

PLEASE RETURN TO
SYSTEMS FILE

PROJECT FILE
Data Systems Division

Category II. A. 7

Date Filed March 31, 1964

Area/Location Systems Development/Poughkeepsie

Project 7289 Drum Channel

Project No. _____

File Section Functional Specifications

Section No. _____

Systems Planning

Planning Rep. or
Project Manager

H. J. Kozuch
H. J. Kozuch

or Area Manager J. A. Giroux

1 DESCRIPTION

The 7289 Drum Channel permits the attachment of the 7320A Drum Storage Unit to the 7090/94/94-II Systems. The 7289 Drum Channel provides for connecting four 7320A Drum Storage Units and attaches to the 7090/94/94-II Systems in the same manner as a 7909 or 7607 Data Channel. The data characteristics are listed in Table 1.

2 GENERAL CHARACTERISTICS

Data is stored on the drum in groups of 1024 words, 4 bits in parallel. Two of these groups are contained around the drum in each sector; 16 sectors constitute a logical drum and there are 6 logical drums per physical drum (Figure 1). A logical drum provides for storage of 32,768 words (36 bits/word).

Each word within a logical drum is individually addressable with an address from 00000 to 77777₈. The 6 logical drums of a physical drum are addressable from 1 to 6₈. The four physical drums are addressable from 0 to 3₈. These three address fields are specified by the command referred to by a RCH instruction.

Reading or writing may start anywhere with any number of words.* However, reading or writing may not proceed from one logical drum to another without a new RDS or WRS. If the word count is not zero when address 77777 on any logical drum is reached, the end of file indicator is turned on and the drum is logically disconnected. When writing, if the starting address specified by the RCH is not the address of the beginning of a 1024 word block (00000, 02000, 04000, etc.), the portion of the group preceding the starting address will be erased. Also, if word count does not go to zero coincident with the end of a group, the remainder of the group will be erased. However, while reading, a single word* or any number of words may be transmitted.

At the end of each 1024 word group, a 4 bit LRRCR character is written. If, while reading, this character does not compare with the character generated from the data, the redundancy (LRRCR) check indicator is turned on and the drum is logically disconnected.

* Except for restrictions described in IOCP and IOCT commands (Sections 3.2.2 and 3.2.3).

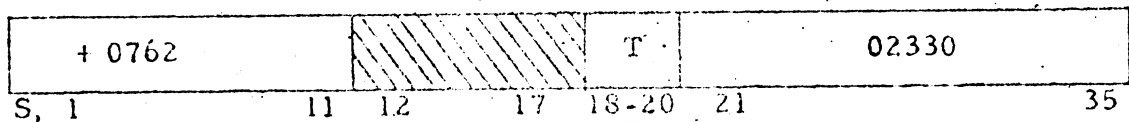
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3 OPERATING CHARACTERISTICS

3.1 Instructions

3.1.1 Rddb - Read Select Drum Channel B



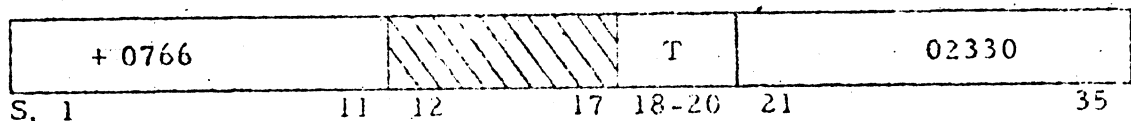
Description: This instruction causes the computer to prepare to read information from any drum on Channel B into core storage.

Execution: The designated channel is prepared to read. A Reset and Load Channel may be given at any time later, but the drum is not selected until the RCH is executed. A RDS given while the channel is busy will halt processing until the channel is available.

Addresses for other channels are:*

- Channel C 3330
- Channel D 4330
- Channel E 5330
- Channel F 6330
- Channel G 7330
- Channel H 10330

3.1.2 WRDB - Write Select Drum Channel B



Description: This instruction causes the computer to prepare to write information on any drum on Channel B from core storage.

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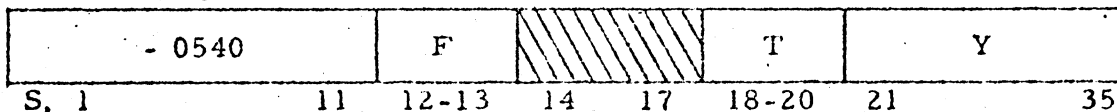
3.1.2 WRDB - Write Select Drum Channel B - (Continued)

Execution: The designated channel is prepared to write. A Reset and Load Channel may be given at any time later, but the drum is not selected until the RCH is executed.

A WRS given while the channel is busy will halt processing until the channel is available.

Addresses for other channels are listed under RDDB.

3.1.3 RCHB - Reset and Load Channel B



Description: If Channel B has been selected by either a RDS or WRS, the C(Y)_{4,5} replace the contents of the physical drum select register, C(Y)₁₅₋₁₇ replace the contents of the logical drum select register, C(Y)₂₁₋₃₅ replace the contents of the drum address register and C(Y)₂ replace the contents of the chain mode control indicator. In addition, the number Y plus one replaces the C (location counter).

If the operation is a read and the chain mode bit is absent or if the operation is a write, the channel selects the proper drum and starting address and executes the command at Y + 1 to begin data transmission. If the operation is a read and the chain mode bit is present, the proper drum and starting address is selected and the first word read from the drum becomes the first control word used.

Execution: If Channel B is not selected when the RCHB is given, the I/O check indicator is turned on. For each RDS or WRS, the corresponding RCHB must be given if any transmission between storage and the selected drum is to take place. For each RDS or WRS, only one RCHB may be given. A RCHB given while the

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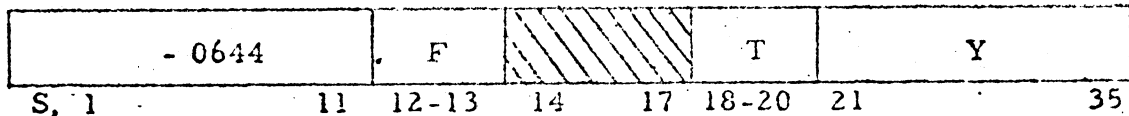
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3.1.3 RCHB - Reset and Load Channel B (Continued)

channel is busy will wait for the channel to cease operation and will then I/O check.

Instruction codes for other channels are as specified in the 7094 Reference Manual A22-6703.

3.1.4 Store Channel B Diagnostic (SCDB)



Description: Execution of this instruction causes the specified channel to be selected and the specified channel's diagnostic indication to be stored in location Y.

<u>Channel Indicator</u>	<u>Y-Position</u>
I/O Check	S
B cycle late	1 (DR 10 562)
Invalid Command	2
Physical Drum Select 4, 5	3, 4
Logical Drum Select 15-17	5-7
Drum address register 1 - 4	8 - 11 (Most significant bits) <i>SECTOR</i>
Group	12
LRCR register 1 - 4	14-17
File protect on	13
Reserved	18-35

Codes for other channels are as specified in the 7094 Reference Manual, A22-6703. Store Channel or Store Channel Diagnostic Instructions must be given only when the channel is not in use.

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3.1.5 Other

The following instructions are compatible with (7607) operations:
RDC, TRC, TEF, IOT, SCH, TCO, TCN.

The following instructions addressed to a 7289 Drum Channel will cause a halt in processing: LCH, BSR, BSF, WEF, REW, RUN, SDN.

The following instructions addressed to a 7289 have no function, but will not cause a halt in processing: RIC, ENB, RCT.

The following instruction addressed to a 7289 will result in a skip since there is no indicator present to be tested: BTT, ETT.

3.2 Commands

3.2.1 IOCD - Input/Output under Count Control and Disconnect



Description: C words are transmitted between the drum and core storage beginning with location Y. The data transmission is under control of the count field only.

Execution: Read Operations: If the word count has been reduced to zero before the end of a group (EOG) has been reached, the channel continues to read drum until the (EOG) is reached, but does not transmit this data to CPU. When the EOG is reached, the LRCR character is checked and the drum is disconnected.

If an EOG is reached before word count has gone to zero, the LRCR character is checked and reading continues from the next group.

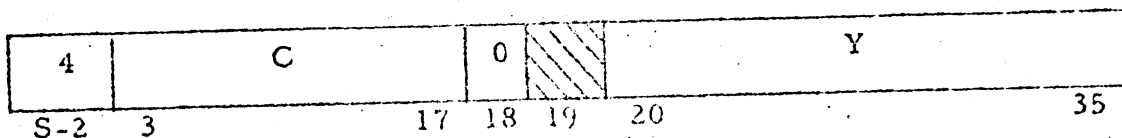
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3.2.1 IOCD - Input/Output under Count Control and Disconnect (Cont'd)

Write Operation: When C words have been written on the drum, the rest of the group is filled with zeros and a DNCP character is written. The channel is then disconnected.

3.2.2 IOCP - Input/Output under Count Control and Proceed



Description: C words are transmitted between the drum and core storage beginning with location Y. When C is returned to zero, the next sequential command is taken from one of two places:

- a. If reading, and not in chain mode, or writing, the next command is found in the location following the IOCP in core storage.
- b. If reading, and in chain mode, the next sequential command is found on the drum at the address following the last word transmitted to core.

Execution: Read Operation: C words are read from drum and stored in consecutive storage locations beginning with location Y. When the word count has been reduced to zero, the channel executes the next command.

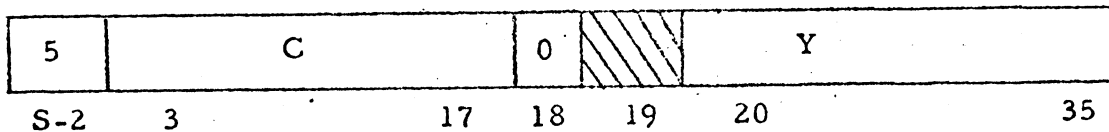
Write Operation: C words from storage beginning with location Y are written on drum. When the specified words have been written, the channel proceeds to the next sequential command.

General: When either reading or writing and executing IOCP command from core storage, the word count may not be less than three.

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3.2.3 IOCT - Input/Output Under Count Control and Transfer



Description: C words are transmitted between the drum and core storage beginning with location Y. When C is returned to zero, the next command is taken from one of two places:

- a. If the channel is writing on drum, the next command is found in the location following the IOCT in core storage. (see 1)
- b. If the channel is reading from drum, control is transferred to the drum and the next command is found on the drum at the address following the last word transmitted to core.

Execution: Same as IOCP.

3.2.4 Command Chaining

While reading from the drum, commands may be chained so that the channel need not refer to core storage for its next command. The chain mode may be entered by an IOCT command or by the presence of a bit in position 2 of the word referenced by a RCH. The channel will proceed in sequence through memory executing IOCP's until either an IOCT or an IOCD is encountered.

Once chain mode is entered, it may not be left until a disconnect (caused by IOCD or EOF) occurs. IOCP or IOCT commands executed from drum are executed identically.

3.3 Load Drum Button

A load drum button is provided on the 7151 console to allow loading of systems from the drum.

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3.3 Load Drum Button (Continued)

When the load drum button is pressed, the words at location 0, 1, and 2 of logical drum 1 of physical drum 1 on a particular channel* are stored in corresponding locations in memory. The channel then executes the command at location 0 and the CPU executes the instruction at location 1. The command at location 0 may be an IOCP, IOCT, or IOCD.

3.4 Timing Consideration

Because of the high speed of the 7320A drum (8.4 us per word average), indirect addressing and TCH commands are not allowed. All IOCP and IOCT commands that are executed from storage must have a word count of three or greater.

Proper operation of the 7289 cannot be guaranteed if other channels are operating simultaneously.

Improper operation, due to short word counts in IOCP's, IOCT's or because of simultaneous channel operation, will result in an I/O check and the channel will disconnect.

3.5 Check Conditions

There are two check indicators in the 7289 channel.

3.5.1 I/O Check

1. A Reset and Load Channel is ^{GIVEN} executed and the channel is not selected.

B time late
2. If, when writing, the channel data register has not been loaded with a word from storage by the time its contents are to be sent to the drum register.

"
3. If, when reading, the channel data register has not stored its contents by the time new data are to be sent from the drum register.

unread com.
4. A command other than IOCP, IOCT, or IOCD is decoded.

* The particular channel is designated at time of channel installation.

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3.5.2 Redundancy Check

While reading, the check character generated from the data read does not compare with the character written on the drum.

3.6 File Protect

Each logical drum may be individually file protected by means of 24 toggle switches on the operator's panel on the 7289. When a file protected drum is specified during a write operation, the main frame will still be capable of operation, but the 7289 will hang up in operation.

3.7 Additional Core Storage

The operation of additional core storage in the 7289 Data Channel is identical to the operation in the 7909 Data Channel as described in Special Features Bulletin L22-6636-1, IBM 7090 and 7094 Additional Core Storage.

3.8 Operator's Panel

The following switches and indicators are available to the operator:

3.8.1 Switches

Power On/Off	Applies primary power to the channel and drum.
DC On/Off	Applies DC power to the channel and drum if Power On-Off switch is on.
File Protect	24 switches for file protecting each logical drum of the four possible physical drums.
File Protect Reset	Pushbutton switch for resetting file protect trigger and file protect indicator. File protect switch of the selected drum must be turned off to permit resetting.

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Area Manager J. A. Caroux Project Manager H. J. Kozuch

3.8.2 Indicators

Power On	Indicates that primary power is on.
DC On	Indicates that DC power is on.
Power Check	Indicates a power failure in channel
Ready	Indicates that channel is in ready status.
File Protect	Indicates an attempt to write a file protected logical drum
Drum Register	Displays the contents of the 36 position drum register.
Location Counter	Displays the contents of the 15 position location counter.
Address Counter	Displays the contents of the 15 position address counter.
Word Counter	Displays the contents of the 15 position word counter.
Drum Address Counter	Displays the contents of the 15 position drum address counter.
Drum Select	Displays the contents of the 2 position physical drum select register and the 3 position logical drum select register.
Drum Counter	Displays the contents of the 10 position drum counter which counts the word in a sector.
Operation Register	Displays the contents of the 3 position operation register.

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3.8.2 Indicators (Continued)

Control Ring	Displays the contents of the 6 position control ring which generates control signals for the channel and drums.
Character Counter	Displays the contents of the 4 position character counter. All indicators off represents a count of one.
Character Register	Displays the contents of the 4 position character register.
Read	Indicates that channel is in read status.
Write	Indicates that channel is in write status.
Gap Search	Indicates successful completion of RDS or WRS and RCH prior to sensing index gap.
Group	Indicates which of the two 1024 word groups in a sector is positioned under the heads. Off for first or low order address group, on for second or high order address group.
Address Compare	Indicates a compare or match condition of the Drum Address Register and Drum Counter.
Head Select	Indicates control signal sent to drum to activate selected heads.
Write Gate	Indicates control signal sent to drum to condition drum for writing.
LRCR	Displays the contents of the 4 position Longitudinal Redundancy Check Register.
LRCR Check	Indicates the Longitudinal Redundancy Check condition described in Section 3.5.2.

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3.8.2 Indicators (Continued)

No Drum	Indicates an attempt to address a non-existent physical drum or a drum with power off.
I/O Check	Indicates the I/O check conditions described in Section 3.5.1.
B Late	Indicates an overrun condition wherein the channel does not receive a storage reference (B) cycle in time.
End of File	Indicates an attempt to read or write past the boundaries of a logical drum.
Command Word Control	For use with additional core storage. See Section 3.7.
Data Word Control	For use with additional core storage. See Section 3.7.

3.9 C.E. Panel

The following switches and indicators are for maintenance:

3.9.1 Switches

CPU/Test	When this switch is in the CPU position, the channel may be operated from the system. This switch must be in test for all other switches to function, except stop on error.
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3.9.1 Switches (Continued)

<u>On-Line/Off-Line</u>	When this switch is in the off-line position, the drum may be operated without disturbing the CPU. Data and commands are taken from the CE Panel. When this switch is in the on-line position, data and commands are taken from core storage.
<u>Stop on Check On/Off</u>	When this switch is on, all counters stop when check condition (I/O Check, LRCR, or data compare) occurs. This allows examination of the conditions which caused the check. This switch is functional at all times.
<u>Data Compare On/Off</u>	When this switch is on, read data is compared with the contents of the drum register. This functions only in off-line mode.
<u>Ripple Counters On/Off</u>	When this switch is on, the address counter, word counter, and location counter ripple.
<u>Read Sel/Write Sel</u>	This switch determines whether a read select or write select will be issued when the start button is depressed.
<u>Entry Switches</u>	These 36 switches are used to: <ol style="list-style-type: none">1. Load data into the drum register.2. Load a drum address.3. Load an address into the location counter.
<u>Single Sector/Single Drum/ Loop Sector/Loop Drum</u>	This rotary selector designates the type of operation desired during CE Panel operations.

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3.9.1 Switches (Continued)

Single Sector/Single Drum/
Loop Sector/Loop Drum

- a. Single Sector. Off Line:
Reading or writing begins at the beginning of the sector and continues to the end of the sector. On Line:
Reading or writing begins at the starting drum address and continues to the end of the sector or word count zero.
- b. Single Drum:
Same as single track except the end of a logical drum is used instead of the end of sector.
- c. Loop Sector:
Same as single sector, except the operation is repeated continuously.
- d. Loop Drum:
Same as single drum, except the operation is repeated continuously, returning to the beginning of the logical drum after each disconnect.

When a disconnect occurs while looping sector or drum on-line, the entry keys are examined for the location of the next command.

3.9.2 Pushbuttons

Reset: This button resets all conditions in channel to the power on reset condition.

Load Drum Registers: The contents of the 36 entry keys are placed in the drum register.

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3.9.2 Pushbuttons (Continued)

Load Drum Address: The contents of the 36 entry keys are placed in the drum address register and drum select register, and the proper drum and heads are set.

Load Location Counter: The contents of keys 20-35 are placed in the location counter.

Step Drum Address: DAR 1-4 are stepped once for each depression and the new heads are set.

Write Format: When this button is depressed, the format is automatically written on the selected drum if its format key is in the write position.

Start: This button starts a read or write operation.

3.9.3 CE Sectors

Four CE Sectors are selected by a five position rotary switch.

Off/1/2/3/4

3.9.4 Indicators

Check Stop

Indicates that the channel has stopped due to a check condition. See Section 3.9.1, Stop On Check and Data Compare switches.

3.10 Programming Considerations

RDS or WRS will turn on the prepare to read and prepare to write triggers respectively. These triggers will be turned off by a new RDS or WRS or by a RCHB instruction. If they are turned off by a RCHB, the read or write indicator will be turned on as the prepare to read or write trigger is turned off.

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3.10 Programming Considerations (Continued)

To assure proper operation of the 7289 and recognition of check conditions one of the following program sequences should be used:

<u>Read</u>		<u>Write</u>	
RDEB		WRDB	
RCHB	A	RCHB	D
TCOB	*	TCOB	*
TEFB	B	TEFB	E
TRCB	C	IOT	
IOT			

Channel In Use

The channel will be in operation from the time a RCHB is executed until a disconnect is issued.

End of File

End of file indicates an attempt to read or write past the boundaries of a logical drum.

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4 PHYSICAL CHARACTERISTICS

4.1 Size and Weight -

The 7289 Drum Channel consists of one rack and panel unit. The dimensions and weight of this unit are as follows:

Weight (lbs.)	Dimensions (inches)			Service clearance (inches)*			
	Front	Side	Height	Front	Rear	Left	Right
750	38	32	70	42	36	30	30

*A clearance of 30 inches is required on any side not abutted to a similar module. A total of five modules or sections may be abutted.

4.2 Power - 208/230 volts, 60 cycle, 1 phase, 3 wire, 15 amps.

The power connector is a Russel & Stoll FS 3750 plug. The mating receptacle is a Russel & Stoll FS 3933. The input voltage regulation shall vary a maximum of $\pm 10\%$ and the frequency $\pm 1/2$ cycle.

4.3 Heat Dissipation -

The 7289 will dissipate 3970 BTU/hour.

4.4 Temperature and Humidity -

	Temperature	Relative Humidity	Maximum Wet Bulb Temperature
Operating (Power On)	50°-90°F	8%-80%	78°F
Non-operating (Power Off)	50°-110°F	8%-80%	80°F

4.5 Cabling -

The total maximum cable length between the 7289 Drum Channel and the drum storage units is 150 feet.

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Data Characteristics

Revolution time	17.5 ms.
Words per revolution (maximum)	2048
Capacity per drum	196,608 words 6-32K memories
Instantaneous word rate	7.2 usec.
Average word rate	8.4 usec.
Instantaneous character rate	833 KC
Revolutions to load 32K memory	16
Time to load 32K memory	0.27 secs.
Average access time	8.6 ms.

TABLE 1

LOGICAL DRIVE

2 Groups per revolution

Early Index

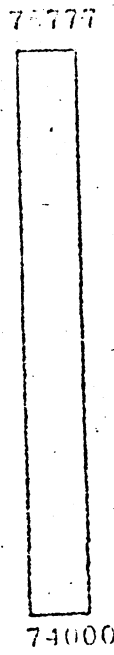
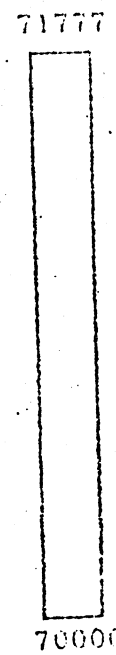
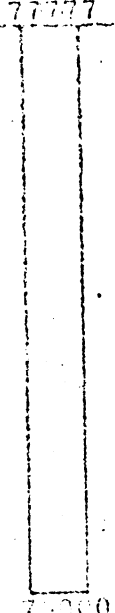
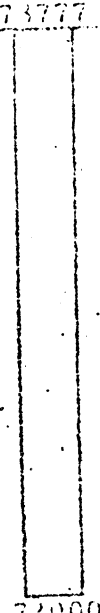
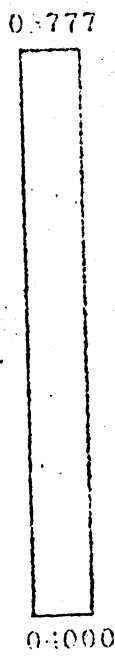
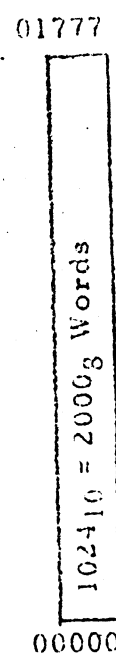
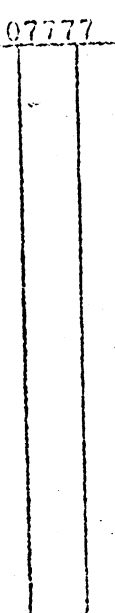
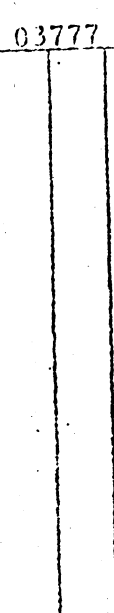
Late Index

Sector 1
4 tracks

Sector 2
4 tracks

Sector 15
4 tracks

Sector 16
4 tracks



16 Sectors/1 Logical Drive

A. PURPOSE:

TO INSTALL A TRAP FEATURE ON THE 7289 PARALLEL DRUM CHANNEL.

B. DESCRIPTION:

THE 7289 TRAP WILL FUNCTION AS FOLLOWS:

1. THE TRAP IS ENABLED WITH THE SAME BIT AS USED TO ENABLE CW/EOF TRAPS ON THE 7607 DATA CHANNEL.
2. THE TRAP IS RESTORED THE SAME AS THE 7607 DATA CHANNEL.
3. TRAP ADDRESSES AND DATA STORED AT THESE ADDRESSES ARE THE SAME AS THE 7607 DATA CHANNEL.
4. THE THREE TRAP FLAGS ARE AS FOLLOWS:
 - A. BIT 15 END OF FILE CONDITION
 - B. BIT 16 REDUNDANCY CHECK
 - C. BIT 17 OPERATION CONCLUDED.

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DESCRIPTION (CONT'D)

5. OPERATION CONCLUDED IS DEFINED TO INDICATE THAT A DISCONNECT CONTROL WORD (I0CD) IS BEING EXECUTED AND THE WORD COUNT HAS BEEN DECREMENTED TO EQUAL ZERO AND NEITHER AN I/O CHECK, END OF FILE, OR REDUNDANCY CHECK HAS OCCURRED PRIOR TO ISSUING A TRAP DEMAND.
6. WITH TRAP INSTALLED, THE END OF FILE AND REDUNDANCY CHECK INDICATORS ARE RESET WHEN A TRAP OCCURS. A TEF INSTRUCTION WILL RESET THE END OF FILE INDICATOR AND PREVENT TRAPS DUE TO THAT CONDITION. A TRC INSTRUCTION WILL RESET THE REDUNDANCY CHECK INDICATOR AND PREVENT TRAPS DUE TO THAT CONDITION.
7. IF THE CHANNEL IS NOT ENABLED PRIOR TO A NEW WRITE SELECT OR READ SELECT BEING ISSUED THE TRAP CONDITION FOR THE PREVIOUS SELECT WILL BE RESET.