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Bell System Data Communications

TECHNICAL REFERENCE

83B3 TELETYPEWRITER SELECTIVE CALLING SYSTEM

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83B3 Teletypewriter Selective Calling System

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System Operation and Interface Specifications

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ENGINEERING DIRECTOR - DATA COMMUNICATIONS

PREFACE

This specification is specifically intended for designers of business machine equippment to be used with Bell System station arrangements to provide 83B3 Teletypewriter Selective Calling System service with customer – provided terminals.

If additional details on the interface and the 83B3 system operation are needed, please contact:

Engineering Director – Data Communications
American Telephone and Telegraph Company
195 Broadway
New York, New York 10007

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1. GENERAL

The 83B3 Teletypewriter Selective Calling System is a half duplex private line system using Model 28 equipment at speeds up to 100 words per minute. The traffic flow is governed by a control station which automatically polls the other stations to start their tape readers.

This Technical Reference describes system operation and provides technical information regarding the interfacing of a customer-provided terminal (CPT) with an 83B3 Teletypewriter Selective Calling System. The CPT may function as either a control or noncontrol station on the 83B3 system.

The characteristics of 83B3 station equipment and telegraph line facilities are described indetail in the remainder of this document.

2. STATION EQUIPMENT

A. Control Station – Basic Equipment

1. 83B3 Station Control Circuit
2. 83B3 Transmitter Start Circuit
3. 28-type Automatic Send and Receive (ASR) Teletypewriter equipped with a 28-type Distributor for use with the Transmitter Start Circuit, and a 28-type Receiving Only Typing Reperforator (ROTR) for intercept purposes.

B. Non-Control Station – Basic Equipment

1. 83B3 Station Control Unit
2. 28-type Automatic Send and Receive (ASR) Teletypewriter

3. SIGNAL CHARACTERISTICS

A. Type

Neutral Operation (current – no current). The telegraph circuit is said to be in a mark condition when current flows and in a space condition when no current flows in the telegraph transmission loop connected to the station equipment. The telegraph transmission loop will be referred to as merely the "loop" throughout this document.

B. Coding

A 5-level teletypewriter code is used. It consists of a start pulse and five information pulses of equal unit length, followed by a stop pulse of 1.42 units length. The start element is always a space, the information elements may be either marking or spacing, and the stop pulse is always marking. It provides what is known as a start-stop (asynchronous) system of operation because the receiving device comes to an actual stop during the stop pulse of each character transmitted. Details concerning pulse and character length for the various speeds of service, 60, 75, or 100, are shown in Table I entitled "Characteristics of 5-Level Teletypewriter Code." Figure 1 entitled "Type Arrangement C, 5-Level Teletypewriter Code" shows the bit combination which defines each printed character and function.

C. Speed

Line speed in terms of bauds and machine speeds in words per minute also are shown in Table I.

D. Method of Transmission

Serial

E. Operation

Half Duplex

4. INTERFACE

A. Physical Characteristics

Normally, cordage equipped with a Cinch or Cannon DB-19604-433 receptable mounted in a Cinch DB-51226-1 hood assembly is provided by the Telephone Company to serve as the interface between the loop and the CPT.* The customer shall provide similar cordage equipped with a Cinch or Cannon DB-19604-432 plug mounted in a Cinch DB-51226-1 hood assembly to mate with this receptacle. A detailed discussion of the characteristics of the interface connector are covered in:

Bell System Data Communications
TECHNICAL REFERENCE
INTERFACE CONNECTORS

which is available from:

Engineering Director – Data Communications
American Telephone and Telegraph Company
195 Broadway
New York, New York 10007

* Special arrangements may be made with local Telephone Company representatives to provide for another type of connector, if necessary. In no case, however, shall the interface be made without some kind of separable connector.

Spacers if used should be "permanently" secured to the female member by means of the locking screw in that hood assembly.

The cable (ordinary house cable) shall not normally exceed 50 feet in length. The tip and ring connections of the loop shall be assigned to pins 2 and 3, respectively, of the interface connector. The CPT also shall be assigned to the same pin numbers in its plug assembly. The pins of the interface connector are assigned as shown in Table IV.

B. Electrical Characteristics

The Telephone Company will furnish loop battery and make any required current adjustments in all cases.

The loop current at the interface will be adjusted to 62.5 milliamperes. This may vary by as much as plus or minus 2.5 milliamperes.

The tip side of the loop will have a negative potential with a maximum of 130 volts and the ring side will have a positive potential with a maximum of 130 volts.

C. Other Considerations

1. Input of the CPT – This should appear to the loop as an inductive circuit having a resistance from 0 – 136 ohms and an inductance from 0 – 0.12 henry. The receiving device should be capable of processing received signals with up to 40 percent telegraph distortion. A CPT that does not meet this performance objective must be handled by special engineering.
2. Output from the CPT – It is expected that this will appear as a set of dry contacts capable of breaking 62.5 milliamperes at 260 volts steady state. If mechanical contacts are used, it is recommended that a spark suppression network be provided to reduce electrical circuit noise and afford mechanical protection. Nominal values of the circuit components should be a resistance of 470 ohms in series with a capacitance of 0.1 microfarads.

   Signals transmitted by the CPT shall contain not more than 5 percent telegraph distortion. A CPT that does not meet this performance objective must be handled by special engineering.
3. Definition of Telegraph Distortion – Telegraph distortion is the measure of the displacement of any mark-to-space or space-to-mark transition from its proper location. The reference point used when measuring telegraph distortion is the initial mark-to-space transition of each character, which occurs at the beginning of each start element. The slicing level for all measurements is at about the 50 percent point on the rising and falling waveforms.

   Referring to Figure 3, transitions measured at the slicing level should occur at integral multiples of t_e from the start transition for no distortion. If a transition occurs at a time Δt earlier or later than this time, the distortion is:

$$\text{Per Cent Distortion} = \frac{\Delta t \times 100}{t_e}$$

   For example, refer to Figure 3(b) and examine the distortion of information element No. 3, which is in the space condition. Assume that the nominal pulse length t_e = 10 milliseconds,* that Δt_2 = 1 millisecond, and that Δt_3 = 2 milliseconds.

$$\text{Peak Distortion} = \frac{\Delta t \text{ max.} \times 100}{t_e} =$$

$$\frac{2 \times 100}{10} = 20\% \text{ per Character}$$

   Thus, although the element is 30 percent shorter than its nominal length, its telegraph distortion, as defined, is 20 percent.

* The value t_e = 10 milliseconds is used here only for simplicity. Actual values employed in 83B3 system operation are shown in Table I.

4. Break Signal – When operating as an entirety, the 83B3 system does not make use of a break signal. Nevertheless, a noncontrol station has the capability of recognizing such a signal on the line

and of stopping its transmitter, when sending, in response thereto. Use of this capability might be desired in cases when a CPT functions as a control station. In such cases, the recommended minimum length of the break signal is 600 msec. for all speeds (60, 75 or 100 words per minute) of service. If meaningful characters are to be sent from the control station to the noncontrol station following use of the break signal to stop the transmitter at the latter,** it is recommended that there be a marking pause on the line of not less than 500 msec. prior to the transmission of those charcters.

** To restore the control logic at the noncontrol station to an idle state under these conditions, the end-of-message code (see Par. V(A) 5) should be sent to it.

5. MESSAGE FORMAT

A. Message Format for Single Line Operation

Shown in Figure 2(a) is an illustrative message format as it would be prepared in tape for subsequent transmission on a single line system. Additional information relative to message format is included in the following list:

1. Call Directing Code (CDC) – A CDC consists of two alphabetical characters followed by a letters (LTRS) character. Any alphabetical characters other than T, O, M, V, G, H and Y may be used, leaving 19 characters for general use- The LTRS character provides timing needed by the control units used at 83B3 noncontrol stations. When such a station is selected, printing (or its equivalent, such as carriage return) takes place on the character immediately following this LTRS character.
2. Group Code – A CDC may be assigned to connect a group of (or all) the stations on a line. Only one station of the group can be arranged to return the V answer-back (AB) on receipt of the CDC. The loss of positive connect assurance from the stations in the group which do not respond with an AB should be carefully considered before a decision is made to use the group code feature.
3. Transmitter Start Code (TSC) – As indicated in Par. 6(A) a TSC consists of two alphabetical characters. The first character of the TSC is one of 10, 20 or 19 letters depending on the number of stations on a line and the polling pattern used. The second character is the letter M for up to 20 stations and if more stations are involved, for up to the first 19 stations. For stations beyond the latter number the letter G is used as the second character. Receipt of its TSC by a noncontrol station will start its transmitter, if the station has traffic ready to send, or will cause the station to transmit the no-traffic response. (See 8 below.)
4. End-of-Address Code (EOA) – Carriage return line feed letters (CR LF LTRS). When received at a noncontrol station this code causes the station to enter a nonselect state, in which it will be unresponsive to character combinations that would otherwise cause it to be selected.
5. End-of-Message Code (EOM) – Figures H letters (FIGS H LTRS). This code restores a noncontrol station from a nonselect to the select, nonprint idle condition. Also, it causes the control station to initiate polling.
6. End-of-Transmission Code – Equivalent to EOM for this system.
7. Answer-back Code (AB) – The character V. This answer-back is given by a noncontrol station to indicate that it has recognized its CDC. The answer-back serves, also, as a transmitter restart code for the station originating a message.
8. No-traffic Response (NTR) – The character V. Receipt of this response by the control station when it is polling causes the control station to continue polling.
9. Transmitter Restart Code M – The character M. This code is used only when an intercept option is provided at the control station. It is sent by the control station, when an addressed noncontrol stations fails to sent its answer-back within 3.5 sec. It then performs the functions of an answer-back (see 7

above) at the originating station and indicates to the originating station that the message will be "intercepted," i.e., recorded on a receiving only typing reperforator (ROTR), at the control station.

B. Message Format for Multiple Line Operation

Arrangements are available for interconnecting two or three separate 83B3 lines with provision for automatically delivering messages originated on the home line to stations on the foreign line and vice versa. The interconnecting tape relay station includes a reperforator – transmitter unit with the reperforator portion functioning as a terminating station on the home line. It receives the originated message and punches it in tape for subsequent transmission by the transmitter portion. The transmitter functions as an originating station on the foreign line and will transmit the message received, by the reperforator, to a terminating station on the foreign line.

The message format required for multiline operation, when delivering messages to only stations on the home line, is the same as that previously described for single line operation (Par. 5 (A)). However, when a message is to be delivered to a station on a foreign line the format must be as described in the following paragraph.

As shown in Figure 2(b), the format of a message intended for delivery to a station on a foreign line must include the special call directing code of the relay station. This is a code having Y as the second character. Call directing codes for stations on the home line are placed ahead of the relay station code and call directing codes for stations on the foreign line are placed after the relay station code. If any of the call directing codes used for stations on the foreign line is a duplicate of one used on the home line, it is necessary to include in the message format the sequence carriage return line feed letters following the relay station code and ahead of the foreign line call directing codes. If the call directing codes used on the foreign line are not duplicates of any assigned to the home line, the sequence carriage return line feed letters following the relay station code may be omitted.

Message formats are also available to enable the automatic sending of a message from line 1 to line 2 and also to line 3 via line 2. However, the particular format to accomplish this depends upon which of several available arrangements for interconnecting the three lines best meets the needs of the customer.

6. POLLING

A. Polling Patterns

The following polling patterns are standard for the 83B3 transmitter start circuit at the control station and the TSCs are generated in the order shown. If a CPT is the control station it must use these same TSCs but it is not necessary to send them in the order shown.

1. 1 to 10 stations:

   AM, CM, EM, IM, LM, NM, PM, RM, SM and ZM.

2. 11 to 20 stations:

   AM, CM, EM, IM, LM, NM, PM, RM, SM, AM, WM, KM, DM, UM, GM, XM, QM, JM, FM and BM.

3. 21 to 38 stations:

   AM, CM, EM, IM, LM, NM, PM, RM, SM, ZM, WM, KM, DM, UM, XM, QM, JM, FM, BM, AG, CG, EG, IG, LG, NG, PG, RG, SG, ZG, WG, KG, DG, UG, XG, QG, JG, FG and BG.

B. Slow Polling

If traffic is being originated on the line, polling occurs on a continuous basis with no delays between successive polls. However, when a complete polling cycle has been made without any traffic having been originated, a delay of (min.) 3.5 seconds is introduced between successive polls. Then when a message is next picked up, normal polling is resumed, i.e., with no delay between successive polls.

If the station is equipped with a keyboard sending and receiving teletypewriter (KSR) in place of an ASR machine, the delay introduced, during slow polling, between polling of the KSR and the next station is 20± 5 seconds instead of (min.) 3.5 seconds. The reason for the specific values of 3.5 and 20 seconds is given in the following paragraph.

As described later, the control station will wait, after a normal poll of an outlying

station, up to 3.5 seconds for an ASR and 20 ±5 seconds for a KSR station to respond to polling. The 20 seconds is provided for the KSR because of the manual response by an attendant. These same time intervals are utilized, for reasons of convenience, during slow polling.

C. Double Polling

A method of giving preferential treatment during polling to certain stations is available as an option. Assuming the availability of traffic, stations designated to receive preferential polling treatment are arranged, by a station wiring option, to send their traffic the first time they are polled. The other stations are arranged to respond with a no-traffic response the first time they are polled and to wait until the second time they are polled before sending their traffic.

To assure that stations not receiving preferential treatment will get a chance to send traffic, the transmitter start circuit is arranged to double poll each station on alternate polling rounds; i.e., on the first round each station is polled a single time while on the second round each station is polled twice before the next station is polled. However, if a single-poll station sends traffic the first time it is polled during a double poll round it will not be polled a second time. Variations from the double polling on alternate rounds also are available.

D. Repeat Polling

For stations where its use would be desirable, a repeat poll feature is available as an option. When repeat polling is provided for a specific originating station, that station will be polled again after it has transmitted a message and again after each subsequent message until all the messages it has waiting to be transmitted have been sent and the station returns a no-traffic response.

7. PRINTER

The typing unit of the page type teletypewriter provided at an 83B3 station is arranged to print ten characters per inch and a 72-character line on an 8-1/2 inch platen with normal margins. Normal line feed provides for spacing six lines per vertical inch. The machines may be arranged either for handling friction feed roll paper or for handling sprocket feed superfold paper.

The sprocket feed machine may be equipped to provide for form feed-out and vertical tabulation or it may be equipped to provide these same features together with horizontal tabulation. In either case the machine is adjusted to accommodate forms 8 inches in length.

Horizontal tabulation takes place at 3 times the speed of normal spacing. It is actuated is response to an upper case G-code combination. Vertical tabulation takes place at 3 times the speed of normal line feeding. It is actuated in response to an upper case J-code combination. Form feed-out takes place at the same speed as for vertical tabulation and is activated by upper case Z. In all three cases it is necessary to follow the actuating code combination with two "fill" characters which can be either FIGS or LTRS. These characters are required for timing to stop the tape reader with the FIGS or LTRS over the sensing pins so that the distributor can then send this character out to the line as a "fill" until the tabulation or form feed-out tab stop is reached and normal transmission resumes from the tape reader.

Variations relative to form lengths and widths and to the code assigned for tabulation and form feeding may be available as special arrangements. The character assigned for tabulation or form feeding (e.g., upper case J) does not print.

8. TELEGRAPH LINE FACILITY – PROPAGATION TIME

Signal propagation time for a particular telegraph circuit depends upon the type of line facility used and the number of terminal sections operated in tandem between the points involved. As noted previously, operation of an 83B3 system is on a half-duplex basis.

For the simplest type of facility, where the points involved are close together, the minimum propagation time could approximate zero milliseconds. Based on past studies of working telegraph facilities, the average one-way propagation time might be in the order of 150 milliseconds and the maximum one-way propagation time about 300 milliseconds.

However, if propagation time is an important factor to be considered in providing service it should be resolved by discussion

between the CPT manufacturer's representative and the Telephone Company's personnel responsible for the service.

9. SEQUENCE OF OPERATIONS – 100 SPEED

The basic sequence of operations that take place on an 83B3 line operating at 100 words per minute (WPM) are shown on Chart I entitled "83B3 – 100 WPM Operation." The chart, for illustrative purposes, was limited to a three-station line consisting of a control station and two separate outlying stations. A more detailed explanation of what occurs will be given in the following with cross reference made to the item numbers shown on the chart.

The idle line pause times shown on this chart are required to enable internal teletypewriter and controller operations to take place. Those pauses associated with the control station equipment would not necessarily be required if the control station were a CPT control station. The times shown are average values based on the premise that stunt box contacts take about 3.5 unit pulse lengths to function after a code is fully received and that average relay operate and release times are used.

1. The transmitter start circuits at the control station sends the TSC for outlying station No. 1 (TSC STN No. 1). At 100-speed operation this takes 200 milliseconds (msec.)
2. Following propagation time, there is an idle line pause of 59.5 msec. after which STN No. 1 sends a no-traffic response, taking 100 msec.
3. Following propagation time plus an idle line pause of 119 msec., the control station sends the TSC for outlying station No. 2 (TSC STN No. 2), taking 200 msec.
4. As station No. 2 is assumed to have traffic for station No. 1, following propagation time plus a pause of 78 msec., it will send the CDC for station No. 1 (CDC STN No. 1), taking 300 msec. and then stop sending. This latter time presumes there are no extraneous LTRS characters ahead of the CDC. If extraneous LTRS characters are ahead of the CDC, then 100 msec. is required to transmit each LTR character.
5. Following propagation time plus a pause of 51 msec., station No. 1 sends a 5 answer-back (AB) to station No. 2, taking 100 msec.
6. Following propagation time plus a pause of 69 msec., station No. 2 resumes sending, starting out with the EOA, followed immediately by the text of the message, and the EOM.
7. Following propagation time plus a pause of 75 msec., the control station sends TSC STN No. 1 again, taking 200 msec.
8. Assume that because of some abnormality station No. 1 fails to make any response. The control station starts to time out and after 3.5 seconds (sec.) sends an EOM plus the letter M taking 400 msec. This action also causes an audible alarm to operate at the control station and if a monitor is provided the letter M is printed. The station attendant can determine from the monitor copy what station failed to respond. If a monitor printer is not provided, the control station attendant will operate a key which will cause the polling process to stop, indefinitely, the next time a station fails to respond to polling. Polling of outlying stations will not resume until the attendant restores the key to normal. After determining which station failed to respond topolling, the attendant can operate a key to prevent further polling of that station until corrective action is taken.
9. After a pause of 75 msec., the control station resumes polling sending out TSC STN No. 2, taking 200 msec.
10. Following propagation time plus a pause of 78 msec., STN No. 2 sends CDC STN No. 1, taking 300 msec., and stops sending.
11. Assume that because of some abnormality STN No. 1 fails to send a 5 (AB). After 3.5 sec. the control station times out, connects the intercept machine and sends the letter M to the line, taking 100 msec.
12. Following propagation time plus a pause of 69 msec. and caused by receipt of the letter M at STN No. 2, transmission resumes from STN No. 2 with the EOA, followed by text and finally the EOM.

13. Following propagation time plus a pause of 75 msec. the control station sends TSC STN No. 1 taking 200 msec.

14. Assume a tape is left in the transmitter at STN No. 1 with a number of LTRS Characters before the end of the torn tape. The transmitter of STN No. 1 will start, after propagation time plus a pause of 78 msec., and send LTRS for 10 msec. until the tape-out pin operates at the end of the tape and causes transmission to stop.

15. The control station starts to time-out and at the end of 3.5 seconds sends an EOM followed by the letter M to restore the line to normal with stations in the select condition.

    After a pause of 75 msec., the control station resumes polling by sending TSC STN No. 2, etc.

    Notes:

    (1) A noncontrol outlying station may be equipped with a 28-type receiving only (RO) teletypewriter in place of an ASR machine. In such a case only items numbered 4, 5, 6, 10, 11 and 12 will apply to such a station, assuming station No. 1 in the illustration has the RO machine.

    (2) A noncontrol outlying station may be equipped with a 28-type keyboard sending and receiving (KSR) teletypewriter in place of an ASR machine. In such a case only items numbered 1 through 12 will apply to such a station. The time-out of 3.5 sec. shown in items 8 and 11 will automatically change to 20 sec. when such a station is polled to give the station attendant time to start sending following receipt of the call-in ring. Pause time shown ahead of a CDC or EOA, TEXT and EOM would not apply to a KSR station.

    (3) As indicated in Section 5 (B), a station used for automatically relaying messages between two 83B3 lines would include a 28-type reperforator-transmitter (RT) instead of an ASR. Considering only the receiving portion of the RT and assuming station No. 1 in the illustration is the receiving portion of the RT machine, items 4, 5, 6, 10, 11 and 12 will apply except that the 51-msec. pause following the CDC is changed to 210±20 msec. Considering only the sending portion of the RT, and assuming station No. 2 is the sending portion of the RT machine, items 1 through 16 will apply except that the 78- and 69-msec. pauses in items 3, 5, 9 and 11 are changed from 78-msec. to 170±20 msec. and from 69-msec. to 160±20 msec., respectively.

    (4) Table III entitled "83B3 Idle Line Pause Time Conversion from Average to Minimum and Maximum" can be used to convert Chart I to apply for either minimum or maximum relay operate and release times, if required.

10. SEQUENCE OF OPERATIONS – 75 AND 60 SPEED

Table II entitled "83B3 Timing Conversion 100 Speed to 75 and 60 Speed" can be used to convert Chart I to apply for 75 or 60 speed, if required. The pause times given are for average relay operate and release times. Table III can be used, in conjunction with Table II, to convert Chart I to apply for either minimum or maximum relay operate and release times if required.

11. SEQUENCE CHARTS DISCRIPTION

Chart II covers the operation of the 83B3 transmitter start unit which is located at the control station. The chart, as shown, applies to automatic transmission from the outlying noncontrol station. The chart can be made to apply to a keyboard sending and receiving outlying station by changing the 3.5 sec. time-out to 20 sec.

Chart III covers the operation of the 83B3 station control unit on transmitting a message and it applies to automatic transmission from that station.

Chart IV covers the operating of the 83B3 station control unit on receiving a message.

12. SENDING STATION – OPEN LINE ALARM

If, while a station is sending, the line goes to a spacing condition for a period of time equivalent to about three character lengths or longer, an alarm is operated at that station. In addition, if the station consists of an ASR machine, the transmitter-distributor will be stopped. When the line returns to a marking condition the transmitter start circuit at the control station will start to time out and at the end of 3.5 sec. will send an EOM plus the letter M on the line and then resume polling. If a monitor is provided, the printing of the M would enable the control station attendant to determine what station was sending at the time the alarm occurred.

CHART I

83B3 – 100 WPM OPERATION

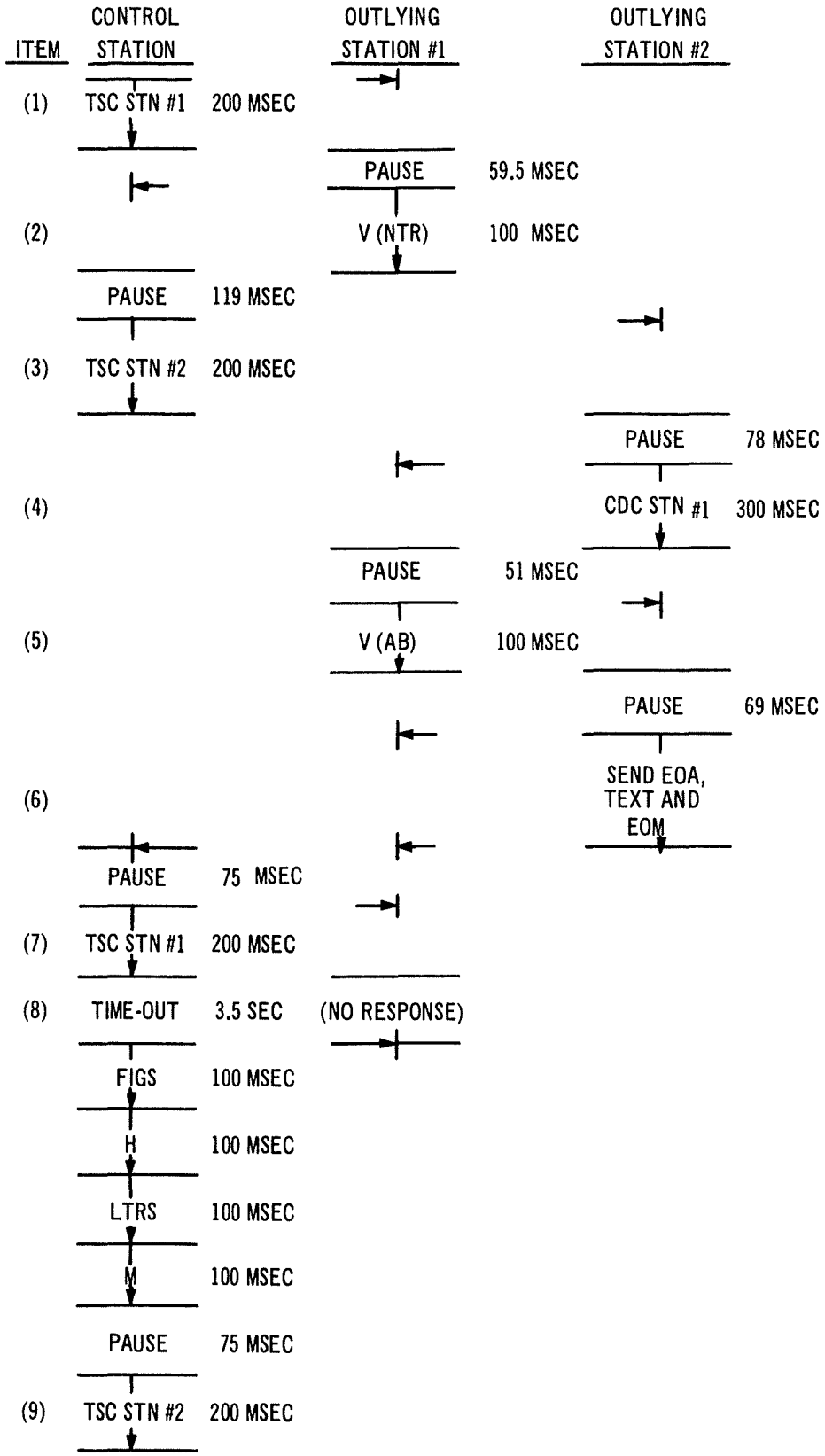


CHART I (CONT'D)

83B3 – 100 WPM OPERATION

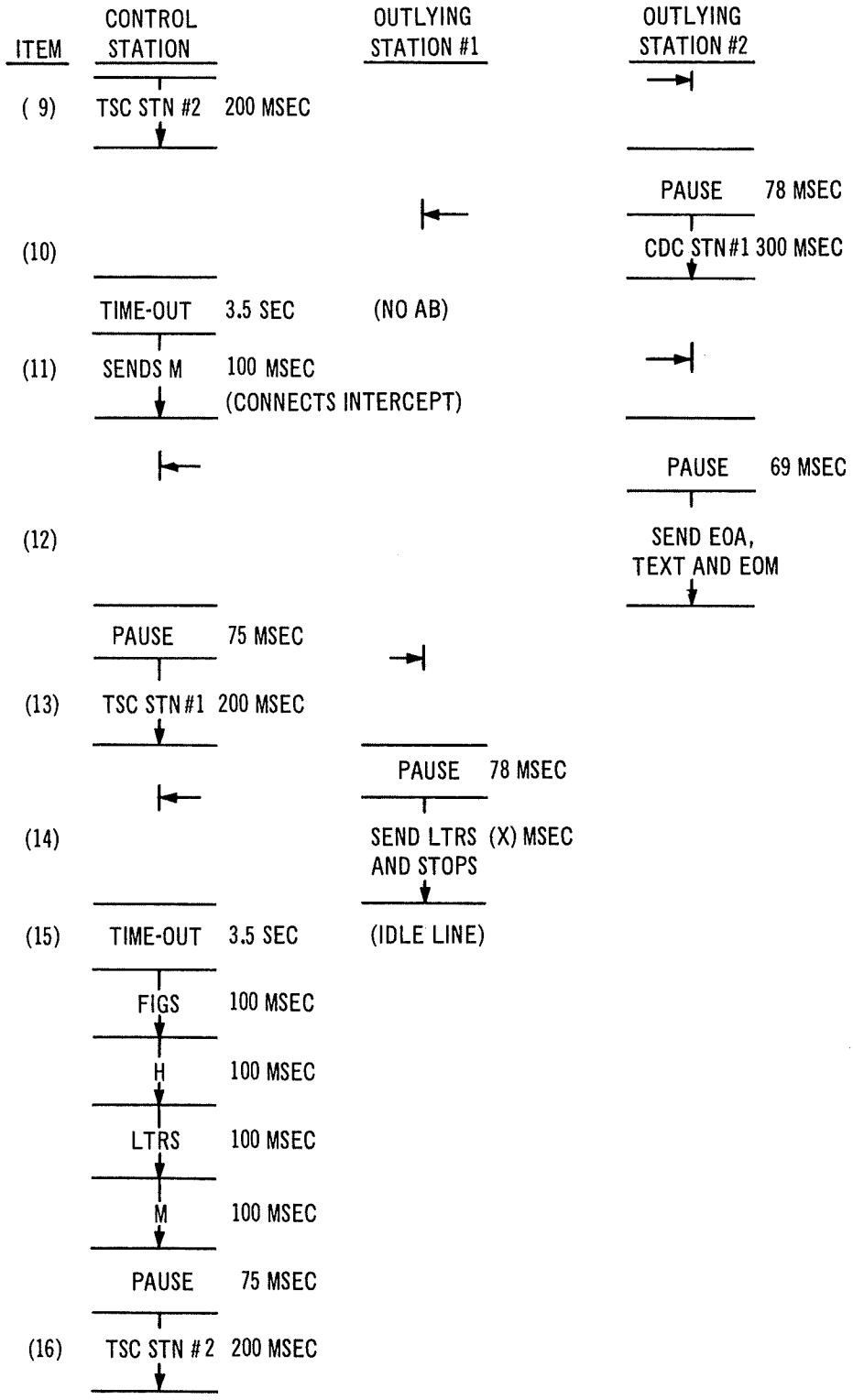


CHART II

OPERATION OF 83B3 TRANSMITTER START UNIT
(AUTOMATIC TRANSMISSION ONLY)

ASSUME LINE HAS JUST BECOME IDLE AND THAT PRECEDING MESSAGE WAS CODED PROPERLY. EOM CODE INITIATES THE FOLLOWING

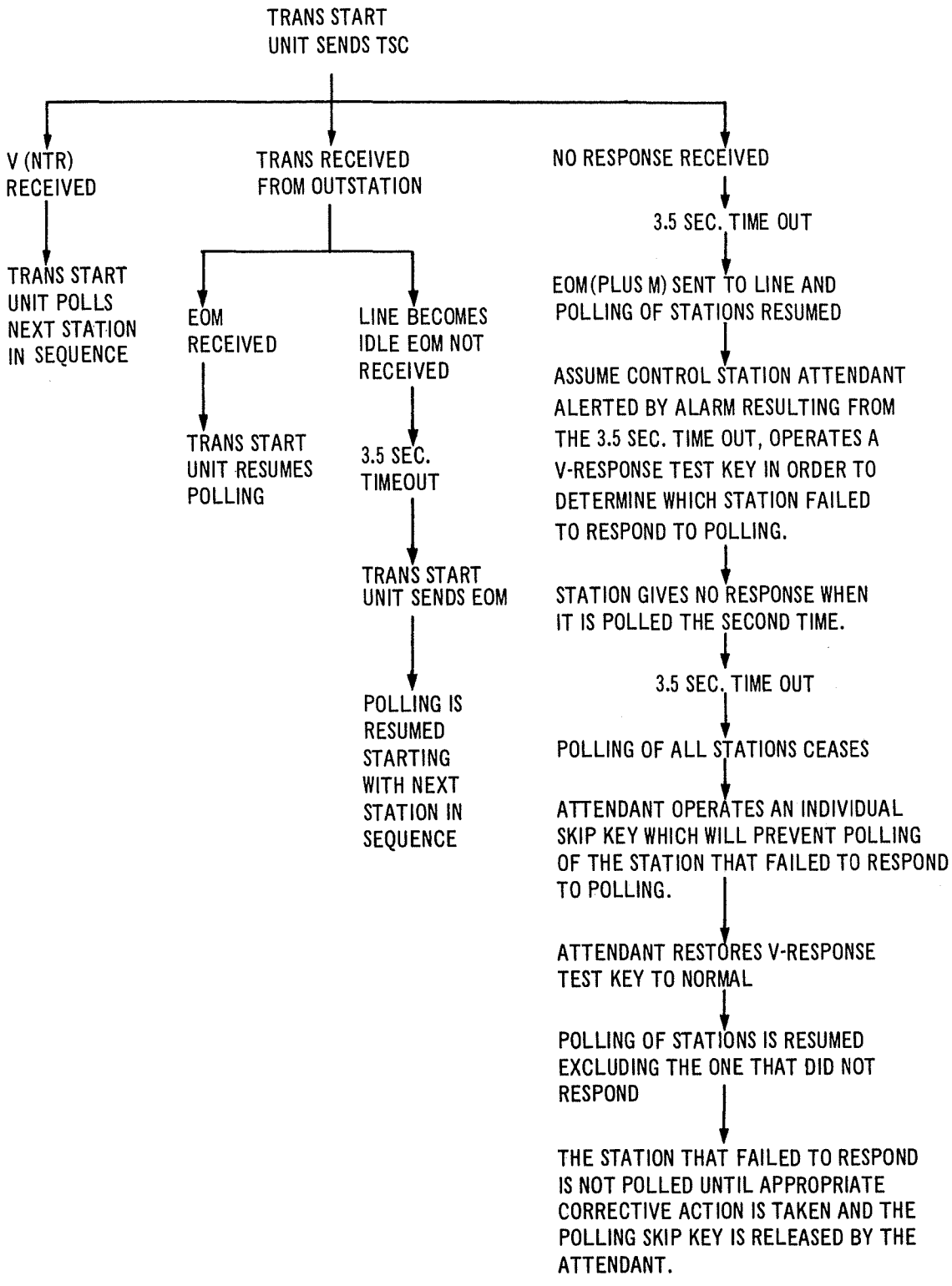


CHART III

OPERATION OF 83B3 STATION CONTROL UNIT

-TRANSMITTING A MESSAGE-

(AUTOMATIC TRANSMISSION ONLY)

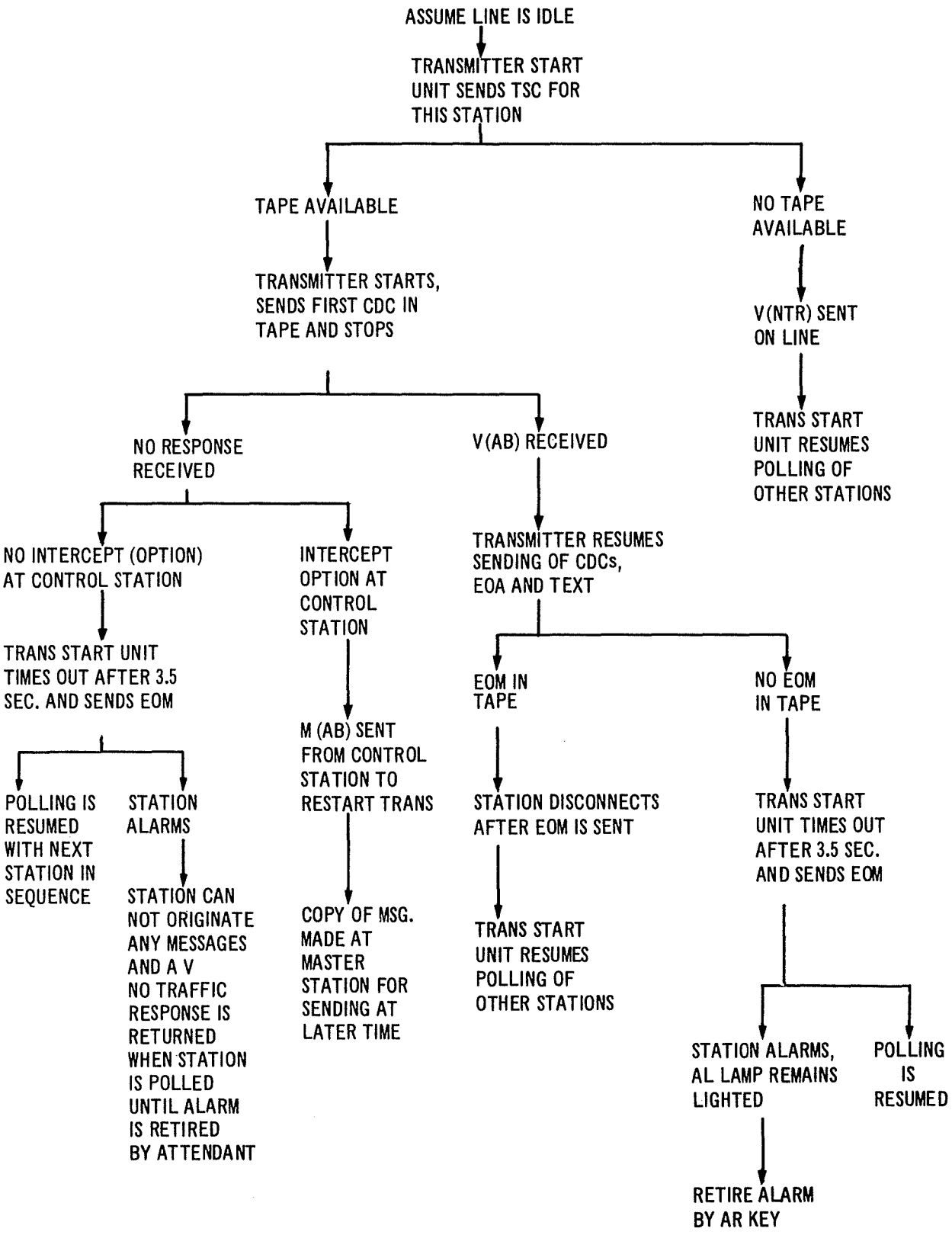


CHART IV

OPERATION OF 83B3 STATION CONTROL UNIT
–RECEIVING A MESSAGE–

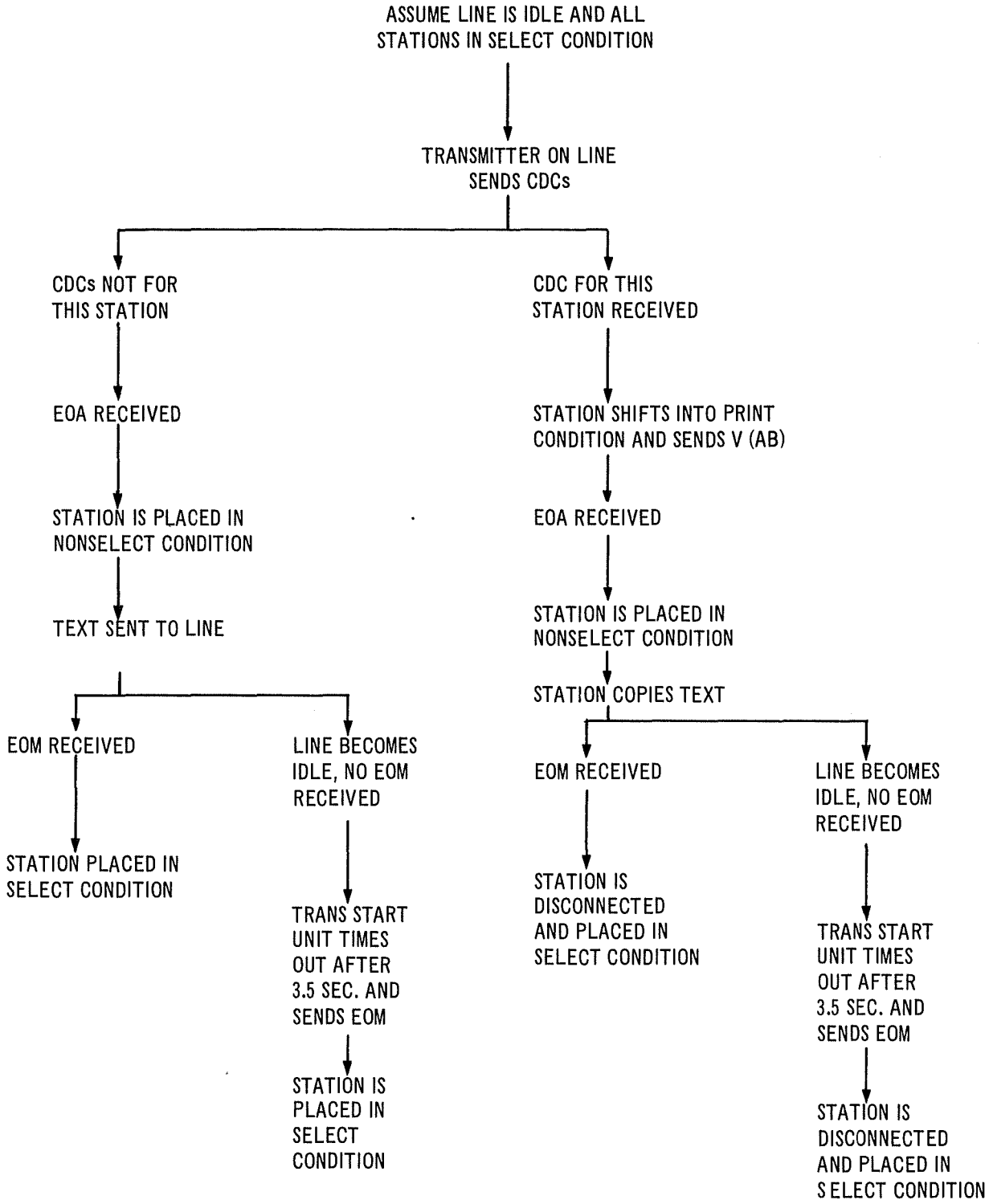


TABLE I
CHARACTERISTICS OF
FIVE LEVEL TELETYPEWRITER CODE

	SPEED OF SERVICE		
	60	75	100
Characters per Minute*	368.2	459.6	600
Words per Minute*	61.36	76.60	100
Characters per Second*	6.136	7.660	10
Bits per Second (Bauds)*	45.55	56.85	74.23
Milliseconds per Character*	163.0	130.6	100
Milliseconds per Unit Pulse*	21.95	17.59	13.47
Milliseconds per Stop Pulse*	31.23	25.02	19.17
Degrees per Unit Pulse	48.5	48.5	48.5
Units per Charater	7.423	7.423	7.423

*Values shown can vary up to ±0.75 percent and still be tolerable. This is based on the frequency of the 60 Hz power supply being regulated within ±0.75 percent.

TABLE II
83B3 TIMING CONVERSION
100 SPEED TO 75 AND 60 SPEED

	TIME IN MILLISECONDS		
	100	75	60
Transmitter Start Code (TSC)*	200	261.2	326
Call Directing Code (CDC)*	300	391.8	489
V No Traffic Response (NTR)*	100	130.6	163
V Answer-Back (AB)*	100	130.6	163
FIGS H LTRS (EOM)*	300	391.8	489
M (Connect Intercept)*	100	130.6	163
Pause Time	51	65.5	81
Pause Time	59.5	74	89.5
Pause Time	69	83.5	99
Pause Time	75	89.5	105
Pause Time	78	92.5	108
Pause Time	119	133.5	149

*Times shown can vary up to ±0.75 percent and still be tolerable. This is based on the frequency of the 60 Hz power supply being regulated to within ±0.75 percent.

TABLE III

83B3 IDLE LINE PAUSE TIME CONVERSION FROM AVERAGE TO MINIMUM AND MAXIMUM

Time In Milliseconds

100 Speed

Average	Minimum	Maximum
51	48	56
59.5	53	75
69	65.5	80
75	62	96.5
78	71	92
119	109	125

75 Speed

Average	Minimum	Maximum
65.5	62.5	70.5
74	67.5	89.5
83.5	80	94.5
89.5	76.5	111
92.5	85.5	106.5
133.5	123.5	139.5

60 Speed

Average	Minimum	Maximum
81	78	86
89.5	83	105
99	95.5	110
105	92	126.5
108	101	122
149	139	155

TABLE IV

INTERFACE CONNECTOR PIN ASSIGNMENT

Pin	Circuit
1	
2	Tip Connection of Loop
3	Ring Connection of Loop
4-25	Spare

UPPER CASE	FUNCTION SYMBOLS ON THIS LINE ARE PRINTED BY TYPING REPERFORATOR TRANSMITTERS AND TYPING REPERFORATORS																																
	–	5/8	1/8	$	3	1/4	&	♦	8	,	1/2	3/4	.	7/8	9	0	1	4	BELL	5	7	3/8	2	/	6	"	BLK	SP	LTRS	LF	CR	FIGS
LOWER CASE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z						
5 LEVEL SELECTING CODE	1	1		1	1	1				1	1						1		1		1		1	1	1	1			1			1
	2		2				2		2	2	2	2				2	2	2			2	2	2						2	2		2
			3			3		3	3		3		3	3		3	3		3		3	3		3	3			3	3			
		4	4	4		4	4			4	4		4	4	4			4				4		4					4		4	4
		5					5	5				5	5		5	5	5			5		5	5	5	5	5				5			5

NOTE: THE DIAMOND SYMBOL SHOWN ON UPPER CASE H IS PRINTED ONLY ON TYPING REPERFORATOR–TRANSMITTERS AND TYPING REPERFORATORS.

FIG. 1 - TYPE ARRANGEMENT C
5-LEVEL TELETYPEWRITER CODE

FILL CHAR. (LEADER)	CDC ADDRESSES FOR TWO TERMINATING STATIONS	END OF ADDRESSES (EOA)	MESSAGE TEXT	END OF MESSAGE (EOM)	FILL CHAR. (TRAILER)
LL L TT . . . T RR R	AB L T R AC L T R	CL L T RF R	TEXT	F L I H T G R	LL L TT . . . T RR R

FIG. 2 (a) ILLUSTRATIVE MESSAGE FORMAT – SINGLE LINE OPERATION
MESSAGE AS PREPARED IN TAPE FOR TRANSMISSION FROM AN 83B3 STATION TO A STATION ON THE SAME LINE.

FILL CHAR. (LEADER)	CDC FOR HOME LINE STATION	CDC FOR RELAY STATION	SEQUENCE REQUIRED WHEN CALL DIRECTING CODES ON LINE 2 DUPLICATE CODES ON HOME LINE	CDC FOR STATION ON LINE 2
LL L TT . . . T RR R	AC L T R	AY L T R	L C L T R F R	AB L T R

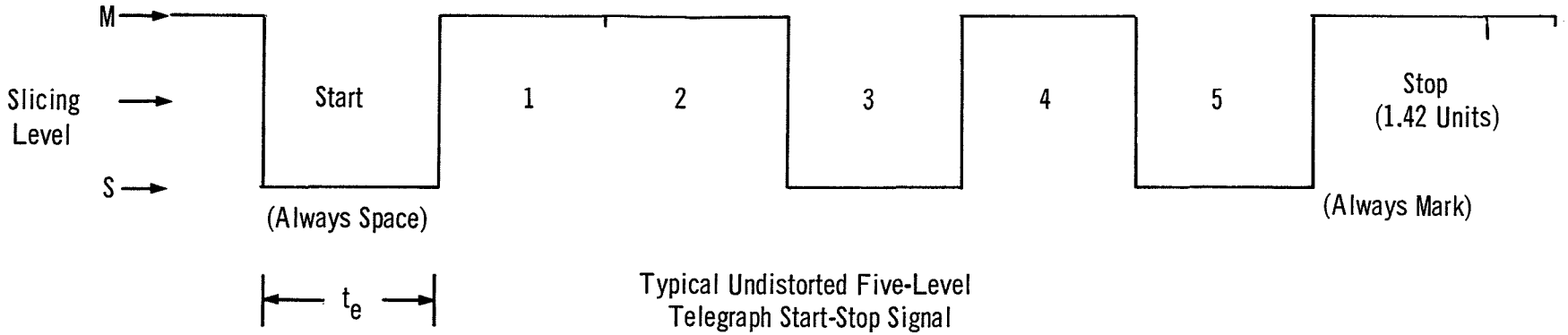
END OF ADDRESSES (EOA)	MESSAGE TEXT	END OF MESSAGE (EOM)	FILL CHAR. (TRAILER)
C L L R F T R	TEXT	F L I H T G R	LL L TT . . . T RR R

FIG. 2 (b) ILLUSTRATIVE MESSAGE FORMAT – MULTI-LINE OPERATION
MESSAGE AS PREPARED IN TAPE FOR TRANSMISSION FROM AN 83B3 STATION TO A STATION ON THE SAME LINE AND TO A STATION ON A SECOND INTER-CONNECTED 83B3 LINE.

FIG. 2 ILLUSTRATIVE MESSAGE FORMATS

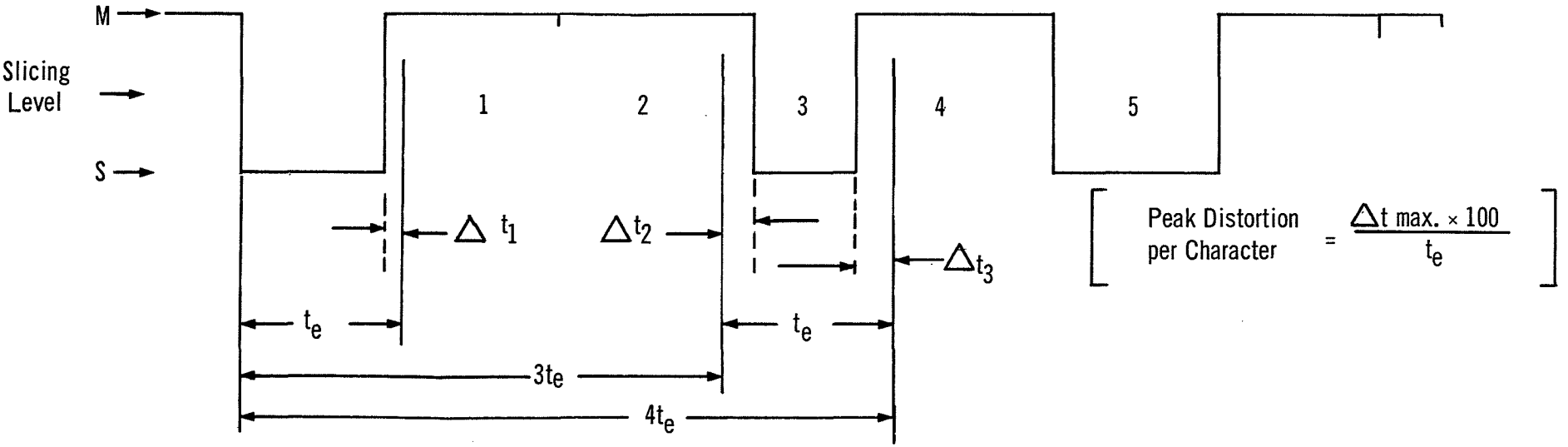
FIGURE 3

(a)



Typical Undistorted Five-Level
Telegraph Start-Stop Signal

(b)



Distorted Five-Level
Telegraph Start-Stop Signal