HEWLETT

## BUFFERED TELEPRINTER INTERFACE KIT

OPERATING AND SERVICE MANUAL 7 MAR 1969

## SECTION I INTRODUCTION AND DESCRIPTION

#### 1-1. INTRODUCTION.

1-2. Interface Kit 12531B provides for bit-parallel transfer of data between the Computer and interface card, while transfer between the interface card and the Teleprinter is bit-serial. This is a single address I/O card, simultaneous input and output is not possible. The kit consists of the following:

a. Buffered Teleprinter Interface Card (HP Part No. 12531-6001 or 02116-6168).

b. BCS Teleprinter Driver Tape (HP Accessory No. 20017).

c. SIO 4K Teleprinter Driver Tape (HP Accessory No. 20322) or SIO 8K Teleprinter Driver Tape (HP Accessory No. 20323).

d. HP 2116 Buffered Teleprinter Test-Binary Tape (HP Accessory No. 20417).

e. HP 2115/2114 Buffered Teleprinter Test-Binary Tape (HP Accessory No. 20420).

#### NOTE

Each tape has a suffix letter after the HP Accessory Number. This suffix letter is subject to change depending on the supplied version of the tape.

1-3. Sections II through IV provide installation, programming, and theory of operation for the Buffered Teleprinter Interface Card and Teleprinter operation information. A supplement to this manual contains a description of the diagnostic program contained on the Buffered Teleprinter Test-Binary Tape.

#### 1-4. DESCRIPTION.

1-5. The Buffered Teleprinter Interface Card plugs into any of the interface-card I/O slots of the Computer. The card contains control and interrupt logic for both input and output Computer functions, and eight flip-flops for temporary storage of data. This data is entered into the Computer or transferred to the

Teleprinter through the Buffered Teleprinter Interface Card. Eight data bits are transferred between the Computer and interface card in parallel and converted by the card to 11-bit ASCII for transfer between the Teleprinter and interface card in bit-serial (one bit at a time). The least-significant 8-bits of the A or B Register are sent via the I/O Bus Out (IOBO) to the interface card and then to the Teleprinter during output operations. During input operations, a character from the Teleprinter enters the Buffered Teleprinter Card in bit-serial and from the card to the Computer in parallel (8-bits at a time). During output operations 8-bits are transferred from the Computer to the interface card in parallel and from the interface card to the Teleprinter in bit-serial. This card can provide automatic readback from keyboard or paper tape to the Teleprinter without Computer intervention.

#### 1-6. TELEPRINTER DRIVER TAPES.

1-7. BCS TELEPRINTER DRIVER TAPE. The BCS (Basic Control System) Teleprinter Driver Tape is a flexible Input/Output routine which permits transfer of data between the Computer and the Teleprinter. The driver is accessed through the BCS I/O Control subroutine (. IOC.) by a 5-word calling sequence. The driver is made part of the Basic Control System through the use of the Prepare Control System routine which is furnished with each Computer. Refer to Chapter 1 of the HP Computer Basic Control System manual for information on Input/Output programming and to Chapter 4 for information on the processing of the BCS Teleprinter Driver Tape.

1-8. SIO TELEPRINTER DRIVER. The SIO (System Input/Output) Teleprinter Driver (4K or 8K, depending on Computer memory size) is a simple, unbuffered Input/Output routine used by standard software systems (FORTRAN, Assembler, etc.) to permit transfer of data between the Computer and the Teleprinter. The driver is incorporated into the system through the use of the SIO Dump Routine furnished with each Computer. The driver may also be accessed directly by a 3-word calling sequence in the user's program. Refer to Appendix F of the HP Computer Assembler manual for detailed programming and use information for the SIO Teleprinter Driver Tape.

12531-9001

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395 Page Mill Road, Palo Alto, California 94306 Area Code 415 326-1755 TWX 910-373-1296

Europe: 54 Route Des Acacias, Geneva, Switzerland, Cable: "HE WPACKSA" Tel. (022) 42.81.50



#### 1-9. HP 2752A TELEPRINTER.

1-10. The HP 2752A Teleprinter (Figure 1-1) is an HP-modified Teletype Model ASR33-TC Teletypewriter set and is recommended for applications requiring operation which does not exceed five hours per day or 30 hours per week. The unit is made up of a typewriter, a tape punch, and a tape reader as a single unit. It is furnished with its own floor stand and is usually placed in a location adjacent to the Computer. The following specifications apply to the HP 2752A Teleprinter:

a. Reading and Punching Speed: 10 characters per second.

b. Typing Speed: 100 words per minute.

c. Data Transfer: bit-serial, 8-bit code.

d. Ambient Temperature: 10°C to 40°C (50°F to 104°F).

e. Relative Humidity: 20% to 80%.

f. Power Requirements: 115 vac  $\pm 10$  percent, 60  $\pm 0.45$  Hz or 50  $\pm 0.12$  Hz, single phase, 230 watts.

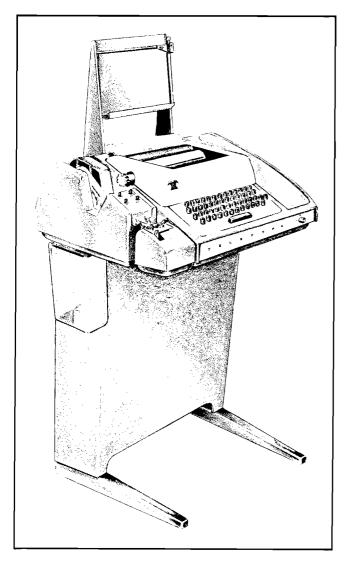


Figure 1-1. HP 2752A Teleprinter

2

g. Tape Handling Capabilities: 8-channel, 1-inch wide paper tape.

h. Dimensions and Weight (including stand):

Height: 33 inches (838 mm) Width: 25-1/2 inches (648 mm) Depth: 18-1/2 inches (470 mm) Weight: 77 pounds (34, 7 kg)

#### 1-11. <u>HP 2754A/B</u> TELEPRINTER.

1-12. The HP 2754A/B Teleprinter (Figure 1-2) is an HP-modified Teletype Model ASR35-AR Teletypewriter Set and is recommended for heavy-use applications where operation exceeds five hours per day or 30 hours per week. It is made up of a typewriter, a tape punch, and a tape reader as a single unit. It is furnished with its own floor stand and is usually placed in a location adjacent to the Computer. The following specifications apply to the HP 2754A/B Teleprinter:

a. Reading and Punching Speed: 10 characters per second.

b. Typing Speed: 100 words per minute.

c. Data Transfer: bit-serial, 8-bit code.

d. Ambient Temperature: 10°C to 40°C (50°F to 104°F).

e. Relative Humidity: 20% to 80%.

f. Power Requirements: 115 vac  $\pm 10$  percent, 60  $\pm 0.5$  Hz, single phase, 350 watts. (Consult factory if 50 Hz operation is desired.)

g. Tape Handling Capabilities: 8-channel, 1-inch wide paper tape.

h. Dimensions and Weight (including stand):

Height: 33-1/2 inches (851 mm) Width: 40 inches (1016 mm) Depth: 24 inches (610 mm) Weight: 225 pounds (102 kg)

#### NOTE

When using the 2754A/B Teleprinter, the computer program can individually select the teleprinter tape punch, printer or both output devices simultaneously.

#### 1-13. DATA PHONE.

1-14. This board used in this kit may also be used as an I/O Data Phone Interface card, providing ASCII formatted characters are to be used. When using a Data Phone, make the following connections on the 48-pin connector plug:

- a. Connect pin Y to pins 4 and D.
- b. Connect pin V to pins 16 and T.

1-15. Refer to the Data Phone Interface manual 12563A for a more detailed description.

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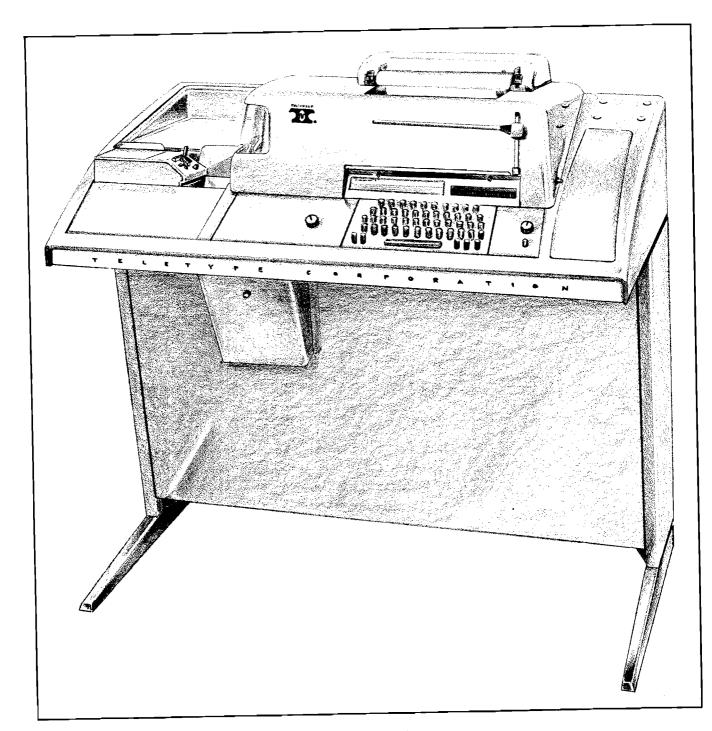


Figure 1-2. HP 2754A/B Teleprinter

## SECTION II INSTALLATION AND PROGRAMMING

#### 2-1. INSTALLATION.

2-2. Refer to the HP 2752A, HP 2754A, or HP 2754B Teleprinter manuals for unpacking, installation, and checkout instructions of the applicable Teleprinter unit. To connect the Teleprinter to the Buffered Teleprinter Interface Card using the cable which is an integral part of the Teleprinter, perform the following:

- a. Turn power off.
- b. Open the Computer for access to the I/O cards.

c. Plug the Buffered Teleprinter Interface Card into the I/O slot assigned for the particular Computer System.

d. Pass the cable connector from the Teleprinter, marked TELEPRINTER, through the computer opening and to the front of the card. Slide the connector onto the Buffered Teleprinter Interface Card.

e. Close the cover of the Computer.

2-3. After the Teleprinter has been connected to the Computer, run the Teleprinter diagnostic program described in supplement. If the diagnostic program is completed without error, the system operates properly. Refer to Tables 2-1 and 2-2 for leadwire connections between the interface card and the HP 2752A and 2754A/B Teleprinters, respectively.

#### 2-4. TELEPRINTER OPERATION.

#### 2-5. <u>MAIN CONTROL</u>.

2-6. Plug the Teleprinter power cable into the appropriate power source. Operation of the Teleprinter is started and stopped by the LINE/OFF/LOCAL switch on the front panel of the HP 2752A Teleprinter, and by the ON LINE/OFF/LOC. switch on the front panel of the HP 2754A/B Teleprinter. Operation of these switches are as follows:

a. In the OFF position, the motor in the Teleprinter is turned off, preventing its operation.

b. In the LINE position (2752A) or ON LINE position (2754A/B) the Teleprinter is in a full-duplex configuration. This configuration, and the Computer programming subroutines, permit the following types of operation:

- 1. Transmit data to the Computer manually from the typewriter keyboard while making a printed-page copy. The data can also be punched into tape simultaneously.
- 2. Receive data from the Computer and provide a printed-page copy. The data can also be punched into tape simultaneously.
- 3. Transmit data to the Computer from the tape reader while making a printed-page copy. The data transmitted can also be punched into tape simultaneously.

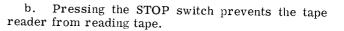
c. In the LOCAL position (2752A) or LOC. position (2754A/B) data cannot be entered into the Computer from the Teleprinter but the following types of operation can be performed:

- 1. Punch data into tape from the typewriter keyboard while making a printed-page copy.
- 2. Punch data into tape from the tape reader while making a printed-page copy.
- 3. Make a printed-page copy of data from the tape reader or the keyboard.

#### 2-7. TAPE READER.

2-8. The tape reader START/STOP/FREE switch performs the following functions:

a. Pressing the START switch when the HP 2752A Teleprinter LINE/OFF/LOCAL switch or HP 2754A/B ON LINE/OFF/LOC. switch is in the LOCAL or LOC. position energizes the tape reader trip coil and the tape reader starts reading the tape. If the switch is in the LINE or ON LINE position, the tape reader trip coil will not energize until a Read Command is issued by the Computer program. When it is issued, the coil energizes and the tape reader starts reading tape. (See Figure 2-1 for a simplified diagram of the switching circuits.)



c. Pressing the FREE switch releases the feed ratchet of the tape reader permitting the tape under the plastic tape lid to move easily for positioning purposes.

#### 2-9. <u>TAPE PUNCH (HP 2752A TELEPRINTER</u> ONLY.

2--10. The tape punch ON/OFF/REL./B.SP. switch on the 2752A Teleprinter performs the following functions:

a. Pressing the ON switch engages the drive mechanism in the punch through mechanical action. This permits a punching operation on receipt of data from the Computer or the typewriter keyboard.

b. Pressing the OFF switch releases the drive mechanism in the punch, preventing its operation.

c. Pressing the REL. (Release) switch disengages the tape-guide assembly from the feed wheel in the punch, allowing easy removal of tape.

d. Pressing the B. SP. (Back space) switch backspaces the tape one feed hole each time it is pressed. .

4, DBlackPin 3 of Teleprinter rear connectorInput Data Bit12, NRed+12-volt input on *Card Assy (one end of resistor R1)+12 volts14, RWhite- Brown-12-volt input on Card Assy (one end of resistor R3)-12 volts16, TGreen- OrangePin 7 of Teleprinter rear connectorOutput Data Bit13, PYellowInput to Card Assy (junction of resistors R1 and R2)Read Command Ground24, BBCable ShieldGnd connection on Card Assy (emitter of transistor Q2)Ground	INTERFACE CARD CONNECTOR PIN	LEADWIRE COLOR CODE	TELEPRINTER CONNECTION	SIGNAL
12, NRed412-volt input on Gard instruction14, RWhite- Brown-12-volt input on Card Assy (one end of resistor R3)-12 volts16, TGreen- OrangePin 7 of Teleprinter rear connectorOutput Data Bit13, PYellowInput to Card Assy (junction of resistors R1 and R2)Read Command Ground24, BBCableGnd connection on Card AssyGround	4, D	Black	· •	Input Data Bit
14, Rwhite- Brown122-voit input on our and most or end of resistor R3)Output Data Bit Output Data Bit16, TGreen- OrangePin 7 of Teleprinter rear connectorOutput Data Bit Read Command of resistors R1 and R2)13, PYellowInput to Card Assy (junction of resistors R1 and R2)Read Command Ground24, BBCableGnd connection on Card AssyGround	12, N	Red		+12 volts
16, 1GreenFin For Forsprince FourOrangeconnector13, PYellowInput to Card Assy (junction of resistors R1 and R2)24, BBCableGround	14, R			-12 volts
13, pYellowInput to Cata Absy (Janetonof resistors R1 and R2)24, BBCableGnd connection on Card AssyGround	16, T		-	Output Data Bit
24. BB Cable Condition on our arrively	13, P	Yellow		Read Command
	<b>2</b> 4, BB	1		Ground
		ard Connector. $14$	& R, 16 & T, and 24 & BB are con	

Table $2-1$ .	Interface Card-to-2752A	Teleprinter	Leadwire Connections
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\* Card Assy refers to the Printed Circuit Card Assembly added during modification of the Teletype Model ASR33. Refer to the Schematic Diagram in the HP 2752A Teleprinter manual for components specified in this Table.

INTERFACE CARD CONNECTOR PIN	LEADWIRE COLOR CODE	TELEPRINTER CONNECTION	SIGNAL
	Black	Terminal T6	Input Data Bit
12, N	Red	+12-volt input on *Card Assy (one end of resistor R1)	+12 volts
14, R	Brown	-12-volt input on Card Assy (one end of resistor R3)	-12 volts
16, T	White	Terminal T7	Output Data Bit
13, P	Yellow	Input to Card Assy (junction of resistors R1 and R2)	Read Command Signal
<b>24</b> , BB	White Black and Cable Shield	Gnd connection on Card Assy (emitter of transistor Q2)	Ground
6, F	Orange	Terminal T8	Punch Control
8, J	Green	Terminal T4	Print Control

Table 2-2. Interface Card-to-2754A/B Teleprinter Leadwire Connections

NOTES:

1. Pins 4 & D, 12 & N, 13 & P, 14 & R, 16 & T, and 24 & BB are connected together on the Interface Card Connector.

\* Card Assy refers to the Printed Circuit Card Assembly added during modification of the Teletype Model ASR35. Refer to the Schematic Diagram in the HP 2754A/B Teleprinter manual for components specified in this Table.

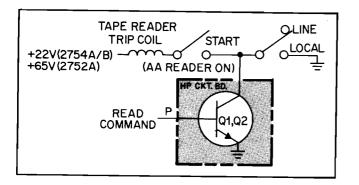


Figure 2-1. Teleprinter Tape Reader Switching Circuit, Simplified Diagram

#### 2-11. <u>MODE SWITCH (HP 2754A/B TELEPRINTER</u> ONLY.

2-12. Although the MODE switch on the 2754A/B Teleprinter contains positions K, KT, T, TTS, and TTR, only positions K, KT, and T can be used. Positions TTS and TTR are mechanically locked out. When the Teleprinter ON LINE/OFF/LOC. switch is in the LOC. position, the K, KT, and T positions of the MODE switch perform the following functions:

a. In the K and KT positions, printed-page copy is typed from either the typewriter keyboard or the tape reader.

b. In the T position, data is punched into tape from either the typewriter keyboard or the tape reader while a printed-page copy is being typed.

2-13. During output operations, with the Teleprinter ON LINE/OFF/LOC. switch in the ON LINE position, the K, KT, and T positions of the MODE switch perform the following functions:

a. In the K position, a printed-page copy of the Computer ASCII output is generated. The tape punch if off, therefore no punch output can take place even if punch is programmed.

b. In the KT position, a printed-page copy of the Computer ASCII output or a punched tape of the Computer binary output is generated. Standard BCS/IOC software restricts the output to one function. Both functions cannot be performed simultaneously. The user may write his own driver software that will do both.

c. In the T position all output data is printed and punched without regard to format content.

2-14. During input operations, with the Teleprinter ON LINE/OFF/LOC. switch in the ON LINE position, the K, KT, and T positions of the MODE switch perform the same functions as output operations if simultaneous output is programmed as in the keyboard function. The keyboard function can be accomplished from the tape reader if the tape is inserted in the reader and the switch set to RUN.

#### 2-15. PROGRAMMING.

2-16. The HP standard software facilities may be used to input data using the 2752A or 2754A/B Teleprinter. The Basic Control System (BCS) includes an Input/Output control subroutine which requires only a simple calling sequence to transfer data between the Computer and the Teleprinter. Refer to Section I, Paragraphs 1-6, 1-7, and 1-8, for programming information using BCS.

2-17. A subroutine may be programmed to perform all necessary operations to input data from the Teleprinter and output data to the Teleprinter. Tables 2-3 through 2-7 illustrate the operations required to input and output data. The Wait for Flag Method (Skip on Flag Set) is used to signal the Computer that a character is available to the Computer or that a character was sent to the Teleprinter.

2-18. The programmer must output a function select code to the Buffered Teleprinter Interface Card before any I/O operation is started. The coding shown in Table 2-3 is the minimum required to input or output one character.

Table 2-3. Pr	ogram Constants
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LABEL	OP CODE	OPERAND	REMARKS		
ттү	EQU	nn	WHERE nn IS THE SELECT CODE		
DOPU	ост	110000	DATA OUT PUNCH ONLY		
DOPR	ост	120000	DATA OUT PRINT ONLY		
DOPP	ост	130000	*DATA OUT PRINT AND PUNCH		
DINP	ост	140000	DATA IN, NO PRINT, NO PUNCH		
DINPU	ост	150000	*DATA IN AND PUNCH		
DINPR	ост	160000	DATA IN AND PRINT		
DINPP	ост	170000	*DATA IN, PRINT AND PUNCH		
CHAR1	ост	000000	TEMPORARY DATA		
CHAR2	ост	000000	STORAGE LOCATIONS		
•	•FUNCTIONS NOT USED IN HP STANDARD SOFTWARE.				

#### 2-19. SAMPLE PROGRAMS.

2-20. Refer to the following tables for sample programs:

- a. Table 2-4, Status Check
- b. Table 2-5, Input Program
- c. Table 2-6, Input Subroutine
- d. Table 2-7, Output Program
- e. Table 2-8, Output Subroutine

Table 2-4.	Status	Check
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OP CODE	OPERAND	REMARKS
LIA SSA	sc	PUT BUFFERED DATA INTO A REG BUSY?
JMP ——	*-2	YES, REPEAT LOOP NO, PROGRAM CONTINUATION

### Table 2-5. Input Program

OP CODE	OPERAND	REMARKS
CLF	0	INHIBIT INTERRUPT
LDA	DXXXX	LOAD "A" WITH I/O FUNCTION
ΟΤΑ	TTY	OUTPUT A READ (DATA IN) FUNCTION TO I/O BOARD
JSB	CHRIN	GET A CHARACTER
STA :	CHAR1	RETURN WITH CHARACTER IN "A" REGISTER
JSB	CHR IN	GET A CHARACTER
STA :	CHAR2	RETURN WITH CHARACTER IN REGISTER "A"

#### Table 2-6. Input Subroutine

LABEL	OP CODE	OPERAND	REMARKS
tCHRIN	NOP		
	ѕтс	ттү,с	START THE TTY
	SFS	ттү	IS THE FLAG SET ?
	JMP	*-1	NO, STAY IN LOOP
	LIA	ттү	YES, GET CHARACTER
	JMP	CHRIN,I	AND EXIT

TCHARACTER INPUT SUBROUTINE WILL READ AND EXIT WITH ONE CHARACTER IN "A" Table 2-7. Output Program

OP CODE	OPERAND	
LDA	DXXXX	LOAD "A" WITH I/O FUNCTION
ΟΤΑ	ттү	OUTPUT A WRITE (DATA OUT) FUNCTION TO I/O BOARD
LDA	CHAR1	LOAD "A" WITH CHARACTER TO BE OUTPUT
JSB	CHROT	OUTPUT A CHARACTER
LDA	CHAR2	LOAD "A" WITH CHARACTER TO BE OUTPUT
JSB	CHROT	OUTPUT A CHARACTER

Table 2-8. Output Subroutine

LABEL	OP CODE	OPERAND	REMARKS
<b>†CHROT</b>	NOP		
	AND	M377	STRIP OFF ANY EXTRANEOUS BITS
	ΟΤΑ	ттү	OUTPUT DATA
	STC	TTY,C	START THE TTY
	SFS	TTY	IS THE FLAG SET ?
	JMP	*-1	NO, STAY IN LOOP
	JMP	CHROT,I	YES,EXIT
M377	ост	377	
TCHARACTER OUTPUT SUBROUTINE WILL OUTPUT ONE CHARACTER FROM THE 8 LEAST SIGNIFICANT BITS OF REGISTER "A" AND EXIT			

## SECTION III THEORY OF OPERATION

#### 3-1. GENERAL THEORY OF OPERATION.

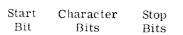
#### 3-2. DATA CODES.

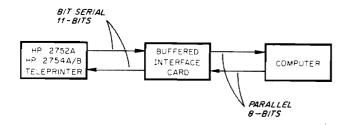
3 - 3. The typewriter portion of the Teleprinter must receive data in ASCII (American Standard Code for Information Interchange) code for it to type readable information. The tape punch will punch whichever code (binary, ASCII, etc.) the Teleprinter receives. However, if the punch is punching data received in a code other than ASCII, the typed copy from the typewriter (which may be typing simultaneously) will not be readable. Refer to the Operating Manual, HP Character Set for the ASCII-code character set. Note that only seven bits are shown used in the code. Whether bit 8 is a logic "one" or "zero" during input operations depends on the parity functions of the particular Teleprinter being used. When reading ASCII coded tapes, programming masks the eighth bit before placing the data in memory so the logic level of the eighth bit is immaterial. During output operations using ASCII code, standard HP software supplied with the Computer automatically sets bit 8 to a logic "one".

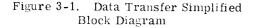
#### 3-4. CHARACTER LENGTH.

3-5. Teleprinter design requires that a total of 11 bits of information be transferred between the Computer and the Teleprinter for each character transferred. The bits are transferred one at a time so the basic data unit is a bit. Figure 3-1 depicts a simplified block diagram of data transfer. Of the 11 bits, eight are character bits and three are start and stop bits. These bits are shown as follows:

Bit Transferred 0 12345678 910





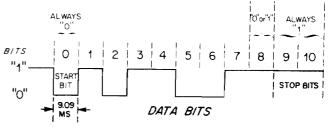


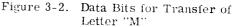
#### 3-6. <u>INPUT OPERATIONS.</u>

3-7. With the Teleprinter LINE /OFF/LOCAL switch in the LINE position, an input operation can be provided from the Teleprinter in one of two ways. a. The input can be provided manually from the Teleprinter keyboard.

b. The input can be provided from the tape reader of the Teleprinter.

When a typewriter key is pressed or the tape 3-8. reader starts reading tape, a Teleprinter timing cycle is started. This timing cycle establishes a bit transfer rate of 110 bits per second or a maximum character transfer rate of 10 characters (including start and stop bits) per second. Thus, a bit is transferred to the Interface card every 9.09 milliseconds. The first bit from the Teleprinter (the start bit) initiates the interface card timing circuits so that Computer and Teleprinter timing is in synchronization. After a character is transferred to the interface card, Teleprinter timing stops and must be reinitiated to transfer another character. Refer to Figure 3-2 for the signals sent to the Computer for the letter "M" from the tape reader or the typewriter keyboard. In TTY terminology a "1" is a mark and a "0" is a space.





3 - 9. An input operation is enabled by transferring bits 14 and 15 true to the Interface card which sets the  $IN/OUT\ {\rm flip}\ {\rm flop}\ to\ the\ IN\ state.$  If printing data as it is input is desired, bit 13 of the control word will also have to be set. Pressing the PRESET pushbutton does the same thing. An input operation is initiated by a Set Control, Clear Flag (STCnn, C) instruction to the interface card for inputs from either the Teleprinter tyepwriter keyboard or tape reader. The STC portion of the instruction causes a Read Command signal to be issued to the Teleprinter when the tape reader is to provide input data. If the typewriter is to be used to input data to the Computer, the tape reader STOP switch is engaged, and the Read Command signal has no effect on the Tape Reader. The STC portion of the instruction also sets the interface card Control Flip-Flop which enables incoming data bits and Flag signals. The CLF portion of the instruction resets the Flag Buffer and Flag Flip-Flops on the interface card to prevent an interrupt signal from being sent to the Computer before data is received from the Teleprinter.

3-10. An LIA or LIB instruction generates an IOI signal to enable parallel transfer of the eight possible data bits representing the character read to the eight least-significant bit positions (bits 0-7) of the A or B



register. To put two characters in the A or B register, and then into a memory location, rotate instructions, ALF or BLF, are used (twice) to rotate the first eight bits into the most-significant bit positions (8 through 15) of the register. An MIA or MIB instruction is then used to transfer the second eight bits from the interface card to the A or B register. An LIA or LIB instruction cannot be used for second-character transfer since these instructions destroy the contents of the register prior to entering data.

3-11. The set or reset condition of the Flag flip-flop may be tested with a Skip on Flag Set (SFS) or a Skip on Flag Clear (SFC) instruction to determine when a character is available to the Computer from the Teleprinter. When using this method, the Interrupt System Enable flip-flop on the I/O Control card must be reset with a Clear Flag (CLF) instruction and a Select Code of 00 (octal).

#### 3-12. OUTPUT OPERATIONS.

3-13. An output operation is enabled by transferring the desired command bits 12, 13 and 15 to the Interface card. This clears the IN/OUT flip-flop and sets the print or punch functions. An output from A (OTA) or an output from B (OTB) instruction must be issued by the Computer program to output 8-bits of data from the eight least-significant bit positions (0-7) of the A or B register to the interface card. The IOO signal which resulted from the OTA/B instruction enables the bits from the A or B register to set the applicable Bit 1 through Bit 8 flip-flops on the interface card.

3-14. Before data transfer to the Teleprinter, the buffered interface card maintains a positive voltage on the input to the Teleprinter. The Computer program initiates an output operation with a STC nn, C command and the first bit to the Teleprinter must be a logic "zero" signal (the start bit). This bit initiates the Teleprinter timing cycle which requires a bit from the Interface card every 9.09 milliseconds until the 11 bits representing the character (including start and stop bits) are received. The timing circuit on the interface card is also initiated to maintain Computer-Teleprinter timing synchronization. After a character is transferred, Teleprinter timing stops and the Interface card must be reinitiated by another STC nn, C command from the Computer for the next character transfer.

#### 3-15. DETAILED THEORY OF OPERATION.

3-16. GENERAL.

3-17. Figure 3-5 depicts the logic diagram for the Buffered Teleprinter Interface Card. For leadwire connections between the interface card and applicable Teleprinter, refer to Figure 3-5 and Tables 2-1 or 2-2. Figure 3-6 depicts the parts location of the Buffered Teleprinter Card.

3-18. Logic diagram reference designations preceded by MC are identified by part number in Section IV and the logic diagram for each Microcircuit Package is shown in Figure 3-7.

#### 3-19. COMPUTER POWER ON.

3-20. When power is initially applied by the POWER switch, on the front panel of the Computer, the POPIO and CRS signals are received simultaneously by the interface card from the I/O Control card. These signals establish initial conditions for operation of the interface card. The POPIO signal is applied to "nand" gate MC16A. All inputs to the "nand" gate are then true and its false output sets the Flag Buffer Flip-Flop (the input to the flip-flop is inverted). At time T2, the ENF signal from the I/O Control card enables "nand" gate MC56B. The output from gate MC56B resets the IRQ flip-flop. The output from gate MC56B is also transferred through "nand" gate MC56D and with the output of the Flag Buffer flip-flop, sets the Flag flipflop and changes the state of the Counter Reset flip-flop.

3-21. When power is first applied, the positive pulse of the Control Reset (CRS) signal is received at pin 13 and inverted by "nand" gate MC66A. The output from this gate resets the Control flip-flop, Clock Enable flip-flop and Read flip-flop. This signal also directly resets the Print flip-flop, Punch flip-flop, directly sets the IN/OUT flip-flop to IN, and resets the Divider network through "nand" gates MC94D and MC84A. Therefore the card is always in the Input state after turn on or whenever PRESET is pressed.

#### 3-22. OUTPUT LOGIC.

3-23. INITIAL CONDITIONS. To output data from the Buffered Teleprinter Card the following assumptions are made:

a. The Teleprinter used is an HP 2754A/B Teleprinter. This model is identical to the HP 2752A Teleprinter with the following exceptions:

- 1. Computer control of punching and printing is not available with the HP 2752A Teleprinter.
- 2. Manual control of punching output data and printing of all output to the HP 2752A Teleprinter.

b. The Flag Buffer and Flag flip-flops are set by the POPIO pulse when power is initially applied to the Computer or when PRESET is pressed.

c. The IRQ and Control flip-flops are in the reset state.

d. A positive voltage is supplied through pins 16 and T of the interface card to the data line of the Teleprinter.

e. The Teleprinter control switch is ON LINE.

f. The Teleprinter MODE switch is in the KT position for Computer control of output data formatting.

3-24. PROGRAM CONTROL OF PUNCH AND PRINT. Before data is output to the Buffered Teleprinter Card, a control word must be output to select the punch or print or both. When bit 13 of the control word is true, the Teleprinter will print. When bit 12 of the control word is true, the Teleprinter will punch output data. Bit 15 is set true to inform the card that the word is a control word and not a data word.

3-25. To print but not punch data, the control word would be 120000. An OTA or OTB instruction with the select code of the interface card location will output the word. When this instruction is executed, IOO comes true at time T3, T4. This signal is input to "nand" gate MC36C and with the output from the Select Code gate MC46A pin 3, enables "nand" gate MC54A. The IOBO 15 signal is input through pin 74 (86-pin connector) to pin 10 of "nand" gate MC55D. The other input to this "nand" gate is the T3 Buffered signal. Gate MC55D is enabled generating a clock pulse at output pin 8. This clock strobes the In/Out flip-flop, MC124A, to a false state since IOBO 14 is false. The clock pulse also strobes the Print flip-flop, MC114B, to the true state since IOBO 13 is true, and strobes the Punch flip-flop MC114A to the false state because IOBO 12 is false. The In/Out flip-flop, MC124A, is now in the reset condition or output state. Print flipflop, MC114B, is set true which turns transistor Q6 off. (This transistor shorts the print circuit in the Teleprinter when it is on.) Punch flip-flop MC114A is false, which turns transistor Q7 on shorting the punch circuit in the Teleprinter. Therefore, the Teleprinter will print the output data but will not punch it.

3-26. The data character to be printed on the Teleprinter is output to the interface card from the eight least-significant bits of the A or B Register. This is accomplished by using the OTA or OTB instruction with the select code of the interface card location. The eight most-significant bits must be zero. The IOO signal comes true at time T3, T4. This signal is input to "nand" gate MC36C and with the output from the Select Code gate MC46A pin 3, enables "nand" gate MC54A. The positive-going output from this gate is transferred as one input to "nand" gates MC86A, MC86B, MC86C, MC86D, MC76A, MC76B, MC76C, and MC76D. The Data Register is reset by the output signal from MC54B pin 8, except flip-flop MC124B which is directly set by the signal at time T3. The  $condition \ of \ the \ IOBO \ lines \ 0 \ through \ 7 \ are \ now \ directly$ set into the 8-bit Data Register flip-flops MC95A, MC95B, MC105A, MC105B, MC115A, MC115B, MC 125A, and MC125B. Data is stored in the register flip-flops during time T4. Flip-flop MC85A is held in the O (false) state and flip-flop MC85B is held in the 1 (true) state by the false Clock Enable signal.

3-27. The Data Register consists of 11 flip-flops. These flip-flops store input data on the positive-going edge of the clock signal and can be directly set or reset. Now that the character is stored in the Data Register, a STC, C instruction is issued to the interface card with the select code of the location of the card.

3-28. The STC signal is input on pin 22 and transferred through "nand" gate MC36B (see Figure 3-3). The output signal on pin 6 of MC36B sets the Control flip-flop. With the use of the skip flag set method of input/output control, the Control flip-flop has no effect as the signal is only used to enable the interrupt circuits on the card. The interrupt system should have been turned off by a CLF instruction to I/O location 00. The STC signal is also sent to "nand" gate MC104B. Since the In/Out flip-flop is in the Out state, "nand" gate MC34D is enabled. The output from this

10

gate sets the Clock Enable flip-flop. The Clock Enable flip-flop had been reset by the CRS signal (from power turn-on or PRESET) or had been reset at the end of the last character, and has held the Data Register flip-flop MC85A in the reset state and flip-flop MC85B in the set state. Flip-flop MC85B kept "nand" gate MC24C at a state such that transistor Q4 has been held in the off position. When Q4 is in the off position, +12volts is applied to the Teleprinter through R12 and CR1 keeping the Teleprinter in a true or mark state (normally on, dormant condition). Once the Clock Enable flip-flop has been set, "nand" gate MC55A is enabled and the 872 Hz oscillator pulses are transferred through "nand" gate MC55C to the A, B, C divider network flip-flop MC64A. This network divides the 872 Hz signal down to 109 Hz (slightly lower than the maximum rate of the Teleprinter). The period of 109 Hz is 9.09 milliseconds. The CLF signal enters through "nand" gate MC16C resetting the Flag Buffer flip-flop and Flag flip-flop.

3-29. Pin 9 of the C flip-flop (MC74B) goes false and pin 8 goes true 9.09 milliseconds after the Clock Enable flip-flop was set. For this period of one pulse, the true signal (mark condition) has been held on by the Teleprinter. Since the Inline to ''uand'' gate MC94C is false, the output on pin 11 is true enabling "nand" gate MC84B. Therefore, the output pin 8 of MC84B is false. At the end of the 9.09 millisecond period, pin 8 of MC84B goes true transferring a clock pulse to the Data Register. This clock pulse shifts the Data Register downward one bit. Since flip-flop MC85A was reset to a false state and the bit shifted to flip-flop MC85B, transistor Q4 is turned on. When Q4 is on, a space condition (false) is sent to the Teleprinter. This is the start bit (false bit) which starts all ASCII characters. At the same time, the Divide by 11 divider is incremented by one count by the negative-going edge of the C flip-flop,  $MC74\mathrm{B}$  pin 9, setting the D flip-flop true. Another 9.09 milliseconds later, the next pulse from the C flip-flop (in the Divide by 8 divider) causes the next bit in the Data Register to shift to flip-flop MC85B and out to the Teleprinter. This procedure is repeated 11 times until bit 11 has been shifted into flip-flop MC85B. Bits 10 and 11 come from flip-flop MC124B which was set true when the Data Register was reset prior to storing the output characters. The output from "nand" gate MC104C has always been high, therefore the Data Register is now all true. On the leading edge of bit 11, divider flipflops D, E, and G are true and F is false. Since this is an output operation, "nand" gate MC55B is enabled. At T3 of the next machine cycle after the eleventh shift of the Data Register, the output of "nand" gate MC66B goes false, directly resetting the Counter Reset flip-flop MC64B. At T5 of the same machine cycle, SIR (pin 32 of 86-pin connector) enables "nand" gate MC94B. The false output from pin 6 of MC94B enables "nand" gate MC94D. Since CRS is true, the true output from pin 8 of MC94D enables "nand" gate MC84A. The false output from pin 6 of MC84A resets both Dividers, the Clock Enable flip-flop and sets the Flag Buffer flip-flop. This signal remains true only for period T5. At T2 of the next machine cycle, the ENF signal sets the Counter Reset flip-flop to its set state preventing the second Flag pulse. Also at the same time, the Flag flip-flop is set and a request for





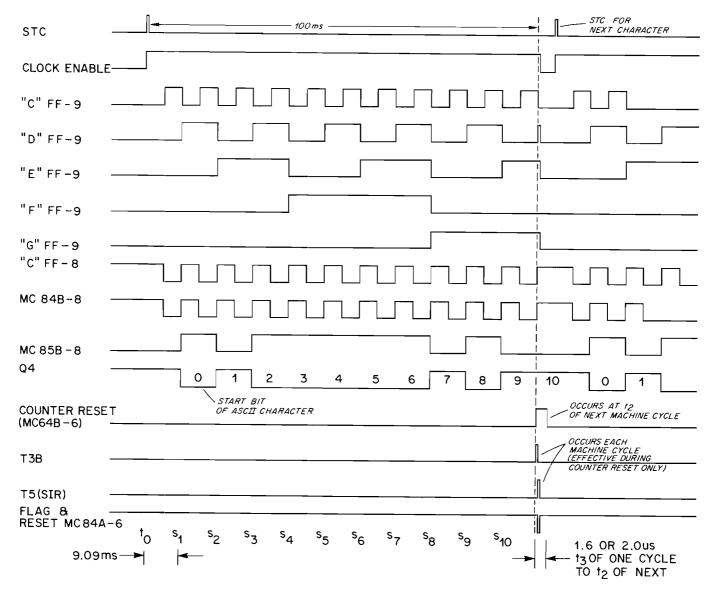


Figure 3-3. Output Timing Diagram

SFS or SFC forces the SKF output to go true. This informs the Computer that the operation is completed and it can now process the next character to the Teleprinter.

3-30. Since the first bit from the interface card is always true (logic 1) it is not necessary to wait until the end of the eleventh bit before issuing a Flag signal to the Computer. Since the Clock Enable flip-flop is turned off, the Teleprinter is resynchronized to the 872 Hz oscillator at the start of each character. Therefore, the maximum speed of the Teleprinter is always available without losing sync with the mechanical mechanism of the Teleprinter. To punch data, rather than print it, bit 12 of the control word is true and bit 13 is false. If printing and punching are desired, bits 12 and 13 are set true. When using an HP 2752A Teleprinter, either bit 12 or bit 13 set true will produce an output, but for any output to occur, one of the bits must be true.

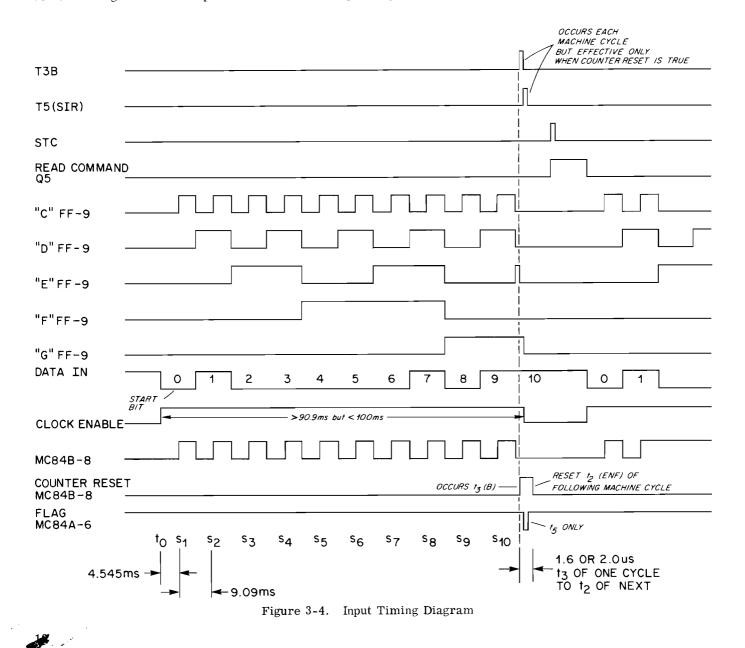
#### 3-31. READ OPERATION.

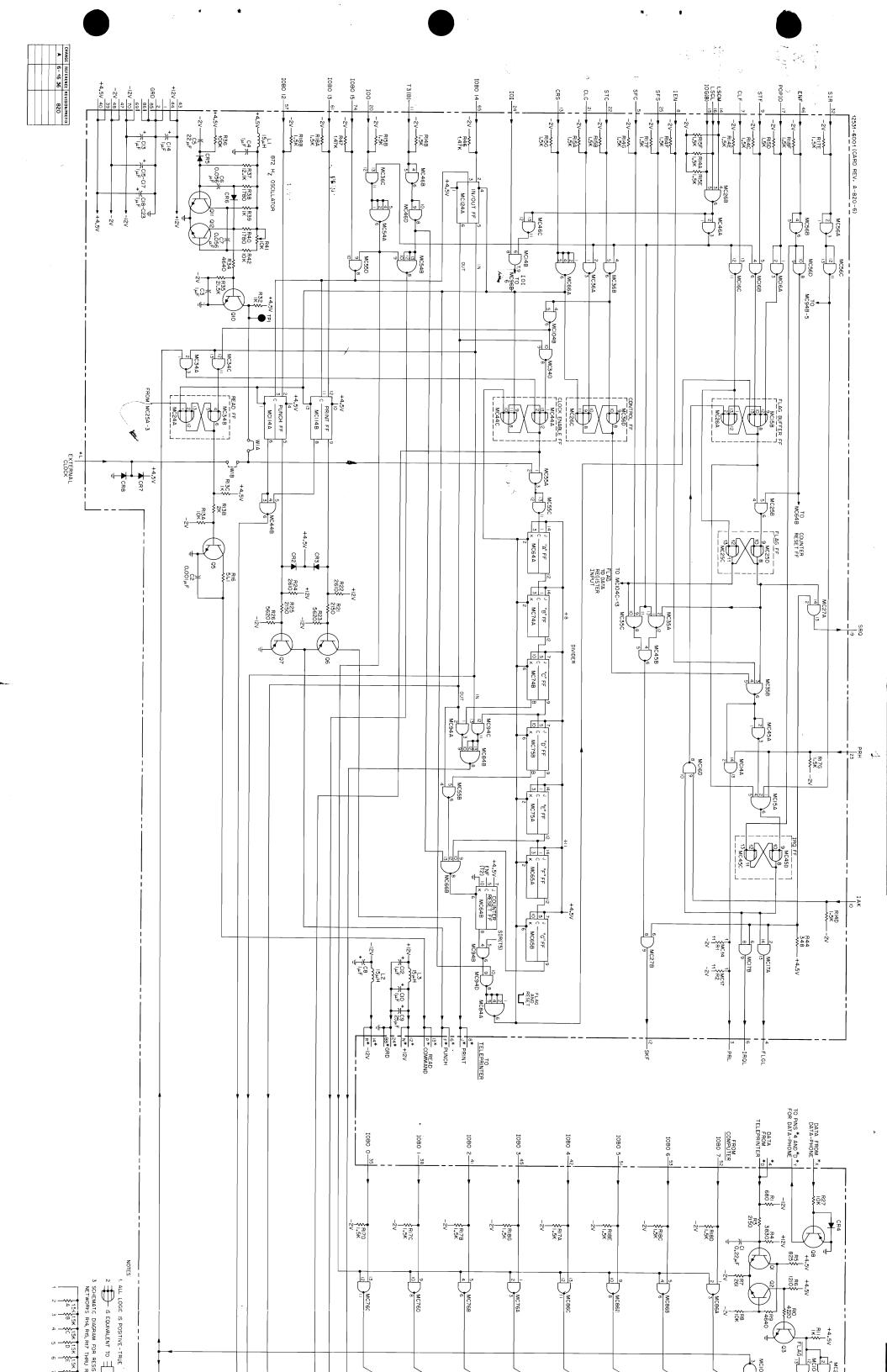
The CRS input signal is transferred through 3-32. pin 13 (86-pin connector) to the input of "nand" gate MC66A. The output of this gate directly sets the In/ Out flip-flop, MC124A, to the Input condition, resets the Print flip-flop MC114B, resets the Punch flip-flop MC114A, and resets the Read flip-flop MC24A, MC34B. This turns off the Read Command signal to the Teleprinter through transistor Q5. To generate a read sequence from the Teleprinter, a control word must be output to the interface card. Bit 15 must be set in the control word as it informs the card that the output is a control word. To input data from the Teleprinter, bit 14 must be true. Bit 14 is used to generate the input condition on the interface card. This is accomplished by an OTA or OTB to the Select Code of I/O location of the Buffered Teleprinter Card after the control word has been loaded in the appropriate register. If it is desired to print the data as it is entered, bit 13 of the control word should also be set.

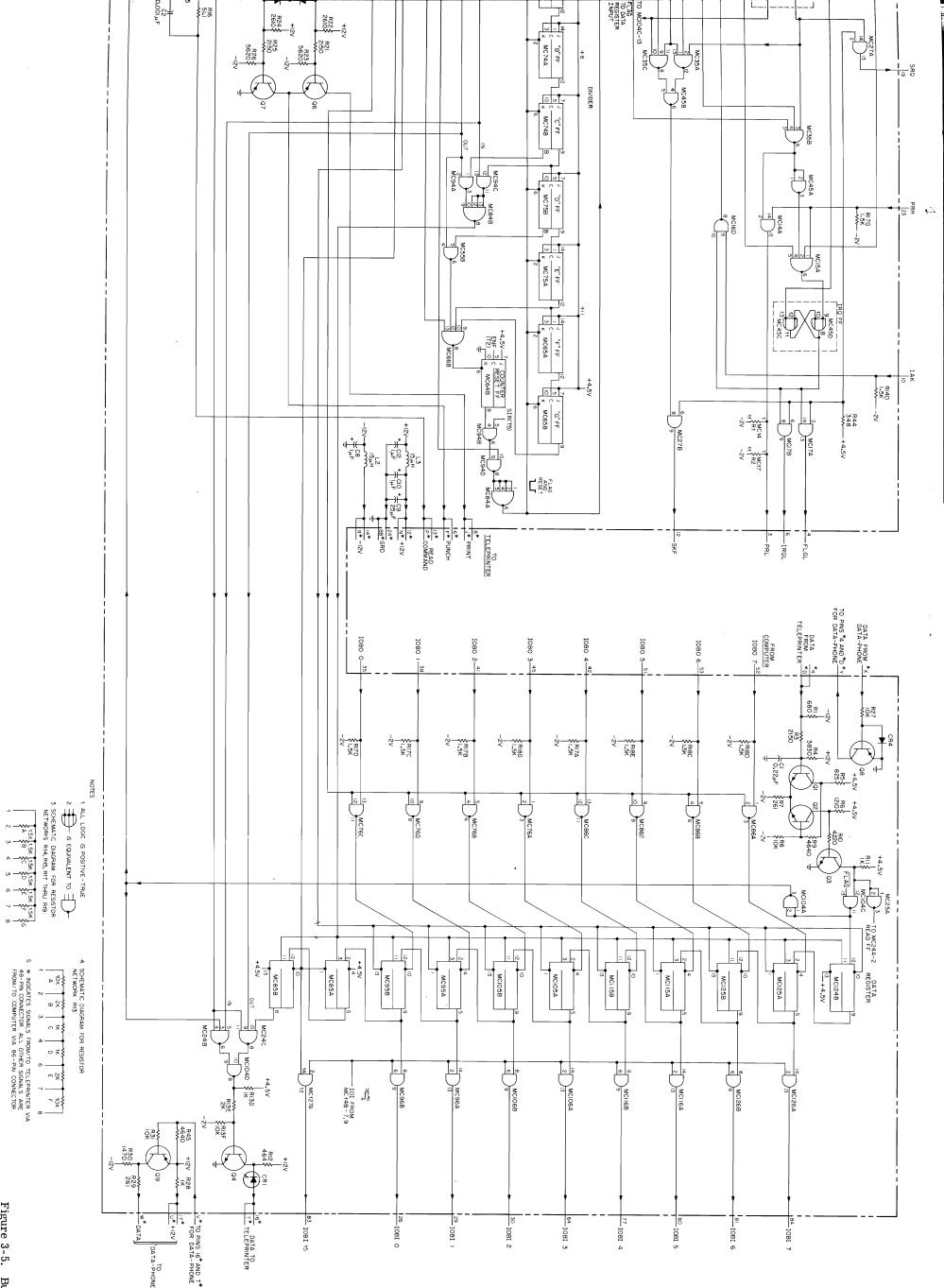
3-33. To read from the Teleprinter tape reader, and print the data on the Teleprinter as it is read in, the control word to be output would be 160000. When the OTA or OTB instruction is implemented, the Select Code for the board location comes true. Since bits 13 and 14 are true, the In/Out flip-flop is set to the In state and the Print flip-flop is set true. Since IOBI 12 is false, the punch flip-flop is set false. At T3B, during the first half of the T3T4 IOO signal, a true signal, through "nand" gates MC46B, MC46D, and MC54B directly resets the Data Register except flipflop MC124B which is directly set. The true state of the Print flip-flop, MC114B, results in pin 8 going false and the output of "nand" gate MC44B pin 6, true. Since the In/Out flip-flop is in the Input state, two of the three inputs of "nand" gate MC24B are true. The pin 3 input to this gate comes from the Data signal of the Teleprinter through pins 4 and D (48-pin connector), Schmitt-trigger Q1 and Q2, driver  $\bar{Q3}$  to "nand" gate MC104C. The output of MC104C, pin 11, is inverted through MC104A to pin 3 of MC24B causing

MC104D to operate transistor Q4. This outputs data that comes in from the Teleprinter input circuit to its separate output circuit. Since Print inhibit transistor Q6 is off, the data is printed.

3-34. The next instruction issued to the card is STC, C. The Flag is cleared in the normal manner and the STC signal is transferred through "nand" gates MC36B and MC104B (see Figure 3-4). The output of gate MC104B (pin 6) is transferred as a true input to "nand" gate MC34C. The other input from the true side of the In/Out flip-flop enables MC34C. These inputs cause MC34C, pin 11, to set the Read flip-flop. This turns transistor Q5 on, which starts the Teleprinter reader, if its FREE/START/STOP switch is in START. When the first space (false signal) from the Teleprinter causes the Schmitt-trigger to go to the false state, transistor Q3 turns off, setting the output of "nand" gate MC104C false and the output of "nand" gate MC104A true. This signal goes through "nand" gates MC24B and MC104D turning transistor Q4 on,









TOP

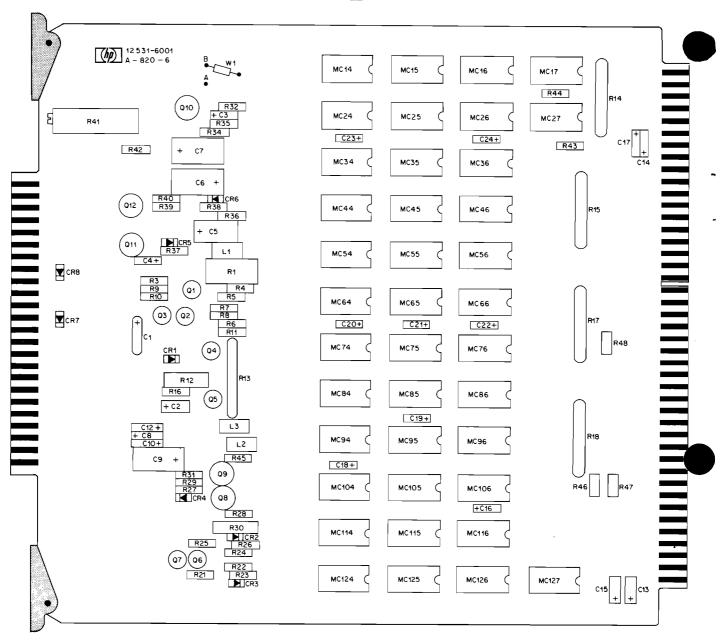


Figure 3-6. Buffered Teleprinter, Part Location Diagram

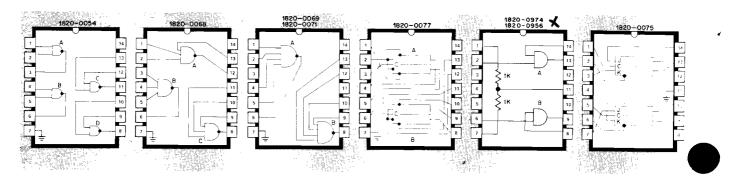


Figure 3-7. Microcircuit Packages, Top View

which transfers the start bit (first false signal) back to the Teleprinter output circuit. At the same time the Clock Enable flip-flop is set by the output of "nand" gate MC34A. The true signal from transistor Q3 is output through "nand" gate MC25A resetting the Read flip-flop. This stops the Teleprinter reader until the Computer is ready for the next character.

3-35. The Clock Enable flip-flop now allows the 872 Hz oscillator signal to start through the A,B,C divider network. Since the input condition is set, "nand" gate MC94C is enabled and the outputs from MC94A and MC55B are always true. At the end of 4.545 milliseconds, the C flip-flop of the divider chain goes true which causes the output of "nand" gate MC94C to go false, and MC84B to go true. This causes the Data Register to shift one character and store the data of the bit of the ASCII word in flip-flop MC124B. This is a zero (false) for the first bit.

3-36. At the end of the other half of the 9.09 milliseconds, the C flip-flop goes false which forces the Divide by 11 divider to step one count. This process continues through the next 10 bits of the ASCII data string entering the card with the shift register storing and shifting the bits in the middle of each bit and incrementing the counter at the end of the bit. At the end of bit 10, the state of divider flip-flops D, E, F, and Gbecome 0, 1, 0, 1, respectively. Because "nand" gate MC55B, pin 6, is true, the output of "nand" gate MC66B goes false after bit 10 at time T3 of the following machine cycle. This forces the Counter Reset flip-flop to be reset which with T5 (through "nand" gate MC94B) resets the entire Divider string and the Clock Enable flip-flop, and sets the Flag flip-flop. Once the signal is detected by the skip flag condition, a LIA or LIB instruction will load the 8-bits of data into the least-significant bits of the A or B Register by enabling IOI, permitting data to pass from the Data Register into the IOBI 0 through 7 lines.

3-37. Since only 10-bits have been shifted, bit 0 is now stored in flip-flop MC85A and bit 10 stored in flip-flop MC124B. Since bit 11 is a known 1 (true), it does not have to be stored or shifted into the Data Register. If the Computer requests another character, another STC, C instruction is issued, energizing the reader, and the circuit then waits for the start bit (false signal) of the next character to restart the divider network and counter.

#### NOTE

The Buffered Interface Card, HP Part No. 02116-6168 is similar to the Buffered Interface Card, HP Part No. 12531-6001 (A-820-6). For re-order purposes, use the 12531-6001 number. The 02116-6168 card does not have the Status Bit capability.

3-38. If IOBI 15 of the status word is set, the card is currently in the process of inputting or outputting a character. The 8 least-significant bits are not effective in a status check.



## SECTION IV REPLACEABLE PARTS

#### 4-1. INTRODUCTION.

4-2. This section contains information for ordering replacement parts for the Buffered Teleprinter Interface Card. Refer to Table 4-1 for a list of replaceable parts in alpha-numerical order of their reference designations, with a description and HP part number for each part. Table 4-2 lists parts alpha-numerically by their HP part numbers.

#### 4-3. ORDERING INFORMATION.

4-4. To order a replacement part, address the order or inquiry to your local Hewlett-Packard field

office. See the list at the rear of this manual for field-office addresses.

4-5. Specify the following information for each part when ordering:

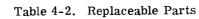
- a. Hewlett-Packard part number.
- b. Circuit reference designation.
- c. Description.

4-6. To order a part not listed in Tables 4-1 and 4-2, give a complete description of the part and include its function and location.

## Table 4-1. Reference Designation Index

Reference Designation			
	HP Part No.	Description	
C1	0160-0263	C:FXD CER 0.22UF 20% 50VDCW	
C2	0160-0153	C:FXD MY 1000 PF 10% 200VDCW	
C3, 4, 8, 10, 12-24	0180-0291	C:FXD ELECT 1UF 10% 250VDCW	
C5	0180-0228	C:FXD ELECT 22UF 10% 35VDCW	
C6,7	0160-0165	C:FXD MY 5600 PF 10%	
C9	0180-0338	C:FXD ELECT 25UF +75-10% 25VDCW	
		011112 111101 200F +13-10% 23VDCW	
CR1, 4, 5	1902-0022	DIODE BREAKDOWN: 2.67V	
CR2, 3, 7, 8	1910-0030	DIODE: GERMANIUM 100 MA 0.65V	
CR6	1901-0040	DIODE: SILICON 30MA 30WV	
T 1 9 9			1 .
L1, 2, 3	9140-0082	COIL: FXD RF 15 UH	-
MC14, 17, 27	1000 0050		
MC14, 17, 27 MC15	1820-0956	INTEGRATED CIRCUIT	
MC16, 25, 34, 36, 45,	1820-0069	INTEGRATED CIRCUIT	
46, 55, 56, 76, 86,	1820-0054	INTEGRATED CIRCUIT	ļ
94, 104			
MC24, 26, 35, 44	1820-0068		1
MC54,66,84	1820-0071	INTEGRATED CIRCUIT	1
MC64, 65, 74, 75	1820-0075	INTEGRATED CIRCUIT	1
MC85, 95, 105, 114,	1820-0077	INTEGRATED CIRCUIT INTEGRATED CIRCUIT	1
115, 124, 125		INTEGRATED CIRCUIT	
MC96, 106, 116, 126,	1820-0974	INTEGRATED CIRCUIT	
127			
MC106	1820-0974	INTEGRATED CIRCUIT	
			}
Q1, 2, 3	1854-0094	TRANSISTOR: SILICON NPN	
Q4,5	1854-0215	TRANSISTOR: SILICON NPN 2N3904	
Q6,7	1853-0036	TRANSISTOR: SILICON PNP	
Q8,9 Q10,11,12	1853-0058	TRANSISTOR: SILICON PNP	
Q10, 11, 12	1854-0094	TRANSISTOR: SILICON NPN	
R1	0000 0005		
R3, R21, R25	0698-3635	R: FXD MET OX 680 OHM 5% 2W	
R4	0698-0084 0698-3153	R:FXD MET FLM 2.15K OHM 1% 1/8W	
R5	0757-0421	R:FXD MET FLM 3.83K OHM 1% 1/8W	
$\mathbf{R6}$	0757-0274	R:FXD MET FLM 825 OHM 1% 1/8W	
R7, 29	0698-3132	R:FXD MET FLM 1. 21K OHM 1% 1/8W	
R8, 27, 31, 42	0757-0442	R:FXD MET FLM 261 OHM 1% 1/8W	
R9, 34, 45	0698-3155	R:FXD MET FLM 10.0K OHM 1% 1/8W R:FXD MET FLM 4.64K OHM 1% 1/8W	
R10	0698-3154	R:FXD MET FLM 4.64K OHM 1% 1/8W R:FXD MET FLM 4.22K OHM 1% 1/8W	
R11, 28, 32, 39, 48	0757-0280	R:FXD MET FLM 4.22K OHM 1% 1/8W	
R12	0698-0090	R:FXD MET FLM 464 OHM 1% 1/8W	
R13	1810-0008	RESISTOR NETWORK: MET FLM (6 RES)	
R14, 15, 17, 18	1810-0020	RESISTOR NETWORK: MET FLM (6 RES)	
R16	0757-0394	R:FXD MET FLM 51.1 OHM 1% 1/8w	
R22, 24	0698-0085	R:FXD MET FLM 2.61K OHM 1% 1/8W	
R23,26 R30,46,47	0757-0200	R:FXD MET FLM 5.62K OHM 1% 1/8W	
R30, 46, 47 R35	0757-1078	R:FXD MET FLM 1.47K OHM 1% 1/2W	
R36	0757-0199	R: FXD MET FLM 21. 5K OHM 1% 1/8W	•
R37	0757-0465 0757-0444	R:FXD MET FLM 100K OHM 1% 1/8	
R38, 40	0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	
R41	2100-1660	R:FXD MET FLM 1. 78K OHM 1% 1/8W	
R43	0698-3440	R:VAR WW LIN 10K OHM 10% 1W	
R44	0698-3445	R:FXD MET FLM 196 OHM 1% 1/8W	
	0000 0110	R:FXD MET FLM 348 OHM 1% 1/8W	
W1	8159-0005	JUMPER WIRE	
-		COMI DI WILL	

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HP Part No.	Description	Mfr.	Mfr. Part No.	TQ
0160-0153	C:FXD MY 1000 PF 10% 200VDCW	28480	0160-0153	1
0160-0165	C:FXD MY 5600 PF 10%	28480	0160-0165	2
0160-0263	C:FXD CER 0. 22UF 20% 50VDCW	56289	5C52B	
0180-0228	C:FXD ELECT 22 UF $10\%$ 15VDCW	28480	0180-0228	1
0180-0291	C:FXD ELECT 1UF 10% 35VDCW	56289	150D105X9035A2	17
	C:FXD ELECT 25UF +75-10% 25VDCW	28480	0180-0338	1
0180-0338		20100		
0698-0084	R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084	3
0698-0085	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085	2
0698-0090	R:FXD MET FLM 464 OHM $1\%~1/2W$	28480	0698-0090	1
0698-3132	R:FXD MET FLM 261 OHM $1\%$ 1/8W	28480	0698-3132	2
0698-3153	R:FXD MET FLM 3.83K OHM $1\%$ 1/8W	28480	0698-3153	1
0698-3154	R:FXD MET FLM 4.22K OHM $1\%$ 1/8W	28480	0698-3154	1
0698-3155	R:FXD MET FLM 4.64K OHM $1\%$ $1/8W$	28480	0698-3155	3
0698-3440	R:FXD MET FLM 196 OHM $1\%~1/8$ W	28480	0698-3440	1
0698-3445	R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445	1
0698-3635	R:FXD MET OX 680 OHM $5\%$ 2W	28480	0698-3635	1
0757-0199	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199	
0757-0200	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200	2
0757-0274	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274	2 1
0757-0278	R:FXD MET FLM 1.78K OHM $1\% 1/8W$	28480	0757-0278	2
0757-0280	R:FXD MET FLM 1K OHM $1\% 1/8W$	28480	0757-0280	5
0757-0394	R:FXD MET FLM 1K OHM 1% 1/00 R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394	5 1
0757-0421	R:FXD MET FLM 31.1 OHM 1% 1/8W	28480	0757-0421	1
	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442	4
0757-0442	R:FXD MET FLM 10.0K OHM 1% $1/8W$	28480	0757-0444	
0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0465	
0757-0465	$\begin{array}{c} \text{R:FXD MET FLM IOUK OHM 1/0 1/0W} \\ \text{D DVD MET FLM 1 47K OHM 10/1 1/9W} \end{array}$	28480	0757-1078	3
0757-1078	R:FXD MET FLM 1.47K OHM 1 $\%$ 1/2W	20400	0757-1078	5
1810-0008	RESISTOR NETWORK: MET FLM (6 RES)	28480	1810-0008	1
1810-0020	RESISTOR NETWORK: MET FLM (7 RES)	28480	1810-0020	4
1820-0054	INTEGRATED CIRCUIT	28480	1820-0054	12
1820-0068	INTEGRATED CIRCUIT	28480	1820-0068	4
1820-0069	INTEGRATED CIRCUIT	28480	1820-0069	
1820-0071	INTEGRATED CIRCUIT	28480	1820-0071	3
1820-0075	INTEGRATED CIRCUIT	28480	1820-0075	4
1820-0077	INTEGRATED CIRCUIT	28480	1820-0077	7
	INTEGRATED CIRCUIT	28480	1820-0956	3
1820-0956		28480	1820-0974	5
1820-0974	INTEGRATED CIRCUIT	20400	1020-0314	0
1853-0036	TRANSISTOR: SILICON PNP	28480	1853-0036	2
1853-0058	TRANSISTOR: SILICON PNP	07263	2N3644	2
1854-0094	TRANSISTOR: SILICON NPN	28480	1854-0094	6
1854-0215	TRANSISTOR: SILICON NPN 2N3904	28480	1854-0215	2
1901-0040	DIODE: SILICON 30MA 30WV	28480	1901-0040	1
1901-0040	DIODE BREAKDOWN: 2,67V	28480	1902-0022	1
1902-0022	DIODE: GERMANIUM 5 WIV	28480	1910-0022	2
	DIODE: GERMANIUM 5 WIV DIODE: GERMANIUM 100 MA 0.65V	28480	1910-0030	4
1910-0030				
2100-1660	R: VAR WW LIN 10K OHM $10\%$ 1W	28480	2100-1660	1
8159-0005	JUMPER WIRE	28480	8159-0005	1
9140-0082	COIL: FXD RF 15 UH	28480	9140-0082	3
12531-6001	BUFFERED TELEPRINTER	04404	12531-6001	1
12031-0001				
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The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

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model 12531B

Manual Supplement 7 MAR 1969

### CONTENTS

Diagnostic Operating Procedure

Diagnostic Program Listing HP 20420AL (for 2114A/15A Computers) Diagnostic Program Listing HP 20417BL (for 2116A/B Computers) Diagnostic Program Listing HP 20420BB (for 2114A/15A Computers) Diagnostic Program Listing HP 20417CL (for 2116A/B Computers)

This Supplement applies to:

Diagnostic Tape HP 20420A (for 2114A/15A Computers) Diagnostic Tape HP 20420B (for 2114A/15A Computers) Diagnostic Tape HP 20417B (for 2116A/B Computers) Diagnostic Tape HP 20417C (for 2116A/B Computers)

and

Interface Board HP Part No. 02116-6168 Interface Board HP Part No. 12531-6001

Diagnostic Supplement

**DS-1** 



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## DIAGNOSTIC OPERATING PROCEDURE

## 1. BUFFERED TELEPRINTER

- 2. A Diagnostic Test Tape and Diagnostic Listing is furnished with each Buffered Teleprinter Interface Kit. The HP part number of the tape is on a label attached to the tape and/or container. Use this number and the system serial number for correspondence and re-ordering purposes.
- 3. This Diagnostic Program checks the Buffered Teleprinter Interface Card (HP 02116-6168 or 12531-6001) with an HP 2752A Teleprinter (ASR33) or an HP 2754A/B Teleprinter (ASR35).
- The program consists of a background control program and four 4. task routines. The first task routine inserts the address of the BUFFERED TELEPRINTER REGISTER into all I/O instructions. The second routine tests the flag, control, and interrupt circuitry and the data register on the Teleprinter Interface Card. The errors are stored, and at the end of the test, the program attempts to print out the errors. If it fails to print, or if bit 1 of the switch register is true, the program will halt where the errors are stored. Pressing DISPLAY MEMORY will show which errors occurred. The third routine tests the tape punch, tape reader, and printer parts of the Teleprinter. All combinations of eight bits are punched out, and this tape is read back while the computer checks the data. Errors are printed out and parts of the tape are also printed out as they are read. The fourth routine tests the printer and the keyboard parts of the Teleprinter. All sixty-four ASCII characters are printed out twice (see tables 1 and 2). The computer then waits for a character from the Teleprinter keyboard (or tape reader), reads in the character and then outputs it to the printer. The operator verifies accuracy.
- 5. The Buffered Teleprinter Interface Card must be in an unbroken interrupt priority string since the diagnostic tests the interrupt capability of the board.

### 6. OPERATING PROCEDURE

- a. Buffered Teleprinter Interface Card
  - 1. Place card in an I O slot such that every slot of higher priority has either another I O board or a priority jumper board in it.

12531B

- 2. Connect card to Teleprinter.
- 3. If 2754A/B Teleprinter, put MODE switch in KT position.
- b. Buffered Teleprinter Diagnostic
  - 1. Load diagnostic Test Tape into memory using Basic Binary Loader.
  - 2. Put 000100 into Switch Register.
  - 3. Push LOAD ADDRESS.
  - Put address of Buffered Teleprinter card into Switch Register.
     3/3
  - 5. Push RUN.
  - 6. Computer will halt with A, B, and T Registers at 102001. This is the beginning of testing.
  - 7. Clear Switch Register.
  - 8. Push RUN (Computer will sit in Run Loop awaiting Switch Register option).
  - 9. Operator must set Switch Register for desired program control option.

#### 7. PROGRAM CONTROL

a. Put Switch 3 of Switch Register in up position. The Con puter then performs the Basic Test task routine and halts if an error occurs or if Switch 1 is up. (When Switch 1 is up the Computer will halt at the top of the Error Codes for all basic tests.)

HLT55 - The T-Register 102055. The A and B Registers program address which called for the halt. This indicates a failure to print, (i.e., no Flag). Push DISPLAY MEMORY 16 times to display which errors occurred. (The T Register will show 000001 for E01, etc.) The 17th push displays all 1's. Push RUN to return to the main program. Clear Switch Register to terminate basic test.

### ERROR CODES

CODE	MEANING
E01	SFC XX true after CLC 0, C instruction
E02	SFS XX false after CLC 0, C instruction
E03	SFC XX false after CLF xx instruction
E04	SFS XX true after CLF XX instruction
E05	SFC XX false after CLF XX and STC XX
E06	SFS XX true after CLF XX and STC XX
E07	No interrupt after STC XX, STF XX, STF 0
E10	SFC XX true after interrupt
E11	SFS XX false after interrupt
E12	DataClock on Buffered Teleprinter Card too fast
E13	Data Clock on Buffered Teleprinter Card too slow
E14	Data buffer error
E15	Clock Enable flip-flop set
E16 -	Clock Enable flip-flop not set
E17	Illegal interrupt from teleprinter
IA	Program address at time of E17

#### NOTE

Only the first 15 error codes (E15) are valid with the 02116-6168 version of the Buffered Teleprinter card. All error codes can occur on the 12531-6001 Buffered Teleprinter card.

b. Put Switch 4 of Switch Register in up position. Program will perform Punch and Read Task routine and Halt.

HLT 2 - A, B and T Registers 102002. This is the beginning of the punch operation. Turp on ounch (if HP 2752A) and push RUN.

HLT 3 - A, B and T Registers 102003. This is the beginning of the tape reader operation — Turn off the punch (HP 2752A), load tape into reader, turn on reader, and push RUN. Since the Printer and Panch can be controlled independently on the 2754A/B but not on the 2752A, the printed output between the two teleprinters will be different. Table 5-1 shows the printout of 2752A Teleprinter and Table 5-2 shows the printout of the 2754A B Teleprinter.

Clear Switch Register to terminate the Punch and Read task routine.

- c. Put Switch 5 of Switch Register in up position. Program will perform Print and Keyboard Task routine. At Teleprinter request, the operator must input data from the teleprinter. This same data is transferred through the computer and printed by the teleprinter. Clear Switch Register to terminate Print and Keyboard task routine.
- d. Put Switch 0 of Switch Register in up position. Computer will halt.

HLT 0 - T Register = 102000, A, B, M, and P Registers = 100. This is the beginning of the program. Put Teleprinter address in Switch Register and press RUN. (This permits the testing of multiple teleprinters.) Return to paragraph 6b, step 6.

e. With Switch 2 of Switch Register in up position, teleprinter printout is suppressed.

### Table 5-1. HP 2752A PRINTOUT

```
BEGIN BASIC TEST
```

END BASIC TEST

```
BEGIN PUNCH AND READ
```

```
!"#$%&'()*+,-./0123456789;;<=>?
                                                                 Printed
@ABCDEFGHIJKLMN0PQRSTUVWXYZ[N] ** @ABCDEFGHIJKLMN0PQRSTUVWXYZ[
                                                                 While
                                                                 Punching
 !"#$%&'()*+,-./0123456789;;<=>?
                                                                 Tape
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]++@ABCDEFGHIJKLMNOPJRSIUVJXYZ[
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[N] **@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
                                                                 Printed
                                                                 While
 !"#$%&'()*+,-./0123456789;;<=>?
                                                                 Reading
●ABCDEFGHIJKLMNOP⊍RSTUVWXYZ[\]++@ABCDEFGHIJKLMNOP⊍RSIUVWXYZ[
                                                                 Tape
END PUNCH AND READ
BEGIN PRINT AND KEYBOARD
@ABCDEFGHIJKLMNOP@RSTUVWXYZEN]++
 1"#$%&'()*+,-./0123456789:3<=>?
@ABCDEFGHIJKLMNOPJRSTUVWXYZ[\]++
 !"#$%&'()*+,-./J123456789:;<=>?
USE KEYBDARD SLOWLY (5 CHS./SEC.)
1234567890:-!"#%%%%'()*=
                              Operator
JWERTYUIOP+0
```

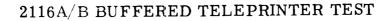
Using

Keyboard

END PRINT AND KEYBOARD

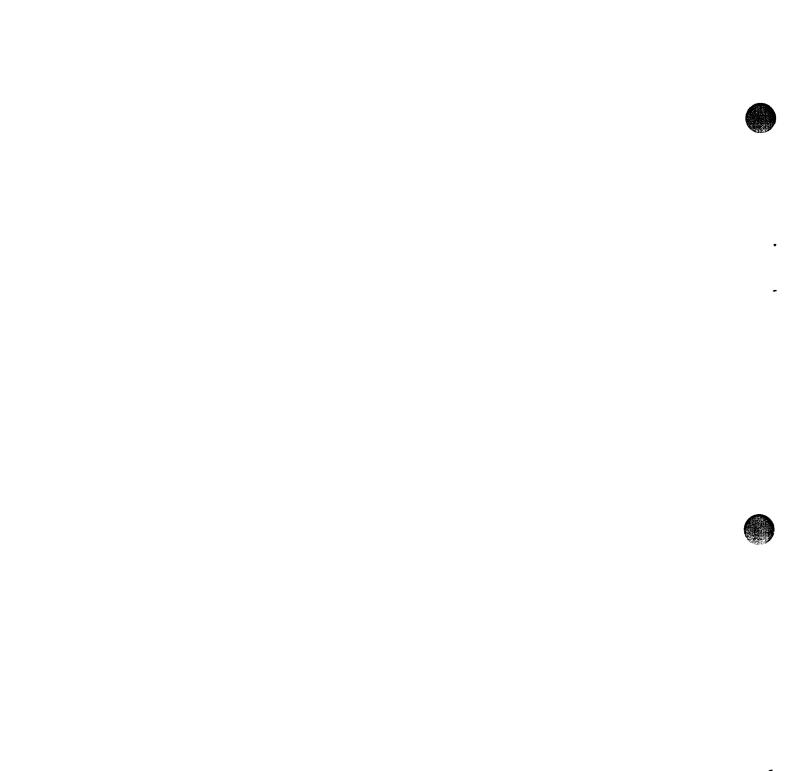
ASDFGHJKL; LX+

ZXCVBNM, ./\* ]<>?





BINARY TAPE-HF20417CSOURCE TAPE-HP20471CSOURCE LISTING-HP20417CL



PAGE 0001

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PAGE 0002 #01
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0001 ASMB, A, B, L 0002+ 0003+ 9004+ 0005+BUFFERED TELETYPE DIAGNOSTIC 2116 07/08/68 0006\* 0007 -800A+ 0009+STARTING OCTAL ADDRESS = 100 8010++++ 0011 THE FOLLOWING SWITCH REGISTER SETTINGS 0012+ARE USED FOR PROGRAM CONTROL 0013+ 0014+BIT Я . 1 HALT AT BEGINNING OF PROGRAM -> 0015+BIT HALT AT ERROR BUFFFR 1 . - 1 • > 0016+BIT 2 = SUPPRESS MESSAGE PRINTOUT - 1 -> 0017+BIT 3 = 1 --> PERFORM BASTC TEST ROUTINE 0018+BIT A = RERFORM PUNCH AND READ ROUTINE 1 -> 0019+BIT PERFORM PRINT AND KEYBOARD ROUTINE 5 = 1-> 8828 \*\*\*\* 0021+ 0022\* 8023+MAIN PROGRAM 8024+ BH25 00777 ORG 778 00777 102700 0026 FND HLT 0 P027 03100 107790 CLC 0,C INITIALIZE, INTERRUPT OFF 9028 00191 102501 LIA I PUT TTY 0029 00102 01P141 AND MSKR ADDRESS 0030 03193 070393 STA BTA INTO ALL 1/0 0031 00104 014203 JSR INTT INSTRUCTIONS 00135 064142 0032 LDB M67 PREPARE 0033 83196 868143 LDA HIS TRAP 0034 00107 070111 STA ++2 FOR 0035 00110 060144 LDA HI ILLEGAL 0036 P0111 879910 STA 10B INTERRUPT 8837 00112 034111 182 +-1 FROM 0038 00113 002004 INA ANDTHER 0039 03114 006336 INR, SZR DEVICE 0040 00115 024111 JMP +-4 9041 00116 060407 IDA ITT PREPARE ILLEGAL TTY 0042 00117 070000 STA1 STA P INTERRUPT TRAP 0043 00120 014752 JSP EOF LINE FEED 0044 00121 060123 LDA ++2 HALT TO CHOOSE 0045 00122 064123 LDB ++1 SWITCH REGISTER 00123 102001 8046 HLT 1 OPTIONS 0047 00124 014145 MP1 JSB MODE CHECK SW. REG. 0048 00125 060177 LDA BIT3 PERFORM 0049 00126 000010 SLA BASIC TEST? 0050 08127 014344 JSB BT YES. 0051 0013P 014145 JSB MODE NO. CHECK SW. REG. 8852 00131 060200 PERFORM LDA BIT4 08132 000010 0053 SI A PUNCH AND READ? 00133 015056 0054 JSB PAR YES. 20134 014145 0055 JSR MODE NO. CHECK SW. PFG. 0056 00135 060201 PERFORM LDA BITS 0057 02136 000010 SI A PRINT AND KEYRDARD?





0058 00137 015342 JSB PAK YES. 00148 024124 0059 JMP MP1 NO. 00141 000077 MSKØ OCT 77 8868 M67 OCT 177711 0061 00142 177711 0862 00143 070010 HIS STA 10B 00144 102019 HLT 108 HI 8863 9964+ 8865+SWITCH REGISTER MONITORED 0866+FOR CURRENT OPERATING HODE 8867\* 80145 800000 MODE ENTER SUBROUTINE 8868 NOP 00146 070173 STORE A 8869 STA ASØ 0079 00147 102501 LIA I EACH BIT 00150 070174 FROM THE 0071 STA BITØ 8872 00151 001300 RAR SWITCH REGISTER 88152 878175 STA BITI 8873 IS ROTATED 00153 001300 0074 RAR INTO THE 00154 070176 0075 STA BIT2 LEAST SIGNIFICANT 00155 001300 8876 RAR POSITION AND 88156 878177 8877 STA BIT3 STORED IN THE 09157 001300 RAR 8078 STORAGE LOCATION 90160 070200 0079 STA BIT4 BEARING ITS NAME 09161 001300 00800 RAR 88162 878281 0081 STA BIT5 00163 060174 **#882** LDA BITO HALT AT BEGINNING 0083 00164 002011 SLA, RSS OF PROGRAMT 8884 88165 824171 JMP ++4 NO. 0985 **99166 960282** LDA HAD YES. LOAD A AND B 88167 864282 0086 LDB HAD WITH 100 88178 824877 JMP END 0987 AND HALT 0088 80171 860173 LDA ASA RESTORE A 00172 124145 JMP MODE, I EXIT SUBROUTINE 0089 89173 888888 9999 ASØ OCT Ø TEMPORARY STORAGE 88174 888988 BITP DCT Ø 0091 88175 888888 6092 BIT1 OCT P 0093 88176 889888 BIT2 OCT Ø 0094 88177 888988 BIT3 OCT P OCT Ø 0095 99200 889999 BIT4 00201 000000 OCT P 0096 BIT5 0097 88282 888198 HAD OCT 100 8898\* 0099\* 0100+INITIALIZATION ROUTINE 0101+ 0102+THIS ROUTINE ADDS THE BUFFERED TELETYPE ADDRESS TO 0103+ALL I/O [NSTRUCTIONS. 8184+ 0105+ 0106 00203 009000 INIT NOP ENTER ROUTINE CLC P,C 0107 00204 107700 INITIALIZE, INTERRUPT OFF 00205 014274 JSB ADIN PUT TTY ADDRESS 0108 88286 182388 SFS 0 0109 INTO SFS INSTRUCTIONS 0110 00207 070340 STA SFS1 88218 878347 STA SFS2 0111 STA SFS3 @112 80211 070357 0113 00212 070401 STA SFS4 00213 070512 STA SFS5 0114

0115	88214	014274	JSB ADIN	PUT TTY ADDRESS
0116		182200	SFC Ø	INTO SEC INSTRUCTIONS
0117		078334	STA SFC1	INTO SIC INSTRUCTIONS
0118		878344	STA SFC2	
0119				
		070354	STA SFC3	
0120		878375	STA SFC4	
0121	00222	814274	JSB ADIN	PUT TTY ADDRESS
0122	66223	192500	OTA Ø	INTO OTA INSTRUCTIONS
0123	88224	070415	STA OTA1	·
8124		879450	STA OTA2	
0125		878471	STA OTAS	
0126		070713		
-			STA DTA4	
9127		878716	STA OTAS	
8128		071357	STA OTA6	
8129		014274	JSB ADIN	PUT TTY ADDRESS
0130	88233	103780	STC 8,C	INTO STC,C INSTRUCTIONS
0131	09234	878417	STA STCC1	
0132	00235	070717	STA STCC2	
0133		071361	STA STCC3	
0134		814274	JSB ADIN	PUT TTY ADDRESS
0135				
-		106798	CLC P	INTO CLC INSTRUCTION
0136		070420	STA CLC1	
0137		014274	JSB ADIN	PUT TTY ADDRESS
0138	00243	102780	STC Ø	INTO STC INSTRUCTION
0139	88244	078353	STA STC1	
0149	88245	877588	STA STC2	
0141	88246	814274	JSB ADIN	PUT TTY ADDRESS
0142		183188	CLF Ø	INTO CLF INSTRUCTION
0143		078343	STA CLF1	
9144		014274		PUT TTY ADDRESS
-			JSB ADIN	
0145		102100	STF Ø	INTO STF INSTRUCTION
0146		879366	STA STF1	
0147		014274	JSB ADIN	PUT TTY ADDRESS
0148	88255	106509	LIB B	INTO LIB INSTRUCTIONS
0149	88256	070451	STA LIBI	
0150	88257	070472	STA LIB2	
8151	88268	070501	STA LIR3	
0152		071122	STA LIRA	
		071311	STA LIRS	
0154		071324	STA LIRG	
0155		071332	STA LIB7	
0156	-	071366	STA LIBS	
0157		814274	JSB ADIN	PUT TTY ADDRESS
0158	88267	079990	STA Ø	INTO STA INSTRUCTIONS
0159	88278	070117	STA STA1	
9169	80271	078364	STA STA2	
0161	00272	078374	STA STAJ	
0162		124203	JMP INIT,I	EXIT ROUTINE
8163+				
		INCLUSION SU	BONITINE	
		FERED TTY ADD		
	INE INS	TRUCTION FOLL	UNING JSB AD	1.
0167*			_	
0168		OOOAAS ADIN	NOP	ENTER SUBROUTINE
0169	00275	168274	LDA ADIN,I	BRING 1/O INSTRUCTION INTO A
0170	00276	010302	AND MSK1	ADD TTY ADDRESS
0171	88277	838303	TOR BTA	TO INSTRUCTION
		-		





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						EXIT
-		034274			ADIN	
-		124274		-	ADIN, I	SUBROUTINE
		177700	MSK1		177780	
	08303	88 <b>8</b> 888	BTA	OCT		TTY ADDRESS STORAGE
176+						
177+						
178*						
8179+8	ASTC 1	TEST ROU	TINE			
8188*						
					FLAG, CO	NTROL,
	ND INT	TERRUPT	CIRCUI	TRY		
8183*						
8184	88384		BT	NOP		
8185	88385	197799		CLC	Ø,C	INITIALIZE, INTERRUPT OF
8186	00306	666738		LDA	SOYN	RESTORE
8187	88367	878727		87 A	OYN	OUTPUT CODE
	88318	868653		LDA	811	PRINT FIRST
		014765		J 5 8	SMPOC	BT HESSAGE
8198	88312	886438		CLB		CLEAR
8191	##313	874628		STB	<b>E</b> 1	ERROR
0192		674621		<b>STB</b>	E2	BUFFER
8193		874622		STB	E3	
8194		₿74623		STB		
0195	-	874624		STB		
8196	-	074625		STB		
0197		874626		STR		
8198		874627			E1#	
0199		87463B			E11	
0200		074631			E12	
0201		874632			E13	
9292		874633			E14	
		<b>874634</b>			E15	
0203	-	874635			F16	
8284					E17	
9285		874636		87B		
0206		074637		INB		INCREMENT ERROR CODE
9207		886884	SFC1			FLAG CLEAR?
0208			3601			NO.
8289		824337			*+2	YES. ERROR 1
0210		874628		STB		INCREMENT ERROR CODE
0211		886884		ING		FLAG SET?
		192320	SF\$1			NO. ERROR 2
8213		074521			E2	-
0214		886884		INB		YES.
9215		183189				CLEAR FLAG
216		192238	SFC2			FLAG CLEART
0217		#74622			EJ	NO. ERROR 3
0218		1106084		INB		YES.
0219		102390				FLAG SETT
0220		824352			**2	NO.
8221		874523			E.4	YES, ERROR 4
8222		106584		1 N B		
8553	99353	192799				SET CONTROL
8224	88354	192290	SFC3			FLAG CLEAR?
0225		874624		ST8	E5	NO, ERROR 5
		886984		TNB		YES.
8226						
8226 8227		102300			# *+2	FLAG SET? NO.

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0229 00361 074625 STB E6 YES. ERROR 6 0230 09362 906004 INB 0231 00363 060406 PREPARE TO TEST LDA IJt 0232 STA2 88364 879888 STA P INTERRUPT SYSTEM 00365 102100 0233 TURN ON INTERRUPT SYSTEM STF P 0234 88366 182188 STF1 STF P SET FLAG 0235 00367 000000 NOP WAIT FOR 0236 99378 999999 NOP INTERRUPT 0237 99371 974626 STB E7 NO INTERRUPT - ERROR 7 0238 88372 886884 P1 INB INTERRUPT ENTRY **1**239 88373 868487 LDA IIJ RENEW ILLEGAL 8248 88374 878888 STA3 STA P INTERRUPT TRAP 88375 182288 8241 SFC4 SFC 0 FLAS CLEAR? 8242 88376 824488 JMP ++2 NO. 0243 00377 074627 STB E10 YES. ERROR 10 0244 00460 006004 INR 88461 192366 0245 SF84 SFS Ø FLAB SET? 00402 074630 8246 STB E11 NO. ERROR 11 0247 98493 996984 TNB YES. **99494 074410** STB ERNO 0248 STORE ERROR CODE 00405 024411 JHP TOUT 8249 8258 88486 824372 1 J 1 JMP P1 90497 914533 JSB ILINT **9251 IIJ** 8252 99419 990668 ERNO OCT P ERROR CODE STORAGE 8253+ 0254 THE FOLLOWING TESTS THE TIME FOR OUTPUTING ONE CHARACTER. 0255+ TOUT 0256 00411 000000 NOP 0257 **884**12 107700 CLC 0,C INITIALIZE, INTERRUPT OFF 0258 00413 102100 STF D INTERRUPT ON 8259 88414 868448 LDA ONN PUT INTO OUTPUT, NO 0260 88415 182688 OTAL OTA Ø PRINT, NO PUNCH HODE 88416 864441 0261 LDB TOCI CHECK 00417 103700 STCC1 STC 0,C 0262 LOWER 0263 00420 106700 CLC1 CLC @ TIME LIMIT 00421 014511 0264 J\$8 T05 FLAG SET? 08422 024424 9265 JHP ++2 YES. DATA CLOCK TOO FAST 9266 00423 024426 JMP ++3 NO. 9267 00424 064410 LDB ERNO ERROR 12 00425 074631 P268 **STB E12** 8269 90126 03441A ISZ ERNO INCREMENT ERROR CODE 8278 88427 8888888 NOP CHECK UPPER LDB TOC2 0271 99430 864442 TIME LIMIT 00431 G14511 8272 JSB TOS FLAG SET? 8273 99432 824435 JMP ++3 YES. TIMING OK 8274 00433 064410 LDB ERNO NO. DAYA CLOCK TOO SLOW 0275 00434 074632 STB E13 ERROR 13 00435 034410 0276 ISZ ERNO INCREMENT ERROR CODE 8277 00436 000000 NOP 0278 00437 024443 JMP DT 0279 00440 100000 OCT 100000 ONN OUTPUT, NO PRINT, NO PUNCH 8288 00441 15030P TOCI OCT 154000 TIMEOUT CONSTANT 1 0281 08442 177940 TOC2 OCT 177048 TIMEOUT CONSTANT 2 9282+ #283+THE FOLLOWING TESTS THE EIGHT BIT DATA BUFFER. 9284+ 8285 70/43 888888 DT NOP

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INITIALIZE, INTERRUPT OFF 0286 08444 107700 CLC 0.C 0287 00145 002400 CLA NUTPUT THE 88446 878465 0288 P2 STA CURWD 0289 AND MSK2 CURRENT 88447 818463 9298 00450 102500 OTA2 OTA Ø WORD 0291 00451 106500 LTB 0 L181 INPUT = OUTPUT ? 0292 00452 050801 CPA 1 JMP ++3 98453 824456 0293 YES. NO. ERROR 14 0294 00454 060410 LDA ERNO 8295 88455 879633 STA EIA 00456 060465 LDA CURWD INCREMENT 8296 CURRENT WORD 0297 00457 902006 INA, SZA 0298 00460 024446 JMP P2 8299 00461 034410 ISZ ERNO INCREMENT ERROR CODE 88462 824467 JMP CET 0300 OCT 377 MSK2 00463 000377 0301 MSK3 OCT 290 0302 88464 888288 Computer CURWD OCT P 8393 88465 888668 Museum 99466 887888 NBE OCT C 6384 8385+ **8386+THE FOLLOWING TESTS THE CLOCK ENABLE FLIP-FLOP** 0307\* 8388 99467 107700 CET CLC 0,C INITIALIZE, INTERRUPT OFF 88478 868440 LDA ONN PUT BUFFER INTO "OUTPUT, NO 0389 PRINT, NO PUNCH" STATE 88471 182688 OTA3 OTA Ø 0310 88472 186599 L182 L19 0 FLIP-FLOP 0311 88473 886921 SSB, R55 SET? 0312 00474 024477 JMP ++3 NO. 0313 88475 868410 LDA ERNO YES. ERROR 15 0314 STA E15 00476 070634 0315 ISZ ERNO INCREMENT ERROR CODE 0316 08477 834410 SET FLIP-FLOP 00500 102700 STC2 STC Ø 0317 FLIP-FLOP 00501 106500 L183 LIB 9 0318 SET? 88582 886828 **\$\$8** 0319 00503 024506 JHP ++3 YES. 0320 00504 060410 0321 LDA ERNO NO. ERROR 16 STA E16 0322 00505 070635 INITIALIZE, INTERRUPT OFF 0323 00506 107700 CLC 0,C HALT AT ERROR BUFFER? 00597 014522 JSB EBH 0324 88518 824545 JHP POUT NO. 0325 0326\* 0327+FLAG TIMEOUT SUBROUTINE 0328+ 0329+TIMEOU'T CONSTANT IN B 0330+IF "FLAG" REFORE TIMEOUT, EXIT TO TOS. IF NOT, 0331 \* EXIT TO TOS + 1. ONE ITERATION = 6.4 MICROSEC. 0332\* ENTER SUBROUTINE 0333 03511 900000 TOS NOP 00512 102300 SF 55 SFS Ø FLAG SETT 0334 0335 00513 024515 JMP ++2 YES. JNP TOS, I EXIT THROUGH TOS 00514 124511 0336 TIMEOUT YET? 00515 005006 NO. 0337 INB, SZB REPEAT JMP SF85 00516 024512 N0. 0338 ISZ TOS YES. EXIT 0339 00517 034511 THROUGH 6340 08520 089300 NOP 0341 00521 124511 JMP TOS, I T08 + 1

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0342+

#343+ERROR BUFFER HALT SUBROUTINE 0344+ 0345 88522 888888 EBH NOP ENTER SUBROUTINE 0346 00523 070532 STA AS1 STORE A \$347 00524 014145 JSB MODE CHECK SW. REG. 0348 88525 868175 LDA BITI HALT AT 8349 00526 000010 SLA ERPOR BUFFER? 0350 00527 014614 JSB POF YES. 0351 00530 060532 LDA ASI NO. RESTORE A 0352 88531 124522 JMP EBH, I EXIT SUBROUTINE 0353 88532 88888A A S 1 OCT Ø TEMPORARY STORAGE 8354+ 8355+ILLEGAL INTERRUPT SUBROUTINE 0356+ 0357 FOR AN ILLEGAL TTY INTERRUPT, THE PROGRAM ADDRESS IS SAVED. 0358+ 00533 000999 8359 ILINT NOP ENTER SUBROUTINE 9360 69534 978543 STA AS2 STORE A 0361 00535 060533 STORE PROGRAM ADDRESS LDA +-2 88536 878637 0362 STA IA 00537 060544 0363 LDA IE STORE 6364 30540 070636 STA E17 ERROR 17 0365 88541 868543 LDA AS2 RESTORE A 0366 00542 124533 JMP ILINT, I EXIT SUBROUTINE Ø367 00543 000000 AS2 OCT Ø TEMPORARY STORAGE 0368 00544 000017 1E OCT 17 0369+ 0370+THE FOLLOWING PRINTS OUT THE RESULTS OF THE BASIC TEST. 0371+IN CASE OF FAILURE TO PRINT OUT, THE PROGRAM 8372+HALTS AT THE BEGINNING OF THE ERROR BUFFER. 0373+PRESSING "DISPLAY MEMORY" WILL SHOW WHICH ERRORS OCCURED. 0374+ 0375 03545 000090 POUT NOP 00546 107700 0376 CLC 0.C INITIALIZE, INTERRUPT OFF 0377 88547 886496 CLB 0378 00550 014511 FLAG SET? JSB TOS 0379 00551 024553 JNP ++2 YES. 0380 88552 814614 JS8 POF NO. HALT AT ERROR BUFFER 0381 00553 060665 LDA SC2 PREPARE TO 0382 99554 979666 STA MIG PRINT OUT 00555 060667 0383 LDA SI3 ERROR CODES 0384 98556 878557 STA P4 0385 03557 064620 P4 LDB E1 LOAD & WITH 9386 00560 034557 15Z +-1 ERPOR STORAGE 00561 006992 0387 SZB ZER0? 0388 00562 024566 JMP ++4 NO. 00563 034666 0389 YES. ISZ M16 PARTIALLY DONE? 0390 00564 024557 JHP P4 NO. 00565 024574 0391 JMP P5 YES. CHECK INTERRUPT ERRORS 0392 88566 868678 LDA E PRINT 0393 09567 014796 JSB OYNA OUT 8394 88578 814733 JSB PONT2 ERROR 0395 00571 014752 JSB EOL CODE 0396 00572 014522 JSB ERH HALT AT ERROR BUFFER? 0397 00573 024563 JMP +-108 NO. 0398 00574 064636 P5 LDB E17 E17 = #? 0399 00575 006003 SZR,RSS

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8488	88576	024610		JHP	P6	YE8.
0401	88577	86967E		LDA	E	NO.
8482	38698	814796			OYNA	PRINT OUT
8483	88681			J 58		ERROR CODE
8484	-	060795			314	AND
8485		015003			MPO	PROGRAM ADDRESS
8486		967637		LDA		WHEN ERROR
8487		015926			0PA	OCCURRED
8488		#14752				LINE FEED
0409		014752				LINE FEED
0419		069664	P6		-	PRINT SECOND
0411	00611				SMPOC	
0412		014522				HALT AT ERROR BUFFER?
0413		124384			BT, I	NO. EXIT ROUTINE
8414		898888	POF	NOP	01,1	
0415	+	<b>060614</b>	rUr		<b>A</b> -1	PUT PROGRAM ADDRSSS
8416		864614				
0417	-	102055			*-2 558	INTO A AND B
0418+	AAGT,	146033		<b>11 L</b> 1	336	INTO A AND 5
	ERROR I					
8429*		UTTER				
8421	88628		Ei	OCT	Ø	SFC TRUE AFTER CLC 0,C
0422		9999999	E2	OCT		SFS FALSE AFTER CLC 0,C
0423			E3	OCT		SFC FALSE AFTER CLF TTY
8424			E4	001		SFS TRUE AFTER CLF TTY
8425			E5	001		SFC FALSE AFTER CLF TTY AND STC
0426			E6	OCT		SFS TRUE AFTER CLF TTY AND STC
8427			E7	OCT		NO INTERRUPT AFTER STC TTY, STF Ø
8428			E10	OCT		SFC TRUE AFTER INTERRUPT
8429		4885888	£11	OCT		SFS FALSE AFTER INTERRUPT
8438			E12	OCT		DATA CLOCK ON TTY BOARD TOO FAST
9431			E12 E13	OCT		DATA CLOCK ON TTY BOARD TOO PAST
0432			E14	OCT		DATA BUFFER ERROR
0433				OCT		CLOCK ENABLE FLIP-FLOP SET
0434				OCT		CLOCK ENABLE FLIP-FLOP NOT SET
8435		000000	E17	OCT		ILLEBAL INTERRUPT FROM TELETYPE
9436			TA	OCT		PROBRAH ADDRESS AT TIME OF E17
8437		177777	• •			ERROR BUFFER TERMINAITON
0438	-	024124			MP1	RETURN TO MAIN PROGRAM
8439+				9.00		ALTONA TO THIN PRODUCT
0449	88542	841185	BTM1	450	R.RESTN	BASIC TEST
•		643511	12 1 ··· •			
		847848				
		941101				
		051511				
		041440				
		052105				
		051524				
8441		000000		007		
8442		868642	511		BTM1	
8443		042516	BTM2	-	7,END BAS	SIC TEST
~ ~ ~ ~ ~		042040		•		
		041171				
		051511				
		041440				
		052195				
		051524				

0444 88663 888888 OCT P 8445 98664 969654 **S12** LDA BTM2 8446 00665 177762 SC2 OCT 177762 8447 88666 888888 OCT Ø M16 **BB667 864620** 0448 \$13 LDB E1 8449 00670 000305 E OCT 305 PRAD 0450 00671 020040 ASC 11, PROGRAM ADDRESS = 88572 828128 09673 051117 99674 943522 88675 848515 88676 828191 00677 042104 88708 851185 00701 051523 00702 020875 00793 020940 0451 88794 888999 OCT 0 8452 80705 868671 S14 LDA PRAD 0453+ 8454+PRINT LEAST SIGNIFICANT 8 BITS OF A. 8455+ 9456 00706 000000 OYNA NOP ENTER SUBROUTINE 8457 88797 187780 CLC 0.C INITIALIZE, INTERRUPT OFF 8458 88718 878731 8TA A53 STORE A 8459 88711 874732 STB BS1 STORE B 86712 868727 8468 LDA OYN PUT BUFFER INTO OUTPUT 88713 19260A OTA4 0461 OTA D AND PRINT HODE 0462 00714 060731 LDA AS3 RESTORE A 8463 99715 919463 AND MSK2 OUTPUT LEAST 6464 99716 182698 OTA5 OTA 8 SIGNIFICANT B 8465 00717 18370A STCC2 STC 0,C BITS OF A 88728 886488 8466 CLB 8467 00721 014511 JSB TOS FLAG SET? 8468 88722 824724 JMP ++2 8469 00723 014614 JSB POF NO. HALT AT ERROR BUFFER 8478 00724 060731 LDA AS3 YES. RESTORE A 88725 864732 8471 LD8 831 RESTORE B 88726 124786 8472 JMP OYNA, I EXIT SUBROUTINE 0473 00727 120980 OYN OCT 120000 OUTPUT, PRINT, NO PUNCH 8474 89738 128888 SOYN OCT 120000 9475 88731 888888 A S 3 OCT Ø TEMPORARY STORAGE 0476 09732 000000 OCT Ø 851 TEMPORARY STORAGE 8477\* 8478+PRINT OUT TWO OCTAL NUMBERS 8479+ 0480 88733 898888 POUT2 NOP ENTER SUBROUTINE 0481 00734 068001 LDA 1 OUTPUT 0482 P0735 00110A ARS FIRST 0483 99736 991198 ARS NUMBER 0484 88737 881198 AR8 00740 010751 0485 AND MSK5 8485 00741 030758 IOR MSK4 8487 90742 814786 JSB OYNA 8488 90743 060991 OUTPUT LDA 1 0489 98744 818751 AND MSK5 SECOND 0490 00745 030750 TOR MSK4 NUMBER



91746 914706 JSB OYNA 0491 JMP POUT2, I EXIT SUBROUTINE 9492 00747 124733 8493 00750 000260 MSK4 OCT 260 88751 888887 OCT 7 8494 MSK5 8495+ 8496+END OF LINE SUBROUTINE 8497+ ENTER SUBROUTINE 8498 EOL NOP 8499 88753 878762 STA AS4 STORE A 00754 060763 LDA CR CARRIAGE 0500 JSB OYNA 99755 914796 RETURN 0501 8582 88756 868764 LDA LF LINE **8583 88757 814786** FEED JSB OYNA 8584 88768 868762 RESTORE A LDA A84 06761 124752 EXIT SUBROUIINE JMP EOL, I 8585 007 0 8586 88762 888898 AS4 TEMPORARY STORAGE 8587 80763 889215 CR OCT 215 OCT 212 0508 S\$764 888212 LF 8589+ 8518+SUPPRESS MESSAGE PRINTOUT CHECK SUBROUTINE 9511+ 9512 00765 900806 SMPOC NOP ENTER SUBROUTINE 8513 88766 871882 STA AS5 STORE A 88767 814145 JSB MODE CHECK SW. REG. 0514 88778 868176 LDA BIT2 SUPPRESS EXCESS 0515 8516 88771 882811 PRINTING? SLA,R85 8517 88772 824775 JMP ++3 NO. 0518 00773 061092 LDA AS5 RESTORE A YES. JHP SHPOC, I EXIT SUBROUTINE 6519 60774 124765 0520 00775 861882 LDA AS5 RESTORE A 0521 00776 015003 JSB MPO PRINT MESSAGE 88777 814752 LINE FEED JSB EOL 8522 LINE FEED 91899 014752 JSB EOL 0523 8524 81401 124765 JHP SHPOC,I EXIT SUBROUTINE A35 0525 **81882 888888** OCT R TEMPORARY STORAGE 9526+ 0527+MESSAGE PRINTOUT SUBROUTINE 8528+ 0529 01003 000900 MPO NOP ENTER SUBROUTINE 81894 971885 ST4 ++1 0530 81885 868888 LOAD A WORD 0531 LDA 0 01006 035095 152 ---0532 WORD = MT 81007 882883 0533 SZA, RSS 8534 01010 125003 JMP MP0,1 YES. EXIT SUBROUTINE 0535 01011 015013 JSB PACO NO. PRINT THE WORD 01012 025005 JMP +-5 REPEAT FOR NEXT WORD 0536 0537\* **0538+PACKED ASCII CHARACTER OUTPUT SUBROUTINE** 0539+MOST SIGNIFICANT & BITS OF A REGISTER PRINTED FIRST. 8548+ 01013 000000 PACO NOP ENTER SUBROUTINE 9541 STA AS6 STORE A 8542 01014 071025 91815 881798 PRINT 0543 ALF FIRST 8544 81916 881788 ALF AND MSK2 8345 01017 010463 CHARACTER 6546 01020 014706 JSB OYNA PRINT 6547 01021 061025 LDA AS6

0548 01922 010463 AND MSK2 SECOND 8549 01923 014786 JBB OYNA CHARACTER 8559 01024 125913 JHP PACO,1 EXIT SUBROUTINE 0551 01025 888898 A 86 0CT 0 TEMPORARY STORAGE 8552+ 0553+OCTAL PRINTOUT OF A 8554+ 0555 01026 000000 OPA NOP ENTER SUBROUTINE 91027 881286 0556 RAL 8557 01030 071042 STA A87 STORE A 8558 01031 011043 AND MSK6 PRINT 0559 81032 838758 IOR HSK4 FIRST 01833 014786 8568 JSB OYNA NUMBER 0561 91934 815944 JSB NXT PRINT 8562 81835 815844 JSB NXT NEXT 01036 015044 0563 JSB NXT FIVE 01037 015044 8564 J88 NXT NUMBERS 01040 015044 0565 JSB NXT 8566 01041 125026 JHP OPA,I EXIT SURROUTINE 91042 000000 OCT Ø 8567 AS7 TEMPORARY STORAGE 0568 01043 009001 MSK6 0CT 1 6569+ 0570+NEXT OCTAL CHARACTER OUTPUT 9571+ 0572 01044 000000 NXT NOP ENTER SUBROUTINE 0573 01045 061042 LDA AS7 PREPARE 8574 81846 881288 RAL THE 01047 001200 0575 RAL NEXT 8576 81858 881288 RAL NUMBER 0577 01051 071042 STA AS7 FOR 0578 01052 010751 AND MSK5 OUTPUTING 0579 01053 030750 IOR MSK4 01054 014706 0580 JSC OYNA OUTPUT 01055 125244 0581 JMP NXT.1 EXIT SUBROUTINE 0582+ 6583+ 8584+ 0585+PUNCH AND READ ROUTINE 2586+ 8587 TESTS TAPE PUNCH AND TAPE READER 0568+BY OUTPUTING ALL COMBINATIONS OF 0589+EIGHT BITS AND READING THEM BACK. 0590+ 0591 01056 000000 PAR NOP ENTER ROUTINE 0592 01057 107708 CLC 0.C INITIALIZE, INTERRUPT OFF 8593 01960 006400 CLB 0594 01061 014511 JSB TOS FLAG SET? 8595 01062 025064 JMP ++2 YES. 01963 014614 0596 JSB POF NO. HALT AT ERROR BUFFER 8597 01064 061250 LDA SIT PRINT FIRST 0598 01065 014765 JSB SMPOC PAR MESSAGE 0599 01966 061970 LDA ++2 HALT TO 0600 01067 065070 LD8 ++1 TURN ON 0601 01070 102002 HLT 2 PUNCH 0602 01071 061143 LDA GNY PREPARE TO 01072 070727 0603 STA OYN PUNCH TAPE 8684 01073 015264 JSB ZEROS PUNCH LEADER



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	0605	01074	003400		CCA		DUTPUT ALL ONES
	0696		010463			MSK2	AS A BEGINNING
	0607	-	014706			CYNA	INDICATOR
	8688		002400		CLA		PUNCH
	0609		015274		_	.64CH	ALL
	0610		015274			.64CH	COMBINATIONS
	0611		061144				OF EIGHT
			079727		STA		BITS
	8612				LDA		0113
	0613		060762			.64CH	
	8614		015274			.64CH	
	0615		015274			ZEROS	PUNCH
	0616		015264			ZEROS	TRAILER
	0617		015264			ZEROS	
	9618		015264			PARE	EXIT ROUTINE?
	0619		015151				NO. HALT TO
	0620		061115				LOAD TAPE
	0621		065115		LDB		INTO READER
	0622		102003		HLT		
	0623		061150		LDA		PREPARE TO
	9624		070727		STA	UTN	READ
	9625		002400		CLA	<b></b>	
	9626		014796			OYNA	READ A
	0627		196598	LIB4			CHARACTER
	0628		006903			RSS	CHARACTER = PT
_	Ø629		025121		JMP		YES. READ NEXT CHARACTER
	0639		015395			R64CH	NO. READ FIRST BLOCK
	0631		861145		LDA		
	0632		070727		STA		
	0633	01130	061341		_	A\$11	
	0634	01131	015305		-	R64CH	READ SECOND BLOCK
	0635	01132	061146		LDA		
	0636	01133	878727		STA		
	0637	01134	061341		LDA	A 5 1 1	
	0638	01135	015375			R64CH	READ THIRD BLOCK
	0639	01136	061147		LDA	IYY	
	0640	01137	070727		STA	DYN	
	P641	01140	061341			AS11	
	0642	01141	015305		JSB	R64CH	READ FOURTH BLOCK
	0643	01142	025151		JMP	P7	EXIT ROUTINE
	9644	01143	110000	ONY	OCT	110000	NUTPUT, NO PRINT, PUNCH
	0645	01144	130000	0 4 4	-	139900	OUTPUT, PRINT, PUNCH
	0646	01145	160070	<b>TYN</b>	007	157800	INPUT, PRINT, NO PUNCH
	9647	Ø1146	150090	INY	TCC	154989	INPUT, NO PRINT, PUNCH
	0648	01147	170370	IYY	OCT	177000	INPUT, PRINT, PUNCH
	9649	01150	149990	INN	OCT	149999	INPUT, NO PRINT, NO PUNCH
	0650+						
	Ø651*	PUNCH	AND READ	EXIT	SUBRI	DUTINE	
	9652+						
	0653	01151	000000	PARE	NOP		ENTER SUBROUTINE
	0654	01152	971167		STA	A S 8	STORE A
-	9655		014145		JSB	HODE	CHECK SW. REG.
	0656		867278		LDA	BIT4	EXIT THIS
	0657	-	042311			R85	ROUTINE?
	0658		025161			**3	YES.
	9659		Ø61167			ASB	NO. RESTORE A
	0660		125151			PARE,1	EXIT SURROUTINE
	Ø661		060730	P7	-	SOYN	RESTORE

F HOL P

8662 01162 070727 STA DYN OUTPUT CODE 01163 014752 0663 JSB EOL LINE FEED 01164 061263 0664 PRINT SECOND LDA SIS 0665 01165 014765 PAR MESSAGE JSB SMPOC 0666 01166 125056 JHP PAR,I EXIT ROUTINE 01167 000800 OCT @ 0667 AS8 TEMPORARY STORAGE 0668\* 0669\*PRINT OUT ERRORS ROUTINE 8678\* 0671 01170 000000 POE NOP ENTER SUBROUTINE 8672 01171 071214 STA AS9 STORE A 01172 060727 0673 LDA OYN SAVE 01173 071215 0674 STA ASIR STATE 81174 869730 0675 LDA SOYN 0676 01175 @70727 STA DYN 8677 01176 014752 JSB EOL LINE FEFD 0678 01177 061224 LDA SI5 PRINT "OUTPUT =\* 0679 01200 015003 JSB MPO 01201 061214 9689 LDA AS9 RESTORE A 01202 015026 0681 JSB OPA PRINT OCTAL NUMBER 0682 01203 061234 LDA SIG PRINT "INPUT =" 0683 81294 915893 JSB MPO 9684 01205 060001 LDA 1 PRINT OCTAL 8685 01206 015026 JSB OPA NUMBER 81297 814752 8686 JSB EOL LINE FEFD 01210 061215 0687 LDA ASTR RESTORE 01211 070727 0688 STA OYN STATE 01212 061214 0689 LDA AS9 RESTORE A 8698 01213 125170 JMP POE, J EXIT SUBROUTINE OCT P 0691 01214 000909 A 5 9 TEMPORARY STORAGE 0692 01215 000000 OCT 8 AS18 TEMPORARY STORAGE 01216 047525 0693 ASC 5, OUTPUT = 00 01217 052120 01220 052524 01221 020075 01222 020040 0694 01223 888888 OCT Ø 0695 01224 061216 \$15 LDA CO 8696 01225 828840 01 ASC 6, INPUT = 01226 020040 01227 044516 01230 059125 01231 052040 01232 036440 0697 01233 000000 OCT 0 0698 01234 061225 S16 LDA OI 0699 01235 041105 PARM1 ASC 10.BEGIN PUNCH AND READ 01236 043511 31237 847848 01240 050125 01241 047103 01242 044740 01243 049516 01244 042340 01245 051105 01246 040504 0708 01247 000299 001 0

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0701 01250 061235 S17 LDA PARMI 01251 042516 PARM2 ASC 9, END PUNCH AND READ 0702 01252 042040 01253 050125 01254 047103 01255 044840 01256 040516 01257 042940 01260 051105 01261 040504 OCT P 01262 000000 0703 LDA PARM2 8784 01263 061251 518 0765\* 0706+OUTPUT BLANK TAPE 0787+ ZEROS NOP 01264 000000 ENTER SUBROUTINE P798 81265 882498 8789 CL A 01256 065273 LDB SC3 0710 01267 014796 OUTPUT ZERO 0711 JSB DYNA 32 ZER057 01270 006006 INB, SZB 0712 0713 01271 025267 JMP +-2 NO. JMP ZEROS, I EXIT SUBROUTINE 01272 125264 YES. 0714 01273 177740 SC3 OCT 177740 8715 8716\* 8717+INCREMENT AND OUTPUT & REG. 64 TIMES 0718\* .64CH NOP ENTER SUBROUTINE 01274 000000 0719 RESET COUNTER 01275 865384 0728 LDB SC4 01276 014706 JSB DYNA OUTPUT A 0721 01277 002094 INCREMENT OUTPUT WORD 0722 INA 01300 006006 64 CHARACTERS? 0723 INB, SZB 01301 025276 JMP +-3 0724 NO. JSB EOL YES. 0725 01302 014752 0726 01303 125274 JMP .64CH,I EXIT ROUTINE 01304 177700 SC4 OCT 177700 8727 0728+ 0729+READ AND CHECK 64 CHARACTERS 0730+ 9731 01305 000000 R64CH NOP ENTER SUBROUTINE 01306 065304 LDR SC4 RESET 0732 01307 075340 STB M64 CHARACTER COUNTER 0733 01310 014736 P8 JSB OYNA READ A 0734 L185 0735 01311 106590 LIB CHARACTER JSB PARE EXIT ROUTINE? 0736 01312 015151 FRROR? P737 01313 050091 CPA 1 NO. 0738 01314 025316 JMP ++2 NO. YES. PRINT OUT ERROR 0739 01315 015170 JSB POE INCREMENT REFERENCE 9740 01316 002004 INA 01317 835340 187 M64 64 CHARACTERS? 0741 01329 025310 8742 JMP P8 NO. STORE A 01321 071341 YES. 0743 STA AS11 CHECK FOR 0744 01322 860763 LDA CR 01323 014706 CARRIAGE 8745 JSB OYNA 0746 81324 186598 LIB6 LTB Ø RETURN ERROR? 8747 01325 050001 CPA 1 01326 025330 JMP ++2 NO. 0748 JSB POE PRINT OUT ERROR 01327 015170 YES. 0749



0750 01330 060764 LDA LF CHECK FOR 0751 01331 014706 JSB OVNA LINE 0752 01332 106598 L187 L18 0 FEED 01333 058001 0753 CPA 1 ERRORT 0754 01334 025336 JMP ++2 NO. 0755 01335 Ø15170 JSB POE YES. PRINT OUT ERROR 0756 01336 061341 LDA AS11 RESTORE A 0757 01337 125305 JMP R64CH,I EXIT SUBROUTINE 0758 01340 177790 M64 OCT 177700 0759 01341 000000 OCT P AS11 TEMPORARY STORAGE 0760+ 0761+ 07624 0763+PRINT AND KEYBOARD ROUTINE 0764+ 0765 01342 000000 PAK NOP ENTER ROUTINE 0766 01343 107790 CLC 0.C INITIALIZE, INTERRUPT OFF 0767 01344 060730 LDA SOYN PREPARE 2768 01345 070727 STA OYN TO PRINT 9769 01346 061423 LDA SIG PRINT FIRST 01347 014765 0770 JSB SMPOC PAK MESSAGE 0771 01358 015464 JSB PRALL PRINT 64 ASCII CHARACTERS 6772 01351 015464 JSB PRALL PRINT 64 ASCII CHARACTERS 0773 01352 014752 JSB EOL LINE FEED 0774 01353 015372 JSB PAKE EXIT ROUTINE? 01354 061446 8775 LDA STIP NO. PRINT SECOND 0776 01355 014765 JSB SMPOC PAK MESSAGE @777 01356 061150 P9 LDA INN PREPARE TO READ 0778 01357 102690 OTA6 OTA P IN FROM KEYBOARD 0779 01360 015372 PIR JSB PAKE EXIT ROUTINE? 0780 01361 103700 STCC3 STC 0,C NO. WAIT 9781 B1362 886400 CLA FOR INPUT 01363 014511 8782 **JSB TOS** ANY INPUT? P783 01364 025366 JMP ++2 YES. 0784 01365 025360 JMP P19 NO. Ø785 01366 106500 LOAD BATA INTO B L188 LIB 0 0786 01367 060001 PUT B INTO A LDA 1 01370 014706 9787 JSB OYNA OUTPUT A 0788 01371 025356 JMP P9 PEAD NEXT CHARACTER 0789+ 0790+PRINT AND KEYBOARD EXIT 8791+ P792 01372 000000 PAKE NOP ENTER SUBROUTINE 0793 01373 071214 STA AS9 STORE A 0794 01374 014145 JSB MODE CHECK SW. REG. 8795 01375 060291 LDA BIT5 EXIT THIS 0796 01376 002011 SLA, RSS ROUTINE? 01377 025402 0797 YES. JMP ++3 8798 01400 061214 LDA AS9 NO. RESTORE A 0799 81401 125372 JMP PAKE, I EXIT SURROUTINE 0800 01402 014752 JSB EOL 91493 061463 0801 LDA ST11 PRINT THIRD 0802 01434 014765 JSB SMPOC PAK HESSAGE 01405 125342 0803 JHP PAK,1 EXIT ROUTINE 0804 81406 841185 PAKM1 ASC 12, BEGIN PRINT AND KEYBOARD 01407 043511 01410 047240

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	91112	044516				
		652740				
		040516				
		042940				
		845585				
	-	054502				
		<b>E47501</b>				
		051104			•	
0805		000000		OCT		
0806					PAKN1	
0897			ANHS	ASC	17,054	(EYBOARD SLOWLY (5 CHS./SEC
		842449				
		045505				
		054582				
		047591				
	01431	051194				
	01432	020123				
	01433	946117				
	01434	053514				
	01435	854449				
	01436	024065				
	01437	020133				
	01440	044123				
	81441	827857				
	81442	051505				
		041456				
		024440				
0808		0000000		007	P	
0869					PAKM2	
9819	-			-		PRINT AND KEYBUARD
010		842748		-00		
		P5P122				
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		852848				
		040516				
		842040				
	-	845595				
		054502				
		847581				
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0811		000000		DCT .		
0812		061447 5	5111	LUA	PAKM3	
9813+		ALL CHARAC	TEDE	CIDE		
		NEL UMARAL	,1643	3055		· ·
Ø815+				N 0 5	,	ENTER SUBROUTINE
			PRALL	NOP	_	PRINT FIRST
		061472			SC5 Tach	
		015474			.3204	LINF OF CHARACTERS
		061473			SCA	PRINT SECOND
PA20		015474			.32CH	LINF OF CHARACTERS
0821		125464			PRALL,I	EXIT SUBROUTINE
0822				OCT		
0823		000240 5	506	OCT	249	
P824+		32 CHARACI				

0827	01474	866868	.32CH	NOP	ENTER SUBROUTINE
0828	01475	075586		STR BS2	STORE B
0829	01476	065273		LDB SC3	RESET COUNTER
8830	01477	014706		JSB DYNA	PRINT A
0831	01500	882894		INA	INCREMENT A
0832	01591	886886		INB, SZB	32 CHARACTERS?
0833	01502	025477		JMP +-3	ND. PRINT NEXT CHARACTER
0834	61593	014752		JSP EOL	YES. LINE FEED
P835	01594	865596		LDB BS2	RESTORE B
0836	01505	125474		JMP .32CH,I	EXIT SUBROUTINE
0837	01506	000000	832	OCT 0	TEMPORARY STORAGE
0838				END	
** N	O ERROF	₹\$•			

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2115A/14A BUFFERED TELETYPE TEST

BINARY TAPE-HP20420BSOURCE TAPE-HP 20474BSOURCE LISTING-HP 20420BL

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0001 ASMB, A, B, L 0002+ 8863+ 8884+ 0005+BUFFERED TELETYPE DIAGNOSTIC 2115/14 07/08/68 0986\* 8887\* 8988\* 0009+STARTING OCTAL ADDRESS = 100 8818+++ 0011+THE FOLLOWING SWITCH REGISTER SETTINGS 0012+ARE USED FOR PROGRAM CONTROL 0013+ HALT AT BEGINNING OF PROGRAM 0014+BIT 0 = 1 -> 0015+BIT 1 = 1 HALT AT ERROR BUFFER -> 9916+BIT 2 = 1-> SUPPRESS MESSAGE PRINTOUT 0017+BIT 3 = 1PERFORM BASIC TEST ROUTINE -> 9018+8IT 4 = 1 -> PERFORM PUNCH AND READ ROUTINE 5 = 1 8819+BIT PERFORM PRINT AND KEYBOARD ROUTINE •> 8828++++ 8021+ 9922\* 8023+MAIN PROGRAM 8824+ 0025 00077 **ORG 778** 00077 102000 0026 END HLT Ø 88198 187788 INITIALIZE, INTERRUPT OFF 8927 CLC 0,C 00101 102501 0028 LIA 1 PUT TTY 0029 00102 010141 AND MSKØ ADDRESS 0030 00103 070303 STA BTA INTO ALL I/O 03104 014203 0031 JSE INIT INSTRUCTIONS 0032 00105 064142 PREPARE LDB M67 0033 99106 060143 LDA HIS TRAP 00107 070111 0034 STA ++2 F09 88118 868144 0035 LDA HT ILLEGAL 0036 86111 870910 STA 108 INTERRUPT 0037 00112 034111 157 +-1 FROM 0038 00113 002004 INA ANOTHER 08114 005006 0039 INB, SZR DEVICE 0040 00115 024111 JMP +-4 88116 868497 0041 LDA IIJ PREPARE ILLEGAL TTY 00117 970009 0842 STA1 STA P INTERRUPT TRAP 0043 00120 014752 JSB EOL LINE FEFD 8844 00121 060123 LDA ++2 HALT TO CHOOSE 0045 80122 864123 SWITCH REGISTER L78 ++1 0046 00123 102001 HLT 1 OPTIONS 0947 00124 014145 MP1 CHECK SW. REG. JS8 MODE 8848 00125 060177 LDA BIT3 **同艺统资源采用** 0049 88126 888818 BASIC TEST? SLA YES, 0050 00127 014304 **JSB BT** 0051 00130 014145 CHECK SW. REG. JSB MODE NO. 0052 00131 060200 PERFORM LDA BIT4 0053 00132 000010 SLA PUNCH AND REANT 0054 00133 015056 JSB PAR YES. 0055 00134 014145 NO. CHECK SW. REG. JSB MODE PERFORM 0056 99135 060291 LDA BITS 0057 00136 000010 SLA PRINT AND KEYROARD?



0058 80137 015342 JSB PAK YES. 00140 024124 0059 JMP MP1 NO\_ 00141 000077 OCT 77 0060 MSKØ 00142 177711 OCT 177711 0061 M67 0062 88143 878818 HIS STA 108 0063 20144 102010 HLT 108 ΗI 0064+ 8065+SWITCH REGISTER MONITORED 0066+FOR CURRENT OPERATING MODE 0067\* MODE ENTER SUBROUTINE 00145 000000 NOP 0068 00146 070173 STA ASP STORE A 0069 0070 00147 102501 LTA 1 EACH BIT 0071 00150 070174 STA BITA FROM THE 00151 001300 SWITCH REGISTER 0072 RAR IS ROTATED 00152 070175 STA BITI 8073 00153 001300 INTO THE 0074 RAR 00154 070176 LEAST SIGNIFICANT 0075 STA BIT2 00155 001300 RAR POSITION AND 0976 00156 070177 STORED IN THE 0077 STA BIT3 88157 881388 STORAGE LOCATION 0078 RAR 00160 070200 8979 STA BIT4 BEARING ITS NAME 80161 801300 RAR 9888 00162 070201 STA BIT5 0081 00163 060174 LDA BITO HALT AT BEGINNING 0082 OF PROGRAM? SLA,RSS 8083 00164 002011 00165 024171 JMP ++4 NO. 0084 00166 060202 LDA HAD YES. LOAD & AND B 0085 00167 064292 LDB HAD WITH 100 8886 0087 80178 824777 JMP END AND HALT 00171 060173 LDA ASØ RESTORE A 9088 JMP MODE, T EXIT SUBROUTINE 0089 00172 124145 00173 000000 ASO OCT P TEMPORARY STORAGE 0090 00174 000000 BITO OCT Ø 0091 OCT 0 00175 000000 **BIT1** 0092 00176 000000 B1T2 OCT Ø 8093 00177 000090 **9173** OCT 0 0094 88208 8888AB BIT4 NCT P 0095 OCT Ø 20221 BBBBBB B175 0096 0CT 184 0097 00202 000130 HAD 8898+ 0099\* **Ø100+INITIALIZATION ROUTINE** 0101+ 0102+THIS ROUTINE ADDS THE BUFFERED TELETYPE ANDRESS TO 0103+ALL I/O INSTRUCTIONS. 0104+ 0105+ 0106 88542 888888 INIT NOP ENTER ROUTINE 00204 107700 CLC 0.C INITIALIZE, INTERRUPT OFF 0107 80205 014274 JSB ADTN PUT TTY ADDRESS 3108 INTO SES INSTRUCTIONS SFS Ø 0109 00206 102300 0110 00207 070340 STA SFS1 STA SFS2 0111 00210 070347 00211 070357 STA SFS3 0112 STA SFS4 0113 83212 879481 STA SFS5 0114 00213 070512

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8115		014274	JSB ADIN	PUT TTY ADDRESS
0116	00215	102200	SFC Ø	INTO SEC INSTRUCTIONS
0117	00216	070334	STA SFC1	THIS SPO PASTRUCTIONS
0118		079344	STA SFC2	
8119		07P354		
0120		070375	STA SFC3	
			STA SFC4	
0121		Ø14274	JSB ADIN	PUT TTY ADDRESS
0122		102600	OTA P	INTO OTA INSTRUCTIONS
0123	00224	079415	STA OTA1	
6124	00225	879450	STA OTA2	
0125		079471	STA OTAJ	
0126		070713		
0127		070716	STA OTA4	
			STA OTA5	
0128		071357	STA DTA6	
0129		014274	JSB ADIN	PUT TTY ADDRESS
0130	80233	103700	STC Ø,C	INTO STC, C INSTRUCTIONS
0131	00234	070417	STA STCC1	
0132		070717	STA STCC2	
0133		071361		
0134		-	STA STCC3	
		014274	JSB ADTN	PUT TTY ADDRESS
0135		196700	CLC P	INTO CLC INSTRUCTION
0136		070420	STA CLC1	
0137	00242	014274	JSB ADTN	PUT TTY ADDRESS
0138	00243	102700	STC R	INTO STC INSTRUCTION
Ø139		079353	STA STCI	THIO STO THEIRUCITUN
0140		878588	STA STC2	
8141		014274		- · · <b>-</b> · · - ·
			JSB ADTN	PUT TTY ADDRESS
0142		103100	CLF P	INTO CLF INSTRUCTION
0143		878343	STA CLF1	
0144	00251	014274	JSB ADIN	PUT TTY ADDRESS
0145	88252	102100	STF 0	INTO STE INSTRUCTION
0146		070366	STA STF1	THIO STE INSTRUCTION
0147		014274	JSB ADIN	
0148		106500		PUT TTY ADDRESS
0149			LIB P	INTO LIB INSTRUCTIONS
		079451	STA LIRI	
0150		079472	STA LIB2	
0151		078501	STA LIBJ	
0152	00261	071122	STA LIGA	
0153	00262	071311	STA LIRS	
0154		071324	STA LIR6	
@155		871332	STA LIB7	
P156		971366		
0157			STA LIB8	
-		014274	JSB ADIN	PUT TTY ADDRESS
0158		070330	STA P	INTO STA INSTRUCTIONS
0159		070117	STA STAI	
0160	00271	070364	STA STA2	
0161	00272	070374	STA STA3	
0162		124203		EXIT ROUTINE
0163+	<b>- / /</b>			
		INDINETON OF	(BOOLSTINE)	
		INCLUSION SI	JOROUTINE.	
0103*	176 9UP	PERED TTY AD	RESS IS PUT I	NTO
N100+)	THE INS	TRUCTION FOLL	OWING JSB ADI	(N
0167+				
0168	00274	BUDBOD ADIN	NOP	ENTER SUBROUTINE
0169		160274	LDA ADTN,T	
	-			
0170	00276	010302	AND MAKE	ADD TTY ADDORGO
0170 0171	-	019392 039343	AND MSK1 Tor Rta	ADD TTY ADDRESS TO INSTRUCTION



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0172 00300 034274 ISZ ADTN EXIT JMP ADTN,T SUBROUTINE 0173 88301 124274 OCT 177700 88392 177798 8174 MSKI BTA DCT Ø TTY ADDRESS STORAGE 88383 888888 0175 0176+ 0177+ 8178+ **0179+BASIC TEST ROUTINE** 6188+ BIBI+THE FOLLOWING TESTS THE FLAG, CONTROL, 0182+AND INTERRUPT CIRCUITRY 0183+ 83384 888838 BT NOP 6184 00305 107700 CLC 0,C INITIALIZE, INTERRUPT OFF 0185 0186 88376 869730 LDA SOYN RESTORE STA DYN 00307 070727 OUTPUT CODE 0187 PRINT FIRST 00310 060653 LDA SIL 0188 JSB SMPOC BT MESSAGE 00311 014765 0189 CLEAR 00312 006400 CLB 0190 0191 00313 074629 STB E1 ERROR STB E2 BUFFER 0192 00314 074621 00315 074622 **STB E3** 0193 STB E4 00316 074623 0194 0195 00317 074624 ST8 E5 0196 00320 074625 STB E6 07321 074626 STB E7 0197 83322 874627 STB E10 0198 0199 88323 874638 STR E11 00324 074631 STB E12 8280 00325 074632 STB E13 0201 \$ STB E14 0202 00326 074633 00327 074634 STB E15 0203 00330 074635 STB EIA 0204 **STB E17** 0205 00331 074636 00332 074637 STB IA 0296 INCREMENT ERROR CODE 00333 006004 INB 0207 00334 102200 SFC1 SFC Ø FLAG CIEAR? 0298 JMP ++2 00335 024337 NO. 0209 STB E1 YES. ERROR 1 00336 074620 0210 INCREMENT ERROR CODE 99337 006004 0211 INB SES P FLAG SET? 00340 102390 SFS1 0212 NO. ERROR 2 0213 00341 074621 STR E2 00342 006904 0214 INB YES. CLF1 CLEAR FIAG 0215 00343 103100 CLE 0 SFC2 9FC Ø FLAG CLEAR? 0215 00344 102200 0217 00345 074622 ST8 E3 NO\_ ERROR 3 0218 88346 886894 INB YES, 0219 00347 102300 SFS2 SFS 0 FLAG SET? JMP ++2 0220 00350 024352 NO. 0221 YES. ERROR 4 00351 074623 STB E4 9222 88352 886984 INB SET CONTROL P223 00353 102700 STC1 STC P 00354 102200 SFC3 SFC P FLAG CLEAR? 0224 00355 074624 STB E5 ERROR 5 0225 NO. 0226 00356 006004 INB YES. SFS3 FLAG SET? 0227 00357 102308 SFS Ø JMP ++2 0228 P0360 024362 NO.

00361 074625 0229 STB E6 ERROR 6 YES. 0230 00362 006004 INR 0231 00363 060466 LDA IJI PREPARE TO TEST @232 83364 878988 STA2 STA Ø INTERRUPT SYSTEM 0233 00365 102100 STF Ø TURN ON INTERRUPT SYSTEM 00366 102100 0234 STF1 STF 0 SET FLAG 0235 00357 000490 NOP WAIT FOR 0236 00370 000000 NOP INTERRUPT 0237 88371 874626 STB E7 NO INTERRUPT - ERROR 7 0238 00372 006004 P1 INB INTERRUPT ENTRY 0239 00373 060407 LDA IIJ RENEW ILLEGAL 0240 09374 070200 STA3 STA P INTERRUPT TRAP SFC4 0241 00375 102200 SFC 0 FLAG CLFAR? 88376 824488 8242 JMP ++2 NO. 00377 074627 0243 ERROR 10 STB ELP YES. 8244 00400 006004 INB 88491 182388 0245 SFS4 SFS 0 FLAG SET? 0246 00402 074630 **STB E11** NO. ERROR 11 0247 00403 006094 INB YES. 0248 00404 074410 STB ERNO STORE ERROR CODE 0249 00495 P24411 JHP TOUT 0250 00496 024372 111 JMP P1 0251 09407 014533 11J JSB ILINT 00410 000000 0252 007 8 ERNO ERROR CODE STORAGE 0253+ 0254+THE FOLLOWING TESTS THE TIME FOR OUTPUTING ONE CHARACTER. 0255+ 0256 03411 009900 TOUT NOP 0257 00412 107700 CLC 0,C INITIALIZE, INTERRUPT OFF 0258 00413 102100 STF A INTERRUPT ON 0259 80414 869448 LDA ONN PUT INTO OUTPUT, NO 0260 00415 102600 OTA1 OTA 0 PRINT, NO PUNCH MODE 0261 00416 064441 LDB TOCI CHECK 00417 103790 9262 STCC1 STC 0,C LOWER 0263 88428 106782 CL.C1 TIME LIMIT CLC Ø 8264 00421 014511 FLAG SET? JSB TOS 0265 00422 P24424 JMP ++2 YES. DATA CLOCK TOO FAST 00423 024426 0266 JMP ++3 NO. 0267 88424 864418 FRROR 12 LDB ERNO 0268 09425 074631 STR E12 0269 00426 034410 ISZ ERNO INCREMENT ERROR CODE 0270 88427 APROPA NOP CHECK HPPER 0271 00430 064442 LDB TOC2 TIME LIMIT 0272 00431 014511 JSB TOS FLAG SET? 0273 00432 024435 JMP ++3 YES. TIMING OK 00433 054410 8274 LDB ERNO NO. DATA CLOCK TOO SLOW 0275 00134 074632 ST8 E13 ERROR 13 0276 00435 034410 18Z ERNO INCREMENT ERROR CODE 8277 00436 000000 NOP 0278 JMP DT 00437 024443 00447 199999 0279 ONN OCT 199999 OUTPUT, NO PRINT, NO PUNCH 0280 00441 142000 TOCI OCT 142000 TIMEOUT CONSTANT 1 0281 88442 176708 T0C2 OCT 176799 TIMEOUT CONSTANT 2 0282\* 0283+THE FOLLOWING TESTS THE EIGHT BIT DATA BUFFER. 0284+ 0285 08443 000000 DT NOP

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INITIALIZE, INTERRUPT OFF 8286 00444 107700 CLC 0,C 88445 882488 8287 CLA OUTPUT THE STA CURWD 88446 878465 P2 8288 AND MSK2 CURRENT 00447 019463 9289 WORD OTA2 OTA Ø 8298 00450 102690 00451 106500 LIB1 L18 Ø 0291 INPUT = OUTPUT ? CPA 1 0292 00452 050001 YES. JMP ++3 88453 824456 8293 LDA ERNO NO. ERROR 14 89454 868410 8294 **STA E14** 99455 970633 0295 LDA CURWD INCREMENT 0296 88456 868465 CURRENT WORD 6297 88457 882896 INA, SZA 88468 824446 JMP P2 8298 INCREMENT ERROR CODE 187 ERNO 99461 83441P 8299 JMP CET 8388 88462 824467 99463 898377 OCT 377 0301 MSK2 OCT 200 88464 888288 MSK3 0382 CURWD OCT 8 99465 998998 0303 NBE OCT Ø 88466 8888998 0304 8385+ 8386+THE FOLLOWING TESTS THE CLOCK ENABLE FLIP-FLOP 8387+ INITIALIZE, INTERRUPT OFF CLC 0,C 98467 187788 CET 8398 PUT BUFFER INTO "OUTPUT, NO 88478 868448 LUA ONN 8389 OTA Ø PRINT, NO PUNCH" STATE 88471 182688 OTA3 0310 FLIP-FLOP 88472 186588 LIB2 LIB 0 0311 SET? 388, R\$5 08473 896921 9312 NO. JMP +3 09474 024477 0313 YES. ERROR 15 LDA ERNO 88475 868418 0314 STA E15 99476 978634 0315 INCREMENT ERROR CODE **ISZ ERNO** 88477 834418 0316 SET FLIP-FLOP STC2 STC @ 00500 102700 0317 FLIP-FLOP LIB 8 00501 106500 LIB3 9318 SET? 0319 00502 006020 358 JMP ++3 YES. 8328 88503 824586 NO. ERROR 16 LBA ERNO 88584 868418 9321 STA E16 88585 878635 8322 INITIALIZE, INTERRUPT OFF CLC 8,C 0323 00506 107700 HALT AT ERROR BUFFER? JSB EBH 88587 814522 0324 JHP POUT NO. 88510 824545 0325 0326+ 8327+FLAG TIMEOUT SUBROUTINE 0328+ 8329+TIMEOUT CONSTANT IN B 0338+IF "FLAG" BEFORE TIMEOUT, EXIT TO TOS. IF NOT, 0331+EXIT TO TOS + 1. ONE ITERATION = 6.4 MICROSEC. 8332+ ENTER SUBROUTINE 98511 000000 T08 NOP 0333 FLAG SET? 8334 00512 102300 SFS5 SFS P JMP ++2 00513 024515 0335 YES. EXIT THROUGH TOS JMP TOS,1 88514 124511 0336 TIMEOUT YET? NO. INB, SZB 0337 98515 896886 NO. REPEAT JMP SFS5 88516 824512 0338 YES. EXIT 00517 034511 137 T03 0339 THROUGH NOP 88528 888888 0340 JMP TOS, I T05 + 100521 124511 0341 8342\*

**#343+ERROR BUFFER HALT SUBROUTINE** 8344+ 0345 95522 999888 EBH NOP ENTER SUBROUTINE 0346 88523 878532 STA AS1 STORE 4 0347 88524 814145 JSB MODE CHECK SW. REG. 8348 08525 060175 LDA BITI HALT AT 99526 888810 0349 SLA ERROR BUFFER? **\$\$527 \$14614** 8356 JSB POF YES. 0351 89530 868532 LDA AS1 RESTORE A NO. 0352 00531 124522 EXIT SUBROUTINE JN≠ EBH,I 0353 00532 000000 AS1 OCT Ø TEMPORARY STORAGE 0354+ 0355+ILLEGAL INTERRUPT SUBROUTINE #356+ 0357+FOR AN ILLEGAL TTY INTERRUPT, THE PROGRAM ADDRESS IS SAVED. 0358+ 8359 89533 888888 ILINT NOP ENTER SUBROUTINF 8368 00534 070543 STORE A STA AS2 88535 868533 8361 LDA +-2 STORE PROGRAM ADDRESS 88536 879637 8362 STA IA 09537 060544 9363 LDA IE STORE 88548 978536 STA E17 ERROR 17 8364 8365 00541 06P543 LDA AS2 RESTORE A 8366 88542 124533 JMP ILINT, I EXIT SUBROUTINE 88543 898888 A \$2 OCT P 0367 TEMPORARY STORAGE 0368 00544 009017 IE OCT 17 8369+ 8378+THE FOLLOWING PRINTS OUT THE RESULTS OF THE BASIC TEST. 0371+IN CASE OF FAILURE TO PRINT OUT, THE PROGRAM \$372+HALTS AT THE BEGINNING OF THE ERROR BUFFER. 8373+PRESSING "DISPLAY MEMORY" WILL SHOW WHICH ERRORS OCCURED. 0374+ 8375 88545 888888 POUT NOP #376 98546 187788 CLC P.C INITIALIZE, INTERRUPT OFF 0377 88547 986488 CLB 00558 014511 9378 JSB TOS FLAG SETT 8379 00551 024553 JMP ++2 YES. 8388 09552 014614 JSB POF NO. HALT AT ERROR BUFFER PREPARE TO 9381 88553 868665 LDA SC2 88554 878666 0382 STA M16 PRINT OUT 8383 88555 868667 LDA SI3 ERROR CODES 8384 98556 878557 STA P4 88557 864628 0385 P4 LDB E1 LOAD B WITH 88568 834557 8386 ERROR STORAGE 98561 886582 9387 87B ZEROT 8388 88562 824566 JHP ++4 NO. 0389 88563 834666 ISZ MIG YES. PARTIALLY DONE? 00554 024557 0390 JNP P4 NO. 8391 00565 024574 JHP P5 YE8. CHECK INTERRUPT ERRORS 0392 88566 868678 LDA E PRINT 0393 88567 814786 JSB OYNA OUT 8394 89578 814733 JSB POUT2 ERROR 0395 89571 914752 JSB EOL CODE 8396 00572 914522 JSB EBH HALT AT ERROR BUFFERT 8397 00573 024563 JMP +-108 NO. 8398 00574 064636 P5 LDB E17 E17 = #7 0399 88575 886983 SZB,RSS

YES. JMP P6 88576 824618 0400 NO. 00577 A60670 LDA E 8401 JSB OYNA PRINT OUT 9482 00600 014706 JSB POUT2 ERROR CODE 00601 014733 0403 AND LDA SI4 6464 00602 060705 PROGRAM ADDRESS JSB MPO 6465 00603 015003 WHEN ERROR 88684 868637 LDA IA 8496 OCCURREN 99695 915926 JSB OPA 8487 LINE FEED JSB EOL 0498 88686 814752 LINE FEED 88687 814752 JSR EOL 8489 PRINT SECOND 98618 969664 P6 LDA SI2 0410 JSB SMPOC BT MESSAGE 00611 014765 8411 HALT AT ERROR BUFFER? JSB EBH 88612 814522 0412 ND. EXIT ROUTINE 00613 124304 JMP BT, I 0413 00614 000000 POF NOP 0414 PUT PROGRAM ADDRSSS LDA +-1 0415 00615 060614 FOR PRINT FAILURE 00616 064614 LDB +-2 0416 HET 55R INTO A AND R 00617 102055 8417 0418+ 8419+ERROR BUFFER 8428+ OCT Ø SFC TRUE AFTER CLC M,C 88628 888888 E 1 0421 SFS FALSE AFTER CLC 9.C 0CT 0 88621 8888888 E2 0422 SFC FALSE AFTER CLF TTY 0CT 0 0423 88622 888888 E 3 0CT 0 TRUE AFTER CLF TTY 88623 888848 **E4** SFS 0424 CLF TTY AND STC SFC FALSE AFTER E5 OCT Ø 80A24 888888 0425 CLF TTY AND STC SFS TRUE AFTER 88625 8888888 E6 OCT Ø 8426 NO INTERRUPT AFTER STC TTY, STF 0 OCT B 0427 88626 88888R E7 SFC TRUE AFTER INTERRUPT 08627 800908 E10 OCT 0 0428 SFS FALSE AFTER INTERRUPT OCT 8 E11 00630 000000 0429 DATA CLOCK ON TTY BOARD TOO FAST OCT 9 00631 000000 E12 0430 DATA CLOCK ON TTY BOARD TOO SLOW OCT @ 00432 000000 E13 0431 DATA BUFFER ERROR E14 OCT M 08433 888898 0432 OCT Ø CLOCK ENABLE FLIP-FLOP SET E15 88634 889888 0433 CLOCK ENABLE FLIP-FLOP NOT SET OCT Ø 80635 886888 E16 8434 ILLEGAL INTERRUPT FROM TELETYPE OCT Ø 88636 888898 E17 0435 PROGRAM ADDRESS AT TIME OF E17 88637 888888 TA. 001 0 0436 00640 177777 OCT 177777 FRROR BUFFER TERMINAITON 0437 RETURN TO MAIN PROGRAM JHP MP1 08641 024124 0438 8439+ 20642 041105 BTM1 ASC 8, BEGIN BASIC TEST 8448 00643 043511 88844 84774H 88645 841191 00646 051511 00647 041440 00650 052105 89651 851524 OCT R 00652 000000 9441 LDA BTM1 07653 060642 ST1 8442 ASC 7, END BASIC TEST 9443 00654 042516 BTM2 00655 042940 00656 041101 00457 051511 00660 041440 00661 052105 00662 051524

8444 88663 888888 001 0 0445 00664 060654 \$12 LDA BTM2 8446 00665 177762 SC2 OCT 177762 0447 00666 000000 M16 OCT Ø 8448 00667 064620 \$13 LD9 E1 00579 000305 8449 E OCT 305 8458 88671 828848 PRAD ASC 11. PROGRAM ADDRESS = 88672 828128 00673 051117 00674 843522 90675 040515 00676 020101 00677 042104 00700 051105 90701 051523 88782 828875 00703 020040 0451 00704 000000 OCT Ø 00705 060671 6452 S14 LDA PRAD 0453+ 0454+PRINT LEAST SIGNIFICANT & BITS OF A. 0455+ 0456 00706 000000 OYNA NOP ENTER SUBROUTINE 8457 00797 107709 CLC 0,C INITIALIZE, INTERRUPT OFF 0458 00710 070731 STA AST STORE A 0459 00711 074732 STB BS1 STORE B 00712 060727 0460 LDA OYN PUT BUFFER INTO OUTPUT 9461 00713 102600 OTA4 OTA Ø AND PRINT MODE 0462 00714 060731 LDA AS3 RESTORE A 0463 00715 010463 AND MSK2 DUTPUT LEAST 8464 83716 102630 OTA5 OTA Ø SIGNIFICANT 8 0465 00717 103700 STCC2 STC 0.C BITS OF A 9466 09720 006400 CLB 0467 00721 014511 JSB TOS FLAG SET? 0468 80722 024724 JMP ++2 8469 00723 014614 JSB POF HALT AT ERROR BUFFER NO. 8478 88724 868731 LDA AS3 YES. RESTORE A P471 00725 064732 LDB BS1 PESTORE B 0472 00726 124796 JHP OYNA, I EXIT SUBROUTINE 00727 120000 8473 OYN OCT 120000 OUTPUT, PRINT, NO PUNCH 8474 88738 129882 SOYN OCT 124049 0475 88731 888888 AS3 OCT 0 TEMPORARY STORAGE 8476 88732 888088 851 OCT C TEMPORARY STORAGE 9477\* 8478+PRINT OUT TWO OCTAL NUMBERS 0479+ 0480 00733 000000 POUT2 NOP ENTER SUBROUTINE 8481 00734 P62901 LDA 1 OUTPUT 0482 89735 891100 ARS FIRST 0483 00736 801100 ARS NUMBER 00737 001100 0484 APS 00740 010751 0485 AND MSK5 0486 00741 030750 IOR MSK4 9487 88742 814796 JSB OYNA 0488 00743 060001 LDA 1 OUTPUT 8489 00744 010751 AND HSK5 SECOND 0490 00745 030750 TOR MSK4 NUMBER

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01021 061025

8491 88746 814796 JSB OYNA 0492 00747 124733 JMP POUT2.1 EXIT SUAROUTINE OCT 260 09758 009260 8493 MSK4 00751 000007 8494 MSK5 OCT 7 8495+ 8496+END OF LINE SUBROUTINE 8497+ ENTER SUBROUTINE 0498 00752 000000 NOP EOL 8499 00753 079762 STA AS4 STORE A 89754 868763 LDA CR CARRIAGE 0500 88755 814786 JSB OYNA RETURN 0501 LINE 0502 00756 060764 LDA LF 0503 00757 014706 JSB OYNA FEED P504 00760 060762 LDA AS4 RESTORE A EXIT SUBROUTINE JMP EOL, I 0505 00761 124752 007 0 TEMPORARY STORAGE 0506 88762 888888 AS4 OCT 215 00763 000215 CR 0507 0508 80754 808212 LF OCT 212 0509+ 0510+SUPPRESS MESSAGE PRINTOUT CHECK SUBROUTINE 0511+ SMPOC NOP 09765 200090 ENTER SUBROUTINE 0512 88766 871002 STA AS5 STORE A 0513 CHECK SW. REG. 00767 014145 JSB MODE 0514 LDA BIT2 SUPPRESS EXCESS 0515 00770 060176 0516 00771 002011 SLA,RSS PRINTING? 88772 824775 JMP ++3 NO. €517 YES. 0518 00773 061002 RESTORE A LDA AS5 JMP SMPOC, I EXIT SUBROUTINE 00774 124765 0519 0520 00775 061992 LDA AS5 RESTORE A 00776 015003 JSB MPO PRINT MESSAGE 0521 LINE FEED 0522 00777 014752 JSB EOL 0523 01000 014752 LINE FEED JSB EOL JMP SMPOC, I EXIT SUBROUTINE 01991 124765 0524 OCT P 9525 01002 000000 AS5 TEMPORARY STORAGE 0526+ 0527 \* MESSAGE PRINTOUT SUBROUTINE 0528+ 8529 81883 888888 MPO NOP ENTER SUBROUTINE 0530 01004 071005 STA ++1 LDA A 0531 01075 068080 LOAD & WORD 01006 035905 0532 0533 01007 002003 S7A,RSS WORD = #? 01010 125003 JHP MPO,I YES. EXIT SUBROUTINE 8534 JSB PACO NO. PRINT THE WORD 01011 015013 0535 0536 81912 825885 JMP ++5 REPEAT FOR NEXT WORD 0537\* **#538+PACKED ASCII CHARACTER OUTPUT SUBROUTINE** 0539+MOST SIGNIFICANT & BITS OF A REGISTER PRINTED FIRST. 0540+ **9541** 01713 000000 PACO NOP ENTER SUBROUTINE STORE A 01014 071025 STA AS6 9542 ALF 0543 01015 001700 PRINT 0544 01016 001700 ALF FIRST 0545 01017 010463 AND MSK2 CHARACTER 8546 81928 814736 JSB OYNA

LDA AS6

PRINT

0548 01022 010453 AND MSK2 SECOND 0549 01023 014706 JSB OYNA CHARACTER 0550 01024 125013 JHP PACO,T EXIT SURROUTINE 0551 01025 000000 AS6 OCT P TEMPORARY STORAGE 0552\* 0553+OCTAL PRINTOUT OF A 8554+ 2555 01926 000090 OPA NOP ENTER SUBROUTINE 0556 81927 881289 RAL 0557 01030 071042 STA AS7 STORE A 01931 011943 0558 AND MSK6 PRINT 0559 01932 030750 IOR MSK4 FIRST 0560 01033 014706 JSB CYNA NUMBER 0561 01934 015944 JSB NXT PRINT 0562 01035 015044 JSB NXT NEXT 0563 01036 015044 JSB NXT FIVE 0564 01037 015044 JSR NXT NUMBERS 01040 015044 0565 JSB NXT 0566 01041 125026 JMP OPA,I EXIT SURROUTINE 0567 01042 000000 A 87 OCT D TEMPORARY STORAGE 81043 088001 8568 MSK6 OCT 1 8569+ 0570+NEXT OCTAL CHARACTER OUTPUT 0571\* 81044 980000 0572 NXT NOP ENTER SUBROUTINE 0873 01045 061042 LDA AS7 PREPARE 01046 801208 0574 RAL THE 01047 001200 0575 RAL NEXT 0576 01050 001200 RAL NUMBER Ø577 01051 071042 STA AS7 FOR 01052 010751 0578 AND MSK5 OUTPUTING 8579 01053 030756 TOR MSK4 0580 01954 014706 JSE OYNA OUTPUT 01955 125044 8581 JHP NXT,I EXIT SUBROUTINE 0582\* 0583+ 9584+ 0585+PUNCH AND READ ROUTINE 9586+ 0587+TESTS TAPE PUNCH AND TAPE READER 9588+BY OUTPUTING ALL COMBINATIONS OF 8589+EIGHT BITS AND READING THEM BACK. 0590+ Ø591 21056 80P200 PAR NOP ENTER ROUTINE 0592 01057 107700 CLC P,C INITIALIZE, INTERRUPT OFF 8593 01060 006400 CLP 0594 01961 014511 JSB TOS FLAG SET? 01062 025064 0595 JMP ++2 YES. 01063 014614 0596 JSB POF NO. HALT AT ERROR BUFFER 8597 01064 061250 PRINT FIRST LDA ST7 01065 014755 0598 JSR SMPOC PAR NESSAGE 0599 01066 061070 LDA ++2 HALT TO 0600 01367 065070 LDB ++1 TURN ON 0601 81978 102092 HLT 2 PUNCH 0602 01071 061143 LDA ONY PREPARE TO 0603 01072 070727 STA DYN PUNCH TAPE 01073 015264 9694 JSB ZEROS PUNCH LEADER



0605 01074 003400 CCA OUTPUT ALL ONES 0606 81075 818463 AND MSK2 AS A BEBINNING 0607 01076 014706 JSB OYNA INDICATOR 0698 01077 002400 PUNCH CLA 8689 01100 015274 JSB .64CH ALL 0610 01101 015274 JSR .64CH COMBINATIONS 01102 061144 8611 LDA OYY OF EIGHT 0612 01103 070727 STA OYN BITS 0613 01104 060762 LDA AS4 0614 01105 015274 JSB .64CH 0615 01106 015274 JSB .64CH 8615 01107 015264 **JSB ZEROS** PUNCH 0617 01110 015264 JSB ZEROS TRAILER 8618 01111 015264 JSU ZEROS 01112 015151 0619 JSB PARE EXIT ROUTINE? 0620 01113 061115 LDA ++2 NO. HALT TO 0621 01114 065115 LDB ++1 LOAD TAPE 8622 01115 102003 HLT 3 INTO READER 0623 81116 861158 LDA INN PREPARE TO 9624 01117 070727 STA OYN READ 01120 002400 8625 CLA TAPE 0626 01121 014706 JSB OYNA READ A 8627 01122 106500 L184 LIB Ø CHARACTER 8628 01123 006003 CHARACTER = 07 SZB,RSS 3629 01124 025121 JMP +-3 YES. READ NEXT CHARACTER 0630 01125 015305 JSB R64CH NO. READ FIRST BLOCK 0631 01126 061145 LDA IYN 81127 878727 0632 STA UYN 0633 01130 061341 LDA AS11 0634 01131 015305 JSB R64CH READ SECOND BLOCK 01132 061146 6635 LDA INY 0636 01133 070727 STA OYN 6637 01134 061341 LDA AS11 0638 91135 015305 JSB R64CH READ THIRD BLOCK Ø1136 Ø61147 0639 LDA IYY 0640 01137 070727 STA OYN 0641 01140 061341 LDA AS11 8642 01141 015305 JSB R64CH READ FOURTH BLOCK JMP P7 8643 01142 025161 EXIT ROUTINE 0644 01143 110000 ONY OCT 110000 OUTPUT, NO PRINT, PUNCH 8645 01144 130000 OCT 130000 OYY OUTPUT, PRINT, PUNCH 0646 01145 160000 IYN OCT 169888 INPUT, PRINT, NO PUNCH 8647 01146 150000 INY OCT 150000 INPUT, NO PRINT, PUNCH 0648 01147 170000 144 OCT 179888 INPUT, PRINT, PUNCH 0649 01150 140000 INN OCT 146000 INPUT, NO PRINT, NO PUNCH 0650\* 0651+PUNCH AND READ EXIT SUBROUTINE 0652\* 01151 000000 0653 PARE NOP ENTER SUBROUTINE 0654 01152 071167 STA ASS STORE A 0655 01153 014145 CHECK SW. REG. JSB MODE 9656 91154 960200 LDA BIT4 EXIT THIS 0657 01155 002011 SLA,RSS ROUTINE? 0658 01156 025161 JMP ++3 YES. 0659 01157 061167 LDA ASS NO. RESTORE A 0660 01160 125151 EXIT SUBROUTINE JMP PARE, T 0661 01161 060730 P7 LDA SOYN RESTORE



0662	P1162	078727		STA	OYN	OUTPUT CODE
0663	01163	014752		JSB	EOL	LINE FEED
8664	01164	061263		LDA	518	PRINT SECOND
9665	01165	014765			SMPOC	PAR MESSAGE
0666		125056		-	PAR,I	EXIT ROUTINE
8667		000000	A 5 8	OCT	•	TEMPORARY STORAGE
\$668*		0000000	<b>A 3</b> 0		U	TERFURART STURAGE
		OUT ERROI				
		UUI ERRUI		THE		
8678*			Dor			
8671		000000	POE	NOP		ENTER SUBROUTINE
8672		071214			A\$9	STORE A
8673		060727			OYN	SAVE
0674		071215			AS10	STATE
6675	01174	060730		LDA	SOYN	
<b>0676</b>	01175	070727		STA	OYN	
9677	01176	014752		JSB	EOL	LINE FEED
8678	01177	061224		LDA	S15	PRINT "OUTPUT ="
0679		015003		JSB		
0680		061214			ASQ	RESTORE A
8681		015026			OPA	PRINT OCTAL NUMBER
8682		061234		LDA		PRINT "INPUT ="
0683		015003			MPO	TAINT INFOL -
						DRINT COTAL
8684		060001		LDA	1	PRINT OCTAL
0685		015026			OPA	NUMBER
0686		014752			EOL	LINE FEED
0687		061215			ASIØ	RESTORE
0688	01211	070727		STA	OYN	STATE
0689	01212	061214		LDA	AS9	RESTORE A
8698	01213	125170		JMP	POE,I	EXIT SUBROUTINE
0691	01214	0009990	A \$ 9	0CT	•	TEMPORARY STORAGE
9692		8988888	ASIO	0CT		TEMPORARY STORAGE
Ø693		047525	00		5, OUTPUT	8
		852128	-			
		052524				
		P20075				
		020040				
8694		9999999		σςτ	a	
8695			0 1 K			
		061216 02 <b>5</b> 040	S15	LDA		
0696		020040	01	ASC	0, 10,	PUT =
		020040				
		044516				
		050125				
		052940				
		036440				
8697	01233	9669960		DCT	8	
8698	01234	061225	S16	LDA	10	
8699	01235	041195	PARM1	ASC	10, BEGIN	PUNCH AND READ
	01236	043511				
		047040				
		050125				
		047103				
		044040				
		040516				
	-	042040				
		051105				
	01246	040504				
0700	01247	889988		OCT	A	

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0701 01250 061235 SI7 LDA PARMI 0702 01251 042516 PARM2 ASC 9, END PUNCH AND READ 01252 042040 01253 050125 01254 047103 01255 044040 01256 040516 01257 042040 01260 051105 01261 048504 0703 01262 000000 007 0 0784 01263 061251 LDA PARM2 518 8785+ 0706+OUTPUT BLANK TAPE 0707\* 0708 ZEROS NOP 01264 000909 ENTER SUBROUTINE 01265 002400 0709 CLA 0710 01266 065273 LD8 \$C3 0711 01267 014706 JSB OYNA OUTPUT ZERO 0712 01270 006006 INB, SZB 32 ZEROS? 01271 025267 0713 JMP +-2 NO. 8714 01272 125264 JNP ZEROS, I YES. EXIT SUBROUTINE 01273 177740 0715 SC3 OCT 177740 8716\* 9717+INCREMENT AND OUTPUT A REG. 64 TIMES 9718+ 8719 01274 000000 .64CH NOP ENTER SUBROUTINF 8728 81275 865384 LDB SC4 RESET COUNTER 0721 01276 014706 JSB OYNA OUTPUT A 8722 01277 002004 INA INCREMENT OUTPUT WORD 0723 01300 006006 INB, SZR 64 CHARACTERS? 01301 025276 0724 JM₽ +=3 NO. 0725 01302 014752 JSB EOL YES. 0726 01303 125274 JMP .64CH,I EXIT ROUTINE 0727 01304 177790 SC4 OCT 177700 0728\* 9729\*READ AND CHECK 64 CHARACTERS 0730\* 0731 01305 8888800 R64CH NOP ENTER SUBROUTINE #732 01306 065304 LDB SC4 RESET 0733 01397 075340 STB M64 CHARACTER COUNTER 0734 01310 014706 P8 JSB DYNA READ A 0735 01311 106500 L185 LIB Ø CHARACTER 0736 81312 015151 JSB PARE EXIT ROUTINE? 01313 050001 0737 CPA 1 ERROR7 NO. 0738 01314 025316 JMP ++2 NO. 0739 01315 015170 JSB POE YES. PRINT OUT ERROR 01316 002004 0740 INCREMENT REFERENCE INA 0741 01317 035340 132 M64 64 CHARACTERS? 0742 01320 025310 JHP P8 NO. 0743 81321 071341 STA AS11 YES. STORE A 0744 01322 060763 LDA CR CHECK FOR 0745 01323 014706 JSB CYNA CARRIAGE 0746 01324 106500 L186 LIB Ø RETURN 8747 01325 050001 CPA 1 ERROR? 0748 01326 025330 NO. JMP ++2 0749 01327 015170 JSB POE YES. PRINT OUT ERROR

0750 01330 060764 LDA LF CHECK FOR 0751 01331 014706 JSB DYNA LINE FEED 6752 01332 106500 L187 LIB Ø 0753 01333 050001 ERROR? CPA 1 0754 01334 025336 JMP ++2 NO. YES. PRINT OUT ERROR 01335 015170 JSB POE 0755 RESTORE A 0756 01336 061341 LDA AS11 0757 01337 125305 JMP R64CH,I EXIT SUBROUTINE OCT 177790 01340 177700 0758 M64 TEMPORARY STORAGE 8759 01341 000000 AS11 007 0 0760+ 8761\* 0762+ 8763+PRINT AND KEYBOARD ROUTINE 8764+ 01342 000000 PAK ENTER ROUTINE 8765 NOP 01343 107700 INITIALIZE, INTERRUPT OFF 0766 CLC Ø,C 01344 060730 LDA SOYN PREPARE B767 TO PRINT 01345 070727 STA OYN 0768 PRINT FIRST 01346 061423 LDA 519 0769 01347 014765 JSB SMPOC PAK MESSAGE 0778 PRINT 54 ASCII CHARACTERS 0771 01350 015464 JSB PRALL 01351 015464 JSB PRALL PRINT 64 ASCII CHARACTERS 0772 LINE FEED 01352 014752 JSB EOL 0773 JSB PAKE EXIT ROUTINE? 0774 01353 015372 NO. PRINT SECOND Ø775 01354 061446 LDA SI10 01355 014765 JSB SMPOC PAK MESSAGE 0776 P9 PREPARE TO READ 01356 061150 LDA INN 8777 IN FROM KEYBOARD 01357 102660 OTA6 OTA Ø 0778 JSB PAKE EXIT ROUTINE? 01360 015372 P10 0779 STCC3 STC Ø,C NO. 0780 01361 103700 WATT FOR INPUT 9781 01362 006400 CLB ANY INPUT? 01363 014511 JSB TOS 0782 01364 025366 YES. 0783 JHF ++2 01365 025360 JHP P10 8784 NO. 6785 01366 106500 L188 LIB Ø LOAD DATA INTO B 01367 060001 PUT B INTO A 0786 LDA 1 JSB OYNA 01370 014706 DUTPUT A 0787 JMP P9 READ NEXT CHARACTER 9788 01371 025356 8789\* 0790+PRINT AND KEYBOARD EXIT 0791+ 01372 000000 ENTER SUBROUTINE PAKE NOP 0792 0793 01373 071214 STA AS9 STORE A CHECK SW. REG. 0794 01374 014145 JSB MODE 0795 01375 060201 LDA BIT5 FXIT THIS 8796 01376 002011 SLA, RSS ROUTINE? 0797 01377 025402 JMP ++3 YES. N0. 01400 061214 RESTORE A 0798 LDA AS9 EXIT SUBROUTINE 0799 01401 125372 JMP PAKE,I 6800 01402 014752 JSB EOL 01403 061463 PRINT THIRD 0801 LDA ST11 JSB SMPOC PAK MESSAGE 0802 01404 014765 JMP PAK,I EXIT ROUTINE 0803 01405 125342 PAKM1 ASC 12, BEGIN PRINT AND KEYBOARD 0804 01406 041105 01407 043511 01410 047340



## PAGE 0016 #01

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	01411	050122				
	01412	044516				
	01413	052040				
	01414	040516				
	01415	042040				
	01416	045505				
	01417	054502				
	01420	047501				
	01421	851104				
0805	01422			OCT	Ø	
0806	01423	861496	519			
9897		052523		-		KEYBOARD SLOWLY (5 CHS./SEC.)
	01425	842448			·	
	01426	645585				
	01427	054502				
	01430	047501				
	01431	851184				
	01432	020123				
	01433	846117				
	01434	053514				
	01435	054440				
	01436	024065				
	01437	020103				
	01440	844123				
		027057				
		051505				
	01443	041456				
	-	024440				
8888	_	000000		OCT	•	
0809		061424	ST10		PAKM2	
P810		842516				PRINT AND KEYBOARD
		842848				
		858122				
		044516				
		052040				
		040516				
		042040				
	01456	045505				
	01457	054502				
	01460	047501				
	01461	051104				
0811	01462	888888		100	0	
0812	01463	061447	SI11		PAKM3	
9813+				_		
0814+	PRINT	ALL CHAR	ACTERS	SUB	ROUTINE	
0815+						
0816	01464	80000	PRALL	NO	P	ENTER SUBROUTINE
0817	01465	061472		LDA	SC5	PRINT FIRST
0818	01466	015474		JSB	.32CH	LINE OF CHARACTERS
0819	01467	061473			SC6	PRINT SECOND
		015474			.32CH	- · ·
		125464			•	EXIT SUBROUTINE
		000300	SC5		300	· · · · · · · · ·
0823		000240			240	
8824+				•••		
	PRINT	32 CHARA	CTERS S	SURRI	DUTINE	
8826+						
Ø826=						

0827	01474	8888888	.32CH	NOP		ENTER SUBROUTINE
0828	01475	075506	-	STB	852	STORE B
8829	01475	865273			SC3	RESET COUNTER
0830	01477	014706			OYNA	PRINT A
0831	01500	082094		INA		INCREMENT A
0832	01501	886886		INB	SZB	32 CHARACTERS?
0833	01502	025477		•	+-3	NO. PRINT NEXT CHARACTER
0834	01503	014752		JSB	EOL	YES. LINE FEED
0835	01504	865586		LDB	852	RESTORE B
0836	01505	125474		JMP	.32CH,I	
8837	01506	000000	882	OCT		TEMPORARY STORAGE
0838				END		
** N	O ERROI	RS+				



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## 2115A BUFFERED

## TELETYPE TEST

Binary Tape - HP20420A

Source Listing- HP20420AL





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868.	1		ASMB, A, B, L
**	ΝÜ	ERRORS	• • • •





PAGE 0002 #01

0001 ASMB, A, B, L 0002+ 0003\* 8664+ 8005+BUFFERED TELETYPE DIAGNOSTIC 8086+ 0007 \* 0008+ 0009\*STARTING UCTAL ADURESS = 100 0010++++ 0011+THE FULLOWING SWITCH REGISTER SETTINGS 0012\*ARE USED FOR PROGRAM CONTROL 8013\* HALT AT BEGINNING OF PROGRAM 0014+BIT r = 1-> 0015+817 1 = 1 -> HALT AT ERROR BUFFER SUPPRESS MESSAGE PRINTOUT 0016+811 2 = 1 -> 0017\*BIT 3 = 1 -> PERFORM BASIC TEST POUTINE 4 = 1 PERFORM PUNCH AND READ ROUTINE 0618+B1T -> PERFORM PRINT AND KEYBOARD ROUTINE 0619\*B11 5 = 1 -> 6020\*\*\*\* 6021+ 0022\* 0023+MAIN PROGRAM NK24+ 0025 00 177 URG 778 00377 102000 HLT Ø 0026 END 00100 107700 INITIALIZE, INTERRUPT OFF 0027 CLC Ø,C 8628 00101 102501 PUT TTY 0029 00102 010141 AND MSKA ADDRESS 8030 00103 070277 STA BTA INTO ALL I/O 00104 014243 INSTRUCTIONS 0031 JSE INIT 00145 064142 LDB M67 PREPARE 8632 0033 00146 060143 LDA HIS TRAP FOR 0034 00107 070111 STA #+2 ILLEGAL 0035 80110 000144 LUA HI 00111 070010 0036 STA 10B INTERRUPT 0037 00112 034111 187 +-1 FHOM TNA 0030 00113 002004 ANOTHER 00114 006406 0639 INH, SZA DEVICE 00115 024111 JMP +-4 6440 PREPARE ILLEGAL TTY 00116 060431 0041 LDA III 0042 00117 070000 STA1 STA 🖌 INTERRUPT TRAP 60120 014720 JSP EUL LINE FEED 0643 HALT TO CHOUSE 0244 00121 060123 LDA \*+2 SWITCH REGISTER 1645 00122 004123 LDB ++1 00123 102001 HLT 1 OPTIONS 0040 WV:47 00124 014145 MP1 JSH MODE CHECK SW. REG. LDA BIT3 PERFORM 00125 060177 0:48 9449 00126 000010 BASIC TEST? SL A 0000 00127 014300 JSB ET YES. NO. CHECK SW. REG. 6651 00131 014145 JSB MUDE LDA BIT4 PERFORM 0052 01131 060200 00132 009010 SLA PUNCH AND READ? 0053 JSH PAR YES. 8054 00133 015924 CHECK SW. REG. 1055 JSB MUDE N9\_ 00134 014145 LDA BIT5 PERFORM 0050 00135 060201 0057 00136 000010 SLA PRINT AND KEYBOARD?

0058 00137 015310 YES. JSR PAK 0059 00140 024124 JMP MP1 NO. 0060 00141 000077 MSKØ OCT 77 0061 00142 177711 M67 007 177711 00143 070010 0062 HIS STA 10B 8463 00144 102010 ΗŢ HLT 10B 6004\* 0065+SWITCH REGISTER MONITORED **WM66\*FOR CURRENT OPERATING MODE** 1057+ 8068 88145 8888888 MODE NOP ENTER SUBROUTINE 80146 070173 0069 STA ASU STORE A 8670 00147 102501 LIA 1 EACH BIT 0071 00150 070174 STA BITO FROM THE 0072 00151 001300 HAR SWITCH REGISTER 0073 00152 070175 STA BITI IS ROTATED 0074 00153 001300 RAR INTO THE 00154 070176 0075 STA RIT2 LEAST SIGNIFICANT 1016 00155 001300 RAP POSITION AND 0077 80156 870177 STA BIT3 STORED IN THE 0078 00157 001300 HAR STORAGE LOCATION 00160 070200 0079 STA BIT4 BEARING ITS NAME 00161 001300 0000 KAR 00162 070201 0081 STA BIT5 80153 864174 HALT AT BEGINNING N695 LDA BITØ 00154 002011 6683 SLA, MSS DE PROGRAM? 0084 00165 024171 JMP ++4 NO. LDA HAD 0085 00166 060212 YES. LOAD A AND H 00157 064202 0800 LDB HAD WITH 100 0087 00175 024377 JMP ENN AND HALT 0088 00171 004173 LDA AST RESTORE A 00172 124145 JMP MODE, T 0009 EXIT SUBROUTINE 00173 0000000 1991 ASU N TOO TEMPORARY STORAGE 00174 000000 NN41 dITØ OCT Ø 9192 00175 0000000 0 CT @ 6111 6693 00176 000000 81T2 OCT 0 Øn94 00177 000000 6113 0CT 0 0095 00200 000000 OCT Ø BI14 0098 80201 000000 B115 0 CT 4 0091 00202 000100 OCT INA HAU 0098\* 0099+ 0100+INITIALIZATION ROUTINE 6101\* 0102\*THIS RUUTINE ADDS THE BUFFERED TELFTYPE ADDRESS IN 2103+ALL I/O INSTRUCTIONS. 6104+ 0105+ 0106 03223 000000 INIT NOP ENTER ROUTINE 6167 00234 107790 CLC M,C INITIALIZE, INTERRUPT OFF 0108 00215 014270 JSR AUTN PUT TIY ADDRESS 00200 102300 SFS M INTE SES INSTRUCTIONS 0109 10207 070332 STA SES1 0110 00210 070341 STA SES2 0111 0112 01211 072351 STA SFS3 6113 00212 070313 STA SFS4 1114 00213 070452 STA SES5





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0115	00214	014210	JSB ADIN	PUT TTY ADDRESS
0116		102200	SFC Ø	INTO SEC INSTRUCTIONS
0117		073326	STA SECI	
Ø118		070336	STA SEC2	
0119		070346	STA SFC3	
0120		070367	STA SFC4	
0121		014270	JSB ADTN	PUT TTY ADDRESS
0122		102600	OTA U	INTO OTA INSTRUCTIONS
0123		070407	STA OTAL	
0124		078442	STA UTA2	
0125		070561	STA OTA3	
0126		070664	STA UTA4	
0127	00230	071325	STA UTA5	
0128	00231	014270	JSB ADIN	PUT TTY ADDRESS
0129	00232	103700	STC 0,C	INTO STC,C INSTRUCTIONS
0130	00233	079411	STA STOCI	
0131	00234	070565	STA STOC2	
1132	00235	071327	STA STOC3	
0133	00236	014270	JSB ADIN	PUT TTY ADDRESS
0134	00237	106700	CLC Ø	INTO CLC INSTRUCTION
0135	00248	070412	STA CLC1	
0136	00241	014270	JSB ADIN	PUT TTY ADDRESS
0137	00242	102700	STC Ø	INTO STC INSTRUCTION
0138	00243	070345	STA STO1	
N139	60204	014270	JSB ADIN	PUT TTY ADDRESS
0140	00245	103100	CLF 0	INTO CLF INSTRUCTION
6141	00246	010335	STA CLF1	
8142	00247	614270	JSB AUTN	PUT TTY ADDRESS
6143	00250	102100	STF И	INTO STE INSTRUCTION
1144		079360	STA STF1	
0145		014270	JSB ADIN	PUT TTY ADDRESS
0146		105500	LIB	INTO LIB INSTRUCTIONS
6147		070443	STA LIHI	
Ø148		071070	STA LIH2	
0149		071257	STA LIH3	
0150	80257		STA LIH4	
0151		071300	STA LIB5	
0152		071334	STA LIA6	
0153		014270	JSB AUTN	PUT TTY ADDRESS
0154		670000	STA Ø	INTO STA INSTRUCTIONS
1155		074117	STA STA1	
0156		070356	STA STA2	
0137		070366	STA STAJ	
0158		124213	JAP INII,I	EXIT ROUTINE
Ø159*		0	61-0 mm+ <b>T</b> t tom	
		S INCLUSION		1 N. 7 ()
			DDRESS IS PUT	
		STRUCTION FL	LLOWING JSB A	
0163= 4164		104 86666	N NOP	ENTER SUBROUTINE
И164 Ю165		000000 ADI 160270	LDA AUTNI	
0165		010276	AND MSK1	ADD TTY ADDRESS
0100 0107		030277	IOP BTA	TO INSTRUCTION
0168 0168		030270	ISZ ADIN	EXIT
169		124270	JMP ADIN,I	
0170		177700 MSH		
v171		000000 BT/		TTY ADDRESS STOPAGE
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8112\* Ø173+ 9174 \* **W175+BASIC TEST ROUTINE** 0170+ 6177 \* THE FULLOWING TESTS THE FLAG, CONTROL, 0178+AND INTERRUPT CIRCUITRY 8179+ 0180 **88348 888488** BT NOP 6181 00301 107700 CLC Ø,C INITIALIZE, INTERRUPT OFF 0182 00302 460676 LDA SOYN RESTORE 0183 00303 070675 STA DYN OUTPHT CODE 0184 00394 064621 LDA SI1 PRINT FIRST 0185 00305 014733 JSH SMPOC BT MESSAGE 0186 00300 000400 CLB CLEAR 0187 88307 874570 STR E1 ERROR 0188 00310 074571 STH E2 BUFFER 0189 00311 074572 STR E3 0190 00312 074573 STH E4 0191 00315 074574 STH 15 0192 30314 474575 STR E6 1143 00315 074576 STB E7 0194 00316 074577 STB E10 0195 00317 074630 STR E11 0196 00320 074601 ST8 E12 6197 00321 074602 STR E13 0198 00322 074543 ST8 E14 0199 00323 074644 STR E15 0200 00324 074605 STP IA 0201 00325 006004 INCREMENT ERROR CODE INB 0202 80321 102200 SFC1 SFC U FLAG CLEAR? 00327 024331 0203 JMP ++2 NO. 00330 074570 4204 STB E1 YES. ERROR 1 1205 00331 006004 INB INCREMENT ERROR CODE 12N6 00332 102340 SF 51 SFS A FLAG SET? 4201 00333 074571 STB E2 N0. ERROR 2 9508 00334 006744 INF YES. 0293 60335 103100 CLF1 CLF Ø CLEAR FLAG 8210 00336 102200 SFC2 SFC M FLAG CLEAR? 6211 00337 074572 STB E3 NO. ERPOR 3 ¥212 00346 000004 INB YES. 00341 102300 ¥213 SFS2 SFS 0 FLAG SET? 4214 00342 024344 JMP ++2 NO. 6215 00343 074573 ST5 E4 YES. ERRUR 4 +216 00344 006MM4 INR 00345 102700 \$217 STC1 STC M SET CONTROL 0218 00346 102200 SFU3 SFC 0 FLAG CLEAR? 1219 00347 074574 STB E5 NO. ERROR 5 00350 006004 0220 INB YES. \$221 00351 102300 SF 53 SFS N FLAG SET? 0222 00352 024354 JMP ++2 NO. 0223 00353 074575 STR ED YES. ERROR 6 8224 80354 886204 INB 0225 00355 064400 PREPARE TO TEST LDA IJ1 0226 80356 878880 STA2 INTERRUPT SYSTEM STA P 0227 00357 102100 STE £\* TURN UN INTERRUPT SYSTEM 1228 00360 102100 STF1 STF N SET FLAG

08443 105500

1205

L161

L18 0

6229 99361 000000 NOP WAIT FOR 0230 00362 000000 NOP INTERRUPT 00363 074576 NO INTERRUPT - ERROR 7 0231 STB E7 INTERRUPT ENTRY INB 8232 00364 006004 Ρi 0233 00365 060401 LDA IIJ RENEW ILLEGAL 0234 00366 070000 STA3 STA Ø INTERRUPT TRAP 0235 80367 102200 SFC4 SFC @ FLAG CLEAR? 0236 88378 824372 JMP ++2 NO. YES. ERROP 10 6237 80371 074577 ST8 E10 6238 00372 006004 INB 0239 00373 102300 SFS4 SFS Ø FLAG SET? 00374 074600 ST8 E11 NO. ERROR 11 0240 00375 006004 0241 INP YES. 00376 074442 STORE ERROR CODE 0242 STR ERNO 0243 00377 024403 JMP TOUT 00400 024304 0244 1 J 1 JMP P1 JSB ILINT 0245 00401 014503 113 FRROR CODE STORAGE 60442 800000 EKNO OCT Ø 0246 0247 \* 0248\*THE FOLLOWING TESTS THE TIME FOR OUTPUTING ONE CHARACTER. 0249\* 6250 00443 000000 TOUT NOP 00004 107700 CLC 0,C INITIALIZE, INTERRUPT OFF 0251 0252 00405 102100 STF Ø INTERRUPT ON PUT INTO OUTPUT, NO W253 00406 004432 LDA ONN 0254 00107 102600 GTAL OTA Ø PRINT, NO PUNCH MODE 00410 064433 LDB TOCL 0255 CHECK 00411 103700 STCC1 STC 0,C 0256 LOWER 4257 00112 100700 CLC1 CLC N TIME LIMIT FLAG SET? W258 00013 014401 JSH TOS 00414 024416 JMP ++2 YES. DATA CLOCK TOO FAST 0259 N0. 0200 00415 024420 JMP ++3 ERROR 12 9261 38416 864412 LDB ERNO 00411 074511 STB E12 0202 00420 034442 INCREMENT ERROR CODE 0263 ISZ ERNO 6264 00421 000000 NOP CHECK UPPER 88422 864434 LOB TOC2 TIME LIMIT 0265 00423 014401 JSB TOS FLAG SET? 0206 0267 YES. TIMING OK 00424 124427 JMP +3 NO. DATA CLOCK TOO SLOW 88425 864442 LDB ERNO 0268 00426 874602 ERROR 13 0209 STH E13 00427 034412 0270 IST ERNO INCREMENT ERROR CODE 00430 000000 NOF 0271 JMP DT 0272 00431 024435 001 100000 OUTPUT, NO PRINT, NO PUNCH 30432 139900 0273 UNN UCT 142000 TIMEOUT CONSTANT 1 8274 00033 142000 TOCE TIMEOUT CONSTANT 2 0275 03434 175700 1002 OCT 176700 0276\* 0277\*THE FOLLOWING TESTS THE EIGHT BIT DATA HUFFER. 0278\* 00405 300700 UT. 0279 NOP INITIALIZE, INTERRUPT OFF 00436 107700 CLC 6.C 6260 00437 002400 9281 CLA STA CURWD 0282 88448 878407 92 OUTPUT THE AND MSK2 CURRENT 00441 014455 . . . 8 **3** WORN 00442 102600 UTA2 GTA V 1284

0286 00444 050901 CPA 1 INPUT = OUTPUT ?0287 00445 024450 JMP P3 YES. 0288 00446 060402 LDA ERNO NO. ERROR 14 0589 88447 878683 STA E14 0290 00450 000457 P3 LDA CURWD INCREMENT 8291 00451 002006 INA, SZA CURRENT WORD 0292 00452 024440 JMP P2 0293 00453 014472 JSB EBH HALT AT ERROR BUFFER? 0294 00454 024515 JMP FOUT NO. 00455 000377 0295 MSK2 OCT 377 0296 88456 888238 MSK3 0CT 200 00457 000000 0297 CURWD OCT 0 0298 00460 000000 NBE 9 T 10 0249+ **U300+FLAG TIMEOUT SUBROUTINE** 0301+ 0302+TIMEOUT CONSTANT IN B 0303+1F "FLAG" BEFORE TIMEOUT, EXIT TO TUS. IF NOT, 0304+EXIT TO TOS + 1. ONE ITERATION = 6.4 MICROSEC. 0305+ 0300 00461 000000 105 NOP ENTER SUBROUTINE 00462 102300 0307 SFS5 SFS Ø FLAG SET? 0308 00463 024465 JMP ++2 0309 80464 124461 JMP TOS, I YES. FXIT THROUGH TOS 0310 80465 086806 INB, SZB NO. TIMEOUT YET? 0311 00466 024462 JMP SFS5 REPEAT NU. 00467 034451 1312 187 TUS YES. EXIT 00470 000000 0313 THROUGH NOP 0314 00471 124401 JMP TOS, I 105 + 11315+ 0316+ERROR BUFFER HALT SUBROUTINE 2517\* 88472 883488 0318 EBH NOP ENTER SUBROUTINF 00473 070502 \$319 STA AS1 STORE A 00474 014145 0320 JSB MODE CHECK SW. REG. 0321 00475 000175 LDA BITI HALT AT 1322 03476 000410 SL 4 ERROR BUFFER? 0323 00477 014564 JSB POF YES. 1324 00500 060502 LDA AS1 NU. RESTORE A 1325 00501 124472 JMP EBH, I EXIT SUBROUTINE 6326 80502 8082408 AS1 UCT 0 TEMPORARY STORAGE 2327 + 0328+ILLEGAL INTERRUPT SUBPOUTINE 1329\* P330\*FOR AN ILLEGAL TTY INTERRUPT, THE PROGRAM ADDRESS IS SAVED. ¥331× 9332 83583 8888888 ILINT NOP ENTER SUBROUTINE 1333 00544 070513 STA AS2 STORE A 00505 060513 0334 STORE PROGRAM ADDRESS LDA +-2 N335 00506 070605 STA IA 00517 060514 0336 LDA IE STORE 0337 00510 070604 STA E15 ERROR 15 0338 00511 060513 LDA AS2 RESTORE A 0339 03512 124503 JMP ILINT, I EXIT SUPROUTINE 0340 00513 000000 NCT W AS2 TEMPORARY STORAGE 0341 00514 000015 IE UCT 15 0342+

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0343+THE FOLLOWING PRINTS OUT THE RESULTS OF THE BASIC TEST. 0344+1N CASE OF FAILURE TO PRINT OUT, THE PROBRAM 0345+HALTS AT THE BEGINNING OF THE ERROR BUFFER. 0346\*PRESSING "DISPLAY MEMORY" WILL SHOW WHICH ERRORS OCCURED. 0347+ 0348 00515 000000 POUT NOP 6349 00516 107700 INITIALIZE, INTERRUPT OFF CLC 0.C 0350 00517 006400 CLB 0351 00520 014461 **JSB T08** FLAG SET? 0352 00521 024523 JMP ++2 YES. \$353 00522 014564 NO. HALT AT ERROR BUFFER JSR POF 00523 060633 0354 PREPARE TO LDA SC2 PRINT OUT 0355 00524 070634 STA M14 9356 00525 060635 LUA 513 ERROR CODES 0357 00526 074527 STA P4 0358 00527 064570 P4 LUAD B WITH LDB E1 0359 00530 034527 152 +-1 ERROR STORAGE 00531 006202 0360 SZH ZERO? ND. 0361 JU532 024536 JMP ++4 00533 034634 0362 PARTIALLY DONE? 157 M14 YES. JMP P4 NO. 1363 00-34 024527 00535 024544 6364 JMP P5 YES. CHECK INTERRUPT ERRORS 00536 060636 0305 PRINT LDA E 00537 014654 0366 JSB GYNA OUT 1367 00540 014701 JSB POHT2 ERROR 1368 00541 014720 JSB EOL CODE 0369 00542 014472 HALT AT ERROR BUFFER? JSB EBH 0370 00543 024533 JMP #=106 NO. 0371 00544 064694 ۲5 LD9 E15 E15 = 9?6372 00545 005003 SZB, RSS 6373 00546 024560 JMP P6 YES. 00547 060636 4374 LDA E NC. 0375 00550 014654 JSB GYNA PRINT OUT 03551 014701 1370 JSB POHT2 ERROR CODE 0377 00552 060653 LDA SIA  $A \sim D$ JSH MPO 0378 00553 014751 PROGRAM ADDRESS 0379 00554 060505 LDA IA WHEN ERROR 0380 00555 014774 JSB OPA OCCURREN 0381 00556 014720 JSB FOL LINE FEED 0382 00557 014720 JSR EOL LINE FEED PRINT SECOND 0383 83564 864632 46 LDA SI2 0384 00561 014733 JSR SMPOC BT MESSAGE 0385 00562 014072 JSR EBH HALT AT ERROR BUFFER? NO. EXIT ROUTINE 9386 00563 124300 JMP BT,1 20564 000200 0387 POF NOP PUT PROGRAM ADDRSSS 0388 30565 060564 LDA ==1 6389 00566 064564 FDB +-5 FOR PRINT FAILURE 0390 00567 102055 HLT 55H INTO A AND B 0391\* 0392\*ERROR BUFFER И**393**\* 0394 83570 888800 E 1 OCT Ø SFC TRUE AFTER CLC Ø.C 0395 83571 800000 E 2 OCT 0 SFS FALSE AFTER CLC Ø,C 0396 00572 000000 E 3 OCT 0 SFC FALSE AFTER CLF TTY 2397 00573 000000 E 4 N TOU SFS TRUE AFTER CLF TTY 7398 00574 000000 E 5 OCT W SEC FALSE AFTER CLF TTY AND STC 0399 03575 0000000 OCT 0 SFS TRUE AFTER £6 CLF TTY AND SIC

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							+
9488	00576		E7	OCT	0	NO INTERRUPT AFTER STC TTY, STF 0	
0491		888888	EIB	OCT		SFC TRUE AFTER INTERRUPT	
9492		000000	E11	OCT		SFS FALSE AFTER INTERRUPT	
8483		899999	E12	OCT		DATA CLOCK ON TTY BOARD TOO FAST	
8484		9999999	E13	OCT		DATA CLOCK ON TTY BOARD TOO SLOW	()
0405			-				
		000000	E14	OCT		DATA BUFFER ERROR	:
8496		888888	E15	OCT		ILLEGAL INTERRUPT FROM TELETYPE	ł
8467		0000000	IA	OCT		PROGRAM ADDRESS AT TIME OF E15	
9408		177777			177777	ERROR BUFFER TERMINAITON	
8489	00607	024124		JMP	MP1	RETURN TO MAIN PROGRAM	1
8419*							•
8411	88610	841105	BTM1	ASC	8, BEGIN	BASIC TEST	1
	00611	043511					
	00612	847848					
		041101					
	-	051511					ļ
		841448					
		052105					1.1
		651524					
					a		:
8412		000000	671	OCT			:
9413		060610	SI1		8TM1		1
0414		042516	BTM2	ASC	7,END BA	SICTEST	
		042040					-
	00624	041101					1
	00625	051511					
	00626	041440					
	80627	052105					
	00630	051524					
0415		8999999		OCT	0		
0415		060622	S]2		BTM2		199 <u>75</u> 2
8417		177764	SC2		177764		
0418		000000	M14	OCT			
0419		064570	\$13	LDB			
0420		000305			305		1
		-	E				
0421		020040	PRAD	ASC	11, PR	OGRAM ADDRESS =	
		020120					
		051117					
		043522					
		848515					
		020101					
	00645	042104					
	88646	051105					
	88647	051523					
	00650	020075					
		020040					
0422	-			001	6		L
8423		060637	S I 4		PRAD		
0424*			- • - •	~ ~ 1	· · · · · · · · · · · · · · · · · · ·		
	PRINT	FAST RI	ANTEIC	ANT	B BITS OF	A	
	- 15 A 19 E - 6		41-11-1U		S BETS OF	<b>¬</b> •	
0426*							!
8427		000000	OYNA	NOP		ENTER SUBROUTINE	:
0428		107790			0,0	INITIALIZE, INTERRUPT UFF	
0429		070677			AS3	STORE A	
0430		074740			8S1	STORE B	
0431		060675			OYN	PUT BUFFER INTO DUTPUT	Section 2
0432		102600	OTAJ	OTA		AND PRINT MODE	i ł
0433	00662	060677		LDA	A 9 3	RESTORE A	-
							t t

0490

00742 124733



0434 00653 010455 AND MSK2 DUTPUT LEAST 0435 00664 102500 OTA4 OTA 8 SIGNIFICANT 8 00665 103700 0436 STCC2 STC 0,C BITS OF A Ø437 00666 006400 CL8 0438 00667 014461 JSB TOS FLAG SET? 0439 00670 024672 JMP ++2 0440 00671 014564 NO. JSB POF HALT AT ERROR BUFFER 0441 88672 868677 LDA AS3 YES. RESTORE A 0442 00673 064700 LD9 881 RESTORE B 0443 00674 124654 JMP OYNA, I EXIT SUBROUTINE 8444 00675 120000 0YN OCT 120000 OUTPUT, PRINT, NO PUNCH 6445 88676 128888 SOYN OCT 120000 0446 00677 000000 ASS OCT @ TEMPORARY STORAGE 0447 00700 000000 851 9 T 20 TEMPORARY STORAGE 0448 + 0449+PRINT OUT THO OCTAL NUMBERS 0450+ 0451 00701 0000000 POUT2 NOP ENTER SUBROUTINE 0452 00742 060001 LDA 1 OUTPUT P453 00703 001100 ARS FIRST 00704 001100 0454 ARS NUMBER 6455 80705 801100 ARS 0456 00706 010717 AND MSK5 0457 00737 030716 IOR MSK4 8458 88710 014654 JSH UYNA 0459 00711 060401 LDA 1 DUTPUT 0460 00712 010717 AND MSK5 SECOND 00713 030716 0461 TOR MSK4 NUMBER 0462 00714 014654 JSB OYNA 0463 00715 124701 JMP POHT2, I EXIT SUBROUTINE 0CT 264 0404 00716 000260 MSK4 0465 00717 000007 MSK5 OCT 7 6466\* 0467 + ENU OF LINE SUBROUTINE 4408\* 0469 00720 000000 EOL NOP ENTER SUBROUTINE 0470 00721 070730 STA AS4 STORE A 0471 00722 060731 LDA CR CARRIAGE 6472 00723 014654 JSB OYNA RETURN 4473 00724 060732 LDA LF LINE 0474 00725 014654 JSB UYNA FEED 6475 60726 660730 LDA ASA RESTORE A 0476 00727 124720 JMP EOL, I EXIT SURROULINE 6477 00730 009000 AS4 UCT W TEMPORARY STORAGE 00731 000215 6478 CR 0CT 215 0479 00732 000212 LF OCT 212 N480× W481\*SUPPRESS MESSAGE PRINTOUT CHECK SUBROUTINE 0482\* 0483 00733 000000 SMPUC NOP ENTER SUBROUTINE 0484 00734 070750 STA AS5 STORE A 0485 00735 014145 JSB MODE CHECK SW. REG. 00735 060176 0486 LDA BIT2 SUPPRESS EXCESS 8487 00737 002011 SLA, PSS PRINTING? L488 00740 024743 JMP ++3 NU. 0489 00741 060750 LDA AS5 YES. RESTORE A

JMP SMPOC.I

EXIT SUBROUTINE

0491 00743 060750 LDA ASS RESTORE A 8492 00744 014751 JSB MPO PRINT MESSAGE 6493 00745 014720 LINE FEED JSB EOL 0494 LINE FEED 00746 014720 JSR EUL 00747 124733 EXIT SUBROUTINE 0495 JMP SMPOC,I 0495 83750 0000000 AS5 OCT 0 TEMPORARY STORAGE 6497\* 0498 MESSAGE PRINTOUT SUBROUTINE 0499+ 8508 80751 808488 MPD NOP ENTER SUBROUTINE 0501 00752 070753 STA ++1 00753 060000 0502 LDA Ø LUAD A HORD 00754 034753 0503 157 +=1 00735 002003 0504 SZA, RSS WURD = P?0505 00756 124751 JMP MPO,I YES. EXIT SUBROUTINE 80757 014751 NO. PRINT THE WORD 0506 JSB PACO 0507 00768 024753 REPEAT FOR NEXT WORD JMP +-5 0508+ 0509\*PACKED ASCII CHARACTER OUTPHT SUBROUTINE 0510+MOST SIGNIFICANT 8 BITS OF A REGISTER PRINTED FIRST. 0511+ 0512 00761 000000 PACO NOP ENTER SUBROUTINE 6513 00762 072773 STORE A STA AS6 00763 001700 0514 ALF PRINT 83764 801700 ALF 0515 FIRST 0516 00765 010455 AND MSK2 CHARACTER 0517 80766 814654 JSB DYNA 0518 00767 060773 LDA AS6 PRINT 0519 00770 010455 AND MSK2 SECOND 0520 00771 014654 JSB UYNA CHARACTER 00772 124751 JMP PACO,I 0521 EXIT SUBROUTINE 0522 01773 000000 ASO OCT Ø TEMPORARY STORAGE 1523+ 0524 HUCTAL PRINTOUT OF A 3525\* 0525 80774 883800 ÜPA NOP ENTER SUBROUTINE 6527 80775 801290 RAL 00776 071010 0528 STA AS7 STORE A 8529 00777 011011 AND MSK6 PRINT 0530 01000 030716 IOR MSK4 FIRST 8531 01001 014654 JSB UTNA NUMBER 01002 N15012 N532 PRINT JSB NXT 0533 81003 015012 JSH NXT NEXT 9534 01004 015012 JS5 NXT FIVE 1535 01905 015012 JSP NXT NUMBERS 85**36** 01006 015012 JSR NXT JMP OPA,1 0537 01007 124774 EXIT SUAROUTINE NCT M 1538 01010 000000 AS7 TEMPORARY STORAGE 8039 01211 000001 MSE6 0CT 1 8540\* 0541 + NEXT OCTAL CHARACTER OUTPUT 6542\* 0543 01912 000000 HX1 NOP ENTER SUBROUTINE 0544 01013 061210 LDA AS7 PREPARE 8545 61414 001200 RAL THE 0546 01015 001200 RAL NEXT 0547 11016 001200 RAL. NUMBER



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1.6 . 6	(A. )	471010		
0548		071010	STA AS7	
0549		010717	AND MSK5	
6550		030716	IOR MSK4	
0551		014654	JSR UYNA	-
0552		125012	JMP NXT,	I EXIT SUBROUTINE
0553+				
0554+				
0555*	<b>.</b>		<b>• -</b>	
	PUNCH	AND READ	ROUTINE	
0557*	<b>-</b> 17 - 1	•		
			CH AND TAPE REA	
			L COMBINATIONS	
	EIGHY	BITS AND	READING THEM B	ACK.
0561*				
0562	-	0000000	PAR NOP	ENTER ROUTINE
0563		107700	CLC Ø,C	INITIALIZE, INTERRUPT D
0564	01026	006400	CLB	
0565	01027	1014401	JSB TOS	FLAG SET?
0566	01030	025032	JMP ++2	YES.
4567	01031	014564	JSB POF	•
0568	01032	061216	LDA SI7	
0569	01033	014733	JSH SMPO	
0570		061936	LDA ++2	HALT TO
0571		865836	LDB ++1	TURN ON
0572		102302	HLT 2	PUNCH
0573		061111	LDA GNY	-
0574		070675	STA OYN	
0575		015232	JSE ZEPO	
0576		093400	CCA	
N577		010455		OUTPUT ALL ONES
1578		010455	AND MSK2	
0579		002400	JSB DYNA	
1580		002400	CLA	PUNCH
1581			JS8 .64C	
		015242	JSR .64C	
0582		061112	LDA UYY	OF EIGHT
1583		070675	STA CYN	8175
0584		060730	LDA ASA	
9585		015242	JSB .64C	
0586		015242	JS8 .64C	
0587		015232	ISP ZERO	
0588		015232	JSR ZERO	
0589		015232	JSB ZEHO	
8540		015117	JSP PARE	EXIT HOUTINE?
0591	01661		LDA ++2	NO. HALT TU
0592	01062		LD <sup>q</sup> *+1	LOAD TAPE
P593	01063	102003	HLT 3	INTO READER
1594	01064	061116	LDA INN	PREPARE TO
0595	01065	070675	STA OYN	REAT
0596	01066	002400	CL▲	TAPE
0597	01067	014654	JSB UYNA	READA
1598	01070	106500	LIH2 LIH Ø	CHARACTER
1599	01471	006303	SZ6,RSS	CHARACTER = 0?
3000		025067	JMP +-3	YES. READ NEXT CHARACTE
8601		015253	JSB R64Ci	
1662		061113	LDA IYN	
8503		071675	STA DYN	
		061337		

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0605 01077 015253 JSB R64CH READ SECOND BLOCK 8696 01100 061114 LDA INY 01101 070675 0607 STA DYN 0608 01102 061307 LDA AS11 READ THIRD BLOCK 0609 81103 815253 JSB R64CH LDA TYY 0610 01194 061115 01105 070675 0611 STA UYN 0612 01106 061307 LDA AS11 0613 01107 015253 JSB R64CH READ FOURTH BLOCK 01116 025127 EXIT ROUTINE 0014 JHP P7 0615 61111 110000 OCT 114000 **OUTPUT, NO PRINT, PUNCH** ONY 01112 130000 0616 OYY DUTPUT, PRINT, PUNCH OCT 130000 0617 01113 160000 IYN OCT 160000 INPUT, PRINT, NO PUNCH OCT 150000 01114 150000 INPUT, NO PRINT, PUNCH 0618 INY 01115 170000 0619 IYY OCT 17:4000 INPUT, PRINT, PUNCH 0620 01116 140000 INPUT, NO PRINT, NO PUNCH INN OCT 144000 0621\* 0622\*PUNCH AND READ EXIT SUBROUTINE N623\* 61117 000000 PARE NOP ENTER SUBROUTINE 1024 STORE A STA AS8 01120 071135 **9625** 1626 81121 014145 JSR MONE CHECK SW. REG. 01122 060200 LDA BIT4 EXIT THIS 0627 01123 002011 ROUTINE? SLA, FSS 9628 01124 025127 JMP ++3 YES. 1029 0030 01125 061135 LDA ASA NO. RESTORE A EXIT SUBROUTINE 01126 125117 JMP PARE, I 0031 01127 064676 P7 LNA SOYN RESTOPE 8632 OUTPUT CODE 01130 070575 STA UYN 0633 01131 014720 LINE FEFD 0034 JSP EOL PRINT SECOND 1635 01132 061231 LDA SIA 01133 014733 JSB SMPOC PAR MESSAGE 0036 01134 125024 JMP PAR, I EXIT ROUTINE ves7 01135 000000 A 58 DCT 0 TEMPORARY STORAGE ØNJA 2639\* U643\*PRINT OUT ERRORS ROUTINF - 641\* ENTER SUBROUTINE 61136 000000 PDE NOP 11042 01137 071152 STA AS9 STORE 4 1643 SAVE 01144 069675 0644 LDA DYM 6645 01141 071153 STA AS10 STATE 01142 060576 N646 LDA SOYN 8647 01143 070675 STA UYN 0548 01144 014720 JSB EOL LINE FEFU 21145 061172 PRINT "OUTPUT =" 6549 LDA SIS 01146 014751 JSH MPO 0350 RESTORE A 0651 01147 061162 LDA AS9 01150 614774 JSB OPA PRINT UCTAL NUMPER F 0 52 PRINT "INPUT =" 01151 061202 9653 LDA SIA 1654 01152 014/51 JS4 MPO PRINT OCTAL 0655 01153 060001 LDA 1 01154 914774 JSH HPA NUMBER 0656 LINE FEED 0557 01155 014720 JSE EUL 01156 061153 LDA ASIA RESTORE 8008 1659 01157 074675 STA OYN STATE 80.60 W1160 061152 LINA ASQ RESTORE A 11161 125136 JMP FOF, I EXIT SUBROUTINE 1n61



9662	01162	000000	ASU	001	91	TEMPOR	ARY STORA	GF
0663	01163	000000	AS10		p		ARY STORA	
Ø664	01164	647525	00	ASC	5, OUTPUT			•
		052120						
		652524						
		020075						
_		020040						
1665		000000		0ÇT	Ø			
Ø666		061164		LDA	00			
0667		020040	-	ASC	6, IN	PUT =		
		020040						
		044516						
		050125						
		652040						
0668		035440						
Ø669		0000000		100				
0670		0011/3	SI6					
0070		041105	rakmi	ASU	10,BEGIN	PUNCH	AND READ	
		047040						
		050125						
		047103						
		044340						
		040516						
		042340						
	01213	051105						
	01214	040504						
r071	01215	000000		GCT	0			
6672	01216	061233	S17	LDA	PARM1			
6673	01217	042516	PARM2	ASC	9, END PU	NCH AND	READ	
	91558	042040						
		050125						
	01222	047103						
		044040						
		040516						
		042840						
		051195						
4674	01227 01230	040504						
675			518	OCT				
0075		001217	210	LUA	PARM2			
	OUTPUT	REANK 1	APE					
6678								
9679		000000	ZEFUS	NOP		FNTER S	UBROUTINE	
0680		002400		CLA		CHILK 3	INDERIOUT ENE	
0681		065241		LDB	SC 3			
P652	01235				UYNA	OUTPUT	7 F R O	
N683	01236	006906			SZH	32 ZERU		
2684	01237	025235			*=2	NO.		
И685	01240	125232		JMP	ZEPOS,1		XIT SURROI	UTINE
0686		177740	SC 3		177740	•		
0687+								
		NTAND	OUTPUT	A RE	G. 64 TIN	1ES		
0689+		<b>A</b> (1) -						
v690		000000	.64CH				UBROUTINE	
	01243				SCA	RESET C		
N692	11244	014554		<b>JS</b> 8	OYNA	NUTPUT	٨	

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0693 01245 002004 INCREMENT OUTPUT WORD **JNA** 0094 01246 006006 64 CHARACTERS? INB, SZR 6695 01247 025244 JMP +-3 NO. 01250 014720 0696 YES. JSB EOL 0697 01251 125242 JMP .64CH,I EXIT ROUTINE 0698 01252 177700 SC4 OCT 177700 0699+ 0700\*READ AND CHECK 64 CHARACTERS 0701+ 0702 01253 000000 R64CH NOP ENTER SUBROUTINE 0703 01254 065252 LDB SC4 RESET CHARACTER COUNTER 0704 01255 075306 ST8 M64 0705 01256 014654 P8 JSB UYNA READ A CHARACTER 0706 01257 106500 L183 L18 0 01260 015117 JSB PARE EXIT POUTINE? 0707 ERPOR? 0108 01251 050001 CPA 1 NQ. 01262 025264 0709 JMP ++2 NC. 01203 015136 PRINT DUT ERROR 0710 YES. JSH POE INCREMENT REFERENCE 0711 01264 002004 INA 01265 035306 ISZ M64 64 CHARACTERS? \$712 0713 01266 025256 JMP P8 ND. 01267 071397 STORE A 0714 STA AS11 YES. 8715 01270 060731 CHECK FOR LDA CR 0716 01271 014654 JSB OYNA CARRIAGE 01272 100500 RETURN 0717 LIP M L164 CPA 1 FRROR? 0718 01273 050001 0719 01274 025276 JMP ++2 N()\_ 0720 01275 015136 JSB POE YES. PRINT DUT ERROR 01276 064732 LDA LF CHECK FOR 6721 01277 014654 JSH UYNA LINF \$722 01300 106500 FEED W723 L185 LIN 6 01301 050001 0724 FRRUR? CPA 1 6725 01302 025304 JMP ++2 NC. JSH POE YES. PRINT OUT ERROR 1720 01303 015136 0727 01304 061307 LDA ASII RESTORE A EXIT SURROUTINE JMP R64CH,I x128 01305 125253 1729 OCT 177744 01306 177700 M64 0730 01307 000000 A \$ 1 1 001 0 TEMPORARY STORAGE 0731\* 0732= 0733\* 4734 + PRINT AND KEYBDARU ROUTINE 4735+ NOP 8736 81310 007000 PAL ENTER ROUTINE INITIALIZE, INTERRUPT OFF 6737 61311 107700 CLC M.C. 01312 062676 ¥738 PREPARE LDA SOYN 1739 01313 070675 STA UYN TO PRINT 1740 LDA SIG PRINT FIRST 01314 061371 0/41 01315 014733 JSR SMPOC PAK MESSAGE PRINT 54 ASCII CHARACTERS 01315 015432 JSH PRALL 1742 0745 01317 015432 JSB PRALL PRINT 64 ASCII CHARACTERS 1744 01320 014726 JSP EOL LINE FEFD 0745 01321 015340 JSB PAKE EXIT POUTINE? PRINT SECOND P1322 061414 LDA SIIN \$746 NO. 0747 01323 014733 JSH SMPOC PAK MESSAGE PQ LUA INN PREPARE TO READ 1748 01324 001110 01325 102500 OTAS NTA H IN FROM KEYBOARD 8749



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0750 01326 015340 P10 JSB PAKE EXIT ROUT!	NE?
0751 01327 103700 STCC3 STC 0,C NO. WAIT	
8752 81330 886438 CLB FOR INPL	I T
8753 81331 814461 JSB TOS ANY INPUT	
0754 01332 025334 JMP ++2 YES.	
9755 01333 025326 JMP P10 NO.	
9756 01334 106500 LIB6 LIB 0 LOAD DATA	INTO B
0757 01335 060001 LDA 1 PUT B INTO	
9758 01336 014654 JSB DYNA DUTPUT A	
0759 01337 025324 JMP P9 READ NEXT	CHARACTER
8760*	
0761*PRINT AND KEYBOARD EXIT	
8762+	
0763 01340 000000 PAKE NOP ENTER SUBF	OUTINE
10764 101341 1071152 STA AS9 STORE A	
0765 01342 014145 JSB MODE CHECK SW.	REG.
0766 01343 060201 LDA BITS EXIT THIS	
0767 01344 002011 SLA,RSS ROUTINET	•
0768 01345 025350 JMP ++3 YES.	
0769 01346 061162 LDA ASO NO. RESTO	
0770 01347 125340 JMP PAKE,I EXIT SUBRO	DUTINE
0771 01350 014720 JSB EOL	
0772 01351 061431 LDA SI11 PRINT THIF	
0773 01352 014733 JSB SMPOC PAK MESS	
0774 01353 125310 JHP PAK, I EXIT ROUTI	
0775 01354 041105 PAKM1 ASC 12, BEGIN PRINT AND	KEYBOARD
01355 043511	
01356 047040	
01357 050122	
01360 044516	
01353 042940 01364 045505	
01365 054502	
01366 047591	
01367 051194	
0776 01370 000000 OCT P	
0777 01371 061354 SI9 LDA PAKM1	
0778 01372 052523 PAKM2 ASC 17, USE KEYBOARD SLC	WEY (5 CHS./SEC.)
01373 042440	
61374 845505	
01375 054502	
01376 047301	
01377 051104	
61408 626123	
01401 046117	
01402 053514	
01403 054440	
01404 024065	
01405 020103	
01406 044123	
01407 027057	
01410 051505	
01410 051505 01411 041456	
01410 051505	

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8780 01414 001372 SI10 LDA PAKM2 8781 W1415 W42516 PAKM3 ASC 11, END PRINT AND KEYBOARD 01416 042040 01417 050122 01420 044516 01421 052040 01422 040516 01423 042040 01424 045505 01425 054502 01426 047501 01427 051134 0782 01430 000300 0 CT Ø 0783 01431 061415 SI11 LDA PAKM3 0784\* 0785\*PRINT ALL CHARACTERS SUBROUTINE 6786\* 0787 N1432 000000 PRALL NOP ENTER SUBRUITINE 6788 01433 061440 LDA SC5 PRINT FIRST 6670 01434 015442 LINE OF CHARACTERS JSH .32CH 0790 01435 051441 LDA SCA PRINT SECOND 0791 01436 015442 JSP .32CH LINE OF CHARACTERS 0792 01437 125432 JMP PRALL, I EXIT SUBROUTINE 0793 01440 000300 SC5 OCT 300 0744 01441 000240 SC6 001 240 0795\* 0796\*PRIDT 32 CHARACTERS SUBROUTINE 1797\* 0798 01442 000000 ENTER SUBROUTINE .32CH NOP 0799 01443 075454 ST8 652 STORE R 0800 01444 065241 LDB SC3 RESET COUNTER 01445 014654 0801 JSB OYNA PRINT A 6342 01446 002004 INA INCREMENT A 6013 01447 006046 INB, SZB 32 CHARACTERS? 6014 01451 025445 JMP +=.3 NO. PRINT NEXT CHARACTER 0805 01451 014720 JSB EUL YES. LINE FEED 01452 065454 0500 LDB 652 RESTORF B 8007 01453 125442 JMP .JOCH, I EXIT SUBROUTINE NONB 21254 201710 HS2 DCT M TEMPORARY STORAGE NSNY ENT \*\* NO ERRORS\*



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## 2116A BUFFERED

## TELEPRINTER TEST

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Binary Tape - HP20417B

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Source Listing- HP20417BL





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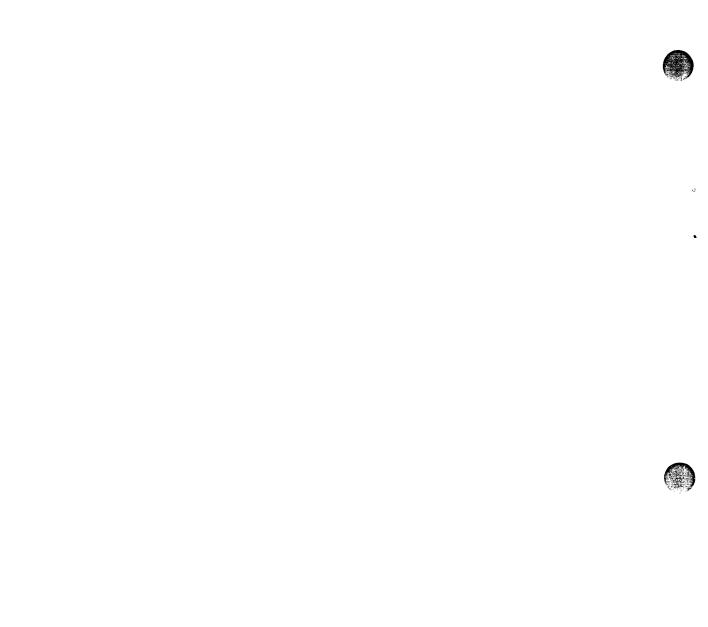
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0361		ASPB, A, P, L
** N0	ERRURS*	





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MAGE DUSS AVI
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0061 ASME, A, B, L 0002\* だいどく\* 47.04 -NUMS#BUFFERED TELETYPE DIAGNOSTIC AU105 + 8007\* 0098\* 6609+STARTING OCTAL ADDRESS = 100 6010++++ 0011+THE FOLLOWING SWITCH REGISTER SETTINGS UN12\*AKE USED FOR PROGRAM CONTROL 2013+ 0014+6IT 1<sup>6</sup> = 1 -> HALT AT BEGINNING OF PROGRAM 0015\*HIT 1 = 1 HALT AT ERROR BUFFER ⇒> = 1 4610+BIT 2 SUPPRESS MESSAGE PRINTOUT -> 3 = 1 WW17\*BIT PERFORM BASIC TEST ROUTINE -> 6018\*811 4 = 1 **~ >** PERFORM PUNCH AND READ ROUTINE 5 = 1 V019+611 -> PERFORM PRINT AND KEYBOARD ROUTINE 4020 \*\*\*\* 8421+ 11122+ B023+M415 PROGRAM 8024+ NV25 00 477 URG 778 44777 102000 0020 END HLT Ø 8227 00100 107740 CLC 44.C INITIALIZE, INTERRUPT OFF 8428 00181 102541 LIA 1 PUT TIY 80102 010141 NY 29 AND MSKR ADDRESS 02103 070277 INTO ALL I/O 0030 STA BTA 63104 614203 1631 JSP INIT INSTRUCTIONS 6232 81105 304142 LDA M67 PREPARE 00120 002143 2033 LUA HIS TRAP 10:34 - ØJ147 070111 Find STA ++2 0535 04116 060144 LDA HI ILLEGAL 00111 070010 WV30 STA 14B INTERRUPT 0031 00112 034111 157 ++1 FRUM 00113 002004 11.30 A N ANDTHER 0039 00114 005006 INR, SZP DEVICE 2540 00115 024111 JMP == J 8241 33116 364401 LHA 11J PPEPARE ILLEGAL TTY 2042 00117 072111 STA1 STA V INTERRUPT TRAP 00120 014720 91.43 JSF FOL LINE FEFD 00121 050123 101.44 LDA ++2 HALT TO CHUDSE 1045 00122 054123 1.08 ++1 SWITCH REGISTER 0246 60123 102001 HIT 1 PETTONS 00124 014145 6447 - P 1 JSH MODE CHECK SW. REG. 8943 43125 Un0177 LDA BITS PERFORM A1.44 10126 NU2010 BASIC TEST? 51 4 9050 80127 114310 JSR HT YES. 9651 03130 414145 JSH MODE NO. CHECK SH. REG. 1000 NN131 250202 PERFORM 104 8174 0053 00132 000010 PUNCH AND READ? SLA 8054 60135 015024 JSH PAR YES. 0055 60134 414145 JSR MODE NU. CHECK SW. REG. 6656 20135 Nov201 LOA BITS PERFORM 101 in 000710 8657 SEA PRINT AND KEYBOARD?

YES. 00137 015310 66.28 JSB PAK 2259 00140 024124 IMP MP1 NO. 00141 000277 0CT 77 3060 MSAV 0001 03142 177711 ~61 GCT 177711 0652 00143 070110 H15 STA 10H 0-263 00144 102010 ΗE HLT 10B 8664\* 2065+SWITCH REGISTER MONITURED WHEE \*FUR CURRENT OPERATING MODE 1067\* ENTER SUBROUTINE 14168 BOLAS NOBADO MOHE NOP STORE A おおちち - ON146 N70173 STA ASM RN70 00117 102531 EACH HIT LIA 1 FROM THE STA 6173 00158 070174 No11 SWITCH REGISTER RAR 10112 011-1 001300 IS ROTATED WV73 00102 070175 STA HITL 60155 001300 RAR DATE THE 1014 LEAST STGNIFICANT 0175 00154 072176 STA BIT2 RAR POSITION AND 00135 001300 1175 STA HITS STURED IN THE 10.71 20150 070177 STORAGE LOCATION 8010/ 001300 RAR V.478 STA BITA HEARING ITS NAME 001011 1170200 N079 30101 401300 RAR 0060 001-2 V70241 STA HITS 1000 HALT AT PEGINNING IDA HITU 40.52 20163 000114 OF PROGRAM? HERS BELLA NORTH SLA. KSS 00105 024171 0184 14+ 4ML 1:5 。 YES. LUAR A AND S 2080 81155 000202 LUA HAN LDS HAD WITH 196 4636 00167 004242 30 18 424411 JMP END AND HALT 8:05/ - WW171 NHV173 LDA AS PESTORE A 0088 6689 33172 124145 JNP MONE, 1 EXIT SUMPOUTINE POT 6 TEMPORARY STORAGE 00173 0000000 6640 ASU HITM UCT P 1641 00174 020,00 0 CT 0 - NO175 BOODAN 4492 8111 0045 00175 000200 51T2 DOT P 60177 608030 1094 3113 0C1 0 69236 654496 0CT - 4 9114 1645 OCT 0 8115 80201 0. 4.120 4040 DCT 100 6897 20202 000100 MAL ×1148 \* 2194 VINC+INIFIALIZATION ROUTINE V161\* 0102\*THIS HUUTINE AUDS THE REFFERED TELETYPE ADDRESS TO 2103\*ALL I/U INSTRUCTIONS. V114\* ¥145\* NOP ENTER ROUTINE 84543 BNDDAD INIT 1100 INITIALIZE, INTERRUPT OFF 31203 117744 CLC M.C. 6131 PUT TTY ADDRESS 4128 60295 014279 JSH ANTR SES V INTO SES INSTRUCTIONS 8109 00226 162346 00207 070332 STA SESI M110 1111 00210 P70341 STA SES2 80211 070351 STA SES3 2112 0115 00212 070313 STA SES4 00213 074462 STA SESS 2114

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9**CT** 96

TTY ADDRESS STURAGE



0115 00214 014270 JSP AUTN PUT TTY ADDRESS 0116 NO512 195500 SFC W INTO SEC INSTRUCTIONS 1117 04216 070320 STA SFC1 9118 00217 070336 STA SFC2 80224 078346 0119 STA SEC3 0120 00221 070357 STA SEC4 9121 03222 014210 PUT TTY ADDRESS JSB AUIN 122 00225 102500 OTA 6 INTO OTA INSTRUCTIONS 00024 070007 0123 STA OTAL 0124 30225 070442 STA DTA2 0125 00221 079561 STA DTA3 \$ 1227 076554 M126 STA OTA4 69230 071325 6127 STA OTAS 03231 010270 0128 JSH ADIN PUT TTY ADDRESS 0129 100232 100700 STC M.C INTO STC.C INSTRUCTIONS 0130 60233 670411 STA STCCI 0131 00234 070665 STA STCC2 6132 00035 071327 STA SICC3 6133 60236 614270 JSH ADIN PUT TTY ADDRESS @134 00237 106700 CLC # INTO CLC INSTRUCTION 1135 00240 076412 STA CLC1 0135 00241 014210 JSB ADTN PUT TTY ADDRESS 1131 00242 102700 STC M INTO STC INSTRUCTION 138 03243 070345 STA SICI 0134 01014 014210 JSA ANTH PUT TTY ADDRESS 1140 00245 183190 CLF V. INTO CLE INSTRUCTION 0141 3024F U7U335 STA CLF1 8142 03247 214274 PUT TTY ADDRESS JSB ANTN 8145 00230 102100 STF @ INTO STE INSTRUCTION 3144 03251 W/3360 STA STEL 145 00252 114270 PUT TTY ANDRESS JSH AUTN 4146 00253 100004 L18 0 INTO LIR INSTRUCTIONS 6141 01254 677443 STA LIBI 4140 - やめりった いアエクアは STA LIP2 0144 81256 071257 STA LINX 0150 00257 071212 STA LIBA 0151 00258 8/1300 STA LIBS ×152 00251 071334 STA LIRS 00282 010214 2153 JSH AUTA PUT TTY ANDERSS N154 00263 070000 INTO STA ENSTRUCTIONS STA V 1155 00264 674117 STA STAL - 10205 N/2376 0150 STA STA2 1107 33266 272366 STA STA3 8158 20267 124213 JMP INIT, T ... EXIT ROUTINE £159\* 0160+ADDRESS INCLUSION SUBROUTINE. M161\*THE RUFFERED TTY ADDRESS IS PUT INTO MID2\*THE INSTRUCTION FOLLOWING JAB ADIN. +155\* 1164 NUDTE STOUD ENTER SUBROUTINE AUIN NOP 2165 00271 100276 LUA AUTN,I BRING 179 INSTRUCTION INTO A 20072 110276 W160 AND MSKI AUD TTY AUDPESS 4161 20273 050277 TOM BIA TO INSTRUCTION 60276 930270 ¥ 1 6 8 IST ADIN EX1T 00215 124270 1154 JMP AUTN, I SUBRITINE 8170 31271 1777AD MSK1 OCT 177702

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4172*						1
0173*						
w174=						
v175*	BASIC (FS	L 6081	ET INF			
M176*						
#177*	THE FULLO	*1 NG 1	TESTS 1	HE F	LAG, CUN	TROL,
0178+	ANU INTER	ROPT (	стясотт	TP Y		
0179+						
Ø180	00300 00	0100	ыT	NOP		
0181	20101 10				€ <b>,</b> Ω	INITIALIZE, INTERRUPT OFF
N182	60.42 40				SOYN	PESTORE
0153	60503 07			STA		OUTPUT CODE
0184	80314 06			LUA		PRINT FIRST
6165	- 11 A Sab 21	-			SMPOC	BT MESSAGE
					SHEUG	CLEAR
V180 0157	00346 00			LLE		
9157	30507 47			STH		ERRAR
W180	40516 07			STR		BUFFER
¥184	00111 07			STR		
2194	80312 01			5 <b>T</b> 9		
₩J <b>41</b>	00313 17			STF		
K175	60314 87	4575		STR		
6143	01315 117	4576		514	E 7	
w194	00110 87	4 - 17		8 <b>T</b> 5	E 1 14	
\$195	08317 47	46.44		STH	E 1 1	
Ø196	00320 07	44-51		STH	F12	
197	00021 61	45.2		STR	613	
0198	81522 01	4-03		STE	E14	
8199	80323 N/	4574		STE	Ein	
0244	00324 47	4405		519	ΙA	
6201	08325 NA	0321		I N A		INCREMENT ERROR MODE
8202	00321 10		SFC1	SEC	4 <b>.</b>	FLAG CLEAR?
AZAS	80321 42			IMP	*+2	40 ·
6284	00334 17			<b>∹ 1</b> ₽	£1	YES. LAROR 1
N205	00331 00	6314		J. North	-	INCREMENT ERROR COME
VZAD	43332 14	2330	SF 31	SES	lv:	FLAG SET?
1207	00355 17	4571		STR	ES.	HO. ERROR 2
1248	00334 30	n 1114		1.85		YES
41149	00335 1E		ULFI	CLF	<i>V</i> i	SLEAR FLAG
8210	0 0 3 3 F 1 .		SFL2			FLAG CLEAR?
6211	00337 -7			STA		NO. FRROR 3
A215	01316 00			148		TES.
v213	60341 16		5F52	SES	6.1	FLAG SET?
v213 v214	01342 02		VI VE	JMH		NG.
0214	00142 02			STS		YES. FREDR 4
					, <b></b>	
1216	60344 00		5.11.1	TVB	0	SET DESTUDI
M217	69345 1d		5101			SET CONTROL ELAC DEFARZ
0218	20345 11		SF(3	SFC		FLAG CLEAR?
#219 •	00347 21			STH		AN, ERROR B
4.24	80301 00		0 <b>.</b>	INR	,	YES.
V ~ 21	00351 10		SFSS	SFS		FLAG SET?
4222	001-52 02			JMP		
v:223	00353 67			STA	たち	YES. EPHOR 6
1224	03354 00			1 N H		
1225	10.55 00			L I) A		PREPARE TO TEST
viz 26	DASSE V7		STA2	STA		INTERROPT SYSTEC
	86557 10		_	STE		TURN ON INTERRUPT STSTEM
6758	201360 14	2101	STE1	STF	(A	SET FLAG

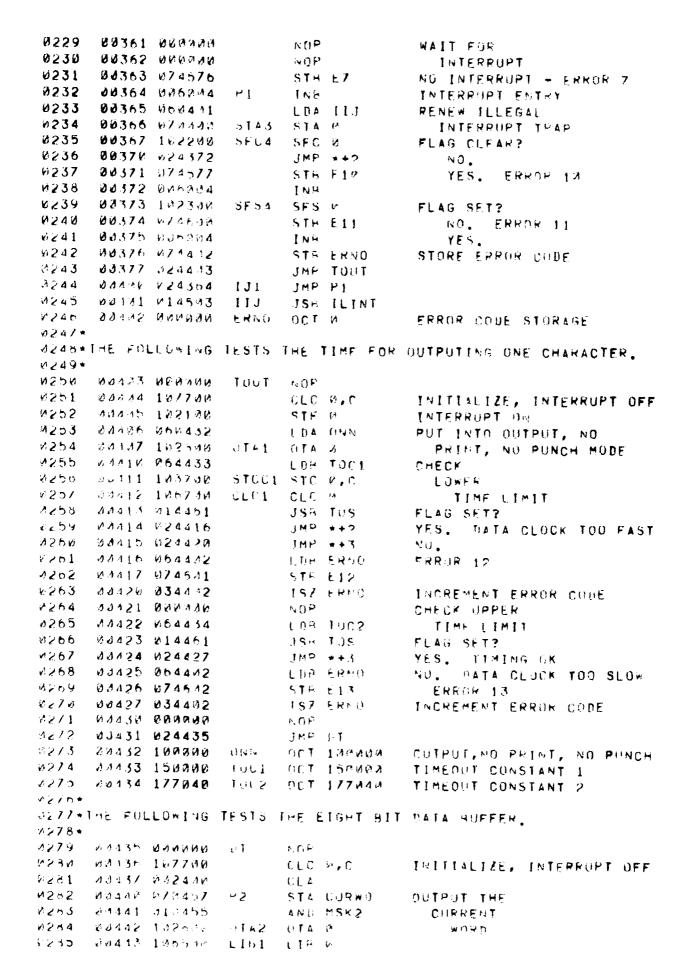


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0286 00444 050001 CPA 1 INPUT = OUTFUT ? 0287 - 00445 024a ja YES. IMP P3 20446 060442 0186 LDA ERNO NO. ERROR 14 2284 00447 070KK3 STA E14 0290 00450 N69457 P3 LDA CURWD INCREMENT 6291 00451 002006 INA, SZA CURRENT WORD 0292 00452 024440 JMP P2 HALT AT ERROR BUFFER? 6293 60453 014472 JSB EBH 1294 00454 024515 JMP POUT NO. 0295 00455 000377 MSK2 OCT 377 0296 00456 000200 MSK3 001 200 6297 80457 808000 CURWL OCT P R298 80468 808388 OCT 0 NBE ¥299+ N3NN+FLAG TIMEOUT SUBROUTINE 9311\* 0302+TIMEOUT CONSTANT IN B V303\*1F "FLAG" BEFORE TIMEOUT, EXIT TO TOS. IF NOT. N304\*EXIT TO TUS + 1. ONE ITERATION = 5.4 MICHOSEC. 4345\* NOF AKNO AJAST ODUJOD TOS ENTER SUBROUTINE 8307 88462 182386 SFS5 SFS FLAG SET? N378 00463 024455 JMP ++2 JMP TOS, L 0384 000n4 124401 YES. EXIL THEOUGH TOS NO16 00465 005046 INB, SZH MD. TIMEOUT YET? W-11 00066 024452 JMP SES5 N9. REPEAT VO12 07467 034461 182 TOS YES. FXIT N313 00110 000000 THROOGH NOP 0314 04171 124461 JMP TUS, I T6S + 1 1313\* V316+ERROR BUFFER HALT SUBROUTINE v317+ 4318 00012 000000 HOP ENTER SUBROUTINE そとれ V314 103473 1070542 STA AS1 STORE A 4324 00474 014145 CHECK SW. REG. JSH MODE 4321 00075 067175 tha BITI HALT AT 6322 00176 110010 511 ERRAR BUFFFH? JSB POF 8523 00477 014554 YES. V324 20518 266502 LDA ASI NO. RESTORE A JMP E8H, T EXIT SUBROUTIKE 1320 60541 124012 OCT N 9326 00542 000040 AS1 TEMPORARY STORAGE 8327\* M326+ILLEGAL INTERRUPT SUBROUTINE 4329\* ROSDEFOR AN ILLEGAL ITY INTERRUPT, THE PROGRAM ADDRESS IS SAVED. - 331 \* 8332 00513 000000 ILINT NOP ENTER SUBROUTINE 4333 63503 070513 STORE A ST6 450 1334 22585 064583 LDA \*=? STORE PROGRAM ADDRESS 4335 UASA6 070635 STA IA 3336 60507 060514 LUA IE STORE 1.537 00510 070604 STA EIS ERROR 15 0338 00511 060513 LIIA AS2 RESTORE A 8339 00512 124503 JMP ILINT,I EXIT SUBROUTINE N340 01513 000000 ASZ NCT M TEMPORARY STORAGE 01514 000015 001 15 \$341 1E v 362+

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PAGE 0028 #01

0343+THE FOLLOWING PRINTS OUT THE RESULTS OF THE BASIC TEST. 0344+IN CASE OF FAILURE TO PRINT OUT, THE PROGRAM 0345 \* HALTS AT THE BEGINNING OF THE ERROP BUFFER. P346+PRESSING "DISPLAY MEMORY" WILL SHOW WHICH ERRORS OCCURED. v347 \* 1348 00515 000000 POUT NOP 1349 00516 107700 CLC 0.C INITIALIZE, INTERRUPT OFF 0350 00517 006400 CLB 3351 00520 014461 JSB TOS FLAG SET? 00521 024523 \$352 JMP ++? YES. 6353 00522 014564 JSB POF HALT AT ERROR BUFFER NO. 0354 00523 060633 PREPARE TO LDA SC2 1355 60524 171634 STA MIA PRINT OUT 4355 00525 060635 LDA SI3 ERROR CODES \$357 00526 070527 STA P4 80527 004570 4358 24 LDB EI LOAD & WITH 0359 00530 034527 152 \*=1 ERROR STORAGE 1300 00531 006002 ZER0? SZH. 20532 024536 r 361 JMP ++4 NO. 1362 00533 034634 157 114 YES. PARTIALLY DONE? 1363 13634 024527 JMP P4 NO. 0354 20035 024544 JMP PS CHECK INTERRUPT ERRORS YES. 4365 Mass6 No4636 LDA E PRINT 00537 014554 4306 JSB OYNA 0UT 13h7 00544 014701 JSB POUT2 ERROR 4368 00541 014720 JSA FOL CODE 1364 201-12 114412 JSB EBH HALT AT ERROR BUFFER? 4370 00543 024533 JMP \*-104 NO. 2371 00544 064614 P5 LDH E15 E15 = A? 11372 40345 006703 SZH, RSS 1375 00046 024560 YES. JMP PS V 574 20547 000636 LDA É NO\_ 10554 014554 \$ 5/5 JSH DYNA PRINT OUT 2370 00551 014701 JSH PUHT2 ERROR CODE \$ 377 00552 060653 LDA SI4 AND 13/3 - QUEES N14751 JSH MPG PROGRAM ADDRESS 0519 20534 060525 LOA JA WHEN ERROR 3540 00555 914774 JSH OPA OCCURREN 60556 214726 M381 JSR EUL LINE FFED 00551 014728 1.502 JSE EOF LINE FEFD \$383 60560 403632 26 LTA SI2 PRINT SECOND 0384 10-61 114733 JSP SMPOC BT MESSAGE 1085 80552 114472 JSK FBH HALT AT ERROR BUFFER? 1360 00553 124330 JMP BI,I NG. EXIT ROUTINE 4387 00564 0x0200 PUF NOP 22565 202504 1388 PUT PROGRAM ADDRSSS LDA \*-1 30506 6545n4 1359 しわら、キース FUP PRINT FAILURE NUCN 00567 102455 HLT 55%  $T \vdash T (Y \cap A \cap \Delta N \to \mathbb{C})$ 2∪91≭ ADASAERS A BUFFER V345+ 1.194 111576 000000 r 1 90T × SEC IRUE AFTER CLC N.C 8355 61-71 688140 £ 2 0CT 0 SES FALSE AFTER GLC M.C 1445 00572 800140 53 0CT 0 SEC FALSE AFTER OLF TTY · · · 7 00073 0000000 £4 001 A SES THUE AFTER CLF TTY 1340 20070 2000000 25 T-CT P SEC FALSE AFTER CLF TTY AND SIC 90T # 2.349 21575 NORANO +6 SES TRUE AFTER CLF TTY AND STC

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0400 00575 0000000 £7 HCT W NO INTERRUPT AFTER STO TTY, STE 0 00-77 000000 6461 SEC TRUE AFTER INTERRUPT E10 0C1 0 0402 83548 888238 £11 CCT 6 SES FALSE AFTER INTERRUPT 00601 000000 8483 E12 UCT A DATA CLOCK ON TTY BUARD TOU FAST 00602 000000 0404 E13 001 4 DATA CLOCK ON ITY SOAPH TOO SLOW 8405 00603 0000000 t14 0CT 4 DATA HUFFER ERROR 0406 00534 000000 DCT P ILLEGAL INTERRUPT FROM TELETYPE E15 03605 000000 1407 UCT M 1 A PROGRAM ADDRESS AT TIME OF E15 8008 80646 177777 OCT 177777 ERROR RHFFER TERMINAITON 00607 024124 0469 JMP MP1 RETURN TO MAIN PROGRAM N410+ 1411 JON10 041105 BTF1 ASC 8, BEGIN BASIC TEST 89611 943511 30612 047940 30513 041101 80614 051511 00515 041440 04610 002145 00A17 051524 V412 00526 000200 9 T 00 4413 00621 000510 511 LIA BIMI V.414 00622 042516 BTM2 ASC 7, FND BASIC TEST 80323 842840 23524 041101 00h25 051511 60576 641446 03527 252105 100% SV V01524 2415 00K11 000300 0CT & 00132 060622 1410 \$12 LOA RTM2 00n33 177704 2411 502 OCT 177764 80634 600200 N TO9 1418 M14 00635 V54570 1.914 513 LDB E1 0429 80630 000305 Ë 0CT 305 1521 00+ 37 52A340 PRAD ASC 11, PROGRAM ADDRESS = 83666 426120 03541 051117 00042 043522 00543 04/515 00544 520101 00545 1142134 20F46 051145 00H47 051523 11650 020075 00-01 023240 ¥422 00052 000100 OCT H 03653 062637 6423 514 I DA FRAU +424 \* #425\*PRINT LEAST SIGNIFICANT & BITS OF A. 4610\* A427 20534 400400 ÛYNA NOP ENTER SUBROUTINE 6428 34455 147730 CLC 0,0 INITIALIZE, INTERHUPT OFF \$423 00656 073677 STA AS3 STORF & 2430 100057 0747:10 STOKE B STR BS1 0451 100560 060515 LDA UYN PUT RUFFER INTO OUTPUT 1132 00661 102640 JTA3 OTA 🖗 AND PRINT MODE 1035 00662 060677 LDA AS3 RESTORE A



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6434 23663 010455 AND MSK2 DUTPUT LEAST 00554 102600 UT44 OTA 0 435 SIGNIFICANT 8 \$436 80605 103700 STUD2 STC 0,C BITS OF A 6437 00666 006490 CLA 6438 00657 014401 JSB TOS FLAG SET? 0439 60678 024672 JMP ++2 00571 014564 0440 JSR PUF NO. HALT AT ERROR BUFFER 6441 00K72 No:1677 LDA ASS YES. RESTORE A 00673 004700 6442 RESTORE B LDR EST 0443 30674 124654 JMP DYNA, T EXIT SUBROUTINE 1444 00675 120300 UYN OCT 120000 OUTPUT, PRINT, NO PUNCH 1445 80676 120300 SOYN UCT 120000 60677 000000 TEMPORARY STORAGE V:040 AS3 OCT 0 OCT 0 6447 00700 000000 351 TEMPORARY STORAGE 1448+ WA49+PRIMT OUT THO OCTAL NUMBERS 335V + 40101 000000 2251 POUT2 NOP ENTER SUBROUTINE 00702 063001 6452 LDA 1 OUTPUT 0453 00773 001100 ARS FIRST 00704 061190 1454 ARS NUMBER 435 60735 801100 ARS 2450 00706 010717 AND MSK5 00707 030716 8401 TOR MSK4 00710 014634 V458 JSB CYNA 00711 1000001 OUTPUT 0454 LUA 1 114610 00712 014717 ANI MSK5 SECOMO 9461 00713 030716 INP MSK4 NUMPER 1402 00714 014654 JSE OYNA 4463 84715 124701 JMP POUT2, I EXIT SHRROUTINE NO716 VO0260 OCT 250 \* SK 4 1404 1455 00117 6600007 4545 0CT 7 ¥460\* EANT +END OF LINE SUBROUTINE 2408× 00130 000000 1054 NOP ENTER SUBROUTINE EUL 04/0 00721 171750 STA ASA STORE A 0471 00722 WAC751 LDA CR CARRIAGE. 00723 014554 JSP GYNA RETURN 8412 00724 061732 LDA LF \$475 LINE 8474 00725 914634 JSH UYNA FEE 6475 00726 060730 LUA ASA RESTORE A 1216 01727 124720 JMP EUL, I EXIT SHPROUTINE 11730 EECOBU A S 4 NCT M TEMPORARY STORAGE 6417 0418 10731 000215 CR OCT 215 01732 NOV212 1479 001 212 LF 1480+ 2481+SUPPRESS MESSAGE PRINTOUT CHECK SUBROUTINE 0482\* 00733 000000 SMPUC NOP ENTER SUBROUTINE 1483 V484 00734 078730 STA AS5 STORE A 8485 00735 814145 JSP MODE CHECK SW. REG. LUA BIT2 SUPPRESS EXCESS 3436 20736 068176 487 00737 002311 SLA, FSS PRINTING? 0074P 024743 JMP ++3 10. 00 8439 LUA ASE RESTORE 4 60741 660750 YES. EXIT SUBROUTINE 12440 07742 124733 JMP SMPOC,1

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RESTORE A 0491 08743 060750 LDA AS5 00744 014751 PRINT MESSAGE 492 JSR MPO LINE FEED 6493 00745 014720 JSB EOL LINE FEED 0494 00746 014720 JSB EUL 00747 124733 JMP SMPOC, I EXIT SUBROUTINE W445 OCT W 8496 80758 808938 ASS TEMPORARY STORAGE 8497\* 0498 \* MESSAGE PRINTOUT SUBROUTINE 0499\* MPU ENTER SUBROUTINE 0500 88751 888488 NOP 00752 070753 0501 ST4 ++1 00753 060000 LOAD & WORD LDA Ø 0502 90754 034753 0503 152 \*-1 WORD = 0? 1504 00755 002703 STA, KSS 0545 00756 124751 JMP MPO,1 YES. EXIT SUBROUTINE NO. PRINT THE WORD 00757 014761 JSB PACO 05:06 00760 024753 REPEAT FOR NEXT WORD 0507 JMP +-5 0508\* #509\*PACKED ASCII CHARACTER OUTPUT SUBROUTINF ADIB\*MOST SIGNIFICANT & BITS OF A REFISTER PRINTED FIRST. 2511\* PACU ENTER SUBROUTINE 8512 00761 000000 NOP 00762 070773 STORE A STA AS6 6513 00763 001700 ALF PRINT 0514 FIRST 2515 - 00764 00170P ALF 0516 00765 010455 AND MSK2 CHARACTER JSE OYNA 1517 00/56 014654 0518 00767 060773 LDA ASA PRINT SECHAR 1519 00770 010455 AND MSK2 00771 014654 JSB UYNA CHARACTER 6010 00772 124761 JMP PACO,I EXIT SUGROUTINE 0521 0 T 10 TEMPORARY STORAGE 00773 000000 4522 ASO 1325\* MORANDETAL PRINTUUT OF A 1525\* OPA NOP ENTER SUBROUTINE 4026 00774 600004 80775 881208 RAL 4927 00776 071010 STORE A 2528 STA AST PRINT にちとう 00777 011011 AND MSK6 1030 01000 030716 JOR MSK4 FIRST 01401 V14654 JSB UYNA NUMAER 81.51 JSB MXT PRINT 1532 81802 815012 0533 01003 015012 JSH NXT NEXT 4334 01004 015212 JSS NXT FIVE JSH NXT WUMAERS 1.535 01905 015012 21226 015012 JSB NAT 1530 2351 61907 124774 JMP OPA, I EXIT SUPROUTINE DOT M STATE BRASHO TEMPOPARY STORAGE 1535 AS7 8539 01411 000001 MSK6 0CT 1 054d\* #541\*NEXT OCTAL CHARACTER OUTPUT 1542+ 61312 000000 ENTER SUBROUTINE 1543 NXT NOP и544 01013 061010 LDA AS7 PREPARE 0545 01014 001200 THE RAL 1546 01015 001200 RAL NEXT MUMPER 4547 01016 001200 PAL

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	0012	-01		
1048	41 217	671910	STA AS7	FOR
d549		010717		FOR
8550			AND MSK5	DUTPUTING
		030716	IOR MSK4	
4551		014654	JSB OYNA	ουτρυτ
0552	01023	125912	JMP NXT,1	EXIT SUBROUTINE
#55 <b>3</b> *				
4554*				
e555*				
155 <b>6</b> =F	PUNCH	AND READ	ROUTINE	
45 <b>57*</b>				
*558#1	ESTS	TAPE PUN	CH AND TAPE READER	
05 <b>59</b> *8	SY OUT	PUTING A	L COMBINATIONS OF	
056 <b>0</b> +E	EIGHT	BITS AND	READING THEM BACK.	
4561*			-	-
0562	01024	000000	PAR NOP	ENTER ROUTINE
		107700	CLC @.C	INITIALIZE, INTERRUPT O
	-	000400	CLB	Infillence, Inferror o
		014461	JSR TOS	FLAG SET?
		025032	JMP ++2	YES.
				•
0567		014554	JSB POF	NO. HALT AT ERROR BUFF
		001216	LDA S17	PRINT FIRST
4569		014733	JSB SMPOC	PAR MESSAGE
1570		061036	LDA ++2	HALT TO
4571		005036	LDB ++1	TURN ON
05/2	01:430	142992	HLT 2	PUNCH
6573	ゆし/37	061111	LDA ONY	PREPARE TO
0574	1240	670675	STA UYN	PUNCH TAPE
6575	01041	P15232	JSB ZEROS	PUNCH LEADER
4576	01342	003400	CCA	PUTPUT ALL ONES
4577	01003	011455	AND MSK2	AS A BEGINNING
6578	31044	614554	JSB UYNA	INDICATOR
		162430	CLA	PUNCH
1580		015242	JSB .64CH	ALL
		15242	JSR .DACH	COMBINATIONS
		261112	L DA UYY	OF EIGHT
0583		070675	STA OYN	SITS
0564		454750	LDA ASA	0110
2004 2005		N12545		
/585 /585			JSR .04CH	
		015242	158 .6404	RUNG
0587		015232	JSB ZEROS	PUNCH
1288		015232	JSH ZEROS	TRAILER
4369		015232	JSH ZERUS	
8548		010117	JSR PARE	EXIT ROUTINE?
1591		¥61463	LDA ++2	NO. HALT TO
4542		065253	LDB ++1	LUAD TAPE
3593	21363	162003	HLT 3	INTO READER
ð59 <b>4</b>	J1154	061116	LDA INN	PREPARE TO
0595	@1w65	174675	STA DYN	READ
2096	\$1966	002400	CL 4	TAPF
1597	61467	414654	JSH DYNA	READ A
		136500	LIN2 LIN 0	CHARACTER
1598			SZH, RSS	CHARACTER = 0?
	21171	0000000		
11598 11599				
4598 4599 8688	01372	425967	JMP +-3	YES. READ NEXT CHARACTE
1598 1599 1601 1611	01372 01373	425367 615253	JMP +-3 JSK k64CH	
6598 6599 8688 8681 682	01372 01373 01374	425967	JMP +-3	YES. READ NEXT CHARACTE

PAGE 0012 #01

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READ SECOND HLUCK JSH REACH 01377 015253 0605 LDA INY 01170 061114 6006 STA UYN 01101 073675 1007 81142 061307 LDA AS11 0048 READ THIRD BLUCK JSR R64CH 01103 015253 6009 01104 061115 IDA IYY 0610 STA UYN 01145 070675 6611 LDA AS11 2612 01100 061307 REAN FOURTH BLUCK JSB REACH 1615 01137 615253 FXIT POHTINE JMP P7 01111 025127 2614 OUTPUT, NO PRINT, PHNUH 001 110000 UNT 41111 110200 4615 **DUTPUT, PRINT, PUNCH** UCT 130000 UYY. 01112 130040 1016 INPUT, PRINT, NO PUNCH OCT 169000 31113 160380 115 8017 INPUT, NO PRINI, PHNCH UCT 150000 21114 150x00 INY 0616 INPUT, PRINT, PHNCH UCT 179090 21115 170000 144 ¥619 INPUT, NO PRINT, NO PUNCH 01116 140900 INN DCT 140000 0620 4621\* 0622\*PUNCH AND READ EXIT SUBPOUTINE N023+ ENTER SUBROUTINE 01117 000000 PARE NOP 4624 STORE A 01120 071135 STA ASH 4625 CHECK SK. REG. JSA MONE 01121 014145 v:626 EXIT THIS IDA HITA N1155 000540 4027 RUUTINE? 01123 042011 SLA, KSS V1028 YES. JMP \*+3 11124 025127 11.24 NO. RESTORE A LDA ASR 01125 001135 1051 EXIT SUPROUTINE JMP PARE, 1 A1126 120117 1.6.51 RESTORE LHA SUYN 47 "n 52 - 01127 - 060676 DUTPHT CODE STA GYN 01130 0/05/75 1033 LINE FEFD JSR FOL 01131 014720 4054 PRINT SECOND LDA STR 01132 101231 1035 PAR MESSAGE JSH SMPOC 21133 014733 21.50 FXIT ROUTINE JMP PAR. 1 01134 125424 2031 TEMPORARY STORAGE OCT M 61135 6000000 453 0015 \* 639× NEAD+PRIST OUT ERRORS ROUTINE 4n4] \* ENTER SUBROUTINE ~:0P MOL 1042 61136 6800003 STORE A STA ASA 01137 071152 2043 SAVE HUA OYN 01119 068515 \$544 B STATE STA ASTA £1141 071163 6n45 LOA SOYN 01142 96:576 9646 STA NYN 01143 17-6/5 VE47 LINE FFFD USH EDL 01144 014720 2648 PRINT POUTPUT #" I DA 515 01145 1611/2 6644 JSH MPO 61146 014751 けっちけ RESTORE A LIA AS9 01147 001102 -- 501 PRINT OCTAL NUMBER JSH OPA 01158 014774 1002 PRINT "INPUT =" LIA SIA 01151 061242 15.73 JSH MPO 01152 014701 1054 PRINT OCTAL e1153 050001 I TIA 1 1200 JSH OPA NUMHER 01154 014774 2 b 5 6 LINE FEFD JSR LOL 01155 014720 1007 RESTORE W1156 461163 LDA ASI@ +65B STA DYU STATE 01157 074675 205Y LDA AS9 RESTORE A Hf. 6 kt 01164 001102 JMP POF, I EXIT SHARDHITINE 01161 125136 8561

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R662					
1002	01162	NNNDDD	ASS	OCT M	TEMPORARY STORAGE
8003		000000			
0664		047525	00		NUTPLIT =
		052120	••		
		652524			
		020075			
		020040			
0065		DDDDDDD		00T /	
0006		161164	SI5	0 CT 0	
2667		020940			•
		020040	01	4SC 6,	INPUT =
		044516			
		050125			
		N52N40			
		035440			
8668		0000000		ODT G	
8669		161173	CTC	OCT 0	
4010		041105			
		943511	E MINIT	ASC 10,	BEGIN PUNCH AND READ
		843511 847340			
		050125			
		047113			
		44646			
		143516			
		842340			
		892840			
		848534			
0071		40434V		11 m T 12	
1672				LUCT N LUCA PAR	W 4
10,73		042516			
		642840	2 A 11 12	P30 9,F	ND PUNCH AND READ
		050125			
		047103			
		044840			
		442516			
		142140			
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1.14		N99460		001 0	
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			010		- ' <b>C.</b>
11110 -					
	001201	BLANK T	APF		
	001201	BLANK T	APE		
BE/7*( 215/2*				N () E	FNTER SHADNATIAN
BF/7*( 955/8* イロ/チ	01232	BLANK T Nønmur 9924.00			ENTER SUBROUTINE
形と <b>ノブ★(</b> 別のノビ★ そのノラ 別のとわ	01232 01233	000-100 002440		CLA	
形と <b>ノブ★(</b> 別のノビ★ そのノラ 別のとわ	01232 01233 01234	Иврания		CLA LEP-SCX	
86/2*( 96/8* 40/9 9688 8688	01232 01233 01234 01235	000-100 002440 065241	ZEROS	CUA URP SCX USB UYN,	A OUTPUE ZERO
BF/7+( 95/5+ 45/4 9551 9552 そ553	01232 01233 01234 01235 01235	000000 002440 065241 014654 006046	ZEROS	CUA URP SCK USB OYN, INB,SZB	A OUTPUT ZERO 32 ZEKOS?
ドトノア★( ジロノビ★ ジロとり ジロとり ジロカ2 そうめ3 どの84	01232 01233 01234 01235 01235 01235 01237	ийиний 002440 065241 014654 006806 025235	ZEROS	CLA LEP SCK JSB UYN TNB,S/B TMP +-2	A OUTPUT ZERO 32 ZEROS? NU.
ドトノア★( ジロノビ★ ジロとり ジロとり ジロカ2 そうめ3 どの84	01232 01233 01234 01235 01235 01235 01237 01240	000000 002420 065241 014654 006006 025235 125235	ZEROS	CLA LEPP SCX JSB UYN INB,SZB IMP *-2 JMP ZEPC	A OUTPUT ZERO 32 ZEROS? NU. DS,1 YES. EX1T SUBROUTLAR
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ドレフォ( ジャノスキ ジャノス ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンスキ ジャンス シャン シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャンス シャン シャンス シャンス シャン シャン シャンス シャンス シャンス シャンス シャンス シャン シャン シャン シャン シャン シャン シャン シャン	01232 01233 01234 01235 01235 01237 01237 01240 01241	000000 002410 065241 014654 006806 025235 125235 125232 177740	2EK08 503	CUA UPP SCX USB UYN TNB,S78 TMP +-2 UMP XEPC UCT 177	A OUTPUT ZERO 32 ZEKOS? NU. DS,1 YES. EX1T SUBROUTINE 740
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ドレフォ( パトノフォ) パトノフォ パトノフ パートト マート パート パート パート パート パート パート パート パ	01232 01233 01234 01235 01235 01237 01237 01240 01241 INCREME 01242	000000 002410 065241 014654 006806 025235 125235 125232 177740	ZEROS SC3 JUTPUT .04UE	CLA LEPP SCX JSB UYN INB, S/B IMP *-2 JMP XEPC UCT 1777 & REG, 6	A OUTPUT ZERO 32 ZEROS? NU. DS,I YES. EXIT SUBROUTINE 54 TIMES ENTER SEBROUTINE

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01245 002904 INCREMENT OUTPUT HOPS 0093 IN L 64 CHARACTERS? 01246 006006 INF. SZH 9694 1695 31247 025244 JMP +-3 NC. 01250 014720 JSH FOL YES. 0696 EXIT POUTINE 1047 x1251 125242 JHP .04CH, I OCT 177790 0698 81252 177730 504 60994 0700\*READ AND CHECK 64 CHARACTERS 0101\* ENTER SUBROUTINE R64CH NOP 0702 01253 000000 0783 01254 465252 LDB SC4 RESET CHARACTER COUNTER 0764 01255 075306 STR M64 READ A 0785 M1256 014554 48 JSB UYNA CHARACTER 41257 106500 L133 LIB Ø 9740 EXIT ROUTINE? 01264 015117 JSH PAPE 0707 ERROR? 6748 - 21261 050801 CPA 1 N0. JMP ++2 NO. 0144 J1262 V25264 YES. PRINT OUT ERRUP 071 e Ø1253 015136 JSH PUE INCREMENT REFERENCE 01264 002N04 0/11 INA 64 CHAMACTERS? 01265 035306 157 M64 8712 W1266 025256 JMP PS NO. 1113 YES. STORE A 01267 071307 STA A311 0714 LDA CR CHECK FOR 01270 060731 6715 CAPPIAGE 0715 01271 014654 JSR OYNA 6711 01272 100500 LIP W RETURN 1.154 01273 050001 ERRUR? UPA 1 0718 IMP ++2 ND. 01274 025276 0719 YES. PRINT OUT ERRUP 01275 015136 JSP PUE 8726 CHECK FOR 0721 01276 060732 LIA LF 1122 01777 014654 JSR UYNA LINE FEED 01300 106500 0125 6185 110 V FRROR? 6124 01301 050001 CPA 1 01302 025304 JMP \*+? 4720 NU. YES. PRINT OUT ERFOR ALCO 21333 215136 JSH PUF 4721 01304 061307 LOA ASIL RESTORE A EXIT SUBROUTINE w720 11345 125253 JNH REACH, L 01396 177790 HCT 177790 0724 464 TEMPORARY STORAGE OCT V 6730 61347 668868 AS11 2151+ 1732+ 1/35\* 2734\*PRIME AND KEYBOARD ROUTINE 1155= 8135 61318 00MAAA PAK NOP ENTER ROUTINE INITIALIZE, INTERRUPT OFF 21311 107/06 CLC V.C 4737 LEA SOYN PREPARE 1138 21312 064676 TO PRINT 01313 070-75 -139 STA UYN PRINT FIRST 1144 31314 851371 LDA STA JSR SMHOC PAK MESSAGE . 141 - ^1 <15 - 214733 PRINT DA ASCII CHANACTERS 0742 - 0131H - 215452 JS9 PRALL 61517 115452 PRINT AN ASCIL CHARACTERS 2143 JSH PHALL LINE FEFD 1744 01326 014720 JSH RUL FXIT HOUTINE? 0142 01321 017340 JSB PAKE 01322 061414 0746 LDA SI10 ND. PRINT SECOND 4/47 \$1323 ×14733 PAK MESSAGE JSH SMPUC PREPARE TO READ V/48 01324 WOLLIG 49 LDA INN IN FROM KEYBOARD W749 01325 102690 0145 UTA N

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0750 01326 015340 P1 % JSB PAKE EXIT ROUTINE? 0751 61327 103700 STCC3 STC 0,C NO. WAIT 0752 21330 006430 FOR INPUT CLH 6753 01331 014451 **JSB TOS** ANY INPUT? 01332 025334 \$754 JMP ++2 YES. 0/55 61333 025326 JMP PIA NO. 0756 01334 106500 LISO LIB @ LOAD DATA INTO B 2757 01335 060201 LDA 1 PUT & ENTO A 1758 01336 014654 JSP UYNA OUTPUT A 4759 01337 025324 JMP P9 READ NEXT CHARACTER 0700+ W/61\*PRINT AND KEYBOARD EXIT \$162\* 1713 01341 000000 PAKE HOP ENTER SUBROUTINE 01341 071162 0704 STA AS9 STORE A 8705 01342 014145 JSH MODE CHECK SW. REG. 0765 01343 060201 LUA BITS EXIT THIS 0767 01344 002011 SLA, FSS ROUTINE? 6708 01345 025350 JMP ++3 YES. 0769 01346 061152 LUA ASO RESTORE A NO. 2770 11341 125340 EXIT SUBROUTINE JMP PAKE,1 01350 014720 2771 JSH EUL 4112 01351 061431 1.04 SI11 PRINT THIRD 1773 61332 014733 JSH SMPOC PAK MESSAGE 2114 01353 125310 JMP PAK, 1 EXIT ROUTINE 0170 01354 041135 PAKMI ASE 12, BEGIN PRINT AND KEYROARD 01355 043511 \$1356 \$4734B 01357 050122 01360 044516 01361 052040 01352 044516 11353 042040 21364 045535 -1355 254512 21366 047501 01367 051104 4776 V1370 600000 UCT M 1177 01371 061354 LDA FAKMI 519 +778 11372 052523 PAKM2 ASC 17, USE KEYBOARH SLUWLY (5 CHS. / SEC. ) 1373 042444 ¥1374 845505 ×1375 054502 \$157F 047501 01377 051104 21148 N24123 01201 040117 81422 053014 +14,3 11544430 ×1144 424255 11-35 020113 2110r 244123 01117 827357 Vitir 051545 241411 °41456 11412 424242

W/79 01013 000000

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## PAGE 0017 #01

0/80 STIR LOA PAKM2 01414 061372 9781 PARM3 ASC 11, END PRINT AND KEYHOARD 01415 042516 01416 042040 01417 050122 01420 044516 01421 052046 01422 040516 01023 042040 81424 045535 01425 054532 81426 847501 01427 001104 1782 01030 000000 UCT P LDA PAKM3 01431 061415 6783 5111 1784\* 0785\*PR1%T ALL CHARACTERS SUBRUUTINE 0730\* ENTER SUBROUTINE 91132 000000 PRALL NOP 0787 PRINT FIRST 8314 01033 001440 LHA SC5 LINE OF CHARACTERS 6789 01034 015442 JSH .32CH LDA SCA PRINT SECOND 01435 061441 4790 LINE OF CHAPACTERS \$791 01436 010442 JSH .32CH v792 1437 125432 JMP PRALL, I FXIT SHARUUTINE 0793 61040 000300 505 OCT 3MA 61441 660240 CCT 240 805 4744 v795\* W796\*PK151 32 CHARACTERS SUBROUTINE 11797\* 6148 01342 000900 .32CH NOP ENTER SHARINGTINF STH 852 STORE N 4799 31443 075454 RESET DOUNTER 01444 005241 LDP 503 8000 JSH NYNA PHINT A 01445 014654 \$591 11112 01446 002004 INA INCHENENT A 61447 026246 INH, SZR 32 CHAHACTERSE Ser. 5 1498 825445 JMP #= 3 MO. PRINT VEXT CHARACTER 1844 JSH EDL YES. LINE FEED 11111 014720 1000 LAA HS2 RESTORE 9 1452 265454 15:15 JMP .320H.1 EXIT SUFROUTINE V. O. / - M1058 125442 CCT V 31150 900300 382 TEMPORAPY STORAGE 4040 8804 END. \*\* ~~U E9R0R5\*

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