TELETYPEWRITER
SOFTWARE SUBSYSTEM DESCRIPTION
NO. 3 ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

1.01 This section describes the software required for the TTY function of the No. 3 Electronic Switching System (ESS). This section will also serve as an aid in accessing the more detailed program listings for the TTY.

1.02 This section is being reissued to provide information concerning the 3E3 generic. Since this is a general revision, no revision arrows have been used to denote significant changes.

1.03 Part 8 contains a glossary of terms and definitions necessary for comprehension of the information contained in this document. Part 9 contains a list of abbreviations used in this document.

1.04 The following Bell System Practices provide background information related to the TTY and its operation.

SECTION	TITLE
233-152-125	System Control SO-2 Generic, Software Subsystem Description, No. 3 Electronic Switching System
233-152-126	System Control 3E3 Generic, Software Subsystem Description, No. 3 Electronic Switching System
254-300-190	Teletypewriter and Teletypewriter Controller, Description and Theory of Operation, Common Systems
254-340-104	Program Listing Organization and Usage, Common Systems Software Description, 3A Processor.

1.05 The following manuals provide additional information relative to this document:

(a) No. 3 ESS Common Systems Command Manual (PD-1C190)

(b) No. 3 ESS Input Message Manual (IM-3H300)

(c) No. 3 ESS Output Message Manual (OM-3H300)

(d) Trouble Locating Manual (TLM-1C900).

1.06 The following programs provide additional information relative to this document:

(a) TTY Message Administration Program (TTYMAP), PR-3H259

(b) Application Teletype Compatibility Program (TTYAPP), PR-3H015

(c) TTY Phrase Table and Word Dictionary Definitions (T1AREA), PR-3H016

(d) Common TTY Handler (CTTYH), PR-3H012

(e) Common TTY Tests (CTTYT), PR-3H013

(f) Autoconnect Port Control Program (ACPORT), PR-3H250

(g) Data Administration Program (DATADM), PR-3H262

(h) Translation Data Area Definition Program (TDATA), PR-3H018

(i) Resident TTY Message Program (MTTYC), PR-3H252

(j) 3A CC Text Scanning and Conversion Subroutines (SCSUBS), PR-3H260.

1.07 The major areas of TTY software functions are as follows:

(a) Process input messages from the TTY (described in Part 3)

(b) Process output messages to the TTY (described in Part 4)

(c) Retrieve data from user program, format for output, and store until TTY is available (described in Part 5)

(d) Connect a remote TTY to the 3A processor through the network (described in Part 6).

1.08 This section applies to the software programs associated with the No. 3 ESS TTY hardware devices and explains the TTY logic functions as a group. A block diagram of these functions is shown in Fig. 1.

1.09 Primary communication with the No. 3 ESS processor is conducted via the TTY devices. This communication consists of maintenance messages and requests, entering or updating of office translation data, traffic analysis data, and test or diagnostic requests.

1.10 The TTY message administration program (TTYMAP) controls all TTY devices through a send/receive buffering device called the TTY controller (TTYC). This program receives the input characters one at a time from the TTYC and stores them until the complete message is received. The message is first converted into a format that can be used by a destination program (user) and is then transferred to that program. TTYMAP accepts a message from a user program, formats the message to a standard output form, stores the message until the destination TTY is available, and outputs the message, one character at a time, as fast as the TTYC can accept the characters.

1.11 A maximum of eight TTYCs can be connected to the 3A processor and each TTYC can serve a maximum of four TTYs. The standard No. 3 ESS is equipped with four TTYCs and two of these controllers are active. Refer to the ***RC:TTY*** input message in the No. 3 ESS Input Message Manual, IM-3H300, for information on TTY message classes that may be assigned to a TTYC.

1.12 Write-protected store contains five programs and a table for the TTY function. In addition, office-dependent initialization constants are stored in the translations area.

1.13 Temporary store contains dedicated control and storage areas for the TTY function.

2. SOFTWARE STRUCTURE

2.01 Tasks performed by the 3A processor are divided into three categories according to their frequency and urgency. These task categories result in three levels of software operation. The base level programs (first category), which are a background of relatively low priority programs, run continuously in the system. These programs are referred to as the base level loop; once the last program in the loop is completed, the first program starts the loop again.

2.02 The next level (second category) consists of programs that are enabled by a timed interrupt. The base level loop is interrupted every 10 milliseconds for the performance of a higher priority, time-dependent task that requires execution more frequently than once every loop interval. When the task is completed, the base level program will resume at the interrupted point.

2.03 Those system functions which require immediate attention and which must be serviced before the execution of the next program instruction are referred to as demand interrupts (third category). A demand interrupt is processed immediately upon occurrence. When the task is completed, the interrupted program continues.

A. Base Level Loop

2.04 The base level loop is a continuous loop of programs which performs a repetitive series of tasks. A minimum of 100 milliseconds is required to execute one cycle of the base loop. TTYMAP is entered at the TTYMON entry point. TTYMAP scans each TTY controller administration block (CAB) as indicated in Fig. 2. The TTY controller parameter block (CPB) contains the address of each TTY CAB. When the CAB is accessed, the state word is isolated to determine which tasks in TTYMAP must be accomplished during this base level entry to TTYMAP. The state word is a combination of bits in the CAB progress mark (CABPM) and the CAB base activity flag (CABBAF). After the TTY controller is checked, TTYMAP performs one of the following functions depending on the value of CAB state:

(a) Sends "who-are-you" (WRU) test and starts a timer to check on response time.

(b) Reroutes messages addressed to an out-of-service TTY to the maintenance TTY.

(c) Checks to see if the autoconnect TTY connection is completed.

(d) Searches the output message queue for a message addressed to this TTY channel and initiates output if a message is found.

(e) Checks for time-outs:

(1) A 10-second time-out for no link return [see paragraph 5.02(e)]

(2) A variable time (RC MESSAGE) autoconnect limit to complete the network path

(3) A time-out when there is a 2-minute delay between input characters.

(f) Processes a completed input message and transfers the message code to the user program.

(g) Transfers the next line of the output message to the buffer for output to the TTY.

(h) Terminates the output message and releases the storage area for later use.

B. Timed Interrupts

2.05 No timed interrupts are used by the No. 3 ESS TTY programs.

C. Demand Interrupts

2.06 Each time the TTYC receives a character from the TTY or sends a character to the TTY, it generates a demand interrupt to the master interrupt controller. When the demand interrupt is recognized, control is given via the transfer vector table (TVTAB) to the common TTY handler program (CTTYH) entry point TTYE_INT, TTYO_INT, or TTYHSP on interrupts 10, 11, and 12, respectively. When this happens, the TTY CPB (depending on the interrupt) is scanned (Fig. 3) and the address of the CAB is used to obtain the state word as in the base level entry. Interrupt 12 is connected to TTYCs 2 and 3 and any high-speed TTYCs. When the base level activity flag (CABBAF) is not set (the state is less than 8), one of the following functions is performed as required.

(a) An acknowledge character is received from the TTY controller in response to the WRU test sent at base level.

(b) A check is made to determine if the same character has been received 128 times. (This condition of a port is referred to as babbling.)

(c) The next character is sent if an output message is in progress.

(d) The received character is checked for action to be taken when an input message is in progress. If it is not a special action character, it is merely stored in the text buffer (CABTXT). Otherwise, the base level activity flag (CABBAF) is set to initiate input message processing at base level.

PROGRAM ORGANIZATION

A. TTYMAP

2.07 The TTY message administration program (TTYMAP) receives control from CTTYH both at the base level and the interrupt level. The state word (CABBAF and CABPM) in the CAB determines the functions to be processed while TTYMAP has control. There are 16 states that determine the processing required to maintain the TTY functions of accepting an input message from the TTY, converting it to user form, and transferring it to the proper user program or of accepting a user program message, converting it to output form, and transferring it (one character at a time) to the designated TTY(s). Other functions include initialization, TTY tests, and autoconnect setup.

2.08 A block diagram of the TTY programs, tables, and control blocks used in accomplishing this task is shown in Fig. 1. When TTYMAP is entered, it must determine the actions required during the control interval for each TTY. The first action is to retrieve the CPB in TDATA as shown in Fig. 2 and 3. The layout of the CPB is shown in Fig. 4. There is a 4-word block for each defined TTYC. The input/output address (CPBIO) determines whether the TTY exists or is a dummy. When the CPBIO is not zero, the address of the TTY controller administration block (CPBCAB) is used to fetch the TTY CAB. Other items in the CPB are as follows:

(a) ***Parity Check Flag (CPBPAR):*** This bit indicates that even parity checking is required for input messages. (Even parity is always generated for an output message.)

(b) ***Logical Channel (CPBCHN):*** These three bits provide the logical input channel (message class).

(c) ***Monitor Port Flags (CPBMON):*** These bits indicate which ports are connected to a monitor TTY.

(d) ***WRU Test Flags (CPBWRU):*** These four bits indicate which ports have answer-back capability.

(e) ***Equipped Flags (CPBEQ):*** These four bits indicate the ports that are equipped.

(f) ***High-Speed Printer Flag (CPBHSP):*** This bit indicates a high-speed TTYC is being used.

2.09 A layout of the TTYC administration block (CAB), which is a 49-word block for each TTY channel located in temporary store, is shown in Fig. 5. The first ten words are for control purposes, and the contents of these words may change as the various states of TTYMAP are entered and errors or equipment failures occur. The next 39 words are used for storing input messages (two characters per word) or output messages (only one line of the output message is in the buffer at any given time). The following items in the TTYCAB are used most frequently:

(a) ***Progress Mark (CABPM):*** These three bits form part of the state word (values of zero through seven).

(b) ***Base Level Activity Flag (CABBAF):*** This bit indicates that base activity is required or is in progress (increases state word value by eight).

(c) ***Character Count (CABCNT):*** This item is incremented by one each time an input character is received. Also, this item is checked to determine when the input characters have overflowed the text buffer.

(d) ***Linked Message Flag (CABLF):*** This flag is set when the user must furnish the next segment of a linked message.

(e) ***Overlay Segment Number (CABSEG):*** This item is used to determine that a nonresident (on-tape) user is still resident in memory. When the user is aborted for some reason, the message to/from that user is also aborted.

(f) ***User Subroutine Address (CABSUB):*** This item is a 20-bit address that points to the user subroutine address for the delayed reply state or to the output message queue (OMQ) for a linked output message.

(g) ***Text Buffer (CABTXT):*** This is a 39-word buffer used for storing the complete input message (two characters per word) or the output message (one line at a time, two characters per word).

(h) ***Timer/Work Area (CABTIM):*** This word is incremented each base level entry to the program and is cleared each interrupt entry.

(i) ***Work Area (CABWRK):*** This word contains the last character received and the number of consecutive times the character has been received.

(j) ***Garbage Character Count (CABGCC), 3E3 Issue 2 Generic:*** In previous generics, when the TTY is printing, any character typed in acts as a break. In the 3E3 Issue 2 generic, only the "break" key will activate a break. Other characters typed in are stored in the CABGCC area. (Only 8 characters may be stored.) The CABGCC bits are cleared after each TTY message.

2.10 A layout of the OMQ is shown in Fig. 6. This is a variable-length block that determines the processing of the output message. The OMQ contains the following items:

(a) ***Link to Next OMQ Element (OMQLNK):*** This is a pointer to the next OMQ and is used when the OMQ must be searched to find a message for a particular TTY channel or to find an empty OMQ for an output message.

(b) ***OMQ Length (OMQLEN):*** This item is used to determine the length of this OMQ entry.

(c) ***OMQ Deferred (OMQDEF):*** This item is set when the output message remains in the user storage area until it is transferred, one line at a time, to the CABTXT.

(d) ***Autoconnect Flag (OMQAC):*** When this item is set, the sign-on message is prefixed to the output message.

(e) ***Route Code (OMQRTE):*** This code is the output channel supplied in the PCLCHN.

(f) ***Link Wait Flag (OMQLW):*** This item is used to determine when the user has not returned the next output segment.

(g) ***Link Ready Flag (OMQLR):*** This is set when the user has returned a linked message segment and is reset when the segment has been printed.

2.11 The remaining portion of the OMQ is variable depending on the requirements of the output message. It may contain the user subroutine address, the data buffer address, or the output data buffer address.

2.12 When TTYMAP is entered at base level, the OMQs are searched for an output message that is destined for a TTY controller in the idle state. When the channel number is located, the output sequence is started for that channel.

2.13 A layout of the input message block (IMB) is shown in Fig. 7. This 4-word block contains a 16-bit search key (IMBVRB and IMBID1), 8 channel-allowed flags (IMBCAF), a 10-bit format number (IMBFMT), the link-allowed flag (IMBLNK), a special-format flag (IMBSFF) that is used with the special format in TTYAPP message processing, and a 20-bit processing subroutine address. These blocks are located in T1AREA, one per message.

B. DATADM

2.14 The data administration program (DATADM) has similar states and state flow as TTYMAP. DATADM receives control from TTYMAP (Fig. 1) and performs the same functions as TTYMAP for data transmission.

2.15 The DATADM program also performs the interface between the No. 3 ESS office and the automatic message accounting recording center (AMARC) by controlling the data flow to and from the AMARC via the data link.

C. T1AREA

2.16 The T1AREA is a table in program store that contains the constants, definitions, formats, system-state and channel-allowed catalog, dictionary tables, action option keywords, input message catalog, and a standard phrase pool. TTYMAP utilizes this area to convert the user program format to output message format or to convert input messages to user program format. It also contains the address of the user program.

D. TTYAPP

2.17 The TTY applications program (TTYAPP) provides the capability for user programs (written before TTYMAP) to be used with TTYMAP. The common system user program calls routines in TTYAPP to process the output message. TTYAPP reformats the output message as required and transfers it to TTYMAP for output.

2.18 A layout of the common systems print call list (CPC) furnished by the user program to TTYAPP is shown in Fig. 8. TTYAPP uses this information to reformat the message for transferral to TTYMAP.

E. CTTYH

2.19 The common TTY handler (CTTYH) module replaces the 3A Central Control (3A CC) common system module CTTYH by providing the necessary routines to link the common system package with TTYMAP, the No. 3 ESS TTY message administration program.

F. CTTYT

2.20 The common TTY tests (CTTYT) module replaces the 3A CC common system module CTTYT by providing the necessary routines to link the common system package with TTYMAP, the No. 3 ESS TTY message administration program.

G. Program Store

2.21 Program store (write-protected store) contains the TTY programs (TTYMAP, TTYAPP, and T1AREA). In addition, program store contains initializing data for the output message routing (OMR) and other office-dependent constants in the translations data area (TDATA).

H. Temporary Store

2.22 Temporary store (call store) contains the CABs, OMQs, and data buffers. When the temporary store is cleared by a stable clear for the office, all pending output messages are cleared

from the system and initialization constants in translation data reform the CABs, OMQs, etc. This causes the TTYCs to go to state 0 (MTC) and initiates a check of all equipped ports for the TTYCs. Depression of the TTY INIT key on the system status panel has the same results.

I. TTYMAP State Diagram

2.23 The TTYMAP program is entered at the TTYINT and TTYHSP entry points for a demand interrupt. The demand interrupt is generated when the TTY controller (TTYC) receives a character from the TTY or the TTYC has sent a character to the TTY. The state word is contained in CABPM and CABBAF of the CAB. The only activity at interrupt level is for states 0 through 7. An interrupt level state change diagram for TTYMAP is shown in Fig. 9. This diagram depicts the state changes that occur when certain events have caused the interrupt. For example, the input state (5) is entered to continue processing an input message when the CABBAF is a 0, CABPM contains the idle state (three bits are 100), and a nonbreak character is received. When the received character is the break character, the break state is entered to check for babbling (128 characters consecutively repeated). When babbling is detected, the maintenance state (0) is entered.

2.24 The TTYMAP program is entered at the TTYMON entry point once each base level loop. The state words (CABBAF and CABPM) are checked. A base level state diagram for TTYMAP is shown in Fig. 10. For the maintenance state (0), the 0.0, 0.2, and 0.3 states are entered to scan for alarms and to perform an abbreviated permanent signal test (babbling) and a WRU/ACK test. This sequence tests all ports of the TTYC; if at least one port is capable of operation, the TTYC is placed in the idle state (4). State 0 is also entered prior to an output message when the TTYC has been idle for more than 2 minutes. This causes the TTY to restart the motor when it is equipped with an idle line control. The TTYC is reinitialized and a WRU/ACK test is initiated. Any change in status is printed on the maintenance TTY. Most of the changes in state at base level are the result of time-outs, normal start-of-output messages, or normal end-of-message routines. Figure 11 is a state change diagram for state changes that occur as the result of time-outs.

3. INPUT MESSAGE PROCESSING

3.01 The TTYC generates a demand interrupt when a character is received from the TTY and stored in the TTYC output buffer. TTYMAP is entered at the TTYINT or TTYHSP entry points. All TTYCs, as defined in T1CPBS, are polled. If a character is found, this character is stored in the CAB. Common system subroutines are used to interrogate the TTYC and the character is returned in general register 11. The idle state routines advance the CABPM to the break state when the break character is present. For a nonbreak character, the input state is entered and the character is checked for backspace (←), line cancel ($), or message cancel (&). If present, the appropriate last character, line, or message is deleted. As long as characters are received, TTYMAP remains in the input state and the received characters are stored in the text buffer (CABTXT).

3.02 Each time a character is received, the repeat character count (CABWRK) is incremented or cleared and checked to determine whether the port is babbling. At base level, a timer is maintained to determine when there is a 2-minute delay between input characters. When the time-out occurs, a **?T** is printed; otherwise, the message remains stored in CABTXT.

3.03 As the characters are received, a character-type check is made. The character classes and characters assigned to each class are listed in Table A. Class 0 characters are always ignored. Class 1 characters are ignored at the start of a line. Class 3 characters are used to terminate messages. The remaining characters are placed in class 2 and are always accepted and stored in CABTXT.

3.04 Although some characters may be ignored, they will continue to be counted to determine when the port is babbling. The characters that are passed are stored in CABTXT; when the termination character (! or /) is received, the base activity flag (CABBAF) is set. This changes the state word from 5 (INPUT) to 13 (INPUT COMPLETE), and the message is then processed at the next base level entry of TTYMAP.

3.05 The INPUT COMPLETE (state 13) routines are entered at base level, and the last character received is checked for babbling port, break, or abort action. If none of these are present, the parity of each character is checked.

TABLE A

TTY CHARACTER CLASSES

CLASS	TTYMAP ACTION	CHARACTER
0	Ignore	SOH, STX, ETX, EOT, ENQ, ACK, BEL, BS, DLE, DC1, DC2, DC3, DC4, NAK, SYN, ETB, CAN, EM, SUB, ESC, FS, GS, RS, US, DEL
1	Ignore at start of line	HT, LF, VT, FF, CR, SO, SI
2	Accept	All other characters (NUL, SP, QU, AM, LP, RP, AS, CO, all numerics, CL, SE, QS, all alphabetics, and UL)
3	Accept and terminate	EX, SL

When the parity-check bit (CABPAR) is set and a parity error occurs, the **?P** reply is printed.

3.06 The TTYMAP program utilizes the message definitions in T1AREA to process the message. When the message is not defined for the TTY, a **?C** reply is printed. Once all checks have been passed and the message is converted to user format, the message is then transferred to the user program address found in the catalog.

3.07 The conversion is accomplished by using the T1AREA formats, definitions, and catalogs stored in program store. The catalog entries contain the following information:

(a) Action and identification for each message

(b) User program address

(c) Linking allowed for the message

(d) Channel from which the input message is received.

3.08 After these checks are completed, the message is loaded in the general registers and the user program is called. The user generates a reply to the message, and the TTYC is returned to the idle state (if the message is not linked) or to the input state (if the message is linked).

3.09 While the input message is being processed, one of the following error messages may be printed.

(a) **?I**—The identification field cannot be found in the catalog

(b) **?D**—The data field has an error

(c) **?A**—The action field has an error

(d) **?E**—A processing error occurred when the user program received the message.

3.10 After the user program has accepted the input message, one of the following messages normally will be printed.

(a) **PF**—The message has been accepted by the user program and a printout follows.

(b) **OK**—The message has been accepted and acted upon by the user program. No further printouts occur.

(c) **IP**—The message has been accepted by the user program and is being acted upon.

(d) **RL**—The message was rejected. Retry later.

(e) **NG**—The message was rejected because one or more conditions for accepting the message were not met.

(f) **WT**—This reply is given when a search of the resident catalog does not result in a match. A composite key of verb or verb and identification will be used to search the autoload message group (T1AMGS) table. After 5 seconds have elapsed, the **WT_** reply is printed. If a match cannot be found within 5 minutes, a **?E** reply is printed. When the message is found before the 5-minute time-out, the normal reply for the message is printed. TTYMAP is in state 9 (AWAIT DELAYED REPLY) for this search.

3.11 An out-of-service TTY does not respond with a reply to an input message. It will respond to a line feed (repeat last character 32 times), carriage return (echo last line), and bell (spill 64 character set). The characters spilled are in Table B. A break character causes a TTY initialization (state 0). When the initialization is successful, the TTY is returned to the idle state and the message can be entered.

3.12 The No. 3 ESS Input Message Manual (IM-3H300) should be consulted for a complete list of messages and the error or acceptance replies.

4. OUTPUT MESSAGE PROCESSING

4.01 There are three levels of output messages for the TTY. Programs written to interface with common system functions do not have a compatible interface with TTYMAP. These programs call the TTYAPP program to process the message. The message is reformatted by TTYAPP to a form that can be used by TTYMAP. From this point, the message is transferred to TTYMAP and processed in a similar manner to programs that have a direct interface with TTYMAP.

4.02 At each base level entry to TTYMAP, the output message queues (OMQs) are checked for each TTYC in the idle state. When a message is found by comparison of the message class (CABCHN) to the output message route (OMQRTE), the output sequence is started. The channel is placed in the initialization state (MTC) which causes a WRU test to be sent. A TTY with an idle line control is started when the channel has been idle for more than 2 minutes. When the initialization is successfully completed, the channel is returned to the idle state. The next base level entry starts assembling the output message in the text buffer (CABTXT).

4.03 The state word is changed to 11 and an 8-second time-out is started. The first character is sent when the TTYC is found idle, and the state word is then changed to 7 (OUTPUT). The demand interrupt generated by the character sent at base level causes the line of characters in CABTXT to be printed.

4.04 The idle state processing places the first line of the message into CABTXT. The first line contains the priority of action (PCLLVL), minutes past the hour, and the first line of the output message. The state word is changed to 11 (PREPARE FOR NORMAL OUTPUT). This state sets the time-out counter to 8 seconds and sends the first character of the message. The state word is changed to 7 (OUTPUT), and subsequent characters are sent from the CABTXT to the TTY controllers at the interrupt level.

4.05 When the last character in the CABTXT is sent, the base level activity flag (CABBAF) is set. This changes the state word to 15 (OUTPUT COMPLETE), and the next base level entry functions as follows:

(a) Informs the user of abnormal termination if a time-out occurred and caused a channel initialization (state 0) to determine the reason for the time-out

(b) Stores the next line in CABTXT if multiline format (linked)

(c) Calls the user program for next segment of the message if linked

(d) Releases the user program if message output is complete (to release user held storage area)

(e) Searches OMQ for another output message for this TTY channel and, if no message exists, returns the TTYC to the idle state.

TABLE B

SPILL CHARACTER SEQUENCE

DECIMAL	OCTAL	CHARACTER	DECIMAL	OCTAL	CHARACTER	DECIMAL	OCTAL	CHARACTER
32	040	b	54	066	6	76	114	L
33	041	!	55	067	7	77	115	M
34	042	"	56	070	8	78	116	N
35	043	#	57	071	9	79	117	O
36	044	$	58	072	:	80	120	P
37	045	%	59	073	;	81	121	Q
38	046	&	60	074	<	82	122	R
39	047	'	61	075	=	83	123	S
40	050	(	62	076	>	84	124	T
41	051	)	63	077	?	85	125	U
42	052	*	64	100	@	86	126	V
43	053	+	65	101	A	87	127	W
44	054	,	66	102	B	88	130	X
45	055	—	67	103	C	89	131	Y
46	056	.	68	104	D	90	132	Z
47	057	/	69	105	E	91	133	[
48	060	0	70	106	F	92	134	\
49	061	1	71	107	G	93	135	]
50	062	2	72	110	H	94	136	^
51	063	3	73	111	I	95	137	—
52	064	4	74	112	J			
53	065	5	75	113	K			

5. OUTPUT MESSAGE QUEUEING

5.01 The user programs call TTYAPP to obtain an output queue. TTYAPP reformats the message and passes it to TTYMAP. TTYMAP accepts the message when an idle OMQ of sufficient length can be found. Maintenance and call processing programs call MTTYC to convert an output message. MTTYC tranfers the message to TTYAPP for reformatting as above.

5.02 The entry points for TTYAPP are PMRY, PMRYR, LPMRY, LPMRYR, REGD, and MFAD. The user program calls an entry point under the following conditions.

(a) REGD—The entire message is in the general registers.

(b) MFAD—The entire message is in the message forming area.

(c) PMRY—Part of the message is in memory and part in the general registers.

(d) PMRYR—The message is stored as in (c), but the user wishes to override the normal output channel.

(e) LPMRY—The message is stored as in (c) and is in linked format. A linked message has more data than the OMQ can handle with one transfer.

(f) LPMRYR—The message storage and format are the same as in (e), and the user wishes to override the normal output channel.

The TTYAPP program uses the common systems print call list (CPC) for processing the message. For all messages that are not linked, the reformatted message information is placed in the general registers and TSPRT0 in TTYMAP is called. For all linked messages, TSPRT4 in TTYMAP is called. In the 3E3 generic, for all AMA data transfers that are not linked, the reformatted message information is placed in the general register and TSXMT0 in TTYMAP is called. For all linked AMA data transfers, TSXMT4 in TTYMAP is called.

5.03 In offices using the S0-2 generic, the AMARC data interface uses the same message queue as the TTY messages. If multiple maintenance messages fill the queue, the AMA data transfer could be affected. The 3E3 generic provides separate data and TTY queues to reduce the possibility of TTY messages affecting AMA data.

5.04 The TTYMAP program processes the output message in conjunction with the parameters that accompany the message. Continuous checks for errors in format, length, and allowable content are made. When an error is found, error routines are entered and a printout provides diagnostic information.

5.05 The message may be left in memory by user program direction or moved to the OMQ data buffer. The output channel (OMQRTE) triggers the start of the output message the next time the OMQ is searched.

5.06 When the message is linked, return codes between the user program and TTYMAP are used to identify the message until it has been completed. The last message segment does not have a linked format and the end of the message (EOM) sequence will be as directed by the EOM sequence (CPCEOM) from the user program or as defined for the format in T1AREA.

5.07 The last output sequence is the standard prompter (TSPRPT) sequence which is defined as ETX, TOFF, and DC1 by T1PRPT in the T1AREA table.

6. AUTOCONNECT SEQUENCE

6.01 The autoconnect feature provides remote TTY access to the processor through the network rather than with a dedicated line. Relays are controlled by the TTY programs that simulate on-hook and off-hook conditions to the call processing programs.

6.02 When a TTY channel equipped with autoconnect ports is idle for a variable interval (if locally initiated, the time limit is 15 seconds; if remotely initiated, the time limit is determined by the time-out parameter in the call-back block), the connection through the network is dropped and the disconnect status is marked in the message route code. The next message for the channel is then delayed until the connection is reestablished through the network and a sign-on message identifying the office is printed. An office can initiate the autoconnect sequence with a call-back arrangement. Once the call-back is initiated, the connection sequence is the same as for an output message with the autoconnect port disconnected.

6.03 Autoconnect monitors on TTYC ports 2 and 3 are provided for offices using the 3E3 generic. By providing for ports 2 and 3 to be monitor autoconnect ports, any TTYC may be monitored without the necessity of special autoanswer data sets in the central office. Autoconnect monitors cannot, however, be used on port 2 of TTYC 1 since it is dedicated to the remote office test line (ROTL).

6.04 When a message is generated, the TSPRT routine of TTYMAP is entered. The TSPRT routine calls TSGOMQ to obtain an output message queue. The TSGOMQ routine checks the message route code. If the autoconnect port is disconnected, TSGOMQ calls the ACPRPI routine in the autoconnect port control program (ACPORT) to start the autoconnect sequence. The proper CAB is placed in state 8 (AUTOCONNECT), and dialing is started by ACPORT routines.

6.05 The next base level entries of TTYMAP or DATADM find the state 8 word in CABBAF and CABPM. A timer checks for a 60-second time-out. When the port alarm does not disappear within 60 seconds (indicating that the path through the network is complete), the attempt is aborted by the ACTERM routine in ACPORT. A 30-second time-out is initiated; at the end of this period, routine ACINIT in ACPORT is called to retry the connection. When this connection is not established within 60 seconds, routine ACFAIL in ACPORT is called to print a failure message on the maintenance channel TTY.

6.06 When a successful initiation is indicated by the port alarm being reset before a time-out occurs, the state word is changed to 0. This starts the initialization sequence; upon successful completion of the initialization routine, the state word is changed to 4 (IDLE).

6.07 The next base level entry locates the output message for this channel and checks the OMQAC bit. This bit is a zero, and TTYMAP calls the ACSIGN routine to store the sign-on message in CABTXT. This identifies the No. 3 ESS office to the remote TTY. After the sign-on message is printed, the OMQ is searched for an output message for this channel. The message that caused the preceding autoconnect sequence is found and printed. If no further messages are pending for this channel, the TTYC is returned to the idle state. A time-out is then initiated; when the time-out is completed, the autoconnect path through the network is terminated. The OMQAC bit is reset and OMQRTE marked idle. The next output message for the channel causes the same sequence to be repeated unless it occurs before the time-out is completed.

7. TTY ALARM DEFINITION

7.01 Each time a TTYC is found idle, a check of the alarm condition is made during the base level entry of TTYMAP. The alarm transfer condition from the system status panel is used to determine whether the local or remote maintenance TTY is the primary indicator for system trouble printouts. When the alarms are transferred, TTYMAP sounds a major alarm when the remote TTY is out of service. When the alarms are not transferred, TTYMAP sounds a major alarm when the local TTY is out of service. Major alarms are only sounded for the maintenance channel. Other channels out of service are only printed on the maintenance TTY. A complete definition of maintenance channel TTY alarms is in Table C.

TABLE C

LOCAL AND REMOTE TTY ALARM DEFINITION

LOCAL TTY	REMOTE TTY	ALARM TRANSFER	ALARM
0	0	0	MAJOR
0	0	1	MAJOR
0	1	0	MAJOR
0	1	1	NONE
1	0	0	MINOR
1	0	1	MAJOR
1	1	0	NONE
1	1	1	NONE

0 = TTY out of service or alarms not transferred

1 = TTY in service or alarms transferred

8. GLOSSARY

8.01 The following terms and definitions are used frequently in this section.

Babbling—When 128 characters are consecutively repeated.

Flag—A bit (or bits) used to store one bit of information. A flag has two stable states and is the software analogy of a flip-flop.

Interrupt—A break in the normal flow of a system or routine such that the flow can be resumed from that point at a later time.

Port—An entrance to or an exit from a network.

9. ABBREVIATIONS

9.01 The following abbreviations and definitions are used frequently in this section.

ACPORT Autoconnect Port Control Program

AMARC	Automatic Message Accounting Recording Center
CAB	Controller Administration Block
CPB	Controller Parameter Block
CPC	Common System Print Call List
CTTYH	Common TTY Handler Program
CTTYT	Common TTY Test Program
DATADM	Data Administration Program
ESS	Electronic Switching System
IMB	Input Message Block
MTTYC	Resident Teletypewriter Message Program
OMQ	Output Message Queue
OMR	Output Message Routing
SCSUBS	3A CC Text Scanning and Conversion Subroutines
TDATA	Translations Data Area
TTYAPP	Application Teletype Compatibility Program
TTYC	TTY Controller
TTYMAP	TTY Message Administration Program
T1AREA	TTY Phrase Table and Word Dictionary Definitions
WRU	"Who-are-you" Test

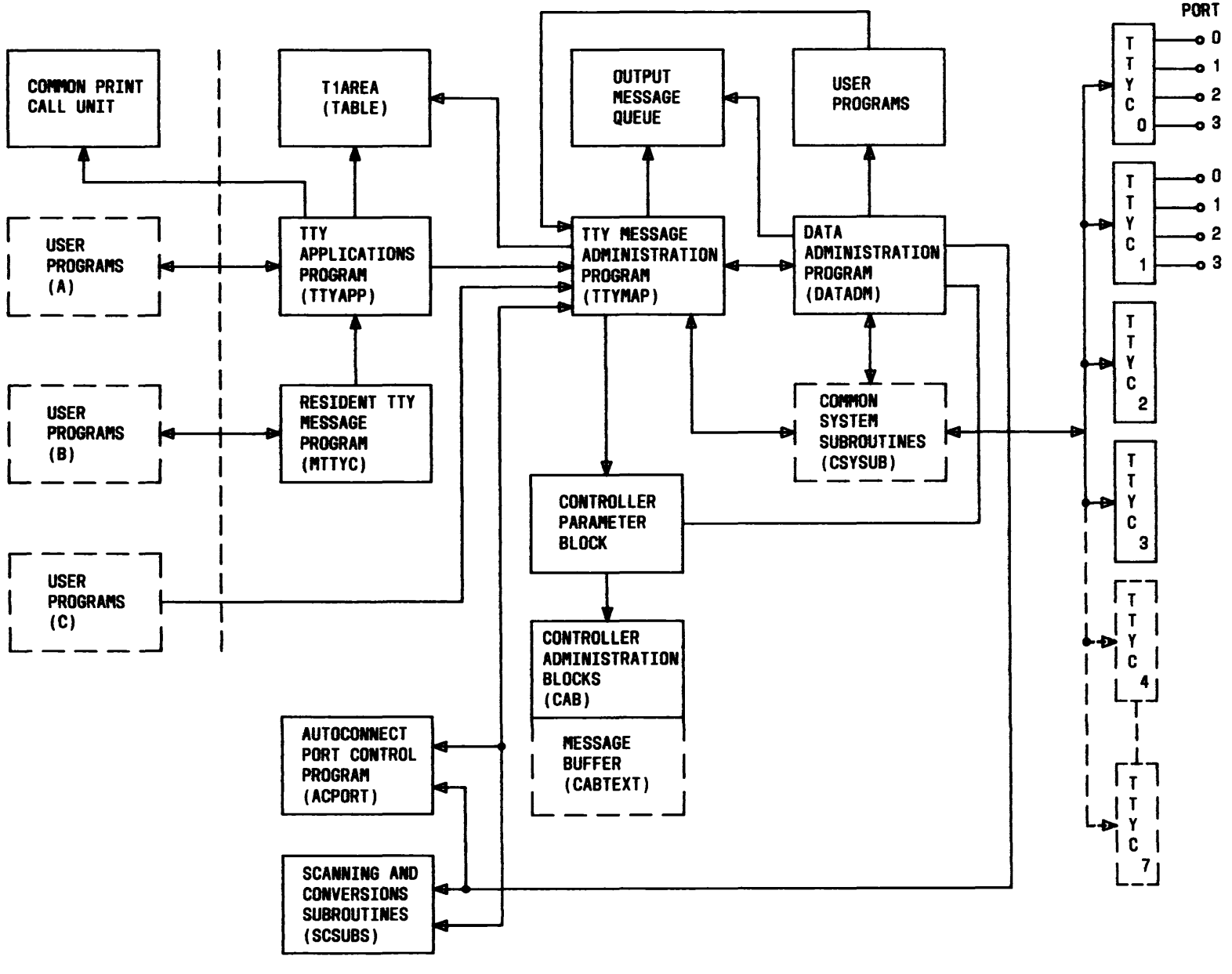


Fig. 1—TTY Message Processing Programs

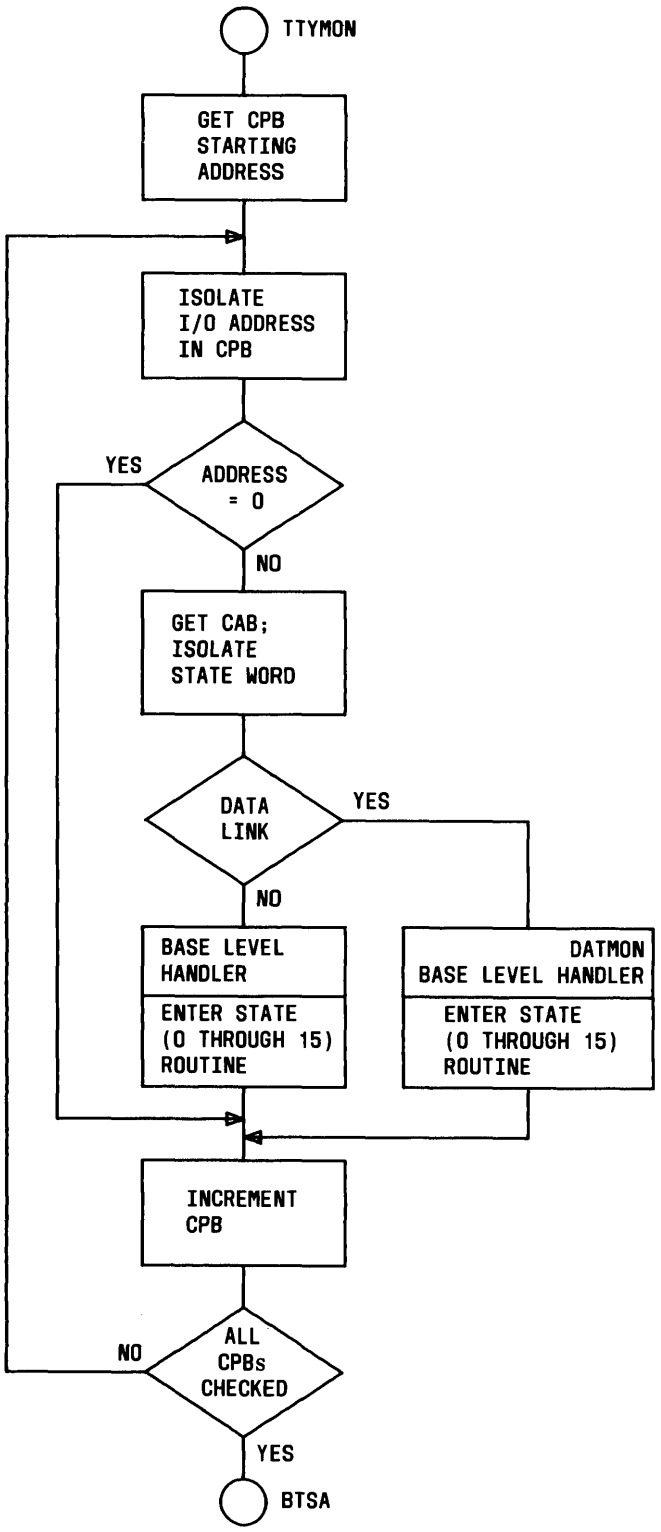


Fig. 2—TTY State Processing (Base Level)

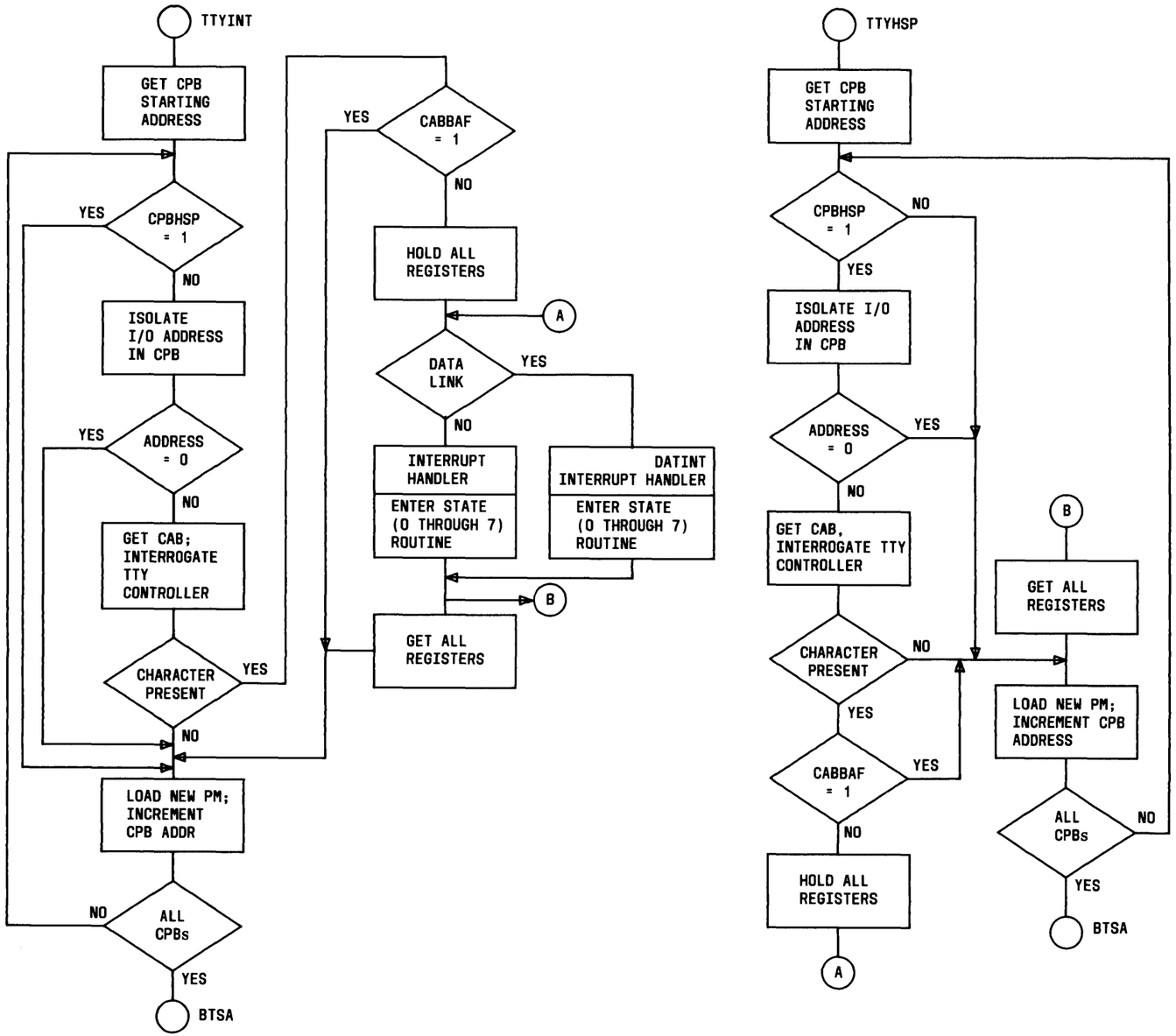
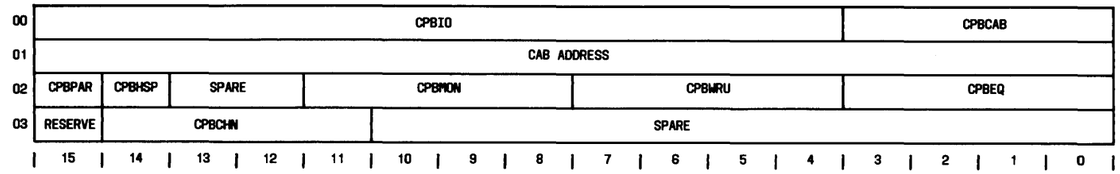
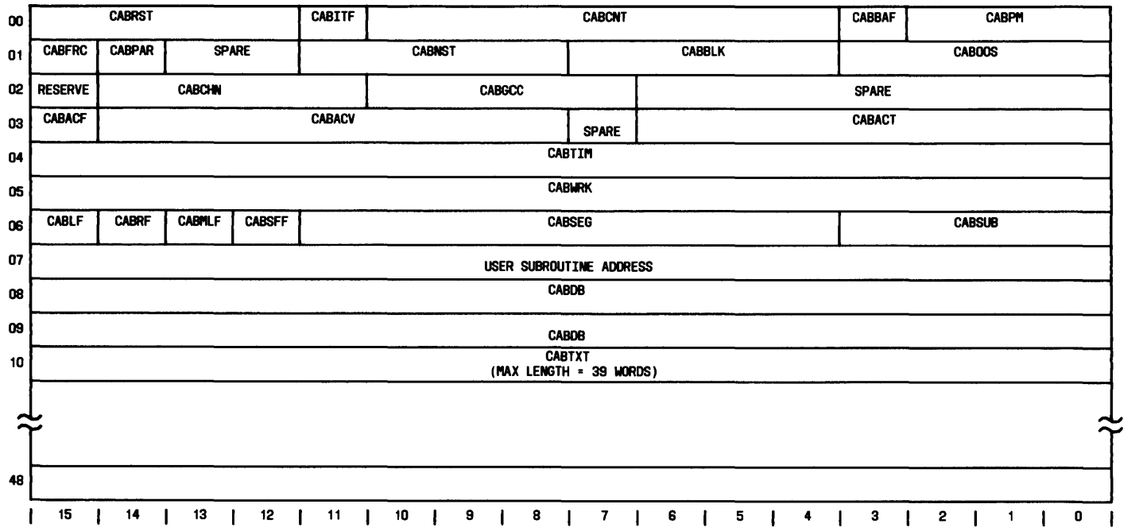


Fig. 3—TTY Controller Polling (Interrupt Level)



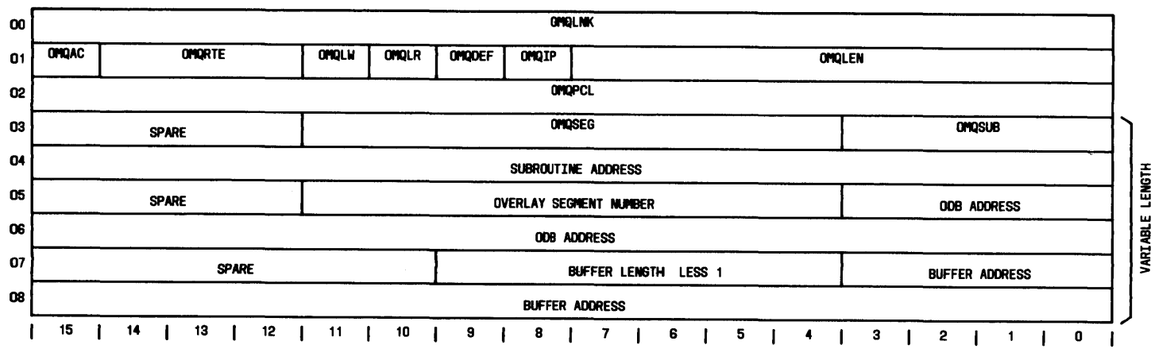
CPBCAB	TTY CONTROLLER ADMINISTRATION BLOCK (CAB) ADDRESS	CPBMON	MONITOR PORT FLAGS
CPBIO	INPUT/OUTPUT ADDRESS	CPBHSP	HIGH SPEED PRINTER FLAG
CPBEQ	EQUIPPED FLAGS	CPBPAR	PARITY CHECK FLAG
CPBWRU	WRU TEST FLAGS	CPBCHN	LOGICAL CHANNEL

Fig. 4—TTY Controller Parameter Block



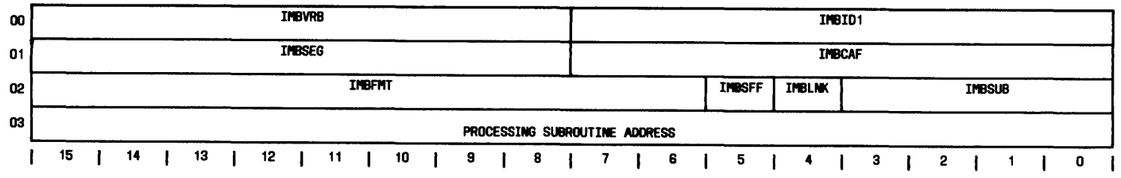
CABPM	PROGRESS MARK	CABACV	AUTOCONNNECT TIME-OUT VALUE
CABBAF	BASE LEVEL ACTIVITY FLAG	CABACF	AUTOCONNECT TIMING FLAG
CABCNT	CHARACTER COUNT	CABTIM	TIMER/WORK AREA
CABITF	IDLE STATE TIME-OUT FLAG	CABWRK	WORK AREA
CABRST	RESUME STATE AFTER REPLY	CABSUB	USER SUBROUTINE ADDRESS
CABOOS	OOS PORTS	CABSEG	OVERLAY SEGMENT NUMBER
CABBLK	BLOCKED PORTS	CABSFF	SPECIAL FORMAT FLAG
CABNST	NEW STATUS FLAGS	CABMLF	MULTILINE FORMAT FLAG
CABPAR	PARITY CHECK FLAG	CABRF	RETURN ADDRESS FLAG
CABFRC	FORCE OOS FLAG	CABLF	LINKED MESSAGE FLAG
CABGCC	GARBAGE CHARACTER COUNT	CABDB	CURRENT IDB/ODB POINTER
CABCHN	LOGICAL CHANNEL NUMBER	CABTXT	TEXT BUFFER
CABACT	AUTOCONNECT TIMER		

Fig. 5—TTY Controller



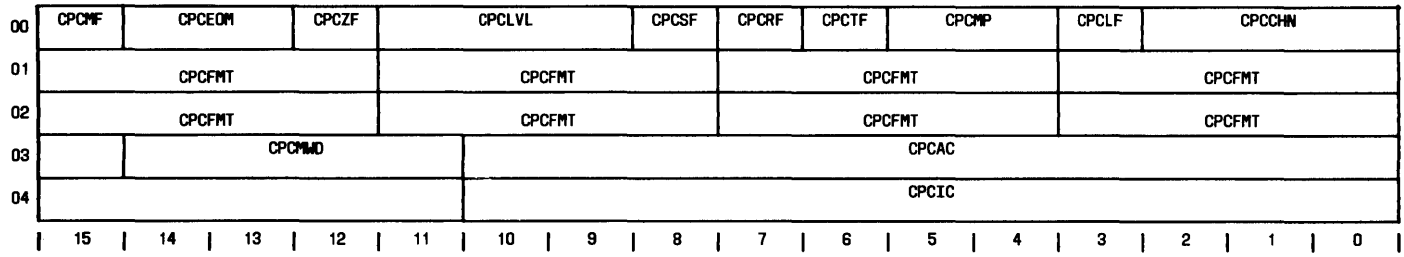
OMQLNK LINK TO NEXT OMQ ELEMENT
OMQLEN OMQ LENGTH
OMQIP PRINT IN-PROGRESS FLAG
OMQDEF OMQ DEFERRED
OMQLR LINK READY FLAG
OMQLW LINK WAIT FLAG
OMQRTE ROUTE CODE
OMQAC AUTOCONNECT FLAG

Fig. 6—TTY Output Message Queue



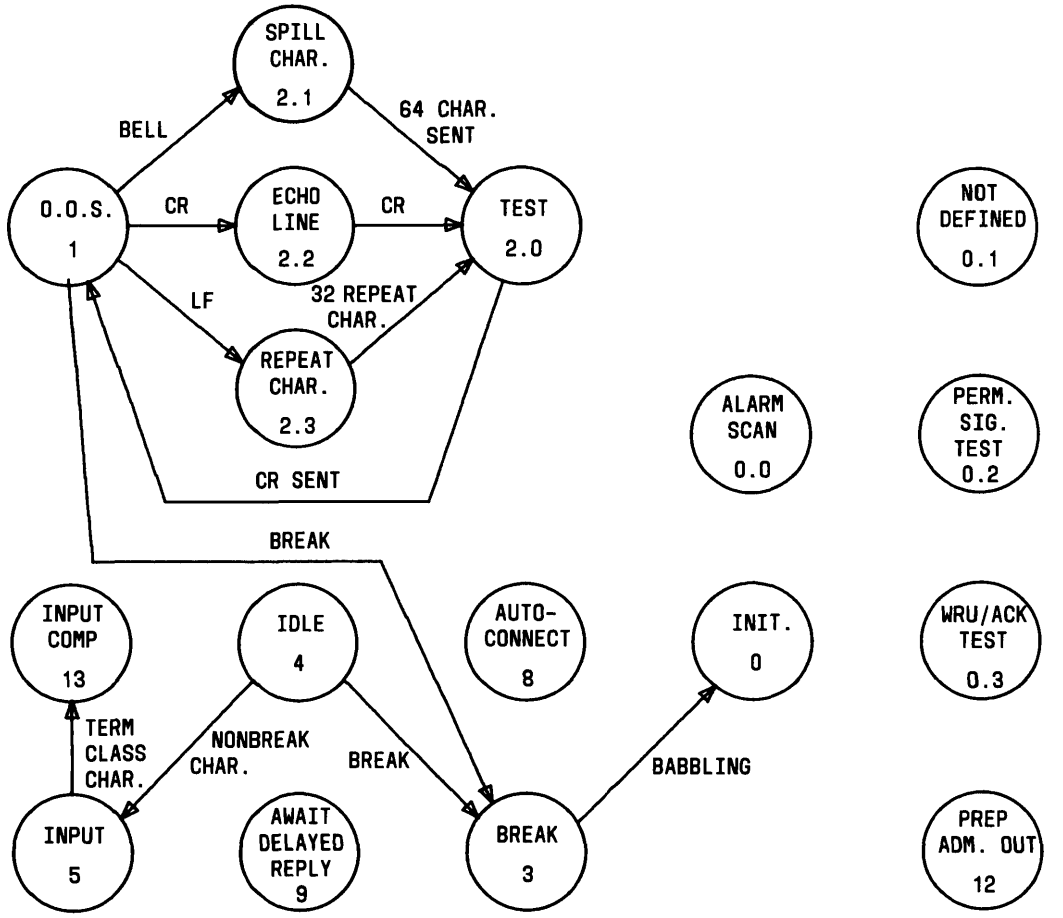
IMBID1 ID 1 PHASE NUMBER
IMBVRB VERB PHASE NUMBER
IMBCAF CHANNEL-ALLOWED FLAGS
IMBSEG SEGMENT NUMBER
IMBSUB CLIENT ADDRESS
IMBLNK LINK FLAG
IMBSFF SPECIAL FORMAT FLAG
IMBFMT FORMAT NUMBER

Fig. 7—TTY Input Message Block



CPCCHN	CHANNEL
CPCLF	LINK FLAG
CPCMP	MESSAGE PRIORITY
CPCTF	TIME FLAG
CPCRF	REGISTER FLAG
CPCSF	SUPPLEMENT FLAG
CPCLVL	MESSAGE LEVEL
CPCZF	ZERO FLAG
CPCEOM	EOM SEQUENCE
CPCMF	MEMORY FLAG
CPCFMT	FORMAT CODES
CPCAC	ACTION PHRASE NUMBER
CPCMWD	MEMORY WORD COUNT
CPCIC	IDENTIFICATION PHRASE NUMBER

Fig. 8—Common Systems Print Call List (TTYAPP)



STATE	NAME
0	INITIALIZATION
0.0	ALARM SCAN (INIT)
0.1	NOT DEFINED
0.2	PERMANENT SIGNAL TEST
0.3	WRU/ACK TEST
1.0	OUT OF SERVICE
2.0	TEST
2.1	SPILL CHARACTERS
2.2	ECHO LINE
2.3	REPEAT CHARACTER
3.0	BREAK
4.0	IDLE
5.0	INPUT
6.0	REPLY
7.0	OUTPUT
8.0	AUTOCONNECT
9.0	AWAIT DELAYED REPLY
10.0	WAIT FOR NEXT SEGMENT
11.0	PREPARE FOR NORMAL OUTPUT
12.0	PREPARE FOR ADM. OUTPUT
13.0	INPUT COMPLETE
14.0	REPLY COMPLETE
15.0	OUTPUT COMPLETE

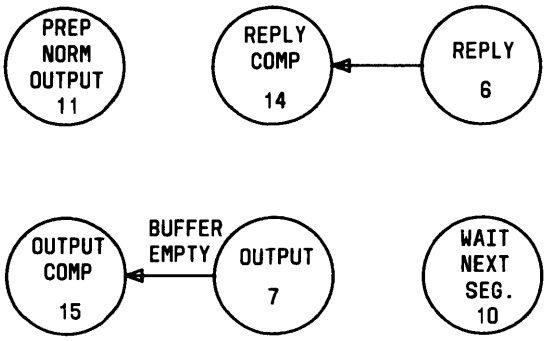
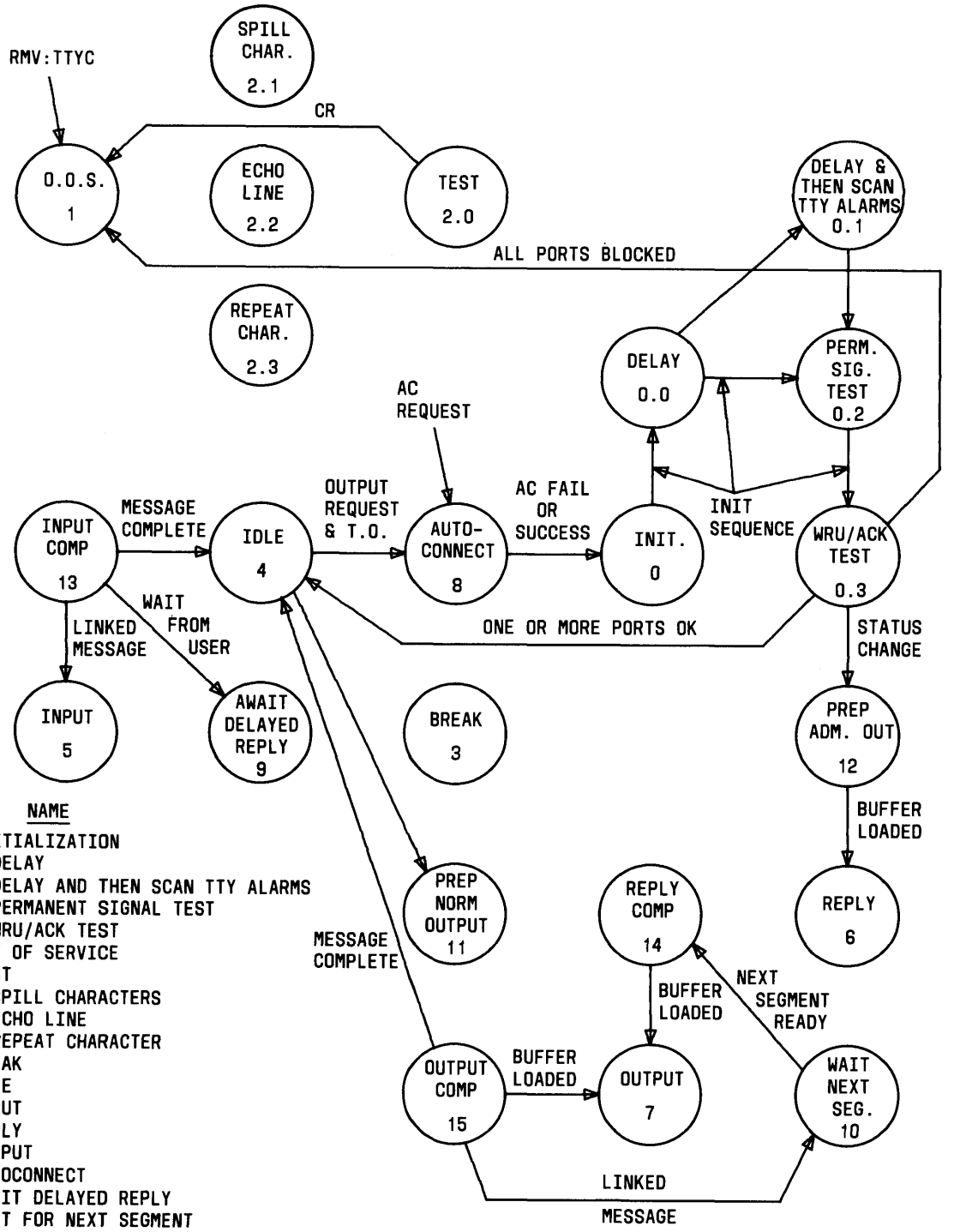
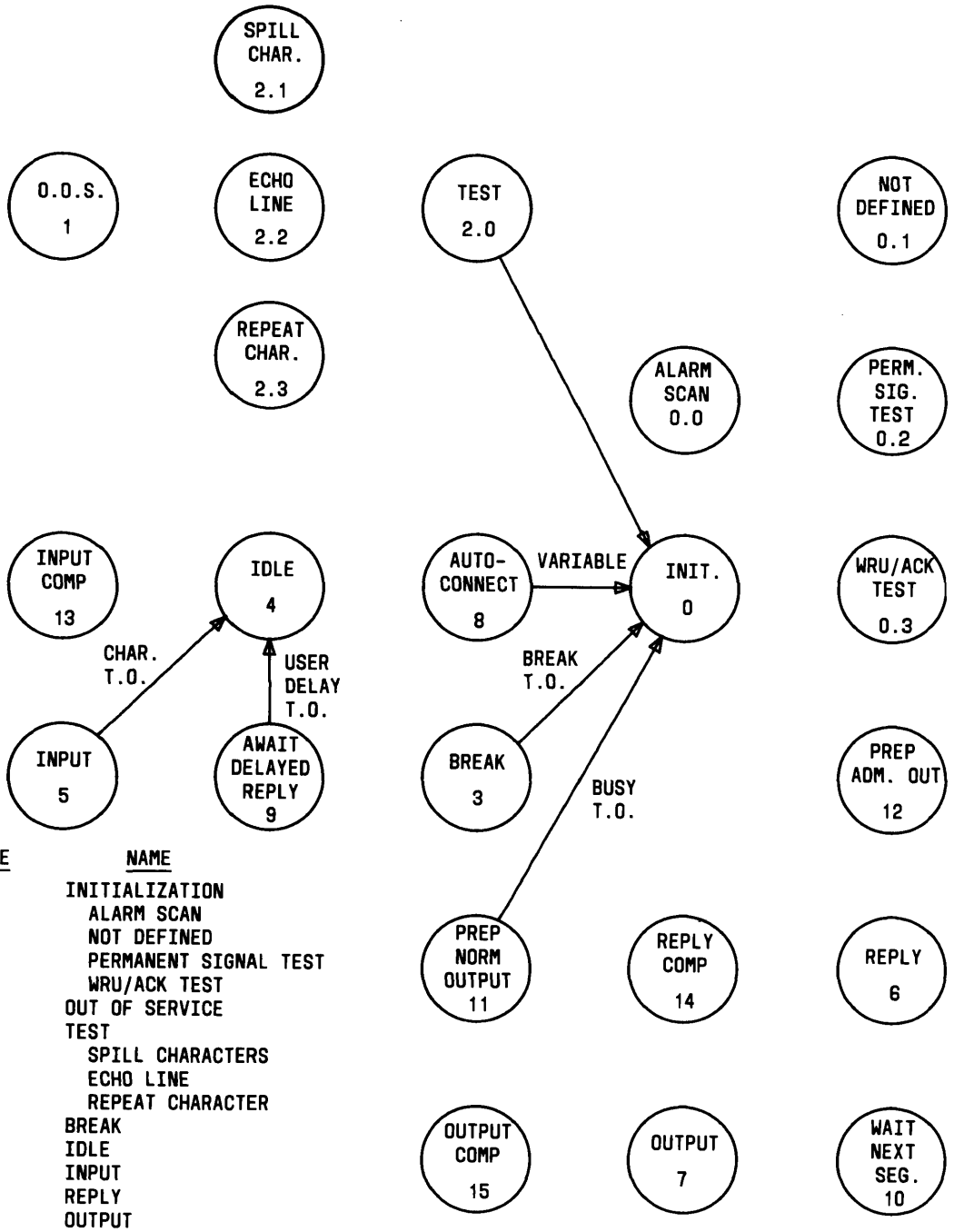


Fig. 9—TTY Interrupt Handler State Diagram



STATE	NAME
0	INITIALIZATION
0.0	DELAY
0.1	DELAY AND THEN SCAN TTY ALARMS
0.2	PERMANENT SIGNAL TEST
0.3	WRU/ACK TEST
1.0	OUT OF SERVICE
2.0	TEST
2.1	SPILL CHARACTERS
2.2	ECHO LINE
2.3	REPEAT CHARACTER
3.0	BREAK
4.0	IDLE
5.0	INPUT
6.0	REPLY
7.0	OUTPUT
8.0	AUTOCONNECT
9.0	AWAIT DELAYED REPLY
10.0	WAIT FOR NEXT SEGMENT
11.0	PREPARE FOR NORMAL OUTPUT
12.0	PREPARE FOR ADM. OUTPUT
13.0	INPUT COMPLETE
14.0	REPLY COMPLETE
15.0	OUTPUT COMPLETE

Fig. 10—TTY Base Level Monitor State Diagram



STATE	NAME
0	INITIALIZATION
0.0	ALARM SCAN
0.1	NOT DEFINED
0.2	PERMANENT SIGNAL TEST
0.3	WRU/ACK TEST
1.0	OUT OF SERVICE
2.0	TEST
2.1	SPILL CHARACTERS
2.2	ECHO LINE
2.3	REPEAT CHARACTER
3.0	BREAK
4.0	IDLE
5.0	INPUT
6.0	REPLY
7.0	OUTPUT
8.0	AUTOCONNECT
9.0	AWAIT DELAYED REPLY
10.0	WAIT FOR NEXT SEGMENT
11.0	PREPARE FOR NORMAL OUTPUT
12.0	PREPARE FOR ADM. OUTPUT
13.0	INPUT COMPLETE
14.0	REPLY COMPLETE
15.0	OUTPUT COMPLETE

VARIABLE= 15 SECONDS FOR LOCAL AUTOCONNECT
= RECENT CHANGE CONTROLLED FOR REMOTE AUTOCONNECT

Fig. 11—TTY Time-out State Changes