SPECTRA 70

RADIO CORPORATION OF AMERICA · ELECTRONIC DATA PROCESSING

COMMUNICATION CONTROL

70/653

REFERENCE MANUAL

RADIO CORPORATION OF AMERICA

70-06-653

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GENERAL DESCRIPTION

♦ The RCA Model 70/653 Communication Control (CC) permits long-distance half-duplex communications between an RCA Spectra 70 Processor (Models 70/25, 70/45, or 70/55) and another RCA Processor equipped with an appropriate communication control Communication Controller Multichannel (CCM) or Communication Mode Control (CMC). Data sets are required to interface the communication line. This unit and the associated data sets can operate by manual dialing or automatic dialing over common carrier facilities. Private leased-line operation is also possible if the dialing function is not required.

OPERATIONAL CHARACTERISTICS

♦ The Models 70/653-25, -26 use a 3KC *voice-grade* line. Model 70/653-34 utilizes a line with a nominal bandwidth of 48KC.

The following chart illustrates the possible interconnections between a Spectra 70 Processor Model 70/25, 70/45, or 70/55 equipped with a Model 70/653-25 or -26 Communication Control and another RCA processor with a communication control.

70/25 70/45 70/55	70/15 equipped with a CC Model 70/652-25 or -26. 70/25 equipped with a CC Model 70/653-25 or -26. 70/45 equipped with a CC Model 70/653-25 or -26. 70/55 equipped with a CC Model 70/653-25 or -26. 301 equipped with a CC Model 376. 3301 equipped with a CC Model 3376.

A Spectra 70 Processor (70/25, 70/45, or 70/55), equipped with a Communications Control 70/653-34, can only communicate with another processor with a Model 70/653-34 or Model 3376-34 Communication Control. Communication Control Models 70/653-25 and -26 can communicate with a processor equipped with the appropriate CCM, CMC and Buffers. The following chart illustrates the possible interconnections:

70/25	70/45 with a CCM and a 70/721 Buffer. 70/55 with a CCM and a 70/721 Buffer.
70/45	301 with a CMC and a 6012 Buffer.
70/55	3301 with a CMC and a 6012 Buffer.

The data sets required to interface the communications lines are listed in table 1. A data set is required at each end of the communication line.

Table 1. Transmission Speeds

Communication Control	Data Set	Dial	Bits/Second		8-Level Code Chars/Second		9-Level Code Chars/Second	
			Dialed Call	Leased Line	Dialed Call	Leased Line	Dialed Call	Leased Line
70/653-25	201A3 201B	Manual	2000	2400	250	300	222	267
70/653-26	201A3	Auto	2000	—	250	—	222	—
70/653-34	301B	P.L.	—	40,800	—	5,100	—	4,533

OPERATIONAL CHARACTERISTICS (Cont'd)

Notes:

1. AT&T Data Set model numbers are shown only as an example.

2. The data sets are synchronous and operate at the specified speeds.

The unattended operation features of a data set are used to receive data where applicable.

The 70/653 Communication Control is capable of transmitting and receiving eight- or nine-level code. The nine-level code is an installation option and, as such, it is selected and wired-in at installation time. When this option is incorporated, only the nine-level code can be handled.

The eight-level transmission line code has even parity and contains six information bits, one parity bit, and one control bit. The nine-level transmission line code also has even parity and contains eight-information bits and one parity bit. The most significant bit of each character is the first bit transmitted to the line. The output code to the line is the complement of the input code from the processor. The transmission line code is recomplemented by the receiving communication control.

The communication control can be connected to a processor multiplexor channel or a selector channel. This control is connected to either type of channel via the RCA standard interface. Only one trunk of a multitrunk channel is required for the communication control.

PROGRAMMING CONSIDERATIONS

♦ Certain instructions and control characters are required for control, synchronization and/or coordination of the communication control, communication line, and data sets. These control characters permit programs to identify a particular occurrence or signal in the sequence of operations required for processor-to-processor communication.

CONTROL CHARACTERS

♦ There are seven control characters that are required for control, synchronization and coordination of the 70/653 Communication Control, data sets and the communication line. Six of these control characters are selectable for each system and can be connected at installation time. The function of each character is defined in table 2.

Table 2. Control Characters

Code	Function
TEL	Telephone character is sent to notify a remote operator to go to the telephone associated with the data set. This character can be sent by depressing and releasing the TEL switch on the control or by the program. When received or transmitted, the TEL character activates the TEL indicator and buzzer. The TEL character should not be sent during message transmission. (See Controls and Indicators, page 14.)
I-L	Idle Line characters are generated and transmitted by the control before the transmission of data and, at other times, to maintain synchonization with the receiving data set. Idle Line characters are *not* transferred into main memory and are *not* included in the Block Parity check.
DD2	Data Delimiter 2 character is sent by the program and is used as a *Request to Transmit* signal and as an *End of Message* signal. DD2 is *not* tranferred into main memory.
ACK	Acknowledge character is sent by the receiving program to signify the reception of a valid transmission after Block Parity has been checked. ACK is *not* transferred into main memory.
DD1	Data Delimiter 1 character is sent by program and is used as a *Go Ahead* signal after transmission of an ACK character; a *Go Ahead* signal in answer to a request to transmit; or as an *End of Data* signal from the transmitting location. DD1 is *not* transferred into main memory.
TERM	Terminate character is used as an *End of Transmission* indicator and can be sent by the program of either processor. A DD1, immediately following a TERM character, is used as a *Terminate Sequence* signal and is recognized by the transmitting and receiving communication controls. Each communication control upon recognition of the *Terminate Sequence* disconnects the communication line and returns to the *Idle Mode*. The TERM character *is* transferred into main memory.
BP	Block Parity character is generated by the transmitting communication control and is sent immediately following DD2. The Block Parity character is checked against an accumulated Block Parity character by the receiving communication control. Block Parity is *not* transferred into main memory and is *not* selectable.

INSTRUCTIONS

♦ Program control of the 70/653 Communication Control is provided by the input/output instructions of each processor.

There are three input/output commands which are used to communicate with the control. These commands provide the program with the means of sending, receiving, sensing errors and operating conditions, *and* informing the control of the functions which it is to execute. The commands are:

Read
Write Control
Sense

Read Command

♦ This command is used in the Receive Mode to initiate the transfer of data from the control into main memory.

The normal termination of the Read Command causes an I/0 interrupt and sets the condition code to zero. The conditions that cause a normal termination are as follows:

1. DD2 is received and no error conditions have been detected.
2. Receipt of a DD1.

This instruction can also be terminated by the detection of the following error conditions: (Also see Accuracy Control, page 12.)

1. Loss of the Data Set Ready signal from the data set.
2. A No Data Time-Out occurs.
3. A character parity error is detected.
4. A Block Parity error is detected.
5. Instruction termination before a DD2 has been received.

Write Control Command

♦ This command is used in the Transmit Mode to initiate the transfer of data and the control byte from main memory to the communication control. The first byte transmitted is always a control byte which specifies the particular function the control is to execute. The control byte format and the control functions are described in table 3.

The Write Control command is terminated by the following error conditions:

1. Loss of the Data Set Ready signal from the data set or PWI from Automatic Calling Unit.
2. Detection of an *Error* signal on the Abandon Call and Retry (ACR) circuit when using the AT&T 801A Automatic Calling Unit with the 70/653-26 Communication Control.
3. Ring Indicator signal is received while in the process of dialing a remote location.

Control Byte Format

♦ A control byte must always precede all data to be transmitted whether it is to be sent over the communication line to another control, sent to a communication buffer, or sent to the Automatic Calling Unit. The functions and the bit structure of the control byte are defined in table 3:

INSTRUCTIONS (Cont'd)

Table 3. Control Byte Format

Bit	Description
2^0	This bit is set to a 1 by the program when initiating an automatically dialed call. This bit is recognized by the control which sends a *Call Request* signal to the Automatic Calling Unit (ACU). When the ACU is ready it signals the control to transfer the telephone number. This bit should only be set to a 1 in systems with a 70/653-26 and an AT&T 801A Automatic Calling Unit or equivalent.
2^1	Not used (must always be zero).
2^2	Not used (must always be zero).
2^3	This bit is set to a 1 by the program prior to transmitting data. The communication control recognizes it and sets the Request to Send circuit to the data set. The data set responds with a *Clear-to-Send* signal and the transmission of the data is initiated.
2^4	Not used (must always be zero).
2^5	Not used (must always be zero).
2^6	Not used (must always be zero).
2^7	Not used (must always be zero).

Sense Command

♦ The execution of this command causes the sense byte to be transferred from the communication control into main memory. The sense byte contains data pertinent to the conditions detected in the previous operation and are unique to this control. It supplies a third level of information which is not available in either the condition code or the standard device byte. The secondary indicator bit (2^2) of the standard device byte is set to 1 when a condition is present which causes a bit in the sense byte to be set.

Sense Byte Format

♦ The functions and the bit structure of the sense byte are defined in table 4.

Table 4. Sense Byte Format

"1" Bit In	Description
2^0	Ring Indicator signal received.
2^1	Idle line code received and synchronization established.
2^2	Error condition detected.
2^3	Present character to be transmitted.
2^4	DD2 and Block Parity received without error.
2^5	Abandon Call and Retry (ACR) signal received from the ACU.
2^6	ACK received.
2^7	DD1 received.

2^0 Ring Indicator

♦ This bit is set to a 1 when a Ring Indicator signal is received from the data set.

2^1 Idle Line Characters

♦ This bit is set to a 1 when the control receives and recognizes the Idle Line character. The Idle Line characters are used for synchronization and are generated and transmitted by the control prior to transmitting data.

2^2 Error Condition

♦ This bit is set when the control detects an error condition. The following conditions cause this bit to be set:

Receive Mode

1. No Data time-out.
2. Character parity.
3. Block Parity.
4. Read instruction terminated before a DD2 has been received.
5. 19-second time-out.

Transmit Mode

1. 1.6-second time-out.
2. Write Control command initiated when the Ring Indicator is present.
3. 19-second time-out.

2^3 Present Character

♦ This bit is set by the control when a Data Set Ready (DSR) signal is received from the data set after a line connection has been established in a system using an Automatic Calling Unit. In leased-line or manual dialing systems, this bit will not be used because (DSR) signal is always present.

2^4 DD2 and Block Parity Received

♦ This bit is set when a DD2 and Block Parity have been received, checked, and no error conditions have been detected.

2^5 ACR Signal Received

♦ This bit is set when an *Abandon Call and Retry* signal is received from the AT&T 801A Automatic Calling Unit. This occurs when the line connection is not properly established or when a common carrier error is detected.

2^6 ACK Received

♦ This bit is set when an Acknowledge (ACK) character is received from a remote location after a transmission has been successfully completed without an error.

2^7 DD1 Received

♦ This bit is set when the control receives and recognizes a DD1.

ADDITIONAL NOTES

♦ 1. The sense byte is set to reflect the error conditions caused by equipment malfunction or line noise. The program must provide the necessary *Error* routines to enable retransmission of the message, protect against loss of messages, and alert the operator when manual intervention is required.

2. When communicating with other communication controls, the various time restrictions must be observed or error conditions will result.

3. A Sense command must be executed whenever an I/O interrupt occurs as a result of an operation involving this control.

4. The program must set the control byte and positions it as the first character of each transmission.

5. Every message must have a DD2 (End of Message) as the last character.

ADDITIONAL NOTES (Cont'd)

6. Code translation must be accomplished by programming when using codes other than EBCDIC.

7. A DD1 does not have to be sent immediately following the ACK. The DD1 can be held up to 18 seconds from the time the DD2 and BP characters were sent by the transmitting communication control. When a DD1 is not received in this time period, a time-out error is detected by the control and indicated in the transmitting program. A time-out error also is detected and indicated to the receiving program. These time-outs cause the interrupt indicator, standard device byte ($2^2 = 1$), and the sense byte ($2^2 = 1$) to be set in each processor and the communication controls return to the *Idle Mode.*

MODES OF OPERATION

♦ The 70/653 Communication Control has three operating modes: *Idle Mode, Receive Mode, and Transmit Mode.* In addition, an Automatic Call Function is available. The neutral condition of this control is the Idle Mode. In this mode the control is operational and is responsive to signals from the processor and the communication line. These signals cause the communication control to enter either the Receive or the Transmit Mode. Once either mode has been established, operation continues in that mode until the end of a transmission, or until an error condition has been detected.

RECEIVE MODE

♦ In the Receive Mode, the communication control transfers data and control character, received from the communication line, into the main memory of the processor.

When the Unattended Answer feature of the data set is used, the receipt of a Ring Indicator (RI) signal starts a 19-second timer in the control and it assumes that the communication line connection has been established. The RI signal is generated by the data set upon receipt of dialing pulses from the communication line. When nothing is received from the line within 19 seconds, the control disconnects the line and returns to the Idle Mode. No error is indicated upon detection of this condition.

The first seven characters received are the Idle Line (I-L) characters. These characters are used for synchronization and are not transferred into main memory. Recognition of the I-L characters causes the control to set the interrupt indicator, standard device byte ($2^2 = 1$), and the sense byte ($2^1 = 1$). The 19-second timer, set when the Ring Indicator was received, is reset. At this point, a Read command is issued.

The next characters received from the line are DD2 and Block Parity. These characters are not transferred into main memory. The Block Parity is compared to the accumulated Block Parity of the receiving communications control. If these Block Parity characters are equal and no previous errors have been detected, the control sets the interrupt indicator, standard device byte ($2^2 = 1$), sense byte ($2^4 = 1$), and the 19-second timer. The timer is set here to indicate an error when a DD1 is not received from the processor within 19 seconds.

RECEIVE MODE (Cont'd)

The receiving program services the interrupt and recognizes the condition set in the sense byte as a Request to Transmit. Since no error was detected, the program replies with an Acknowledge (ACK) character and a DD1. If an error has been detected, the program should not send either the ACK or DD1 characters which will cause a time-out condition. The time-out condition indicates to the transmitter that the message was received with an error or errors and must be retransmitted.

The receiving program must acknowledge receipt of a good message within 1.3 seconds or a time-out error will be detected by the transmitting control. DD1 must be sent within 18 seconds or a time-out error will be detected by both controls. When the transmitting control receives the ACK and DD1, the timers are reset.

To send the ACK and the DD1, the receiving program must issue a Write Control command. A control byte ($2^3 = 1$) is the first character specified by the command and is transferred to the line to send a Request to Send signal to the data set. When the 70/653 Communication Control receives a Clear to Send signal from the data set, the control generates and transmits seven I-L characters, and then transmits the ACK and DD1 characters. After the characters have been transmitted, the 19-second timer and the Request to Send signal are reset by the control.

Receipt of a DD1 character by the transmitting control within 19 seconds is interpreted by the program as a *Go Ahead* invitation to send a message. The transmitting program then initiates a Write Control command to send the control byte, message, and DD2 Block Parity is generated and transmitted by the control. The same timers described above are set when DD2 and BP are sent.

The receiving processor is interrupted on receipt of the I-L character. The standard device byte ($2^2 = 1$) and the sense byte ($2^1 = 1$) are set. Upon recognition of this condition, the program should initiate a Read command. The message is received and then transferred byte-by-byte into main memory until DD2 and BP are received. The receiving program should send an ACK and a DD1 if the message was received without error. The transmitting program interprets the receipt of these characters as message received without error and as an invitation to send another message. The time restrictions described above also apply here.

If the transmitting program has another message or messages to send, the procedure described above is repeated until the transmitting program has exhausted the message queue, or desires to terminate transmission, or desires to terminate and disconnect the line.

In the first two cases described above, the transmitter sends a DD1 character to the receiver. The DD1 character is received, recognized, and interpreted as *End of Data,* and as an invitation to send a message. The receiver now becomes the transmitter if there are messages to send and the procedures described in the Transmit Mode are followed.

If the receiver does not have any messages to send, the TERM and DD1 characters are sent by the receiving program. The 70/653 Communication Control at both locations recognizes the terminate sequence (TERM, DD1), disconnects the communication line, and returns to the Idle Mode.

RECEIVE MODE (Cont'd)

When the transmitter desires to terminate communications and to disconnect the line without inviting the receiver to send, the termination sequence (TERM, DD1) is sent by the transmitting program. This terminates communications and disconnects the line, and the controls return to the Idle Mode.

The receiving program must distinguish between receipt of DD1 only and TERM, DD1. In each case, the interrupt, the standard device byte ($2^2 = 1$), and the sense byte ($2^7 = 1$) are set and the Read command is terminated. The TERM character is transferred into main memory in the latter case. The read-in area can be interrogated to see if a TERM character was received and, in this way, distinguishes between the termination sequence and an invitation to send.

TRANSMIT MODE

♦ In the Transmit Mode, the 70/653 Communication Control transfers data from main memory and transmits it via a communication line. Data is transmitted byte-by-byte until a DD2 (End of Message) is sent. Recognition of the DD2 causes the control to generate Block Parity which is sent immediately following the DD2.

In order to initiate a transmission, whether in a system using dialing (See Auto Call Function, page 10) or a private lease line system without dialing, the originating processor is required to follow the procedure described below.

After a communication line connection has been established, the initiating program issues a Write Control command to send a control byte ($2^3 = 1$) and a DD2 (Request to Transmit). The control byte instructs the communication control to send a Request to Send signal to the data set. After a Clear to Send signal is received from the data set, the control then transmits the DD2, generates and transmits the Block Parity (BP). After transmitting the DD2 and BP, the control sets a 1.6-second timer for receipt of an ACK and sets a 19-second timer for receipt of DD1.

When data is received without error, the receiving program responds with an ACK indicating receipt of an error free transmission. The transmitting control, upon receipt of the ACK, sets the interrupt indicator, standard device byte ($2^2 = 1$), sense byte ($2^6 = 1$), and resets the 1.6-second timer. ACK is not transferred into main memory. Receipt of a DD1 within 19 seconds sets the interrupt indicator, standard device byte ($2^2 = 1$), sense byte ($2^7 = 1$), and resets the 19-second timer. The DD1 is interpreted as an invitation to send another message. DD1 is not transferred into main memory.

If either ACK and/or DD1 are not received by the transmitting control within the required time period, a time-out condition occurs. A time-out causes the control to set the interrupt indicator, standard device byte ($2^2 = 1$), and the sense byte ($2^2 = 1$). Lack of either response requires the transmitting program to retransmit the message.

After receipt of ACK and DD1 the transmitter can send a message. A Write Control command is initiated by the program to send the control byte ($2^3 = 1$), the message and a DD2 (End of Message). The transmitting control generates and sends seven I-L characters when a Clear to Send signal is received from the data set. The message and the DD2 are sent after the I-L characters. The control then generates and sends a Block

TRANSMIT MODE (Cont'd)

Parity immediately following the DD2. The 1.6-second timer and the 19-second timer are set by the control after the transmission of Block Parity. When the transmission is received without error, the receiver responds with ACK and DD1. When the transmitting control receives the ACK and DD1, the timers are reset. The program interprets the receipt of these characters as a message received without error and as an invitation to send another message.

If the transmitting program has another message or messages to send, this procedure is repeated until the transmitting program exhausts the message queue, or desires to terminate transmission, or desires to terminate and disconnect the line.

In the first two cases mentioned above, the transmitter sends a DD1 to the receiver. The DD1 is received, recognized and interpreted as *End of Data,* and as an invitation to send a message. The receiver now becomes the transmitter if there are messages to send and the procedures described above are followed.

If the receiver does not have messages to send, TERM and DD1 characters are sent by the program. The 70/653 Communication Control at both locations recognizes the terminate sequence (TERM, DD1), disconnects the communication line, and returns to the Idle Mode.

If the transmitter desires to terminate communications and to disconnect the line without inviting the receiver to send, the termination sequence (TERM, DD1) is sent by the transmitting program. This terminates communications and disconnects the line, and the controls return to the Idle Mode.

AUTO CALL FUNCTION

♦ The Auto Call Function is an optional feature of the 70/653-26 Communication Control which permits the program to automatically dial other processors equipped with the appropriate communications equipment. An AT&T Model 801A Automatic Calling Unit (ACU), or equivalent, is required in conjunction with the data set.

An automatically dialed call can only be initiated by a program in the Transmit Mode. The dialing function precedes the transmission of data. In order to initiate a transmission to a remote location, the transmitting program must first transmit the telephone number. This number is the standard seven-digit telephone number plus the area code if required.

The program uses a Write Control command to transmit the control byte and the telephone number to the ACU. These bytes are transferred to the ACU one byte at a time until the last digit of the telephone number has been transmitted. The control byte ($2^0 = 1$) is the first byte transferred to send a Call Request (CRQ) signal to the ACU. The Write Control command terminates after the last digit has been transferred. Termination of the Write Control is caused by address equality in the 70/25 Processor and a byte count equal to zero in the 70/45 and 70/55 Processors.

When the communication line connection has been established with the remote location, a signal is received from the data set which causes an interrupt to occur. The sense byte ($2^3 = 1$) is set indicating receipt of the

AUTO CALL FUNCTION (Cont'd)

Data Set Ready signal. This setting indicates to the program that the connection has been established and that a transmission can be initiated.

If the connection is not properly established or if a common carrier error is detected, the control functions as follows:

1. Sets the Standard Device Byte ($2^2 = 1$).
2. Sets the Sense Byte ($2^5 = 1$ — Abandon Call and Retry).
3. Sets the Interrupt.
4. Resets the Call Request.
5. Activates the error light and buzzer.
6. Terminates the Write Control command.

On recognition of this condition, the program should attempt to redial the distant processor until the connection is established. If after several retries the connection is not established, the call should be abandoned, and notification of the situation should be printed out for the operator and/or supervisory intervention.

INTERRUPT

♦ The conditions which cause the communication control to set the interrupt indicator can be classified as service request interrupts and error interrupts. These interrupts have been previously described but are listed here by type for ease of reference.

SERVICE REQUEST INTERRUPTS

♦ 1. Receipt of Data Set Ready signal from the data set (Transmit Mode).
2. Receipt of DD2.
3. Receipt of DD1.
4. Receipt of ACK.
5. Receipt of Idle Line characters.
6. ACR received from ACU (Communication line connection not established).

ERROR INTERRUPTS

♦ 1. Loss of Data Set Ready signal from the data set.
2. Loss of Power Indication from the ACU.
3. 19-second time-out.
4. 1.6-second time-out.
5. Error signal on the ACR circuit.
6. Ring Indicator present at the initiation of a Write Control command.
7. Character parity error.
8. Block parity error.
9. Termination of a Read command before receipt of DD2.
10. No data time-out.

ACCURACY CONTROL

TRANSMIT MODE

♦ The accuracy control features of the 70/653 Communication Control include the detection and indication of the error conditions listed below.

♦ *Loss of the Data Set Ready signal from the data set.*

1. Interrupt indicator is set.
2. Termination of the Write Control command.
3. Condition code 1 (inoperable) is set when the Sense command is initiated.

This error condition can only be cleared by the depression of the Master Reset switch.

Loss of the Power Indication from the Automatic Calling Unit.

1. Interrupt indicator is set.
2. Termination of the Write Control command.
3. Condition code 1 (inoperable) is set when the Sense command is initiated.

This error condition can only be cleared by the depression of the Master Reset switch.

Time-out.

1. ACK is not received within 1.6 seconds after transmitting DD2 and BP.
   a. Standard device byte ($2^2 = 1$) is set.
   b. Sense byte ($2^2 = 1$) is set.
   c. Interrupt indicator is set.
2. DD1 was not received within 19 seconds after receipt of an ACK from a remote location.
   a. Standard device byte ($2^2 = 1$) is set.
   b. Sense byte ($2^2 = 1$) is set.
   c. Interrupt indicator is set.

Detection of an Error signal on the Abandon Call and Retry circuit when using the Automatic-Calling Unit.

1. Standard device byte ($2^2 = 1$) is set.
2. Sense byte ($2^5 = 1$) is set.
3. Interrupt indicator is set.
4. Termination of the Write Control command.

Ring Indicator present when a Write Control command is initiated.

1. Standard device byte ($2^2 = 1$) is set.
2. Sense byte ($2^2 = 1$) is set.
3. Interrupt indicator is set.
4. Termination of the Write Control command.

RECEIVE MODE

♦ *Loss of the Data Set Ready signal from the data sets.*

1. Interrupt indicator is set.
2. Termination of the Read command.
3. Condition code 1 (inoperable) is set when the Sense command is initiated.

This condition can only be cleared by depressing the Master Reset switch.

Time-out.

1. "No Data" received for more than one character time.
   a. Standard device byte ($2^2 = 1$) is set.
   b. Sense byte ($2^2 = 1$) is set.
   c. Interrupt indicator is set.
   d. Termination of the Read command.
2. No response from a remote location within 19 seconds after transmission of a DD1.
   a. Standard device byte ($2^2 = 1$) is set.
   b. Sense byte ($2^2 = 1$) is set.
   c. Interrupt indicator is set.

   Exception: Transmission of a DD1 following a TERM code.
3. DD1 was not received from the processor within 19 seconds after receipt of DD2 and BP.
   a. Standard device byte ($2^2 = 1$) is set.
   b. Sense byte ($2^2 = 1$) is set.
   c. Interrupt indicator is set.

Character parity error detected.

1. Standard device byte ($2^2 = 1$) is set.
2. Sense byte ($2^2 = 1$) is set.
3. Interrupt indicator is set.
4. Terminates Read commands.

Block Parity error detected.

1. Standard device byte ($2^2 = 1$) is set.
2. Sense byte ($2^2 = 1$) is set.
3. Interrupt indicator is set.
4. Terminates Read command.

Termination of Read command on address equality (70/25) or byte count equal to zero (70/45 and 70/55) before the receipt of DD2.

1. Standard device byte ($2^2 = 1$) is set.
2. Sense byte ($2^2 = 1$) is set.
3. Interrupt indicator is set.

RECEIVE MODE (Cont.)

In addition to the program indications, these error conditions cause the appropriate audible and visual alarms of this control to be activated (See Controls and Indicators).

Each of the above error conditions causes the interrupt indicator to be set. In the 70/25 the interrupt is indicated by setting the condition code to zero (I/O Interrupt). In the 70/45 and 70/55 the interrupt is indicated in the Interrupt Flag Register by setting the appropriate bit corresponding to the selector channel or the multiplexor channel that requires service.

CONTROLS AND INDICATORS

TEL (Momentary Contact Switch)

♦ Operating this switch causes a TEL character to be transmitted to the line (when permitted). This activates the corresponding TEL indicator and buzzer at both locations and notifies the remote operator to go to the telephone associated with the data set. The accuracy checking circuits are not *set* because a *confirm* character (ACK) is not returned by the remote equipment.

TEL can be sent when this unit is in the Idle Mode. TEL shall not be sent during message transmission. Specifically, if this unit is transmitting, it is permitted to send TEL after receiving DD1, or after the 19-second *time-out* if DD1 is not received within 19 seconds after transmitting DD2. If this unit is receiving, it is permitted to send TEL after sending ACK, or in lieu of ACK if an *error* condition exists. Receipt of Transmission of TEL sets condition code 1 (inoperable).

TEL (Indicator and Buzzer)

♦ Receipt or Transmission of TEL character activates both the TEL indicator and buzzer. These alarms are deactivated by placing the associated data sets in the Talk Mode. After transmission or reception of the TEL character, this unit returns to the Idle Mode, and terminates the Write or Read instruction, if staticized.

TRANSMIT (Indicator)

♦ This indicator is activated whenever this unit is in the Transmit Mode.

RECEIVE (Indicator)

♦ This indicator is activated whenever this unit is in the Receive Mode.

Tx ERROR (Indicator and Buzzer)

♦ This indicator is activated whenever a transmit *Error* condition has been detected. (See Accuracy Control, page 12.) Also, the *Error* condition activates the buzzer. The indicator and buzzer are deactivated when the computer program attempts a retransmission (except when the error is caused by loss of Data Set Ready signal, then manual depression of Master Reset switch is required). The buzzer can be deactivated by operating the Buzzer Reset switch.

Rx ERROR (Indicator and Buzzer)

♦ This indicator is activated whenever a receive *Error* condition has been detected. (See Accuracy Control, page 13.) Also, the *Error* condition activates the buzzer. The indicator and buzzer are deactivated when data is again received from the communication line (except when error is caused by loss of Data Set Ready signal, then manual depression of Master Reset switch is required). The buzzer can be deactivated by operating the Buzzer Reset switch.

BUZZER RESET (Momentary Contact Switch)

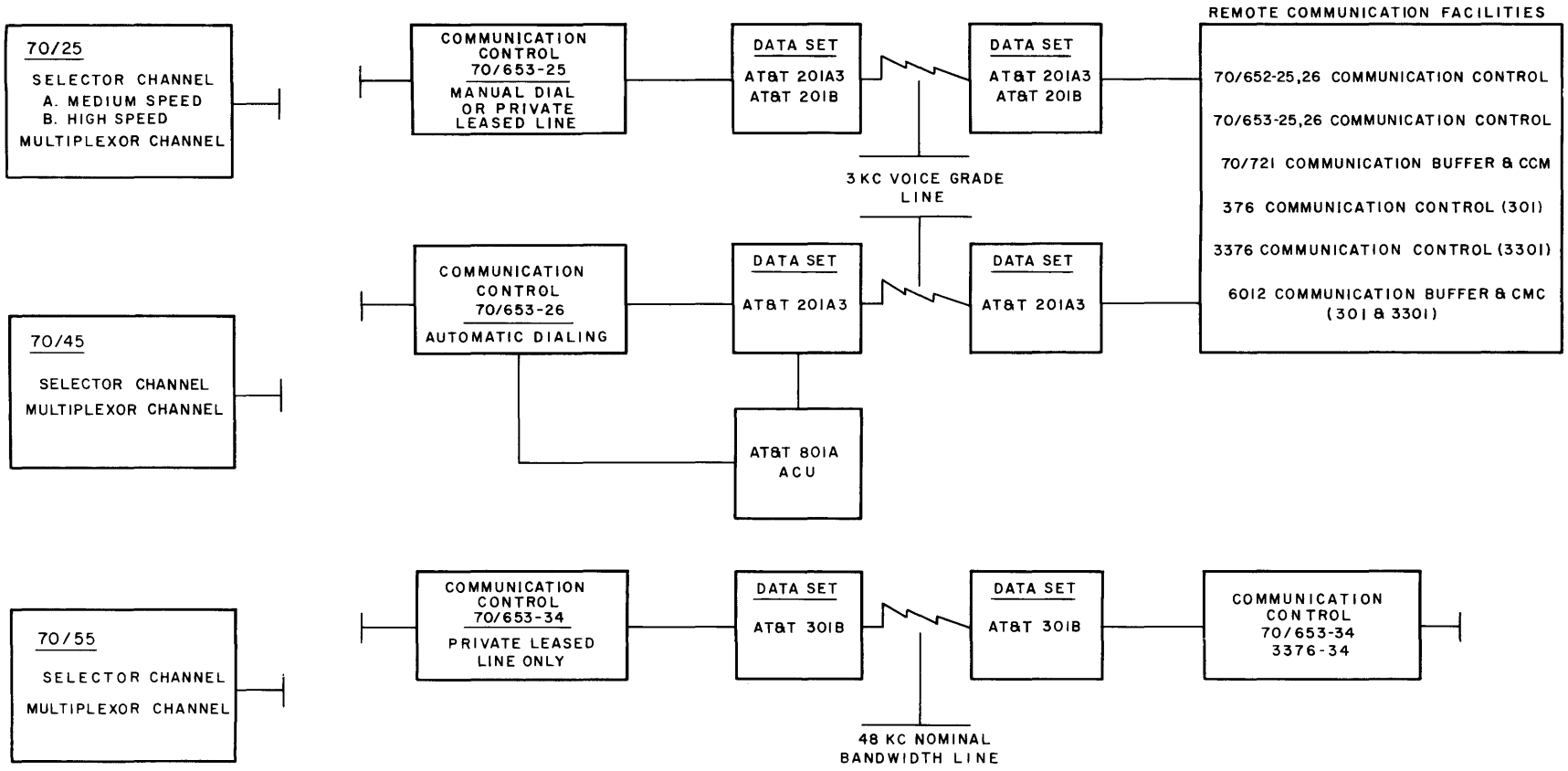
♦ Operation of this switch restores this unit to the Idle Mode, and *clears* errors. This switch is not operable if the Data Set Ready signal is present from the data set. Exception: Switch is always operable when using a data set without alternate voice facilities.

AUTO-MANUAL-PRIVATE (Switch)

♦ This switch must be placed in the AUTO position when using the Automatic Calling Unit. This switch must be placed in the MANUAL position when using manual dialing. This switch must be placed in the PRIVATE position when using a private leased-line.

APPENDIX A

70/653 Communication Control Configurator



NOTE: THE COMMUNICATION CONTROL OCCUPIES ONE TRUNK OF A MULTI-TRUNK CHANNEL.