DATA LINE TERMINAL
TYPE 2

UNIVAC®
1004 CARD PROCESSOR

UP-3926

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*Certain pages have been reprinted without change; they are "backs" or "fronts" of pages containing changes. Such pages do not have a new revision number assigned to them.

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Updating Package "B"

The following pages contained in Updating Package"B" of the DATA LINE TERMINAL TYPE 2 Reference Manual, UP-3926, should be utilized as follows:

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* "Fronts" or "backs" of revised pages do not carry a revision number since they remain unchanged.

UNIVAC 1004

Data Line Terminal

Type 2

A UNIVAC 1004 Card Processor equipped with a Type 2 Data Line Terminal enables that Processor to communicate directly with a Digitronics Dial-o-verter Type 520 Magnetic Tape Terminal regardless of their distance of separation. This communication would be over private or exchange telephone facilities through the use of the Bell System 201A or 201B DATA PHONE Data Set or its equivalent.

NOTE:- The Dial-o-verter Type 520 is a product of the Digitronics Corporation, Albertson, New York. It is marketed by that company.

A UNIVAC 1004 Card Processor equipped with a Type 2 Data Line Terminal operating with a Bell System 201A or 201B DATA PHONE Data Set or its equivalent can also communicate directly with another UNIVAC 1004 similarly equipped.

The Type 2 Data Line Terminal thus permits a UNIVAC 1004 to communicate with a wide variety of data processing systems by means of magnetic tape. These data processing systems may be UNIVAC Solid-State, UNIVAC III, UNIVAC 490, and UNIVAC 1107 as well as those of competitive manufacture.

NOTE:- For direct communication with a UNIVAC 490 or 1107 System, the Type 1 Data Line Terminal would be used.

The intercommunication may, therefore be either direct or through the use of magnetic tape:

1. For direct communication, the data as it is being processed by a UNIVAC 1004 in one location is transmitted over private or exchange facilities to be received and processed by a UNIVAC 1004 in another location. The UNIVAC 1004 at each such location would contain a Type 2 Data Line Terminal and operate with a 201A or 201B Data Set to give it both receiving and transmitting abilities.

2. The communication through the medium of magnetic tape is as follows:

   UNIVAC 1004 to Dial-o-verter - Data as it is being processed by the UNIVAC 1004 in one location is transmitted over the telephone facilities. It is received and recorded on magnetic tape by the Dial-o-verter at the other location.

   Dial-o-verter to UNIVAC 1004 - Data recorded on magnetic tape is read by the Dial-o-verter at one location and transmitted over the telephone facilities. It is received and processed by the UNIVAC 1004 at the other location.

The data as transmitted or received by the UNIVAC 1004 is in the six-bit code form in which the Core Storage of that Processor is operating. This can be; XS-3 (80-Column or Code Image), 90-Column, or any other six-bit code form.

The data read from or recorded on magnetic tape by the Dial-o-verter is in the code form in use at that location. During transmission, the Dial-o-verter converts the particular magnetic tape code to the desired UNIVAC 1004 code. While receiving, the Dial-o-verter translates the UNIVAC 1004 code to whatever code form the data is to be recorded on the magnetic tape.

The UNIVAC 1004 would be equipped with the Type 2 Data Line Terminal. The UNIVAC 1004 and the Dial-o-verter would each operate with its own 201A or 201B Data Set to afford both receiving and transmitting abilities.

The compatability of a UNIVAC 1004 Card Processor equipped with a Type 2 Data Line Terminal, in conjunction with the Digitronics Type 520 Magnetic Tape Terminal, provides extreme flexibility to communicate with virtually all computing systems.

Where a location presently contains a computer system capable of producing magnetic tape, there need be no disruption to those facilities. The data communication becomes a most advantageous by-product of the present operation.

This flexibility of data communication is further enhanced by the choice of a wide variety of transmitting and receiving media, including:

Card-to-Card with a printed report (1004 to 1004).
Card-to-Paper Tape with a printed report (1004 to 1004).
Card-to-Magnetic Tape (1004 to 520).
Paper Tape-to-Card with a printed report (1004 to 1004).
Paper Tape-to-Paper Tape with a printed report (1004 to 1004).
Paper Tape-to-Magnetic Tape (1004 to 520).
Magnetic Tape-to-Card with a printed report (520 to 1004).
Magnetic Tape-to-Paper Tape with a printed report (520 to 1004).

By these means, direct and immediate communication is established between the various operating facilities of an organization.

This communication can be between the various operating facilities for the exchange of information.

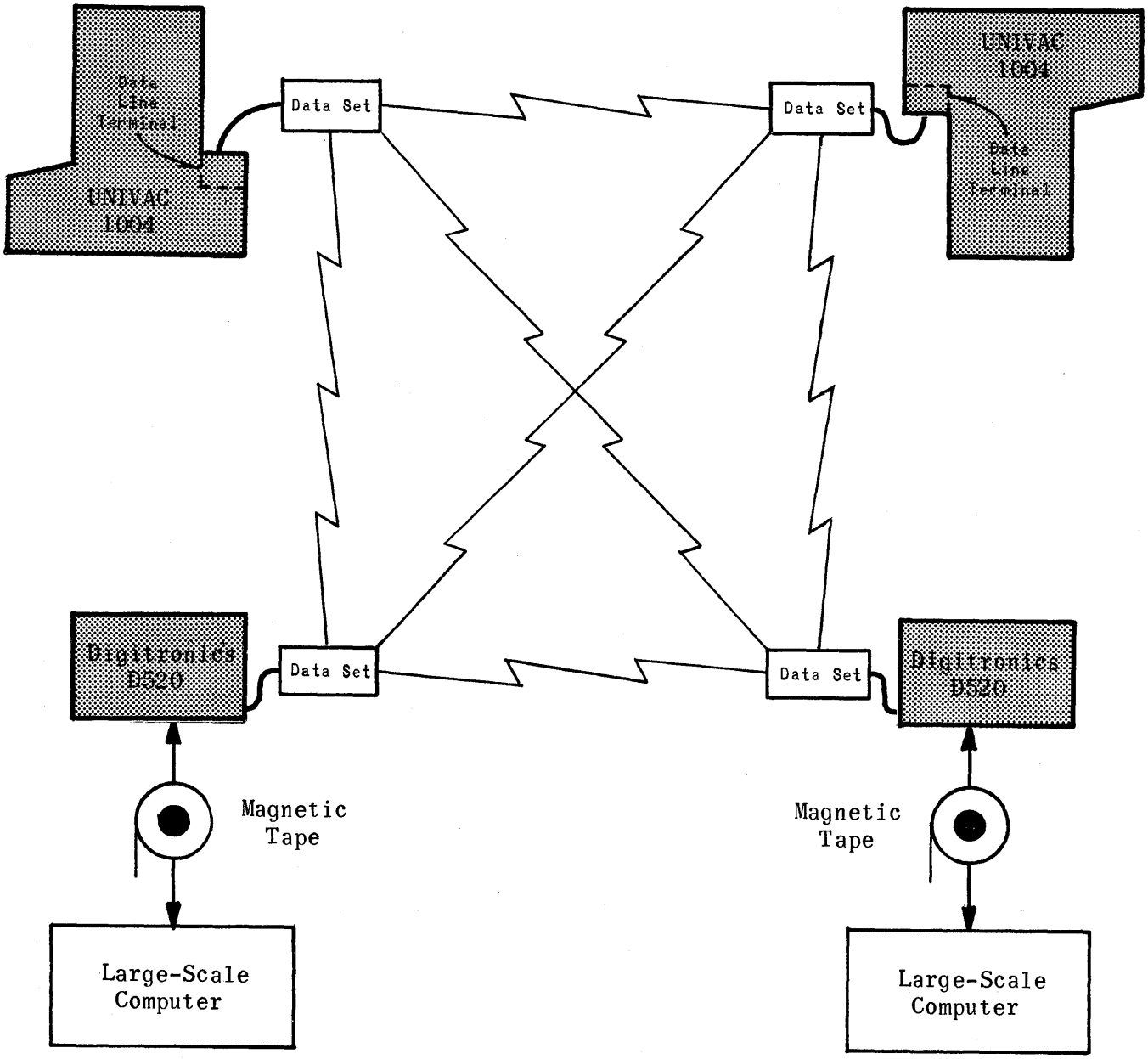
It can be the channelling of information into a headquarters for the central processing of consolidated reports or resulting reports pertinent to the individual locations.

It can be the return of centrally processed data to the individual locations originating the data.

It is to be noted that the data at a given location can be handled either in the form of punched cards, paper tape, or magnetic tape, whichever is most convenient.

This direct, immediate, and compatible data communication, coupled with the many editing and processing abilities of the UNIVAC 1004, can result in a high degree of efficiency in the data transmission and a reduction in the overall cost of the data processing operation.

UNIVAC 1004 -- Digitronics D520 Interconnection



Because the data used in the processing is immediate, the resulting reports are most pertinent.

Centralized data processing functions at its greatest efficiency when the remote locations are provided with small-scale data processing units.

Both the amount of time required for transmittal and the occasional failure or delay in transmission by carriers such as the mail are eliminated.

Data Communication Elements

For a data communications system involving the UNIVAC 1004 Card Processor and the Digitronics Dial-o-verter Type 520 Magnetic Tape Terminal:

Each Processor in the system is equipped with a Type 2 Data Line Terminal.

Each Processor and each Magnetic Tape Terminal in the system is provided with a Bell System 201A or 201B DATA PHONE Data Set or its equivalent.

The communication is over a leased private telephone line or over the exchange facilities of the telephone network.

The data communication is performed in the following manner depending on the facilities used.

UNIVAC 1004 to Magnetic Tape Terminal

The Type 2 Data Line Terminal at the transmitting end receives the characters in six-bit parallel form from the Core Storage of the UNIVAC 1004. The characters stored may be in either XS-3, 90-Column, or any other six-bit code form. The information can be read from any portion of the Core Storage as determined by the programming of the UNIVAC 1004. The maximum number of characters that may be transmitted at any one time in the form of a "Message" is determined by the number of storage locations available for the purpose.

NOTE:- The term "Message" is considered here to be one Unit Record of the transmission. One "Transmission" can consist of any number of Messages desired.

A Message can be the information contained in individual cards or it can be summarized data. One Transmission can be a combination of individual card data and summarized data.

Upon receiving each character code in six-bit parallel form from the Core Storage, the Type 2 Data Line Terminal converts this to an eight-bit serial form for transmission by the related 201 Data Set. This eight-bit character code consists of the six character bits read from Core Storage, a parity bit, and a "synchronizing" bit. At the end of Message, the Data Line Terminal transmits a Longitudinal Parity Count of the bits in that Message.

The 201 Data Set at the transmitting end converts the character pulses from the Data Line Terminal into information bearing signals that can be transmitted over the telephone line.

The 201 Data Set at the receiving end converts the telephone signals to the same character pulses as those originated by the Data Line Terminal at the sending end. These pulses are delivered in serial bit form to the Magnetic Tape Terminal.

The Magnetic Tape Terminal converts the character pulses from serial bit form to parallel bit form while checking for odd parity and translating the UNIVAC 1004 code to the desired magnetic tape code for entry into a buffer storage. The Longitudinal Parity Count at the end of the Message is verified.

NOTE:- The integral part of the Magnetic Tape Terminal performing this function is called a "Coupler". The Coupler of the Magnetic Tape Terminal performs a function similar to that of the Data Line Terminal of the UNIVAC 1004.

When the Message transmission is ended, the contents of the buffer storage is written as a "Block" on the magnetic tape.

Magnetic Tape Terminal to UNIVAC 1004.

A Tape Block of information constituting a Message is read from the tape in parallel bit form and entered into the buffer storage of the Magnetic Tape Terminal.

NOTE:- The number of characters constituting a Message within a Tape Block cannot exceed the capacity of the Core Storage of the UNIVAC 1004 or, more exactly, the number of locations allocated for the Message in the Core Storage of the receiving UNIVAC 1004.

IMPORTANT:- A variable Message length (Tape Block length) can be received or transmitted by the UNIVAC 1004. The ability of the UNIVAC 1004 equipped with a Type 2 Data Line Terminal to recognize termination codes at any time during the transmission of a Message permits the Message length to vary from Message-to-Message within the same Transmission run.

As each character is read from the buffer storage in serial bit form it is translated into the desired six-bit UNIVAC 1004 code, a parity bit and a "synchronizing" bit applied, and all eight bits transmitted through the Data Sets to the Data Line Terminal of the UNIVAC 1004. At the end of a Message, a Longitudinal Parity Count of the bits in that Message is transmitted.

This Data Line Terminal converts the six UNIVAC 1004 character pulses from serial bit form to parallel bit form for entry into Core Storage of the UNIVAC 1004 while checking for parity. The synchronizing bit is dropped off. The Longitudinal Parity Count at the end of each Message is verified. The storage area into which the information will enter is determined by the programming of the UNIVAC 1004.

If a character parity error is detected by the Magnetic Tape Terminal as a block of data is being read from the tape, up to four re-readings of that Tape Block will be attempted in order to obtain a correct reading. The operator has the option of by-passing the error block or forcing its transmission.

If the operator chooses to force the transmission of an error block, this type of message is called a "Forced Magnetic Tape Block Message". In this message, the Magnetic Tape Terminal will substitute an error indication character for each data character in error. It will also insert the same error indication character following the last data character in the Message to designate an error block.

UNIVAC 1004 to UNIVAC 1004

The elements of this transmission are contained in the above explanations. The characters as they are entered into the receiving UNIVAC 1004 would be in the same code form as they originated from the Core Storage of the transmitting UNIVAC 1004.

In addition to data transmission, various control functions are also involved:

To synchronize the receiving end with the transmission.

To alert the receiving end of the start of a Message.

To generate and check both transverse and longitudinal parity to assure correct transmission.

To signal the receiving end of the end of the Message.

To signal the receiving end of the end of the Transmission.

To signal the transmitting end that the Message has or has not been properly received or properly executed.

Both the UNIVAC 1004 Card Processor and the Type 520 Magnetic Tape Terminal are provided with switches which are manually set prior to a transmission to establish the basic role of each unit in the communication as to whether the related unit is to be a transmitter or a receiver. The Alteration Switches on the Central Control Panel of the UNIVAC 1004 are used for this purpose.

In addition, when the communication is between a UNIVAC 1004 and a Magnetic Tape Terminal, the following short preparatory procedure is performed before the start of the transmission of the first Data Message:

One of the two units (this may be either the UNIVAC 1004 or the Magnetic Tape Terminal) transmits a "Bid Message" to its opposing unit. This message advises the opposing unit to be either a receiver or a transmitter during the communication run about to take place.

NOTE:- In Digitronics terminology; the unit transmitting the Bid Message is called the "Master" unit, the unit receiving that message is called the "Slave".

The opposing unit (Slave) then returns a "Connect Message" to the originating unit (Master) confirming the instruction given in the Bid Mode Message. In this Message, the Slave unit instructs the Master unit as to what the Masters' function is to be during the communications run.

During this procedure, each of the two units as well as their related Data Sets are conditioned to transmit or to receive the first Data Message according to the instructions given. Immediately following this preparatory procedure, the Data Message transmission will start.

In order to facilitate programming and the establishment of communications between the two units, prior agreement as to which unit is to operate as "Master" or "Slave" should be established initially and remain constant for all transmissions.

Following the transmission of each Data Message, the receiving end (UNIVAC 1004 or Magnetic Tape Terminal) returns an "Acknowledgement Message" to the sending end. This can be either:

Acknowledge Correct Message - The Message was received correctly.
Acknowledge Incorrect Message - The Message was not received correctly.

At the end of a Transmission run, an End of Transmission Message is sent. Upon the receipt of an Acknowledge Correct Message, the run is ended.

The data communication is entirely under the control of the operating features of the UNIVAC 1004 and the Magnetic Tape Terminal. The tasks of the attending operator remain virtually the same as when performing the usual internal data processing.

When performing data communication, a sending UNIVAC 1004 uses only two Program Steps, not necessarily consecutive, to perform the transmission; a Request to Transmit Step, a Transmit Step. A receiving UNIVAC 1004 uses but one Program Step; a Receive Step.

Other steps in both the transmitting and receiving programs would be used to edit and accumulate the information into the most desirable and proper form for transmission and to classify and accumulate the information received.

The storage readout when sending and the storage entry when receiving are performed by Transfer operations. The maximum length of the Message is determined by the Operand wiring of the Operating Steps of the UNIVAC 1004 Connection Panel. This maximum can, therefore, be of any length desired up to the capacity of the Core Storage.

The contents of the adjacent storage locations to be used as the Operand 1 of the Operating Step of the sending program must be edited into the proper Message format on a step prior to the Operating Step.

Message Format

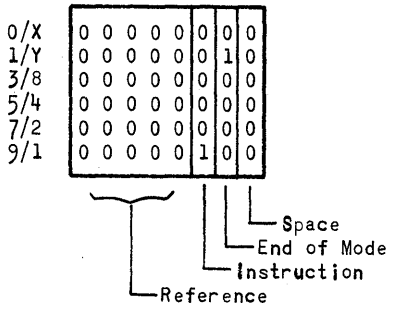
The format of the various Message types as entered in the six-bit UNIVAC 1004 Core Storage are shown here in two forms:

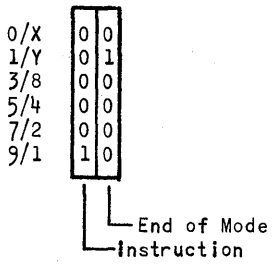
For Transmission - The Message characters as they are entered into storage ready to be transmitted at the sending end.

As mentioned previously, the Messages within a Transmission may be of variable length. To accomplish this purpose, the UNIVAC 1004 is provided with an "Early Terminate" (ET) feature. Where the Message is shorter than the maximum length provided, the Early Terminate is impulsed from the storage location of the last character of that Message.

As Received - The characters of that Message as they are entered into storage at the receiving end. It is to be noted that some of the characters of the original Message are dropped out by the Data Line Terminal at the receiving end.

Bid Message





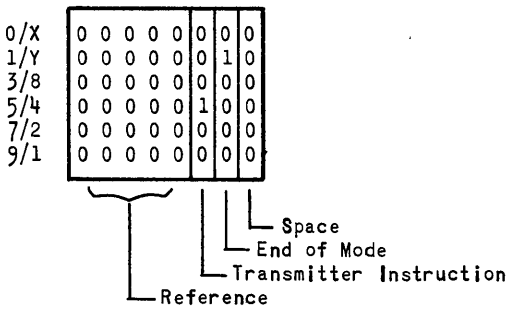
For Transmission
- Five Reference characters - Space code (00 0000).
- An Instruction character - Receiver (00 0001) or Transmitter (00 0100) - This character in the UNIVAC 1004 Bid Message advises the Magnetic Tape Terminal that the tape unit is to be a receiver or a transmitter.
- An End of Mode character (01 0000).
- A Space character (00 0000).

As Received
- The Instruction character transmitted - Receiver (00 0001) or Transmitter (00 0100) - This character in the Bid Message received from the Magnetic Tape Terminal advises the UNIVAC 1004 that the 1004 is to be a receiver or a transmitter.
- The End of Mode character (01 0000).

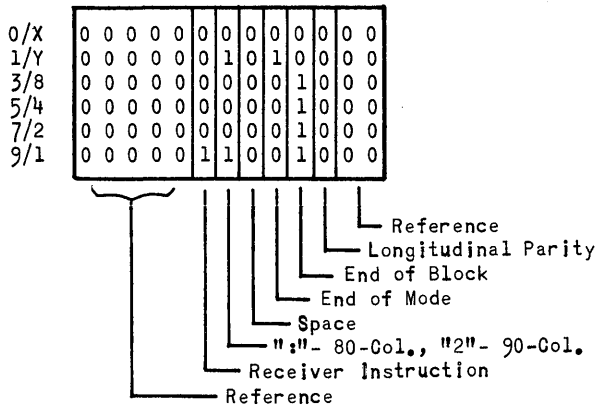
Connect Message

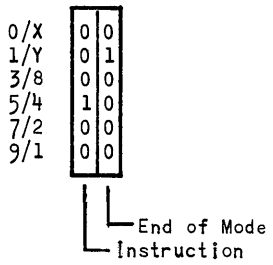
For Transmission
- D520 to be the Transmitter
  - Five Reference characters - Space codes (00 0000).
  - Transmitter Instruction character (00 0100) - The Magnetic Tape Terminal is advised to be a transmitter.
  - An End of Mode character (01 0000).
  - A Space character (00 0000).

D520 - Transmitter



D520 - Receiver





D520 to be the Receiver.

Five Reference characters - Space codes (00 0000).

Receiver Instruction character (00 0001) - The Magnetic Tape Terminal is advised to be a receiver.

Code (01 0001) - This is the ":" in 80-Column operation or the "2" in 90-Column operation. This code is used here to make the six data bit levels even Longitudinal Parity through the End of Mode.

A Space character (00 0000) - This code is used here to make the Parity bit level even Longitudinal Parity through the End of Mode.

An End of Mode character (01 0000).

End of Block character or characters. There may be from one to three of these characters according to the customer's specifications (see Data Message below).

A Space character (00 0000) for Longitudinal Parity.

Two Reference characters - Space codes (00 0000).

This Connect Message will appear to the Magnetic Tape Terminal to be a Connect followed by a Data Message. Since the Data Message will consist of only an EOB followed by an LP character, the Message will be acknowledged by the Magnetic Tape Terminal but will not be written on tape or counted as a Data Tape Block.

After transmitting this Connect Message, the UNIVAC 1004 program must provide for receiving an acknowledgement.

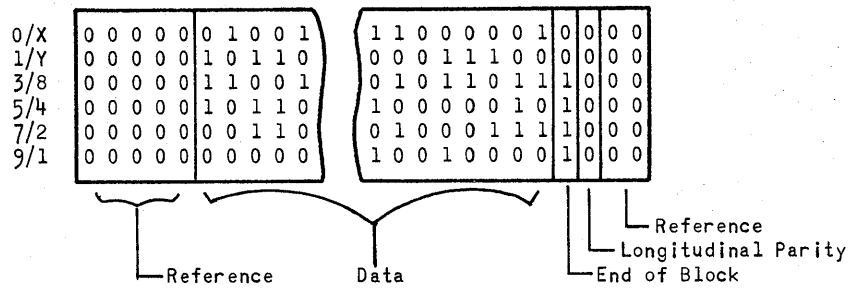
As Received

The Instruction character transmitted - Receiver (00 0001) or Transmitter (00 0100) - This character in the Connect Message received from the Magnetic Tape Terminal advises the UNIVAC 1004 that the 1004 is to be a receiver or a transmitter.

The End of Mode character (01 0000).

Data Message

For Transmission

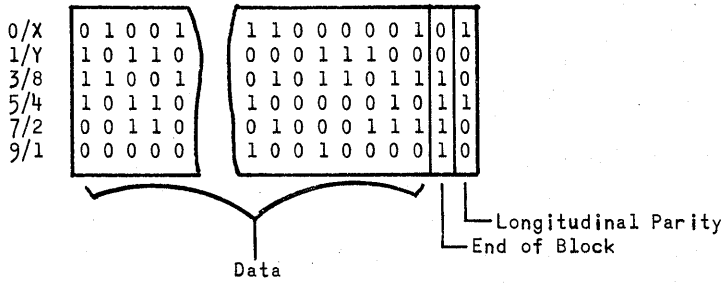


Five Reference characters - Space codes (00 0000).
The Data characters of the Message.
End of Block character or characters. There may be from one to three of these characters. The number and the nature of these characters is determined by the specifications of the Magnetic Tape Terminal to meet the customer's requirements.

Where one character is used, it must be unique in that it will not appear elsewhere in the Message. Where two or three different characters are used, the character combination must be unique. The individual characters forming this combination can appear individually throughout the Message but not in immediately adjacent locations as in the End of Block character sequence.

A Space character (00 0000) - A Longitudinal Parity Count character will be entered automatically in this position during the transmission by the sending Data Line Terminal.
Two Reference characters - Space codes (00 0000). Transmission of these two reference characters is required for a control function delay in the Magnetic Tape Terminal. If the Magnetic Tape Terminal is to be compatible with a Digitronics Paper Tape Terminal used elsewhere in the system, five reference characters must be provided.

As Received

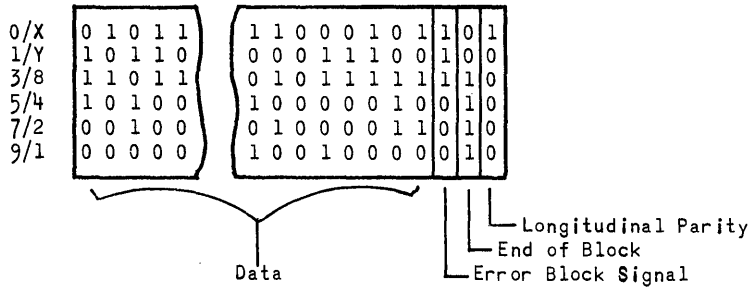


The Data characters of the Message transmitted.
The End of Block character or characters.
The Longitudinal Parity Count character as received from the sending Magnetic Tape Terminal.

Forced Magnetic Tape Block Message

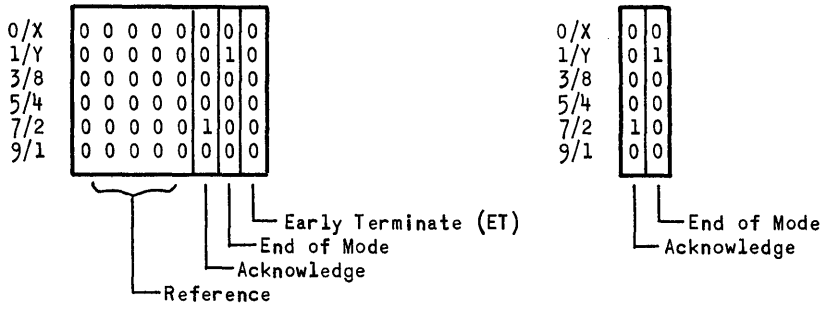
If an error is discovered as data characters are being read from the tape by the Magnetic Tape Terminal during its transmission of a Message, the transmission to the UNIVAC 1004 or the related tape block can be forced.

In this event, the Message as received would be as follows:



The Data characters of the Message. In this Message, the Magnetic Tape Terminal will substitute an Error character indication for each data character in error. The question mark (?) is used as the error character indication - XS-3 (01 0011), 90-Column (11 1000).
An Error Block Signal character (also a question mark).
End of Block character or characters.
The Longitudinal Parity Count character.

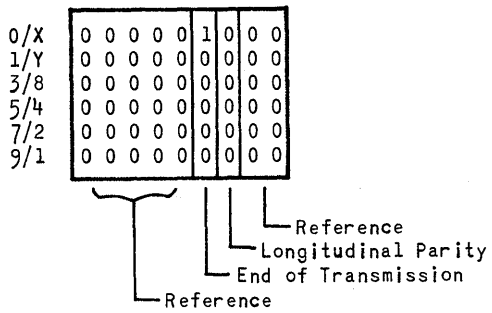
Acknowledge Message

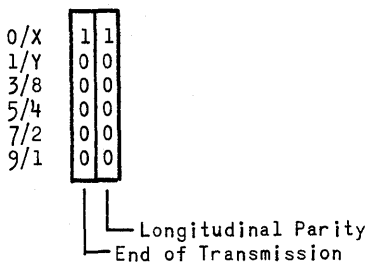


For Transmission
Five Reference characters - Space codes (00 0000).
An Acknowledge character - For an Acknowledge Correct Message (00 0010). For an Acknowledge Incorrect Message (10 0000), "Request to Retransmit".
An End of Mode character (01 0000).
A Space character (00 0000). The Early Terminate (ET) can be impulsed from the storage location of this character.

As Received
The Acknowledge character. Correct (00 0010) or Incorrect, Request to Retransmit, (10 0000).
The End of Mode character (01 0000).

End of Transmission Message





For Transmission

Five Reference characters - Space codes (00 0000).
The End of Transmission character or characters specified by the customer.
A Space character (00 0000) - A Longitudinal Parity Count character will be entered automatically in this position during the transmission by the sending Data Line Terminal.
Two Reference characters - Space codes (00 0000).

As Received

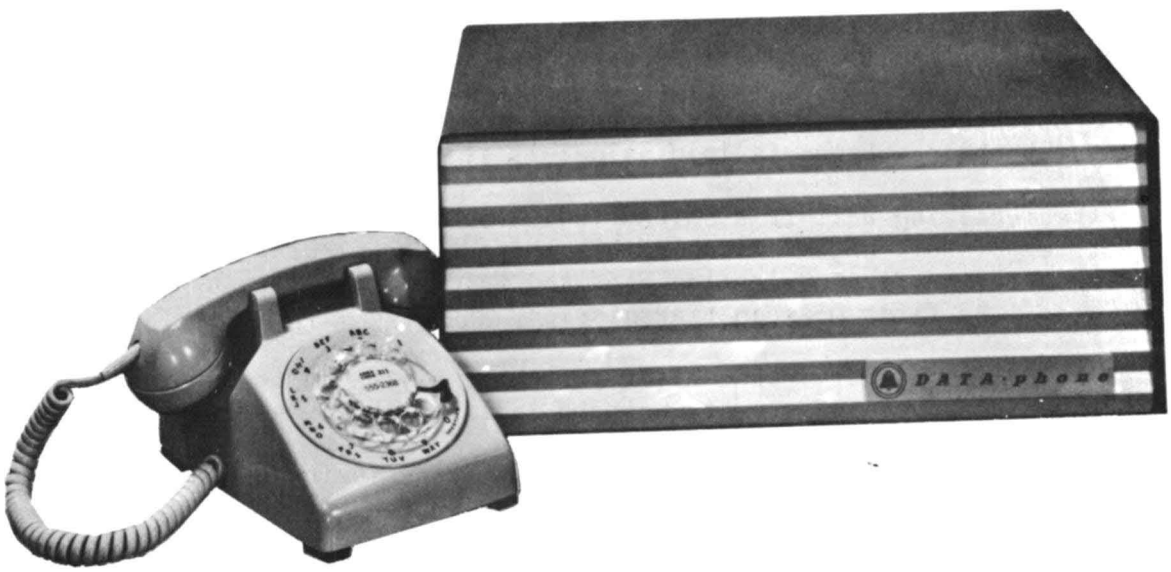
The End of Transmission character or characters specified.
The Longitudinal Parity Count character transmitted.

Communications System Equipment

The Bell Systems 201A or 201B DATA PHONE, Data Sets as used with the UNIVAC 1004 data communications systems provide "Half-Duplex" capability. They are used for sending and receiving but not for both operations simultaneously.

The Data Set at the transmitting end takes the character pulses from the Data Line Terminal of the UNIVAC 1004 or the Coupler of the Digitronics Dial-o-verter Type 520 Magnetic Tape Terminal and converts them to modulated information bearing signals that can be transmitted over the telephone line.

The Data Set at the receiving end converts the signals from the telephone line back to the same character pulses as those delivered by the transmitting Coupler or Data Line Terminal and delivers these pulses to the receiving Data Line Terminal or Coupler.



A Data Set conditions itself in the receiving mode unless instructed to be in the transmitting mode. The "turn-around" of the Data Set at the transmitting end is performed by the Request to Transmit Step in the UNIVAC 1004 at the sending end or by a similar command by the Magnetic Tape Terminal at the sending end.

The Type 201A DATA PHONE, Data Set operates at a speed of 2000 Bits per Second. It may be used with either the private line or the exchange telephone facilities.

The Type 201B DATA PHONE, Data Set operates at a speed of 2400 Bits per Second. It can be used only with the private line facilities.

Both Data Sets measure 7-3/4" high x 17-1/2" wide x 11-5/8" deep and weigh approximately 35 pounds.

The housing of a Data Set has no external controls of interest to the operator. A 40 foot cable, originating at the UNIVAC 1004 or Magnetic Tape Terminal, connects the related unit to its Data Set. The Data Set can, therefore, be located where desired in the installation.

A telephone hand set is provided with a Data Set. The connection between the sending and receiving locations is established by this means. This telephone differs from the usual hand set only in that it has switches to convert from voice to data communication.

For convenience, the telephone hand set can be placed on the UNIVAC 1004 within easy reach of the operator or on a stand adjacent to the Processor. With the hand set, a 5 foot cord length to the Data Set is provided as standard. An extension to this cord of up to 25 feet can be supplied by the Bell System if it is requested at the time the Data Set is ordered. Any extension beyond this length is considered special.

When the UNIVAC 1004 or Magnetic Tape Terminal at the sending end is ready for a transmission, a call to the receiving location establishes the connection.

Conversation between the operators determines whether or not data transmission is to start.

If it is, the receiving operator readies his unit to receive. When it is so conditioned, the transmitting operator is so informed.

Both operators then switch their phones to data communication. The hand set of both telephones is laid aside; it is not "hung up".

If the receiving unit is a UNIVAC 1004, the receiving operator starts his unit immediately after switching his phone. The program of this unit will advance to the first Operating Step and hold on that step awaiting the receipt of the first message transmission.

Following a momentary pause after switching his phone to data, the operator at the sending end starts his unit to initiate the transmission.

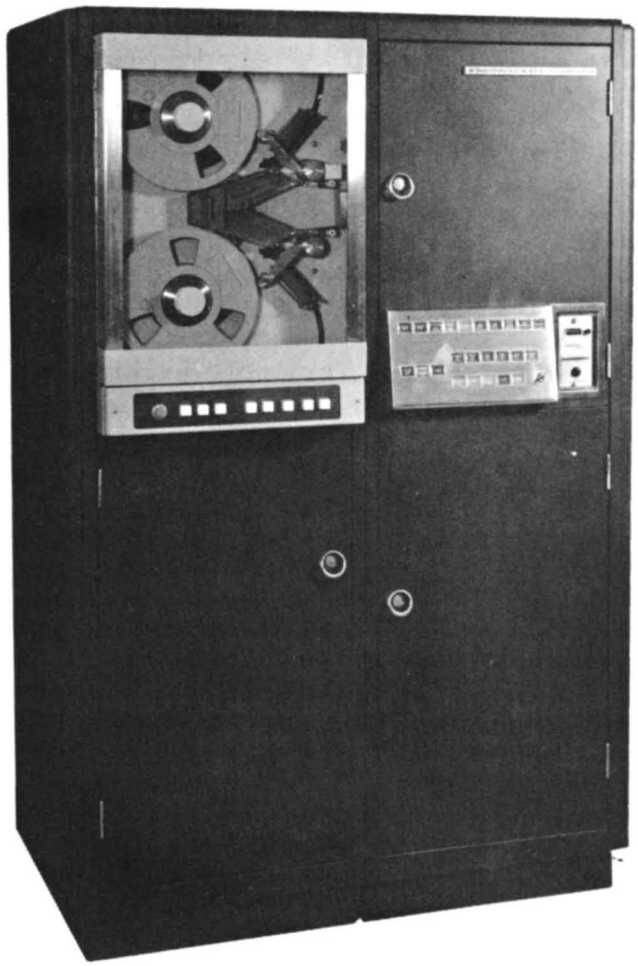
When a transmission is concluded, the End of Transmission character in the last message advises the receiving operator of the fact.

Both operators then switch their phones to voice communication.

Following any voice communication necessary, both phones are "hung up".

Digitronics Dial-o-verter

Type 520 Magnetic Tape Terminal



The Dial-o-verter Type 520 Magnetic Tape Terminal in a UNIVAC 1004 data communications system functions to:

Receive data transmitted in UNIVAC 1004 code, translate that code to the magnetic tape code desired, write the data in tape code form on the tape.

Read data from a magnetic tape, translate the tape code to the UNIVAC 1004 code desired, transmit the data in the UNIVAC 1004 code form.

Based on its translating ability, the Type 520 Magnetic Tape Terminal is available in two forms, the D520 and DC520:

The D520 is fixed in its translating ability. The particular UNIVAC 1004 code and magnetic code to be handled must be specified when the unit is ordered.

The DC520 is flexible in its translating ability. It is equipped with a Connection Panel (Plugboard) so that the codes, both tape and UNIVAC 1004, can be varied from application to application according to the wiring of the removable Connection Panel to be used at the time.

The Type 520 Magnetic Tape Terminal transmits and receives the six-bit plus parity data at a maximum rate of 15,000 characters per second. Its speed of operation is, of course, governed by the abilities of the data communications system with which it operates.

The Magnetic Tape Terminal is housed in a cabinet with overall dimensions of; height - 69", width - 45", and depth - 25". It weighs approximately 1600 pounds.

The standard components of a Type 520 Magnetic Tape Terminal are; a Magnetic Tape Handler including read and write circuits, a 1024 character Core Storage, the Coupler, a Printing Counter, and a Control Panel.

The MAGNETIC TAPE HANDLER operates at 75 inches per second. The tape is 1/2 inches wide for recording 6 data channels plus parity at the density specified for the tape handler. The unit includes a read-after write head. Other tape width options are available.

When TRANSMITTING, the Magnetic Tape Terminal functions in the following manner for each Tape Block (Message):

As each tape character is read, it is entered into the Buffer Storage. Each character is checked for parity at this time.

If a parity error is detected in one or more characters in the block, characters in error are replaced by error signal characters in storage. The Magnetic Tape Terminal will automatically attempt four reading operations to arrive at a parity-correct block. If unsuccessful in those attempts, the operation will halt. The operator can then either force the block transmission or pass over the block. If the block is forced, a character is inserted automatically immediately ahead of the End of Block character to signal an Error Block.

When the full tape block has been read and entered into storage, the Buffer Storage is read out through the Coupler in bit-serial form for transmission through the Data Set. At the time of this storage readout:

The translating of each character from the tape code to the desired UNIVAC 1004 code takes place.

A Longitudinal Parity Count character for the block based on the UNIVAC 1004 code is generated.

The Longitudinal Parity Count character is transmitted following the End of Block character.

Following the transmission of each block of data, the Magnetic Tape Terminal awaits an acknowledgement from the UNIVAC 1004. The acknowledgement must be returned within 20 seconds or the Magnetic Tape Terminal will disconnect.

If "OK", the transmission proceeds with the next tape block.

If the UNIVAC 1004 detects a parity error and returns a Request to Retransmit, the block in error will be retransmitted automatically. If four successive Request to Retransmit signals are returned by the UNIVAC 1004, the Magnetic Tape Terminal will disconnect.

When RECEIVING, the Magnetic Tape Terminal functions in the following manner for each Message:

Each character as it is received from the Data Set in bit-serial form is converted by the Coupler to bit-parallel form for entry into the Buffer Storage. At the time of this storage entry:

The translation from the UNIVAC 1004 code to the desired tape code takes place.

A parity check of each Message character is made.

A Longitudinal Parity Count character for the Message based on the UNIVAC 1004 code is generated.

The Longitudinal Parity Count character generated is checked against the count transmitted following the End of Block character in the Message.

Where a parity error is detected in one or more of the characters of the Message as received, characters in error are replaced by an error signal character in storage.

If there is a parity error or a difference in the Longitudinal Parity Count, the Magnetic Tape Terminal will acknowledge the Message by sending a Request to Retransmit to the UNIVAC 1004. The Magnetic Tape Terminal will automatically request up to four retransmissions to arrive at a parity-correct Message received. If unsuccessful in these attempts, the operation will halt.

NOTE:- The Request to Retransmit is issued immediately and automatically just as soon as the full Message is entered into the storage and a turn-around of the Data Sets has taken place. The UNIVAC 1004 must be ready to receive this request.

When the operation halts as the result of the entry of a parity-incorrect Message, the operator can then either force the storage readout or pass over the Message. If the readout is forced, a character is inserted automatically immediately ahead of the End of Block character to signal an Error Block.

When a fully correct Message has been entered into storage, the Buffer Storage is read out to write the characters on the tape in the form of a tape block. An acknowledge indicating the Message was received "OK" is sent to the UNIVAC 1004.

The PRINTING COUNTER of the Magnetic Tape Terminal advances by one for each tape block transmitted or received. At the end of transmission, the total number of tape blocks for the run is printed automatically. During a run upon the detection of an error block when receiving, the number of that tape block is printed.

The CONTROL PANEL of the Magnetic Tape Terminal contains all of the switches and indicators necessary for the complete control and signalling of its operation. Among these controls, the following are of significance in the explanations offered by this writeup:

CALLING STATION START - When the Magnetic Tape Terminal is the "Master", this switch is pressed to initiate the data communication. If the UNIVAC 1004 is the "Master", this switch is not used; the data communication is initiated by the UNIVAC 1004.

TRANSMIT/RECEIVE - When the Magnetic Tape Terminal is the "Master";

This switch is pressed to light its TRANSMIT indicator if the Magnetic Tape Terminal is to be a transmitter.

If the Magnetic Tape Terminal is to be a receiver, this switch is pressed to light its RECEIVE indicator.

This switch is not used when the UNIVAC 1004 is the "Master"; the Magnetic Tape Terminal becomes the "Slave". Whether the Magnetic Tape Terminal is to be a transmitter or receiver is determined by the Bid Message issued by the UNIVAC 1004.

RETRANSMIT - When this switch is ON (its indicator lit), the Magnetic Tape Terminal will honor Request to Transmit signals so that data received in error will be retransmitted as outlined above.

When this switch is OFF, the receiving Magnetic Tape Terminal will halt and disconnect if four successive blocks contain errors. The transmitting UNIVAC 1004 will give an error indication after 20 seconds.

READ BAD TAPE - Pressing this switch following stoppage due to the detection of a parity error in a tape block will force the transmission of that tape block.

A complete description of the features and functions of the Dial-o-verter Magnetic Tape Terminal is contained in a writeup prepared by the Digitronics Corporation.

UNIVAC 1004 Data Line Terminal, Type 2

The UNIVAC 1004 Type 2 Data Line Terminal is located inside the Card Processor at the rear. It is internally connected to the various elements of the Processor with which it functions. A 40 foot cable connects it to the Data Set.

The internal connections between the Data Line Terminal and the UNIVAC 1004 include:

Six data bit lines for the character serial, bit parallel readout of Core Storage during transmission.

Six data bit lines for the character serial, bit parallel entry into Core Storage during receiving.

Various lines for function control.

The cable connections between a Data Line Terminal and its Data Set include:

A data line for character transmitting in bit serial form.

A data line for character receiving in bit serial form.

Synchronizing control lines for transmitting and receiving.

A Request to Transmit control line.

A Clear to Send control line.

In addition to its function of converting the six-bit character codes from bit parallel to bit serial or the reverse, the Data Line Terminal performs two automatic parity checking operations. It also adds a synchronizing bit to the eighth level of each character transmitted for compatability with the receiving characteristics of the Magnetic Tape Terminal. A Data Message and an Acknowledgement are transmitted in this fashion:

Character Parity Check

During transmission as the Core Storage readout is being converted from parallel to serial bit form, the Data Line Terminal at the transmitting end functions to add a parity bit, where necessary, to make each data character odd or even parity (see UNIVAC 1004 Modifications, Auxiliary 4 below).

As the data characters are being received, the Data Line Terminal makes a parity check as the conversion from serial to parallel bit form takes place for the storage entry. The parity and synchronizing bits are dropped off at this time.

If the wrong parity is detected, an error is signalled by the receiving UNIVAC 1004.

Longitudinal Parity Check

The Data Line Terminal generates a Longitudinal Parity Count character as the data characters are being transmitted. This is essentially a count for even parity of all bits in each one of the bit levels for all data characters in the Message. This same count is also generated for the bits of the data characters entering the Data Line Terminal when the UNIVAC 1004 is receiving.

The Longitudinal Parity Count character generated by the Magnetic Tape Terminal at the sending end follows immediately after the End of Block character to be compared with the Longitudinal Parity Count character generated at the UNIVAC 1004 at the receiving end.

If the two characters agree, the Processor interlock of the UNIVAC 1004 is removed after the Longitudinal Parity Count character has been entered into storage; the program for the UNIVAC 1004 is allowed to proceed. NOTE:- When a UNIVAC 1004 is receiving a Message, the Processor is interlocked in the same manner as during any other Transfer operation.

If the two characters do not agree, the Processor interlock is removed after the Longitudinal Parity Count character is transferred to storage; an error is signalled.

The Type 2 Data Line Terminal has the ability to generate and transmit automatically a continuous series of "Non-Reference" characters (1000 0111) as long as the Request to Transmit is being impulsed and the Core Storage is not being accessed for the transmission of Reference characters or the Message characters. When the Core Storage is accessed, the Message characters stored will be transmitted.

UNIVAC 1004 Basic Capabilities

All of the basic programming capacities and abilities of a UNIVAC 1004 Card Processor are available when it is being used with a Data Line Terminal for data communication. These capabilities can be used to great advantage to increase the speed of transmission by eliminating unwanted or repetitive data and to add to the effectiveness of the system by performing the usual UNIVAC 1004 functions while the communication is in progress.

These programming capabilities can be used to conserve the time of any computing system communicating with the UNIVAC 1004 either directly or through the medium of magnetic tape. The ability of the UNIVAC 1004 to edit the input and output data permits the data to be communicated in the most suitable and economic form.

Here are some of the ways in which the programming capabilities of the UNIVAC 1004 can be used to increase efficiency in the data communication:

Data Transmission

The programming features of the UNIVAC 1004 provide great flexibility when transmitting data from either punched cards, paper tape, or magnetic tape:

1. Unwanted data can be deleted. The sequence of the data can be rearranged.

2. Cards of various types, each with widely differing format requirements, can be accommodated in the same transmission together with data from tape. The UNIVAC 1004 will process each item of data in accordance with its format requirements.

3. When the data to be transmitted by the Magnetic Tape Terminal can be arranged by group, the first block of each group can contain the information common to the group while the following blocks of the group carry only the individual items of variable information. The receiving UNIVAC 1004 will reassemble the constant and variable data for each item before punching or printing that data.

4. Data transmitted for each card or tape block need not be limited to what is punched in that card or block. The UNIVAC 1004 can transmit, along with the card or tape data, such additional data as:

   Data stored in the UNIVAC Core Storage. This data may have been introduced into the storage from a constant card at the start of the run or from some previous card or tape block such as a heading or master.

   Data generated by the UNIVAC 1004 Connection Panel.

   Results of arithmetic operations performed with the input data.

Printing Transmitted Data

Data transmitted to the UNIVAC 1004 for printing purposes can be completely edited by the Processor. When more than one format is to be used, a code character or other means in each Message can identify the print line format applicable to the Message. Among the print editing functions the UNIVAC 1004 will perform are the following:

1. Inspect the Message to determine the print line format to be used. A variety of print line formats can be accommodated during one transmission.

2. Unpack message data, arrange sequence, zero suppress and punctuate amounts, generate sign and total indications, and arrange the print line in accordance with the format requirements.

3. Print report headings from data contained in Core Storage. Heading data can be entered into the UNIVAC 1004 Core Storage from a constant card at the receiving end or it can be transmitted from the sending end at the start of the run.

4. Control form spacing including form overflow skipping. Perform form overflow routines including sheet numbering, dating, and the printing of whatever heading information is necessary.

5. Perform specialized printing operations such as multi-line printing, two-, three-, or four-up printing from a single message.

Punching Transmitted Data

Data received by the UNIVAC 1004 to be punched into cards or paper tape is also subject to the UNIVAC 1004 programming capabilities.

1. The sequence of data can be rearranged; unwanted data can be deleted.

2. Various card or tape formats can be punched during one transmission.

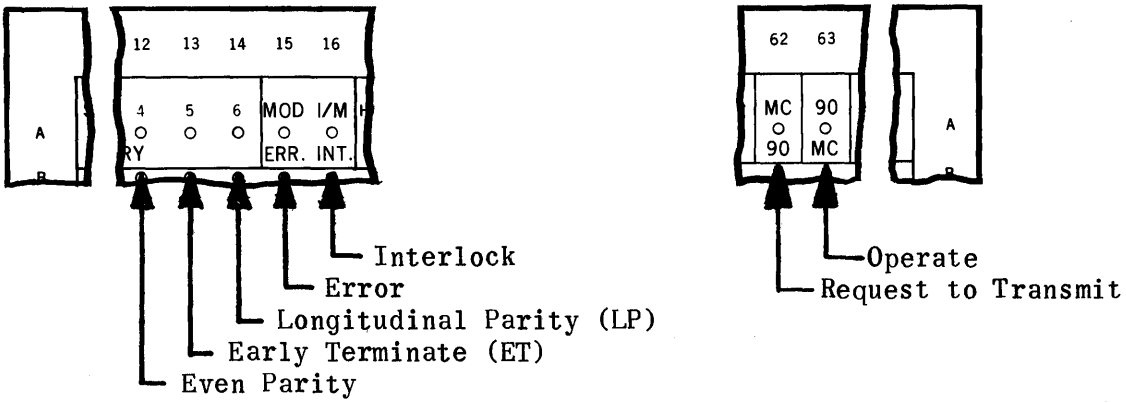
3. Common or repetitive data can be repeat-punched with the transmitted data.

4. Cards can be segregated under program control through the use of optional segregating features.

UNIVAC 1004 Modifications

Because data communication is an auxiliary operation to the usual data processing functions of the UNIVAC 1004 Card Processor, added features and modifications in the use of basic features adapt the UNIVAC 1004 to this use.

Part of this adaptation is to permit a UNIVAC 1004 equipped with the Type 2 Data Line Terminal to handle either fixed-length or variable-length Messages.



The Connection Panel hubs shown here are of prime importance in the data communications programming. Their use is explained below.

As stated previously, the UNIVAC 1004 uses two Program Steps when transmitting; a Request to Transmit Step, a Transmit Step. The UNIVAC 1004 uses but one Program Step when receiving; a Receive Step.

IMPORTANT:- A transmitting operation and a receiving operation cannot occur on two successive Program Steps. At least one step must intervene between a Transmit Step and a Receive Step to allow an automatic clearing of the Data Line Terminal to occur.

The following explanation of these steps and their functioning includes the added features and modifications mentioned above.

TRANSMITTING

Request to Transmit Step

The purpose of this step is to initiate the Request to Transmit which will condition the Data Set at the sending end in the Transmitting mode and to hold it in that mode. As previously stated, a Data Set will condition itself automatically in the Receiving mode unless conditioned and held conditioned in the transmitting mode. The Request to Transmit should be turned on immediately following any Receiving operation.

This step must include the following Connection Panel wiring:

The wiring of its Step Output PRO hub to the ON of a Program Select.

The wiring of the Power hub of that Program Select to the Request to Transmit (MC/90) hub (A,62).

An arithmetic or transfer operation of a minimum of two characters if the next step is to be the Operating Step.

IMPORTANT:- At least one Operating Cycle A must occur after the Request to Transmit is signalled.

The Request to Transmit signal is sent through the Data Line Terminal to the transmitting Data Set. The Type 201A or 201B Data Set requires approximately 150 milliseconds to switch from the receiving mode to the transmitting mode when a 2-wire telephone line is used. This is referred to as "turn-around" and "turn-around time". The 201 Data Set accomplishes this turn-around in approximately 8 milliseconds when 4-wire telephone service is used.

When the turn around of the Data Set is completed, it sends a "Clear to Send" signal to the Data Line Terminal. Transmission cannot start until the Data Line Terminal has this signal.

NOTE:- "Non-Reference" characters (1000 0111) will be generated and transmitted automatically when the Request to Transmit is being signalled and data is not being transmitted.

To add to the efficiency of the programming, this step can be used to edit the Message into its proper format for transmission on the Operate Step. If this is not convenient, this step can be used to perform some other transfer operation, an arithmetic process or an input/output function.

Transmit Step

The purpose of this step is to control the issuance of the characters to be transmitted by the UNIVAC 1004.

This step must include the following Connection Panel wiring:

The wiring of its Step Output PRO hub to:

TRF (Transfer), Ascending or Descending
The Operate (90/MC) hub (A,63)
The CMPS (Compress) END
The 90/80 Δ

The wiring of the Step Output OP1 and OP2 hubs to define the storage locations of the Message to be transmitted. Where the transmission is to include Messages of variable length, the number of storage locations required must be based on the maximum length Message that might be included in the transmission.

The wiring of the I/M INT (Interlock) hub (A,16) to:

INS (Insert) Transfer, Ascending or Descending
The CMPS ST (Compress Start)

The wiring of the LP (Longitudinal Parity) hub (A,14) from:

The Bit Emitter for variable-length Message transmissions.
The Address Emitter for fixed-length Message transmissions.

NOTE:- A more detailed explanation of this wiring is given below.

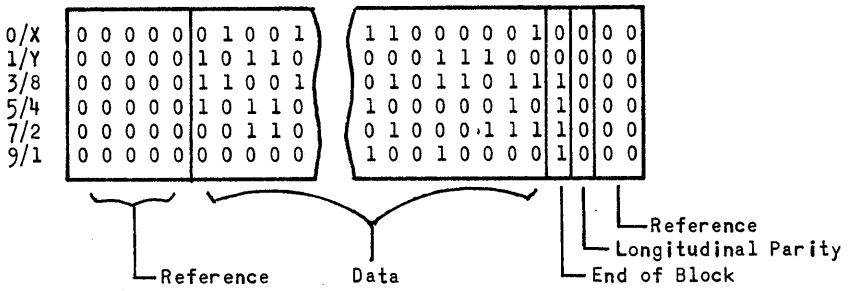
The wiring of the ET (Early Terminate) hub (A,13) from Program Select Power. NOTE:- A more detailed explanation of this wiring is given below.

The Operands used on this Transfer operation are as follows:

OP1 - The characters for this operand include all of those comprising the Message. The Message having been fully edited on a prior step into the proper format. No editing can take place on this step. This operand may be in any storage area, but must consist of consecutive storage locations.

The number of storage locations required for this operand is determined by the maximum length Message to be transmitted. This would include all special and data characters included in the Message format.

The Data Message format is as follows:



The first characters to be transferred (transmitted) are the Reference (Space) characters with the others following in sequence. The application requirements dictate whether the characters of the Message will be in ascending or descending order in the storage and whether Ascending or Descending Transfer will be used.

OP2 - This operand must be of the same length as OP1.

For variable-length Data Message transmissions where it is necessary to use the Bit Emitter to examine the OP1 characters being transmitted to detect the End of Block, OP2 must comprise the same storage locations as OP1.

For fixed-length Data Message transmissions, the OP2 locations can be anywhere in storage but must be consecutive. The transmission terminates automatically following the transfer of a character into the last OP2 storage location.

During the transfer, each Operand 1 character enters a single-character register in the Data Line Terminal directly from the Data Register for conversion from bit parallel to bit serial form for transmission. It is also sent along the usual transfer lines for entry into its OP2 storage location. (See Data Flow, Transfer Operations - UP-3871)

When the single-character register of the Data Line Terminal is filled with the six bits of a character, the transfer from the Data Register is halted momentarily while those bits plus the parity and synchronizing bits are issued in serial form to the Data Set. When this register is empty, the transfer of the next character in the Message to the Data Line Terminal is permitted.

The contents in the first OP1 location will not be transmitted. The first character other than a space in a location following the first OP1 location will start the generation of Character and Longitudinal Parity by the Data Line Terminal. The Data Line Terminal adds the Synchronizing bit to the Space codes transmitted prior to the first significant character so that they are recognized as Reference characters by the Magnetic Tape Terminal.

IMPORTANT:- Only the processes and functions specified here are to be wired on a Transmit Step. Do not include such operations as Test Selector Delay, Punch Test, or any Input/Output function. The possible delay in the termination of the Transmit Step may cause incorrect results.

PRO - 90/MC (OPERATE) - When the UNIVAC 1004 is on this Transmit Step, the Step Output PRO to 90/MC connection causes an "Operate" signal to be delivered to the Data Line Terminal.

If the Data Line Terminal has received a Clear to Send signal from the transmitting Data Set and the register of the Data Line Terminal is empty, the coincidence of the Operate and Clear to Send signals causes a B-Pulse to be issued from the I/M INT (Interlock) hub.

If the Data Line Terminal has not received a Clear to Send signal from the transmitting Data Set and although the register of the Data Line Terminal may be empty, the lack of coincidence between the Operate and Clear to Send signals causes an A-Pulse to be issued from the I/M INT hub.

When the register of the Data Line Terminal becomes filled with the bits of one character despite the fact that coincidence exists between the Operate and Clear to Send signals, an A-Pulse will be issued from the I/M INT hub. This A-Pulse emission will continue until the register of the Data Line Terminal is empty; at that time, a B-Pulse will emit and continue until the register is filled.

I/M INT - INS & CMPS ST - The wiring of the I/M INT hub to the Insert Transfer and Compress Start uses the Operand One and Operand Two Address Control abilities of these two features to govern the issuance of the Message characters from Core Storage to the Data Line Terminal. (See Page 2, Address Controls, Data Flow, Transfer Operations - UP-3871.)

When the I/M INT hub issues an A-Pulse, the Operand Address Controls are prevented from advancing the Operand One and Operand Two Addresses, thus blocking the entry of a new character code into the Data Line Terminal.

When the I/M INT hub issues a B-Pulse, the Operand Address Controls allow the Operand One and Operand Two Addresses to advance to permit the entry of a new character code into the Data Line Terminal.

When the UNIVAC 1004 is in a Transmit Step and is waiting for the Data Set to turn around, the I/M INT hub will emit an A-Pulse.

The I/M INT hub will emit a B-Pulse when the Early Terminate (ET) is signalled or when a "time-out fault" or parity error occurs.

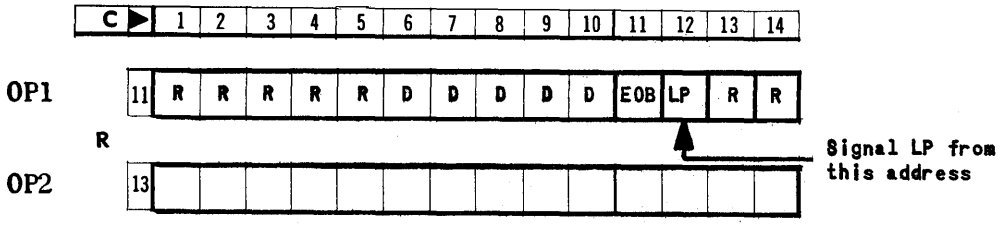
PRO - 90/80 Δ - The wiring of the 90/80 Δ from Step Output completes the wiring requirements of the Insertion operation for address control.

PRO - CMPS END - The wiring of the Compress End from Step Output allows the advance of the Operand Two Address except when prevented by the impulsing of Compress Start by an A-Pulse from the I/M INT hub.

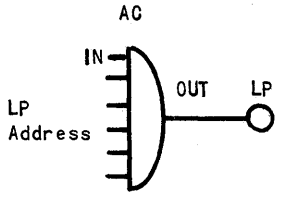
PRO - Even Parity - The wiring of the Even Parity hub from Step Output will add a Parity bit, when required, to make the bit count even for each character transmitted. If this hub is not wired, a Parity bit will be added, when necessary, to make the character bit count odd.

LP - Address or Bit Emitter - The impulsing of the Longitudinal Parity hub at the end of the transmission of a Data or End of Transmission Message causes the Data Line Terminal to replace the Space code following the last End of Block character with the Longitudinal Parity Count character generated by the Data Line Terminal and to transmit that count character.

The proper time for signalling the LP hub is on the OP1 location immediately following the End of Block character.

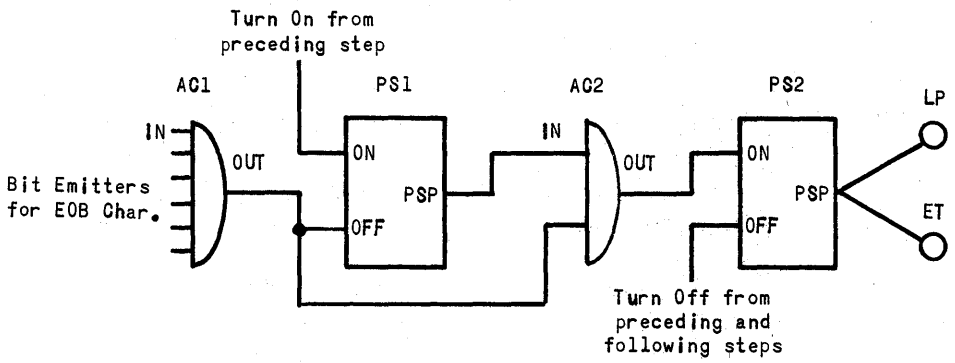


For fixed-length Data Messages, the OP1 storage location for the Space assigned to the Longitudinal Parity transmission is always the same. The address of this location is wired from the Address Emitter through an Address Combine to the LP hub.



For variable-length Data Messages, the storage location for the Space assigned to the Longitudinal Parity transmission will vary from Message to Message; in the Message format however, it always follows the last End of Block character. The Bit Emitter is used to examine the Message for the unique code of the last End of Block character to cause the impulsing of the LP hub in the following manner:

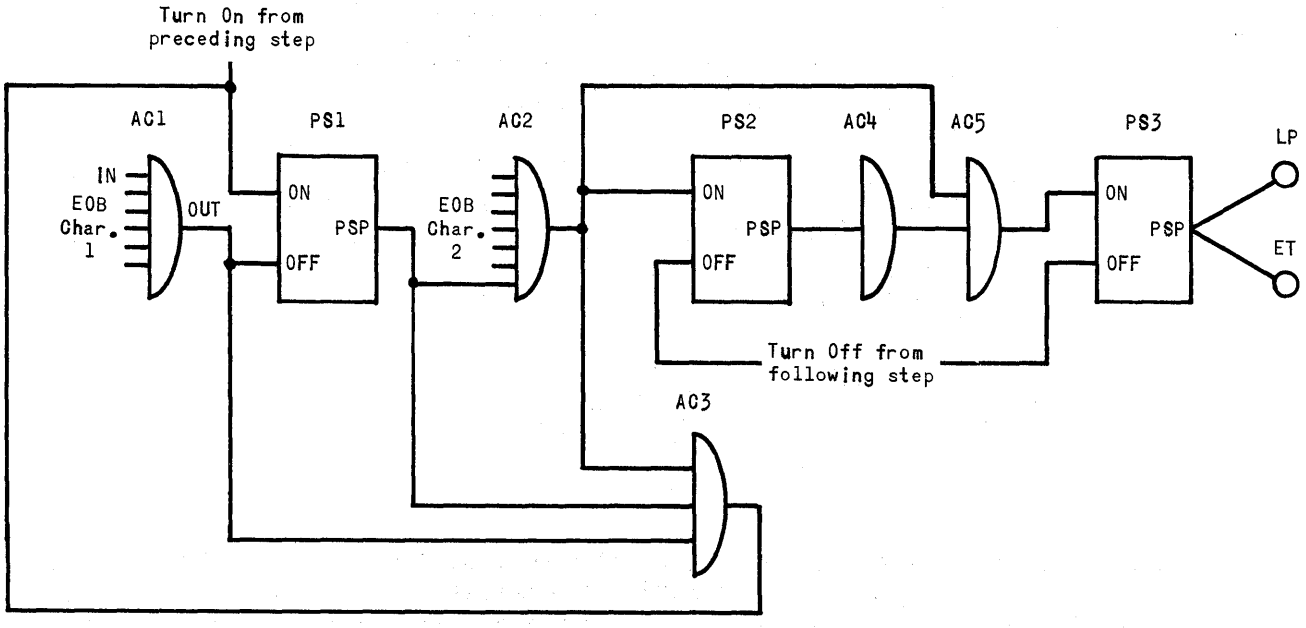
The combination of Bit Emitter hubs representing this End of Block character is wired through an Address Combine to turn Off a Program Select. This Program Select having been turned On before the Transmit Step is entered.



The Power of this Program Select, together with the Out of the first Address Combine, is wired to the In of a second Address Combine. The Out of this Address Combine is wired to the On of a second Program Select. This Program Select is turned Off from the step preceding and the step following the Transmit Step.

The Power of the second Address Combine is wired to the LP hub and also to the ET (Early Terminate) hub.

If a character sequence is used for the End of Block and none of the characters in this sequence is unique, a Bit Emitter, Address Combine, and Program Select chain similar to that shown below in schematic form for a two-character sequence is used to impulse both the Longitudinal Parity (LP) and Early Terminate (ET). The various Program Select Controls used in this chain would have been conditioned before the start of the Transmit Step.



The operation for recognizing the End of Block with a two-character sequence is as follows:

First End of Block Character - When this character is recognized during the Message, the A-Pulse from AC1 turns Off PSC1. PSC1 would have been turned On from the step preceding the Transmit Step.

Second End of Block Character - If the next character in sequence is the Second End of Block Character, the A-Pulse from AC2 turns On PSC2. This is converted to a B-Pulse by AC4.

If this is not the proper Second End of Block Character, the three B-Pulses entering AC3 will turn On PSC1.

When the End of Block character sequence has been sensed, the Longitudinal Parity (LP) hub is to be impulsed from the location following that for the last End of Block character. This delay is achieved by AC5.

At this location; AC2 will emit a B-Pulse, AC4 is emitting a B-Pulse. The resulting A-Pulse turns On PSC3.

PSP3 impulses the Longitudinal Parity (LP) and Early Terminate (ET) hubs.

Program Selects 2 and 3 are turned Off from the step following the Transmit Step.

For the End of Transmission Message, the most suitable of the above methods can be used for the impulsing of the LP hub. In any case, the End of Transmission Message would contain an End of Transmission character or a character sequence for End of Transmission rather than the End of Block character or characters.

For fixed-length Message transmissions, the program would be altered by the use of Selectors to transmit the End of Transmission Message.

For variable-length Message transmissions, the control wiring would be varied by Selectors to recognize the End of Transmission rather than the End of Block.

ET - Address or Bit Emitter - The Early Terminate (ET) is impulsed on the OP1 location following the last character to be transmitted. Any character in the location on which the ET is impulsed will not be transmitted. To prevent transmission from the balance of the OP1 locations, Program Select Power is used to impulse the ET and to hold it impulsed until the end of OP1 is reached to end the step.

The impulsing of the ET hub removes the I/M Interlock. The Processor will then advance through the balance of the Operand at the faster Transfer speed rather than at the slower Transmitting rate.

As previously mentioned, Message transmission will also end automatically following the transfer of a character into the last OP2 storage location.

NOTE:- To stay in step with the receiving Magnetic Tape Terminal, it is usually required to terminate the transmission after two Reference characters have been sent following the transmission of the Longitudinal Parity Count character.

For fixed-length Data Messages, the automatic termination at the end of OP2 would usually be used where the Message format fills the storage area for OP1. In this case, the Data Message format would end with two Reference characters following the Longitudinal Parity.

Where it is desired to transmit fixed-length Messages of a length shorter than the storage area provided, the OP1 address of the second of the two Reference characters is wired through an Address Combine to turn On a Program Select. The Power of that Program Select is wired to the ET hub.

For Bid, Connect, Acknowledge Correct, and Acknowledge Incorrect Messages if the step and the storage areas are the same as those used for the Data Message, the combination of Bit Emitter hubs representing the End of Mode character (01 0000) is wired from the OP1 address through an Address Combine to turn on a Program Select. The Power of that Program Select is wired to the ET hub. If a separate step is used, automatic termination will apply.

For variable-length Data Messages, the methods shown above for the impulsing of the LP (Longitudinal Parity) hub include the impulsing of ET hub.

For the End of Transmission Message a combination of the above methods can be used to terminate the Message transmission. The wiring to the ET hub would be selected by recognizing the End of Transmission code in an End of Transmission card.

When the same step is used to transmit both the Data and the End Transmission Messages, the address of the second of the two Reference characters in the End of Transmission Message is wired through an Address Combine to turn On a Program Select when the End of Transmission code is recognized. The Power of that Program Select is wired to the ET hub.

When a separate step is used to transmit the End of Transmission Message, that step is selected by the recognition of the End of Transmission code during card reading. The address of the second of the two Reference characters in the End of Transmission Message is wired through an Address Combine to turn On a Program Select. The Power of that Program Select is wired to the ET hub.

Terminating the Request to Transmit:- The Clear to Send is generated by the Data Line Terminal as long as either the Request to Transmit or the Operate or both are being impulsed. The impulsing of the Request to Transmit must be in effect when the Transmit Step is entered.

The Request to Transmit can be dropped out at any time during a fixed-length Message transmission.

For variable-length Messages, the Clear to Send must be continued until the 2 or 4 required Reference characters at the end of the Message are transmitted. At the end of the Transmit Step, the Request to Transmit is allowed to remain on for at least the time necessary for the Reference character transmission before being dropped out. If this time cannot be provided for in the regular routine, a delay sub-routine can be incorporated in the program for this purpose.

RECEIVING

RECEIVE STEP

The purpose of this step is to control the entry of the characters transmitted into the Core Storage of the receiving UNIVAC 1004.

This step must include the following Connection Panel wiring:

The wiring of its Step Output PRO hub to:

SI (Superimpose), Ascending or Descending
The Operate (90/MC) hub (A,63)
The CMPS (Compress) END
The 90/80 Δ

The wiring of the Step Output OP1 and OP2 hubs to define the storage locations of the Message to be received. Where the transmission is to include Messages of variable length, the number of storage locations required must be based on the maximum length message that might be included in the transmission.

The wiring of the I/M INT (Interlock) hub (A,16) to:

INS (Insert) Transfer, Ascending or Descending
The CMPS ST (Compress Start)

The wiring of the MOD ERR (Error) hub (A,15) to Step Sequence Change for the routine to be followed in the event of a parity error in the transmission. This can be a Character Parity or Longitudinal Parity error.

The wiring of the LP (Longitudinal Parity) hub (A,14) from:

The Bit Emitter for variable-length Message transmissions.
The Address Emitter for fixed-length Message transmissions.

NOTE:- A more detailed explanation of this wiring is given below.

The wiring of the ET (Early Terminate) hub (A,13) from Program Select Power. NOTE:- A more thorough explanation of this wiring is given below.

The Operands used on this Transfer operation are as follows:

OP1 - This can be a single-character operand or it can be of the same length as OP2. The actual Operand 1 data is the Message received.

OP2 - The number of storage locations required for this operand is determined by the maximum number of data characters to be transmitted in one Message plus from one to three locations for the End of Block characters plus one location for the Longitudinal Parity Count. If Forced Magnetic Tape Data Messages are to be received, an additional location must be provided for the entry of the Error Block signal character immediately following the last data character.

IMPORTANT:- The inclusion of Forced Magnetic Tape Block Messages in any transmission classifies that transmission as variable-length despite the fact that the Data Messages are of fixed length.

For fixed-length Data Message transmissions, the operands may be as follows:

OP1 can be a single-character operand. OP2 would consist of the multiple number of locations to provide for the length outlined above.

OP1 and OP2 can be of the same length and may occupy the same or different storage locations.

Offset operands must be used if it is necessary to examine the characters by the Bit Emitter as they are received. OP1 and OP2 can occupy the same storage locations but offset one location. If descending transfer is being used, OP1 would be offset one location to the left of OP2. If ascending transfer is being used, OP1 would be offset one location to the right of OP2.

For variable-length Data Message transmissions, OP1 and OP2 would occupy the same storage locations but offset one location. If descending transfer is being used, OP1 would be offset one location to the left of OP2. If ascending transfer is being used, OP1 would be offset one location to the right of OP2.

Offset operands would be required for variable-length Messages because it is necessary to examine the characters with the Bit Emitter for the End of Block character.

As the Message is being received, each character as it is received in bit serial form enters into the single-character register of the Data Line Terminal. When this register is filled, the character is then delivered in bit parallel form to the Data Register under the control of the current OP1 address. It is then entered into Core Storage under the control of the current OP2 address.

The character entry into Core Storage from the register of the Data Line Terminal is much faster than the character transmission. For this reason, full and empty signals from the register of the Data Line Terminal are used for Operand Two Address Control.

Whether the characters as they are received are entered into Core Storage in ascending or descending order depends on whether Ascending or Descending Superimpose Transfer is specified for the Receive Step.

PRO - 90/MC (OPERATE)- When the UNIVAC 1004 is on this Receive Step, the Step Output PRO to 90/MC connection causes an "Operate" signal to be delivered to the Data Line Terminal.

With the register of the Data Line Terminal empty, the coincidence of the Operate signal allows the I/M INT (Interlock) hub to issue an A-Pulse until such time as the register is filled.

When the register of the Data Line Terminal becomes filled, the I/M INT hub issues a B-Pulse until it is emptied.

I/M INT - INS & CMPS ST - The wiring of the I/M INT hub to the Insert Transfer and Compress Start uses the Operand One and Operand Two Address Control abilities of the two features to govern the issuance of the Message characters from the Data Line Terminal to Core Storage.

When the I/M INT hub issues an A-Pulse, the Operand Address Controls are prevented from advancing the Operand One and Operand Two addresses, thus blocking the entry of a new character code into the Core Storage.

When the I/M INT hub issues a B-Pulse, the Operand Address Controls allow the Operand One and Operand Two addresses to advance to permit the entry of a new character code into Core Storage.

When the UNIVAC 1004 is in a Receive Step and is waiting for the Data Set to turn around, the I/M hub will emit an A-Pulse.

The I/M INT hub will emit a B-Pulse when; the Data Line Terminal is full, the Early Terminate (ET) is signalled, a parity error (MOD ERR) is detected, or a "time-out fault" occurs.

PRO - 90/80 Δ - The wiring of the 90/80 Δ from Step Output completes the wiring requirements of the Insert operation for address control.

PRO - CMPS END - The wiring of the Compress End from Step Output allows the advance of the Operand Two Address except when prevented by the impulsing of Compress Start by an A-Pulse from the I/M INT hub.

PRO - Even Parity - The wiring of the Even Parity hub from the Step Output causes the characters received to be checked for even-parity. If this hub is not wired, an odd-parity check will be made.

MOD ERR - Step Sequence Change - The wiring of the Error (MOD ERR) hub to Step Sequence Change allows the UNIVAC 1004 to follow an Error subroutine in the event of a Character Parity or Longitudinal Parity error.

The MOD ERR hub will also emit when a "time-out fault" occurs. A "time-out fault" will occur if the UNIVAC 1004 enters a Receive Step but a Message is not received within twenty seconds.

LP - Address or Bit Emitter - The impulsing of the Longitudinal Parity hub at the end of the receipt of a Message allows the verification of the Longitudinal Parity Count to be made. This is a comparison between the Longitudinal Parity Count character contained in the Message received against the Longitudinal Parity Count generated automatically by the Data Line Terminal as the data characters of that Message are being received.

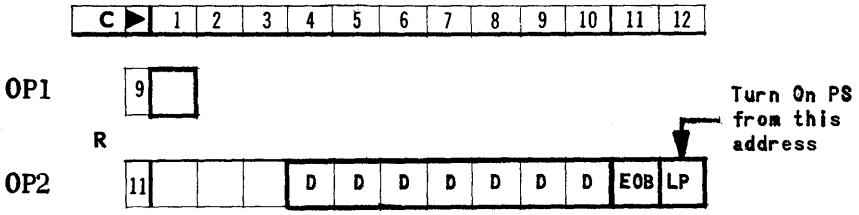
Any character received after the LP hub is impulsed will not be parity checked.

When receiving, the occurence of a Character Parity error or a Longitudinal Parity error will release the Processor interlock and cause a constant A-Pulse to be emitted by the MOD ERR hub. Any remaining OP2 storage locations will be space filled.

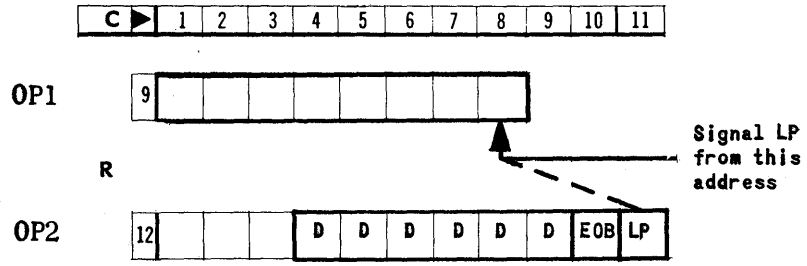
To initiate the Longitudinal Parity check at the correct time, an A-Pulse must be present at the LP hub during the OCA (OP1) following the receipt of the last End of Block character.

For fixed-length Data Messages, the method of impulsing the LP hub depends on the operands used.

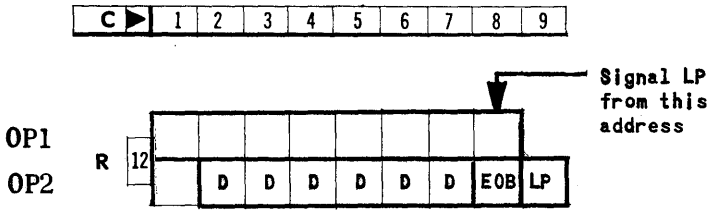
1. When OP1 is a single-character operand with multiple locations for OP2, the LP hub is signalled from the Power hub of a Program Select turned On from the OP2 address of the Longitudinal Parity character.



2. When OP1 and OP2 are of the same length but occupy different storage locations, the LP hub is signalled from the OP1 address equivalent to the Longitudinal Parity location by wiring that OP1 address through an Address Combine to the LP hub.

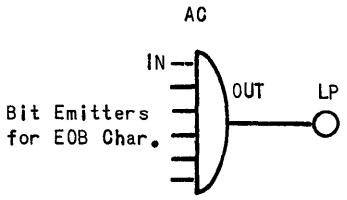


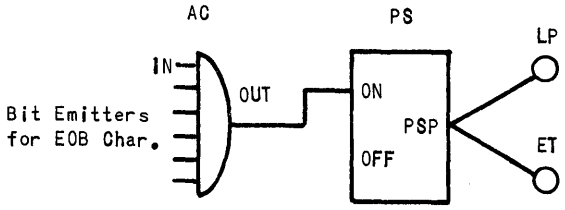
3. When OP1 and OP2 occupy the same storage locations but are offset one storage location, the LP hub is signalled from the OP1 address equivalent to the Longitudinal Parity location by wiring that OP1 address through an Address Combine to the LP hub.



For variable-length Data Messages, the OP1 address of the Longitudinal Parity Count character will vary from Message to Message; in the Message format however, it always follows the last End of Block character. The Bit Emitter is used to examine the Message for the unique code of the last End of Block character to cause the impulsing of the LP hub.

OP1 and OP2 will occupy the same storage locations but are offset one storage location. The LP hub is signalled from the OP1 address equivalent to the Longitudinal Parity location by wiring the in either of these two ways:

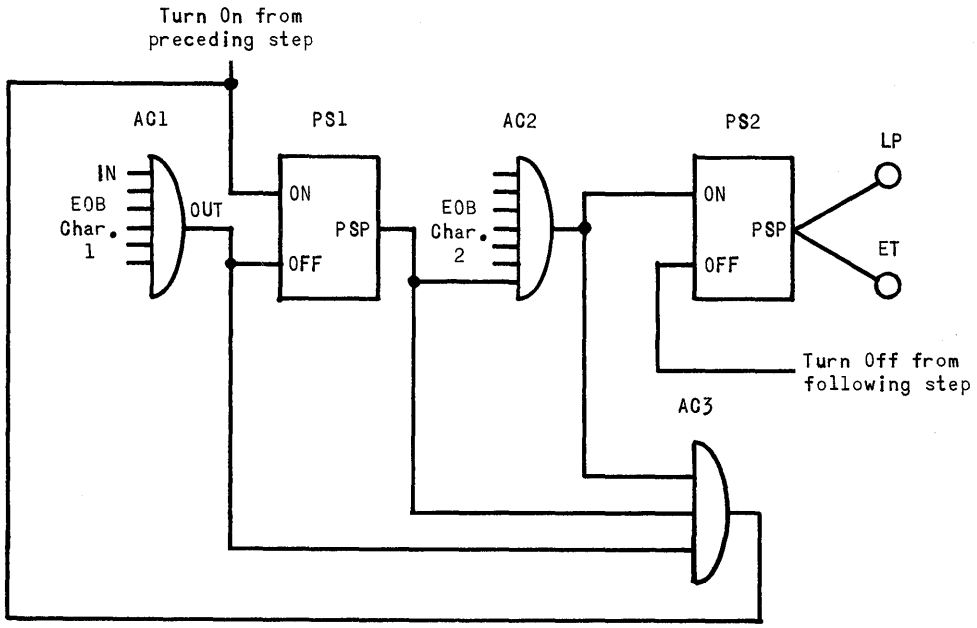




Bit Emitter wiring for the last End of Block character through an Address Combine to the LP hub.

Bit Emitter wiring for the last End of Block character through an Address Combine to the On of a Program Select. The Power of this Program Select is wired to both the LP and ET hubs. This Program Select would have been turned Off before the Receive Step is entered.

If a character sequence is used for the End of Block and none of the characters is unique, a Bit Emitter, Address Combine, and Program Select chain similar to that shown below in schematic form for a two-character sequence is used to impulse both the Longitudinal Parity (LP) and Early Terminate (ET). The various Program Select Controls used in this chain would have been conditioned before the start of the Receive Step.



The operation for recognizing the End of Block with a two-character sequence is as follows:

First End of Block Character - When this character is recognized during the Message, the A-Pulse from AC1 turns Off PSC1. PSC1 would have been turned On from the step preceding the Receive Step.

Second End of Block Character - If the next character in sequence is the Second End of Block Character, the A-Pulse from AC2 turns On PSC2. PSC2 impulses the LP and ET hubs.

If this is not the proper Second End of Block character, the three B-Pulses entering AC3 will turn On PSC1.

For the End of Transmission Message, the most suitable of the above methods can be used for the impulsing of the LP hub. In any case, the End of Transmission Message would contain an End of Transmission character or a character sequence for End of Transmission rather than the End of Block character or characters.

Receipt of the End of Transmission is usually used to alter the program to initiate the ending routine.

ET - Address or Bit Emitter - If the end of the OP2 has not been reached, the Early Terminate must be impulsed to end the receiving operation following the receipt of the End of Block and Longitudinal Parity Count characters. If this is not done, the Processor will stall in the Receive Step.

The ET hub must be impulsed immediately following the storing of the Longitudinal Parity Count character, i.e., on the OP1 address (OCA) of the following storage location. It must be held impulsed for the balance of the Receive Step.

The impulsing of the ET hub removes the I/M Interlock. The Processor will then advance through the balance of the operand locations at the faster Transfer speed rather than at the slower Transmitting rate.

A Receive Step will end automatically following the transfer of a character into the last OP2 storage location.

For fixed-length Data Messages, the automatic termination at the end of OP2 would usually be used where the Message format fills the storage area for OP1. In this case, the Data Message format would end with the Longitudinal Parity Count character.

Where it is desired to receive fixed-length Messages of a length shorter than the OP2 storage area provided, the OP2 address of the Longitudinal Parity character is wired through an Address Combine to turn On a Program Select as described above for Longitudinal Parity. The Power of that Program Select is wired to the LP and ET hubs.

For Bid, Connect, Acknowledge Correct, and Acknowledge Incorrect Messages if the step and storage areas are the same as those used for the Data Message, the combination of Bit Emitter hubs representing the End of Mode character (01 0000) is wired through an Address Combine to turn On a Program Select. The Power of that Program Select is wired to the ET hub. If a separate step is used, the automatic termination will apply.

For variable-length Data Messages, the address used to impulse the Early Terminate will vary from Message to Message; in the Message format however, it will always be effective on the second location following that containing the last End of Block character. The Bit Emitter is used to examine the Message for the unique code of the last End of Block character to cause the impulsing of the ET hub and the LP hub in the following manner as described above for Longitudinal Parity:

The combination of Bit Emitter hubs representing this End of Block character is wired through an Address Combine to turn On a Program Select. This Program Select having been turned Off before the Receive Step is entered.

The Power of this Program Select is wired to the LP and ET hubs.

If a character sequence is used for the End of Block and none of the End of Block characters is unique, the Bit Emitter, Address Combine, and Program Select chain shown above is used to impulse the ET hub as well as the LP hub.

For the End of Transmission Message, the recognition of the End of Transmission character or characters would be used for the impulsing of the ET hub and, usually, to alter the program to initiate the ending routine.

Error Detection

In addition to the parity checking operations described previously, the following errors in data communication are detected by the UNIVAC 1004:

Forced Magnetic Tape Block Messages - When the transmission can include erroneous Data Messages, the program at the receiving UNIVAC 1004 would provide for examining of all Messages by the Bit Emitter to detect the unique Error Block Signal character. This character is entered automatically by the Magnetic Tape Terminal following the last data character when Message transmission is forced.

Short Message - If the Message is short of the OP2 length in the Receive Step and the Early Terminate is not impulsed, a "time-out fault" will occur. The Processor interlock will be released, the remaining OP2 locations will be spaced filled, the MOD ERR hub will emit an A-Pulse.

Long Message - If the received Message is greater than the OP2 length, all characters up to the last character location in the OP2 are stored. The remaining data and the Longitudinal Parity Count character are lost; a MOD ERR impulse is issued immediately.

Operate without Request to Transmit - If the UNIVAC 1004 performs its Transmit Step without the Request to Transmit having been impulsed, the Data Set at the sending end will, of course, not be in the transmitting mode. A time-out fault (or disconnect) will occur at both the transmitting and the receiving ends. The receiving end will wait 20 seconds for a Message.

Request to Transmit without Operate - If the UNIVAC 1004 makes a Request to Transmit without transmitting a Message, a time-out fault (or disconnect) will occur at the receiving end.

The Magnetic Tape Terminal, in addition to the parity checking operations described previously, will detect the following errors in data communication and issue a disconnect signal:

When in a Receiving mode and a Message is not received within 20 seconds.

If the Master or Slave unit does not receive its proper instruction.

In the event of four consecutive errors. When the Magnetic Tape Unit is set to Retransmit, this disconnect signifies one incorrect transmission followed by three incorrect retransmissions. When the Magnetic Tape Unit is not set to Retransmit, this signifies the occurrence of at least one error in each of four consecutive blocks received.

Program Timing

The basic time elements around which a data communications program is built are as follows:

Transmitting 1004

Card Reading - The number of frames to be read.
Turn-Around to Transmit Message (Request to Transmit) - See below.
Transmit Message - Message characters x Rate of Transmission - See below.
Turn-Around to Receive Message (Automatic) - See below.
Receive Acknowledgement - 8 characters x Rate of Transmission.

Receiving 1004

Receive Message - Message characters x Rate of Transmission.
Turn-Around to Transmit Acknowledgement (Request to Transmit) - See below.
Transmit Acknowledgement - 8 characters x Rate of Transmission.
Turn-Around to Receive Message (Automatic) - See below.

The Rate of Transmission depends on the type of Data Set used:

For a 201A Data Set, operating at a speed of 2000 Bits per Second, the rate of transmission is 4 milliseconds per character.

For a 201B Data Set, operating at a speed of 2400 Bits per Second, the rate of transmission is 3.3 milliseconds per character.

The Turn-Around intervals must be considered for each end of the line; the time required depends on the type of Data Set used.

The change from the receiving mode to the transmitting mode (Request to Transmit) prior to the transmission or an Acknowledgement:

201A or B Data Set (2-Wire) - 150 milliseconds minimum.
201A or B Data Set (4-Wire) - 8 milliseconds minimum.

The automatic reverting to the receiving mode when the Request to Transmit is removed:

201A or B Data Set (2-Wire) - 100 milliseconds approximately.
201B Data Set (4-Wire) - 8 milliseconds approximately.

Propagation Time can be a consideration depending primarily on the distance and communications facilities between the two locations, sending and receiving. This is the time required for an electrical impulse to travel from one point to the other.

When the connection is by private wire, the distance and facilities would be known and the time fixed for each transmission.

Where the connection is through the exchange facilities, the routing could change from call-to-call depending on the lines available in the telephone network at the time a particular call is placed.

The Propagation Time can be obtained from the telephone company representative. It would be added to the Turn-Around Time for program timing.

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