

MULTIPLEXING TECHNIQUES,  
2000C HIGH-SPEED & 2000F HP TIMESHARE SYSTEMS

July, 1972  
Ralph Carpenter

Audio Tape Course

Course: MULTIPLEXING TECHNIQUES, 2000C HIGH-SPEED & 2000F HP  
TIMESHARE SYSTEMS

Objective: To enable Systems Analysts to support software utilizing the  
12920A multiplexer, particularly the 2000C High-Speed and  
2000F Timeshare Systems.

Abstract: Techniques for programming the 12920A Asynchronous Multiplexer  
are discussed in detail, along with a functional description of  
the hardware. The 2000C High-Speed and 2000F Timeshare Systems  
are discussed, with emphasis on their use of the 12920A Multi-  
plexer and the ways in which they differ from the 2000C.

Total Length: Approximately 3 days, assuming that the prerequisite is met;  
audio tapes are approximately 3 hours long.

Prerequisite(s): "Systems Analysts' 2000C Audio Tape Course", July, 1971,  
by L. Walsh.

Chronology Suggested:

- I. Study background material
  - A. Ref's. (1) and (2)
  - B. Prerequisite (2000C Audio Tapes), if not already met.
  - C. Ref. (5), pp. 1-10.
- II. HP12920A Asynchronous Multiplexer Programming
  - A. Ref. (9), tape #1, side A (plus notes and slides).
  - B. Ref.(7); remainder of Ref. (5).
  - C. Ref. (9), tape #1, side B and tape #2 (plus notes and slides)
  - D. Exercises (1), (2), and (3).
- III. Timeshare Systems, HP 2000C High-Speed and 2000F
  - A. Ref's. (4) and (6).
  - B. Exercise (4).
  - C. Ref. (9), tape #3 (plus notes and slides).
  - D. Ref's. (8) and (3).
  - E. Exercise (5).
- IV. Course Review/Refresher
  - A. Ref. (9), tape #4.
  - B. Ref's. (5) and (7).
  - C. Ref. (9), notes and slides.

### Course References:

- (1) HP02000-90017 (June '72) - 2000C Time-Shared Basic System Operator's Guide.
- (2) HP02000-90016 (April '71, updated April '72) - 2000C: A Guide to Time-Shared Basic.
- (3) May '72 - 2000C Time-Shared Basic Internal Maintenance Specifications. Pearson & Haccou.
- (4) HP S.A. Note #TS-65 (March '72) - Preliminary High-Speed 2000C Overview. Carpenter.
- (5) Jan. '72 - The 12920 Asynchronous Multiplexer: Application Note. Lyman.
- (6) Nov. '71 - HP 2000C (High Speed) Time-Shared Basic System External Reference Specifications. Pearson & Haccou.
- (7) HP12920-90001 (Aug. '72) - HP12920A, 12920A-001 Asynchronous Multiplexer Interface Kits: Operating and Service Manual.
- (8) HP S.A. Note #TS-66 (March '72) - 2000C High-Speed: Telephone Lines for Terminals Faster Than 30 cps. Carpenter.
- (9) Course tapes (cassettes), outline, slides (July '72) - Multiplexing Techniques and 2000C High-Speed and 2000F Timeshare.

### Organization of Audio Tapes:

- Tape 1, Side A -- Information transfer, multiplexing, data communications environment, possible methods of multiplexing, introduction to the 12920A Asynchronous Multiplexer.
- Tape 1, Side B and Tape 2 -- Programming the 12920A Asynchronous Multiplexer.
- Tape 3 -- The 2000C High-Speed and 2000F HP Timeshare Systems.
- Tape 4 -- Course Summary and Overview.

## COURSE OUTLINE

### I. Multiplexing Techniques

#### A. Information Transfer

1. Parallel transfer used in inter-computer and intra-computer information transfer.
2. Serial transfer used in data communications and hardwired computer/terminal transfer.
3. Components of serial transfer
  - a) parallel to serial converter
  - b) modems (digital, frequency-shifted, digital)
  - c) serial to parallel converter
  - d) data source and data sink (computer and terminal)
4. Multiple-path serial transfer --  
combine many converters to get multiplexer

#### B. How best to perform multiplexing task

1. Anatomy of a serial character  
Mark, space, start bit, band-rate, character size, stop bits, parity, ASCII, full-duplex, half-duplex, echo-plex defined.
2. Macro environment
  - a) Telephone lines may or may not be employed
  - b) Asynchronous activity level
  - c) Terminals may differ in baud-rate, character size, code convention, control signals
  - d) RS232C interface standard specifies pin numbers and voltage levels for data and control signals
  - e) ASCII code convention is widely accepted, but it's not the only code employed
3. Possible solutions to multiplexing problem
  - a) Give each terminal special consideration in design of multiplexer; deny support to terminals having different characteristics
  - b) Modify non-standard terminals to equate them to one or two standard characteristics
  - c) Design a multiplexer that is totally general in nature; let software compensate for differences in terminals
  - d) Design a programmable "black box" which is software-controlled; support the RS-232C interface specification; handle all code conventions, but allow ASCII as the standard
4. Past HP solution - the 12584C
  - a) Constant 880 Hz interrupt rate
  - b) Very software-dependent
  - c) Difficult to support non-standard terminals
  - d) Limited baud-rate allowed

- I. B. 5. Desirable programmable features of "black box"
  - a) Variable baud-rate and character size
  - b) Parity generation by hardware
  - c) Automatic hardware echo
  - d) Modem control levels
  - e) Interrupt upon receive/transmit character completion
  - f) Monitor modem status lines and interrupt on change
  - g) Recognize the BREAK character as a special case
  - h) Sample and collect received bits
  - i) Provide a character buffer per port, in addition to the bit-collection buffer
- 6. What the "black box" would have to do
  - a) Recognize start bit
  - b) Count received bits and compare with programmable character size
  - c) Sample received bits in accordance with programmable baud-rate
  - d) Interrupt upon character completion
  - e) Recognize reception of BREAK during data transmission
  - f) Perform bit-by-bit echo (1/2 bit-time delay)
  - g) Accept from software logic levels for modem control signals
  - h) Monitor status signals from modem and interrupt upon change from software-specified value
- C. HP's new multiplexer - the 12920A
  - 1. Features of the 12920A
    - a) Allows operation of 16 full-duplex ports simultaneously
    - b) Meets RS-232C specification
    - c) Allows operation of 103- and 202-type modems, and the 801 automatic calling unit
    - d) Programmable speed, parity, and character size for receive and transmit for each of the 16 ports independently
    - e) Provides a received-character buffer for each port
    - f) Echo can be turned on or off by software; when on, hardware performs echo automatically
    - g) BREAK is recognized in a special fashion, and software is notified with a specific indicator
    - h) 5 diagnostic, receive channels are supplied (in addition to standard 16 channels); these may be used for automatic speed detection
    - i) Software may provide logic levels for two modem control signals - Data Terminal Ready and Request to Send
    - j) Two modem status lines are monitored - Data Set Ready and Signal Detect (carrier)
    - k) Any port may be operated over modems or may be hardwired
    - l) Each port's receive and transmit channel may be enabled or disabled independently

- I. C. 2. Software required to operate the 12920A
  - a) Transmission, reception, and modem-control parameters must be supplied for each port prior to its use - configuration
  - b) Reception interrupt handling
    - receive interrupt determined by status bit
    - channel number available from interface
    - store character or perform special function
    - CLF to acknowledge interrupt, STC to enable next interrupt
    - interrogate status bits - break, parity, character-lost
  - c) Transmission interrupt handling
    - transmit-complete interrupt determined by status bit
    - channel number available from interface
    - completion interrupt normally triggers transmission of next datum
    - CLF to acknowledge interrupt, STC to re-arm interface
  - d) Modem-control interrupt handling
    - determine reason for interrupt (dial-up, carrier established, hang-up, etc.)
    - take appropriate action and re-arm interface
  - e) Real-time modem status determination
    - stop scanning process and select a specific channel
    - obtain real-time status and complete software processing
    - restart scanning operation
- D. HP 12920A Programming Techniques [Tape 1, Side B]
  1. For 16 ports operating over 103's, three boards required
    - a) 2 data boards, LSC (12921-60001) and USC (12921-60002)
    - b) One control board (12922-60001)
    - c) Cables from interface boards to connector panel (data cable is 12921-60003, control cable is 12922-60003)
    - d) Connector panel for 16 ports (30062-60002)
  2. Data interface programming
    - a) LSC and USC boards must be in adjacent I/O slots
    - b) LSC used for parameters and data output, data input; all flag and control signals are used on LSC only
    - c) USC used for channel numbers output, channel numbers and status input
    - d) Configuration (output parameters and channel numbers)
      - (1) reception configuration
        - check SEEKING status bit prior to configuration
        - supply parameters for enable, echo, diagnose, character length, baud-rate to LSC
        - supply channel number to USC
      - (2) transmission configuration
        - check SEEKING
        - supply parameters for enable, parity generation, diagnose, character length, baud-rate to LSC
        - supply channel number to USC

- I. D. 2. e) Actual information transfer
  - (1) reception interrupt handling
    - by hardware:
      - start bit begins sample
      - bits echoed at sample-time
      - oscillator bumps baud counter
      - baud counter = parameter causes sample
      - least significant data bit first, parity last
      - bit counter = character length causes flag to be set
      - flags are buffered (16 flip-flops)
      - bits copied to character buffer when flag turned on
      - interrupts unstructured
      - BREAK caused by no mark within data bits
      - only first character of BREAK is echoed and causes interrupt
    - by software:
      - input data from LSC, channel from USC
      - determine reception from status bit in USC word
      - sample program on slide 12
  - (2) transmission interrupt handling
    - by software
      - first output character normally sent upon reception of carriage return
      - transmit interrupt used to trigger transmission of next character
      - bit 7 of data character must be consistent with parity generator
      - synchronization word for delay purposes simulates an all-mark (idle) condition
      - stop bits must be supplied with data character
    - by hardware
      - oscillator bumps baud counter
      - baud counter = parameter causes bit transmission
      - data bits transmitted LSB data first, parity last
      - parity generated at transmit time
      - bit counter = character length causes flag to be set
      - flags buffered (as in reception)
      - stop bits of data character must be marks or long space could result (chatter at terminal)
  - (3) use of diagnostic channels
    - set diagnose bit in configuration of transmit channel (0-15) to lash its output to the 5 receive-only channels (16-20); configure each of the six channels for a different speed to allow automatic speed detection, while diagnostic bit set during reception configuration.

- I.
  - D.
    3. Control interface programming
      - a) 103-type modem operation
        - supply 12922 with logic levels for Data Terminal Ready and Request to Send (command signals C1,C2)
        - monitor status lines Data Set Ready and Signal Detect (status signals S1,S2)
      - b) 202-type modem operation
        - for full-duplex, 4-wire operation over leased line, can be treated like 103 operation
        - for dial-up operation (half-duplex) an additional control board is required for command lines Supervisory Transmit and Frequency Select, and status lines Supervisory Receive and Clear to Send
      - c) 12922 has one-bit registers which are dedicated to the command signals (C1,C2) and stored status values (SS1,SS2)
      - d) software must initially load the 12922 with values for C1,C2,SS1, and SS2 (like configuration)
      - e) output control word to 12922 specifies
        - scan (on/off)
        - update (on/off) - whether to consider EC1,EC2 channel number
        - EC2,EC1 - enable locks for strobe of C2,C1
        - C2,C1 - command values
        - ES2,ES1 - enable comparisons (SS1=S1?, SS2=S2?)
        - SS2,SS1 - comparison values for modem status
      - f) initialization program - slide 15
      - g) input status word from 12922
        - I2,I1 - indicates whether SS2≠S2 or SS1≠S1
        - ES2,ES1 - from board (same as were output)
        - S2,S1 - real-time values at interrupt time

This word can be output to the 12922 in order to allow interrupt on subsequent change.
      - h) control interrupt handling program - slide 17
      - i) real-time status retrieval program - slide 18
    4. Command and status signal requirements for data communications - slide 19
    5. Conditions for 202-type modem operation - slide 20
    6. Review of 12920A programming techniques



## II. The 2000C High-Speed and 2000F HP Timeshare Systems [Tape 3]

### A. Concept of a communications processor

1. Devoting an entire processor to terminal I/O increases the efficiency of both functions - problem-solving by System processor, terminal handling by Communications processor.
2. Modules of communications processor
  - a) initialization
  - b) power-fail/auto-restart driver
  - c) processor interconnect driver
  - d) TBG driver (ENTER, LOG-ON, line drop-out timing)
  - e) multiplexer driver
  - f) modem control driver
  - g) line printer driver
3. Thus, the I/O processor is almost totally interrupt-driven. Only initialization and idle are not caused by interrupt.

### B. Relationship between 12920A and 2000C High-Speed I/O processor

1. Initialization effects TTY tables only
  - a) parameter words
    - ?RPRM - reception
    - ?SPRM - transmission
    - ?PPRM - modem control
  - b) initial values
    - ?RPRM: 110 baud
      - 11 bits per character
      - echo on
      - enable on
    - ?SPRM 110 baud
      - 11 bits per character
      - parity generator on
      - enable on
    - ?PPRM Data Terminal Ready on
    - Request to Send on
2. Data board (12921) interrupt processing
  - a) Routines MPXIO and MPYIO are invoked to handle receive/transmit interrupts
  - b) Upon reception interrupt, the input character is tested for special handling; normal characters are buffered. If code conversion required, it is done first.
  - c) Status bits for parity and character lost are not interrogated
  - d) Abort triggered by BREAK status bit on receive interrupt
  - e) Output completion interrupt triggers output of next buffered character
3. Modem control interrupt processing
  - a) 12922 primed to interrupt if either Data Set Ready (CC) or Signal Detect (CF) goes true
  - b) If Carrier goes true, the driver simply discontinues line-dropout timing, in case it had begun
  - c) If Data Set Ready goes true, the driver initiates log-on timing (120 seconds)
  - d) If either CC or CF goes false, the driver begins line-dropout timing

- II. B. 4. Time-base generator interrupt processing
  - a) Interrupts occur every 100 ms. At each interrupt the TTY table for each user is scanned for disconnect, ENTER timing, log-on timing, line-dropout timing, and user hung-up bits.
  - b) When line-dropout times out, tells System Processor that user hung up; after housekeeping, System tells I/O Processor that user-hung-up.
  - c) When log-on times out, turns off log-on timing, line-drop-out timing, and user-hung-up bits; it then turns off Data Terminal Ready on the 12922 and sets phones-disconnect
  - d) When ENTER times out, resets ENTER-timing, sets no-input, resets echo, and tells System that ENTER timed-out
  - e) Hang-user-up bit set causes reset of hang-user-up, log-on timing, and line-dropout timing; phones-disconnect is set; and Data Terminal Ready is dropped
  - f) Phones-disconnect bit set causes reset of phones-disconnect and reconfiguration of 12921 and 12922 for next caller
  - g) TBG driver occasionally retrieves real-time status (stop scan, select channel, get status, start scan)
- C. Commands different, 2000C vs 2000C High-Speed/2000F
  - 1. Deleted in 2000C High-Speed, 2000F  
FAST, SLOW
  - 2. Added in 2000C High-Speed, 2000F  
SPEED, PORT - concerning terminal characteristics  
PRINTER, LPRINTER - concerning the line printer
  - 3. Modified in 2000C High-Speed, 2000F  
HELLO - sometimes a terminal sub-type is required
- D. Difference between 2000C High-Speed and 2000F  
The 2000F uses 2100A with hardware floating pint; the 2000C High-Speed uses pseudo-floating-point routines.
- E. 2000C High-Speed/2000F Communications Processor  
core map - slide 21
- F. Selected communications processor routines - slides 22a through 32b

### III. Summary and Overview [Tape 4]

#### A. Introduction

Course covers multiplexed information transfer techniques, a description of the 12920A asynchronous multiplexer, how to program the 12920A and a discussion of the HP Timeshare Systems 2000C High-Speed and 2000F.

#### B. Information Transfer

1. Parallel transfer used inside a computer and for communication from one computer to another.
2. Serial transfer used for communication between a computer and its terminals, or between two terminals.

#### C. Serial Information Transfer

1. Serial transfer may take place in a local environment, and must take place in a remote environment.
2. Local serial transfer = hardwired communication
3. Remote serial transfer is called data communications. We consider only asynchronous data communication in this course.
4. Asynchronous serial data-communication takes place over common carrier (e.g. telephone) lines. Modems perform interface between digital signal requirements of computers and terminals and analog signal requirements of the common carriers.
5. Since computers think in parallel, in order to prepare data for serial transmission (and in order to interpret received serial data), there must exist, between computer (or terminal) and modem, a code transformer (parallel-to-serial, serial-to-parallel).

#### D. Multiple Serial Data Paths

1. From an economy standpoint, for systems requiring communication with many terminals, it is better to combine a series of parallel-serial/serial-parallel converters into one piece of hardware.
2. The combination of many such converters is called a "multiplexer".

#### E. The Data-comm Environment for Asynchronous Information Transfer

1. Terminals' characteristics may vary in speed, character-size, code convention, and in other ways which are more subtle.
2. Some terminals are designed for half-duplex operation (can only receive or only transmit at a given time - cannot do both simultaneous); in such a terminal, when a key is depressed, it is transmitted and printed at the same time; when a character is received it is printed.
3. Other terminals operate in full duplex mode (simultaneous transmit and receive); when a key is depressed it is simply transmitted (not printed); received characters are printed. A full-duplex receiver, upon receipt of a character, in turn transmits the same character back to the terminal for printing; the mode of operation is called echo-plex.

- III. E. 4. Telephone lines and modems may be employed to carry data over long distances. Or, a simple cable may be used for a local terminal.
5. Activity level from one terminal to another is totally asynchronous and (on input) uncontrollable.
6. A standard serial code convention is in wide use among terminal and computer manufacturers - ASCII. Others include EBCDIC, Call/360, Baudot, Six-level Transcode - but ASCII is the current attempt at standardization.
7. The EIA Standard, RS232C, is a set of rules governing pin connectors and voltage levels for purposes of interfacing computers, terminals, and modems.

F. HP's Solution to the Multiplexing Problem - the 12920A

1. Features

- a) programmable  
    baud-rate  
    character size  
    parity generation (odd/even) for 8-level code (on/off)  
    automatic echo (on/off)  
    16 independent ports  
    independent transmit and receive channels for each port  
    self-diagnosis via 5 receive only diagnostic channels
- b) automatic  
    modem status monitoring  
    input character buffer per port  
    RS232C I/F  
    interrupt upon input and output character completion  
    bit sampling, distribution, and collection  
    break reception recognition

2. Software requirements

- a) configuration  
    initially load I/F with parameters for receive and transmit
- b) interrupt processing  
    determine if receive or transmit complete  
    buffer input (or process it)  
    supply next output character  
    control echo when necessary  
    compute parity other than 8-level  
    furnish modem control logic levels

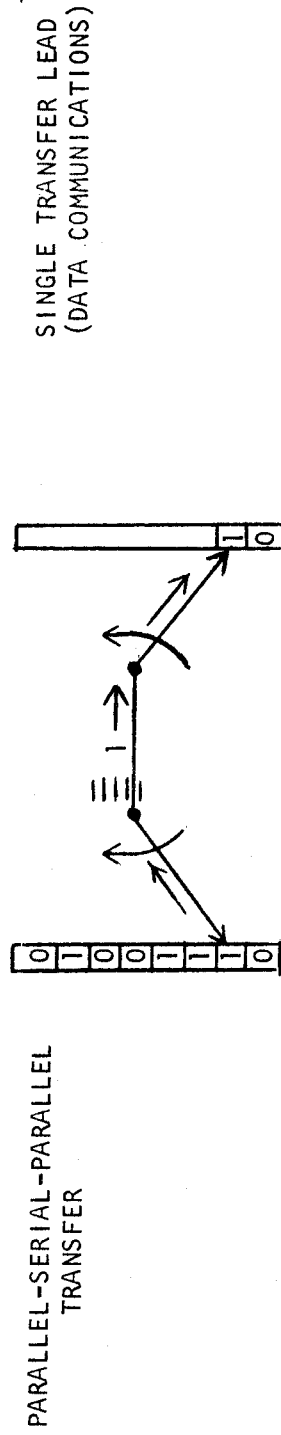
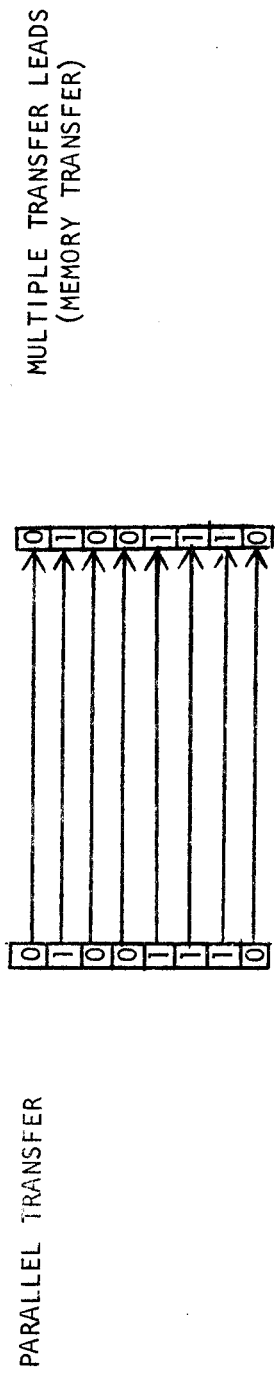
### III. G. Programming the 12920A

1. General
  - a) 3 boards required for 1-16 ports over 103's
    - data, LSC & USC (12921-60001,2) in adjacent I/O slots
    - control (12922-60001)
  - b) For 202 dial-up for 1-16 ports add 1 control board (total - 4)
2. Data I/F Programming
  - a) Separate into configuration and interrupt processing
  - b) Configuration - receive channel
    - output parameters for baud-rate, character size, echo and diagnosis (LSC)
    - output channel # with each parameter word (USC)
    - no interrupt occurs -- must check SEEKING bit of status word before outputting
  - c) Configuration - transmit channel
    - output parameters for baud-rate, character size, parity generation, diagnosis (LSC)
    - output channel # with each parameter word (USC)
    - no interrupt (check SEEKING)
  - d) Interrupt processing
    - interrogate receive/transmit status bit
    - store or process input
    - provide next output
    - interrogate break reception during output
3. Modem control I/F Programming
  - a) Initialize control signals, status monitors
  - b) Interrupt processing
    - determine physical reason for status change
    - modify control output signals in accordance with new status
    - change status monitor state of I/F to allow interrupt upon another change
    - set-up timer for carrier loss in case "hit" (not hang-up) occurred
  - c) When using auto-speed-detect capability, set up diagnostic ports for various speeds so that baud-rate can be determined by process of elimination.

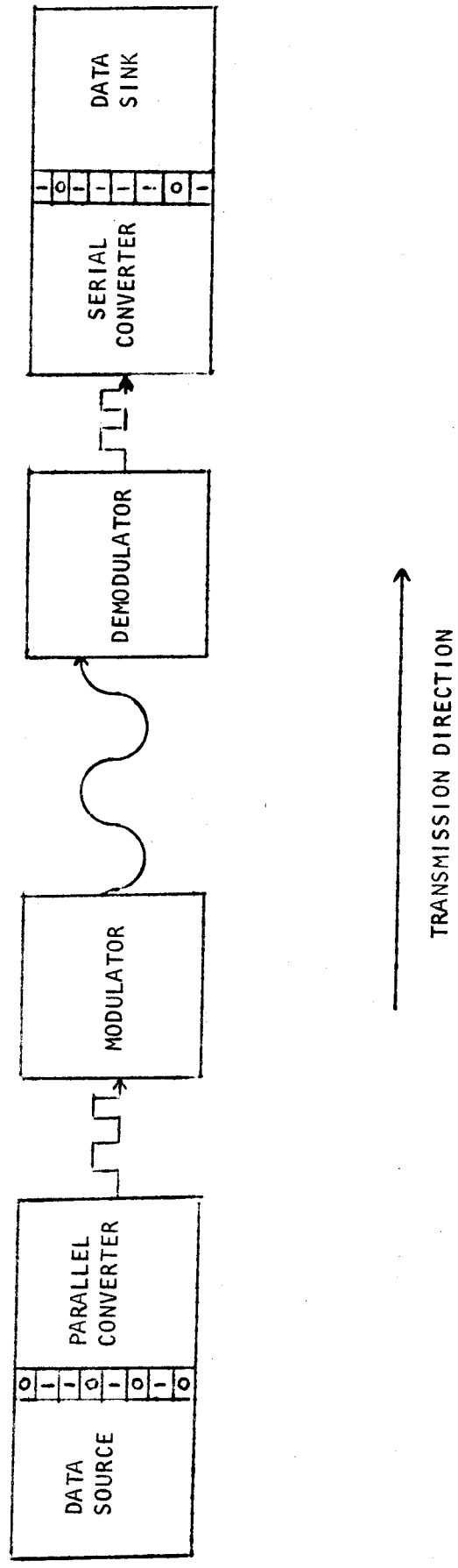
III. H. Use of the 12920A: HP Timeshare Systems 2000C High-Speed, 2000F

1. Hardware employed
  - 2 kits (12920A) to allow 32 ports via 103's
  - TBG to time log-ons, enter time-outs, line-dropouts
  - Use of 12920 resulted in less code than 2000C multiplexing, therefore, a line printer has been added as an option (2610, 2614, 2767, 2778).
  - interconnect to System processor
2. Software
  - a) I/O processor totally different from B/C
  - b) System processor in C' same as C, except 4 library routines.
  - c) System processor in F only differs from C' in that floating point 2100A micro-code employed instead of pseudo-floating point routines.
3. Commands different from 2000C
  - a) FAS & SLO of C deleted
  - b) New commands
    - (SPE - specifies speed & character size for port(s)
    - System(POR - prints speed & character size for all ports
    - Console(PRI - adds or deletes LP from system, specifying typ
  
    - LPR - allows user to request LP for output
    - QC - suspends LP output, user maintains LP
    - WC - resumes LP output following QC
  - c) Changed command
    - HEL - sometimes necessary to specify terminal sub-type

INFORMATION TRANSFER



SINGLE PATH  
PARALLEL-SERIAL-PARALLEL  
INFORMATION TRANSFER

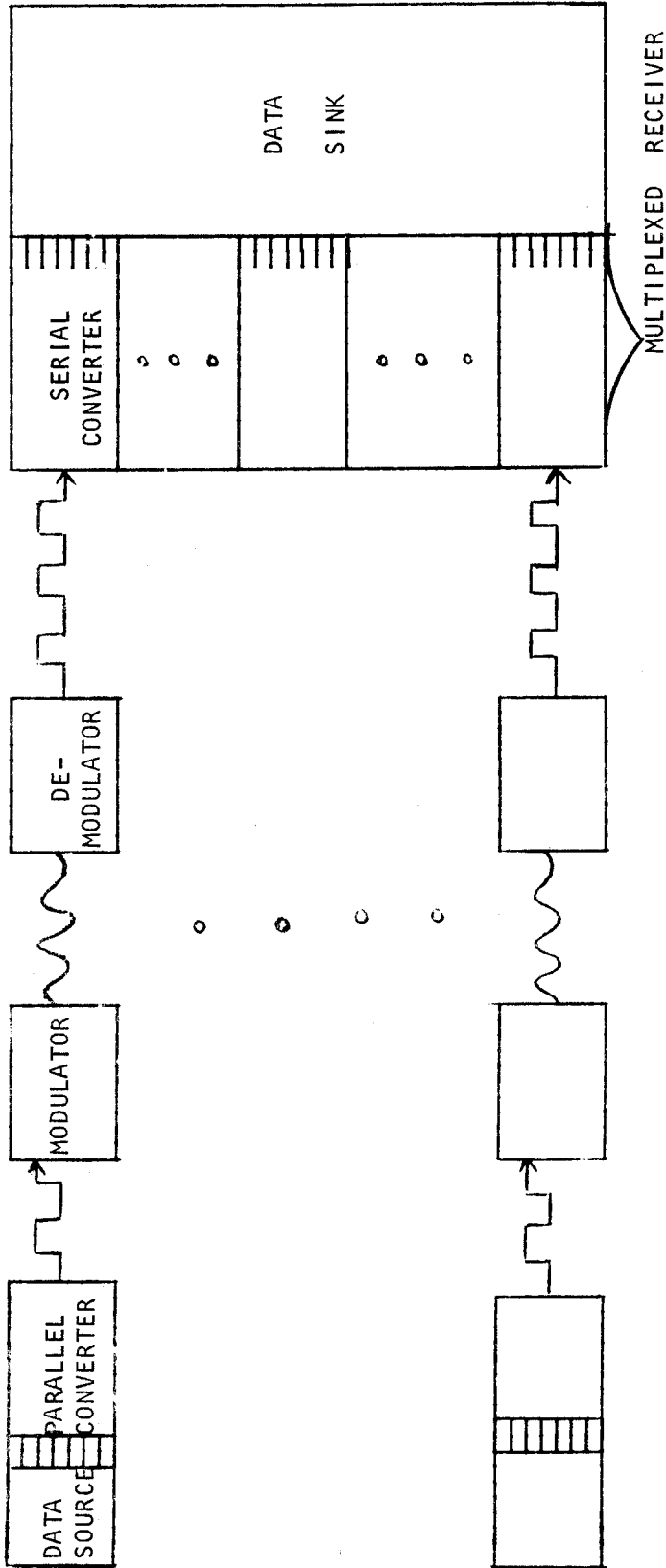




MULTIPLE PATH

PARALLEL-SERIAL-PARALLEL

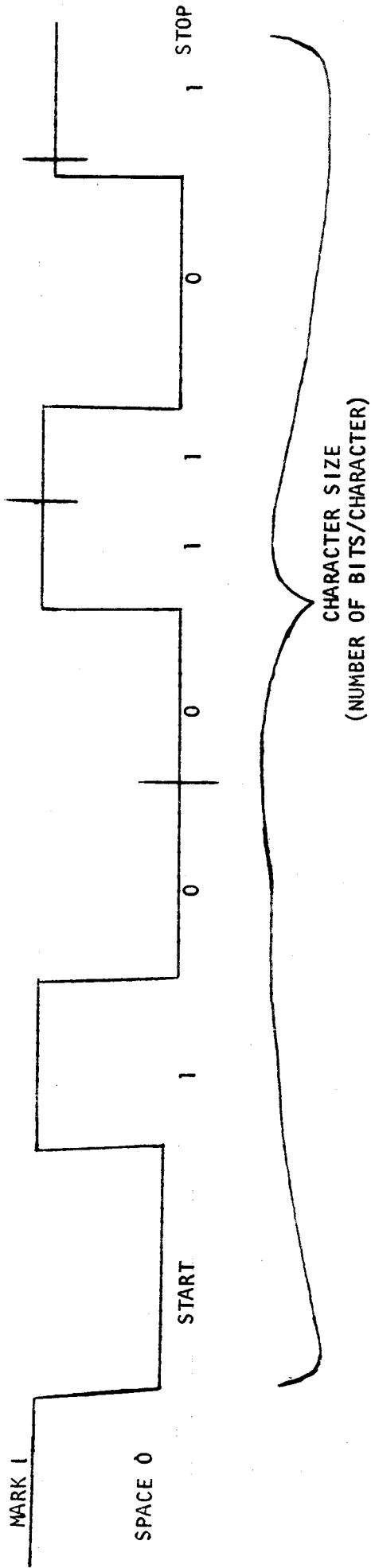
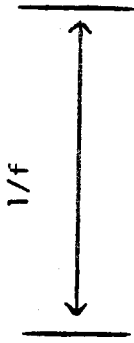
INFORMATION TRANSFER



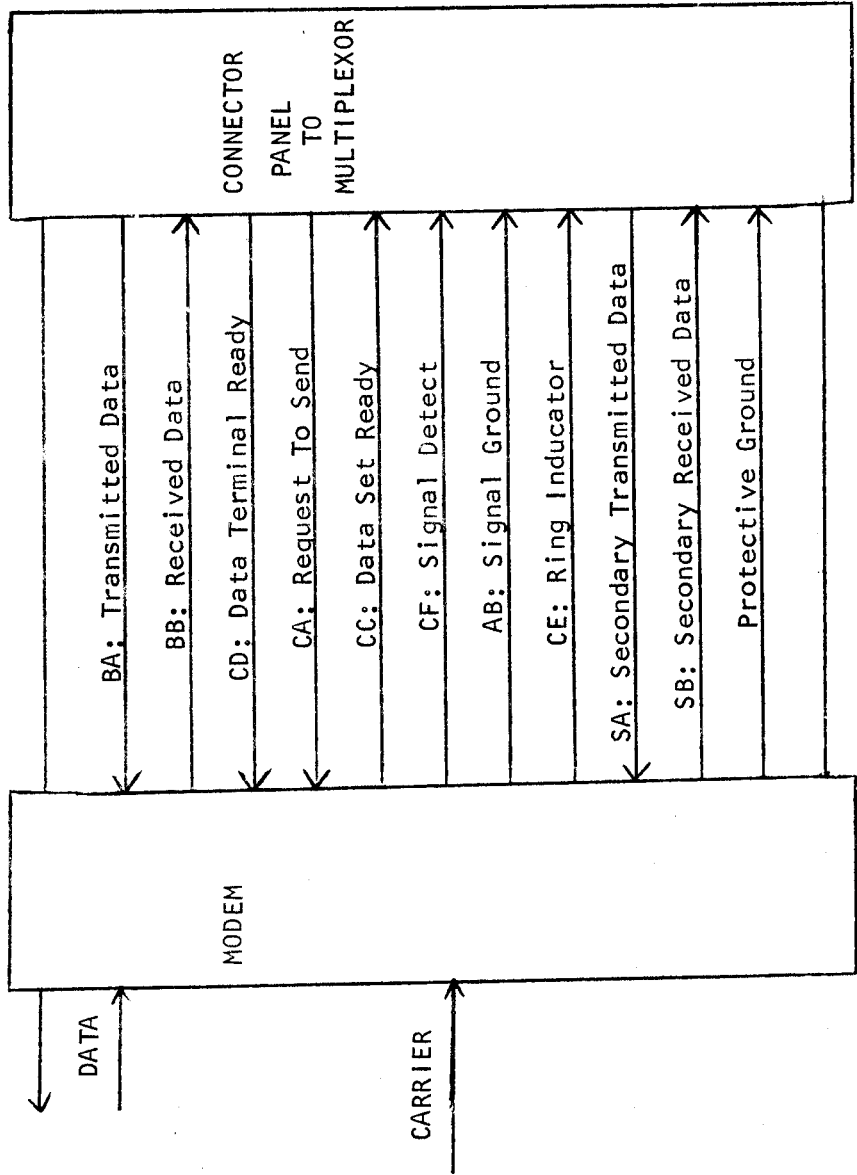
TRANSMISSION DIRECTION



$f =$  BAUD RATE (BITS/SEC)



DATA TRANSMISSION  
IMPORTANT STANDARDS FOR LINE CONTROL  
EIA RS-232C



12920

ASYNCHRONOUS MULTIPLEXOR

FEATURES

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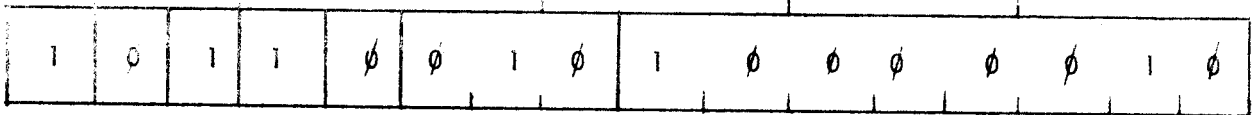
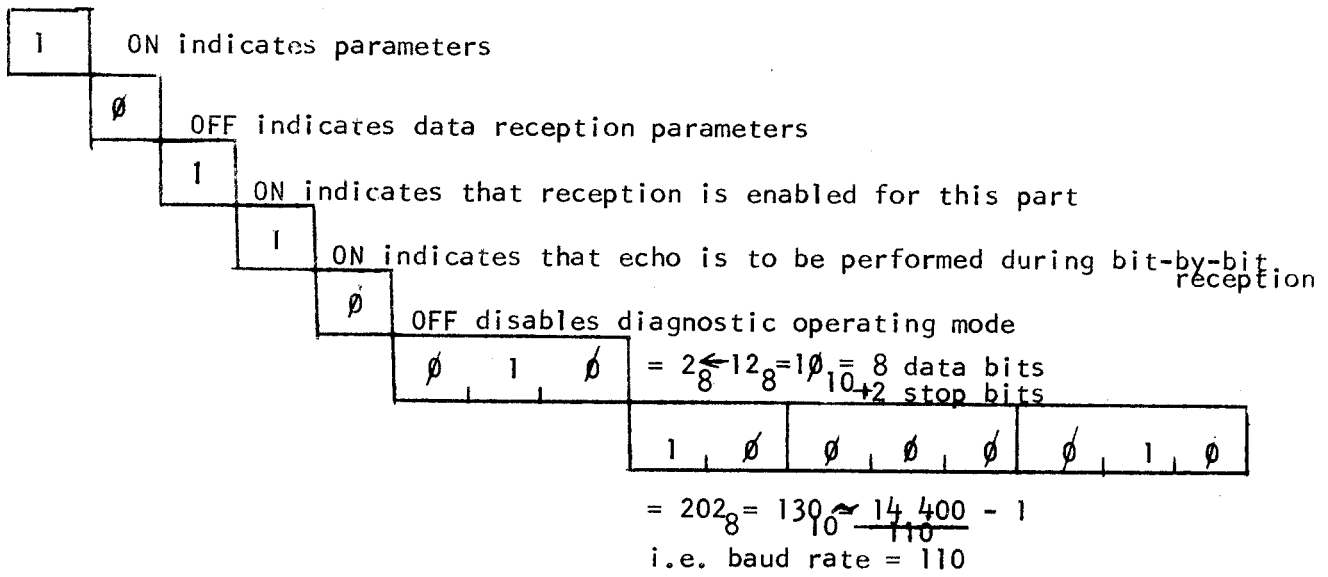
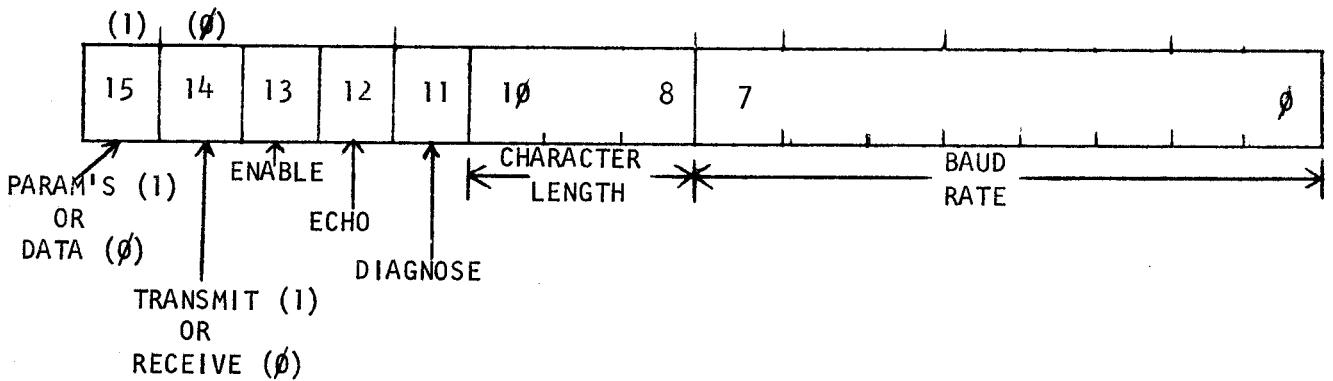
- 16 I/O CHANNELS
- RS-232-C I/F
- CONTROL LINE CAPABILITY ALLOWS 103 AND 202 MODEMS AND 801 A.C.U.
- PROGRAMMABLE SPEED, PARITY, AND CHARACTER SIZE FOR EACH CHANNEL
- ONE CHARACTER BUFFER PER CHANNEL
- AUTOMATIC, PROGRAMMABLE ECHO
- FIVE AUXILLAIRY RECEIVE CHANNELS ALLOWS AUTOMATIC SPEED DETECTION
- SIMPLIFIED BREAK DETECTION

Flag comes in on this board.

Lower I/O board

Input

PARAMETERS FOR DATA RECEPTION



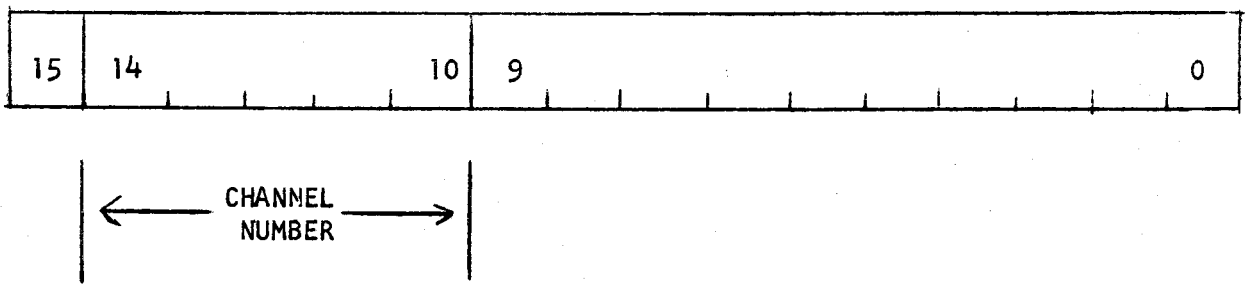
OR

131202

PARAMETER - WORD FOR DATA RECEPTION:  
 BAUD RATE = 110  
 CHARACTER SIZE = 8 DATA + 2 STOP BITS  
 ECHO = ON

# Upper I/O Board

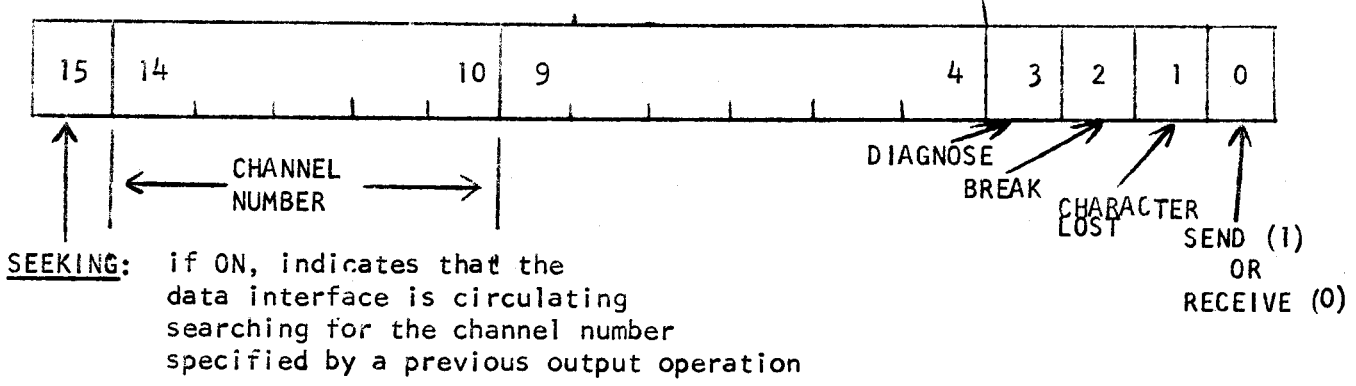
CHANNEL - NUMBER WORD  
SUPPLIED TO USC BOARD



EXAMPLE: channel # 10  
 :  
 LDA CHAN (CHAN OCT 12)  
 ALF,ALF  
 RAL,RAL (RESULT = 024000)  
 OTA USC  
 :

# Upper I/O board

RECEIVE STATUS WORD  
"SEEKING" INDICATOR



RECEIVE CONFIGURATION  
SAMPLE PROGRAM FRAGMENT

.  
.  
.  
\* RECEIVE INITIALIZATION - 110 BAUD, SIZE = 10 BITS, ECHO - ON  
\* ENTER WITH  
\* B = CHANNEL NUMBER  
\*  
\*

```
INTR    NOP
        STA    INTA    RETAIN A
        LDA    RPARM   GET RCV PARMATERS
        JSB    OUT     & OUTPUT
        LDA    INTA    RESTORE A
        JMP    INTR, 1  EXIT
```

\*  
\* GENERAL OUTPUT ROUTINE - -  
\* ENTER WITH: A = PARAM/DATA; B = PORT #  
\*

```
OUT     NOP
        STB    INTB    RETAIN PORT #
        CLF    Ø       DISABLE INTERRUPTS
        LIB    USC     GET STATUS WORD
        SSB                    STILL SEEKING?
        JMP    *-2     YES - WAIT.
        OTA    LSC     OUTPUT PARAM/DATA
        LDB    INTB    GET PORT #
        BLF, BLF        SHIFT PORT #
        RBL, RBL        TO BITS 14 - Ø
        OTB    USC     OUTPUT PORT #
        STC    LSC     INITIATE OPERATION
        STF    Ø       ENABLE INTERRUPTS
        LDB    INTB    RESTORE B.
        JMP    OUT, 1  EXIT
```

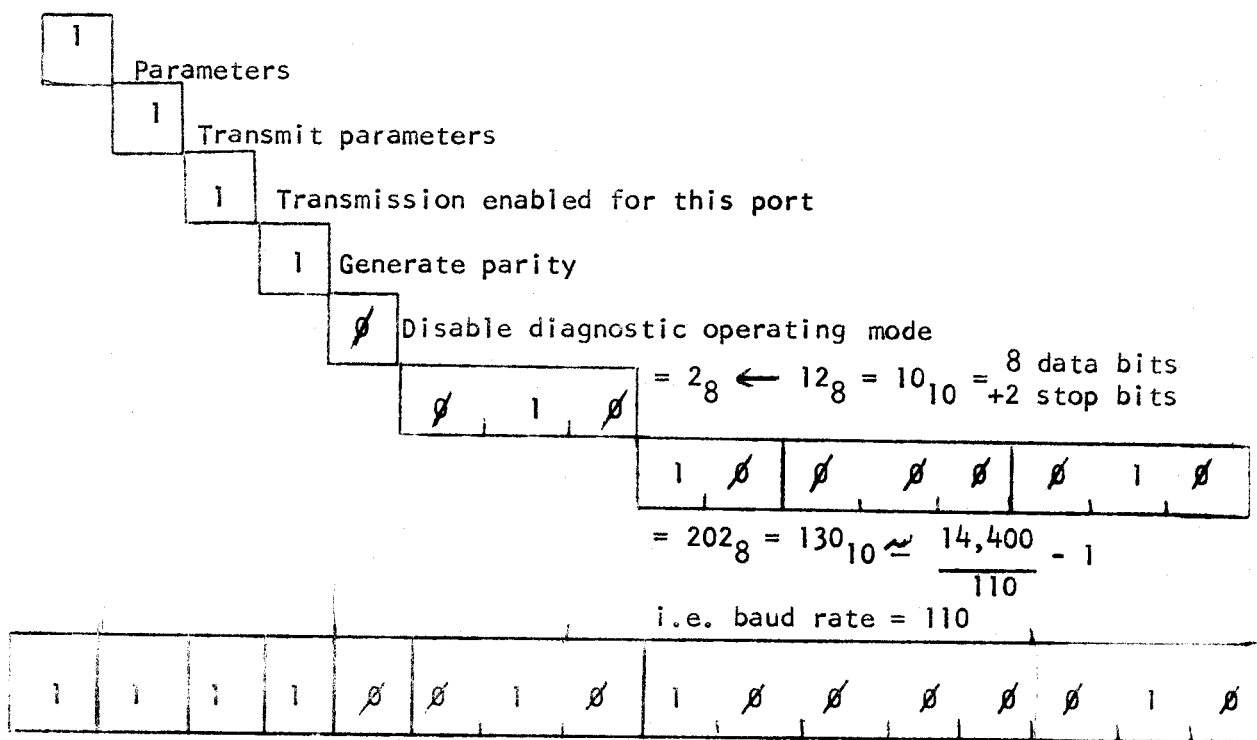
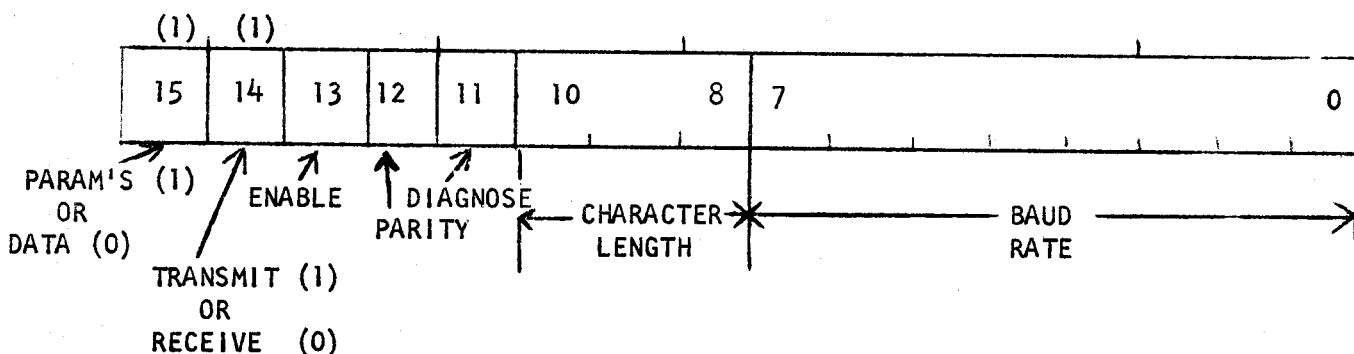
\*  
\*  
RPARM OCT 1312Ø2 RECEIVE PARAMETERS  
\*

```
INTA    BSS    1
INTB    BSS    1
```

\*  
LSC EQU 12B
USC EQU LSC+1

.  
.  
.

### PARAMETERS FOR DATA TRANSMISSION



OR

171202

}

- parameter - word for data transmission
- baud - rate = 110
- character size - 8 data + 2 stop bi
- parity generator = 0N



TRANSMIT CONFIGURATION

SAMPLE PROGRAM FRAGMENT

.  
.
.  
.

\*
\* TRANSMIT INITIALIZATION - 110 BAUD, SIZE = 10 BITS, ASC II
\* ENTER WITH
\* B = CHANNEL NUMBER
\*

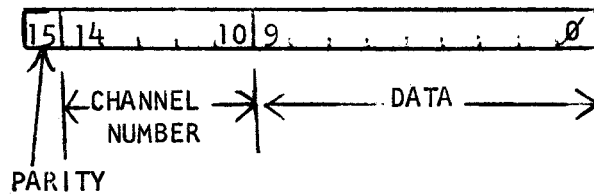
INITS NOP
STA INTA RETAIN A
LDA SPARM GET XMT PARAMETERS
JSB OUT & OUTPUT (SEE SLIDE 9)
LDA INTA RESTORE A
JMP INITS, I EXIT

\*
\*
\*

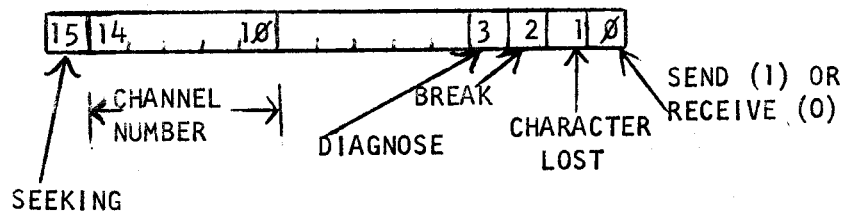
SPARM OCT 17202 TRANSMIT PARAMETERS

DATA RECEPTION  
 INTERRUPT INPUTS

Receive data from channel (LIA LSC)



Receive status from channel (LIA USC)



```

0001                               ASMB,A,B,L
0002*
0003* THIS PROGRAM READS A LINE FROM PORT 0 AND WRITES THAT LINE
0004* ON PORT 15.
0005*
0006 00100                ORG 100B
0007 00100 103100        START CLF 0                DISABLE INTERRUPTS.
0008 00101 060243        LDA BUFA                SET UP BUFFER
0009 00102 070310        STA BUF                ADDRESS COUNTER.
0010 00103 064242        LDB NEG36
0011 00104 074313        STB TEMP
0012 00105 006400        CLB
0013 00106 174000        STB 0,I
0014 00107 002004        INA
0015 00110 034313        ISZ TEMP
0016 00111 024106        JMP *-3
0017 00112 003400        CCA                INITIALIZE
0018 00113 070311        STA SW1                BYTE POINTER.
0019 00114 006400        CLB                PORT ZERO.
0020 00115 060316        LDA RPARM                GET INPUT PARAMETERS.
0021 00116 014220        JSB OUT←                PRIME PORT ZERO.
0022 00117 102314        LOOPI SFS LSC                HAS A CHARACTER
0023 00120 024117        JMP *-1                BEEN TYPED?
0024 00121 102514        LIA LSC                YES.
0025 00122 010236        AND MASK
0026 00123 070313        STA TEMP
0027 00124 064311        LDB SW1                WHICH BYTE SHOULD
0028 00125 006002        SZB                CHARACTER BE LOADED INTO.
0029 00126 001727        ALF,ALF                UPPER BYTE.
0030 00127 130310        IOR BUF,I
0031 00130 170310        STA BUF,I
0032 00131 006003        SZB,RSS
0033 00132 034310        ISZ BUF                BUMP BUFFER ADDRESS.
0034 00133 007000        CMB                SWITCH THE
0035 00134 074311        STB SW1                BYTE POINTER.
0036 00135 060313        LDA TEMP
0037 00136 050237        CPA CR                WAS CHARACTER A CR?
0038 00137 024142        JMP OUTPT                YES.
0039 00140 103114        CLF LSC←
0040 00141 024117        JMP LOOPI
0041 00142 060241        OUTPT LDA DSABL                DISABLE INPUT FROM
0042 00143 006400        CLB                PORT
0043 00144 014220        JSB OUT                ZERO.
0044 00145 102055        HLT 55B
0045 00146 060315        LDA CPARM                GET OUTPUT PARAMETERS
0046 00147 064314        LDB FIFTN                FOR PORT 15.
0047 00150 014220        JSB OUT                PRIME PORT 15 FOR OUTPUT.
0048 00151 102114        STF LSC
0049 00152 060243        LDA BUFA                SET UP BUFFER
0050 00153 070310        STA BUF                ADDRESS COUNTER.
0051 00154 003400        CCA                INITIALIZE
0052 00155 070311        STA SW1                BYTE POINTER.
0053 00156 160310        LOOPO LDA BUF,I                GET OUTPUT WORD.
0054 00157 064311        LDB SW1                GET BYTE POINTER.
0055 00160 006002        SZB                WHICH BYTE?
0056 00161 001727        ALF,ALF                UPPER BYTE IS THE ONE.

```

0057	00162	010236		AND	MASK	
0058	00163	030235		IOR	STOP	ADD THE STOP BITS,
0059	00164	006003		SZB,	RSS	IS THIS THE LOWER BYTE?
0060	00165	174310		STB	BUF, I	YES. BLANK BUFFER.
0061	00166	006003		SZB,	RSS	
0062	00167	034310		ISZ	BUF	YES. BUMP BUFFER ADDRESS.
0063	00170	007000		CMB		SWITCH THE
0064	00171	074311		STB	SW1	BYTE POINTER.
0065	00172	064314		LDB	FIFTH	PORT 15.
0066	00173	102314		SFS	LSC	
0067	00174	024173		JMP	*=1	
0068	00175	014220		JSB	OUT	OUTPUT CHARACTER.
0069	00176	010236		AND	MASK	
0070	00177	050237		CPA	CR	WAS IT A CR?
0071	00200	024202		JMP	*+2	YES.
0072	00201	024156		JMP	LOOP0	NO.
0073	00202	060240		LDA	LF	OUTPUT
0074	00203	030235		IOR	STOP	A LINEFEED
0075	00204	102314		SFS	LSC	
0076	00205	024204		JMP	*=1	PORT
0077	00206	014220		JSB	OUT	15.
0078	00207	006400		CLB		PORT ZERO.
0079	00210	060317		LDA	SPARM	GET OUTPUT PARAMETERS.
0080	00211	014220		JSB	OUT	PRINME PORT 0 FOR OUTPUT.
0081	00212	060240		LDA	LF	OUTPUT
0082	00213	030235		IOR	STOP	A LINEFEED
0083	00214	102314		SFS	LSC	TO
0084	00215	024214		JMP	*=1	PORT
0085	00216	014220		JSB	OUT	ZERO.
0086	00217	024100		JMP	START	
0087*						
0088*						
0089	00220	000000	OUT	NOP		
0090	00221	074312		STB	INTB	RETAIN PORT NUMBER.
0091	00222	106515		LIB	USC	GET STATUS WORD.
0092	00223	006020		SSB		STILL SEEKING?
0093	00224	024222		JMP	*=2	YES. WAIT.
0094	00225	102614		OTA	LSC	OUTPUT DATA/PARAMETERS.
0095	00226	064312		LDB	INTB	GET PORT NUMBER.
0096	00227	005727		BLF,	BLF	
0097	00230	005222		RBL,	RBL	
0098	00231	106615		OTB	USC	OUTPUT PORT NUMBER.
0099	00232	103714		STC	LSC, C	INITIATE OPERATIN.
0100	00233	064312		LDB	INTB	RESTORE B.
0101	00234	124220		JMP	OUT, I	RETURN.
0102*						
0103*						
0104	00235	043600	STOP	OCT	43600	
0105	00236	000177	MASK	OCT	177	
0106	00237	000015	CR	OCT	15	
0107	00240	000012	LF	OCT	12	
0108	00241	121202	DSABL	OCT	121202	Disable
0109	00242	177734	NEG36	DEC	=36	
0110	00243	000244	BUFA	DEF	BUFR	
0111	00244	000000	BUFR	BSS	36	
0112	00310	000000	BUF	BSS	1	

0113	00311	000000	SW1	BSS	1	
0114	00312	000000	INTB	BSS	1	
0115	00313	000000	TEMP	BSS	1	
0116	00014		LSC	EQU	14B	
0117	00015		USC	EQU	15B	
0118	00314	000017	FIFTN	DEC	15	
0119	00315	170405	CPARM	OCT	170405	OUTPUT PARAMETERS FOR PORT 1
0120	00316	131202	RPARM	OCT	131202	
0121	00317	171202	SPARM	OCT	171202	
0122			END			

\*\* NO ERRORS\*

Input

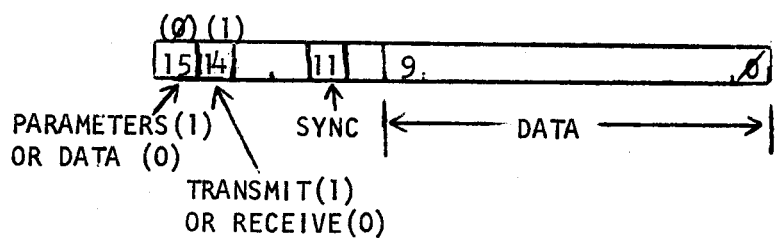
Output

DATA RECEPTION  
INTERRUPT PROGRAMMING

MUX	NOP		
	.		
	.		
	.		
	LIA USC	Input status word	
	ALF,ALF	and	
	RAR,RAR	isolate	
	AND B17	unit #	
	STA UNIT	Store channel #	
	LIA USC	Get status again	
	SLA	Bit 0 = ON? (send?)	
	JMP SEND	Yes.	
	RAR,RAR	Shift bit 2 to LSB	
	SLA	Break depressed?	
	JMP BREAK	Yes.	
	LIA LSC	Input data word.	
	AND B177	Isolate received character	
	.		
	.		
	.		
		(store character and/or	
		perform special function)	
RTURN	STC LSC,C	Acknowledge mux and re-arm	
	JMP MUX,I	Exit	
*			
SEND	LDB BPNT	Xmit. intrpt.--Send next character	
	ERB	Change byte ptr. to wd. ptr.	
	LDA B,I	Get word in question	
	SEZ,RSS	Left - half needed?	
	ALF,ALF	yes - shift.	
	AND B177		
	CPA CR	Carriage - return?	
	JMP FIN	Yes - special action.	
	LDB UNIT	Get unit number	
	JSB OUT	Output next character	
	.		
	.		
	.		
FIN		(check for special	
		action)	
	.		
	.		
	.		
	JMP RTURN	Exit normally.	

DATA TRANSMISSION  
INFORMATION OUTPUT

Output data to a channel (OTA LSC)



Synchronization Word for ASCII Terminals

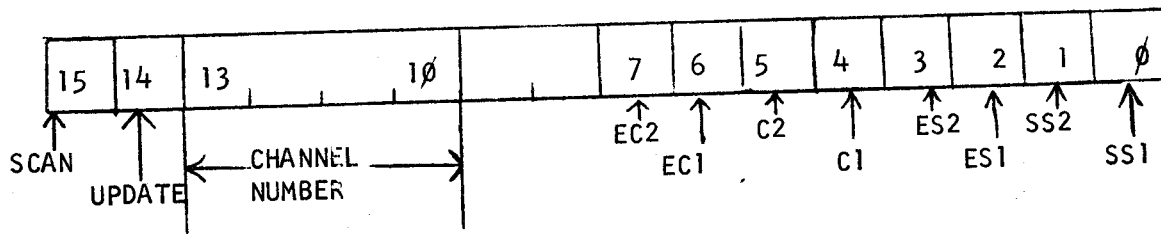
045577

Mask word for IOR with ASCII data character

041400

## CONTROL INTERFACE PROGRAMMING

### OUTPUT CONTROL WORD



- SCAN:** ON Causes control interface to step through each channel, comparing input status bits (real time) with the stored status bits (software - supplied); when a difference is found, scanning halts and an interrupt occurs.
- UPDATE:** ON enables output latches for C2 & C1 and causes the enable bits ES2 & ES1 to be stored along with the stored status bits SS2 & SS1 in the random - access memory.
- EC2,EC1:** if ON when UPDATE=ON, then the corresponding command bit (C2 and C1 respectively) is stored in the interface.
- C2,C1:** command bits, set to enable associated command line; on first control interface C1 = Data Terminal Ready (CD) & C2 = Request to Send (CA); on second control interface, C1 = Supervisory Transmit (SA) & C2 = Frequency Select (CH).
- ES2,ES1:** enable bits for comparison logic; stored in random - access memory, and enable comparison logic when ON; if an enable bit is set when a difference is detected between an input status (S2,S1) and a stored status (SS2,SS1), scanning stops, a flag bit is set (I2 or I1), and an interrupt occurs.
- SS2,SS1:** stored status bits that are stored in the random access memory for comparison with input status bits (S2, S1) during the scanning operation; on the first control interface, SS1=Supervisory Receive (SB) & SS2 = Clear to Send (CB).



## CONTROL INTERFACE PROGRAMMING

## INITIALIZATION

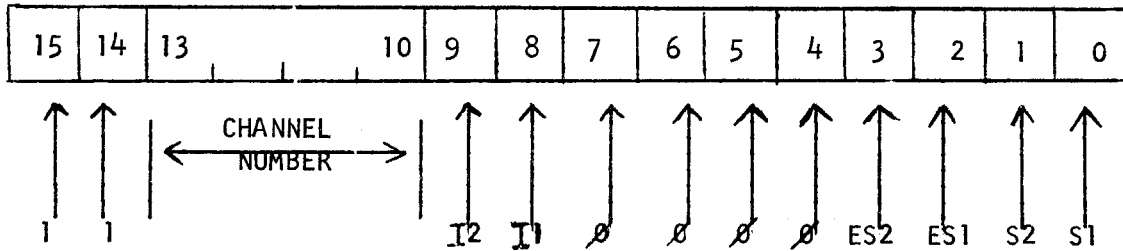
```

*
* Initialize control I/F for ports 0 - 15
*
          CLB          Set channel = 0
          LDA          INCTL Get init. control - word
INITC    JSB          COUT  Output control - word to channel
          INB          Next Channel
          CPB          D16   0 - 15 done?
          RSS          yes.
          JMP          INITC no - [nit. next.
          .
          .
          .
ICNTL    OCT          140374 Scan, update, and --
*
*          Set: EC2, EC1, C2, C1, ES2, ES1
*          Reset: SS2, SS1
D16      DEC          16
*
* Control I/F output routine:
*          A = command - word (channel # = 0)
*          B = channel # (right - justified)
COUT     NOP
          STA          CA    Retain A
          STB          CB    & B
          BLF,BLF      Rotate channel # to 13 - 10
          RBL,RBL
          IOR          B     Insert channel # into control - wd.
          CLF          0     Disable interrupts
          OTA          CNTRL Output command - word
          STC          CNTRL,C Enable the command
          LDA          CA    Restore A
          LDB          CB    & B
          STF          0     Allows interrupts
          JBP          COUT,I Exit.
*
CA        BSS          1
CB        BSS          1
CNTRL     EQU          USC + 1 One control board - 103 operation.

```

# CONTROL INTERFACE PROGRAMMING

## INPUT STATUS WORD



- I2,I1
: flag indicator bits; 0N indicates that comparison logic detected a difference in corresponding status (which caused the interrupt)
- ES2,ES1
: copies of enable - status bits from the random access memory
- S2,S1
: real-time status values at time of interrupt; on first control board S1 = Data Set Ready (CC) & S2 = Signal Detect (CF); on second control board, S1 = Supervisory Receive (SB) & S2 = Clear to Send (CB)

## CONTROL INTERFACE PROGRAMMING

## INTERRUPT HANDLING ROUTINE

```

*
* Routine to handle interrupts
* from control I/F (CNTRL)
*
*
CINT      NOP
          .
          .           (Save registers)
          .
          CLF      0           Disable further interrupts
          LIA      CNTRL      Input status of control I/F
          STA      CSTAT
          ALF
          RAL,RAL           Shift channel #
                           to right - justified
          AND      B17       Isolate channel #
          STA      UNIT      and save.
          LDA      CSTAT     Input status again.
          ALF,ALF          Isolate
          AND      B3        I2, I1 (right - just.)
          ADA      * + 2     Branch on
          JMP      A,I       value of (2*I2)+I1
          DEF      *+1,I
          DEF      CERR
          DEF      CC        Data Set Ready changed
          DEF      CF        Signal Detect changed
          DEF      CCCF      Both changed.
          .
          .
          .
CRTN      LDA      CSTAT     Common return point.
          OTA      CNTRL     Copy new S2, S1 to SS2, SS1.
          STC      CNTRL,C   Resume scan.
          .           (restore registers)
          .
          .
          STF      0         Allow interrupts
          JMP      CINT,I    Exit
CSTAT    BSS      1
UNIT     BSS      1
B3       OCT      3
B17      OCT      17

```

## CONTROL INTERFACE PROGRAMMING

### OBTAINING REAL-TIME STATUS

```
*
*
* Routine to capture real-time status-word
* Enter with
*     Interrupts off
*     A = channel # (right - justified)
* Upon exit
*     Interrupts off
*     A = status word of given channel #
*     Scan ON
*
*
GSTAT  NOP
      .
      .      (save registers - except A)
      .
AND     B17      Mask to 0-17 B (channel #)
ALF,ALF      Rotate Channel #
RAL,RAL      to 13 - 10 in A.
OTA      CNTRL   Stop scan & "dial" channel #
LIA      CNTRL   Input real-time status
OTA      CNTRL   Resume scan
STC      CNTRL,C Enable CNTRL
      .
      .      (restore registers - except A)
      .
JMP     GSTAT,I  Exit
```

DATA TRANSMISSION  
REQUIREMENTS

AUTO-ANSWER

- (1) DATA SET 'AUTO' BUTTON DEPRESSED
- (2) CD, DATA TERMINAL READY, ON

103 COMMUNICATIONS:

- (1) CC, DATA SET READY, ON
- (2) CF, CARRIER DETECT, ON
- (3) CD, DATA TERMINAL READY, ON
- (4) CA, REQUEST TO SEND, ON

CAUSES FOR DISCONNECTION:

- (1) CD, DATA TERMINAL READY, OFF
- (2) CARRIER LOSS, WITH CARRIER-LOSS-DISCONNECT OPTION
- (3) 3-SECOND SPACE, WITH LONG-SPACE-DISCONNECT OPTION
- (4) PRESSING DATA SET 'TALK' BUTTON
- (5) 10-SECOND SIGNAL LOSS FROM DDD NETWORK
- (6) HOUSEWIFE CALL, WITH OPTION TO DISCONNECT IF  
CARRIER DOES NOT COME UP 10-20 SEC, AFTER CC,  
DATA SET READY, COMES UP
- (7) CABLE OR DATA SET UNPLUGGED

CONTROL INTERFACE  
202-TYPE MODEM OPERATION

Possible modes of 202 operation

- (1) Full-duplex over leased-line, 4-wire line.
- (2) Half-duplex over DDD switched network (2-wire line).

Hardware required

- (1) For full-duplex operation, modems are used in a 103-type mode; thus only one control I/F is required to supply Data Terminal Ready and Request to Send.
- (2) For half-duplex operation within the 202 speed range, one must use Request to Send and Clear to Send to allow time for echo suppression between line turnaround; thus, two control I/F's are required.

COMMUNICATIONS PROCESSOR  
2000C HIGH - SPEED & 2000F  
CORE MAP

OCTAL WORD #

2	Initialization
4	Interrupt locations
21	
40	"PANIC"
45	Multiplexer constants
101	Line printer constants
125	Gen. usage constants
352	Teletype tables
1552	RFS driver, decode & branch (from SYS)
1660	OMTOM driver (to SYS)
1711	MUXOR multiplexor output rtne.
1740	MPXIO & MPYIO multiplexer interrupt handlers
2755	Line printer driver
3332	Service routines (from RFS)
	⋮

\* - Driver

	⋮
4554	DS101 & DS102 Phones driver
5017	ICNVR Selectric input conversion
5343	OCNVR Selectric output conversion
5615	CTBPI & CTBP2 Selectric conversion tables
6217	TBGEN Time - Base generator driver
6463	INIF & INI Initialization section
6675	IDLE loop
7055	POWF Power fail/ Auto restart driver
7647	TTPT Pointers to TTY tables
7707	user buffers
17607	

PAGE 0002 #01

```

0001          ASMB,A,B,C,L      I/O PROGRAM 2000C H8 (VER A) 4/17/72
0002 00002          ORG 2
0003 00002 124003      JMP ++1,I
0004 00003 006660      DEF INI          ADDRESS OF INITIALIZER
0005 00004 114335      JSB POW,I          POWER FAIL
0006 00005 102005      HLT 5          PARITY ERROR
0007          SUP
0008 00000          A      EQU 0          A REGISTER ADDRESS
0009 00001          B      EQU 1          B REGISTER ADDRESS

0011 00010          C1     EQU 10B       CHANNEL FROM OTHER MACHINE
0012 00011          C2     EQU 11B       CHANNEL TO OTHER MACHINE
0013 00010          ORG C1
0014 00010 015552      JSB RFS
0015 00011 106711      CLC C2

0017 00012          TBASE EQU 12B
0018 00012          ORG TBASE
0019 00012 114337      JSB TBGDR,I

0021 00013          MPX    EQU 13B
0022 00013          ORG MPX
0023 00013 015740      JSB MPXIO
0024 00014 000000      NOP

0026 00015          DSCB1 EQU 15B
0027 00015          ORG DSCB1
0028 00015 114324      JSB DSDR1,I

0030 00016          MPY    EQU 16B
0031 00016          ORG MPY
0032 00016 015762      JSB MPYIO
0033 00017 000000      NOP

0035 00020          DSCB2 EQU 20B
0036 00020          ORG DSCB2
0037 00020 114325      JSB DSDR2,I

0039*
0040**
0041*** PANIC ROUTINE
0042**
0043*
0044* IF THE I/O PROCESSOR CRASHES, START THE MACHINE AT LOCATION
0045* 40B AND THIS ROUTINE WILL MAKE THE NECESSARY RESPONSES SO
0046* THAT THE SYSTEM CAN BE SLEPT. THEN THE I/O PROCESSOR CAN BE
0047* RE-LOADED AND THE SYSTEM CAN BE BROUGHT UP FROM DISC.
0048*
0049 00040          ORG 40B
0050 00040          PANIC EQU *
0051 00040 060170      LDA ,+15B
0052 00041 102610      OTA C1          CONTINUE
0053 00042 103710      STC C1,C        RESPONDING
0054 00043 106710      CLC C1          TO OTHER
0055 00044 024040      JMP PANIC       MACHINE

```



PAGE 0006 #01

0226	00324	004554	DSDR1	DEF	D8101
0227	00325	004675	DSDR2	DEF	D8201
0228	00326	005017	ICNV	DEF	ICNVR
0229	00327	006675	IDLEL	DEF	IDLE
0230	00330	003271	LDWR	DEF	LDWNR
0231	00331	002755	LPIN	DEF	LPINT
0232	00332	002001	MUXX	DEF	MUXX
0233	00333	077677	NIEBT	OCT	077677
0234	00334	005343	OCNV	DEF	OCNVR
0235	00335	007055	POW	DEF	POWF
0236	00336	002627	PMPXP	DEF	MPXEP
0237	00337	006217	TBGDR	DEF	TBGEN
0238	00340	004541	TKO.1	DEF	TKO1
0239	00341	004543	TKO.2	DEF	TKO2
0240	00342	004544	TKO.3	DEF	TKO3
0241	00343	000352	TTY	DEF	TTY00
0242	00344	000353	TTCC	DEF	TTY00+?CCNT
0243	00345	000373	TTRP	DEF	TTY00+?RPRM
0244	00346	007647	TTYTP	DEF	TTPT
0245	00347	177404	MBLEN	ABS	=BUFLN=BUFLN
0246	00350	000374	BLEN	ABS	BUFLN+BUFLN
0247	00351	177406	MAXBL	ABS	=BUFLN=BUFLN+2

## PAGE 0007 #01 TELETYPE TABLES

0249.  
 0250\*\*  
 0251\*\*\*  
 0252\*\*  
 0253\*  
 0254\*  
 0255\*  
 0256\*  
 0257\*

## TELETYPE TABLES

THE TELETYPE TABLES ARE LOCATED IN BASE PAGE AND CONTAIN INFORMATION ABOUT THE SYSTEM USERS. EACH OF THE 32 USERS HAS ONE TABLE CONTAINING THE FOLLOWING ENTRIES:

0259 00000            ?TNUM EQU 0  
 0260\*                    PORT NUMBER IN BITS 12-8

0262 00001            ?CCNT EQU ?TNUM+1  
 0263\*                    USED BY MPX FOR COUNTING OUTPUT CHARACTERS. IT  
 0264\*                    EQUALS -# OF CHARACTERS, INCLUDING CURRENT ONE.

0266 00002            ?BPNT EQU ?CCNT+1  
 0267\*                    ON INPUT = POINTS TO THE CHARACTER LOCATION INTO  
 0268\*                    WHICH THE NEXT CHARACTER WILL BE  
 0269\*                    DEPOSITED.  
 0270\*                    ON OUTPUT= POINTS TO THE LAST CHAR. TRANSMITTED.

0272 00003            ?BSTR EQU ?BPNT+1  
 0273\*                    ON INPUT = POINTS TO THE FIRST CHARACTER OF THE  
 0274\*                    MOST RECENT BUFFER.  
 0275\*                    ON OUTPUT= POINTS TO THE LOCATION INTO WHICH THE  
 0276\*                    NEXT CHARACTER WILL BE PLACED BY THE  
 0277\*                    OUTCR ROUTINE.

0279 00004            ?BHED EQU ?BSTR+1  
 0280\*                    ON INPUT = POINTS TO THE NEXT CHARACTER TO BE  
 0281\*                    FETCHED.

0283 00005            ?BSAV EQU ?BHED+1  
 0284\*                    SAVED BUFFER PICKUP POINTER.

0286 00006            ?BGIN EQU ?BSAV+1  
 0287\*                    POINTS TO BEGINNING OF PHYSICAL BUFFER

0289 00007            ?BEND EQU ?BGIN+1  
 0290\*                    POINTS TO FIRST CHARACTER FOLLOWING PHYSICAL  
 0291\*                    BUFFER.

## PAGE 0008 #01 TELETYPE TABLES

0293	00010	?3STAT EQU ?8BEND+1	
0295	00154	TFBT EQU BIT0	USER IS IN TAPE MODE
0296	00151	TPNBT EQU NBT0	
0297	00155	STBT EQU BIT1	USER WAS TURNED OFF
0298	00150	STNBT EQU NBT1	
0299	00157	CXBT EQU BIT2	'CONTROL X' WAS HIT
0300	00163	IOBT EQU BIT3	USER IS IN INPUT MODE
0301	00142	IONBT EQU NBT3	
0302	00173	LDBT EQU BIT4	LINE DROPOUT OCCURRED
0303	00132	LONBT EQU NBT4	
0304	00276	LTBT EQU BIT5	WAIT FOR LOG TIMING
0305	00311	LTNBT EQU NBT5	
0306	00277	ENBT EQU BIT6	TIMING FOR <ENTER>
0307	00312	ENNBT EQU NBT6	
0308	00300	RNBT EQU BIT7	USER IS RUNNING
0309	00313	RNNBT EQU NBT7	
0310	00301	PDBT EQU BIT8	PHONE DISCONNECTED
0311	00302	NIBT EQU BIT9	NO INPUT ALLOWED
0312	00315	NINBT EQU NBT9	
0313	00303	HUBT EQU BIT10	HANG USER UP
0314	00304	XOBT EQU BIT11	X-OFF WAS READ FROM TERMINET
0315	00317	XONBT EQU NBT11	
0316*		STYP2 EQU BIT12	*
0317*		STYP3 EQU BIT13	*
0318*		STYP4 EQU BIT13	** TELETYPE SUBTYPES
0319*		STYP5 EQU BIT14	*
0320*		STYP6 EQU BIT14	*
0321	00310	ICBT EQU BIT15	INPUT CONFIGURATION NEEDED
0322	00322	ICNBT EQU NBT15	
0324	00011	?ATIM EQU ?STAT+1	
0325*			CONTAINS ALLOWED TIME FOR <ENTER STATEMENT>
0326*			EXECUTION.
0328	00012	?TIMO EQU ?ATIM+1	
0329*			TIMEOUT VALUE FOR USER EXECUTING <ENTER
0330*			STATEMENT>.
0332	00013	?PHON EQU ?TIMO+1	
0333*			USED AS TIME COUNTER FOR PHONES LOGIC.

## PAGE 0009 #01 TELETYPE TABLES

0335	00014	?TYPE EQU ?PHON+1		
0336*		TERMINAL TYPE: ASCII	#0	
0337*				
0338*		EBCD	BIT0 #0	
0339*			BIT15#1	
0340*				
0341*		CALL/360	BIT0 #1	
0342*			BIT15#0	
0343*				
0344*		FOR EBCD & CALL/360 TERMINAL:		
0346	00155	CDBT EQU BIT1	CODE DETERMINED	
0347	00157	UCBT EQU BIT2	UPPER CASE MODE	
0348	00146	UCNBT EQU NBT2		
0349	00163	CNBT EQU BIT3	"CENT" CHARACTER	
0350	00142	CNNBT EQU NBT3		
0351	00173	CCBT EQU BIT4	"CENTC" CHARACTER	
0352	00276	CRBT EQU BITS	"CR" BIT(OUTPUT ONLY)	
0353	00311	CRNBT EQU NBT5		
0354	00277	XBIT EQU BIT6	"CONTROL X" WAS INPUT	
0355	00312	XNBIT EQU NBT6		
0356	00300	CBBT EQU BIT7	"CIRCLE C" WAS SENT	
0357	00313	CBNBT EQU NBT7		
0358*		BIT8	CIRCLE D *	
0359*		BIT9	SYNC * TRANSMIT	
0360*		BIT10	SPACE ** INTERRUPT	
0361*		BIT11	SPACE * BITS	
0362*		BIT12	SPACE *	
0364	00015	?CDLY EQU ?TYPE+1		
0365*		CARRIAGE RETURN DELAY (NEGATIVE).		
0367	00016	?LDLY EQU ?CDLY+1		
0368*		LINE FEED DELAY (NEGATIVE).		
0370	00017	?DCNT EQU ?LDLY+1		
0371*		CR AND LF DELAY COUNTER.		
0373	00020	?SCNT EQU ?DCNT+1		
0374*		CHARACTER COUNTER USED FOR DETERMINING CARRIAGE		
0375*		RETURN DELAYS.		
0377	00021	?RPRM EQU ?SCNT+1		
0378*		RECEIVE CHANNEL PARAMETERS.		
0380	00022	?SPRM EQU ?RPRM+1		
0381*		SEND CHANNEL PARAMETERS.		
0383	00023	?PPRM EQU ?SPRM+1		
0384*		PHONE PARAMETER.		

## PAGE 0019 #01 MULTIPLEXER OUTPUT ROUTINE

```

0723*
0724**
0725***      MULTIPLEXER OUTPUT ROUTINE
0726**
0727*
0728*      THIS ROUTINE HANDLES ALL OUTPUT TO BOTH MULTIPLEXER BOARDS.
0729*      THE FORMAT IS AS FOLLOWS:
0730*              A REGISTER = DATA
0731*              B REGISTER = UNIT NUMBER
0732*
0733      01711 000000      MUXOR NOP
0734      01712 103100      CLF 0          STOP INTERRUPTS
0735      01713 070237      STA ATEMP      SAVE A
0736      01714 005765      BLF,CLE,ERB  POSITION
0737      01715 005300      RBR          UNIT NUMBER
0738      01716 002040      SEZ          FIRST BOARD?
0739      01717 025730      JMP MUXOY    NO

0741*
0742**      FIRST MUX BOARD
0743*
0744      01720 102514      LIA MPX+1   WAIT FOR
0745      01721 002020      SSA          SEEKING BIT
0746      01722 025720      JMP *-2     TO CLEAR
0747      01723 060237      LDA ATEMP   RESTORE A
0748      01724 102613      OTA MPX     OUTPUT DATA
0749      01725 106614      OTB MPX+1   AND UNIT NUMBER
0750      01726 102713      STC MPX
0751      01727 125711      JMP MUXOR,I RETURN

0753*
0754**      SECOND MUX BOARD
0755*
0756      01730 102517      MUXOY LIA MPY+1   WAIT FOR
0757      01731 002020      SSA          SEEKING BIT
0758      01732 025730      JMP *-2     TO CLEAR
0759      01733 060237      LDA ATEMP   RESTORE A
0760      01734 102616      OTA MPY     OUTPUT DATA
0761      01735 106617      OTB MPY+1   AND UNIT NUMBER
0762      01736 102716      STC MPY
0763      01737 125711      JMP MUXOR,I RETURN
0764      01740      MUXRE EQU *
```

## PAGE 0020 #02 MULTIPLEXER DRIVER

```

0002+
0003++
0004++      INTERRUPT ROUTINE FOR FIRST MULTIPLEXER
0005++
0006+
0007 01740 000000  MPXIO NOP
0008 01741 070062  STA MPXA          S  A,
0009 01742 074063  STB MPXB          A  B,
0010 01743 005500  ERB              V  AND
0011 01744 074064  STB MPXE          E  E
0012 01745 102513  LIA MPX          GET MPX
0013 01746 070073  STA MPXLC        STATUS
0014 01747 102514  LIA MPX+1        AND
0015 01750 070075  STA MPXUC        SAVE IT
0016 01751 060100  LDA YFLAG        IS Y-MULTIPLEXER FLAG SET?
0017 01752 002003  SZA,RSS
0018 01753 124332  JMP MUXXX,I      NO - CONTINUE
0019 01754 070077  STA XFLAG        YES - SET X-MULTIPLEXER FLAG
0020 01755 060064  LDA MPXE        RESTORE
0021 01756 001600  ELA              E,
0022 01757 060062  LDA MPXA          A,
0023 01760 064063  LDB MPXB          AND B
0024 01761 125740  JMP MPXIO,I      RETURN

```

```

0026+
0027++
0028++      INTERRUPT ROUTINE FOR SECOND MULTIPLEXER
0029++
0030+

```

```

0031 01762 000000  MPYIO NOP
0032 01763 103100  CLF 0
0033 01764 070065  STA MPYA          S  A,
0034 01765 074066  STB MPYB          A  B,
0035 01766 005500  ERB              V  AND
0036 01767 074067  STB MPYE          E  E
0037 01770 102516  LIA MPY          GET MPY STATUS,
0038 01771 070074  STA LOWER        CONVERT TTY# TO
0039 01772 102517  LIA MPY+1        UPPER 16 TTYS,
0040 01773 030307  IOR SYBIT        AND SAVE THEM
0041 01774 070076  STA UPPER
0042 01775 006404  CLB,INB          SET Y-MULTIPLEXER FLAG
0043 01776 074100  STB YFLAG
0044 01777 102100  STF 0
0045 02000 026005  JMP MUXY

```

```

0047+
0048++      DRIVER INITIALIZATION
0049+

```

```

0050 02001 060073  MUXX  LDA MPXLC  SET
0051 02002 070074  STA LOWER      STATUS
0052 02003 060075  LDA MPXUC      VARIABLES
0053 02004 070076  STA UPPER
0054 02005 001700  MUXY  ALF      MOVE TTY# TO

```

## PAGE 0021 #02 MULTIPLEXER DRIVER

0055	02006	001222	RAL,RAL	RIGHT END AND
0056	02007	010210	AND B37	MASK TO 5 BITS
0057	02010	040346	ADA TTYTP	ADD ON TTY TABLE POINTER
0058	02011	164000	LDB A,I	B => TTY#
0059	02012	074045	STB XTNUM	SAVE
0060	02013	060076	LDA UPPER	GET THE STATUS
0061	02014	001323	RAR,RAR	AND TEST FOR
0062	02015	000010	SLA	ATTEMPTED ABORT
0063	02016	026350	JMP ABORT	YES - GO TO ABORT LOGIC
0064	02017	060076	LDA UPPER	NO - GET STATUS AND
0065	02020	000010	SLA	TEST FOR INPUT
0066	02021	026412	JMP MPXOP	NO GO TO OUTPUT LOGIC
0067	02022	044163	ADB .+?STAT	GET USER'S
0068	02023	160001	LDA B,I	STATUS
0069	02024	010302	AND NIBT	IS INPUT ALLOWED?
0070	02025	002002	SZA	YES
0071	02026	026627	JMP MPXEP	NO - IGNORE IT

## PAGE 0024 #02 MULTIPLEXER DRIVER - RECEIVE CHANNEL PROCESSING

0185	02166	170001		STA B,I	
0186	02167	064045		LDB XTNUM	B => TTY#
0187	02170	006004		INB	B => CHARACTER COUNT
0188	02171	060150		LDA , -3	SET CHARACTER
0189	02172	170001		STA B,I	COUNT TO -3
0190	02173	160055		LDA XSTAT,I	CHANGE
0191	02174	010142		AND IONBT	STATUS
0192	02175	170055		STA XSTAT,I	TO OUTPUT
0193	02176	010300		AND RNBT	IF USER NOT
0194	02177	002003		SZA,RSS	RUNNING
0195	02200	016326		JSB OPUT	STOP INPUT
0196	02201	060201		LDA SYNCC	
0197	02202	164057		LDB XTYPE,I	AND
0198	02203	006002		SZB	
0199	02204	030300		IOR SLBIT	INITIATE
0200	02205	164045		LDB XTNUM,I	
0201	02206	015711		JSB MUXOR	OUTPUT
0202	02207	026627		JMP MPXEP	
0203*					
0204	02210	160055	INPX3	LDA XSTAT,I	SET THE
0205	02211	030157		IOR CXBT	CANCEL BIT
0206	02212	170055		STA XSTAT,I	IN STATUS
0207	02213	026627		JMP MPXEP	
0208*					
0209**	PROCESS CARRIAGE RETURN				
0210*					
0211	02214	160055	INPX4	LDA XSTAT,I	GET USER'S STATUS
0212	02215	010154		AND TPBT	IS USER IN
0213	02216	002002		SZA	TAPE MODE?
0214	02217	026263		JMP INPX6	YES
0215	02220	016326		JSB OPUT	NO, CHANGE STATUS AND MPX PARAMS
0216	02221	160055		LDA XSTAT,I	A = STATUS
0217	02222	010277		AND ENBT	IS USER TIMED
0218	02223	002003		SZA,RSS	FOR <ENTER>?
0219	02224	026260		JMP INPX5	NO
0220*					
0221**	PROCESS RESPONSE TO <ENTER STATEMENT>				
0222*					
0223	02225	120055		XOR XSTAT,I	YES = CLEAR
0224	02226	170055		STA XSTAT,I	TIMING FLAG
0225	02227	064066		LDB XATIM	B => ATIM
0226	02230	160001		LDA B,I	A = TIME-OUT VALUE
0227	02231	006004		INB	B => TIMO
0228	02232	140001		ADA B,I	A = TIME ACTUALLY USED
0229	02233	070072		STA MPXT0	SAVE NUMBER
0230	02234	001000		ALS	2 * NUMBER
0231	02235	040072		ADA MPXT0	3 * NUMBER
0232	02236	070072		STA MPXT0	
0233	02237	001723		ALF,RAR	24 * NUMBER
0234	02240	000066		CLE,ELA	
0235	02241	040072		ADA MPXT0	51 * NUMBER
0236	02242	001500		ERA	
0237	02243	001727		ALF,ALF	DIVIDE BY 512
0238	02244	010215		AND B377	A = NUMBER DIVIDED BY 10
0239	02245	002002		SZA	ZERO AND NEGATIVE
0240	02246	002020		SSA	NOT ALLOWED



## PAGE 0026 #02 MULTIPLEXER DRIVER - RECEIVE CHANNEL PROCESSING

```

0294*
0295** PROCESS CONTROL W (RESUME LINE PRINTER OUTPUT)
0296*
0297 02316 060045 INPX9 LDA XTNUM GET TTY# ADDRESS
0298 02317 050105 CPA TLPR IS LP SUSPENDED
0299 02320 002001 PSS FOR THIS USER?
0300 02321 026125 JMP INPX1 NO - RETURN AND PROCESS CHAR.
0301 02322 070103 STA LPTTY YES - RESET LP INDICATOR
0302 02323 002400 CLA CLEAR TEMPORARY LINE
0303 02324 070105 STA TLPR PRINTER RELEASE FLAG
0304 02325 026627 JMP MPXEP
0305*
0306** STOP INPUT - CONFIGURE SEND CHANNEL
0307*
0308 02326 000000 OUTPUT NOP
0309 02327 064045 LDB XTNUM
0310 02330 044163 ADB ,+?STAT B => STATUS
0311 02331 160001 LDA B,I SET
0312 02332 030302 IOR NIBT 'NO INPUT ALLOWED'
0313 02333 170001 STA B,I BIT
0314 02334 044164 ADB ,+?PRM-?STAT PREVENT
0315 02335 160001 LDA B,I CHARACTER
0316 02336 010320 AND NECHO ECHO
0317 02337 164045 LDB XTNUM,I GET UNIT NUMBER
0318 02340 015711 JSB MUXOR OUTPUT TO MULTIPLEXER
0319 02341 102100 STF 0
0320 02342 160057 LDA XTYPE,I
0321 02343 002003 SZA,RSS RETURN IF TERMINAL
0322 02344 126326 JMP OUTPUT,I IS NOT A SELECTRIC
0323 02345 030301 IOR BITS SET "CIRCLE D" BIT
0324 02346 170057 STA XTYPE,I
0325 02347 126326 JMP OUTPUT,I

0327*
0328**
0329** ABORT PROCESSING
0330**
0331*
0332 02350 103100 ABORT CLF 0
0333 02351 068076 LDA UPPER GET MUX STATUS AND TEST
0334 02352 000010 SZA FOR RECEIVE INTERRUPT
0335 02353 026412 JMP MPXOP NO - OUTPUT NEXT CHARACTER
0336 02354 044163 ADB ,+?STAT
0337 02355 160001 LDA B,I A * STATUS
0338 02356 010302 AND NIBT CHECK FOR
0339 02357 002003 SZA,RSS OUTPUT MODE
0340 02360 026627 JMP MPXEP INPUT MODE - IGNORE
0341 02361 160001 LDA B,I
0342 02362 010224 AND B71M CLEAR STATUS BITS
0343 02363 030163 IOR IOBT SET 'INPUT' BIT
0344 02364 170001 STA B,I STORE NEW STATUS
0345 02365 064045 LDB XTNUM B => TTY#
0346 02366 054103 CPB LPTTY BRANCH IF
0347 02367 016374 JSB PABRT USER HAS LP
0348 02370 160045 LDA XTNUM,I GET TTY# AND ADD

```

## PAGE 0028 #02 MULTIPLEXER DRIVER - SEND CHANNEL PROCESSING

0368\*

0369\*\*

0370\*\*\* SEND CHANNEL PROCESSING

0371\*\*

0372\*

0373	02412	006004	MPXOP	INB	B => CHARACTER COUNT
0374	02413	074046		STB XCCNT	
0375	02414	006004		INB	B => RUNNING BUFFER POINTER
0376	02415	074047		STB XBPNT	
0377	02416	006004		INB	B => START OF BUFFER
0378	02417	074050		STB XBSTR	
0379	02420	006004		INB	B => START OF FIRST BUFFER
0380	02421	074051		STB XBHED	
0381	02422	006004		INB	B => SAVED BUFFER POINTER
0382	02423	074052		STB XBSAV	
0383	02424	006004		INB	B => START OF PHYSICAL BUFFER
0384	02425	074053		STB XBCIN	
0385	02426	006004		INB	B => END OF PHYSICAL BUFFER
0386	02427	074054		STB XBEND	
0387	02430	006004		INB	B => STATUS
0388	02431	074055		STB XSTAT	
0389	02432	044157		ADB .+?TYPE=?STAT	B => TERMINAL TYPE FLAG
0390	02433	074057		STB XTYPE	
0391	02434	044156		ADB .+?DCNT=?TYPE	B => DELAY COUNTER
0392	02435	074058		STB XDCNT	
0393	02436	006004		INB	B => CR DELAY CHARACTER COUNTER
0394	02437	074061		STB XSCNT	
0395	02440	164046		LDB XCCNT,I	IF NO CHARACTERS
0396	02441	006003		SZB,RSS	LEFT, GO TO END OF
0397	02442	026552		JMP MPXEO	OUTPUT PROCESSING
0398	02443	164047		LDB XBPNT,I	B => BUFFER POINTER
0399	02444	006004		INB	B => NEXT CHARACTER
0400	02445	154054		CPB XBEND,I	IF END OF BUFFER,
0401	02446	044347		ADB MBLN	CHANGE TO BEGINNING
0402	02447	074071		STB XTPNT	SAVE POINTER
0403	02450	160060		LDA XDCNT,I	CHECK DELAY COUNTER FOR CR
0404	02451	002002		SZA	OR LF DELAY IN PROGRESS
0405	02452	026522		JMP DELAY	GO TO DELAY PROCESSING
0406	02453	004065		CLE,ERB	POSITION AS WORD POINTER
0407	02454	160001		LDA B,I	A = WORD CONTAINING CHARACTER
0408	02455	002041		SEZ,RSS	POSITION CHARACTER
0409	02456	001727		ALF,ALF	IN BITS 7-0
0410	02457	010213		AND B177	MASK OUT CHARACTER
0411	02458	070070		STA XCHAR	AND SAVE IT
0412	02461	164057		LDB XTYPE,I	GET TERMINAL TYPE
0413	02462	006002		SZB	IF TYPE IS A SELECTRIC,
0414	02463	016533		JSB SELPR	BRANCH FOR CONVERSION
0415	02464	030221		IOR DMASK	ADD STOP AND PARITY BITS
0416	02465	164045		LDB XTNUM,I	B = UNIT NUMBER
0417	02466	015711		JSB MUXOR	OUTPUT CHARACTER
0418	02467	102100		STF 0	
0419	02470	060070		LDA XCHAR	A = CHARACTER
0420	02471	050170		CPA .+15B	IF CHARACTER IS
0421	02472	016676		JSB CRDLY	CR, SET UP DELAY
0422	02473	050165		CPA .+12B	IF CHARACTER IS
0423	02474	016737		JSB LFDLY	LF, SET UP DELAY

## PAGE 0029 #02 MULTIPLEXER DRIVER - SEND CHANNEL PROCESSING

```

0424*
0425**      ADJUST BUFFER POINTERS
0426*
0427 02475 103100   BUFAD CLF 0
0428 02476 134046   ISZ XCCNT,I   INCREMENT CHARACTER COUNT
0429 02477 002001   R88          IF COUNT IS ZERO, GO
0430 02500 026627   JMP MPXEP    TO MUX END OF PROCESSING
0431 02501 134061   ISZ XSCNT,I   INCREMENT CR DELAY CHAR. COUNT
0432 02502 060071   LDA XTPNT    GET BUFFER POINTER TEMPORARY
0433 02503 170047   STA XBPNT,I  RESET BUFFER POINTER
0434 02504 160046   LDA XCCNT,I  GET CHARACTER COUNT
0435 02505 102100   STF 0
0436 02506 050141   CPA  =10     ARE EXACTLY 10
0437 02507 002001   R88          CHARACTERS LEFT?
0438 02510 026627   JMP MPXEP    NO - CONTINUE
0439*
0440**      NOTIFY SYSTEM - BUFFER CAN TAKE CHARACTERS AGAIN
0441*
0442 02511 160055   LDA XSTAT,I  YES, GET THE STATUS
0443 02512 010150   AND STNBT    AND CHECK WHETHER USER
0444 02513 150055   CPA XSTAT,I  WAS STOPPED OR NOT
0445 02514 026627   JMP MPXEP    NOT - CONTINUE
0446 02515 170055   STA XSTAT,I  CLEAR BUFFER FULL BIT
0447 02516 160045   LDA XTNUM,I  GET USER'S TTY#
0448 02517 031663   IOR BFE     ADD BUFFER EMPTY CODE
0449 02520 015666   JSB ONTOM   AND TELL OTHER MACHINE
0450 02521 026627   JMP MPXEP
0451*
0452**      OUTPUT DELAY CHARACTER
0453*
0454 02522 060201   DELAY LDA SYNCC  GET DELAY CHARACTER
0455 02523 164057   LDB XTYPE,I
0456 02524 006002   SZB
0457 02525 030300   IOR SLBIT
0458 02526 164045   LDB XTNUM,I  B = UNIT NUMBER
0459 02527 015711   JSB MUXOR    OUTPUT DELAY CHARACTER
0460 02530 134060   ISZ XDCNT,I  CHECK FOR FURTHER DELAY TIME
0461 02531 026627   JMP MPXEP    YES
0462 02532 026475   JMP BUFAD    NO - ADJUST BUFFER POINTERS
0463*
0464**      SELECTRIC CHARACTER PROCESSING
0465*
0466 02533 000000   SELPR NOP
0467 02534 060045   LDA XTNUM    IF USER HAS LP,
0468 02535 050103   CPA LPTY     IGNORE THE
0469 02536 026546   JMP SLPII    INTERRUPT
0470 02537 114334   JSB OCNV,I   CONVERT ASCII CHARACTER
0471 02540 006003   SZB,R88     RETURN UNLESS
0472 02541 126533   JMP SELPR,I  MULTI-CHARACTERS REQUIRED
0473 02542 164045   LDB XTNUM,I  B = UNIT NUMBER
0474 02543 030221   IOR DMASK   ADD STOP AND PARITY BITS
0475 02544 015711   JSB MUXOR   AND OUTPUT IT
0476 02545 026627   JMP MPXEP
0477*
0478 02546 160057   SLPII LDA XTYPE,I  CLEAR
0479 02547 010314   AND N8TB    CIRCLE 0

```

## PAGE 0031 #02 MULTIPLEXER DRIVER - END OF PROCESSING

```

0533*
0534**
0535*** MULTIPLEXER END OF PROCESSING
0536**
0537*
0538 02627 103100 MPXEP CLF 0
0539 02630 060100 LDA YFLAG IS Y=MULTIPLEXER FLAG SET?
0540 02631 002002 SZA
0541 02632 026656 JMP MP.Y YES
0542 02633 060077 LDA XFLAG NO - IS X=MULTIPLEXER FLAG SET?
0543 02634 002002 SZA
0544 02635 026645 JMP MP.X YES
0545 02636 060064 LDA MPXE NO - RESTORE
0546 02637 001600 ELA E,
0547 02640 060062 LDA MPXA A,
0548 02641 064063 LDB MPXB AND B
0549 02642 103113 CLF MPX ENABLE X=MULTIPLEXER INTERRUPTS
0550 02643 102100 STF 0
0551 02644 125740 JMP MPXIO,I
0552*
0553 02645 002400 MP.X CLA
0554 02646 070077 STA XFLAG CLEAR X=MULTIPLEXER FLAG
0555 02647 060067 LDA MPYE RESTORE
0556 02650 001600 ELA E,
0557 02651 060065 LDA MPYA A,
0558 02652 064066 LDB MPYB AND B
0559 02653 103113 CLF MPX ENABLE X=MULTIPLEXER INTERRUPTS
0560 02654 102100 STF 0
0561 02655 125762 JMP MPYIO,I
0562*
0563 02656 060077 MP.Y LDA XFLAG IS X=MULTIPLEXER
0564 02657 002002 SZA FLAG ALSO SET?
0565 02660 026671 JMP MP.YX YES
0566 02661 070100 STA YFLAG CLEAR Y=MULTIPLEXER FLAG
0567 02662 060067 LDA MPYE RESTORE
0568 02663 001600 ELA E,
0569 02664 060066 LDA MPYA A,
0570 02665 064066 LDB MPYB AND B
0571 02666 103116 CLF MPY ENABLE Y=MULTIPLEXER INTERRUPTS
0572 02667 102100 STF 0
0573 02670 125762 JMP MPYIO,I
0574*
0575 02671 002400 MP.YX CLA
0576 02672 070100 STA YFLAG CLEAR Y=MULTIPLEXER FLAG
0577 02673 103116 CLF MPY ENABLE Y=MULTIPLEXER INTERRUPTS
0578 02674 102100 STF 0
0579 02675 026001 JMP MUXX GO PROCESS X-MPX INTERRUPT

```

## PAGE 0047 #04 SERVICE ROUTINES

```

0023*
0024**    FETCH NEXT BUFFER CHARACTER
0025*
0026    04014          FNC    EQU *
0027    04014    044162    ADB .+?BEND    B => BUFFER END
0028    04015    074265    STB STMP      SAVE IT
0029    04016    044150    ADB .+?BHED=?BEND B => PICKUP POINTER
0030    04017    160001    LDA B,I      A => CHARACTER
0031    04020    000065    CLE,ERA     A => WORD
0032    04021    160000    LDA A,I      A = WORD
0033    04022    002041    SEZ,RSS     EXTRACT
0034    04023    001727    ALF,ALF     DESIRED
0035    04024    010215    AND B377    CHARACTER
0036    04025    102610    OTA C1      SEND CHARACTER TO INTERFACE
0037    04026    160001    LDA B,I      INCREMENT CHARACTER
0038    04027    002004    INA         ADDRESS
0039    04030    150265    CPA STMP,I  IF BEYOND END OF
0040    04031    040347    ADA MLEN    BUFFER, WRAP AROUND
0041    04032    170001    STA B,I     RESET POINTER
0042    04033    025651    JMP SRRTN
0043*
0044**    SET NEW PHONES TIMING VALUE
0045*
0046    04034          PHS    EQU *
0047    04034    060264    LDA RCODE   GET REQUEST WORD
0048    04035    010215    AND B377    MASK TO TIME
0049    04036    001000    ALS         CONVERT
0050    04037    070265    STA STMP    TIME TO
0051    04040    001020    ALS,ALS     TENTHS OF
0052    04041    040265    ADA STMP    A SECOND
0053    04042    003004    CMA,INA     MAKE NEGATIVE
0054    04043    070260    STA PHR     SET TIME ALLOWED FOR LOGON
0055    04044    025651    JMP SRRTN
0057*
0058**    SET NEW BAUD RATE AND SET/RESET PARITY BIT.
0059*
0060    04045          SPE    EQU *
0061    04045    060264    LDA RCODE   GET REQUEST WORD
0062    04046    010215    AND B377    MASK TO BAUD RATE
0063    04047    070265    STA STMP    SAVE
0064    04050    044167    ADB .+?TYPE B=> ?TYPE
0065    04051    160001    LDA B,I     A= ?TYPE
0066    04052    044161    ADB .+?SPRM=?TYPE B=> ?SPRM
0067    04053    074273    STB TEMP1   SAVE IT,
0068    04054    064000    LDB A       B=?TYPE
0069    04055    160273    LDA TEMP1,I A= ?SPRM
0070    04056    030305    IOR BIT12   SET PARITY BIT#1.
0071    04057    006002    SZB         SET PARITY BIT#0 FOR TYPE#1.
0072    04060    010320    AND NBT12
0073    04061    010232    AND HIMSK   CLEAR OLD BAUD RATE
0074    04062    030265    IOR STMP    MERGE WITH NEW BAUD RATE
0075    04063    064273    LDB TEMP1   B=> ?SPRM
0076    04064    170001    STA B,I     RESTORE SEND PARAMETER
0077    04065    070273    STA TEMP1   SAVE ?SPRM
0078    04066    044152    ADB .+?RPRM=?SPRM B => RECEIVE PARAMETER

```

```

0079 04067 160001 LDA B,I A = RECEIVE PARAMETER
0080 04070 010232 AND HIMSK REMOVE OLD BAUD RATE
0081 04071 030265 IOR STEMP MERGE NEW BAUD RATE.
0082 04072 170001 STA B,I RESTORE RECEIVE PARAMETER
0083 04073 044132 ADB ,+?TNUM=?RPRM B => TTY#
0084 04074 164001 LDB B,I B = TTY#
0085 04075 074265 STB STEMP SAVE ?TNUM
0086 04076 015711 JSB MUXOR OUTPUT PARAMETER
0087 04077 060273 LDA TEMP1 A=?SPRM
0088 04100 064265 LDB STEMP B=?TNUM
0089 04101 015711 JSB MUXOR OUTPUT PARAMETER.
0090 04102 025651 JMP SRRTN

```

0092\*

0093\*\* SAVE BUFFER POINTER

0094\*

```

0095 04103 SBP EQU *
0096 04103 044157 ADB ,+?BHED B => CURRENT PICKUP POINTER
0097 04104 160001 LDA B,I A = CURRENT PICKUP POINTER
0098 04105 006004 INB B => SAVE LOCATION
0099 04106 170001 STA B,I SAVE CURRENT POINTER
0100 04107 025651 JMP SRRTN

```

0102\*

0103\*\* RESTORE BUFFER POINTER

0104\*

```

0105 04110 RBP EQU *
0106 04110 044160 ADB ,+?BSAV B => SAVED PICKUP POINTER
0107 04111 160001 LDA B,I A = SAVED PICKUP POINTER
0108 04112 044152 ADB ,+?BHED=?BSAV B => CURRENT PICKUP POINTER
0109 04113 170001 STA B,I SET PICKUP POINTER BACK
0110 04114 025651 JMP SRRTN

```

0112\*

0113\*\* USER IS RUNNING

0114\*

```

0115 04115 UIR EQU *
0116 04115 044163 ADB ,+?STAT A = STATUS
0117 04116 160001 LDA B,I SET 'USER IS RUNNING' BIT
0118 04117 030300 IOR RNBT STORE NEW STATUS
0119 04120 170001 STA B,I
0120 04121 025651 JMP SRRTN

```

0122\*

0123\*\* USER IS NOT RUNNING

0124\*

```

0125 04122 UNR EQU *
0126 04122 044163 ADB ,+?STAT A = STATUS
0127 04123 160001 LDA B,I REMOVE 'USER IS RUNNING' BIT
0128 04124 010313 AND RNNBT REMOVE 'X-OFF' BIT
0129 04125 010317 AND XONBT STORE NEW STATUS
0130 04126 170001 STA B,I
0131 04127 044143 ADB ,+?TNUM=?STAT
0132 04130 054103 CPB LPTTY
0133 04131 074111 STB LPDIS
0134 04132 054104 CPB TLSUP

```

PAGE 0059 #04 PHONES LOGIC

```

0557*
0558* DSC BOARD#1.
0559*
0560 04554 000000 DS101 NOP
0561 04555 070252 STA PHA1 SAVE REGISTERS.
0562 04556 074253 STB PHB1
0563 04557 001500 ERA
0564 04560 070254 STA PHE1
0565 04561 102515 LIA DSCB1 GET NEW STATUS.
0566 04562 070261 STA PHTM1 SAVE.
0567 04563 001722 ALF,RAL ROTATE UNIT NR.
0568 04564 001200 RAL INTO RIGHT END.
0569 04565 010172 AND .+15 ISOLATE.
0570 04566 040346 ADA TTYTP ADD ON TABLE ADDRESS.
0571 04567 164000 LDB A,I B=> ?TNUM
0572 04570 044176 ADB .+?PPRM B=> ?PPRM
0573 04571 160001 LDA B,I A= ?PPRM
0574 04572 010156 AND .+3 ISOLATE STORED STATUS BITS.
0575 04573 070243 STA DSTP1 SAVE.
0576 04574 044140 ADB .+?STAT=?PPRM B=> ?STAT
0577 04575 060261 LDA PHTM1 GET NEW STATUS.
0578 04576 010156 AND .+3 ISOLATE STATUS BITS.
0579 04577 070245 STA DSTS1 SAVE.
0580 04600 020243 XOR DSTP1
0581 04601 002003 SZA,RSS TAKE CARE OF NOISE!
0582 04602 026616 JMP DS102
0583 04603 002011 SLA,RSS WHICH BITS CHANGED?
0584 04604 026610 JMP DS107 CARRIER!  $\phi_2$ 
0585 04605 001310 RAR,SLA DSR! ALSO CARRIER?
0586 04606 026670 JMP DS105 DSR<CARRIER!  $\parallel_2$ 
0587 04607 026646 JMP DS104 DSR!  $\phi_1$ 
0588 04610 DS107 EQU *  $\phi_1$ 
0589 04610 010243 AND DSTP1
0590 04611 001310 RAR,SLA
0591 04612 026630 JMP DS103 CHANGED FROM 1 TO 0.
0592*
0593* CHANGED FROM 0 TO 1.
0594* DSR(OLD)=1 CARRIER(OLD)=0
0595* DSR(NEW)=1 CARRIER(NEW)=1
0596*
0597* CONNECTION MADE OR CONNECTION RESTORED
0598* WITHIN LINE DROP-OUT TIMING.
0599*
0600 04613 160001 LDA B,I A= ?STAT
0601 04614 010132 AND LDNBT REMOVE LDNT BIT.
0602 04615 170001 STA B,I
0603*
0604*
0605* EXIT.
0606 04616 DS102 EQU *
0607 04616 060261 LDA PHTM1 A=NEW STATUS.
0608 04617 044166 ADB .+?PPRM=?STAT B=> ?PPRM
0609 04620 170001 STA B,I SAVE.
0610 04621 102515 OTA DSCB1 OUTPUT TO BOARD.
0611 04622 060254 LDA PHE1 RESTORE REGISTERS.
0612 04623 001600 ELA

```

## PAGE 0060 #04 PHONES LOGIC

```

0613 04624 060252 LDA PHA1
0614 04625 064253 LDB PHB1
0615 04626 103115 CLF DSCB1 ENABLE INTERRUPTS.
0616 04627 126554 JMP DS101,I RETURN.
0617*
0618*
0619* DSR(OLD)=1 CARRIER(OLD)=1
0620* DSR(NEW)=1 CARRIER(NEW)=0
0621*
0622* LINE DROP-OUT OR HANG UP.
0623*
0624 04630 DS103 EQU *
0625 04630 160001 LDA B,I A= ?STAT
0626 04631 010211 AND LTLDB
0627 04632 002002 SZA LTBT OR LDBT SET?
0628 04633 026616 JMP DS102 YES, EXIT.
0629 04634 103100 CLF 0
0630 04635 160001 LDA B,I NO, A= ?STAT
0631 04636 030173 IOR LDBT SET LDBT.
0632 04637 170001 STA B,I
0633 04640 044156 ADB .+?PHON=?STAT B=> ?PHON
0634 04641 060127 LDA .-20 SET 2 SECONDS TIMING.
0635 04642 170001 STA B,I
0636 04643 102100 STF 0
0637 04644 044150 ADB .+?STAT=?PHON B=> ?STAT
0638 04645 026616 JMP DS102 EXIT.
0639*
0640 04646 DS104 EQU *
0641 04646 001200 RAL
0642 04647 010243 AND DSTP1 WHICH WAY?
0643 04650 000010 SLA
0644*
0645* CHANGED FROM 1 TO 0.
0646* "HOUSE WIFE HUNG UP" OR HARDWIRED TERMINAL
0647* REMOVED.
0648*
0649* DSR(OLD)=1 CARRIER(OLD)=0
0650* DSR(NEW)=0 CARRIER(NEW)=0
0651*
0652* TREAT LIKE LINE DROP-OUT OR HANG UP.
0653*
0654 04651 026630 JMP DS103
0655*
0656* CHANGED FROM 0 TO 1.
0657* PHONE JUST ANSWERED OR HARDWIRED TERMINAL CONNec.
0658* TED.
0659*
0660* DSR(OLD)=0 CARRIER(OLD)=0
0661* DSR(NEW)=1 CARRIER(NEW)=0
0662*
0663 04652 DS106 EQU *
0664 04652 160001 LDA B,I A= ?STAT
0665 04653 010211 AND LTLDB
0666 04654 002002 SZA LTBT OR LDBT SET?
0667 04655 026616 JMP DS102 YES, EXIT.
0668 04656 160001 LDA B,I NO, A= ?STAT

```



## PAGE 0061 #04 PHONES LOGIC

```

0669 04657 103100      CLF 0
0670 04660 030276      IOR LTBT      SET LTBT BIT.
0671 04661 170001      STA B,I
0672 04662 044156      ADB .+?PHON=?STAT B=> ?PHON
0673 04663 060260      LDA PHR
0674 04664 170001      STA B,I      SET LOG-ON TIMING.
0675 04665 102100      STF 0
0676 04666 044150      ADB .+?STAT=?PHON B=> ?STAT
0677 04667 026616      JMP DS102     EXIT.
0678*
0679*
0680 04670              DS105 EQU *
0681 04670 001200      RAL
0682 04671 010243      AND DSTP1     WHICH WAY?
0683 04672 002002      SZA
0684*
0685*
0686*              CHANGED FROM 1 TO 0.
0687* DSR(OLD)=1      CARRIER(OLD)=1
0688* DSR(NEW)=0      CARRIER(NEW)=0
0689*
0690*
0691* TREAT LIKE LINE DROP-OUT OR HANG UP.
0692*
0693*
0694 04673 026630      JMP DS103
0695*
0696*
0697*              CHANGED FROM 0 TO 1.
0698* DSR(OLD)=0      CARRIER(OLD)=0
0699* DSR(NEW)=1      CARRIER(NEW)=1
0700*
0701*
0702* TREAT LIKE PHONE JUST ANSWERED!
0703*
0704 04674 026652      JMP DS106
0705 04675              DS1E EQU *
0706*
0707*
0708*
0709*
0710* DSC BOARD#2.
0711*
0712 04675 000000      DS201 NOP
0713 04676 070255      STA PHA2     SAVE REGISTERS.
0714 04677 074256      STB PHB2
0715 04700 001500      ERA
0716 04701 070257      STA PHE2
0717 04702 102520      LIA DSCB2   GET NEW STATUS.
0718 04703 070262      STA PHTM2   SAVE.
0719 04704 001722      ALF,RAL     ROTATE UNIT NR.
0720 04705 001200      RAL         INTO RIGHT END.
0721 04706 010172      AND .+15    ISOLATE.
0722 04707 040346      ADA TTYTP   ADD ON TABLE ADDRESS.
0723 04710 040173      ADA .+16    GET TO UPPER PART OF TABLE.
0724 04711 164000      LDB A,I     B=> ?TNUM

```

## PAGE 0080 #06 TBG LOGIC

```

0002*
0003 06217 000000 TBGEN NOP
0004 06220 070267 STA TBGA SAVE
0005 06221 074270 STB TBGB
0006 06222 001500 ERA
0007 06223 070271 STA TBGE REGISTERS.
0008 06224 064250 LDB NPORT GET NR. OF PORTS.
0009 06225 007000 CMB MAKE =(NPORT+1).
0010 06226 074272 STB TBGCN SAVE.
0011 06227 064343 LDB TTY B=> ?TNUM OF TTY00
0012 06230 TBG1 EQU *
0013 06230 074275 STB TTYN
0014 06231 044163 ADB .+?STAT
0015 06232 074274 STB TPONT SAVE IT.
0016 06233 160001 LDA B,I A= ?STAT
0017 06234 010217 AND PLOHE
0018 06235 002003 SZA, RSS SOMETHING GOING ON?
0019 06236 026407 JMP TBG6 NO.
0020 06237 160001 LDA B,I YES. A= ?STAT
0021 06240 010301 AND PDBT
0022 06241 002002 SZA PDBT BIT SET?
0023 06242 026301 JMP TBG2 YES.
0024 06243 160001 LDA B,I NO. A= ?STAT
0025 06244 010277 AND ENBT
0026 06245 002002 SZA ENBT BIT SET?
0027 06246 026330 JMP TBG4 YES.
0028 06247 026254 JMP TBG3 NO.
0029 06250 TBG5 EQU *
0030 06250 160001 LDA B,I NO. A= ?STAT
0031 06251 010216 AND HLTLD
0032 06252 002003 SZA, RSS LTBT OR LDBT OR HUBT BIT SET?
0033 06253 026407 JMP TBG6 NO.
0034 06254 TBG3 EQU *
0035 06254 160001 LDA B,I YES. A= ?STAT
0036 06255 010303 AND HUBT
0037 06256 002002 SZA HUBT BIT SET?
0038 06257 026365 JMP TBG7 YES.
0039 06260 TBG14 EQU *
0040 06260 044156 ADB .+?PHON=?STAT NO. LTBT OR LDBT SET.
0041 06261 134001 ISZ B,I BUMP TIMING COUNTER.
0042 06262 026407 JMP TBG6 NOT = 0 YET
0043 06263 044150 ADB .+?STAT=?PHON B=> ?STAT
0044 06264 160001 LDA B,I A= ?STAT
0045 06265 010276 AND LTBT
0046 06266 002002 SZA LTBT BIT SET?
0047 06267 026400 JMP TBG15 YES. MUST BE LOG-ON TIMING OUT.
0048*
0049* NO. LDBT SET!
0050*
0051 06270 160275 LDA TTYN,I A = TTYN
0052 06271 031665 IOR UHU MERGE WITH OPCODE.
0053 06272 015666 JSB OMTOM TELL 2116.
0054 06273 064274 LDB TPONT B=> ?STAT
0055 06274 060132 LDA LDNBT REMOVE LDBT
0056 06275 010333 AND NIEBT AND ENBT+ICBT BITS.
0057 06276 110001 AND B,I

```

## PAGE 0081 #06 TBG LOGIC

```

0058 06277 016442      JSB TBG11
0059 06300 026407      JMP TBG6
0060+
0061+
0062 06301      TBG2 EQU *
0063 06301 120001      XOR B,I          REMOVE PDBT BIT
0064 06302 170001      STA B,I
0065 06303 002400      CLA
0066 06304 016423      JSB TBG10
0067 06305 060266      LDA T1          A= ?TNUM
0068 06306 001710      ALF,SLA        1ST OR 2ND BOARD?
0069 06307 026312      JMP ++3
0070 06310 106515      LIB DSCB1      1ST. GET STATUS.
0071 06311 002001      RSS
0072 06312 106520      LIB DSCB2      2ND. GET STATUS.
0073 06313 062766      LDA DTRON      A= BASIC PHONES PARAM.
0074 06314 004010      SLE           DSR ON?
0075 06315 030154      IOR BIT0      YES. SET BIT#0 IN BASIC PARAM.
0076 06316 005310      RBR,SLB      CARRIER ON?
0077 06317 030155      IOR BIT1      YES. SET BIT#1.
0078 06320 016423      JSB TBG10
0079 06321 064275      LDB TTYN
0080 06322 044174      ADB .+?RPRM
0081 06323 160001      LDA B,I          A= ?RPRM
0082 06324 064266      LDB T1          B= ?TNUM
0083 06325 015711      JSB MUXOR      OUTPUT PARAMETER
0084 06326 102100      STP 0
0085 06327 026407      JMP TBG6
0086+
0087 06330      TBG4 EQU *
0088 06330 044144      ADB .+?CCNT-?STAT B=> ?CCNT
0089 06331 160001      LDA B,I
0090 06332 002003      SZA,RSS        NR. OF OUTPUT CHARS.=0?
0091 06333 026336      JMP TBG12      YES.
0092 06334      TBG13 EQU *
0093 06334 064274      LDB TPONT      NO. B=> ?STAT
0094 06335 026250      JMP TBG5
0095 06336      TBG12 EQU *
0096 06336 044164      ADB .+?TIMO-?CCNT B=> ?TIMO
0097 06337 134001      ISZ B,I        UPDATE TIMING COUNTER.
0098 06340 026334      JMP TBG13      NOT #0 YET!
0099 06341 064274      LDB TPONT      TIME IS UP
0100 06342 160001      LDA B,I        REMOVE "ENTER
0101 06343 010312      AND ENNBT      TIMING" BIT AND
0102 06344 030302      IOR NIBT      SET "NO INPUT
0103 06345 170001      STA B,I        ALLOWED" BIT
0104 06346 044157      ADB .+?TYPE-?STAT
0105 06347 160001      LDA B,I        IF THE DUDE HAS
0106 06350 002003      SZA,RSS        A SELECTRIC, SET
0107 06351 026354      JMP ++3        HIM UP FOR A
0108 06352 030220      IOR TRINT      TRANSMIT INTERRUPT
0109 06353 170001      STA B,I
0110 06354 044160      ADB .+?RPRM-?TYPE
0111 06355 160001      LDA B,I        TURN OFF THE
0112 06356 010320      AND NECHO      USER'S ECHO
0113 06357 164275      LDB TTYN,I

```

## PAGE 0082 #06 TBG LOGIC

```

0114 06360 015711 JSB MUXOR
0115 06361 160275 LDA TTYN,I TELL THE SYSTEM
0116 06362 031664 IOR ETO THAT ENTER HAS
0117 06363 015666 JSB OMTOM TIMED OUT
0118 06364 026407 JMP TBG6
0119+
0120 06365 TBG7 EQU *
0121 06365 044144 ADB .+?CCNT=?STAT B=> ?CCNT
0122 06366 160001 LDA B,I A= ?CCNT
0123 06367 002003 SZA,RSS NR. OF OUTPUT CHARS.=0?
0124 06370 026377 JMP TBG9 YES.
0125 06371 044162 ADB .+?STAT=?CCNT B=> ?STAT
0126 06372 160001 LDA B,I A= ?STAT
0127 06373 010211 AND LTLDB
0128 06374 002002 SZA LTBT OR LDBT BIT SET?
0129 06375 026260 JMP TBG14 YES.
0130 06376 026407 JMP TBG6 NO.
0131+
0132 06377 TBG9 EQU *
0133 06377 044162 ADB .+?STAT=?CCNT B=> ?STAT
0134 06400 TBG15 EQU *
0135+ REMOVE LTBT,LDBT AND HUBT BITS.
0136 06400 060216 LDA HLTLD
0137 06401 003000 CMA
0138 06402 110001 AND B,I
0139+ SET PDBT BIT.
0140 06403 030301 IOR PDBT
0141 06404 016442 JSB TBG11
0142+ HANG PHONE UP.
0143 06405 062765 LDA DTROF A= "DATA TERM. READY OFF" PARAM.
0144 06406 016423 JSB TBG10
0145+
0146 06407 TBG6 EQU *
0147 06407 034272 ISZ TBGCN BUMP COUNTER.
0148 06410 002001 RSS
0149 06411 026415 JMP TBG16 DONE. GET OUT.
0150 06412 064275 LDB TTYN
0151 06413 044177 ADB .+TTY01-TTY00 NOT DONE YET.
0152 06414 026230 JMP TBG1 GO BACK.
0153+
0154+ EXIT.
0155+
0156 06415 TBG16 EQU *
0157 06415 060271 LDA TBGE RESTORE
0158 06416 001600 ELA
0159 06417 060267 LDA TBGA
0160 06420 064270 LDB TBGB REGISTERS,
0161 06421 103112 CLF TBASE ENABLE NEXT INTERRUPT.
0162 06422 126217 JMP TBGEN,I RETURN.
0163+
0164+ ENTER WITH A=PARAM, AND B=> ?STAT
0165+ EXIT WITH A= PARAM
0166+ ?TNUM IS SAVED IN T1.
0167+
0168 06423 000000 TBG10 NOP
0169 06424 164275 LDB TTYN,I B = TTY#

```

## PAGE 0083 #06 TBG LOGIC

0170	06425	074266	STB T1	SAVE.
0171	06426	005765	BLF,CLE,ERB	
0172	06427	005300	RBR	
0173	06430	030001	IOR B	MERGE UNIT NR.
0174	06431	064274	LDB TPONT	B=> ?STAT
0175	06432	044166	ADB .+?PPRM-?STAT	B=> ?PPRM
0176	06433	170001	STA B,I	STORE.
0177	06434	002049	SEZ	SKIP IF FIRST BOARD
0178	06435	026448	JMP ++3	
0179	06436	102615	OTA DSCB1	1ST. OUTPUT PARAM.
0180	06437	002001	RSS	
0181	06440	102620	OTA DSCB2	2ND. OUTPUT PARAM.
0182	06441	126423	JMP TBG10,I	RETURN.
0183*				
0184*				
0185*	ENTER WITH NEW STATUS IN (A) AND			
0186*	B=> ?STAT			
0187*				
0188	06442	000000	TBG11 NOP	
0189	06443	030163	IOR IOBT	SET IOBT BIT.
0190	06444	170001	STA B,I	SET NEW STATUS.
0191	06445	044157	ADB .+?TYPE-?STAT	B=> ?TYPE
0192	06446	160001	LDA B,I	A= ?TYPE
0193	06447	002003	SZA,RSS	TYPE 0?
0194	06450	026453	JMP ++3	YES.
0195	06451	002404	CLA,INA	NO. RESET TO CALL/360.
0196	06452	170001	STA B,I	
0197	06453	002400	CLA	
0198	06454	044140	ADB .+?CCNT-?TYPE	B=> ?CCNT
0199	06455	170001	STA B,I	SET ?CCNT=0
0200	06456	044171	ADB .+?DCNT-?CCNT	
0201	06457	170001	STA B,I	SET ?DCNT=0
0202	06460	006004	INB	
0203	06461	170001	STA B,I	SET ?SCNT=0
0204	06462	126442	JMP TBG11,I	RETURN.
0205	06463		TBGED EQU *	

PAGE 0004 007 POWER FAIL/AUTO RESTART

0170	07247	102100	0150	STF 0	ENABLE INTERRUPTS. CAUSES ADDI-
0171	07250	073252		STA POWFL	TION OF CPU TO 8-RESERVED.
0172	07251	103100	0153	CLF 0	DISABLE INTERRUPTS.
0173	07252	106700	0000	CLC 2	EXECUTE LOAD SET.
0174	07253	160001		LDI R,1	RESTORE TRAP CALL
0175	07254	173555		STA POWFL	CONTENTS.
0176	07255	063555		LDI ROST	UPDATE INTERRUPT BIT IN
0177	07256	073550		STA POWFL	POINTER.
0178	07257	027154		JMP POWS	TEST NEXT DRIVER.

0179  
0180  
0181 ALL DUMMY INTERRUPTS ARE DONE,  
0182 NOW DO THE FOLLOWING

0183  
0184  
0185  
0186  
0187  
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POWER EQU \*

STC 0110  
LDA #TEMP  
OTA C2  
STF C2  
LDA POWFL  
END  
STA, R33  
BTC C2,0  
CLC C2  
STC #TEMP  
LDA #TEMP  
STA, R33  
JMP POWS

START UP RECEIVE CHANNEL.  
OUTPUT LAST DATA WORD  
TO SEND CHANNEL.

GET INTERRUPT INDICATOR.

WAS FLAG SET?  
NO. 2116 NEVER RESPONDED.  
YES, WE WANT NO INTERRUPT.  
START UP TBG.  
IF FLAG=0 DO NOT OUTPUT  
PARAMETERS TO MIX AND  
DSC BOARDS.

0204 REINSTATE PARAMETERS ON MUX BOARD(S)  
AND DSC BOARD(S).

0209 REINSTATE 1ST MIX AND DSC BOARD

0209	07300	00200	0150	STF 0	
0210	07301	00200		STA #15	
0211	07302	00200		LDI R,15	
0212	07303	00200		STA, R55	MORE THAN 16 PORTS?
0213	07304	00200		LDI R,15	YES.
0214	07305	00200		CMR	NO.
0215	07306	00200		STA #TEMP	SET COUNTER.
0216	07307	00200		LDI #TEMP	0=> ?RPRM OF TTY00.
0217	07308	00200	0007	EQU *	
0218	07309	00200		LDI #TEMP	CHECK SEEKING.
0219	07310	00200		STA #TEMP	A= ?RPRM
0220	07311	00200		LDI #TEMP	B=> ?SPRM
0221	07312	00200		STA #TEMP	SAVE POINTER TO ?SPRM
0222	07313	00200		LDI #TEMP	ADD #?RPRM-?SPRM B=> ?TNUM
0223	07314	00200		STA #TEMP	B= ?TNUM
0224	07315	00200		LDI #TEMP	SAVE IT.

PAGE 0095 #07 POWER FAIL/AUTO RESTART

0226	07314	017460	JSB POW31	OUTPUT ?RPRM
0227	07315	017453	JSB POW30	CHECK SEEKING.
0228	07316	163563	LDA VTEMP,I	A= ?SPRM
0229	07317	067564	LDB FTNUM	B=?TNUM
0230	07320	017460	JSB POW31	OUTPUT ?SPRM
0231	07321	063563	LDA VTEMP	A=> ?SPRM
0232	07322	064000	LDB A	B=> ?SPRM
0233	07323	040141	ADA .+?STAT=?SPRM	A=> ?STAT
0234	07324	160000	LDA A,I	A= ?STAT
0235	07325	010302	AND NIBT	
0236	07326	002003	SZA,RSS	NIBT SET?
0237	07327	027343	JMP POW8	NO. INPUT MODE!
0238	07330	017502	JSB POW34	
0239	07331	017453	JSB POW30	CHECK SEEKING.
0240	07332	060001	LDA B	A=SYNC. CHAR.
0241	07333	067563	LDB VTEMP	B=> ?SPRM
0242	07334	044131	ADB .+?TNUM=?SPRM	
0243	07335	054103	CPB LPTTY	DOES USER HAVE LP?
0244	07336	027342	JMP POW35	YES.
0245	07337	067564	LDB FTNUM	NO. OUTPUT SYNC CHAR.
0246	07340	017460	JSB POW31	
0247	07341	002001	RSS	
0248	07342		POW35 EQU *	
0249	07342	017512	JSB POW41	DISCONNECT LP.
0250	07343		POW8 EQU *	
0251	07343	063564	LDA FTNUM	UNIT# IN BITS 10-13.
0252	07344	001222	RAL,RAL	
0253	07345	032766	IOR DTRON	OUTPUT BASIC PHONE PARAM.
0254	07346	102615	OTA DSCB1	
0255	07347	067563	LDB VTEMP	B=> ?SPRM
0256	07350	006004	INB	B=> ?PPRM
0257	07351	160001	LDA B,I	A= ?PPRM
0258	07352	102615	OTA DSCB1	OUTPUT ?PPRM
0259	07353	044175	ADB .+TTY01-TTY00+?RPRM=?PPRM	MOVE TO NEXT
0260	07354	037562	ISZ CTEMP	DONE?
0261	07355	027305	JMP POW7	NO. GO BACK.
0262	07356	062762	LDA NNPRT	YES. ONE OR TWO BOARDS?
0263	07357	040133	ADA .-16	
0264	07360	002020	SSA	
0265	07361	027436	JMP POW9	ONE.
0266*			TWO. RE-INSTATE	2ND MUX AND
0267*			2ND DSC.	
0268*				
0269	07362	003000	CMA	SET COUNTER.
0270	07363	073562	STA CTEMP	
0271	07364		POW11 EQU *	
0272	07364	017466	JSB POW32	CHECK SEEKING.
0273	07365	160001	LDA B,I	A= ?RPRM
0274	07366	006004	INB	B=> ?SPRM
0275	07367	077563	STB VTEMP	SAVE POINTER TO ?SPRM
0276	07370	044131	ADB .+?TNUM=?SPRM	B=> ?TNUM
0277	07371	164001	LDB B,I	B= ?TNUM
0278	07372	077564	STB FTNUM	SAVE IT.
0279	07373	017473	JSB POW33	OUTPUT ?RPRM
0280	07374	017466	JSB POW32	CHECK SEEKING.
0281	07375	163563	LDA VTEMP,I	A= ?SPRM