BSTAM

BYROM SOFTWARE TELECOMUNICATIONS ACCESS METHOD

A commercially oriented,
telecommunications facility,
for CP/M™* CP/M-86,™* MS-DOS,™* PC-DOS™* systems.

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FOREWORD

Audience

This manual is intended for the user of systems who has a need for data communication services.

Purpose

It will describe in detail how to send and receive any file over telephone lines.

Scope

The reader should gain sufficient comprehension of types of channels, modes of transmission, sending and receiving any file.

Acknowledgement

The number of individuals and groups who have contributed to this manual makes it impractical to give individual credit. Their contributions are greatly appreciated for they have helped to make this a more useful publication.

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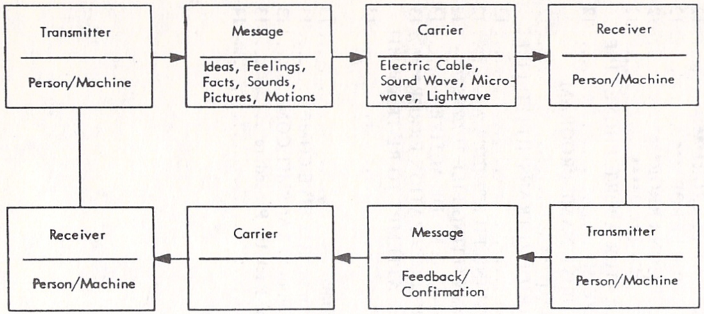

Figure 1A. The Communications Process

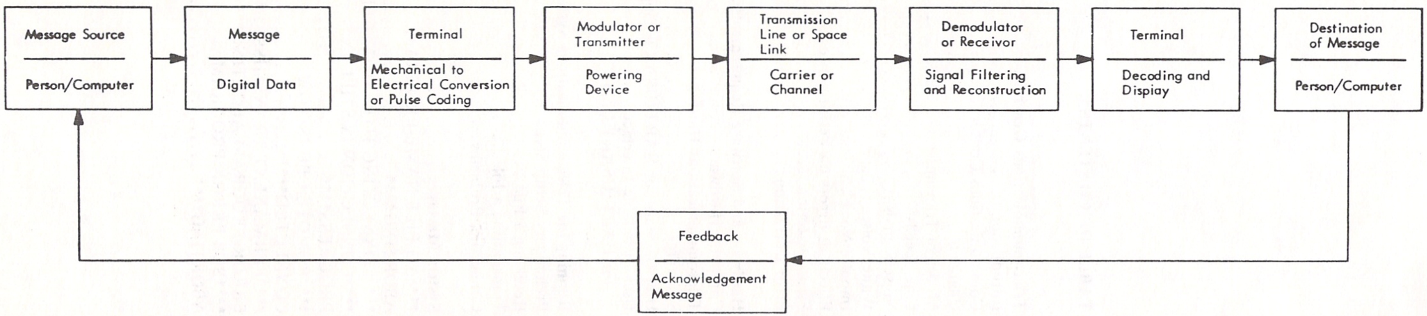

Figure 1B. Conceptual Telecomunications Network

1. TELECOMMUNICATIONS GENERAL

1.1 Introduction

Managements of today's complex and diversified businesses must have up to date knowledge of their customers, and to maintain close surveillance over critical activities. This calls for rapid collection, processing, and subsequent use of business information.

Because data collection by messenger or mail is slow and subject to weather and traffic conditions, many new types of communications systems have been developed. Advances in computer design and application, have brought about increased use of electronic transmission systems for conveying information between widely separated business locations and the computers installed there. Thus, it is possible for the management at the main office to know in seconds what the state of affairs is at a branch at the other end of the country.

1.2 Communications Concepts

In this publication communication is defined as the transmission of signals between points of origin and destination without alteration of the sequence or of the information content of such transmission. A special form of communication whereby information is conveyed over a distance is called telecommunications. Telephone, radio, and television are examples of modern telecommunications.

The communication process generally requires at least four parts — a transmitter or source of information; a message; a transmission channel or carrier, often called a data link; and a receiver of transmitted information. Feedback is usually required to close the loop. This is illustrated in Figure 1.

1.2.1 Channels

A channel or communications link is defined as a path for electrical transmission between two or more stations or terminals. It may be a single wire, a group of wires or a special part of the radio frequency spectrum. The purpose of a channel is to carry information from one location to another. All channels have limitation on their information handling abilities,

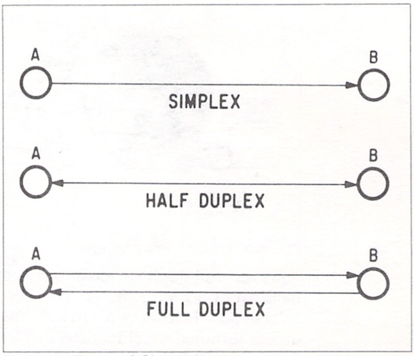

Figure 2. Types of Channels

depending upon their electrical and physical characteristics. The term "circuit" is used conversationally as a synonym for channel, but in practice, a circuit may contain several communications channels.

Three basic types of channels are simplex, half duplex and full duplex. As an example of each, consider transmission between points A and B in Figure 2.

Transmission from A to B only and not from B to A, describes a simplex channel.

Transmission from A to B and then from B to A but not simultaneously, describes a half duplex channel.

Transmission from A to B and from B to A simultaneously describes a full duplex transmission.

Usually, all three types of channels are available. In the United States the communications companies or common carriers offer only half or full duplex channels. The half duplex channel may be used in simplex mode by the selection of terminals which restrict the direction of the half duplex channel, e.g., a "transmit only" terminal. Figure 2 illustrates the channel terminology.

Data can be transmitted in half or full duplex modes over 2 or 4 wire facilities. The assumption that half duplex operation utilizes a 2 wire circuit and a full duplex requires a 4 wire circuit can be erronious. In most instances half duplex transmission is over a 2 wire circuit;

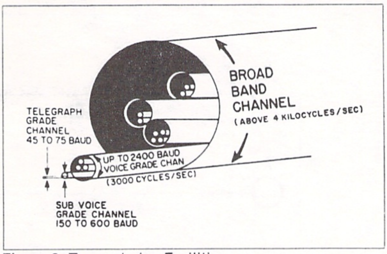

Figure 3. Transmission Facilities

however, full duplex transmission can be handled by a 2 wire circuit. The 2 or 4 wire selection is the common carrier's responsibility unless terminal specifications call for 2 wire or 4 wire connections.

In addition to the direction of transmission, a channel is characterized by its band width. In general, the greater the band width of the assigned channel the higher the possible speed of transmission. The bits are formed into data characters or control codes by equipment included in the terminals.

Data channels are graded or identified on the basis of their information carrying capacity as specified by their bit speed capacity. The range of channels includes broad band, voice grade, sub voice and telegraph. Broad band, as its name implies, is the widest or highest grade, while telegraph is the narrowest or lowest grade channel as illustrated in Figure 3.

1.3 Modes of Transmission

There are two primary modes of transmission.

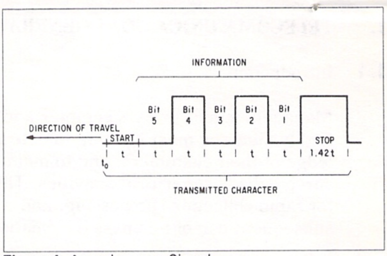

Figure 4. Asynchronous Signal

They are asynchronous and synchronous.

A typical asynchronous signal is shown in Figure 4.

The five information bits representing a character are preceded by a zero bit one unit of time in length and followed by a one bit of 1.42 units of time. These "start" and "stop" bits are used to separate characters and to synchronize the receiving station with the transmitting station. When signal elements or bits of a character travel in a transmission medium in sequence (first bit first, etc.) as shown in Figure 5A, it is called a serial mode or serial transmission. With the start and stop bits added, this type transmission is called serial start-stop or asynchronous, meaning each character is individually synchronized.

Figure 5B shows a series of bits traveling in a communications medium without the start-stop bits. This is synchronous transmission. It requires more complex and, usually, more costly terminal equipment. A synchronous system is a "clocked" or "fixed rate" system,

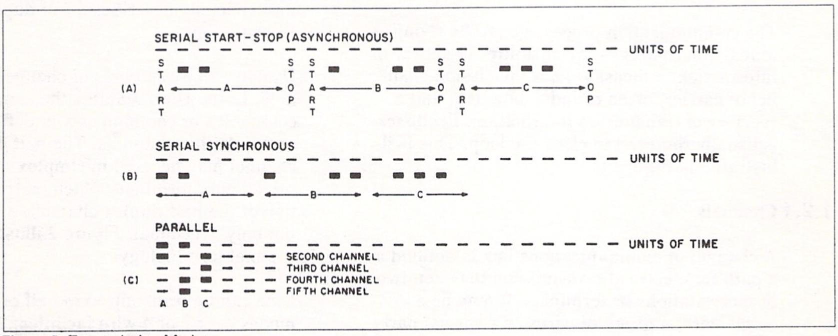

Figure 5. Transmission Modes

meaning the line is sampled at regular intervals to receive and record information bits. Synchronous transmission permits more information to be passed over a circuit per unit time because no transmission time is required for the insertion of start-stop signal elements. This is illustrated in Figures 5A and 5B which show 21 units of time are required for asynchronous transmission compared to only 15 units for synchronous transmission of the same information.

It is possible to send all the information bits in a character simultaneously over separate paths or channels as shown in Figure 5C. This mode of communication is called parallel transmission.

The advantage of parallel transmission, that makes the transmitters less costly than the receiving equipment, is the relatively low cost of producing such a signal. The parallel mode of transmission is most commonly used where the increased bandwidth is cheaper than serializing equipment, or where more transmitters are required than receivers.

Let us summarize the advantage and disadvantages of the various methods of transmission discussed so far. (See Table 1)

1.4 Line Speeds

Regardless of the mode of transmission (serial or parallel), the measure of the maximum speed at which information can be conveyed is called the Bit Rate. In high speed data communications, the term kilobits, meaning thousands of bits per second, is often used.

The line signalling speed is measured in bauds. The baud is defined as the reciprocal of

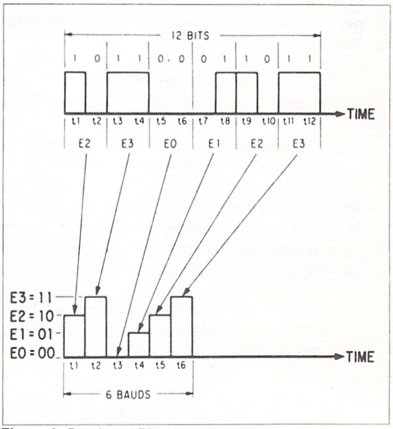

Figure 6. Bauds vs. Bits

the length in seconds of the shortest element in the signaling code. A bit per second is equal to a baud. Figure 6 shows how signal amplitude may be used as a coding method.

Line speeds also can be expressed in either words per minute or characters per second. Characters per second is most commonly used to express the operating speed of a parallel transmission system. However, direct equivalency exists between bit rate, words per minute and characters per second. If any measure of speed is known, the other two expressions can be calculated.

In communications, a word consists of five characters and one space for a total of six characters. All punctuation, spacing and control characters must be counted because they must be transmitted.

Table 1	Serial		
	Start—Stop	Synchronous	Parallel
Advantages	Low cost receiver and transmitter	Good ratio of data to control bits (low redundancy)	Low cost transmitter
Disadvantages	High rate of control information to data information (high redundancy)	Much data can be lost beween synch pattern if devices become "un-synched"	High cost receiver may wast bandwidth

The conversion from bits per second to words per minute can be made using the following formula:

$$\text{Bits Per Second} = \frac{\text{Words/Min} \times \text{Char/Word}}{60 \text{ Seconds}} \times \text{Bits/Char}$$

With this formula, and knowing that the Baudot Code has 7.42 Bits/Character, the bit rate of 60 words per minute teletypewriters service can be calculated as follows:

$$\text{Bits Per Second} = \frac{60 \text{ Words/Min} \times 6 \text{ Char/Word} \times 7.42 \text{ Bits/Char}}{60 \text{ Seconds}}$$

$$= \frac{360 \text{ Char/Min} \times 7.42 \text{ Bits/Char}}{60 \text{ Seconds}}$$

$$= 6 \text{ Char/Sec} \times 7.42 \text{ Bits/Char}$$

ANSWER = 45.45 Bits/Second

Note: For convenience these figures can be rounded off to (7.5) and (45).

When the bit rate is known, words per minute (WPM) can be determined from the formula:

$$\text{WPM} = \frac{\text{Bits/Second} \times 60 \text{ Seconds/Min}}{\text{Char/Word} \times \text{Bits/Char}}$$

$$= \frac{45 \text{ Bits/Second} \times 60 \text{ Seconds/Min}}{6 \text{ Char/Word} \times 7.5 \text{ Bits/Char}}$$

ANSWER = 60 WPM

1.5 Noise Signals

Noise is the name given to unwanted signals which appear on a communication channel and distort or mask the baseband signals. Noise can come from terminals, switching equipment, or the communication channel itself. One of the most common types is noise induced by high voltage power lines. Other noise causes are cross talk currents from adjacent channels and unbalanced line conditions.

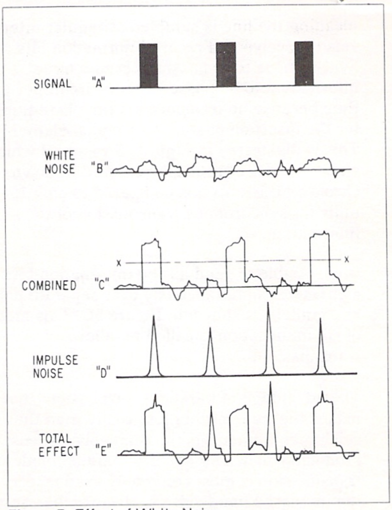

Figure 7. Effect of White Noise

1.5.1 White Noise

This type of noise usually maintains a constant level and is called "steady" or "white" noise. If the "white" noise level is relatively low, it ordinarily causes no difficulty or errors in data communications. Figure 7 shows a digital signal A impressed upon a communication channel having a white noise B. The signal C will be unaffected and correctly identified at the receiver as long as the noise level remains below the signal detection level X.

1.5.2 Impulse Noise

There is another type of noise, however, which sometimes cannot be heard but which can cause great difficulty in data communications. This is called impulse noise D and can be caused by lightning, switching equipment or maintenance personnel. Impulse noise, as its name implies, takes the form of large narrow spikes or impulses which can either obliterate or negate a data signal E. Figure 7 illustrates impulse noise. Impulse noise limitations are expressed in both magnitude and rate of occurence. A typical common carrier specification would be about 70 peaks per hour as a tolerable occurrence rate.

The term "signal to noise ratio" (S/N) is used to express noise levels. Its unit is the decibel (db) and it is measured on a logarithmic scale from a standard or reference signal level.

1.5.3 Effects of Errors on Performance

Considerable effort has resulted in a family of statistics concerned with actual error occurrence during data calls on the exchange telephone network. Although impossible to predict, an average rate of one error bit to every 104 to 105 bits transmitted can be considered representative of average performance. The important point to remember is these are averages resulting from thousands of transmissions and for any one call performance may deviate drastically. As expected, it was found that error rates went up as the bit rate was increased. Error rates also were found to be higher during the busy times of the day, indicating error rate is also a function of switching activity.

Errors may be classified into two types: The random or intermittent type and the burst or long series of errors type. The random error is the most troublesome because it can occur at any time. The burst errors usually are detected easily because entire blocks of information are received in error.

The effect or "costliness" of an error must be evaluated before error controls are considered. For example, teletypewriter communication is ordinarily in the form of plain message text. Errors in the form of a few misspelled words wouldn't appear to be very costly — especially when compared with the effect of loading a program containing transmission line errors into a computer.

In summary, data signals are subject to numerous "hazards" while traveling in a communications medium. These usually are the result of the many factors mentioned or may even be the result of less significant happenings such as sudden transmission level changes. The problems of errors and error control must be considered in any data communication system.

1.5.4 Error Detection

There are several methods used to detect

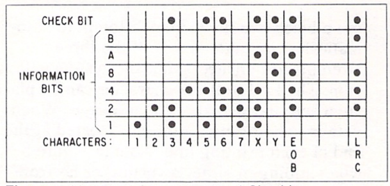

Figure 8. Vertical and Longitudinal Checking

errors. The two most commonly used are parity or vertical redundancy check (VRC) and longitudinal redundancy check (LRC). Parity may be either even or odd, meaning the sum of the "one" bits for any character or column will always be even or odd depending upon which arrangement is chosen. Figure 8 shows a six bit code arranged for odd parity. The seventh bit is the parity or check bit. The number of information bits in characters 3, 5, 6 X and Y shown are even. To satisfy the odd parity requirement, a bit is simply inserted in the 7th (check) position for each of the characters to change the sum of the "one" bits to an odd number. This is done to all even bit characters. At the receiving terminal, each character is checked for the proper parity. If an odd number of bits are either lost or added, the character received will be in error. The receiver will detect the error, punch special characters, turn on an indicator light and send a negative check answer indicating errors were detected.

With longitudinal checking, each transmitting and receiving terminal generates a separate count of "one" bits for each of the bit positions of the code. This count, when completed, results in an LRC character which could be considered to be a horizontal parity bit for each channel. For checking purposes, data are grouped into a unit containing a specified number of characters. This unit is called a block and may vary in length, depending upon the application. After each block of information, indicated by an EOB (end of block) character, the LRC character generated at the transmitter is sent to the receiver. It is compared to the LRC character generated by the receiving terminal. If they are equal, a positive response is sent back and the next information block is transmitted. If they are unequal, a negative answer is sent back to the transmitter. On receipt of a negative answer, many terminals will retransmit a block two times in an attempt to automatically eliminate errors. If the three attempts are unsuccessful, the system will stop. The End of Block character can be placed anywhere in the text of the message. When data is to be printed it often is located at the end of each printing line. Note in Figure 8 when adding in either a vertical or horizontal direction, the sum is always an odd number. If it is not, the received information is in error. Check this for yourself by adding or removing a single bit. Try it with 2 bits, etc. Another form of checking is cyclic or polynomial checking. When compared with VRC and LRC, it is considerably more complex, and as a result, capable of detecting almost all errors.

Cyclic checking works similar to LRC. Instead of generating a check character by adding the bits in each data channel of a block, it divides all the serialized bits in a block by a predetermined binary number. The remainder of this division is the check character which is sent and compared with the check character obtained in similar fashion at the receiving terminal.

1.5.5 Error Correction

Checking is a means of detecting errors only. Some terminals have the ability not only to detect errors but to correct them. Figure 9 shows the same set of characters previously shown but with an error introduced. The error is the addition of an unwarranted "one" bit in the character "four". The receiving terminal will automatically recognize the vertical and horizontal "no check". Their intersection is the bit in error and it will be negated or reversed.

Error detection and/or correction take time. Rated or nominal speed has been defined as the highest speed at which a terminal can operate. The effective speed reflects the added time necessary for checking and control functions and must always be considered. If errors are being received, several retransmissions would be required and effective speed would be further reduced.

Effective speed for a representative terminal is calculated below and is based on a rated speed of 135 BPS and a block equal to one seven inch writing line:

# of characters in a block = 7 inches X 10 characters/inch
= 70 characters

# of bits in a block = 70 characters X 9 bits/character
= 630 bits

Time to transmit a block = 630 bits ÷ 135 bits/second
= 4.7 seconds

Effective Speed = 630 bits ÷ total time (transmission + checking time)
= 630 bits ÷ (4.7 sec. + 0.3 sec.)
= 630/5

Effective Speed = 125 bits/second

Should average error performance be experienced, one out of 15 blocks would be retransmitted which would reduce the effective speed to about 110 bits/second. In high speed systems where start and stop times become significant, effective speed may be as low as one-half rated speed.

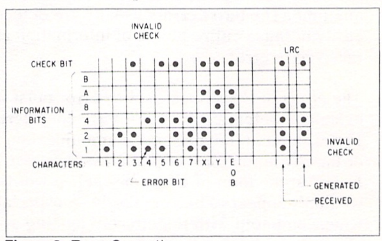

Figure 9. Error Correction

2. HARDWARE AND SOFTWARE REQUIREMENTS

2.1 Computer Hardware

The minimum requirements for the Computer Hardware are:

A) 32K Memory
B) 1 Disk Drive
C) 1 CRT
D) CPU 8080/Z-80/8085/8088/8086

2.2 Telecommunications Hardware

The minimum requirements for the Telecommunications Hardware are:

A) Asynchronous modem or short wire between two computers (may be 300 - 9600 Baud). If using modems, you will need the following options:
   1) Full duplex option
   2) Originate or Answer option
   3) RS-232 option

2.3 Software

The telecommunications system requires CP/M, CP/M-86, MS-DOS, PC-DOS or some derivative to be the primary operating system. Also, RECEIVE.COM and TRANSMIT.COM must be present on the system.

2.4 User Interface for UART/USART Chips.

A) 1602, 8250, 8251, 6850, 5501, ZSIO, etc.
B) All of the above programs are included on the disk if BSTAM has not been installed on your computer.

2.5 User Installable Interface for UART/USART Chip

BSTAM can be installed on many types of computers. If BSTAM has not been installed for your computer you will need to do this. On your disk there are many ASM files. Each ASM file is for a different computer. Also, some ASM's are for more than one computer. You must pick out the ASM FILE for your computer and assemble it. Before assembling, you must also know what port addresses you will be using. The first part is the "data" port address and the second part is the "status" port. Together they make up one port on your computer. After you know what ports you are using, you will need to change two equates in the ASM file you will be assembling. The first is labeled TPS; which is the status port. The second is labeled TP; which is the data port. For example, in U8251.ASM to change from data 2 and status 3, find the following:

```
TPS     EQU     3
TP      EQU     2
```

After finding the equates just change them to match the ports you will be using.

EXAMPLE OF UART INSTALLATION DIALOGUE FOR CP/M

```
A>ASM U8251
A>DDT RECEIVE.COM
   or
A>DDT TRANSMIT.COM
-IU8251.HEX
-R
-^C
A>SAVE 27 RECEIVE.COM
   or
A>SAVE 35 TRANSMIT.COM
```

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3. RUNNING THE TELECOMMUNICATION SYSTEM

3.1 Preliminary Setup Steps

To receive or transmit a CP/M file (this may be a COM type) these preliminary steps are required.

A) Be sure to have the modem in Full Duplex.
B) Decide which modem (sender or receiver) will be set to Originate. The other end must have their modem set to Answer.
C) Decide which file to be received or transmitted.
D) Set head set in cradle (if using acoustic couplers) or press data button (if using direct wired modems). At this point each end should have a CARRIER LIGHT displayed. The system is now ready to receive or transmit data.

3.2 Receiving a File

Key in the following:

A>RECEIVE [A: / B:] [*] ← Extended Mode

The message:

******CONNECTING TO REMOTE CPU******

will indicate that the CPU is looking for a sign on message from the other end (transmitter). After 5 to 10 seconds the message

******TIME OUT ERROR******

will indicate that the REMOTE CPU still has not signed on. When the sign on message is received,

******REMOTE CPU IS NOW CONNECTED******

will appear on the screen and data transmission will begin. As each block of data (128 bytes + line control bytes) is received it is checked for transmission errors. If no errors are found, the message

******BLOCK RECEIVED CORRECTLY******

will be displayed. If errors are found in the data, the receiver will signal the transmitter to resend the block again. After 20 successive errors the following messages will be displayed

******PERMANENT TRANSMISSION ERROR — PROGRAM ABORTING******

----FILE IS NOW STORED ON DISK----

******DISCONNECTING FROM REMOTE CPU****.**

SEE CHAPTER 4 FOR ERROR MESSAGE DESCRIPTIONS.

3.3 Transmitting a File

Key in the following:

A>TRANSMIT [A: / B:] [FILENAME.TYP / *.COM] ← Full wildcards may be used

The message:

******CONNECTING TO REMOTE CPU******

will indicate that the CPU is looking for a "POSITIVE ACKNOWLEDGE" from the receiver. This "POSITIVE ACKNOWLEDGEMENT" signal indicates that the remote CPU has received the sign on and is ready to accept data. If no signal has been received after 5 to 10 seconds, the message

******TIME OUT ERROR******

will indicate that the REMOTE CPU has not sent a "POSITIVE ACKNOWLEDGEMENT". When the signal has been received, the message

******REMOTE CPU IS NOW CONNECTED******

and data transmission can now begin. After each block of data (128 bytes + line control bytes) has been transmitted, a "POSITIVE ACKNOWLEDGEMENT" must be received from the "RECEIVER" indicating that the block was received correctly. If the block was not received correctly, a "NEGATIVE ACKNOWLEDGEMENT" is returned and the block is retransmitted. After 200 successive errors the message

******PERMANENT TRANSMISSION ERROR — PROGRAM ABORTING******

will be displayed. If a "POSITIVE ACKNOWLEDGEMENT" was received the message

******BLOCK TRANSMITTED CORRECTLY******

will be displayed.

The process of transmitting and receiving blocks of data is repeated until the entire file has been transmitted (no file size limit). When the entire file has been transmitted, the messages

----FILE HAS BEEN COMPLETELY TRANSMITTED----
******DISCONNECTING FROM REMOTE CPU******

will be displayed.

SEE CHAPTER 4 FOR ERROR MESSAGE DESCRIPTIONS.

3.4 Connecting Problems

There are a number of reasons why connection may be difficult. Table 2 shows a list of possible problems with a solution to each one.

After the remote CPU has connected, errors may continue to be displayed. These errors may be due to "NOISE" on the line. If the errors continue, re-dial the number.

Table 2.	Symptom	Solution
	A. No Carrier Light	A. Push headset harder into coupler B. Re-dial 1. Key in control C 2. Re-dial number C. Modify modem to transmit a stronger tone
	B. Steady Time-out Errors	A. Start over 1. Key in control C 2. Receive or transmit the file again
	C. Steady Error Messages 1. Framing Errors 2. Parity Errors 3. Overrun Errors 4. Lost Data Errors 5. Exception Errors 6. BCC Errors 7. All of the above in any combination	A. Start over 1. Key in control C 2. Receive or transmit the file again B. Re-dial 1. Key in control C 2. Re-dial number 3. Recieve or transmit the file again C. If using couplers try the following: 1. Push the headset harder into coupler 2. Use a different headset

4. SYSTEM MESSAGES

4.1 ****NO FILE NAME — PROGRAM ABORTING****

This message will be displayed if the file name is forgotten to be keyed in after "TRANSMIT".

A> TRANSMIT [A:/B:] FILENAME.TYP

FILENAME.TYP (Filename was missing)

4.2 ****CONNECTING TO REMOTE CPU****

This message indicates that the computer is looking for a sign on message (receiver) or a positive acknowledgement (transmitter) from the remote computer.

4.3 ****CONNECTION IS STILL IN PROGRESS****

This message is very seldom displayed. If displayed, this may indicate that the remote computer may have erroneously received a false connect signal. In any event, key in a Control C and start over if connection is not made within 5 to 10 seconds.

4.4 ****REMOTE CPU IS NOW CONNECTED****

After receiving the correct sign on (receiver) or positive acknowledgement (transmitter) signal this message will be displayed. At this point data transmission will begin.

4.5 ****PERMANENT TRANSMISSION ERROR — PROGRAM ABORTING****

This message will be displayed if 200 successive errors are displayed.

4.6 ****BCB ERROR — PROGRAM ABORTING****

(BCB = Block Control Byte Counter)

As each block of data is transmitted and received, a BCB is transmitted along with the data. This BCB byte is used to determine if a block of data was missed. This message will only appear if error recovery procedures received a false positive acknowledgement — NOISE ON THE LINE.

4.7 ****BLOCK RECEIVED CORRECTLY****

If the entire block was received correctly this message will displayed (only on receive).

4.8 ****BLOCK TRANSMITTED CORRECTLY****

If a positive acknowledgement was received after the block was transmitted this message will be displayed (only on transmit).

4.9 ----FILE IS NOW STORED ON DISK----

This message will be displayed on two occasions:

A) The entire file has been received correctly.
B) Error recovery has terminated transmission — partial file is stored on disk.

(Receive only)

4.10 ----FILE HAS BEEN COMPLETELY TRANSMITTED----

This message will be displayed when the end of the file is found, and when the last block of transmitted data has been verified — POSITIVE ACKNOWLEDGEMENT. (Transmit only)

4.11 ****DISCONNECTING FROM REMOTE CPU****

This message indicates that the remote CPU has signed off and the telephone may be hung up.

4.12 ****FILE IS EMPTY — PROGRAM ABORTING****

When an empty file is found this message will be displayed.

4.13 ****FRAMING ERROR****

If a valid stop bit is not received at the end of every byte this message will be displayed.

4.14 ****PARITY ERROR****

As each byte is received it is checked for EVEN parity. If the byte does not have the correct numbers of bits set this message will be displayed.

4.15 ****OVERRUN ERROR****

This message is usually displayed when the receiver is not in time with the transmitter.

4.16 ****BCC ERROR****

BCC = Block Control Check or CRC (Cyclic Redundancy Check)

After each block of data is transmitted a BCC byte is transmitted to the receiver. This BCC byte is compared with the receivers calculated BCC byte and if they do not match this message is displayed. (Receive only)

4.17 ****LOST DATA ERROR****

Because of line protocol, certain control bytes must be present as each block of data is transmitted. If noise is present on the line, some line control bytes may be distorted and cause this message to be displayed.

4.18 ****TIME OUT ERROR****

If there has been no signals on the line after 5 to 10 seconds this message will be displayed.

4.19 ****EXCEPTION ERROR****

This message will be displayed if the two computers try transmitting at the same time. The transmitter will always discontinue its message and receive the incoming message.

4.20 ****LENGTH ERROR****

Because of cross talk on telephone lines, it is possible to receive a burst of noise in the data portion of a block. If this noise is valid, meaning parity and framing was correct, a check is made on the expected length to the received length, and if different, this message will be displayed.

4.21 ****OPERATOR ABORT, PHONE LINE IS ACTIVE****

This message is displayed only if the operator has keyed in a Control C. A Control C will only be effective before the "CONNECTED" message is displayed. After the "CONNECTED" message has been displayed there are two ways to stop the system.

A) Reset the computer (Hit Stop)
B) Wait for 200 successive error displays

4.22 ****NO DRIVE NAME - PROGRAM ABORTING****

This message is displayed when receiving a group of files. To receive a group of files be sure to key in RECEIVE A: or RECEIVE B:. Be sure to key in the colon:.

4.23 ----OVERRIDING TRANSMITTED FILE NAME---- ----USING USER SUPPLIED NAME---- ----ONLY ONE FILE WILL BE RECEIVED----

These three (3) messages are displayed when you key in RECEIVE [A: or B:]FILENAME.TYP. This feature is very useful for naming a file with another name to prevent overlaying an existing file.

4.24 ----RECEIVING FILE ????????.???----

This message is displayed upon receiving the transmitted file name. The ?'s are replaced with the actual file name. This file name may be overridden by the command:

RECEIVE [A: or B:]FILENAME.TYP.

4.25 ----TRANSMITTING FILE ????????.???----

This message is displayed just before transmitting any data. The ?'s are replaced with the actual file name. This file name is transmitted to the receiver for file naming at the receiver end.

4.26 ----EXTENDED MODE ACTIVE----

This message is displayed only in the receive mode.

4.27 ****SYNCHRONIZATION ERROR****

This message is displayed when receiver or transmitter has been restarted in mid-file operations.

4.28 ****WILL ATTEMPT TO RE-TRANSMIT FILE****

This message will always follow the synchronization error for the transmitter only.

5. SAMPLE RUNS

5.1 Sample run of "RECEIVE.COM"

The run below shows three error messages. The first two error messages are a result of no signals on the line — receiver started before transmitter. The message following the third error message is an example of total error recovery of the fourth data block.

```
A>RECEIVE A:
BYROM SOFTWARE
TELECOMMUNICATIONS
SERIAL NO. 100 VERSION 4.6
COPYRIGHT (C) 1983 ALL RIGHTS
RESERVED
****CONNECTING TO REMOTE CPU****
****TIME OUT ERROR****          (1) Error
****TIME OUT ERROR****          (2) Error
****REMOTE CPU IS NOW
CONNECTED****
****BLOCK RECEIVED CORRECTLY****
****BLOCK RECEIVED CORRECTLY****
****BLOCK RECEIVED CORRECTLY****
****LOST DATA ERROR****         (3) Error
****BLOCK RECEIVED CORRECTLY****
****BLOCK RECEIVED CORRECLTY****
----FILE IS NOW STORED ON DISK----
****DISCONNECTING FROM REMOTE
CPU****
A>
```

5.2 Sample run of "TRANSMIT.COM"

The run below shows one error message. While transmitting the fourth data block, the receiver encountered an error, and sent back a "NEGATIVE ACKNOWLEDGE." The exception error indicates both CPU's were transmitting at the same time. The transmitter discontinued transmitting and received a "NEGATIVE ACKNOWLEDGEMENT" from the receiver. This "NEGATIVE ACKNOWLEDGEMENT" told the transmitter to resend the fourth data block again.

```
A>TRANSMIT XYZ.COM
BYROM SOFTWARE
TELECOMMUNICATIONS
SERIAL NO. 100 VERSION 4.6
COPYRIGHT (1983) ALL RIGHTS
RESERVED
****CONNECTING TO REMOTE CPU****
****REMOTE CPU IS NOW
CONNECTED****
****BLOCK TRANSMITTED
CORRECTLY****
****BLOCK TRANSMITTED
CORRECTLY****
****BLOCK TRANSMITTED
CORRECTLY****
****EXCEPTION ERROR****          (1) Error
****BLOCK TRANSMITTED
CORRECTLY****
****BLOCK TRANSMITTED
CORRECTLY****
----FILE HAS BEEN COMPLETELY
TRANSMITTED----
****DISCONNECTING FROM REMOTE
CPU****
A>
```

5.3 File Name Backup Procedure

When receiving a file, the file name is first built on disk as FILENAME.$$$. When the file has been completely received, the file is renamed to FILENAME.TYP. If reception is interrupted, the partially received file will not be mistaken for a completed file.

5.4 Full Disk

If you are receiving a file and your disk becomes full do the following:

A) Demount receiving disk
B) Mount new disk
C) A>RECEIVE[A:/B:][*]

You will receive the SYNCHRONIZATION ERROR at both computers. This means that BSTAM knows you have re-started the receiving computer and will re-transmit only the last partially transmitted file. Also, after re-transmitting this file, the transmitter will continue to transmit the remainder of it's files.