8097/8297

**CONTROL DATA® 8097/8297
DATA SET CONTROLLER
MANUAL**

CONTROL DATA 8097/8297 FUNCTION CODES

36X0	SELECT STOP SEND MODE
36X1	SELECT SEND MODE
36X2	SELECT RECEIVE DATA
36X3	REQUEST 8097/8297 STATUS
36X4	INHIBIT 8097/8297 INTERRUPT
36X5	ENABLE 8097/8297 INTERRUPT

CONTROL DATA 8097/8297 STATUS RESPONSES

BIT 0	LOCAL 8097/8297 IN SEND MODE
BIT 1	REMOTE 8097/8297 IN SEND MODE
BIT 2	8097/8297 REQUEST FOR COMPUTER OUTPUT
BIT 3	8097/8297 REQUEST FOR COMPUTER INPUT

8097/8297

CONTROL DATA® 8097/8297
DATA SET CONTROLLER
MANUAL

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Figure 1. 8297 Data Set Controller

CONTROL DATA® 8097/8297 DATA SET CONTROLLER

INTRODUCTION

Computer facilities often have a need to transmit information from one operational site to another. This ability permits, for example, several divisions of a large organization to have fast access and turn-around-time on a centrally located computing function. Remote offices, too, need up-to-the-minute reports and information from their office headquarters to exercise better management control over their operation.

The Control Data 8097/8297 Data Set Controller provides the means for connecting computers together using telephone company facilities. The function of the Control Data 8097/8297 is to convert parallel information from the computer to serial information for a data set, and vice-versa. The Control Data computers which may be connected to a Control Data 8097/8297 Data Set Controller are:

    1. The Control Data 8092 Teleprogrammer   (8097 and 8297)

    2. The Control Data 160   (8297 only)

    3. The Control Data 160A   (8297 only)

    4. The Control Data 924 (operating in the 160 mode)   (8297 only)

    5. The Control Data 924A (operating in the 160 mode)   (8297 only)

    6. The Control Data 8090   (8297 only)

The Control Data 8097/8297 Data Set Controller is the connection between any of the computers listed above and a standard Bell System 201A or 201B Data Set®. Information is transferred under program control at a rate of 2000 bits per second using the 201A, and 2400 bits per second using the 201B. The Control Data 8097/8297 does not restrict the format or code of transmitted data in any manner, and allows operation on a standard full or half-duplex telephone channel. Pictures of an 8097/8297 are shown in Figure 1, and a block diagram of a complete communication facility is shown in Figure 2.

Since the Control Data computers themselves require only a fraction of their time to service the 8097/8297 in actual operation, the remainder of their time can be used for other information processing, editing, and computing tasks.

The Control Data 8097 and the Control Data 8297 are completely equivalent from a programming point of view. The differences are electrical and physical and are discussed in the section PHYSICAL AND ELECTRICAL CHARACTERISTICS.

SITE 1

TRANSMISSION IS
BIT SERIAL

The Data Sets and connection
between them is
supplied by the
Telephone
Company.

COMPUTER 1

8097/
8297

DATA
SET

TRANSMISSION IS
8 BIT PARALLEL

TELEPHONE CHANNEL
TRANSMISSION IS BIT SERIAL

8097
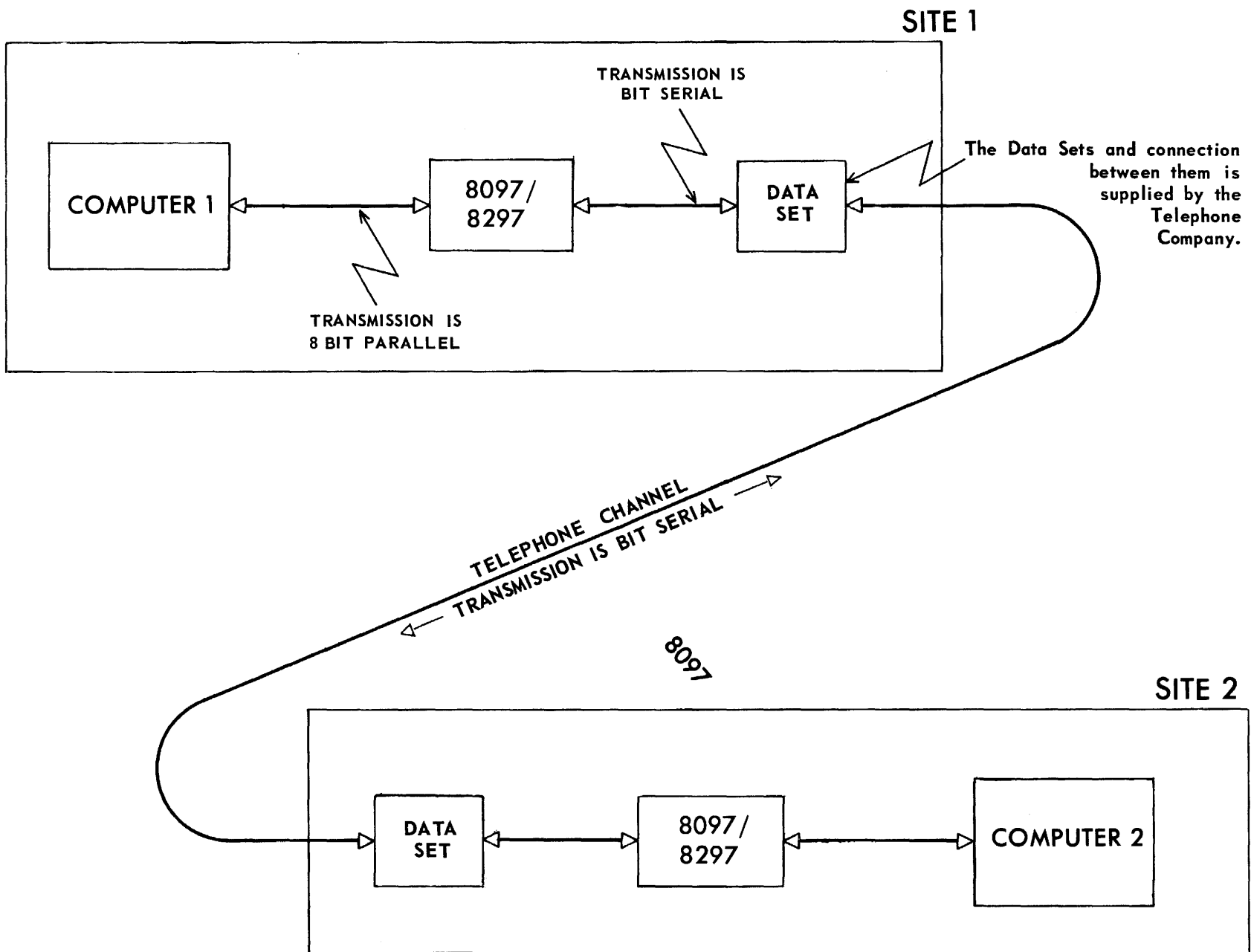
SITE 2

DATA
SET

8097/
8297

COMPUTER 2

Figure 2. Data Flow Using The Control Data 8097/8297

CONTROL DATA 8097/8297 PRINCIPLES OF OPERATION

For ease of explanation throughout this manual, we will choose Computer 1 (See Figure 2) and its associated 8097/8297 to be the sending computer and Computer 2 and its associated 8097/8297 to be the receiving computer. Since both computers will be sending and receiving, in our discussion this distinction is made for explanation purposes only. We will refer to the 8097/8297 associated with Computer 1 as 8097/8297-1 and the 8097/8297 associated with Computer 2 as 8097/8297-2.

Assume that Computer 1 has traffic to be sent to Computer 2. Assume also that both computers are in a Master Clear state. The steps needed to accomplish this transmission are:

1. Using the Data Set at the 8097/8297-1, the operator at Computer 1 dials the operator at Computer 2 and tells him that Computer 1 has traffic to send.

2. Depending on the specific program being used, both operators set the appropriate jump switches, etc., and place their respective computers in RUN. The telephone connection has been made and we will now look separately at the actions of each computer.
NOTE: When a 201B Data Set is used on a private or leased communication channel Step No. 1 is not necessary since 8097/8297-1 would always be connected to 8097/8297-2 and ready for transmission.

Computer 1

1. Computer 1 issues an EXF 36X1 SELECT SEND MODE instruction.

2. Computer 1 issues as many output instructions as needed to send the traffic.

3. Computer 1 issues an EXF 36X0 SELECT STOP SEND MODE.

Computer 2

1. For Computer 2 to successfully receive the traffic sent by Computer 1, Computer 2 must issue an EXF 36X2 SELECT RECEIVE DATA.

2. Computer 2 must issue as many input instructions as needed to receive the amount of traffic sent by Computer 1. These inputs must have been issued in time to receive each word as it is received by 8097/8297-2.

In its simplest form, the above procedure is all that is required to transmit data between two computers using the CONTROL DATA 8097/8297. The 8097/8297 automatically controls the remaining transmission tasks.

The above example made no use of the important interrupt features of the 8097/8297. This feature allows the computer to perform its normal computing operations while transmission takes place. On computers with more than one I/O channel, other peripheral operations may also be performed. Using this interrupt feature means that the computer will spend less than 5% of the transmission time actually servicing the 8097/8297. This includes the housekeeping and input or output operation.
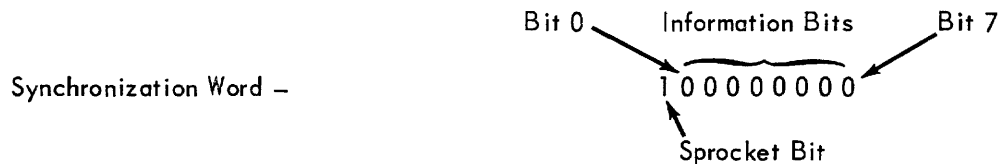
When the interrupt feature is used, following the initial selection of the respective 8097/8297's, the computers will receive an interrupt 40 only when a word is actually ready to be input or output. On a 2000 bit/second telephone line these interrupts will occur every 4.5 milliseconds. Only when an interrupt occurs does the computer need to service the 8097/8297. This service usually takes less than 250 micro-seconds, including house-keeping.

When the 8297 is used with a computer whose word size is larger than 8 bits, the 8 bit transfers between the 8297 and the computer will be to and from the 8 low order bits (bits 0 - 7) of the computer word.

SYNCHRONIZATION

In order for communication between two 8097/8297's to take place both units must be synchronized. The 8097/8297's must remain in synchronization for the entire transmission period.

When an 8097/8297 is placed in the SEND MODE it automatically establishes synchronization with the receiving 8097/8297 by sending two synchronization patterns to the receiving 8092/8297. Each pattern consists of 9 bits; 8 information bits and one sprocket bit. The information bits are all equal to zero and the sprocket bit is equal to one:

```
                                    Bit 0      Information Bits      Bit 7

Synchronization Word —                          1 0 0 0 0 0 0 0 0

                                                 Sprocket Bit
```

After these two synchronization words are sent the 8097/8297 will request data from the computer. The 8097/8297 will accept 8 bits of information from the computer, add one sprocket bit, and present this 9 bit word serially to the data set or modem for transmission.

The receiving 8097/8297 will receive all 9 bits, remove the sprocket bit and present the 8 information bits to the receiving computer for input. The result is that actual data is transmitted at 88.8% of the line or channel transmission speed.

Each time a 9 bit word is required by the data set or modem to maintain communication the 8097/8297 will supply this word in one of two ways:

1. If the computer outputs 8 information bits the 8097/8297 will add one sprocket bit and present this 9 bit word to the 201 data set.

2. If the computer does not output information the 8097/8297 will present a synchronization word to the data set or modem. In this case the receiving computer will receive a word of zeros.

USING THE SYNCHRONIZATION FEATURE

The 8097/8297 synchronization feature allows the computer to perform operations completely independent of the 8097/8297 and to output data when it is available. Without this feature resynchronization would have to be performed each time a pause in communication took place. The time required to synchronize two 201 data sets or reverse the direction of transmission is between 150 - 200 ms on a half duplex channel.

Once the 8097/8297 is placed in the SEND MODE and initial synchronization has taken place, the 8097/8297 will maintain synchronization with the receiving 8097/8297 until it is taken out of the SEND MODE, whether or not the 8097/8297 remains selected by the computer. The receiving and sending computers can be programmed in one of two basic ways:

1. If the application is of such a nature that data to be transmitted is available asynchronously or the computer could be unavailable when the 8097/8297 requests a word of data, then the data to be transmitted should be organized so that a zero word is never valid data. The receiving computer is then easily programmed to discard all zero words.

2. If the sending computer will always be available when the 8097/8297 requests data, then zero data words can be used and the 8097/8297 will never send a synchronization word once initial synchronization has been established.

MESSAGE FORMAT

The 8097/8297 imposes no restrictions on the length or format of data to be transmitted. Information in any code may be transmitted using the 8097/8297. The length of messages which can be sent using the 8097/8297 will depend on the line condition and is independent of the 8097/8297 itself.

Communication between the 8097/8297's is a twofold process under normal circumstances:

1. Sending a message.

2. Receiving acknowledgment that the message was correctly received.

Several suggested message formats follow:

1. SOM   DATA   EOM

2. SOM   BLOCK COUNT   DATA   EOM

3. SOM   BLOCK COUNT   WORD COUNT   DATA

4. SOM   WORD COUNT   DATA

<u>SOM</u> indicates Start-of-Message and can be any unique word or combination of words which uniquely identifies the beginning of a message.

<u>EOM</u> should be a unique code indicating End-of-Message.

<u>BLOCK COUNT</u> is a message identifying number and can be used to check message sequence.

<u>WORD COUNT</u> is the count of the number of data words to be transmitted in the message.

<u>DATA</u> is the actual information being transmitted and should include some form of <u>Error Checking</u>.

ERROR CHECKING

The type of tests which must be made on data transmitted via a Control Data 8097/8297 will depend upon a number of factors:

1. The average noise conditions on the line.

2. The actual types of data changes which occur on the line.

3. The validity with which the data itself must be transmitted.

Numbers 1. and 2. are variables which depend on the actual communication line conditions. Number 3. depends on the application.

Various validity testing methods are discussed in CONTROL DATA TECHNICAL RE-PORT TR-54. The object of these methods is to create the maximum checking ability with the minimum amount of redundancy. Under some conditions, for example, a simple longitudinal parity check will be sufficient. Many conditions require a more sophisticated method such as a cyclic code.

It is important that before any particular checking method is adopted a controlled test on the line using the check should be run. This test should measure not only detected errors but also undetected errors.

Since the type of checking required in any particular application varies, the 8097/8297 permits any type of check to be used as determined by the computer, the line and the application.

TIMING

Initial Synchronization. This is the time required to bring up the carrier and establish synchronization between the sending and receiving 8097/8297's. Using 201 Data Sets and standard data grade lines this time averages 160 ms. This initial synchronization time is the time between initially selecting 8097/8297 SEND MODE and the time when the first data word will be accepted for output.

Transmission Rate. The rate at which the 8097/8297 will transmit data words is found by dividing the bit rate of the line itself by 9. For example, on a 2000 bit/second line a data word is sent every 4.5 ms. On a 2400 bit/second line a data word is transmitted every 3.65 ms.

Turn-Around Time. In a half duplex system there is a waiting period each time the direction of transmission is reversed. This time is the same as the time required to establish initial synchronization. In a full duplex system this time is reduced to approximately 16 ms.

CONTROL DATA 8097/8297 FUNCTION CODES

The 8097/8297 Function Codes are all listed in the form:

3 6 X Y

"X" is the 8097/8297 Unit Designator Digit and can be any of the digits 0 - 7. When a single 8097/8297 is attached to a computer this digit is normally 0. This feature allows up to eight 8097/8297's to be attached to a single computer. More than eight 8097/8297's may be attached by using master bits other than 36. This is preset at the factory.

"Y" is the specific function code designator.

36X1   Select Send Mode

This code places the 8097/8297 in the SEND MODE. Approximately 150-200 ms following this code the 8097/8297 automatically sends two synchronization words to the receiving terminal. The receiving computer will receive one or both of these words. As soon as these two words have been send the 8097/8297 will send an interrupt 40 to the computer. This interrupt 40 will then be issued whenever the 8097/8297 is ready to accept a word of output from the computer (on a 2000 bit/second line this occurs every 4.5 ms). Following the receipt of this interrupt 40 the computer must output a word of data before the next interrupt 40. If no data is output within this time the 8097/8297 automatically sends out a word of synchronization to the receiving terminal.

On a 2000 bit/second line, for example, once the 36X1 code is given and the first interrupt 40 received, the 8097/8297 will continue to issue an interrupt 40 to the computer every 4.5 ms and, if no data is output, send a synchronization word every 4.5 ms until a 36X0 code is given.

If interrupt has been inhibited, the 8097/8297 will perform as described above but the interrupts will not be received by the computer. In this case it is up to the program in the computer to have data ready at the proper times. If no data is output to the 8097/8297, the 8097/8297 will automatically send synchronization words as indicated above.

After the last character in a message has been sent, a 36X0 code should be given to remove the SEND MODE selection.

36X0   Select Stop Send Mode

This code clears the SEND MODE selection in the 8097/8297. Once the 8097/8297 is put in the SEND MODE, either this code or a computer master clear must be given to remove that mode selection. The 36X0 code does not alter the interrupt selection.

36X4   Inhibit 8097/8297 Interrupt

This code inhibits all interrupts from the 8097/8297 to the computer. Mode selection is not altered.

36X5   Enable 8097/8297 Interrupt

This code allows the 8097/8297 to send interrupts to the computer. The interrupts sent are those described under SELECT SEND MODE and SELECT RECEIVE DATA function codes. Once interrupts have been inhibited this code must be given when interrupts are again desired.

NOTE: A computer Master Clear does not alter interrupt selection.

36X2   Select Receive Data

The 36X2 and 36X3 Function Codes define which type of information can be input to the computer. Either data input (36X2) or status input (36X3), once selected, will remain selected until the other code is issued. This allows two way communication on a full duplex channel since both 36X2 and 36X1 may be simultaneously selected.

The 8097/8297 will issue an interrupt 30 to the computer whenever it has data for the computer. This interrupt 30 will be issued whether the computer has selected 36X2 or not.

Following the interrupt 30, a word of data must be input by the computer before the next word is ready for input (and the next interrupt 30 issued). If no input takes place the next word will replace the current word and the current word will be lost.

If interrupt has been inhibited, the 8097/8297 will perform as described above but the interrupts will not be received by the computer. In this case it is up to the program in the computer to input data at the proper times.

If the computer attempts an input and either initial synchronization has not been established or the sending computer has ceased transmission, the 8097/8297 will automatically issue a Disconnect to allow the receiving computer to continue operation.

36X3   Request 8097/8297 Status

This code allows 8097/8297 status to be input to the computer. The use of this code differs depending on the mode selection of the 8097/8297.

1. SEND MODE. Once the 8097/8297 has been placed in the SEND MODE, the 36X3 code need be given only once. From that point on any input by the computer will transmit the current 8097/8297 status. Additional 36X3 codes may be given but these are ignored.

2. RECEIVE MODE. When the 8097/8297 is in the RECEIVE MODE a 36X3 code must be given each time status is desired. The 36X3 code allows status to be input but also removes the RECEIVE MODE selection. Therefore, to restore the selection, a 36X2 code must be given after the status is input.

3. NO MODE SELECTED. Follow the procedure for status in the SEND MODE.

CONTROL DATA 8097/8297 STATUS RESPONSE CODES

Bits 0 - 3 of the Status Response word are used to indicate the current status of the 8097/8297. These bits are defined as follows:

BIT 0:   If bit zero is 'on' (equal to 1) this indicates that the 8097/8297 is in the SEND MODE. If bit zero is 'off' (equal to 0) this indicates that the 8097/8297 is NOT in the SEND MODE.

BIT 1:   If bit one is 'on' (equal to 1) this indicates that the 8097/8297 of the other end of the line is in the SEND MODE. If bit one is 'off' (equal to 0) this indicates that the 8097/8297 on the other end of the line is not in the SEND MODE.

BIT 2:   This bit is turned on if and only if the 8097/8297 is in the SEND MODE. It is then turned on when the 8097/8297 is ready to accept a word of output from the computer. Once the computer outputs to the 8097/8297 this bit is turned off. It is then turned on once again when the 8097/8297 is ready to accept the next word of output.

BIT 3:   This bit is turned on if and only if bit 1 is on and the 8097/8297 has a word of data to be input by the computer. It is turned off as soon as the computer inputs the data word and is then turned on again when the next data word is ready for input.

OPERATION

The 8097/8297 control panel consists of switches and indicators and is used primarily for establishing initial operating conditions and for maintenance.

POWER This is a combination switch and indicator. When lit, it indicates that A.C. power has been turned on (8297 only).

SEND This indicator (blue) is lit when the local 8097/8297 is in the SEND MODE and the data set or modem has returned a clear-to-send signal to the 8097/8297 and is ready to accept data.

RECEIVE This indicator (green) is lit whenever the remote 8097/8297 is in the SEND MODE and the data set or modem detects a carrier signal.

To operate the Control Data 8097/8297:

1. Turn the power on. (NOTE: In the 8097 the power will be on whenever the 8092 Teleprogrammer is on.)

2. Using the Telephone attached to the data set, dial the remote station. Verify that the remote site is ready for communication.

3. Both the local and remote operators then press the DATA button on the telephone and place their computers in RUN.

PHYSICAL AND ELECTRICAL CHARACTERISTICS

The Control Data 8097 is designed for use with the Control Data Teleprogrammer only. The 8097 is rack mounted within the 8092 Teleprogrammer cabinet itself. Power is supplied by the 8092.

The Control Data 8297 is a separate cabinet mounted unit complete with power supply, fans and storage space for the data set.

The Control Data 8097/8297 can be connected to any of the following Control Data computers:

1. The Control Data 8092 Teleprogrammer   (8097 and 8297)

2. The Control Data 160   (8297 only)

3. The Control Data 160A (buffer or normal channel)   (8297 only)

4. The Control Data 924   (in the 160 mode)   (8297 only)

5. The Control Data 924A (in the 160 mode)   (8297 only)

6. The Control Data 8090 (buffer or normal channel)   (8297 only)

The Control Data 8097/8297 in turn connects to any Telephone Company 201 Data Set ® with clock, or to any other modem unit which has an EIA RS232 interface with clock. Other Control Data Communication Terminal Units are available with different interface characteristics. For information about these units consult your local Control Data Sales Representative.

Physical Characteristics

CONTROL DATA 8097:

> The 8097 is a chassis assembly 10-1/2 inches high, 6-1/2 inches deep and 19 inches wide. The chassis assembly contains 118 printed circuit plug-in logic cards, two indicators (send and receive) and six connector receptacles. The 8097 chassis assembly is mounted on a hinged rack immediately behind the front door of the 8092 Teleprogrammer cabinet. Standard hardware is used to bolt the chassis to the standard rack frame. The environment is the same as required for the 8092 Teleprogrammer.

CONTROL DATA 8297:

Height:	29 inches
Width:	19-1/2 inches
Depth:	30 inches
Weight:	250 lbs. (with data set). Floor loading on 4 casters each 2.5 inches dia. on 15 X 21 inch centers which is approximately 63 lbx. on each caster.
Power:	155 watts, 60 cps, 1 phase, 115 v ± 10% 5 Amps.
Environment:	The 8297 may be installed in any area which meets the requirements for the computers listed above. No special air conditioning is required since the 8297 generates less than 600 B.TU/HR. The 8297 may be operated at and stored at 10 to 90% humidity.
Temperature:	Storage —40° to + 150° F. Operation —60° to + 100° F.

NOTE: The 8097/8297 does not include the 201 Data Set or the communication channel. These are supplied by the telephone company.

CONTROL DATA
CORPORATION

Reader Survey Card

Publications such as this are prepared to give you a better understanding of Control Data Corporation computing equipment and systems – their design, their application and their operation. We would appreciate your evaluation of this manual to guide us in planning others. Thank you for your cooperation.

Tear off – Fill in – Mail

Reader's Survey Card

CONTROL DATA
CORPORATION
IDP DIVISION

INSTRUCTIONS FOR RATING

For each factor, select and circle the number which most accurately measures your feeling. For example, to rate the readability of a 5th grade reader

EASY TO READ ① 2 3 4 5 **DIFFICULT TO READ**

Select and circle the number 1.

PRESENTATION

Easy to read	1 2 3 4 5	Difficult to read
Too detailed	1 2 3 4 5	Too general
Well organized	1 2 3 4 5	Poorly organized
Too "educational"	1 2 3 4 5	Too "promotional"
Too many illustrations	1 2 3 4 5	Too few illustrations

SUBJECT MATTER

Interesting	1 2 3 4 5	Dull
Adequately covered	1 2 3 4 5	Inadequately covered
Too technical	1 2 3 4 5	Too elementary

USEFULNESS (Rate only those uses which you feel apply to this manual.)

As an introduction to the subject	Good 1 2 3 4 5	Poor
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As a reference	Good 1 2 3 4 5	Poor
As a guide to planning	Good 1 2 3 4 5	Poor
As a maintenance aid	Good 1 2 3 4 5	Poor

ADDITIONAL COMMENTS OR SUGGESTIONS

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