
			NRZI	Not applicable.
	3	TU Not Set 1600	GCR	TU Not Set 1600 sets when a 3600 TU is in 6250 GCR Mode.
			PE	Bit 3 is OFF for any 1600 BPI Operation.
			NRZI	TU Not Set 1600 sets when a 3400 TU is in NRZI Mode.
	4 5 6 7	TU Model Identification	GCR PE NRZI	Model - 3430, 3630, 3450, 3650, 3480, 3470, 3670 Code - 0 1 0 1 0 1 0 0 1 1 1 1 1 1 0 0 0 0 1 1 0 0 1 1
7	0	Column Top or Bottom	GCR PE	Used with bit 1 or 2 to indicate location of a cloumn failure. A one indicates the tape bottomed. A zero indicates there is a top error.
			NRZI	Always zero.
	1	Tape Fail Left Column	GCR PE	Tape Fail Left Column indicates that tape failed in the left column. See bit 0 for top/bottom indication.
			NRZI	Always zero.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	2	Tape Fail Right Column	GCR PE	Tape Fail Right Column indicates that tape failed in the right column. See bit 0 for top/bottom indication.
			NRZI	Always zero.
	3	Reset Key	GCR PE	Reset Key indicates the tape unit is not ready because the RESET pushbutton was pressed. This bit is set only if a read or write type command was executed before the RESET pushbutton was pressed.
			NRZI	Always zero.
	4	DSE Failure	GCR PE	DSE Failure indicates that a DSE command failed to reach a normal termination.
			NRZI	Always zero.
	5	Erase Head Failed	GCR PE	Erase Head Failed indicates that no erase head current is flowing during a write or erase operation.
			NRZI	Always zero.
	6	(Not used)		Always zero.
	7	Load Failure	GCR PE	Load Failure indicates that the tape unit has failed to load properly.
			NRZI	Always zero.
8	0	IBG Detected	GCR PE	IBG Detected sets if an interblock gap is detected while writing the data portion of a record.
			NRZI	Not applicable.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	1 ↓ 7	(Not used)		Always zero.
9	0	6250 BPI Correction	GCR	6250 BPI Correction sets only when 1 or 2 track correction was necessary.
			PE NRZI	Not applicable.
	1	Velocity Change	GCR PE NRZI	Velocity Change sets when an excessive velocity change is detected during a write operation.
	2	Channel Buffer Check	GCR PE	Channel Buffer Check sets when data into the channel buffer does not match the data out of the channel buffer.
			NRZI	Not applicable during read operation.
	3	CRC III	GCR PE	CRC III sets when a CRC error is detected.
			NRZI	Not applicable
	4	6250	GCR	6250 sets when the TCU has the capability to read and write 6250 BPI code.
			PE NRZI	Not applicable.
	5	(Not used)		Always zero.
	6	(Not used)		Always zero.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	7	TCU Reserved	GCR PE NRZI	TCU Reserved sets when the control unit is in reserved status. This bit is set by a Sense Reserve command only when the TCU has the 2 Channel Switch feature.
10	0	Command Status Reject	GCR PE	Command Status Reject is set: • When the tape unit fails to go into the proper command status. • When Erase Only is on in the initial selection.
			NRZI	Not applicable.
	1	(Not used)		Always zero.
	2	(Not used)		Always zero.
	3	Record not Detected	GCR PE	Record Not Detected sets when Begin Block condition is not detected during a write or write-tape-mark operation. The tape unit cannot space over the record.
			NRZI	Not applicable.
	4	(Not used)		Always zero.
	5	Tach Start Failure	GCR PE NRZI	Tach Start Failure is set when no change is detected in the tachometer status for 35 ms during any write operation or a read operation at load point.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
	6	(Not used)		Always zero.
	7	Velocity Check	GCR PE NRZI	Velocity Check sets when the tape unit fails to attain proper velocity or WRITE INHIBIT fails to drop in the specified time.
11	0 ↓ 7	(Not used)		Always zero.
12	0 ↓ 7	(Not used)		Always zero.
13	0 ↓ 1	TCU	GCR PE NRZI	TCU features: Bit 0 Bit 1 0 0 None of the following: 0 1 7-Track NRZI (9-Track NRZI required). 1 0 9-Track NRZI. 1 1 Reserved.
	2 ↓ 7	TCU I.D.	GCR PE NRZI	TCU I.D. provides the TCU serial number (high order).
14	0 ↓ 7	TCU I.D.	GCR PE NRZI	TCU I.D. provides the TCU serial number (low order).

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
15	0	TU I.D.	GCR PE	TU I.D. provides the Tape Unit serial number (high order).
	7		NRZI	Always zero.
16	0	TU I.D.	GCR PE	TU I.D. provides the tape unit serial number (low order).
	7		NRZI	Always zero.
17	0	2-Channel Switch	GCR PE NRZI	2 channel Switch indicates the Programmed 2-Channel Switch feature is present.
	1	Switch Features	GCR PE NRZI	Bit 1 Bit 2 Bit 3 0 0 0 1x8 Device Switch (low order). 0 0 1 2x8 Device Switch (low order). 0 1 0 3x8 Device Switch (low order). 0 1 1 4x8 Device Switch (low order). 1 0 0 Remote Control Unit. 1 0 1 2x8 Device Switch (high order). 1 1 0 3x8 Device Switch (high order). 1 1 1 4x8 Device Switch (high order).
	3			
	4	CU EC Level	GCR PE NRZI	CU EC Level reflects the diagnostic release level of the control unit.
	7			
18	0	(Not used)		Always zero.
	1	Same TU I.D.	GCR PE	Same TU I.D. is available for tape unit I.D.
	3		NRZI	Always zero.
	4	TU EC	GCR PE	TU EC reflects the EC level of the tape unit.
	7		NRZI	Always zero.

SENSE BYTE	BIT	DESIGNATION	MODE	DEFINITION
19	0 ↓ 7	Device End	GCR PE NRZI	Device End indicates the tape units primed for Device End (addresses 7 - 0).
20	0 ↓ 7	Device End	GCR PE NRZI	Device End indicates the tape units primed for Device End (addresses F - 8).
21	0 ↓ 7	(Not used)		Always zero.
22	0 ↓ 7	FRU	GCR PE NRZI	FRU is under microprogram control (can be used for Field Replaceable Unit) detection.
23	0	MOD IV TCU	GCR PE NRZI	MOD IV TCU identifies the Control Unit as a 3800-IV.
	1 ↓ 7	Under Microprogram Control	GCR PE NRZI	Under Microprogram Control (may be used for Field Replaceable Unit) detection.

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CHAPTER 7

OPERATOR MAINTENANCE

Certain preventative maintenance functions must be performed during each eight-hour shift. Prior to any such maintenance, unload the tape unit and remove the file reel. The following steps can then be followed:

- First clean the read/write head and tape cleaner block with a lint-free cloth moistened with cleaning fluid. Then, check the read/write head slots to be sure they are free of oxide deposits (the sharp corner of a folded tab card will clean such deposits). The cleaner block should also be checked for corrosion and oxide deposits. Use a sponge-tipped applicator to get at hard-to-reach areas.

- The threading channels, tape guides and air bearings should also be cleaned with a lint-free cloth moistened with cleaning fluid during each shift. Once again, the sponge-tipped applicator should be used in hard-to-reach areas.

- Although it is important to clean the capstan, never touch the surface of the capstan with the bare finger. It is sensitive to contamination, and must be cleaned with a lint-free cloth (wrapped around the finger) mositened with transport cleaning fluid. Using the upper Z-Bar as support for the hand to avoid excess pressure on the capstan, rotate the capstan hub at least two full turns with the free hand. (Do not clean the capstan excessively-two or three revolutions is sufficient.) Follow up by wiping the capstan with a dry portion of the cloth to remove excess cleaning fluid.

- The EOT/BOT block should be cleaned with a dry cloth.

- Clean the vacuum cloumns and the door glass using water and a lint-free cloth. The sharp corner of a folded tab card works well to remove stubborn oxide build-up from corners. Also, wipe clean the LSA lens.

- Clean the stubby column screens and remove any bits of tape.

- As a final check, inspect bottoms of the columns for bits of tape and dirt build-up.

On a weekly basis, the following should be performed:

- Clean the rubber surfaces of the automatic hub with a lint-free cloth moistened with hub cleaning fluid.

- Inspect the upper restraint grommet and replace if damaged (applies only if cartridges are in use).

CHAPTER 8

PLANNING CONSIDERATIONS

GENERAL

When attaching the STC 3600/3800 Tape Subsystem to an IBM central processing unit and channel, certain cabling requirements must be met. The planned combination of different model tape units also has a direct bearing on the subsystem power requirements.

POWER CONSIDERATIONS

The maximum number of tape units that can be powered from one 3800-IV TCU with a standard 60 Amp power supply is as follows:

3670	3650	3630
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	*	*
0	*	*

* If only one 3670 is attached, any other combination of 3650 or 3630 drives is acceptable. If no 3670's are attached, eight 3650's or 3630's are acceptable. If 3480's are to be attached, they should follow the same rules as 3670's.

NOTE

Combinations other than those listed require that the 3800-IV be equipped with the no-charge 100 Amp power feature. This requires that the user-supplied facility power must also be 100 amp service.

CABLING CRITERIA

For maximum interface cable lengths, refer to Table 6. (Cable length should be calculated from channel origin.) For each intervening control unit, subtract 20 feet for a 3670 subsystem and 15 feet for a 3650 subsystem from the maximum allowable length. When IBM Mechanical Switch feature 2914 is used between the channel origin and the TCU, subtract 40 feet from the maximum allowable length.

Table 6. INTERFACE CABLING REQUIREMENTS

Maximum Allowable Distance from Channel Origin to Last Control Unit (Feet)

Channel System Type	Type	3670	Model 3650	3630
370/195	2880	119	200	200
	2860*	72	200	200
370/168/165	2880	119	200	200
	2860*	72	200	200
370/158/155	BLK	103	200	200
370/145	SEL	119	200	200
370/135	SEL	72	200	200
360/195	2880	119	200	200
	2860*	72	200	200
360/91	2860*	72	200	200
360/85	2880	119	200	200
360/67	2860*	72	200	200
360/65	2860*	72	200	200
360/50	SEL	___	___	200

* When 6250 BPI equipment is planned for attachment to a 2860, a "3803 Model 2 Attachment" -feature number 7850-must be ordered from IBM for it. This feature is required on each channel of the 2860 that will be handling 6250 BPI units. When ordering, specify part number 9181 for the first channel needing the attachment, 9182 for the second and 9183 for the third.

The maximum lengths for tape unit signal cables and communicator cables are:

- Tape control unit to tape unit - 100 feet.
- Communicator - 85 feet.
- Communicator, plus tape control unit to tape unit - 120 feet.
- For each intervening control unit, subtract 20 feet from the maximum allowable length if 3670 tape units will be attached; subtract 15 feet if 3650 tape units will be attached.

PROGRAMMING SUPPORT

The 6250 BPI equipment is supported by these control programs:

- * OS 21.6
- * OS 21.7
- OS 21.8
- OS/VS1 Release 3
- * OS/VS2 Release 1.6
- OS/VS2 Release 2
- DOS/VS Release 29
- ASP Release 3.1

* An Incremental Component Release (ICR) for 6250 BPI must be added to these control programs.

A list of PTF's and APAR's (applicable to 6250) can be obtained from the local STC Marketing Representative. The following manuals should be obtained from IBM to assist in the implementation of 6250 subsystems:

- IBM 3803/3420 Customer Conversion Guide, GA 32-0023-1.
- IBM 3803/3420 Programming Conversion Guide.

Additional references are:

- IBM System/360 Operating System: Utilities, GC28-6586.
- OS System Generation, GC28-6554.
- IBM System/360 Operating System: Tape Labels, GC28-6680.
- OS Data Management Services Guide, GC26-3746.
- IBM System/360 Operating System Supervisor and Data Management Macro Instructions, gc28-6647.
- IBM System/360 Operating System: Programmer's Guide to Debugging, GC28-6670.
- IBM System/360 Operating System: Job Control Language Reference, GC28-6704.
- IBM System/360 Operating System: Messages and Codes, GC28-6631.
- IBM System/360 Operating System: System Control Blocks, GC28-6628.

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