33 AND 35 TELETYPEWRITER STATIONS FOR GENERAL PURPOSE, POINT-TO-POINT PRIVATE LINE SERVICE

DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This section provides a description and the operation of 33 and 35 Teletypewriter Stations for General Purpose, Point-to-Point Private Line Service. It is reissued to include information on the Model 35 stations, and the 1A Data Station Single Channel Arrangement used on both 33 and 35 stations. Marginal arrows ordinarily used to indicate changes and additions have not been used.

1.02 This General Purpose Private Line Service provides facilities for the exchange of data between two teletypewriter stations or between a teletypewriter station and a computer.

1.03 A 33 station for this Private Line Service consists of:

(a) A 33 Teletypewriter Set, RO, KSR, or ASR, friction or sprocket feed.

(b) A TP186670 Private Line Modification Kit.

(c) A data set 108A-, 108C-, or 109A-type with DAS 820D-type and AR17 Circuit Pack, or 1A Data Station Single Channel Arrangement.

1.04 A 35 station for this Private Line Service consists of:

(a) A 35 Teletypewriter Set, RO, KSR, or ASR, friction or sprocket feed.

(b) A TP186670 Private Line Modification Kit.

(c) A TP336474 Modification Kit providing 48 volt supply needed for internal power within the 35 set and interconnecting cabling between the ESU Electrical Service Unit and the UCC29 Call Control Unit.

(d) A TP340011 Modification Kit which provides function box and electrical service unit modifications necessary for reader and logic control in the TP186670 modification kit.

(e) A data set 108A-, 108C-, or 109A-type with DAS 820D-type and AR17 circuit pack, or 1A Data Station Single Channel Arrangement.

1.05 The stations operate according to the Data Communication Control Procedures outlined in ANSI (American National Standards Institute ANSI X3.28-1971) document. The two subcategories which apply to station operation are:

(a) Subcategory 2.3 (establishment and termination control procedures): Two-way alternate; nonswitched point-to-point.

(b) Subcategory A1 (message transfer control procedures): Message oriented; without replies and without longitudinal checking.

1.06 The TP186670 modification kit is the interface between the teletypewriter and the data set. It provides the station controls with their associated lamps, a control lamp assembly for the PAPER ALARM and PRO-

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CEED indicators, and a break detector. The interface provided by the TP186670 modification kit is per EIA RS-232-C.

1.07 Data auxiliary set 820D-L1A/2 with data set 108A-, 108C-, or 109A-type, and the 1A Data Station Single Channel Arrangement mount within the teletypewriter pedestal.

1.08 The operating speed of the 33 and 35 stations is 110 baud (100 words per minute).

1.09 References to left, right, front, rear, etc, consider the stations as viewed by the station operator.

1.10 Unless specifically indicated, the descriptions in this practice refer to both the 33 and 35 stations.

1.11 This equipment is intended to be operated in a room environment within the temperature range of 40° F to 110° F. Serious damage to it could result if this range is exceeded. In this connection, particular caution should be exercised in using acoustical or other enclosures.

2. DESCRIPTION

MODEL 33 STATION

2.01 The 33 ASR Private Line Station is shown in Figure 1. The data set or 1A Data Station Single Channel Arrangement mounts within the pedestal and connects with the teletypewriter by means of a cable.

2.02 The 33 station shown in Figure 1 is equipped with either a 108A-, 108C-, or 109A-type data set, therefore the call control unit faceplate has two lamps: PAPER ALARM and PROCEED. A 33 station equipped with the 1A Data Station Single Channel Arrangement has a faceplate with the PAPER ALARM, PROCEED, and a VBLA (Voice Band Loop Around) lamp-switch. The two faceplates are shown in Figure 2.

2.03 The function of the Voice Band Loop Around (VBLA) switch is to check the integrity of the 2- or 4-wire facility from the central office. Operating the VBLA test switch connects the send pair of the 1A Data Station Single Channel to the receive pair. This will allow central office personnel to test the integrity of the 2- or 4-wire facility.

2.04 The keyboard arrangement is shown in Figure 3. The keyboard generates even parity codes. The CTRL key and the control designations (such as DC1, ETB, ENQ, DC2, DC4, etc) are red; all other designations are white, both for normal and shift positions.

2.05 The 33 RO, KSR, and ASR teletypewriters used in this service may be equipped with either a friction feed or a sprocket feed typing unit. Both the friction feed and the sprocket feed typing units are equipped with the NEW LINE feature which mechanically operates carriage return when a line feed or form feed code combination is received. This feature is disabled when shipped from the factory by means of a disabling bracket. If the feature is desired, it should be enabled by removing the TP186557 disabling bracket from slot A at the rear of the function box. Both typing units are equipped with the following function box contacts:

Contact Designation	Contact Type	Function
DC1	Normally open	Tape reader control
ACK	Normally open	Logic control
ENQ/EOT	Transfer	Logic control
DC1/DC3	Normally closed	Tape reader control
EOT	Normally open	Logic control

Note: The DELETE character should be transmitted after DC1, DC3, ENQ, or EOT which will serve as a "fill" character.

2.06 The 33 ASR Station is equipped with an automatic tape punch which turns on automatically when the station receives the DC2 code and turns off either by manual operation of the OFF pushbutton or automatically when the station receives DC4. The tape punch can be manually turned on by operating the ON pushbutton. Besides the ON and OFF pushbuttons, the tape punch is equipped with B. SP. (backspace) and REL (release) pushbuttons. Operation of the B. SP. pushbutton moves the tape back one space. Depressing the REL pushbutton allows the tape to be pulled through the punch freely.

2.07 The ASR station is equipped with an automatic tape reader which turns on automatically when the station receives the DC1 code and off when the DC3 code is received. The tape reader can also be manually operated on or off by a control lever which has four positions: MANUAL START, AUTO, MANUAL STOP, and FREE. The FREE and AUTO positions are locking; the MANUAL START and MANUAL STOP positions are nonlocking. A feature automatically turns off the tape reader if the tape becomes taut or runs out of tape.

MODEL 35 STATION

2.08 The 35 ASR Private Line Station is shown in Figure 4. The data set or 1A Data Station Single Channel Arrangement mounts within the pedestal and connects with the teletypewriter by means of a cable. Stations with data sets 108A-, 108C-, or 109A-type have a call control unit faceplate with two indicator lamps, PROCEED and PAPER ALARM. Stations with 1A Data Station Single Channel Arrangement have a call control unit faceplate with PROCEED, PAPER ALARM, and VBLA (Voice Band Loop

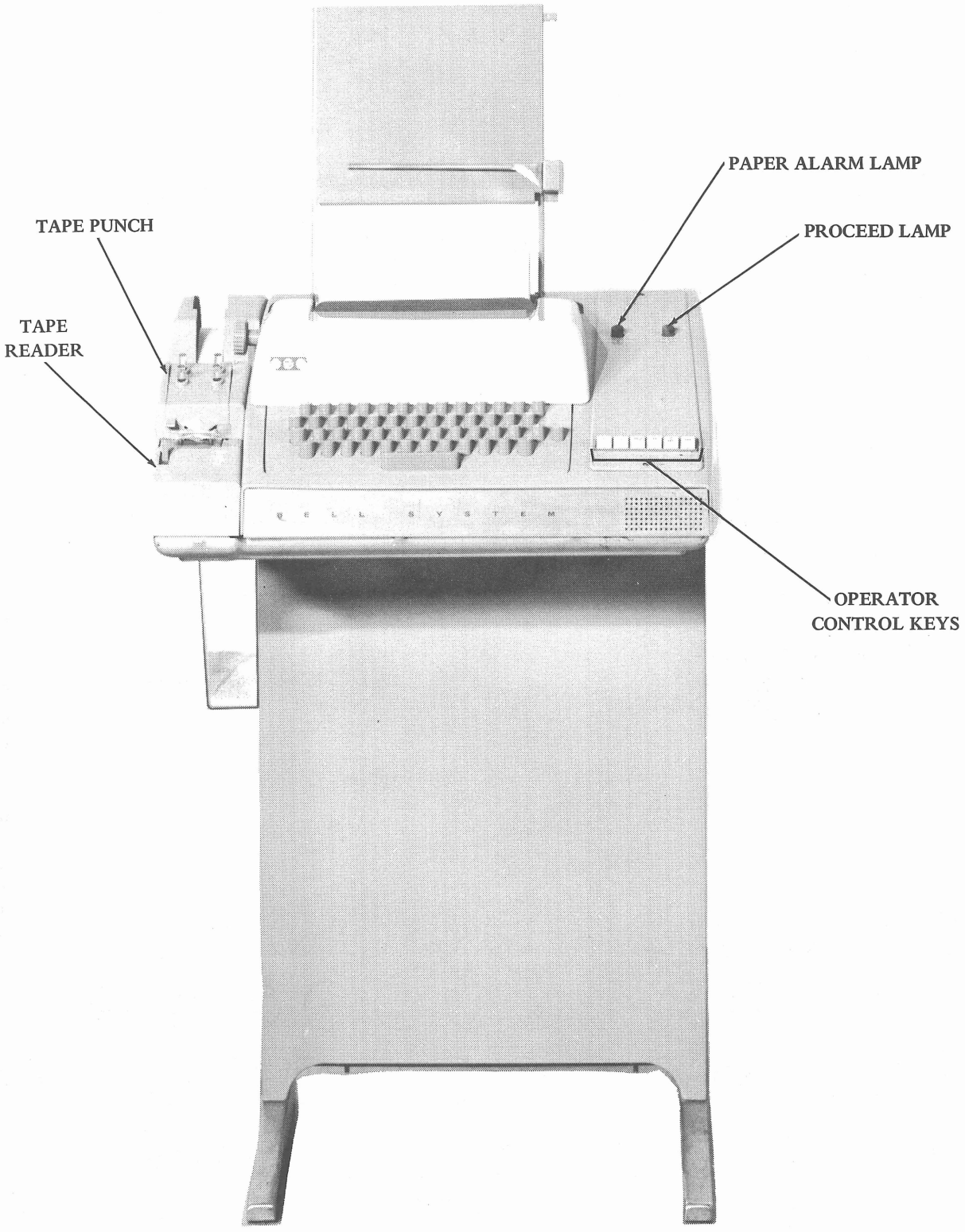
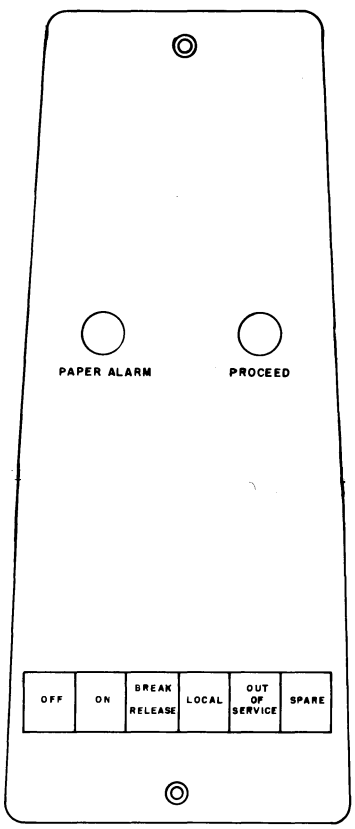
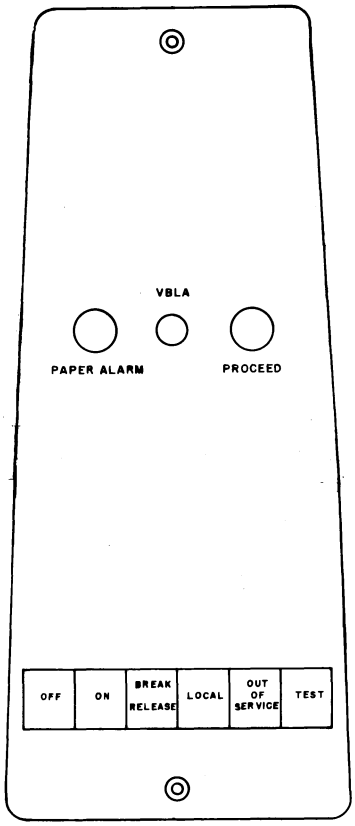


Figure 1 - 33 ASR Private Line Station



TP186672 Faceplate for
DAS 820D-Type With Data
Set 108A-, 108C-, or 109A-Type



TP341362 Faceplate for
1A Data Station Single Channel
Arrangement

Figure 2 - Call Control Unit Faceplates

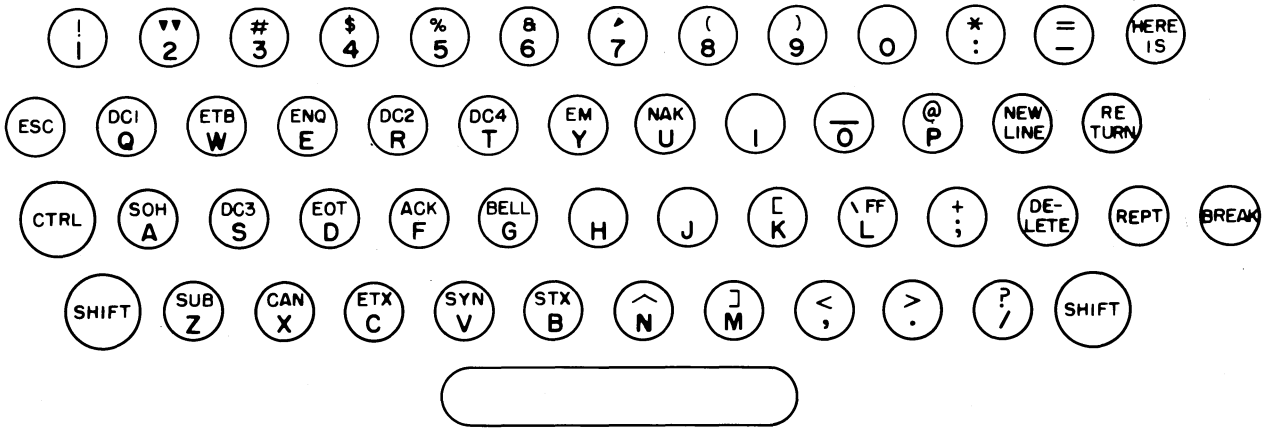


Figure 3 - Keyboard Arrangement for 33 Private Line Station

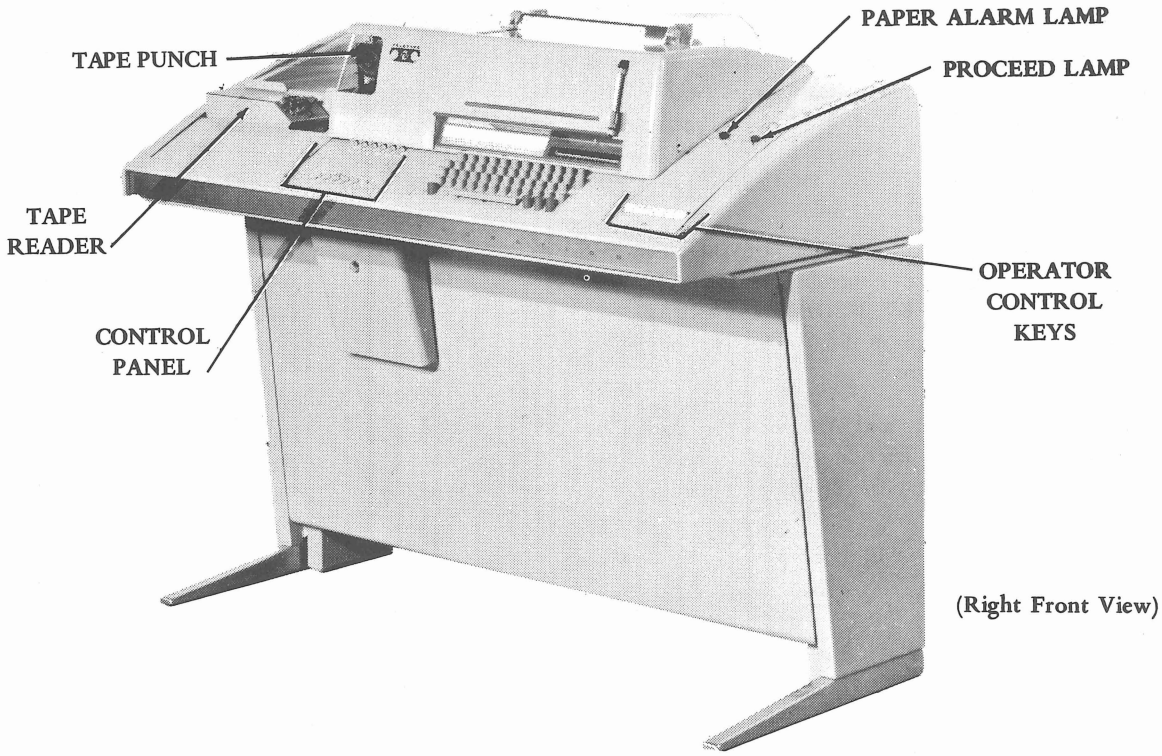


Figure 4 - 35 ASR Private Line Station

Around) lamp-switch. The two faceplates are shown in Figure 2. The function of the VBLA lamp-switch is discussed in 2.03.

2.09 The 35 teletypewriter set is a modified switched network set. Modification kit TP336474 adapts the set for use with the UCC29 Call Control Unit. Modification kit TP336474 also modifies the keyboard and includes modifications in the stunt box.

2.10 Installation of the TP186670 Private Line Modification Kit to the modified 35 set enables it to interface with a data set on an EIA voltage basis. The TP186670 kit provides the following control keys: OFF, ON, BREAK RELEASE, LOCAL, OUT OF SERVICE, and SPARE.

2.11 The TP340011 modification kit provides further modifications which enables the 35 teletypewriter to operate according to the procedures prescribed by ANSI X3.28. These modifications are:

(a) Addition of a separate stunt box contact responding to ACK (RU) and diodes to isolate the contact from the rest of the tape reader control circuitry. This contact is connected through a noncontention relay break contact so that it will be sensed when received only.

(b) Addition of a DC1 function bar and a special pawl in slot 30 of the stunt box. The function bar and pawl will operate the function lever and contact in slot 31. Operation of the contact in slot 31 will turn off the local tape reader when a DC1 character is used in the message tape. The distant tape reader then turns on. Also a diode and resistor are added across the TDC (Transmitter Distributor Control) relay coil to slow its release so that the tape readers of both stations will not stop due to open time interval in the circuit path of the TDC relay after the reception of DC1.

(c) Addition of a universal function bar coded for NAK and a pawl in slot 17 (friction feed units) to operate the signal bell lever in slot 18. For sprocket feed units function bar and pawl in slot 15 to operate signal line bell in slot 16.

(d) On ASR sets, shunting the secondary winding of the NCT (noncontention) relay with a strap instead of through its make contact to make the relay a slow operate instead of a fast operate relay. This enables the TDC relay to energize on DC1 received without an NCT break contact opening its operate path too soon.

(e) Replacing the 0.8 amp SL-BL fuse and label with a 1.0 amp SL-BL fuse and label for the -20 v supply in the UCC29.

(f) A schematic is included in the kit for rewiring the MSR (Mode Switch Reperforator) relay on ASR sets. This rewiring is necessary to operate the keyboard-mounted reperforator automatically from DC2 (Reperforator On) and DC4 (Reperforator Off) characters on line. The reperforator will turn on from DC2 when received only and turn off from DC4 either transmitted or received.

2.12 A control panel to the left of the keyboard provides additional controls for the ASR set, including the mode keys T, KT, K, HERE IS, BREAK, etc. The control panel is shown in Figure 5. The keyboard arrangement is shown in Figure 6.

2.13 The 35 RO, KSR, and ASR may be optionally equipped with a friction feed or sprocket feed typing unit. Either the friction or the sprocket feed has five stunt box contacts which serve to control the station logic and operation. They are:

Contact Designation	Contact Type	Function
DC1	Normally open	Tape reader control
ACK	Normally open	Logic control
ENQ/EOT	Transfer	Logic control
DC1/DC3	Normally closed	Tape reader control
EOT	Normally open	Logic control

2.14 The keyboards on KSR and ASR stations provide even parity and generate the 1967 ASCII. As mentioned in 2.09, TP336474 modification kit modifies the keyboard so that it includes ENQ, ACK, DELETE, and NEW

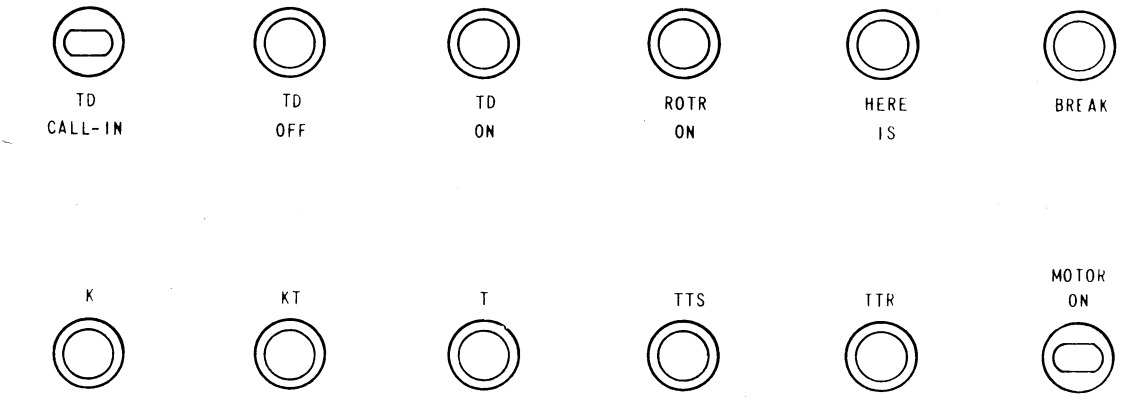


Figure 5 - Model 35 ASR Teletypewriter Control Panel

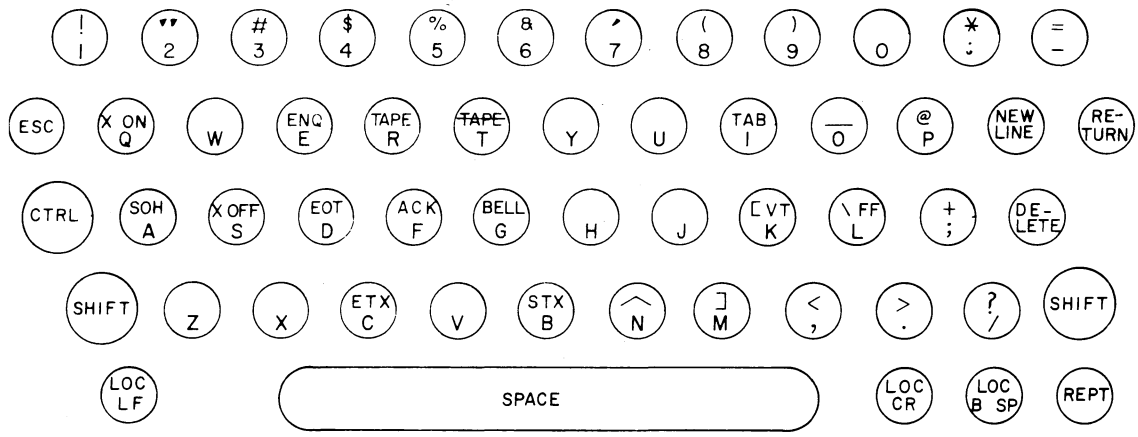


Figure 6 - 35 Station Keyboard Arrangement

LINE keys. The keys have designations in white for normal and shift positions. The control keys and control codes are in red.

2.15 ASR stations may be equipped with a typing or nontyping reperforator which is driven by means of its own cross shaft from the motor. Receipt of DC2 will turn the reperforator on. The reperforator will turn off either by manual operation or upon receiving DC4.

2.16 The tape readers on ASR stations are standard 35 readers. The control lever has two positions, FREE and RUN. The control lever is spring loaded to the RUN position. In the FREE position the tape can be moved freely in the reader. With the control lever in the RUN position and the TD CALL IN twist key on the control panel on, the tape reader will respond to remote start and stop commands. These commands may originate either in the stunt box or the TP186670 kit. Manual operation of the tape reader involves the TD ON and TD OFF buttons on the control panel.

2.17 Automatic mode switching for the 35 ASR set provides the following:

(a) Ability to prepare tape while transmitting or receiving traffic in T or TTS mode

(b) Ability to transmit or receive traffic using codes foreign to the equipment, in the TTS or TTR mode

(c) Ability to receive traffic on tape and page copy simultaneously in the KT mode

(d) Ability to revert to a common mode of operation (T) when manually turning off the set; an optional EOT disconnect or optional idle line disconnect.

To obtain these features, the keyboard and reperforator are switched between the set logic signal circuit and the auxiliary local circuit according to the following:

MODE	TD	KBD	LPR or LRPE	LP
K	L	L	O	L
KT	L	L	L	L
T	L	O	O	L
TTS	L	O	O	B
TTR	X	O	L	B

L – Indicates signal line circuit
O – Indicates auxiliary local unit
B – Indicates unit is blinded in signal line circuit
X – TD is disabled
K – Keyboard
KT – Keyboard-Tape
T – Tape
TTS – Tape-to-Tape Send (Disabled at customer's request)
TTR – Tape-to-Tape Receiver (Disabled at customer's request)

INTERFACE

2.18 The operator controls for the 33 or 35 station are provided by the TP186670 modification kit which is the interface device between the teletypewriter and the data set. The controls, from left to right, and a brief functional description, are:

OFF – This is a nonlocking, releasing key that does not have an indicator lamp. When depressed, any locking key previously operated will be released. An interlock prevents the OFF key from being depressed simultaneously with any other key, except the BREAK RELEASE key. Depressing the OFF key turns the station off, if it was in the local mode or on line. It places the station in the off mode, if the OUT OF SERVICE or SPARE* keys have been depressed.

*Note: Some stations may have TEST instead of SPARE.

ON – Nonlocking, releasing key. When depressed, any locking key previously operated will be released, the ON lamp will light, the teletypewriter set motor will start, and the station will be on line. An interlock prevents the ON key from being depressed simultaneously with any other key, except the BREAK RELEASE key. If the ON key is depressed while the station is in the out-of-service mode (the OUT OF SERVICE lamp is lighted when not receiving an on signal on the CC or CF lead) the ON lamp will light but the terminal will remain in the out-of-service mode. When the ON key is released, the ON lamp will turn off.

BREAK RELEASE – Nonlocking, nonreleasing key whose lamp will light whenever the station detects a break signal. The lamp will remain lighted until the break condition is cleared. Operation of the BREAK RELEASE key is independent of the other control keys. It can be depressed simultaneously with or while other keys are depressed without being locked out or affecting the other keys. Depressing this key removes the station from a break condition by enabling the tape reader, unblinding the keyboard, unblinding the BA circuit (transmitted data), and enabling the proceed circuit. Depressing the BREAK RELEASE key extinguishes its lamp if the break signal is no longer present.

LOCAL – This is a locking, releasing key. When depressed and locked, its lamp will light. The key can be released by any of the releasing keys. An interlock prevents this key from being simultaneously depressed with any of the other keys. Depression of the LOCAL key places the station in the local mode, prevents locally originated signals from being transmitted on the BA circuit (transmitted data) and prevents the station from recognizing any line activity on the BB circuit (received data). This allows the operator to prepare punched tape for later transmission, or practice typing. The station can be placed in any other mode from the local mode or from any other mode into local.

OUT OF SERVICE – This is a locking, releasing key which, when depressed and locked will light its lamp. The lamp will also light when the station does not receive an on signal on the CC circuit (data set ready) or an on indication on the CF circuit (data carrier detector). When depressed and locked, the key will only be released by any of the releasing keys. An interlock prevents the OUT OF SERVICE key from being simultaneously depressed with any other key, except the BREAK RELEASE key.

Note: Depress the OUT OF SERVICE key prior to changing the ribbon, paper, or tape.

Depressing the OUT OF SERVICE key prior to changing the ribbon, paper, or tape prevents the station motor from starting upon receiving a remote start signal. Also, operation of this key keeps a steady marking signal on the BA circuit (transmitted data) and inhibits the station from responding to signals on the BB circuit (received data). The station may be placed in the out-of-service mode from any other mode, or it may be placed in any other mode from the out-of-service mode. The station is placed out of service without the OUT OF SERVICE key being depressed whenever the CC or CF lead indicates the data set is not ready or a carrier fail condition exists. The OUT OF SERVICE lamp is also turned on. This state exists as long as there is an indication. Once restored the lamp is turned off and the terminal is no longer inhibited to "on-line" operation. This state should not be depended upon for changing the ribbon, paper, or tape, but the pushbutton should be depressed until the terminal is ready for operation. Depressing the OFF key will release the OUT OF SERVICE key. If the station is on-line when a signal on the CC or CF circuit causes the OUT OF SERVICE lamp to light, the station will turn off and revert to the out of service mode. If at any time that the OUT OF SERVICE lamp is lighted the ON key is depressed, the ON lamp will light but the teletypewriter will not be affected. Releasing the ON key will turn the ON lamp off.

SPARE – This key may be field converted to a TEST key for the purpose of testing the data set. This is a locking, releasing key which lights when depressed and turns off when released. When depressed and locked, it will only be released by any of the releasing keys. An interlock prevents this key from being depressed with any other key, except the BREAK RELEASE key. Depressing the SPARE (TEST) key will turn off the motor, if running, or prevent it from starting. While the SPARE (TEST) key is operated, the BA (transmitted data) and BB (received data) circuits are not inhibited nor blinded. It is possible to transmit a break on the BA circuit and to receive data, including a break, on the BB circuit. The selector will chatter in response to the BB signals and the break detector will detect any BREAK signal. It is possible to go into the spare (test) mode from any other mode or to go into any other mode from spare (test). When the data set is in the test mode and if it opens or drives the CC circuit (data set ready) negative, the station will indicate an out-of-service condition.

2.19 The two indicator lamps above the 33 or 35 station controls are, from left to right, PAPER ALARM and PROCEED. The PAPER ALARM lamp has a red lens. A low paper condition on a friction feed station or a form out condition on a sprocket feed station will cause the lamp to light. A paper alarm indication will not interfere with the normal operation of the station, but it will disable its automatic answering capability. Any signal line activity on circuit BB (received data) will be ignored. It is possible to manually turn on the station when a paper alarm condition exists. Depressing the ON key overrides the paper alarm condition and turns the station on. The PROCEED lamp has a green lens. Its function is to indicate to the operator when it is permissible to transmit. When the lamp is on, the operator may send data; when the lamp is off, the operator should not transmit. The tape reader is disabled whenever the PROCEED lamp is off.

2.20 The interface between the teletypewriter and the data set is provided by the TP186670 modification kit which mounts in front of the call control unit. Six circuits are provided per EIA RS-232-C as follows:

AA – Protective Ground: This circuit is connected to the frame of the station and metal chassis parts. This in turn is connected to the ground wire of the AC power cord.

AB – Signal Ground: This circuit is the common or ground return for all signal circuits. It is also the connection for all the TP186670 modification kit power supply grounds. The AA and AB circuits are not connected together.

BA – Transmitted Data: This circuit presents the transmitted data to the distant station whether generated by the keyboard, tape reader, answer-back, or the BREAK key.

BB – Received Data: This circuit receives data from the distant station.

CC – Data Set Ready: When the signal on this circuit is positive, the data set is ready to transmit or receive data. When it is negative, the data set will not be ready. If the data set loses power, the voltage on this circuit will be zero. Whenever the voltage is negative or zero, the terminal will be placed in the out-of-service mode and light the OUT OF SERVICE lamp.

CF – Data Carrier Detector: This circuit gives the status of the data sets and connects them together. Normally this circuit is positive. It will be negative if the carrier is not detected or if the data link is lost. When this happens, the station will be placed in the out-of-service mode and light the OUT OF SERVICE lamp.

BREAK DETECTION

2.21 Mounted on the call control unit of the 33 and 35 stations but actually being part of the TP186670 modification kit is a break detector circuit consisting of a circuit card and connector. The circuit is connected to latch up the relay on the circuit card. The relay will remain energized until the BREAK RELEASE key is depressed. The operation of the relay will light the lamp in the BREAK RELEASE key, shunt the keyboard, disable the tape reader, turn off the PROCEED indicator lamp, and generate a steady mark from the transmit circuit BA (transmitted data). A BREAK is generated by the station operator depressing the BREAK keytop on KSR and ASR Sets. This puts a spacing signal on line. The signal is fed into a timing circuit which limits the BREAK signal from 380 to 750 milliseconds of spacing.

MOTOR CONTROL

2.22 Remote Motor Control: The teletypewriter motor will start if a spacing signal longer than 3 msec is present on the received data circuit (BB). A remote start signal greater than 100 msec, however, may trigger the break detector circuit. If the station is in the local mode, or the paper alarm is activated, or if the station is in the out-of-service or test modes, the spacing signal on circuit BB will be ignored.

OPTIONS

2.23 The TP186670 modification kit has four factory-wired options which are installed and may be retained or opened at the time of installation. The straps are located on the two circuit cards which comprise the logic of the TP186670 modification kit. For options on the data set, refer to the appropriate BSP.

EOT Disconnect –

Strap 1 retained – Upon receipt of EOT, the station will turn off.

Strap 1 removed – Station will not turn off on EOT. When the station receives EOT, it will go in contention. The set motor will continue to run until turned off manually by depression of the OFF key or idle line disconnect.

Idle Line Disconnect –

Strap 2 retained – A timer monitors the BA (transmitted data) and BB (received data) circuits. After a nominal 5 minutes (2 to 8 minutes) of inactivity the station will turn off automatically.

Strap 2 removed – No idle line disconnect.

Note: The idle line disconnect option is an independent option and may be used with or without the EOT disconnect option. The various combinations of these two options are shown in the following chart:

EOT DISCONNECT OPTION	IDLE LINE DISCONNECT OPTION	STATION OPERATION
Present	Present	Station will automatically disconnect on EOT or any period of inactivity exceeding 2 minutes.
Removed	Present	Station will go into contention on EOT and disconnect automatically after a period of inactivity exceeding 2 minutes.
Present	Removed	Station will automatically disconnect on EOT. No timeout and disconnect.
Removed	Removed	Station can only be disconnected manually. (Not Recommended)

Local Break Override –

(a) When connected to a full-duplex data set, the no. 3 strap should be removed. The BA and BB circuits handle the transmission and reception of a break signal respectively.

(b) When connected to a half-duplex data set, the no. 3 strap should be retained or removed to achieve the following condition:

Strap 3 retained – The receiving circuits of the station transmitting the break will be prevented from responding to the break and interfering with its generation.

Strap 3 removed – The receive circuits of the station transmitting the break will respond to the locally generated break and will limit the break generation from 100 to 190 msec instead of the nominal 380 to 750 msec of space. Garble will result if break is transmitted.

Half or Full Duplex –

Strap 4 retained – The TP186670 modification kit is manufactured with strap 4 installed. This connects the send data signals (except the BREAK signal) to the receive circuit, providing half-duplex operation.

Strap 4 removed – The send and receive circuits will be separated. The station will send data without generating local copy, and receive data completely unrelated to what is being locally transmitted. This is full duplex.

A special circuit is enabled when the teletypewriter is placed in the local mode. This couples the send to the receive circuits for operating in local whether the teletypewriter is arranged for half- or full-duplex operation.

Note: For full-duplex operation, unless the data set is limited, it should always be full duplex and the teletypewriter half duplex.

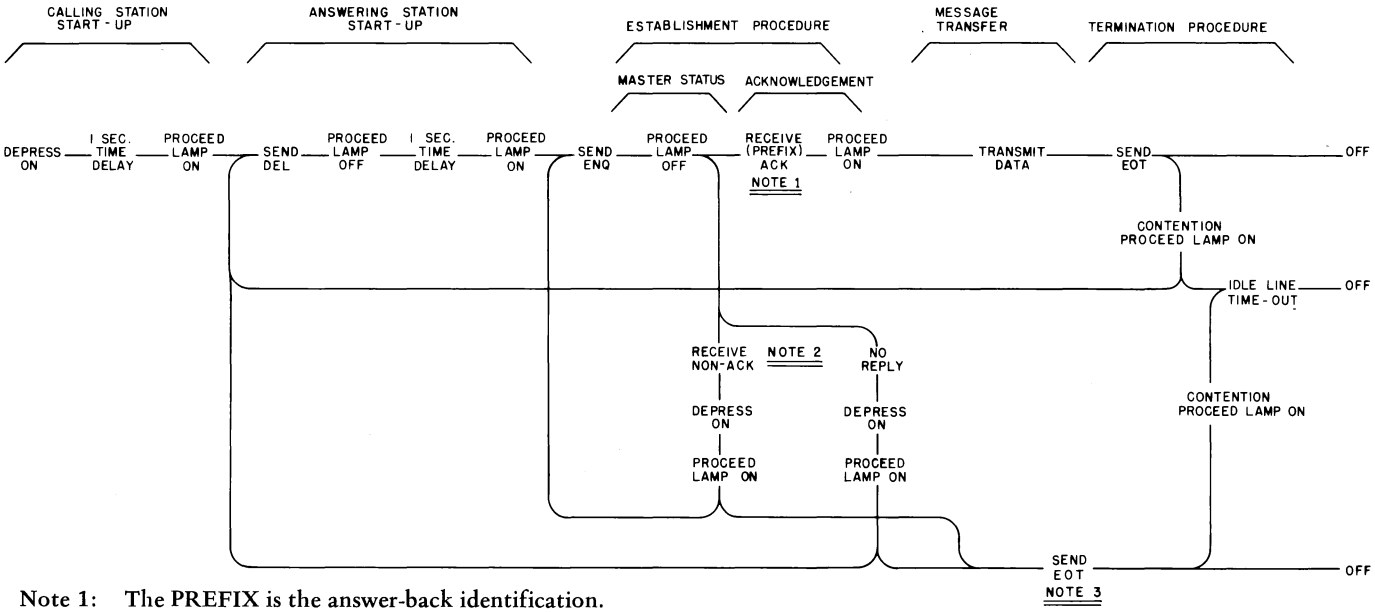
3. OPERATION

MASTER STATUS

A. Station-to-Station

Manual Operation (Figure 7)

3.01 Prior to initiating a call, the calling 33 or 35 station should have a sufficient supply of paper to complete all messages. If the BREAK lamp is lighted, a break condition exists which may be cleared by depressing the



Note 1: The PREFIX is the answer-back identification.

Note 2: NON-ACK is any character except ACK.

Note 3: The station will either turn off or go into an idle line condition and turn off after a time-out period. Either function depends upon the strapping option installed.

Figure 7 - Operating Procedures (Master Status) Station-to-Station

BREAK RELEASE key. If the OUT OF SERVICE lamp is lighted but the key is not depressed, the data link is not in service; it is impossible to initiate a call until the data link is restored.

3.02 Depressing the ON key turns the station on. The ON lamp lights and remains lighted after the key is released. After one second, the PROCEED lamp lights. This is an indication that the motor has reached operating speed and it is permissible to transmit.

3.03 The operator at the calling station then depresses the DELETE key on the keyboard. This results in two things:

(1) At the calling station, the PROCEED lamp turns off for 1 second and then turns on again. This 1-second delay allows the answering station motor to reach operating speed.

(2) At the answering station, reception of DELETE is interpreted as line activity and causes the station to turn on. The station will not turn on, however, if it is in local, out of service, or spare mode.

3.04 The station desiring to transmit data bids for master status by transmitting ENQ; this initiates the establishment procedure to form the master/slave relationship. Both the sending and receiving stations recognize the ENQ, with the following results:

(1) At the receiving station, the PROCEED lamp turns off and the answer-back is automatically operated. The PROCEED lamp remains off. The answer-back message is printed.

(2) At the sending station, the PROCEED lamp turns off and the answer-back is prevented from operating. The station prints the answer-back being transmitted by the receiving station.

3.05 The answer-back sequence transmitted by the receiving station consists of a maximum of 15 identification characters with ACK as the last character. Receipt of ACK indicates the receiving station has assumed slave status. At the sending station, receipt of ACK turns the PROCEED lamp on again and the station assumes master status. Transmission of data may now take place.

Note: The 35 station requires a minimum time interval of two characters between the transmission of ENQ and the response character ACK transmitted from the distant station (or computer). This time interval may be generated by prefix characters or suitable buffering.

3.06 Transmission of data is in one direction only – from the master to the slave. It could be a single message or a series of messages. There may be special headings or text separators within the message. All of these codes and procedures do not relate to the mode of operation of the station and, therefore, the station does not respond to them other than in a message handling fashion. Figure 7 illustrates the message transfer procedure.

3.07 When all messages have been sent, the master station sends EOT. If the stations are equipped with the idle line disconnect option, both go into contention for a nominal 5 minutes (2 to 8 minutes) after which both disconnect. If the EOT turn-off option has been installed, both stations will turn off their motors when the master station sends EOT. No indication appears at either station that the other has turned off.

Automatic Operation (Figure 7)

3.08 The operating procedure can be completed from punched tape provided ACK is received the first time. The message tape should be as follows:

D	E	D	E	D
E	N	E --- text ---	O	E
L	Q	L	T	L

3.09 Depressing the ON key turns the station on. (On 35 stations the TD CALL IN key is on and its TD ON button is depressed.) The ON lamp lights and remains lighted after the key is released. After 1 second, the PROCEED lamp lights, indicating the motor has reached operating speed. On 33 stations, the control lever of the tape reader having the punched tape is momentarily operated from AUTO to MANUAL START. When the first DEL character of the tape is transmitted the following results:

(1) At the calling station, the tape reader stops. The PROCEED lamp turns off and after 1 second turns on again.

(2) At the answering station, DEL is interpreted as line activity. The answering station turns on.

(3) When the calling station's PROCEED lamp comes on, its tape reader also starts.

3.10 The ENQ and DEL characters are transmitted. Again the tape reader at the calling station stops due to detection by the function box of the ENQ code. The PROCEED lamp turns off.

3.11 The answering station responds to the ENQ by transmitting its answer-back sequence whose last character is ACK. Upon receiving ACK, the calling station PROCEED lamp lights, and the tape reader starts automatically; the station has assumed master status.

3.12 At the end of the message, the master station transmits EOT followed by DELETE. The function box of the master station will detect EOT and cause the tape reader to turn off. The slave station will also turn off when it receives the EOT code if the EOT option has been installed. If the idle line disconnect option has been installed both stations will turn off after a nominal 5 minutes (2 to 8 minutes) of contention.

Incomplete Call Attempt

3.13 NO RESPONSE – A station in the local, out-of-service, or spare (test) mode, or with a paper alarm condition will not respond to the start-up DEL character when called. The calling station sends ENQ, which turns the PROCEED lamp off. The PROCEED lamp will not turn on again until ACK is received. If the answering station fails to respond with ACK, the calling station remains idle. A second attempt by the calling station, starting with depressing the ON key (OFF key need not be depressed), and repeating the start-up and establishment procedures will reduce the possibility of ENQ being garbled. No response to this second attempt indicates the station being called is in the local, spare (test), out-of-service in a paper alarm condition, or has a BREAK condition. EOT should be transmitted and a later attempt made.

3.14 NON-ACK REPLY – A calling station that has followed normal start-up procedures and sends ENQ is idle awaiting ACK or ACK preceded by an optional prefix. Failure to receive ACK will prevent the calling station from achieving master status. If further attempts to achieve master status fail, EOT should be transmitted and a later attempt should be made.

3.15 RECEIPT OF BREAK – A break signal received by the master station will stop the tape reader, electrically short out the keyboard, reader and answer-back, place a steady mark condition on the BA circuit, light the BREAK lamp (within the BREAK RELEASE key), and turn off the PROCEED lamp. This condition will exist until the station no longer receives a spacing signal and the BREAK RELEASE key is depressed.

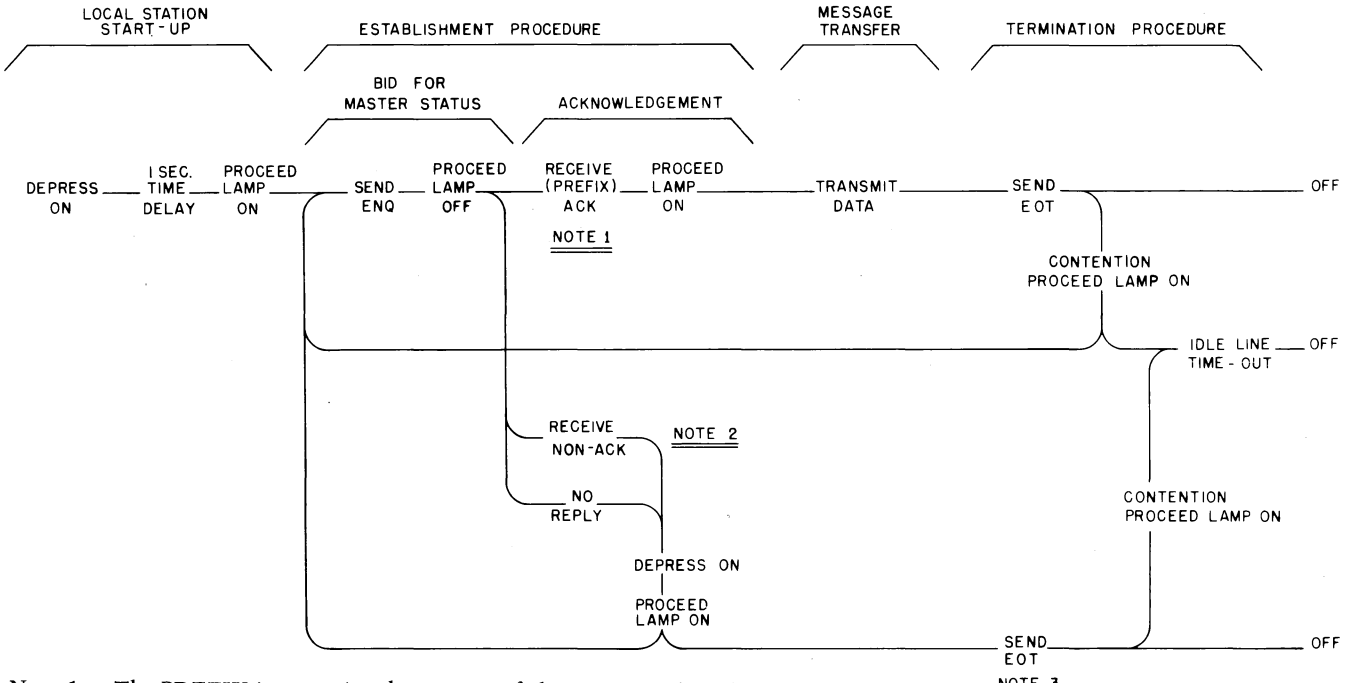
3.16 SIMULTANEOUS ENQ – If both stations transmit ENQ simultaneously during start-up procedures, the ENQ will be garbled. ENQ must be retransmitted.

B. Station-to-Computer

3.17 The control procedures that follow for manual, automatic, and incomplete call attempt describe the teletypewriter station as the master station in station-to-computer operation. Computer-to-station operation in which the computer attains master status is possible and would follow the same control procedures.

Manual Operation (Figure 8)

3.18 Prior to initiating a call, the teletypewriter station should have a sufficient supply of paper to complete all messages. If the BREAK lamp is lighted, a break



Note 1: The PREFIX is an optional sequence of characters used as identification.

Note 2: NON-ACK is any character except ACK. The computer can send NAK, but when received the teletypewriter will recognize it as just another character.

Note 3: The station will either turn off or go into an idle line condition and turn off after a time-out period. Either function depends upon the strapping option installed.

Figure 8 - Operating Procedures (Master Status) Station-to-Computer

condition exists which may be cleared by depressing the BREAK RELEASE key. If the OUT OF SERVICE lamp is lighted but the key is not depressed, the data link is not in service; it is impossible to initiate a call until the link is restored.

3.19 Depressing the ON key turns the teletypewriter station on. The ON lamp lights and remains lighted after the key is released. After one second, the PROCEED lamp lights. This is an indication that the motor has reached operating speed and it is permissible to transmit.

3.20 The teletypewriter station bids for master status by transmitting ENQ. Both the teletypewriter station and the computer recognize ENQ with the following results:

(1) The PROCEED lamp on the teletypewriter station turns off and the answer-back mechanism is prevented from operating.

(2) The computer generates an optional prefix followed by ACK.

Note: The 35 station requires a minimum time interval of two characters between the transmission of ENQ and the response character ACK transmitted from the distant station (or computer). This time interval may be generated by prefix characters or suitable buffering.

3.21 Receipt of ACK by the teletypewriter establishes it in the master status; the computer assumes slave status; the PROCEED lamp on the teletypewriter station turns on. If the 33 station tape reader has tape in it and the control lever is in the AUTO position, receipt of ACK will automatically start the tape reader. If the 35 station tape reader has tape in it and the TD CALL IN key is on, receipt of ACK will automatically start its tape reader.

3.22 Transmission of data is in one direction only – from the master to the slave. It could be a single message or a series of messages. There may be special headings or text separators within the message. All of these codes and procedures do not relate to the mode of operation of the station and, therefore, the computer does not respond to them other than in a message handling fashion.

3.23 When all messages have been sent, the master station transmits EOT. If the teletypewriter station is equipped with the EOT turn-off option, it will turn off upon transmitting EOT. If the teletypewriter station is not equipped with the EOT turn-off option, the idle line disconnect option must be installed. This will place the teletypewriter station in contention upon sending EOT. During contention, the station will continue running idle for a nominal 5 minutes (2 to 8 minutes) after which it will turn off. The teletypewriter station turns off without giving any indications to the computer that is has done so. The station could also be turned off by depressing the OFF key.

Automatic Operation (Figure 8)

3.24 The operating procedure can be completed from punched tape provided ACK is received the first time. The message tape should be as follows:

E	D	E	D
N	E --- text ---	O	E
Q	L	T	L

3.25 Depressing the ON key turns the teletypewriter motor on and places the station on line. (On 35 stations the TD CALL IN key is turned on and the TD ON button is depressed.) The ON lamp lights and remains lighted after the key is released. After 1 second, the PROCEED lamp lights, indicating the motor has reached operating speed. The 33 station operator then momentarily operates the control lever of the tape reader from AUTO to MANUAL START. The tape reader starts and transmits ENQ. Sending ENQ stops the tape reader and turns the PROCEED lamp off. The 35 station starts the tape reader automatically after the PROCEED lamp lights.

3.26 The computer acknowledges ENQ with an optional prefix followed by ACK, or ACK only without the prefix. In the latter case, the teletypewriter station will recognize the ACK but will not turn on the tape reader until an activity time delay energizes the proceed circuit. When this occurs, the tape reader will automatically start, data will be transmitted, and the PROCEED lamp will turn on again. The station has assumed master status.

Note: The 35 station requires a minimum time interval of two characters between the transmission of ENQ and the response character ACK transmitted from the distant station (or computer). This time interval may be generated by prefix characters or suitable buffering.

3.27 At the completion of transmission, the teletypewriter station transmits EOT followed by DEL. The function box will detect EOT and cause the tape reader to turn off. If the station is equipped with the EOT turn-off option, it will turn off upon transmitting EOT; if the station is not equipped with the EOT option, the idle line option must be installed. This will place the station in contention upon sending EOT. During contention, the station will continue running idle for a nominal 5 minutes (2 to 8 minutes) after which it will turn off. The station turns off without giving any indication to the computer that it has done so.

Incomplete Call Attempt (Figure 8)

3.28 NO RESPONSE – The teletypewriter station bids for master status by transmitting ENQ. Transmitting ENQ turns off the PROCEED lamp. The PROCEED lamp will remain off until ACK is received. If the computer

does not respond, the station will remain idle. The station operator should again depress the ON key and retransmit ENQ, thus reducing the possibility that ENQ has been garbled. If the computer still fails to respond, the link has not been established and the station should be turned off. A later attempt should be made.

3.29 NON-ACK REPLY – If the ACK code is not received, the station cannot assume master status. After a second unsuccessful attempt for master status, the station should be turned off and a later attempt made. On 35 stations receipt of NAK will ring the signal bell.

3.30 RECEIPT OF BREAK – Transmission of break by the computer to the teletypewriter station will electrically short out the keyboard, reader and answer-back, place a steady mark condition on circuit BA, light the BREAK lamp (within the BREAK RELEASE key), and turn off the PROCEED lamp. This condition will exist until the station no longer receives a spacing signal and the BREAK RELEASE key is depressed.

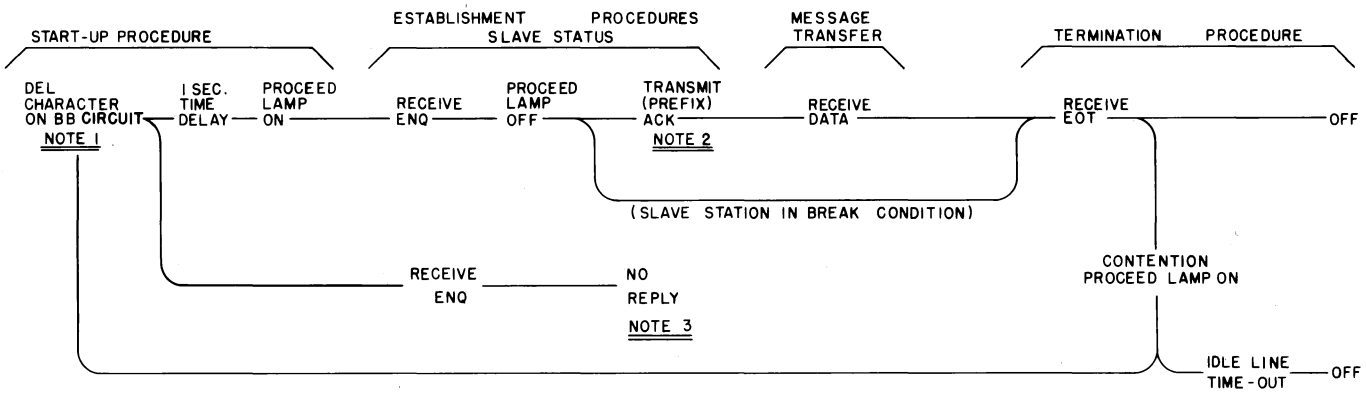
SLAVE STATUS (Figure 9)

3.31 The slave station is activated by a distant station bidding for master status by recognizing activity on the BB circuit (received data). If the station about to assume slave status is a teletypewriter station, the slave station will receive a DELETE code; if the station is the computer, the slave station will receive the ENQ code.

3.32 Upon receiving DELETE or ENQ, the station motor turns on. After 1 second, the PROCEED lamp will light. The slave status has not yet been established, therefore, the status of the station (or the computer) is in contention; it is ready to transmit or receive.

3.33 ENQ is received. The PROCEED lamp turns off and remains off for the entire slave operation. The station (or computer) transmits its optional prefix message with ACK. The ACK is recognized by the distant station (the master station), but not by the station generating it (slave station).

Note: The 35 RO station is restricted to having the PROCEED lamp off continuously, showing a permanent slave condition.



Note 1: ENQ in station-to-computer operation.

Note 2: The PREFIX is an optional sequence of characters used as identification.

Note 3: If station is in out-of-service, local, spare (test), or paper alarm mode.

Figure 9 - Operating Procedures (Slave Status)