



Communications
Canada

A USER ORIENTATED DISCUSSION OF RECORD TELECOMMUNICATIONS

GOVERNMENT

TELECOMMUNICATIONS

AGENCY



TELECOMMUNICATIONS
APPLICATIONS
MANAGEMENT BRANCH

HD
9696
T442
U73
1973



Government of Canada Gouvernement du Canada

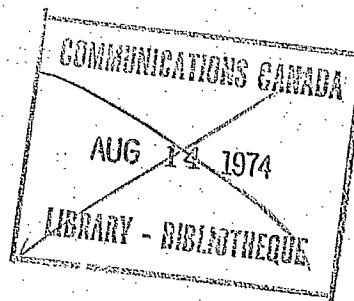
HD
9696
T442
U73
1973

Department of Communications
100 Metcalfe Street
OTTAWA, Ontario

Ministère des Communications

July 8, 1974

A.B. Donaldson
General Manager
Government Telecommunications Agency
Communications Canada
100 Metcalfe Street
Ottawa, K1A 0C8



Dear Sir:

The following report entitled "A User Oriented Discussion of Record Telecommunications" is submitted in compliance with your request.

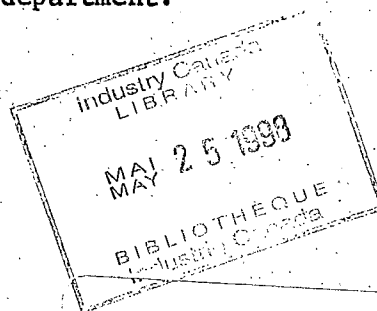
The report will assist departmental Telephone Service Officers in determining what services are available to satisfy a particular record requirement. An appendix listing various record communication suppliers is included in addition to descriptions and comparisons of services for this purpose.

The report extends the offer of GTA assistance in the selection and evaluation of these services. General recommendations are made regarding the application of specific services; however, because of the report's restricted length; conclusions regarding a particular requirement can only be arrived at through an examination of the requirement in co-ordination with the user department.

Yours truly,

Denis Martin
Denis Martin

Director, Voice and Data Telecommunications
Application Design and Management
Government Telecommunications Agency



①
A USER ORIENTATED DISCUSSION

OF

RECORD TELECOMMUNICATIONS

PREPARED BY

COMMUNICATIONS CANADA

GOVERNMENT TELECOMMUNICATIONS AGENCY

A. BRUCE DONALDSON, GENERAL MANAGER

December 20, 1973

HD

9696

T442

U73

1973

DD5019718

DL542546

PREFACE

This report briefly describes the record telecommunication services available from the common carriers and record communication equipment suppliers. The technical details of the various services have been, for clarity and brevity, purposely minimized. Although a comparison of services is made, wherever possible, this comparison is meant only to highlight the similarity between various services, and should not be mistaken for the cost versus benefits comparison of services that should be performed during the selection of a service for a particular requirement.

The various services, for discussion purposes, are divided into public and private networks. A partial list of record communication equipment suppliers is provided in Appendix 1.

In summary, the report is intended to arouse the reader to consider the variety of possible solutions to a particular record telecommunication requirement. Through proper analysis of the requirement and solutions, the reader will be able to determine the solution best suited for his needs.



N. Robinson
Project Officer
Record Telecommunications
Government Telecommunications Agency

TABLE OF CONTENTS

LETTER OF TRANSMITTAL

PREFACE

TABLE OF CONTENTS

- 1 INTRODUCTION
 - 1.1 Objective
 - 1.2 To Whom is the Report Addressed
 - 1.3 Method of Presentation
 - 1.4 An Approach Towards Evaluating a System
- 2 PUBLIC RECORD COMMUNICATION NETWORK SERVICES
 - 2.1 Switched Line Record Communication Services
 - 2.1.1 Telex/TWX
 - 2.1.2 Info-fax/Faxcom Switched Line Record Service
 - 2.2 Store and Forward Message Switching Services
 - 2.2.1 Telenet/MSDS
 - 2.2.2 MATS (Multiple Address Telex Service)
 - 2.2.3 Teltex
 - 2.2.4 Telegram Service
 - 2.2.5 Telepost
- 3 PRIVATE RECORD COMMUNICATION NETWORKS
 - 3.1 Transmission Facilities
 - 3.1.1 Switched Line Transmission Facilities
 - 3.1.1.1 Data line II/TCIS
 - 3.1.1.2 Data line III
 - 3.1.1.3 Data Telex
 - 3.1.1.4 Foreign Exchange Telephone Service (FX)
 - 3.1.1.5 Wide Area Telephone Service (WATS)

- 3.1.1.6 Federal Government Switched Telephone Network
- 3.1.1.7 Multicom II/Broadband
- 3.1.1.8 Multicom III
- 3.1.2 Dedicated Point-to-Point or Multi-point Transmission Facilities
 - 3.1.2.1 Private Line Data Circuits
 - 3.1.2.2 Data Route/Infodat
- 3.2 System Equipment
 - 3.2.1 Visual Display Units
 - 3.2.1.1 Line Printers
 - 3.2.1.2 Character Printers
 - 3.2.1.3 Facsimile Receivers
 - 3.2.1.4 Pen Recorders
 - 3.2.1.5 Vidio Display Units (CRT's)
 - 3.2.1.6 Nixie Tube Display Units
 - 3.2.2 Data Storage Units
 - 3.2.2.1 Perforated Tape Recorders
 - 3.2.2.2 Perforated Card Recorders
 - 3.2.2.3 Magnetic Tape
 - 3.2.2.4 Magnetic Card Recorder
 - 3.2.2.5 Magnetic Disc and Drum Storage
 - 3.2.2.6 Printed Paper Tape or Cards or Page
 - 3.2.2.7 Computer Output Microfilm (COM)
 - 3.2.2.8 Electronic Storage Units
 - 3.2.3 Record Communication Terminal Transmitters
 - 3.2.4 Terminal Control and Interface Equipment

- 3.2.4.1 Terminal Selector
- 3.2.4.2 Digital Repeaters
- 3.2.4.3 Polling or Control Units
- 3.2.4.4 Dial or Touch Tone Signalling Unit
- 3.2.4.5 Data Speed Converter
- 3.2.4.6 Data Code Converter
- 3.2.4.7 Error Detector and Converter or Alarm Unit
- 3.2.4.8 Circuit Switch
- 3.2.4.9 Store and Forward Message Switching Centre
- 3.2.4.10 Modems or Data Sets
- 3.2.4.11 Stored Program Computers
- 3.2.4.12 Analogue to Digital Converter (A/D)
- 3.2.4.13 Digital to Analogue Converter (D/A)
- 3.2.4.14 Line Coupling Units
- 3.2.4.15 Line Concentrator Units
- 3.2.4.16 Time or Frequency Division Multiplexing Unit

APPENDIX 1 - List of Suppliers

1 INTRODUCTION

Record communications is the branch of communications that concerns itself with the storage (i.e. recording of the information) of information in a suitable medium, the retrieval of the information from the recording medium, and the transmission of information between recording media. Under this broad definition falls the entire field of communications, since one can justly make the claim that it is impossible to communicate, even in conversation, without following this procedure. In the stricter sense, however, record communications is restricted to storage media external to the human body, and to systems where the information is recorded for more than a few moments. This paper will place a further restriction by considering only record telecommunications.

1.1 Objective

The objective of the report is to stimulate the awareness of the reader to the variety of record telecommunication techniques available to him. The approach taken to accomplish this objective, has been to briefly describe the various record telecommunication facilities offered by the common carriers and the record communication equipment suppliers. In addition, examples of application for these services have been given where it was felt it would clarify the description; moreover, an effort has been made to classify similar type services and to explain their similarities and differences.

1.2 To Whom is the Report Addressed

The report has been written specifically for the Federal government departmental telephone service officers; however, it is felt that it would be of interest to any person desiring an overview of the present state of record telecommunication services in Canada. The technical details of the various services have been purposely minimized for clarity and brevity. So also have the details on costs, and comparison of various features. Some guidelines providing these details have been prepared by GTA for specific services; however, guidelines providing a comparison of cost versus benefits of all record telecommunication services are still in the process of being completed. As soon as they are completed, they will be made available to all Federal government departments and agencies. In the meantime, assistance or further information on a service of particular interest may be obtained from your Government Telecommunication Agency representative.

1.3 Method of Presentation

The approach taken in this paper is to first divide record communications into two groups:

1. Public networks where all users are assured compatability between their terminal and every terminal on the network.
2. Private networks where the user must ensure that his equipment is compatable with those persons with whom he wishes to communicate.

Group number one then permits further classification into two more groups:

1. Switched line networks.
2. Store and forward message switching.

A final classification into the various types of service offerings within these two groups may be then made. The similar services offerings are then described, and their differences explained.

The classification of group number two is slightly more difficult than that of group number one. Since we are not assured compatibility between members sharing the same network transmission facilities, a common ground for classification was found by classifying group number two into:

1. Transmission facilities.
2. System Equipment.

A further classification of transmission facilities may then be performed as follows:

1. Switched line transmission facilities.
2. Dedicated point-to-point, or multi-point transmission facilities.

A final classification of the above two groups into their respective service offerings may then be made.

Similarly, system equipment falls naturally into the classification of:

1. Visual Display Units.

2. Data Storage and Retrieval Units.
3. Terminal Control and Interface Equipment.

A final classification of each of these groupings into their various types may then be done, and brief functional description of these types is then given.

1.4 An Approach Towards Evaluating a System

As with any service a potential user is considering, two areas should be closely examined: benefits and cost. To determine the benefits of a service with any justice, the user must accurately define his requirements. A feature of a particular service provides zero benefit, if it is not required; indeed, it may provide a negative benefit, or harm. The potential user should compare his requirements against the systems features, and determine those that are required, and those that are superfluous. He should then weigh each feature with a benefit value expressed in dollars, (i.e. how much is the particular feature worth to the user?) so a meaningful comparison can be made with other systems that may also satisfy the users requirement.

The reader will become aware, after reading the descriptions of the various service offerings, that the above approach is by no means a simple task. Indeed, a great deal of expertise is required if one hopes to arrive at a reasonable solution.

Fortunately, for Federal government departments at least, this problem has been anticipated and a Federal government agency (GTA) has been charged by Treasury Board specifically with this responsibility.

The department considering the implementation of a new record communication service, or the modification of an existing system is urged to consult GTA for advice in this area. We would like to emphasize that the department is under no obligation through consulting GTA. Although the advice from GTA is given only after a careful consideration of the requirement by GTA's user application staff and telecommunication experts, it is given freely, and the final decision with regards to the best system for a departments record communication needs rests with the user department.

2 PUBLIC RECORD COMMUNICATION NETWORK SERVICES

As stated in paragraph 1.3, the public network services assure all subscribers compatability of transmission to another subscriber of the same service. They are total record services (i.e. terminal, transmission facilities, and switching facilities) provided by the common carriers. The cost of the service is a fixed monthly charge for terminal equipment, plus a usage charge for all transmissions. Rates for a specific service may be found in the CN/CP or TCTS tariffs. A minimum contract period of one month is normally required.

For ease of discussion, these services have been divided into two categories - switched line record communication services, and store and forward record communication services. The comparable services in each category have been listed under their respective supplier, CN/CP or TCTS, and are discussed in the following paragraphs.

2.1 Switched Line Record Communication Services

The switched line record communication services differ from the store and forward record communication services in that they permit direct communication between subscribers terminals. The store and forward services, in contrast, requires the originator to transmit his message to an intermediary point, from which it is relayed to its destination. Consequently direct communication between terminals is not possible.

The following switched line record services are provided by CN/CP and TCTS. These services will be discussed in more detail in subsequent paragraphs.

<u>CN/CP</u>	<u>TCTS</u>
Telex	TWX
Info-fax	Faxcom

2.1.1 Telex/TWX

Telex service is a baudot code, 66 2/3 wpm, national and international, half duplex, record communication service. Record communications via Telex provides access to 260,000 subscribers in 149 countries, and is restricted to subscribers of this service. The terminal equipment generally consists of a character printer model 32 ASR plus associated dial and control equipment; however, any CN/CP standard tariff equipment offering may be used, providing that it is code and speed compatible with other Telex subscribers. Calls are established over the switched Data Telex network by dialing a four digit number for local calls and a six digit number for long distant calls.

By comparison, Telewriter Exchange Service (TWX) is an ASCII code, 100 wpm, national and international, half duplex record communication service. Record communications via TWX provides access to 400,000 subscribers in 183 countries, and is restricted to subscribers of this service. The terminal equipment generally consists of a character printer model 33 ASR plus associated dial and control equipment; however any TCTS standard tariff equipment offering may be used, providing that it is code and speed compatible with other TWX subscribers. Calls are established over the public telephone network by dialing a ten digit number.

Telex and TWX provide a similar type of service, with Telex having a greater variety of national subscribers. They have an application for low volumes of traffic (less than 2 hrs/day) or where it is essential to have access to other Telex or TWX subscribers. Volumes of traffic greater than 2 hrs/day are generally handled more economically by other record services.

2.1.2 Info-fax/Faxcom Switched Line Record Service

These are facsimile record communication services provided via the carrier's telephone networks. CN/CP uses their broadband telephone network to provide the Info-fax service, while TCTS uses the public telephone network to provide their Faxcom service. Facsimile equipment and transmission facilities are provided as a single package. The subscriber pays a fixed monthly rate for equipment, plus telephone network terminations, in addition to usage charges for each transmission. These services have application for low to medium volumes of traffic, or where it is desirable to communicate with other Faxcom or Info-fax subscribers. Persons desiring more information on facsimile, may obtain a report entitled "Evaluation Report on Facsimile Communications" from their GTA representative.

2.2 Store and Forward Message Switching Services

As stated in 2.1 store and forward services do not permit direct communication between terminals; however, this does not necessarily mean that traffic will encounter delay. Indeed, it is possible with some store and forward systems, to actually increase the overall speed of delivery of traffic in comparison to switched line systems.

The following store and forward record communication services are provided by CN/CP and TCTS. These services will be discussed in more detail in subsequent paragraphs.

CN/CP

TCTS

Telenet

MSDS

MATS

Teltex

Telegram

Telepost

2.2.1 Telenet/MSDS

Telenet and MSDS provide access to a store and forward message switching centers for delivery of messages to any member of the respective Telex or TWX networks. Access to Telenet or MSDS can respectively be via the Telex or TWX networks, or dedicated record communication facilities. Subscribers to Telenet or MSDS are permitted respectively to define a group of Telenet or MSDS subscribers to be members of their network, thereby forming a sub-network with access to the sub-network members via Telenet or MSDS restricted to those who are defined to be members. A complete description of all of the features available on Telenet or MSDS would be too lengthy to present in this guideline; however, a report describing this service, and comparing Telenet and MSDS services for features and cost has been published by GTA, and may be obtained from your GTA representative. Careful consideration must be given to the service features and cost of Telenet and MSDS to determine if these services are suitable for a particular record communication requirement.

2.2.2 MATS (Multiple Address Telex Service)

This service provides Telex subscribers access to a computer for the delivery of a message. It permits the user through a single transmission to send a message that is intended for several Telex terminals. A specific message format must be followed when sending the message to the computer. The computer is given a list of the Telex numbers and answerbacks of all the intended recipients, and one copy of the message text. It will then transmit a copy of the text to each terminal for which it has the proper Telex number. The normal Telex tolls are charged for each message the computer delivers, in addition to a fixed charge for the computer handling of the message.

2.2.3 Teltex

This service permits a Telex subscriber to transmit a message to a CN/CP telegraph office for delivery of the message as a Telegram to a non-telex subscriber. The Telex rate to the telegraph office nearest to the non-telex subscriber is charged, plus a flat rate for the delivery of the telegram.

2.2.4 Telegram Service

Telegram service provides for the acceptance of messages at the local telegraph office via Telex, telephone, or by hand. The message is relayed over the Commercial Telegraph record network to the telegraph office nearest to the addressee, and is delivered to the addressee by Telex, telephone or by hand.

2.2.5 Telepost

Telepost is a service that permits Telex subscribers to send a message via Telex to the central post office of the city where the message is to be delivered. The post office will then deliver the Telex message via the special delivery mail service. The normal Telex rate, plus a flat rate (approximately \$0.75) for the special delivery service is charged.

3 PRIVATE RECORD COMMUNICATION NETWORKS

Private record communication networks were mentioned in section 1.3 in comparison to the public networks, as being networks where the user must ensure that his equipment is compatible with that of the persons with whom he wishes to communicate. This statement was not meant to discourage the reader from considering this type of network for his particular application. Indeed, the private network, in many instances, is the only viable solution to a record communication requirement.

The public networks were designed to meet the general requirements of the majority of Canadian users. Consequently it is impractical and uneconomical to provide for the special requirements that many users feel are essential. In an effort to provide for these special requirements, the common carriers permit the users to form private record communication networks, using the same transmission facilities and switching equipment as the public networks or where necessary, providing dedicated transmission facilities. The user is thus free to provide for his specialized requirements, by either negotiating with the common carriers to obtain the desired equipment and provide it on a special assembly basis, or by obtaining the equipment directly from one of the many telecommunication equipment suppliers and arranging

with the carrier to provide a suitable interface to his transmission facilities. It is obvious, especially in the latter case, that the user must ensure that the equipment he obtains is compatible with the equipment of those persons with whom he wishes to communicate.

Because a description of the possibilities for the variety of possible private networks would unduly extend the length of this paper, the private networks will be discussed under the heading of their two major components:

1. Transmission facilities.
2. System equipment.

The user will then be free to match the various items under these headings and design the system that is most cost effective for his particular needs.

We cannot overemphasize that this discussion is by no means complete. Subtle differences in these services exists that may make one service more cost effective than another, depending on the particular requirements. The department may obtain GTA's user application staff and telecommunication experts' assistance in evaluating these services.

In addition, the common carriers offer a considerable reduction in rates to single customers who bulk lease large quantities of their services. In this area, GTA acts as the focal point to present all of the Federal government department as a single customer.

Consequently the department, simply by requesting GTA to order the communication service instead of ordering the service directly from the carrier, can achieve a significant reduction in cost.

The above two points have been the basis for Treasury Boards Directive MI-2-66 to departments to consult with GTA for assistance in satisfying their telecommunication requirements. We would also like to emphasize that the department is under no obligation because of these consultations, and that the decision to select or reject a particular record communication service rests entirely with the user department. GTA's only purpose is to provide sufficient unbiased information so that this decision can be made.

3.1 Transmission Facilities

With the exception of local record communication channels, which may be provided by the user installing his own cabling between record terminals, or by using cabling which may have been provided by the building contractor during construction of the building, there are two suppliers of record communication channels in Canada. These are:

1. The Trans-Canada Telephone Systems,
2. Canadian National/Canadian Pacific Telecommunication.

This section will deal with the various record communication channel offerings of these carriers, and give some examples of their use.

The record communication channels provided by the common carriers may also be classified into two groups:

1. Switched line transmission facilities.
2. Dedicated point-to-point, or multi-point transmission facilities.

3.1.1 Switched Line Transmission Facilities

Switched line transmission facilities is a method of sharing transmission facilities between a large number of users. It is this type of service that the user encounters in his use of the common carriers' public record networks, telex, TWX and the carriers' telephone networks, Multicom, Broadband, etc.

The establishment of the communication channel is under control of the switching exchange. The exchange receives information, identifying the destination, from the originating terminal. If a communication channel is available to that destination and the destination terminal is idle, the exchange will provide the channel, and wait for a signal that indicates when the origin and destination terminals are finished communicating. When this signal is received, the communication channel between the originating terminal and destination terminal is removed, and may now be used between two other terminals wishing to communicate.

The advantage of line switching over other methods of sharing transmission facilities is that the originator has a direct connection to the destination terminal. No delay is encountered once the connection is established, and it is possible for the destination terminal to reply or make inquiries about the message being received while the connection is still established. This method has the disadvantage that the originating terminal must wait for the destination terminal and a communication channel to become free before a connection can

be established. At a busy office, (i.e. an office with a low grade of service) several attempts may be required before this occurs. Consequently, large queues of originating terminals may develop.

The following switched line transmission facilities are provided by CN/CP and TCTS. Following the method used in previous sections, an effort has been made to discuss similar services of the two carriers under the same heading.

TCTS

Data line II

Data line III

Foreign Exchange Telephone
(FX) Service

Wide Area Telephone
Service (WATS)

Federal Government
Switched Telephone Network

Multicom

CNCP

Telex Computer Inquiry Service (TCIS)

Data Telex

Broadband

3.1.1.1 Data line II/TCIS

These are half duplex national data services that permit terminals at various locations to originate calls to a central location such as a computer, a switching centre, a central record storage office, etc. Calls are established over the public telephone or data telex networks by automatic dialing equipment located at and under the control of the originating terminal. The data channel, in the case of Data line II, is derived by interfacing a 300 b/s modem with the public telephone network. Consequently, the data speed is restricted to 300 b/s.

In the case of TCIS, a modem may or may not be required, depending on the type of terminal equipment used, the length of local loop, etc. Speed is restricted to that of the Data Telex network, 200 b/s.

Both of these services are suitable for low volume (approximately 2 hrs/day) data requirements; the cost of these services are fixed monthly charges applied on a banded mileage basis. These charges are also dependant on the number of terminals in the various mileage bands.

3.1.1.2 Data line III

This service is identical to data line II except that an appropriate modem is provided to increase the transmission speed to the limitations of the public telephone network which, in some cases, is less than 2400 b/s. Lower data speeds (less than 1200 b/s) may be satisfactorily achieved over most of the network. The cost of this service is a fixed monthly charge applied on a banded mileage basis, similar to inwats. This charge is also dependant on the modem (i.e. the data speed) required, and the number of terminals in the various mileage bands.

3.1.1.3 Data Telex

This is a half duplex national and international data service, which permits any terminal using this service to originate a call to any other terminal on the Data Telex network. Care must be taken to ensure compatability between terminals. Data telex calls are established via the Telex network by dialing the appropriate Telex number. Data speeds are possible up to 200 b/s.

This is a usage based service with rates established on a banded mileage basis. It is suitable for low volume, (less than 2 hr/day), low speed data transmission.

3.1.1.4 Foreign Exchange Telephone Service (FX)

This service can provide half duplex record channel for facsimile or data transmission up to the limits of the public switched telephone network approximately 2400 b/s. Unlike the Data Line or WATS service, it provides access within a specific exchange area. Consequently, it is less expensive than a corresponding WATS facility. If the foreign exchange is terminated at a central location to fulfill a requirement as discussed in Data Line II, it will permit all users within the exchange area to access the central location toll free. Users outside the exchange area, moreover, will be able to access the central location and only incur the toll between their terminal and the exchange area. In addition, the central location will be able to access all terminals connected to the public telephone network within the foreign exchange area, toll free and incur additional tolls only when going outside the foreign exchange area.

3.1.1.5 Wide Area Telephone Service (WATS)

This is a record communication service suitable for half duplex data and facsimile transmission. It can provide half duplex data channels, using the appropriate modems, over the public switched telephone network. INWATS would provide a service similar to Data Line II or III, the difference being that any terminal within a given zone would be able to access the central location via his telephone by dialing the appropriate number. In addition, OUTWATS would permit the central location to access any terminal connected to the telephone exchange, within the corresponding zone.

The rating structure is a flat rate for a measured service, plus additional charges for the appropriate modem and terminating charges.

3.1.1.6 Federal Government Switched Telephone Network

This service can provide half duplex switched record channels suitable for data or facsimile transmissions. Using appropriate modems, data speeds up to 2400 b/s are possible. No usage charges are incurred for local service. Long distance interexchange service is charged for on a shared usage basis, and is considerably less expensive than similar service via the public switched telephone network. The service is comparable to service via the public network, and is suitable for record service between terminals or between terminals and a central location such as a computer main frame.

3.1.1.7 Multicom II/Broadband

These are switched record communication services, providing full duplex or half duplex channels suitable for facsimile or data transmission. Using appropriate modems, data speeds up to 4800 b/s are possible. They are usage based services, and should be considered for medium speed, low volume record communication requirements. Additional charges are incurred for the appropriate modems and terminations.

3.1.1.8 Multicom III

This is a switched record communication service, providing full duplex or half duplex record communications suitable for data or facsimile transmission. Using appropriate modems, data speeds up to 50,000 b/s are possible. This is a usage based service and should be considered for highspeed, low volume, record communication requirements.

3.1.2 Dedicated Point-to-Point or Multi-point Transmission Facilities

Dedicated transmission facilities are suitable for service where the number of users are well defined, or where high volumes of traffic must be handled. As with the switched transmission facilities, it is possible to share these facilities, thus increasing the facility utilization. A large variety of equipment is available to permit this type of service. This equipment is classified as line concentrators, time or frequency division multiplexers, polling devices, station selectors, etc. A discussion of this equipment is given in the chapter 3.2 on System Equipment.

Users wishing to obtain systems of this type must arrange with the common carriers or telecommunication equipment suppliers to provide the appropriate equipment. The user is again reminded that he can obtain GTA assistance in this area.

Following the methods used in previous chapters, we will list the similar types of service under their respective carrier, and discuss them jointly where possible.

CN/CP

Private Line Data Circuits

Infodat

TCTS

Private Line Data Circuits

Data-route

3.1.2.1 Private Line Data Circuits

These services provide point-to-point or multi-point record communication channels suitable for facsimile or data transmission. Data channels are derived from dedicated voice or wideband facilities using appropriate data modems. Data speed up to 50,000 b/s are available. A fixed monthly rate applies for the dedicated record channel, and additional charges are incurred for modems and terminations.

3.1.2.2 Data-Route/Infodat

These services provide point-to-point or multi-point, full duplex or half duplex, data channels. Channels between 15 serving areas in the case of Data-route, and fifteen serving areas in the case of Infodat are available. A fixed monthly rate applies for the data channel. Additional charges are incurred for terminations. This type of service is usually suitable for high data volumes.

3.2 System Equipment

In contrast to the two Canadian suppliers of record communication channels, there is a multitude of record communication terminal equipment suppliers. Although this is an important advantage to the user, in that he can pick and choose between suppliers, and shop around for the best price, it brings with it the responsibility of requiring the user to evaluate the many and subtle difference in the various terminal equipment offerings, and their costs. This places a heavy burden on the user, and requires him to obtain a great deal of expertise in this area if he intends to achieve a cost effective record communication service by more than sheer luck.

Deviating slightly from the method used in the chapter on Record Communication Channels, this chapter will give a general description of the various types of record communication system equipment and where applicable, briefly describe its application. A partial list of the persons supplying this equipment is given in Appendix 1. The reader may wish to refer to "Computer technology reports on data communications, "or" Datapro 70, The EDP buyer's bible" for further information on various suppliers of equipment. Because of the complex nature of this area, the reader is urged, moreover, to contact his

local GTA representative for assistance in selecting and evaluating the various service offerings available.

Record communication terminal equipment may be classified in four broad categories:

1. Visual display units which are used to display information at the terminal site.
2. Terminal Transmitters which are used to transmit information to a visual display unit or data storage unit.
3. Data Storage Units which are used to provide temporary or permanent storage for information preparatory to transmission or until the information is required for processing.
4. Terminal Control and Interface Equipment which is used to control the transmission and reception of information to and from the terminal and to convert the information to a form compatible with the transmission facility.

The following is a list of the various types of equipment which are in common use in each of the above categories. This equipment may be connected in various configurations and combinations to provide a cost effective record communication system that will satisfy most record communication requirements utilizing the transmission facilities of the common carriers previously discussed.

3.2.1 Visual Display Units

Visual display units is the entire class of equipment used for displaying information at the terminal or computer mainframe. Much of the equipment, in this category can be used as "stand alone"

telecommunication units for communication between terminals. Some of the equipment, however, requires a special communication interface before it can be used as a telecommunication device. The various classes of equipment in this category will be discussed in the following paragraphs.

3.2.1.1 Line Printers

Line printers print a line at a time on a paper page. This type of terminal equipment is the fastest of the visual display units that produce a permanent copy. Their display speeds vary from 15 LPM (lines per minute) to 8000 LPM. They have an application where it is necessary to produce a permanent display of a high volume of data.

3.2.1.2 Character Printers

Character printers print a character at a time on either a paper tape, or a paper page. This type of terminal equipment is among the slowest of the visual display units that produce a permanent copy. Their display speeds vary from 10 cps (characters per second) to 260 cps. They have an application where it is necessary to produce a permanent display of a low or medium volume of data.

3.2.1.3 Facsimile Receivers

Facsimile receivers reproduce a photograph of the document being transmitted. Their display speeds vary for an $8\frac{1}{2}$ x 11 page from six seconds to several minutes. To compare this with the speed of a character printer, we may assume 400 words per page, and arrive at a maximum display speed of 400 cps. Facsimile receivers have the additional feature that they can reproduce writing, drawings, photographs, etc. They have an application where it is necessary to produce a permanent display of a low or medium volume of data.

3.2.1.4 Pen Recorders

Pen receivers are known by the various trade names of electrowriter, telescript, etc. These receivers provide a reproduction of the written communication being transmitted. This is accomplished by causing a pen on the receiver to follow the motion of the pen on the transmitter. Consequently the display speed of the information depends on how fast a person writes. They have an application where it is necessary to produce a permanent display of very small volumes of data.

3.2.1.5 Viduo Display Units (CRT's)

Viduo display units display information on a television type screen (cathode ray tube). The display is temporary, and the time interval of the display may be controlled by the originating or destination terminal. The display speeds vary from 1800 cpm to 72000 cpm. A single line or a page of information may be displayed at one time. They have an application where it is necessary to produce a temporary display of information. The limiting factor for the volume of information displayed, is not the CRT, but rather the person processing the information.

3.2.1.6 Nixie Tube Display Units

These display units compose and display characters on a nixie tube. A line of print is displayed at one time. The display is temporary, and the display interval may be controlled. Like the viduo unit, the limiting factor for the volume of information displayed depends on the person processing the information. It has an application where a temporary display of a small amount of information at a time is suitable.

3.2.2 Data Storage Units

Data storage units covers the entire class of communication equipment that is capable of acting as either temporary or permanent storage mediums for data that has been transmitted. Into this category would also fall some of the visual display units, such as character and line printers.

3.2.2.1 Perforated Tape Recorders

These storage units record the information to be stored in one of the binary codes (i.e. ASCII, Baudot, EBCDIC, or BCD) by perforating holes into paper tape. The recording speed varies from 300 cpm to 60,000 cpm. They have an application where short term storage and limited or sequential retrieval of the stored information is suitable.

3.2.2.2 Perforated Card Recorders

These storage units record the information to be stored in one of the binary codes (i.e. ASCII, Baudet, EBCDIC or BCD) by perforating holes into paper cards. The recording speed varies from 300 cpm to 176,000 cpm. They have an application where long term storage of medium amounts of data is desirable.

3.2.2.3 Magnetic Tape

These storage units record the information to be stored in one of the binary codes (i.e. ASCII, Baudet, EBCDIC or BCD). Their recording speeds vary from 300 cpm to 15,000,000 cpm. They have application where case of retrieval or storage of large amounts of data is desirable.

3.2.2.4 Magnetic Card Recorders

These storage units record the information to be stored in one of the binary codes, on magnetic cards. The maximum recording speed is 60,000 cpm. They have application where storage of medium amounts of data is desirable.

3.2.2.5 Magnetic Disc and Drum Storage

These storage units record the information to be stored in one of the binary codes, on magnetic discs or drums. Recording speeds up to 500,000,000 cpm are possible. They have application for storage of large amounts of data, where fast retrieval of stored data is desirable.

3.2.2.6 Printed Paper Tape, Cards or Page

This storage units records the information in a binary code or normal printed characters that can be read by an optical character reader. Recording speeds up to 8000 line per minute are possible. This type of storage is suitable for data that requires manual as well as automatic processing.

3.2.2.7 Computer Output Microfilm (COM)

This storage unit translates the digital data output from a computer into a human language record of the information on micro film. Recording speeds up to 50,000 lines per minute are possible. It has application where high volumes of data require storage, and where the stored data requires human as well automatic processing.

3.2.2.8 Electronic Storage Units

These storage units record the information to be stored in data registers in one of the binary codes. Recording speeds vary from 300 c/m to several million characters per minute. They have application where limited storage is required for data buffers, code and speed conversion, and as high speed core for data processing units.

3.2.3 Record Communication Terminal Transmitters

Terminal transmitters are functionally composed of a reading device that retrieves the information to be transmitted from the storage medium, and a transmitting device, that interfaces with the communication channel and converts the information into a form compatible with the medium of the record communication channel.

In the case of manually operated pen transmitters and keyboards, the keyboard operator performs the function of the reading device while the pen or keyboard acts as the interface to the communication channel. For perforated tape, magnetic tape, printed tape, magnetic card, perforated card, printed card or page, magnetic disc, facsimile, mini-computers, and computers, the reading of the information from the stored medium is done automatically by an appropriate device. Transmission speeds correspond to those discussed under data terminal storage units. The selection and application of an appropriate terminal transmitter is obviously defined by the storage medium from which the information must be retrieved.

3.2.4 Terminal Control and Interface Equipment

Terminal control and interface equipment, includes the entire class of equipment that performs a control or interface function within the record communication system. This equipment may be located at the terminal, the computer main frame, a telephone companies' central office, etc. What determines the classification is the function the equipment performs, not the physical make-up or location.

This equipment is used to control the flow of information over the record communication network, in addition to the reception and transmission of information by the various record communication terminals. The following is a brief functional description of the more common devices in this category.

3.2.4.1 Terminal Selector

The function of the selector is to monitor all transmission on the network, and identify those transmissions intended for its associated terminal. It controls the flow of information to and from the associated terminal, and is itself controlled by signalling information transmitted over the network. There are numerous machines that can perform the selector functions. They range from electro mechanical solid state switching devices with a minimum of logic circuitry designed for this specific purpose, to stored program computers.

3.2.4.2 Digital Repeaters

The function of the repeater is to repeat all the digital information received on one input of the repeater, on all of the outputs from the repeater. In this way, the information originating in one branch of the network will be transmitted on all other branches or selected branches of the network. There are a number of machines that can

perform the repeater function. They range from electro mechanical or solid state devices designed especially for this purpose, to stored program computers.

3.2.4.3 Polling or Control Units

The function of the control or polling unit, is to control transmission on the network. It works in conjunction with the selector, and controls the transmission by sequentially polling (i.e. generating a signal unique to a given selector) each of the selectors thereby inviting transmission from a particular terminal. The control unit monitors all transmissions to and from terminals assigned to it, and controls their status via the station selectors. Again there are numerous devices that can perform the function. They range from electro mechanical devices to stored program computers.

3.2.4.4 Dial or Touch Tone Signalling Unit

This is a device that generates dial pulses or multifrequency signals from a touch tone pad. Its purpose is to provide signalling information for control of the circuit switch. In some cases it may be used in conjunction with a code converter at the receive terminal to transmit messages.

3.2.4.5 Data Speed Converter

This is a device that will accept information from a terminal at one speed and retransmit it to another terminal at a higher or lower speed as desired.

3.2.4.6 Data Code Converter

This is a device that will accept information from a terminal in one of the digital codes (say ASCII) and transmit it to another terminal in a different digital code (say Baudot).

3.2.4.7 Error Detector and Converter or Alarm Unit

This is a device that will monitor the transmission to or from a terminal, and detect and correct errors or generate an alarm, providing an appropriate error detection and correction code has been chosen for transmission to and from terminals.

3.2.4.8 Circuit Switch

The circuit switch performs the function of providing a record communication channel between two terminals. For the circuit switch to perform its function, it interprets signalling information from the terminal originating a transmission. These signals are commonly generated by dial or touch tone signalling units. There are numerous equipments that can perform this function.

3.2.4.9 Store and Forward Message Switching Centre

The store and forward message or package switching center performs the function of accepting pre-addressed messages or packages of information from the terminals. It stores the message, identifies the destination terminal address of the message, and forwards the message to its destination when the destination terminal is ready to accept the message. It may also perform many other functions such as the polling unit function, speed conversion, code conversion, error detection and correction or alarm, sequential number generation, time and date generation, data storage units, digital repeater, terminal selector, etc. In addition it may keep traffic statistics on messages transmitted

by terminals, the quality of terminal transmission, the status of all terminals and record channel facilities etc., and generate reports concerning these items.

Store and forward message switching centres can be as simple as torn tape switching centres with many of the above functions performed manually with the assistance of specialized equipment. Modern store and forward message or packet switching centres, however use stored program computers to perform all of the above functions, and many functions that cannot be discussed here because of the restricted length of this guideline.

3.2.4.10 Modems or Data Sets

The purpose of the modems or data sets are to interface the terminal equipment with the record communication channel. The modem regenerates the data transmitted by the terminal, and converts it to a form acceptable to the record communication channel.

3.2.4.11 Stored Program Computers

The stored program computer has the ability through proper programming to perform all of the control function mentioned above, and is used in many instances to perform these functions. It becomes desirable over equipment designed specifically to perform these functions because of the ability to assign to it one or more of these tasks, in addition to having it perform such functions as preprocessing of information, editing, restricting access to certain types of information, regulating and assigning priorities to transmission from terminals, etc.

3.2.4.12 Analogue to Digital Converter (A/D)

These devices are used interface terminal equipment that is collecting and generating information in the analogue form, with the digital transmitter. For example, suppose we wish to transmit the information from a meter reading (say a wind velocity meter). The analogue signal produced by the meter can be encoded into a digital output by the A/D converter, and fed directly into the terminal transmitter, thereby eliminating the need for operator intervention.

3.2.4.13 Digital to Analogue Converter (D/A)

This device is used to interface digital information received from the record communication channel, and convert it to analog form for control of another device or operation. For example, suppose it was necessary to correct the position of an antenna. The digital information specifying the new position can be transmitted to the remote terminal where it is converted by the D/A converter to an analogue signal which causes the antenna to move to the designated position. Hence the need to display the information to be acted upon by an antenna-operator is eliminated.

3.2.4.14 Line Coupling Units

These devices are used to limit and isolate signals generated by customer owned equipment from the public telephone network.

3.2.4.15 Line Concentrator Units

This is a device that permits a number of terminals to compete for and share the use of a lesser number of record communication channels. It has an application where the volume of traffic generated by a single terminal is insufficient to warrant a dedicated channel. By permitting

two or more users access to the same record communication channel via a line concentrator the utilization of the channel is increased, and the cost/terminal is decreased.

3.2.4.16 Time or Frequency Division Multiplexing Unit

This is a device that divides the time or frequency spectrum of a record communication channel into several individual record channels of lower speed or lesser bandwidth. It permits each terminal to have complete access to a dedicated record channel, while increasing the overall utilization of the higher speed channel. Hence the cost per terminal for the record channel is reduced.

APPENDIX 1

SUPPLIERS OF RECORD COMMUNICATION TERMINAL EQUIPMENT

List of Record Communication Equipment Suppliers

The following is a partial list of record communication equipment suppliers under the various headlines discusses above. For assistance in selecting the appropriate equipment and supplier, the user is urged to contact his local GTA representative.

VISUAL DISPLAY TERMINALS

Character Printers Display

Anderson Jacobson Inc. 1065 Morse Ave., Sunnyvaly, Calif, 94086	<u>TELEPHONE</u> (408) 734-4030
Canadian General Electric 830 Lansdowne Ave., Toronto 172, Ontario	(416) 534-6511
Carterfone Communications Corporation 2639 Walnut Hull Lane, Ste. 223, Dallas, Texas 75229	(214) 350-7011
ComData of Canada Ltd. Oak Ridge, Ontario	(416) 773-4161
Compro Corporation Bldg. 6-103, 3001 Red Hill Ave., Costa Mesa, Calif. 92626	(714) 540-7153
Computer Devices of Canada Box 8508, Ottawa, Ontario	(613) 829-1800
Megatronix Limited 100 Penn Dr., Unit 1, Weston, Ontario.	(416) 742-8015
Data Access Systems Inc. 100 Route 46, Mountain Lake, New Jersey 07046	(201) 335-3322
Louis Albert Associates 28 Palace Street, Ottawa, Ontario.	(613) 746-0021

TELEPHONE

Data Products Co. Telecommunications Division, 17 Amelia Place, Stamford Connecticut 06902	(203) 325-325-4161
Di/An Controls Inc., (Megatronix Ltd.) 100 Penn Dr., Weston, Ontario.	(486) 742-8015
Digital Equipment Cda Ltd. 100 Herzberg Road, Ottawa, Ontario ,	(617) 897-5111
Extel Corp. 310 Anthony Trail, Northbrook, 111 60062	(312) 272-8650
General Electric Co. 214 King Street West, Toronto, Ontario.	(416) 366-7311
GTE Information Systems, Inc 1 Stamford Forum, Stamford, Connecticut 06904	(203) 357-2000
Harris Communications Systems Cda Ltd. 1400 Don Mills Road, Don Mills, Ontario.	(416) 449-8571
Instronics Techno-Prod. Stittsville, Ontario	(613) 836-4411
International Business Machines Cda Ltd. 1150 Eglinton Ave., E., Don Mills, Ontario.	(416) 443-2111
I/O Devices Inc. 100 Route 46, Mountain Lake, New Jersey 07046	(335)-2935
Memorex Cda Ltd. 2025 Shapard Ave., E., Willowdale, Ontario	(416) 275-2222
National Cash Register Cda Ltd. 6865 Century Ave., Mississauga, Ontario	(416) 491-2390
Plessey Canada Ltd. 300 Supertest Road, Downsview, Ontario	(416) 661-3711
Printer Technology Inc. Sixth Road, Woburn Industrial Park, Woburn, Mass 01081	(617) 935-4246

RCA, 21001 N. Service Road, Ste-Anne-de-Bellevue, 810 P.Q.	(514) 453-9000
RCA Service Co., A Div. of RCA Corp. Camden, New Jersey.	(609) 779-4129
Redactron Corp. 100 Parkway Dr., South, Hauppauge, New York, 11787	(516) 543-8700
SCM/Kleinschmidt, Div. of SCM Corp. Lake Co., Road, Deerfield, Ill. 60015	(312) 945-1000
Scope Data Inc., 5870 S. Tampa Ave., Orlando, Fla. 32809	(305) 859-1410
The Singer Co. International Teleprinter Div. 493 Washington Ave., Carlstadt, New Jersey 07072	(201) 438-1770
Teletype Corp. 224 Wildcat Road, Toronto, Ontario	(416) 536-2168
Instronics Techno-Products Ltd. Box 100, Stitsville, Ontario	(613) 836-4411
Transcom Inc., 580 Spring Street, Windsor Locks, Connecticut 06096	(203) 243-1486
Greyhound Computers of Canada Ltd., 65 Adelaide Street, Toronto, Ontario	(416) 366-1513
Typagraph Corp. 7547 Convoy Court, San Diego, Calif. 92112	(714) 279-5690
UNIVAC Div. Sperry Rand Corp, P.O. Box 500, Blue Bell, Pennsylvania 19422	(215) 542-4011
Eastern Union Data Services Co., 16 McKee Drive, Mahwah, New Jersey 07430	(201) 542-4011
Wiltek, Inc. Glover Ave., Norwalk, Connecticut 06852	(203) 853-7400
Xerox of Canada Ltd., 703 Don Mills Road, Don Mills, Ontario.	(406) 429-6750

Line Printers Display

Ahearn & Soper Ltd., 280 Albert Street, Ste. 1016, Ottawa, Ontario	(613) 232-4518
Anderson-Jacobson Inc., 1065 Morse Ave., Sunnyvale, Calif 94086	(408) 734-4030
Centronics Data Computer Corp., One Wall Street, Hudson, New Hampshire 03501	(603) 883-0111
Clary Corp., 404 Junipero Serra Dr., San Gabriel, Calif 91776	(213) 283-9485
Commetrics Ltd., P.O. Box 278, St-Lambert, P.Q.	(514) 672-4534
Datamet Ltd., 580 Suptertest Road, Downsview, Ontario	(416) 661-1404
Electrodesign Ltd., 290 Montreal Road, Vanier, Ontario.	(613) 745-0541
Megatronix Ltd., 100 Penn Dr., Unit 1, Weston, Ontario.	(416) 742-8015
Control Data Corp., 50 Hallcrown Place, Willowdale, M2J 1P7, Ontario	(416) 491 5210
Datadyne Corp., Bldg. 37A Valley Forge Centre, King of Prussia, Pennsylvania 19406	(215) 265-1793
Louis Albert Ass. 182 Palace Street, Ottawa, Ontario	(613) 746-0021
Data 100, Canada 40 Wynford Dr., Don Mills, Ontario	(416) 449-1080
DataPrinter Corp. 201 Vassar Street, Cambridge, Massachusetts 02139	(617) 492-7484
Data Products Corp., OEM Marketting, 16055 Ventura Blvd., Ste. 419, Encino, Calif 91316	(714) 879-9600
Datum Inc., Peripheral Equipment Division 170 East Liberty Ave., Anaheim, Calif 92801	(714) 879-3070

Decision Inc. 5601 College Ave., Oakland, Calif 94618	(415) 654-8626
Diablo Systems Inc. (subsidiary of Xerox Corp.) 24500 Industrial Blvd. Hayward, Calif, 94545	(415) 783-3910
Megatronix Ltd., 100 Penn Dr., Weston, Ontario.	(486) 742-8015
A.B. Dick Co., 5700 West Tougy Ave., Chicago Ill 60648	(312) 763-1900
Philips Electron Devices 116 Vanderhoof Avenue, Toronto, Ontario.	(416) 425-5161
Dytro Corp. 63 TEC Street, Hicksville, New York, 11801	(516) 822-2130
Eclectic Corp. 2830 Walnut Hill Lane, Dallas, Texas 75229	(214) 358-1307
Esterline Angus Division of Esterline Corp. Box 24000, Indianapolis, Indiana, 46224	(317) 244-7611
Facit-Odhner Inc., 501 Winsor Dr., Secaucus, New Jersey 07094	(201) 806-5111
Allan Crawford Ass. 6427 Northam Dr., Mississauga, Ontario.	(416) 678-1500
Instonics Ltd., Box 100, Stittsville, Ontario	(613) 836-4411
Intercomp, 68 Rogers Street, Cambridge, Massachusetts 02142	(617) 864-4700
International Computers Limited 199 Bay Street, Toronto 116, Ontario	(416) 360-1450
ITT, General Controls Division 1838 Flower Street, Glendale, Calif. 91201	(213) 842-6131
International Teleprinter Corporation 493 Washington Ave., Carlstadt, New Jersey 07072	(201) 438-1770
I/O Devices Inc. 100 Rte 46, Mountain Lakes, New Jersey, 07046	(201) 335-2935

Kleinschmidt (Div of SCM Corp.) Lake- Cook Road, Deerfield, Ill 60015	(312) 945-1000
Litton Systems Inc., 25 City View Drive, Rexdale, Ontario	(416) 249-1231
Macro Products Corp., 14403 Crenshaw Blvd, Gardena, Calif 90249.	(213) 675-7151
Mite Corp., 446 Blake Street, New Haven, Connecticut 06515	(203) 387-2572
NCR, 6865 Century Ave., Mississauga, Ontario.	(416) 275-2222
ODEC, Computer Systems Inc., 25 Graystone Street, Warwick, Rhode Island 02886	(401) 738-9500
Per Data (Peripheral Data Machines Inc.), 102 New South Road, Hicksville, New York, 11801	(516) 938-2851
Photophysics Inc., 1601 Stierlin Road, Mountain View, Calif. 94040	(415) 969-9500
Printer Technology Inc., Sixth Road, Woburn Industrial Park Woburn, Massachusetts 01801	(617) 935-4246
Repco. In., 1940 Lockwood Way, P.O. Box 7065, Orlando, Fla. 32804	(305) 843-8484
Megatronix, 100 100 Penn Dr., Weston 486, Ontario.	(416) 742-8015
Teletype Corporation, 5555 Tougy Ave., Skokie, Ill. 60076	(312) 982-2000
Terminal Equipment Corporation, 750 Hamburg Turnpike, Pompton Lakes, New Jersey 07442	(201) 839-3000
Instonics Techno-Products Ltd., Box 100, Stitsville, Ontario.	(613) 836-4411
Typagraph Corp., 7547 Convoy Court, P.O. Box 586, San Diego, Calif. 92112	(714) 279-5690

Uppster Corp.,
Southfield Ave., Stamford, Connecticut 06902 (203) 359-4841

Varian Ass. of Canada
45 River Drive, Georgetown, Ontario (416) 877-6901

Ahearn and Soper Ltd.,
31 Enterprise Road, Rexdale, Ontario. (416) 247-7141

Vogue Instrument Corp., Shepart Diviosn.
131 St. at Jamaica Ave., Richmond Hill, New York, 11418 (212) 641-8800

VIDEO CRT DISPLAY:

Adage Inc.,
1079 Commonwealth Ave., Boston, Massachusetts 02215 (617) 78301100

Allan Crawford
1299 Richmond Road, Ottawa, Ontario. (613) 829-9651

Ann Arbor Terminals Inc.,
6107 Jackson Road, Ann Arbor, Michigan 48103 (313) 769-0926

Adhearn and Soper Ltd.
31 Enterprise Road, Rexdale, Ontario (416) 247-7141

Basic/Four Corp. (Subsidiary of Management Assist inc.)
18552 MacArthur Blvd, Santo Ana, Calif, 92707 (714) 833-9530

Megatronix Ltd.,
100 Penn Drive, Unit 1, Weston, Ontario (416) 742-8015

Bendix Interactive Terminals Corp.,
Bendix Centre, Southfield Michigan 48076 (313) 352-5000

Bunder Ramo (Can.) Ltd.,
Business & Industry Div., Box 327, T-D Centre, Toronto, Ont. (416) 362-1-86

Bunder Ramo Corp., Business & Industry Division
Trumbull Industrial Park, Trumbull Connecticut 06609 (203) 377-4141

Burroughs Corp.,
Burroughs Place, Detroit, Michigan 48232 (313) 972-7000

Car-Mell Electronics Inc., 5794 Venice Blvd. Los Angeles, Calif 90019.	(213) 934-1866
Centronics Data Computer Corp. One Wall Street, Hudson, New Hampshire 03051	(603) 883-0111
Commetrics Ltd., P.O. Box 278, St. Lambert, P.Q.	(514) 672-4534
Control Data 1491 Yonge Street, Toronto, Ontario	(416) 622-1450
Boothe Computer Ltd. 1 Westside Drive, Etobicoke, Ontario	(416) 964-9006
Data 100 Canada 40 Wynford Drive, Don Mills, Ontario	(416) 449-1080
Data 100 Corp., 7725 Washington Ave., S., Minneakpolis, Minnesota 55434	(612) 941-6500
Datapoint Cor. (formerly Computer Terminal Corp.) 9725 Datapoint Drive, San Antonio, Texas 78284	(512) 696-4520
Datagraphics, 1505 Laperrière Ave., Ste. 406, Ottawa, Ontario.	(613) 722-3489
Digi-Log Systems Inc., 666 Davisville Road, Willow Grove, Pennsylvania 19090	(215) 659-5400
Digital Equipment, 100 Herzberg Road, P.O. Box 11500, Ottawa, Ontario	(613) 592-5111
Digital Information Systems, Box 88500, Seattle, Washington, 98188	(206) 641-2717
Electronics Systems Ltd. 2171 Ave. Road, Suite 102, Toronto 12, Ontario .	(416) —

Parvac Corp. Ltd, 150 Consumers Road, Ste 109, Toronto, Ontario.	(416) 493-1893
Combined Market Quotations Ltd, 226 Bay Street, Toronto, Ontario	(416) 368-3031
Hazeltine Corporation, Greenlawn, New York 11740	(516) 261-7000
Hendrix Electronics, Grenier Industrial Village, Bldg T-213, Londonderry, New Hampshire 03053	(603) 669-9050
Honeywell Information Systems Inc., 2025 Sheppard Ave. E. Willowdale, Ontario.	(416) 491-0660
Infoton Inc. (subsidiary of Optical Scanning Corp.) Second Ave, Burlington, Massachusetts 01803.	(617) 272-6660
International Business Machines Corp. (IBM), Data Processing Division, 1133 Westchester Avenue, White Plains, New York 10604.	(914) 696-1900
International Computers Ltd., 199 Bay Street, Toronto 116, Ontario	(416) 360-1450
International Telephone and Telegraph Corp. (ITT) Data Equipment and Systems Division, 157 E, Union Ave., East Rutherford, New Jersey 07073.	(201) 935-3500
Datamex Ltd., 580 Supertest Road, Unit 9, Downsview, Ontario.	(416) 661-1404
MAI Corp., 300 East 44 Street, New York, N.Y. 10017	(212) 557-8310
Megadata Computer and Communications Corporation, 10 Evergreen Place, Deer Park, New York 11729	(516) 667-2900
National Cash Register Co., 6865 Century Ave., Mississauga, Ontario.	(416) 275-2222
Olivetti Canada Ltd., 1390 Don Mills Road, Don Mills, Ontario.	(416) 447-3351
Olivetti Corporation of America, 500 Park Ave., New York, New York 10022	(212) 371-5500

Parvac Corporation, 150 Consumers Road, Willowdale, Ontario.	(416) 493-1839
Plessey Canada Ltd., 300 Supertest Road, Downsview, Ontario	(416) 661-3711
Commetrics Ltd., Box 278, St-Lambert P.Q.	(514) 672-4448
Quantic Data Systems Ltd., Box 5254, Stn F, Ottawa, Ontario	(613) 224-7978
Ahearn & Soper Ltd., 844 Caledonia Road, Toronto, Ontario	(416) 789-4325
Research Inc., P.O. Box 24064, Minneapolis, Minnesota 55424	(612) 941-3300
Sanders Data Systems Inc., Daniel Webster Highway S., Nashua, New Hampshire 03060	(603) 885-4220
Sugurman Laboratories Inc., 3 Fairchild Court, Plainview, New Jersey 11803	(516) 822-7800
Sycor International Ltd., 797 Don Mills Road, Don Mills, Ontario	(416) 429-0883
Tec Inc., 9800 N. Oracle Road Tucson, Arizona 85704	(602) 297-1111
Tektronix Inc., 900 Selkirk Street, Pointe Claire, Quebec.	(514) 697-5340
Texas Scientific Corporation, 8120 Westglen, Houston, Texas 77042	(713) 785-7731
Trivex Inc., Information Systems Division, 3180 Red Hill Ave., Costa Mesa, Calif 92626	(714) 546-7781
UNIVAC Division, Sperry Rand Corporation, P.O. Box 500, Blue Bell Pennsylvania 19422	(215) 542-4011
Louis Albert Ass., 281 Palace Street, Ottawa, Ontario.	(613) 746-0021

Westinghouse Canada Ltd.,
1800 Bank Street, Ottawa, Ontario K1V 7Y7 (613) 733-2500

Westinghouse Canada Ltd.,
P.O. Box 510, Hamilton, Ontario. (416) 528-8811

Wiltek Inc.,
59 Danbury Road, Wilton, Connecticut 06897 (203) 762-5521

Wyle Computer Products Inc.,
128 Maryland Street, El Segundo, Calif 90245 (213) 322-1763

Xerox of Canada Ltd.,
703 Don Mills Road, Don Mills, Ontario (416) 429-6750

Xerox Data Systems,
280 Belfield Road, Rexdale, Ontario (416) 677-8422

Facsimile Display

Alden Electronics & Impulse Recording Equipment Co. Inc.,
250 St. Urbain Street, Granby Que. (514) 378-1019

Computing Devices Canada Ltd.,
P.O. Box 8508, Ottawa, Ontario K1G 3M9 (613) 829-1800

Dacom Inc., (Commetrics Ltd.)
P.O. Box 278, St Lambert Quebec (514) 672-4534

Datalog Division, Litton Systems,
25 City View Drive, Rexdale, Ontario. (416) 249-1231 ext. 375

EG&G Inc., Bedford Division,
Crosby Drive, Bedford Mass. (617) 271-5000

Graphic Communications Ltd.,
2025 Sheppard Ave E., Willowdale 425, Ontario. (416) 491-3491

Magnavox Systems Inc. 1 Rockefeller Plaza, New York 541-9330

Metox, Paris France 366-3557

Muirhead Inc.,
50 Galaxy Blvd., Rexdale, Ontario (416) 677-7450

Philco-Ford Corp., Comm. & Tech Svcs Division,
3900 Welch Road, Willowgrove, PA 19090 (215) 659-7700

Shintron Co. Inc.,
144 Rogers Street, Cambridge, Mass. (617) 491-8700

Siemens Canada Ltd.,
7300 Trans Canada Highway, Box 7300, Pt. Claire, Quebec. (514) 695-7300

Stewart-Warner/Datafax, Chicago, Ill (312) 292-3214

Telaugraph Corp.,
8700 Bellanc Ave., Los Angeles Calif (213) 776-5022

3M Company,
Box 5757 London, Ontario (519) 451-2500

Victor Comptometer Ltd.,
Box 10 55 Salvage Drive, Galt, Ontario (519) 621-8720

Visual Sciences Inc., (Plessey Canada Ltd.,)
300 Supertest Road, Downsview, Ontario (416) 661-3711

Xerox of Canada Ltd.,
703 Don Mills Road, Don Mills, Ontario (416) 429-6750

Pen Recorder Display Terminal

Canadian National/Canadian Pacific Telecommunications,
140 Wellington Street, Room 108, Ottawa, Ontario K1P 5A2 (613) 236-7226

Trans-Canada Telephone Systems,
160 Elgin Street, Place Bell Canada, Ottawa, Ontario K1G 3J4 (613) 237-2997

Victor Comptometer Ltd.,
Box 10, 55 Salvage Drive, Galt, Ontario (519) 621-8720

Telaugraph Corp.,
523 The Queensway, Etobicoke, Ontario (416) 259-2223

DATA STORAGE UNITS

Perforated Tape Data Storage Units

Adtrol, 700 Abbot Drive, Broomall, Pennsylvania 19008	(215) 544-6900
Datascan Inc., 1111 Paulison Ave., Clifton, New Jersey 07013	(201) 478-2800
Data Specialties Inc., 1548 Old Skokie Road, Highland Park, Ill 60035	(312) 831-3750
Decision Inc., 5601 College Ave., Okland, Calif 94618	(415) 654-8626
Deciteck, a division of Jamesbury Corp., 15 Sagamore Road, Worcester, Massachusetts 01605	(617) 798-8731
Philips Electron Devices, 116 Vanderhoof Avenue, Toronto, Ontario	(416) 425-5161
Eclectic Corp., 2830 Walnut Hill Lane, Dallas Texas 75229	(214) 358-1307
Facit-Odhner Inc., 501 Winsor Drive, Secaucus, New Jersey 07094	(201) 866-5111
Internation Teleprinter Corp., 493 Washington Avenue, Carlstadt, New Jersey 07072	(201) 438-1770
Pivan Data Systems, 6955 Hamlin Ave, Lincolnwood, Ill 60645	(312) 676-0790
Whittaker Electronics Ltd., 1478 Merivale Road Ottawa, Ontario K2E 6Z5	(613) 224-1221
Superior Electric Co., 484 Middle Street, Bristol, Connecticut 06010	(203) 582-9561
Megatronix, 100 Penn Drive, Weston 486, Ontario	(416) 742-8015
Teletype Corp., 224 Wildcat Road, Toronto, Ontario	(416) 536-2168

Perforated Card Units

Bridge Data Products Inc., 738 South 42nd Street, Philadelphia, Pennsylvania 19104	(215) 382-8700
Control Data Corp., 1491 Yonge Street, Toronto, Ontario	(416) 964-9006
Data Products Corp., OEM Marketing, 16055 Ventura Blvd, Suite 419, Encino, Calif 91316	(213) 981-9600
Decision Data Computer Corp., 100 Witmer Road, Horsham, Pennsylvania 19044	(215) 674-3300
Decision Inc., 5601 College Avenue, Oakland, Calif 94618	(415) 654-8626
Documation Inc., P.O. Box 1240, Melbourne, Fla 32901	(305) 724-1111
Eclectic Corp., 2830 Walnut Hill Lane, Dallas, Texas 75229	(214) 358-1307
Electronic Associates Inc., (EAI), 185 Monmouth Parkway, West Long Branch, New Jersey 07764	(201) 229-1100
GDI (see Electronics Associates Inc.)	
Hewlett-Packard Co., 275 Hymus Blvd, Pointe Claire P.Q.	(514) 697-4232
International Computers Limited (ICL), 199 Bay Street, Toronto 116, Ontario	(416) 360-1450
Peripheral Dynamics Inc., East Norriton Industrial Park, 1030 W. Germantown Pike, Norristown, Pennsylvania 19401	(215) 539-5500
True Data Corp., 17905 Skypark Blvd., Suite G. Irvine, Calif 92707	(714) 979-4842
Vogue Instrument Corporation, 131st Street at Jamaica Ave., Richmond Hill, New York 11418	(212) 641-8800

Magnetic Tape Data Storage Units

Ampex Corporation, 100 Skyway Ave, Rexdale, Ontario.	(416) 677-2370
Anderson Jacobson In., 1065 Morse Avenue, Sunnyvale, Calif 94086	(408) 734.4030
Astro-Science Corp., 9700 Factorial Way, So. El Monte, Calif 91734	(213) 443-3211
Auricord Division, Conrac Corp., Old Saybrook, Connecticut 06475	(203) 388-3574
Bell & Howell, Microfilm Products, 45 Jutland Road, Toronto, Ontario	(416) 259-4641
Canberra Industries, 45 Gracey Avenue, Meriden, Connecticut 06450	(203) 238-2351
Cipher Data Products Inc., 7655 Convoy Court, San Diego, Calif 92111.	(714) 277-8070
Computer Access Systems, 2645 East Buckeye Road, Phoenix, Arizona 85034	(602) 267-1444
Computer Operations Inc., 10774 Street, Beltsville, Maryland 20705.	(301) 937-5377
Datacom Inc., P.O. Box 278, 40 Lincoln Drive, Fort Walton Beach Fla. 32548	(904) 242-3113
Decision Inc., 5601 College Avenue, Oakland, Calif. 94618	(415) 654-8626
Dicom Industries, 715 North Pastoria Avenue, Sunnyvale, Calif 94085	(408) 732-1060
Electronetic Systems Ltd., 62 Alness Street, Downsview Ontario.	(416) 661-3673
Philips Electron Devices, 116 Vanderhoof Avenue, Toronto, Ontario	(416) 425-5161

Electric Corporation, 2830 Walnut Hill Lane, Dallas, Texas 75229	(214) 358-1307
Hewlett Packard Co., 275 Hymus Road, Pointe Claire, P.Q.	(514) 697) 4232
Infotec, 70 Newtown Road, Plainview, New York 11803	(516) 694-9633
Interdyne, 14761 Califa Street, Van Nuys, Calif 91401	(213) 787-6800
International Computers Ltd., 199 Bay Street, Toronto 116, Ontario.	(416) 360-1450
International Computers Products Inc., P.O.Box 34484, Dallas, Texas 75234	(214) 239-5381
Adhern & Soper, 844 Caledonia Road, Toronto 19, Ontario	(416) 789-4325
Kybe Corp., 132 Calvary Street, Waltham, Massachusetts 02154.	(617) 899-0012
Memodyne Corp., 369 Ellito Street, Newton Upper Falls, Mass. 02164	(617) 527-6600
Mobark Instruments Corp., 1080 East Duane Avenue, Sunnyvale, Calif. 94086	(408) 736-8540
Per Data (Peripheral Data Machines Inc.) 102 New South Road, Hicksville, New York 11801	(516) 938-2851
Peripheral Dynamics Corp., (subsidiary of Datum Inc.) 170 East Liberty Avenue, Anaheim Calif 92801	(714) 879-3030
PERTEC Peripheral Equipment, 9600 Irondale Ave., Chatsworth, Calif 91311.	(213) 882-0030
Datamex Ltd., 580 Supertest Road, Unit 9, Downsview, Ontario	(416) 661-1404
Raymond Precision Industries Inc., 217 Smith Street, Middletown, Connecticut 06457	(203) 347-5611

Redactron Corporation, 100 Parkway Drive South, Hauppauge, New York 11787	(516) 543-8700
Whittaker Electronics Ltd., 1478 Merivale Road, Ottawa, Ontario	(613) 224-1221
International, 797 Don Mills Road, Don Mills, Ontario	(416) 429-0883
Megatronix Ltd., 100 Penn Drive, Unit 1, Weston, Ontario.	(416) 742-8015
Teac Corporation of America, 7733 Telegraph Road, Montebello, Calif 90640	(213) 726-0303
Techtran Industries, 580 Jefferson Road, Rochester, New York 14623	(716) 271-7953
Instronic Techno-Products Ltd., Box 100, Stittsville, Ontario.	(613) 836-4411
3M Company, Box 5757, London, Ontario	(519) 451-2500
Tri-Data Corporation, 800 Maude Avenue, Mountain View, Calif 94040	(415) 969-3700
Wangco Inc., 2400 Boradway, Santa Monica, Calif 90404	(213) 828-5565
Willard Laboratories Inc., 4221 Redwood Avenue, Los Angeles, Calif 90066	(213) 821-8026
Wiltek Inc., 59 Danbury Road, Wilton- Connecticut 06897	(203) 762-5521
Xebec Systems Incorporated, 566 San Xavier Ave., Sunnyvale, Calif 94086	(408) 732-9444

Magnetic Disc/Drum Data Storage Units

Alpha Data Incorporated, 8759 Remmet Ave., Canoga Park, Calif 91304	(213) 882-6500
--	----------------

Applied Magnetics Corporation, (OK Data), 75 Robin Hill Road, Goleta, Calif 93017	(805) 964-3536
Caelus Memories Inc., (a subsidiary of Electronic Memories & Magnetics Corp.) P.O. Box 6297, San Jose, Calif 95150	(408) 298-7080
Computex Centres Ltd., 16 Lesmill Road, Don Mills, Ontario	(416) 449-6380
California Electro Mechanisms, 22519 South Normandie Ave., Torrance, Calif 90501	(213) 328-2151
Century Data Systems Inc., (a subsidiary of California Computer Products Inc.), 1270 North Kramer Ave., Anaheim, Calif 92806	(714) 632-7111
Clary Corp., Control Data Corporation, 320 West Clary Ave., San Gabriel, Calif 91776.	(213) 287-6111
Data Disc Inc., 1491 Yonge Street, Toronto, Ontario	(416) 964-9006
Data General Corporation, 308-124 O'Connor Street, Ottawa, Ontario	(613) 234-4797
Data Systems Design, 1122 University Ave., Berkeley, Calif 94702	(415) 849-1102
Datum Inc., Peripheral Equipment Division, 170 East Liberty Ave., Analeim, Calif 92801 (714)	(714) 879-3070
Decision Inc., 5601 College Ave., Oakland, Calif 94618	(415) 654-8626
Diablo Systems Inc., 24500 Industrial Blvd, Hayward, Calif 94545	(415) 783-3910
Digital Development Corp, 5575 Kearny Villa Rd., San Diego, Calif 92123	(714) 278-9920
Digital Equipment Corp, 100 Herzberg Rd., PO Box 11500, Ottawa	(613) 592-5111

Diva Associates Inc., 58 Maple Ave., Red Bank, New Jersey 07701	(201) 842-6500
Eclectic Corp., 2830 Walnut Hill Lane, Dallas, Texas 75229	(214) 358-1307
Hewlett-Packard, 275 Hymus Blvd., Pt. Claire, P.Q.	(514) 697-4232
Information Data Systems Inc., 7550 Walnut Lake Rd., Walled Lake, Michigan 48088	(313) 624-5525
Intercomp, 68 Rogers St., Cambridge, Massachusetts 02142	(617) 864-4700
International Memory Systems, 7315 East Evans Rd., Scottsdale, Arizona 85254	(602) 948-2120
IOMEC Inc., 345 Mathew St., Santa Clara, Calif 95050	(408) 246-2950
Librascope (Div. of the Singer Co.), 808 Western Ave., Glendale, Calif 91201	(213) 245-8711 (ext 1847)
Omron Systems Inc., 440 East Middlefield Rd., Mountain View, Calif 94040	(415) 964-2266
Pacific Micronetics Inc., 5037 Ruffner St., San Diego, Calif 92111	(714) 279-7500
Per Data (Peripheral Data Machines, Inc.), 102 New South Rd., Hicksville, N.Y. 11801	(516) 938-2851
PERTEC, 9600 Irondale Ave., Chatsworth, Calif 91311	(213) 882-0030
Potter Instrument Co. Inc., 532 Broad Hollow Rd., Melville, New York 11746	(516) 694-9000
Sagem Corp., 35 South Main St., Derry, New Hampshire 03038	(603) 432-2013

Systems Industries,
535 Del Rey Ave., Sunnyvale, Calif 94086 (408) 732-1650

Systematics/Magne-Head (Division of General
Instrument Corporation),
13040 South Cerise Ave., Hawthorne, Calif 90250 (213) 679-3377

(Megatronix),
100 Penn Dr., Weston 486, Ontario (416) 742-8015

Vermont Research Corp.,
Precision Park, North Springfield, Vermont 05150 (802) 886-2256

(Electronic Systems Supply Co.,)
250 Bloor St. E., Ste 201, Toronto, Ontario (416) 964-9100

Xebec Systems Inc.,
566 San Xavier Ave., Sunnyvale, Calif 94086 (408) 732-9444

XLO Computer Products,
850 Ladd Rd., Walled Lake, Michigan 48088 (313) 624-4571
(Or try the OEM sales office in Fort Washington,
Pennsylvania. Telephone (215) 646-7417)

Microfilm - Data Storage Units

Burroughs Corp.,
Second Ave. at Burroughs, Detroit, Michigan 48232 (313) 972-9115

(Computrex Centre Ltd.,)
424 Queen St., Ottawa (613) 232-7147

Eastman Kodak Co.,
343 State St., Rochester, New York 14650 (716) 325-2000

Ferranti-Packard Limited,
121 Industry St., Toronto 15, Ontario, Canada (416) 762-3661

Hughes-Owens Co. Ltd.,
124 Bermondsey Rd., Toronto M4A1X, Ontario
Canada (416) 757-8751

(Allan Crawford Assoc.,)
6427 Northam Dr., Mississauga, Ontario (416) 678-1500

Harris Communications System Inc.,
1400 Don Mills Rd., Don Mills (416) 449-8571

Information International,
12435 West Olympia Blvd., Los Angeles, Calif 90064 (213) 478-2571

Memorex Corp.,
2025 Sheppard Ave. E., Willowdale, Ontario (416) 491-2390

Pertec Corp.,
17112 Armstrong Ave., Santa Ana, Calif 92705 (714) 540-8340

Quantor Corp.,
520 Logue Ave., Mountain View, Calif 95014 (415) 965-3700

SEACO Computer-Display Incorporated,
2800 West Kingsley Rd., Garland, Texas 7504 (214) 271-2431

Singer Micrographic Systems,
Singer Link Div., a Div. of Singer-General Precision
Inc., 1077 East Arques Ave., Sunnyvale, Calif 94086 (408) 732-3800

Sperry Remington,
P.O. Box 1000, Blue Bell, Pennsylvania 19422 (215) 542-4011

Stromberg-Datagraphix Inc.,
A General Dynamics subsidiary,
P.O. Box 2449, San Diego, Calif 92112 (714) 291-9960

Syner Graphics Inc.,
Transamerica Pyramid, P.O. Box 7958, San Francisco,
Calif 94120 (415) 983-5200

3M Company,
Box 5757 London, Ontario (519) 451-2500

Printed Paper Tape or Page Data Storage Units

Acme Sealy Business Systems Ltd.,
32 Mendota Rd., Toronto (416) 259-8435

Addressograph-Multigraph Corporation,
42 Hollinger Rd., Toronto (416) 751-8700

Addressograph-Multigraph Corp.,
Documentor Div., 2921 South Daimler,
P.O. Box 10547, Santa Ana, Calif 92711 (714) 546-3551

Automata Corp.,
2952 George Washington Way, Richland, Washington 99352 (509) 946-4143

Electronetic Systems,
62 Alness, Downsview, Ontario (416) 661-3673

Burroughs Corp.,
Business Machines Group,
801 York Mills Rd., Don Mills (416) 445-4030

Cognitronics Corp.,
41 East 28th Street, New York, New York 10016 (212) 889-3650

CompuScan Inc.,
900 Huyler St., Teterboro, New Jersey 07608 (201) 288-6000

Computer Entry Systems Corp.,
2141 Industrial Parkway, Silver Spring, Maryland
20904 (301) 622-3500

Control Data Corporation
1491 Yonge St., Toronto (416) 964-9006

Creative Logic Corp.,
80 East Ridgewood Ave., Paramus, New Jersey 07652 (201) 265-7700

Halliburton & White Ltd.,
85 Monpelier Blvd., St. Laurent, Montreal PQ (514) 661-3769

Data Recognition Corp.,
908 Industrial Ave., Palo Alto, Calif 94303 (415) 326-4810

Datatrend Corp.,
(Division of Republic Corp.,)
9732 Cozycroft Ave., Chatsworth, Calif 91311 (213) 341-9200

Datatype Corp.,
1050 N.W. 163rd Dr., Miami, Fla 33169 (305) 625-8451

Decision, Incorp.,
5601 College Ave., Oakland, Calif 94618 (415) 654-8626

EAI,
185 Monmouth Park Highway West, Long Branch,
New Jersey 07764 (201) 229-1100

ECRM Inc.,
17 Tudor St., Cambridge, Massachusetts 02139 (617) 661-8600

Farrington Electronics: see Lundy

Hewlett-Packard Co.,
275 Hymus Blvd., Pt. Claire, P.Q. (514) 697-4232

Honeywell Inc.,
2025 Sheppard Ave. E., Willowdale, Ontario (416) 491-0660

IBM Corp.,
1150 Eglinton Ave. E., Don Mills (416) 443-2111

Information International Inc.,
12435 West Olympic Blvd., Los Angeles, Calif 90064 (213) 478-2571

Input Business Machines Inc.,
12111 Park Lawn Dr., Rockville, Maryland 20852 (301) 881-0661

Laser Computer Corp.,
318 West Ball Rd., Anaheim, Calif 92805 (714) 778-5890

Lundy Electronics and Systems Inc.,
Computer Peripherals Div.,
5535 Wilkinson Blvd., Charlotte, North Carolina 28208 (704) 394-1161

National Cash Register Co.,
6865 Century Ave., Mississauga, Ontario (416) 275-2222

National Computer Systems,
4401 West 76th Street, Minneapolis, Minnesota 55435 (612) 920-3670

OCR Systems Inc.,
328 Maple Ave., Horsham, Pennsylvania 19044 (215) 674-1800

Optical Business Machines Inc.,
900 East New Haven Ave., Melbourne, Fla 32901 (305) 727-1774

Optical Recognition Systems Inc.,
1928 Isaac Newton Square West, Reston, Virginia 22070 (703) 471-5060

Optical Scanning Corp.,
3300 Covendish Blvd., Rm 130, Mtl., PQ (514) 488-6010

Orbital Systems, Inc.,
Church and Fellowship Rds., Moorestown, New
Jersey 08057 (609) 234-1700

Recognition Equipment Inc.,
1262 Don Mills Rd., Ste 99, Don Mills (416) 449-2575

Saber Management Systems Inc.,
123 W. "D" Street, Ontario, Calif 91762 (714) 986-3808

Scan-Data Corp.,
800 East Main St., Norristown, Pennsylvania 19401 (215) 277-0500

Scan-Optics Inc.,
22 Prestige Park Rd., East Hartford, Connecticut
06108 (203) 289-6001

Terminal Communications Inc.,
2490 Bloor St. W., Toronto (416) 767-0090

UNIVAC Div.,
Sperry Rand Corp., Peripheral Sub-Systems,
P.O. Box 500, Blue Bell, Pennsylvania 19422 (215) 646-9000

Electronic Data Storage Units

Advanced Memory Systems Inc.,
1276 Hammerwood Ave., Sunnyvale, Calif 94086 (408) 734-4330

Ampex Corp.,
100 Skivay Ave., Rexdale (416) 677-2370

Cambridge Memories Com. (Ltd),
282 Belfield Rd., Rexdale, Ontario (416) 677-5667

CIG Computer Products Inc.,
170 University Ave., Ste 807, Toronto 1, Ont (416) 364-5534

Computer Hardware Consultants and Services Inc.,
Pheasant Run, Newtown, Pennsylvania 18940 (215) 968-5900

Control Data Corp.,
50 Hallcrown Place, Willowdale, Ont (416) 491-5210

Data Recall Corp.,
1320 Franklin Ave., El Segundo, Calif 90245 (213) 322-9024

Electronic Memories & Magnetics Corporation,
15 Gevais Dr., Don Mills, Ontario (416) 493-1761

Greyhound Computer of Canada Ltd.,
65 Adelaide St. E., Toronto 1, Ontario (416) 366-1513

Albar Industries Ltd.,
1698 W. 3rd Ave., Van 9, BC (604) 763-9413

Intel Corp.,
3065 Bowers Ave., Santa Clara, Calif 95051 (408) 246-7501

Intel Corp.,
Data Products Group, One Embarcadero Centre,
San Francisco, Calif 94111 (415) 989-4220

Lockheed Electronics Co., Inc.,
Data Products Div., 6201 E. Randolph St.,
Los Angeles, Calif 90040 (213) 722-6810

Memory Technology Inc.,
83 Boston Post Rd., Sudbury, Massachusetts 01776 (617) 443-9911

Storage Technology Corp.,
701 Evans Ave., Etobicoke Ont (416) 622-7228

Standard Memories Inc.,
2221 South Anne St., Santa Ana, Calif 92704 (714) 540-3605

Telex Computer Products Inc.,
6422 East 41st St., Tulsa, Oklahoma 74135 (918) 627-1111

Analogue to Digital Converters

Aadam Business Equip.,
105 Hinricher Dr., Willow Springs, Illinois
60480 (312) 839-5164

Adage Inc.,
1079 Commonwealth Ave., Boston, Mass 02215 (316) 263-4235

Ahearn & Soper Ltd.,
31 Enterprise Rd., Rexdale, Ont (416) 247-7141

Batyrnix Ltd., 6338 Victoria Ave., Suite 5, Mtl Quebec	(514) 342-4281
CSI Computer Corp., 320 Yonkers Ave., Yonkers, N.Y. 10701	(914) 969-0807
Crawford A. Associates 6427 Northam Dr., Mississauga, Ontario	(416) 675- 1550
Data General Corp., (Datagen of Cda. Ltd.) Richelieu Park, Hull, Que.	(819) 770-2030
Data Technology Corp., (Ahearn & Soper Ltd.) 31 Enterprise Rd., Rexdale, Ont.	(416) 247-7141
Datagen Cda Ltd., 190 Edmonton St., Richelieu Park, Hull, Que	(819) 770-2030
Datagraphics 1505 Laperriere Ave., Ottawa	(613) 722-3489
Datamex Ltd., 580 Supertest, Downsview, Ontario	(416) 661-1404
Datawest Corp., (Datagraphics) 1505 Laperriere Ave., Ottawa	(613) 722-3489
Digital Equip. of Cda. Ltd., 150 Rosamond St., Carleton Place, Ont	(613) 257-2615
Digitech Ltd., 500, 441-5 Ave. S.W., Calgary, Alta	(403) 265-3484
Donsky Industries Ltd., Box 3452, Strn "8", Calgary, Alta	(403) 288-1415
Electronic Assoc. Ltd., (Allen Crawford Assoc.), 6427 Northam Dr., Mississauga, Ont	(416) 675-1550
Garrett Mfg. Ltd., 255 Attwell Drive, Rexdale, Ontario	(416) 677-1410

General Instrument Corp., 13040 S. Gerise Ave., Hawthorne Calif 90250	(213) 679-3377
Hewlett Packard Cda. Ltd., 275 Hymus Blvd., Pt. Claire, Que.	(514) 697-4232
Honeywell Information Systems 2025 Sheppard Ave., E., Willowdale, Ont	(416) 491-0660
Instronics Techno Products Ltd., Stittsville, Ontario	(613) 836-4411
Interdata of Canada Ltd., 6471 Northam Dr., Mississauga, Ont	(416) 677-8990
Litton Data (CDA) Systems 25 City View Drive, Rexdale, Ontario	(416) 249-1231
Megatronix Ltd., (see Teledyne Philbrick)	(416) 742-8015
Mumac Intl., Ltd., 30-32 Capital Dr., Ottawa, Ontario	(613) 825-4747
Singer Co. Librascope Div., 833 Sonora Ave., Glendale, Calif 91201	(213) 244-6541
Systems Engr Labs., (Selcan Ltd.) 75 Albert St., # 911, Ottawa, Ont	(613) 237-0551
Teledyne Philbrick, (Megatronix Ltd.) 100 Penn Dr., Unit 1, Weston, Ont	(416) 742-8015
Time Shore Peripherals Corp., (Data Cap Ltd.) 224 Laurier Ave., W., Ottawa, Ontario	(613) 232-7777
Varian Assoc. of Cda. Ltd., 45 River Dr., Georgetown, Ontario	(416) 877-6901
Westinghouse Cda. Ltd., Box 510, Hamilton, Ontario	(416) 528-8811
Whittaker Electronics Ltd., 1478 Merivale Rd., Ottawa, Ontario	(613) 224-1221

Communication Controllers

American Data Systems (PYE TMC), 15 Sheffield St., Toronto	(416) 249-7044
American Regitel Corp., 870 Industrial Way, San Carlos, Calif	(415) 593-1013
Astrocom Corp., (ESE Ltd.), 1780 Albion Rd., Rexdale, Ontario	(416) 749-2271
Bunker Ramo Canada Ltd., Toronto Dominion Centre, Box 327, Toronto, Ontario	(416) 362-1086
Burroughs Business Machines Ltd., 801 York Mills Rd., Don Mills, Ontario	(416) 445-4030
CSI Computer Corp., 320 Yonkers Ave., Yonkers, N.Y.	(914) 969-0807
Canadian General Electric Co. Ltd., 830 Lansdowne Ave., Toronto, Ontario	(416) 534-6511
Combined Market Quotations Ltd., 1055 Beaver Hall Hill, Montreal.	(514) 866-9324
Computer Communications Inc., 101 Duncan Mill Rd., Don Mills, Ontario	(416) 449-4224
Computer Complex (Domsky Industries) 5015 Vienna Dr., Calgary, Alta.	(403) 288-1415
Computer Consultants Corp., Route 46, E. Denville, N.Y.	(201) 625-1213
Control Data Cda. Ltd., 1491 Youngs St., Toronto, Ontario	(416) 964-9006
Courier Terminal Systems Inc., (Boothe Computer Ltd.), 1 Westside Drive, Etobicoke, Ontario	(416) 622-1450
Crawford (Allen) Associates 6427 Northam Dr., Mississauga, Ontario	(416) 678-1500

Datagen of Cda. Ltd., 190 Edmonton St., Richelieu Park, Hull, Quebec	(819) 770-2030
Datapoint Corp., (TRW Data Syst.), 85 Eglinton Ave. E., Toronto	(416) 481-7288
Digital Equipment of Cda. Ltd., 100 Herzberg Rd., Ottawa, Ontario	(613) 592-5111
Domsy Industries Ltd., Box 3452 Stn B, Calgary, Alta.	(403) 288-1415
Entrex Cda. Ltd., 201 Consumers Rd., Willowdale, Ontario	(416) 493-9333
Executone Ltd., 331 Bartlett Ave., Toronto, Ontario	(416) 531-9961
Garrett Manufacturing Ltd., 255 Attwell Drive, Rexdale, Ontario	(416) 677-1410
Gandalf Data Communications Ltd., 15 Grenfell Cr., Ottawa, Ontario	(613) 825-4526
General Devices Inc., (Electrodesign Ltd.), 840 La Fleur, Ville LaSalle, Que	(514) 363-5120
Harris Communication System Cda Ltd., 1400 Don Mills Rd., Don Mills, Ont.	(416) 449-8571
Honey Information Systems, 2025 Sheppard Ave., E., Willowdale, Ont.	(416) 491-0660
IBM Cda. Ltd., 1150 Eglinton Ave. E., Don Mills, Ontario	(416) 443-2111
Incoterm Corp., 4221 St. Catherine St., Montreal, Que	(514) 931-6284
Inforex Inc., 6 Lansing Sq., Willowdale, Ontario	(416) 493-1761
Instronics Techno. Prods., Stittsville, Ont.	(613) 836-4411

Litton Systems Cda. Ltd., 25 Cityview Dr., Rexdale, Ontario	(416) 249-1231
Louis Albert Associates Ltd., 2264 Stevenage Rd., Ottawa, Ontario	(613) 737-5941
Memorex Cda. Ltd., 2025 Sheppard Ave. E., Willowdale, Ontario	(416) 491-2390
National Cash Register Cda. Ltd., 6865 Century Ave., Mississauga, Ont	(416) 275-2222
Olivetti Cda. Ltd., 1390 Don Mills Rd., Don Mills, Ontario	(416) 447-3351
Pacemaker Business Machines, 314 Colborne St., Brantford, Ont.	(519) 753-3444
RCA Ltd., 21001 N. Service Rd., St. Anne de Bellevrie, Que	(514) 453-9000
Sagetec Corp. (Megatronic Ltd.) 100 Penn Dr., Unit 1, Weston Ont	(416) 742-8015
Sperry Rand Cda. Ltd. (Univec Div.) 35 City Centre Dr., Mississauga, Ont	(416) 270-3030
Systems Engineering Labs. 75 Albert St., Ottawa, Ontario	(613) 237-0551
Telefile Computer Prods (Ahearn Soper Ltd.) 31 Enterprise Rd., Rexdale, Ontario	(416) 247-7141
Texas Instrument Inc., (Instronics Techno Prods) 280 Center St. E., Richmond Hill, Ont	(416) 889-7373
Time Share Peripherals Corp., (Datacup Ltd.) 224 Laurier St., Ottawa, Ontario	(613) 232-7777
Varian Associates of Cda. Ltd. 45 River Dr., Georgetown, Ont.,	(416) 877-6901
Xerox of Cda. Ltd., 703 Don Mills Rd., Don Mills, Ont.	(416) 429-6750

Touch Tone Signaling Units

Acrodyne Inc., 320 Colfax Ave., Clifton, New Jersey 07013	(201)
Applied Information Industries (AII), 345 New Albany Rd., Moorestown, New Jersey 08057	(201) 234-1000
Beverly Bancorporation Inc., 1357 West 103rd St., Chicago, Ill 60643	(312) HI5-2200
Burroughs Corporation, Second Ave. at Burroughs, Detroit, Michigan 48232	(313) 972-7000
Chancellor Industries Inc., 3005 LTV Tower, Dallas, Texas 75201	(214) 741-6065
Cognitronics Corp., 333 Bedford Rd., Mt. Kisco, New York 10549	(914)
Compunetics Inc., 1100 Eldo Rd., Monroeville Industrial Park, Pennsylvania 15146	(412) 555-1212
Datatrol Inc., Kane Industrial Dr., Hudson, Massachusetts 01749	(617) 568-8382
Dimension Inc., (a subsidiary of Scope Inc.), 1860 Michael Faraday Dr., Reston, Virginia 22070	(703) 471-1938
Honeywell Information Systems Inc., 2025 Sheppard Ave. E., Willowdale	(416) 491-0660
IBM Corporation, 1150 Eglinton Ave. E., Don Mills	(416) 443-2111
Interface Industries Inc., Box 240 Hauppauge, New York 11787	(516) 234-8080
Metrolab Inc., (a subsidiary of Cubic Corporation), 10457 Roselle St., San Diego, Calif 92109	(714) 277-6780
Metroprocessing Corp. of America, 64 Prospect St., White Plains, New York 10606	(914) WH9-0890

Periphonics Corp., 75 Orville Drive,
Airport International Plaza, Bohemia, New York 11716 (516) 567-1000

Phonplex Corp. (a subsidiary of Instrument Systems Corp.),
789 Park Ave., Huntington, New York 11743 (516) HA3-6243

Terminal Communications,
2490 Bloor St. W., Toronto (416) 767-0090

Transcom (a division of HI-G Inc),
12 Tobey Rd., Bloomfield, Connecticut 06002 (203)

Wavetek Data Communications,
PO Box 651, San Diego, Calif 92112 (714) 279-2200

Western Data Products Inc.,
2321 Pontius Ave., Los Angeles, Calif 90064 (213)

Modem or Data Sets

Acrodyne Data Services Inc.,
1217 Summit Ave., Union City, New Jersey 07087 (201) 865-3220

Anderson Jacobson Inc.,
1065 Morse Ave., Sunnyvale, Calif 94086 (408) 734-4030

Astrocom Corp.,
293 Commercial St., St. Paul, Minnesota 55106 (612) 933-2208

Automatic Electric Co.,
400 N. Wolf Rd., Northlake, Ill 60164 (312) 562-7100

Badger Meter Inc.,
Electronics Div., 150 East Standard Ave.,
Richmond, Calif 94804 (415) 233-8220

Bell System: distributed by local Bell System offices

Burroughs Corp.,
Burroughs Place, Detroit, Michigan 48232 (313) 972-7735

Carterfone Communications Corp.,
2639 Walnut Hill Lane/Suite 223, Dallas, Texas 75229 (214) 350-7011

T.E. Field Assoc.,
4151 Sheppard Ave., E., Agincourt, Ont (416) 291-4478

Coherent Communications Systems Corp., 85D Hoffman Lane, Central Islip, New York 11722	(516) 582-4044
Collins Radio, 150 Bartley Drive, Toronto, Ontario	(416) 757-1101
Collins Radio Co., 19700 Jamboree Rd., Newport Beach, Calif 92663	(714) 833-0600
ComData Corp. of Canada, Oak Ridges, Ont	(416) 773-4161
Commetrics Ltd., P.O. Box 278, St. Lambert, PQ	(514) 672-4534
Computer Transmission Corp., 2352 Utah Ave., El Segundo, Calif 90245	(213) 973-2222
Data Access Systems Inc., 100 Route 46, Mountain Lakes, New Jersey 07046	(201) 361-2345
Datapoint Corp., 9725 Datapoint Dr., San Antonio, Texas 78284	(512) 696-4520
Data Products Corp/Telecommunications Div., Commerce Dr., Stamford, Connecticut 06902	(203) 325-4161
Dataserv, 770 Airport Blvd., Burlingame, Calif 94010	(415) 342-0877
Design Elements, 1356 Northam Ave., Columbia, Ohio 43212	(614) 294-2694
Digital Techniques Corp., 4248 Delemere Court, Royal Oak, Michigan 48073	(313) 549-8663
ESE Ltd., 130 Albert St., Ste 8, Ottawa, Ont K1P 5H4	(613) 235-8284
ESE Ltd., 1780 Albion Rd., Rexdale, Ontario	(416) 749-2271
General DataComm Industries, Incorp., 5000 Buchan, Ste 601, Mtl. 308	(514) 735-3079

General Electric Co., 214 King St. W., Toronto, Ontario	(416) 366-7311
GTE Information Systems, Incorp., 1 Stamford Forum, Stamford, Connecticut 06904	(203) 357-2000
GTE Lenkurt, 7018 Lougheed Highway, Burnaby 2, BC	(604) 298-2464
GTE Lenkurt, Incorp., 1105 Country Rd., San Carlos, Calif 94070	(415) 591-8461
Hughes Aircraft Co., Ground Systems Group, Fullerton, Calif 92634	(714) 871-3232
Hycom, 6841 Armstrong Ave., Irvine, Calif 92705	(714) 557-5252
International Business Machines Corp., Data Processing Div., 1133 Westchester Ave., White Plains, New York 10604	(914) 696-1900
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla 33147	(305) 691-1220
I.I. Communications Corp., 139 Terwood Rd., Willow Grove, Pennsylvania 19090	(215) 657-3600
Intertel, Incorporated, 6 Vine Brook Park, Burlington, Massachusetts 01803	(617) 273-0950
ITT/Data Equipment & Systems, East Union Ave., East Rutherford, New Jersey 07073	(201) 935-3900
Livermore Data Systems, Incorporated, 2050 Research Dr., Livermore, Calif 94550	(415) 447-2252
Louis Albert Ass., Ottawa, Ontario	(613) 746-0021
Multi-Tech Systems, Incorporated, 47 Bedford St. S.E., Minneapolis, Minnesota 55414	(612) 331-5000
Datagraphics, 1505 Laperrier Ave., Ottawa	(613) 722-3489

Megatronix Ltd., 100 Penn Dr., Unit 1, Weston, Ont.	(416) 742-8015
Paradyne Corp., 8550 Ulmerton Rd., Largo, Fla 33540	(813) 536-4771
Gandalf Data Com. Ltd., 15 Glenfell Cr., Ottawa, Ont	(613) 825-4526
Prentice Electronics Corporation, 795 San Antonio Rd., Palo Alto, Calif 94303	(415) 327-0490
Pulse Communications Incorp., (a division of Harvey Hubbell, Incorp.), 5714 Columbia Pike, Falls Church, Virginia 22041	(703) 820-0652
PYE TMC 15 Sheffield St., Toronto, Ont	(416) 249-7044
Quindar Electronics, Incorp., 60 Fadem Rd., Springfield, New Jersey 07081	(201) 379-7400
RFL Industries Incorp., Communication Div., Powerville Rd., Boonton, New Jersey 07005	(201) 334-3100
Sangamo Co. Ltd., 215 Laird Dr., Toronto, Ontario.	(416) 425-3330
Sanders Associates Incorp., 95 Canal St., Nashua, New Hampshire 03060	(603) 885-5875
TMC Canada Ltd., RR5 Ottawa, Ontario.	(613) 822-0244
Sonex Incorp., (formerly I/Onex, a division of Sonex Incorp.), Data Communication Products, 2337 Philmont Ave., Huntingdon Valley, Pennsylvania 19006	(215) 947-6100
Louis Albert Assoc., 281 Palace, Ottawa, Ontario.	(613) 746-0021
Universal Data Systems, 2611 Leeman Ferry Rd., Huntsville, Alabama 35805	(205) 533-4500

T.E. Field Assoc.,
24 Cassandra Blvd., Don Mills, Ont (416) 445-4916

Stored Program Computers

Ahearn & Soper,
280 Albert St., Ste 1016, Ottawa, Ont (613) 232-4518

Applied Computing Technology,
17815 Sky Park Circle, Irvine, Calif 92707 (714) 549-3123

Automatic Electronic Systems Inc.,
5455 Pare St., Montreal 309, P. Quebec, (514) 735-6581

Basic/Four Corp.,
18552 MacArthur Blvd., Santa Ana, Calif 92707 (714) 833-9530

Bendix Corp.,
Navigation & Control Div., Tererboro, New Jersey
07608 (201) 288-2000

Berg-Haus Corp.,
770 Washington St., Holliston, Massachusetts 01746 (617) 429-6836

Burroughs Corp.,
Business Machines Group, 801 York Mills Rd.,
Don Mills (416) 445-4030

Canadian General Electric,
830 Lansdowne Ave., Toronto 172 (416) 534-6511

Cascade Data Inc. (a subsidiary of Apecorp.),
3000 Kraft Ave. S.E., Grand Rapids, Michigan 49508 (616) 949-8850

Cincinnati Milacron Co.,
Process Controls Div., Lebanon, Ohio 45036 (513) 494-1200

Clary Datacomp Systems Inc.,
404 Junipero Serra Dr., San Gabriel, Calif 91776 (213) 283-9485

CNA/Systems,
310 South Michigan Ave., Chicago, Ill 60604 (312) 822-5178

Compagnie Internationale pour l'Informatique (CII),
68 Route de Versailles, 78 Louveciennes, France 951-8600

Computer Automation Incorp., 895 West Sixteenth St., Newport Beach, Calif 92660	(714) 642-9630
Computer Interactions Inc., 425 Northern Blvd., Great Neck, New York, 11021	(516) 487-9810
Comstar Corp., 7413 Washington Ave. S., Edina, Minnesota 55435	(612) 941-4454
Control Data Corp., 1491 Yonge St., Toronto	(416) 964-9006
Custom Computer Systems, 40 South Mall, Plainview, Long Island, New York 11803	(516) 293-5353
Datagen of Canada Ltd., Richelieu Park, Hull, P.Q.	(819) 770-2030
Datacraft Corp., 1200 N.W. 70th St., P.O. Box 23550, Fort Lauderdale, Fla 33307	(305) 974-1700
Datapoint Corp., 9725 Datapoint Dr., San Antonio, Texas 78284	(512) 696-4520
Ahearn & Soper, 31 Enterprise Rd., Rexdale, Ont.	(416) 247-7141
Digital Equipment, 100 Herzberg Rd., P.O. Box 11500 Ottawa	(613) 592-5111
Digital Equipment Corp., Maynard, Massachusetts 01754	(617) 897-5111
Digital Scientific Corp., 11455 Sorrento Valley Rd., San Diego, Calif 92121	(714) 453-6060
Eldorado Electrodata Corp., 601 Chalomar Rd., Concord, Calif 94518	(415) 686-4200
Electronic Associates Inc., West Long Branch, New Jersey 07764	(201) 229-1100
Electronic Processors Incorp., (a subsidiary of the Samsonite Corp.) 5050 South Federal Blvd. Englewood, Colorado 80110	(303) 798-9305

Focus IV Corp., 2103 Mannix, San Antonio, Texas 78217	(512) 828-3183
Paravac Corp. Ltd., 150 Consumers Rd., Ste 109, Toronto	(416) 493-1839
Fujitsu Ltd., 680 Fifth Ave., New York, NY 10019	(212) 265-5360
Greyhound Computer of Canada, 65 Adelaide St. E., Toronto	(416) 366-1513
GRI Computer Corp., 320 Needham St., Newton, Massachusetts 02164	(617) 969-0800
GTE Information Systems Inc., Four Corporate Park Drive, White Plains, New York 10604	(914) 694-8840
Hewlett-Packard Co., 275 Hymus Blvd., Pt. Claire	(514) 697-4232
Hitachi Ltd., 23-15 6-chrome, Minamiohi, Shinagawa-ku, Tokyo 140, Japan	(765) 3111
Honeywell Information Systems Inc., 2025 Sheppard Ave. E., Willowdale, Ont.	(416) 491-0660
Information Computer Systems Ltd., Heron House, 19 Marylebone Rd., London NW1, England	(01) 486-4635
Intel Corp., 3065 Bowers Ave., Santa Clara, Calif 95051	(408) 246-7501
Interdata of Canada, 6471 Northam Dr., Mississauga Ont.	(416) 677-8990
Litton Industries Inc., Automated Business Systems (ABS) Div., 600 Washington Ave., Carlstadt, New Jersey 07072	(201) 935-2200
Litton Industries Inc., Monroe Div., 550 Central Ave., Orange, New Jersey 07501	(201) 673-6600

IBM Corp., 1150 Eglinton Ave., E., Don Mills, Ont.	(416) 443-2111
Linolex Systems Inc., 5 Esquire Rd., North Billerica, Massachusetts 01862	(617) 667-4151
Martin, Wolfe Inc., 8369 Vickers St., San Diego, Calif 92111	(714) 277-3700
Lockheed Electronics Co., (a subsidiary of Lockheed Aircraft Corp.), Data Products Div., 6201 E. Randolph St., Los Angeles, Calif 90022	(213) 722-6810
MBC Inc., 88 White Pond Rd., Waldwick, New Jersey 07463	(201) 447-2696
Microdata Corp., 17481 Red Hill Ave., Irvine, Calif 92705	(714) 540-6730
Microline Corp., 1310 E. Edinger Ave., Santa Ana, Calif 92705	(714) 558-7721
Mini-Computer Systems, 1075 Central Park Ave., Scarsdale, New York 10583	(914) 723-5776
Mobydata Inc., One Nouvelle Park, New Hartford, New York 13413	(315) 797-0397
Modular Computer Systems Inc., 1650 West McNab Rd., Fort Lauderdale, Fla 33309	(305) 974-1380
The National Cash Register Co., 6865 Century Ave., Mississauga, Ont.	(416) 275-2222
Nixdorf Computer Inc., 5725 East River Rd., Chicago, Ill 60631	(312) 693-6600
Nuclear Data Inc., PO Box 451, Palatine, Ill 60067	(312) 529-4600
Olivetti Canada, 1390 Don Mills Rd., Don Mills	(416) 447-3351

Omnus Computer Corp., 1538 East Chestnut St., Suite E., Santa Ana, Calif 92701	(714) 547-8444
Paillard Incorporated, 1900 Lower Rd., Linden, N.J. 07036	(201) 381-5600
Phillips Business Systems Inc., 100 East 42nd St., New York, NY 10017	(212) 697-3600
Philips-Electrologica B.V., OEM Marketing, P.O. Box 245, Apeldoorn, the Netherlands	05760-30123
Prime Computer Inc., 17 Strathmore Rd., Natick, Massachusetts 01760	(617) 655-6988
RUF Computer Systems Ltd., 795 Progress Ave., # 6, Scarboro, Ont	(416) 438-6244
Raytheon Data Systems Co. (a division of Raytheon Co.) 1415 Boston-Providence Turnpike, Norwood, Massachusetts 02062	(617) 762-6700
Rolm Corp., 18922 Forge Dr., Cupertino, Calif 95014	(408) 257-6440
Scidata Inc., 3 Executive Park Dr., Atlanta, Georgia 30329.	(404) 325-3100
Search Computer Systems, 111 Ash St., East Hartford, Connecticut 06108	(203) 289-9506
The Singer Co., Business Machines Div., 2350 Washington Ave., San Leandro, Calif 94577	(415) 357-6800
SYSTEMS Engineering Laboratories, 75 Albert St., # 911, Ottawa,	(613) 237-0551
Instonics Techno-Products Ltd., Box 100, Stittsville, Ontario	(613) 836-4411
Ultimacc Systems Inc., 9 Brook Ave., Maywood, New Jersey 07607	(201) 845-0500
Varian Assoc. of Can., 45 River Dr., Georgetown, Ont.	(416) 877-6901

Westinghouse Electric Corp.,
Box 510, Hamilton, Ont. (416) 528-8811

Xerox Corp.,
703 Don Mills Rd., Don Mills, Ont (416) 429-6750

Line Concentrator and Multiplexer

PYE/TMC,
15 Sheffield St., Toronto, Ont. (416) 249-7044

Canadian General Electric,
830 Lansdowne Ave., Toronto 172, Ont (416) 534-6511

T.E. Field Assoc.,
4151 Sheppard Ave. E., Agincourt, Ont (416) 291-4478

Coherent Communications Systems Corp.,
85D Hoffman Lane, South, Central Islip,
Long Island, N.Y. 11722 (516) 582-4044

Collins Radio, 150 Bartley Drive,
Toronto, Ontario (416) 757-1101

ComData of Canada,
Oak Ridges, Ont. (416) 773-4161

Commetrics Ltd.,
P.O. Box 278, St. Lambert, P.Q. (514) 672-4534

Computer Communications, Inc.,
101 Duncan Mill Rd., Don Mills, Ont (416) 449-4224

Computer Transmission Corp., (Tran),
1508 Cotner Ave., Los Angeles, Calif 90025 (213) 477-5020

Datagen of Canada, Richelieu Park, Hull, P.Q. (819) 770-2030

Data Products, Telecommunications Div.,
17 Amelia Place, Stamford, Connecticut 06904 (203) 325-4161

Digital Computer Controls Inc.,
12 Industrial Rd., Fairfield, New Jersey 07006 (201) 227-4861

General DataComm Industries Inc.,
5000 Buchan, Ste 601, Mtl 308 PQ (514) 735-3079

General Electric Co., 214 King St. W., Toronto, Ontario	(416) 366-7311
GTE Lenkurt, 7018 Lougheed Highway, Burnaby 2, BC	(604) 298-2464
GTE Kenkurt Inc., (a subsidiary of GTE Information Systems), 1105 Country Rd., San Carlos, Calif 94070	(415) 591-8461
IBM Corp., 1150 Eglinton Ave. E., Don Mills, Ont.	(416) 443-2111
Infotron Systems, 7300 North Crescent Blvd., Pennsauken, N.J. 08110	(609) 665-3864
Commetrics Ltd., Box 278, St. Laurent, P.Q.	(514) 672-4534
Northern Radio Co. Inc., (a subsidiary of R.F. Communications, Harris Intertype Corporation), 325 West Hibiscus Blvd., Melbourne, Fla 32901	(305) 727-6700
Pye TMC, 15 Sheffield St., Toronto 385, Ont.	(416) 249-7044
RFL Industries Inc., Boonton, New Jersey 07005	(201) 334-3100
Rixon Electronics Inc., 2120 Industrial Parkway, Silver Spring, Maryland 20904	(301) 622-2121
TMC Canada Ltd., RR#5 Ottawa	(613) 822-0244
Tele-Dynamics, Div. of AMBAC, 525 Virginia Dr., Fort Washington, Pennsylvania 19034	(215) 643-3900
Tel-Tech Corp., 11810 Parklawn Dr., Rockville, Maryland 20852	(301) 933-8170
Electronetics, 62 Alness St., Downsview, Ont.	(416) 661-3673
Tuck Electronics, 235 Market St., New Cumberland, Pennsylvania 17070	(717) 232-3431

Combined Market Quotations Ltd.,
1055 Beaver Hall Hill, Rm. 300, Mtl, PQ (515) 866-1107

Acoustic Couplers

Aadam Business Equipment Co.,
105 Hinricher Dr., Willow Springs, Ill 60480 (312) 839-5164

Action Systems Co.,
34 Cambridge St., Mekiden, Conn 06450 (617) 783-1100

Astrocom Corp., (ESE Ltd.),
1780 Albion Rd., Rexdale, Ont (416) 749-2271

CAE Electronics Ltd.,
PO Box 1800, Montreal, Que (514) 341-6780

Canadian General Electric
830 Lansdowne Ave., Toronto, Ont. (416) 534-6511

Cantel Tech Ltd.,
Box 1125, St. C., Scarborough, Ont. (416) 291-8179

Combined Market Quotations Ltd.,
(part of GTE)
1055 Beaver Hall Hill, Rm. 300, Montreal,
Que (514) 866-9324

Computer Complex Inc., (Domshy Industries Ltd.)
5015 Vienna Dr., Calgary, Alta (403) 288-1415

Crawford A. Associates Ltd.,
6427 Northam Dr., Mississauga, Ont (416) 675-1550

Data Pacific Corp.,
1165 E. Ash St., Fullerton, Calif 92631 (714) 879-9084

Data Graphics
834 Clyde Avenue, Ottawa, Ontario. (613) 722-6534

Datamex Ltd.,
580 Supertest, Downsview, Ont. (416) 661-1404

Dataphonics Ltd.,
600 6th Ave. S.W., Calgary, Alta (403) 263-6723

Datapoint Ltd. Corp., (TRW Data Systems) 85 Eglinton Ave. E., Toronto, Ont.,	(416) 481-7288
Digital Equip Cda. Ltd., 150 Rosamond St., Carleton Place, Ont	(613) 257-2615
Domshy Industries Ltd. Box 3452, Stn "B", Calgary, Alta	(403) 288-1415
Edmemde Newhall Assoc. Ltd., 1245 Martingrove Rd., Rexdale, Ont	(416) 743-1513
Ford Industries Inc.	
Honeywell Information Syst., 2025 Sheppard Ave. E., Willowdale, Ont.	(416) 491-0660
Instronics Techno Prods. Ltd., Stittsville, Ont.	(613) 836-4411
LMC Data of Cda Ltd., 787 Halpern, Dorval, Que	(514) 631-1689
Louis Albert Assoc. Inc., 2264 Stevenage Rd., Ottawa, Ont	(613) 737-5941
Megatronix Ltd., 100 Penn Dr., Unit 1, Weston, Ont	(416) 742-8015
Micro Data Comm Equip Soc. Ltd., 17481 Redhill Ave., Irvine Calif 92705	(714) 540-6730
Multiple Access Ltd., 885 Don Mills Rd., Don Mills, Ont M3C 1W2	(416) 443-3900
Mumac International Ltd., 30-32 Capital Dr., Ottawa, Ont K2G OE9	(613) 825-4747
Novation Inc., (Datagraphics) 834 Clyde Avenue, Ottawa, Ontario.	(613) 722-6534
Pyetmc Cda. 15 Sheffield St, Toronto	(416) 249-7044
Okidata Corp., 111 Gaither Dr., Mooreston, N.J.	(609) 235-2600

Olivetti Cda. Ltd., 1390 Don Mills Rd., Don Mills, Ont.	(416) 447-3351
Omnitec Corp., (Megatronix Ltd.), 100 Penn Dr., Unit 1, Weston, Ont.	(416) 630-7672
Prentice Electronics Corp., 795 San Antonio Rd., Palo Alto, Calif 94303	(415) 327-0490
TRW Data System, 85 Eglinton Ave. E., Toronto, Ont	(416) 481-7288
Ultronic System Corp., (Combined Market Quotations Ltd.), 1055 Beaver Hall Hill, Rm. 300, Mtl., Que.	(514) 866-1107
Vidio Systems Corp., (Louis Albert Associates) 281 Palace St., Ottawa, Ontario	(613) 746-0021
Wang Laboratories Cda. Ltd., 180 Duncan Mill Rd., Don Mills, Ont.	(416) 449-7890
Whittaker Electronics Ltd., 1478 Merivale Rd., Ottawa, Ont. K2E 6Z5	(613) 224-1221

83334

HD
9696
T442
U73
1973

DATE DUE
DATE DE RETOUR

[illegible]

LOWE-MARTIN No. 1137.

