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Systems Reference Library

IBM 1410/7010 Operating System (1410-PR-155)

Tele-processing Supervisor-1410-SV-964

This publication contains information on the Tele-processing Supervisor and the programs under its control; the material supplements information in the publication *IBM 1410/7010 Operating System; System Monitor*, Form C28-0319.

The Tele-processing Supervisor, generated as part of the System Monitor for the 1410/7010 Operating System, provides control facilities for the user's programs that process input/output for Tele-processing devices. Information in this publication includes a description of the basic principles of the Tele-processing Supervisor, instructions for writing programs to operate under its control, and considerations for generating a Tele-processing Supervisor tailored to the requirements of the individual installation.

MAJOR REVISION (September, 1966)

This publication is a major revision of *IBM 1410/7010 Operating System; Tele-processing Supervisor*, Form C28-0321-4, and makes obsolete that publication and its associated Technical Newsletters, N27-1212 and N27-1218. This publication also incorporates the information contained in, and makes obsolete, the publications *IBM 1410/7010 Operating System; Programming Support for the 1050 Data Communication System—Preliminary Specifications*, Form C28-0365 and *IBM 1410/7010 Operating System; Programming Support for the IBM 7770 Audio Response Unit — Preliminary Specifications*, Form C28-0369, and *IBM 1410/7010 Operating System; Programming Support for the IBM 1015 Inquiry Display Terminal—Preliminary Specifications*, Form C28-0403. The revision also includes corrections to system symbols in the Resident Monitor, Control Information for the Executive and other minor additions and deletions to the publication. These changes are indicated by a vertical bar to the left of the updated text and by a bullet (•) to the left of the updated figure.

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This publication is intended for use by data processing installations having Tele-processing facilities and operating under the IBM 1410/7010 Operating System. The publication contains the information that, together with the material contained in the prerequisite publications listed below, will enable the user to analyze his installation's programming requirements, write the required programs and routines, perform System Generation and initialization, and process data in a TP environment.

The publication is arranged to present in logical order introductory material about Tele-processing systems and components, operating logic of the TP complex, instructions for writing the required programs, and considerations for programming and System Generation for the various types of TP components. Also given are lists of console messages and communication symbols, and other useful information.

Purpose of the Tele-processing Supervisor

The Tele-processing Supervisor (hereinafter referred to as "the Supervisor") is an Operating System component that controls and coordinates all programming relating to Tele-processing input/output operations. It is incorporated into the Resident Monitor by each installation having TP facilities that are to operate under the Operating System.

The Supervisor is created by the user during System Generation according to the installation's TP configuration from a group of IBM-supplied Supervisor modules located on the Master file. This permits the user to create a configuration of the Supervisor that is tailored to his specific requirements and that is only as large as necessary to support his TP system.

The Supervisor is capable of supporting input/output operations for the following TP systems and devices:

- IBM 7740 Communication Control System
- IBM 7750 Programmed Transmission Control
- IBM 1440 Data Processing System (with an attached IBM 1448 Transmission Control Unit)
- IBM 1414 Input/Output Synchronizer, Models 4 and 5, with one or more of the following devices attached:
 - IBM 1009 Data Transmission Unit
 - IBM 1014 Remote Inquiry Unit
 - IBM 1015 Inquiry Display Terminal.

- IBM 1050 Data Communications System
- IBM 7770 Audio Response Unit
- Telegraph terminal units (by means of the IBM telegraph input/output special feature)

NOTE: The IBM 7740, 7750, and 1440 are each referred to in this publication as Programmed Transmission Control (PTC) units. Almost all of the Supervisor's operations for these components are identical; the few exceptions are covered in appropriate sections of this publication. One or more of the above TP devices are assumed to be included in an installation's machine requirements.

Prerequisite and Related Publications

This manual supplements the publication *IBM 1410/7010 Operating System; System Monitor*, Form C28-0319; it is assumed that the reader is thoroughly familiar with the information in that publication.

In addition, the reader must be familiar with the information presented in these publications:

- IBM 1410/7010 Operating System; Autocoder*, Form C28-0326
- IBM 1410/7010 Operating System; Basic Input/Output Control System*, Form C28-0322
- IBM 1410/7010 Operating System; System Generation*, Form C28-0352
- IBM 1410/7010 Operating System; Operator's Guide*, Form C28-0351

The reader should also be familiar with any of the following publications that pertain to devices in his installation's particular Tele-processing system.

For the IBM 1414 and attached devices:

- IBM Telecommunications Equipment with IBM 1410 System*, Form A22-0525
- IBM 1009 Data Transmission Unit*, Form A24-1039
- IBM 1015 Inquiry Display Terminal with IBM 1410 or 7010 Systems*, Form A22-6829
- IBM 1050 Data Communications System*, Form A24-3020
- IBM 7770 Audio Response Unit Model 1*, Form A22-6800
- IBM Audio Response Unit with 1410 and 7010 Systems*, Form A22-6804

For the IBM 7740:

- IBM 7740 Communication Control System; Principles of Operation*, Form A22-6753
- IBM 7740 Communication Control Package*, Form C28-6903

For the IBM 7750:

IBM 7750 Principles of Operation, Form A22-6679

IBM 7750 Data Control Package, Form C28-8140

IBM 7750 Programmed Transmission Control with IBM 1050 Data Communications System, Form A22-6792

For the IBM 1440-1448:

IBM 1448 Transmission Control Unit, Form A22-3010

IBM 1410 and 7010 Systems with IBM 1440 and 1448, Form A22-0537

IBM 1410/7010 with 1440/1448 Tele-processing System; Principles of Operation, Form A22-0538

IBM 1050 with IBM 1448 and 1440 for IBM 1410 and 7010 Systems, Form A22-0540

Intersystem IOCS Specifications, IBM 1440 with IBM 1410 or 7010 (Communications IOCS), Form C24-3051

Other publications that may be helpful are:

Data Communications Concepts and Communications Facilities, Form E20-8158. This publication describes communications common carriers, coding systems, modulation, channels and communications concepts, with brief descriptions of IBM Tele-processing units and systems.

IBM Tele-processing Systems Summary, Form A24-3090. This publication contains brief descriptions and operating characteristics of IBM Tele-processing units and systems.

This list of publications is not all-inclusive. Other publications pertaining to Tele-processing systems and devices are available through IBM Branch Offices.

Detailed information concerning the machine requirements for a Tele-processing system within the 1410/7010 Operating System is presented in the *System Generation* publication.

The remainder of this Introduction is intended to acquaint the reader with the overall layout and functioning of a TP system that operates under the control of the TP Supervisor so that he may become familiar with the context within which he will be working, prior to undertaking actual programming. It is expected that the reader is already familiar with the TP devices and components that his system will be using. However, before TP programming is introduced, a brief summary of TP equipment is presented, in "TP Systems and Devices." This summary is followed by an explanation of how TP is related to the Operating System and how the TP programming complex operates; and by a list of TP programming modules from which the user selects those that fill his installation's requirements.

TP Systems and Devices

Because data transmission requirements differ greatly between and within organizations many different IBM

Tele-processing systems and devices are available. Some of the factors a user must consider in selecting device types are: media for and volume of input and output; speed, distance, and direction of transmission; number and configuration of terminals required; manner of handling errors; types and grades of communication channels available; and amount of processing to be done.

Each of the many Tele-processing systems and devices is covered in detail in appropriate publications, but the following list will serve to summarize the characteristics of those capable of being controlled by the Tele-processing Supervisor. In the following paragraphs, references to connecting or attaching two units together means direct, local cable connection, while references to one unit communicating with another means that communications-company (e.g., telephone company) facilities separate the two.

NOTE: Because this publication is concerned only with those Tele-processing System configurations that operate under the 1410/7010 Operating System, references to the data processing systems with which the various TP devices are connected are limited to the 1410 and 7010.

The following three devices are termed Programmed Transmission Control units. They have a stored program and perform many functions relating to message handling that would otherwise have to be handled by the program in the central processing unit (CPU). PTC units are essentially computers that specialize in performing input/output operations for a number of different TP devices, and are used to serve an IBM 1410 or 7010.

IBM 7740 Communication Control System

The IBM 7740 is used to supervise a communication network consisting of a number of terminals of different types and operating characteristics. The 7740 controls traffic by polling sending terminals, addressing receiving terminals, checking communication lines, and maintaining queue control; assembles messages; and performs related functions, such as message protection, error checking, code conversion, and editing. Messages are relayed to or from a remote terminal or the attached 1410 or 7010. (Messages may be stored on an IBM 1311 Disk Storage Unit.) The 7740 can be connected directly to a 1410 or 7010 data processing system, and can communicate with any or all of the following types of devices:

Telegraph terminals

IBM 65 and 66 Data Transceivers

IBM 1009 Data Transmission Units

IBM 1013 Card Transmission Terminals

IBM 1050 and 1060 Data Communications Systems

IBM 7701 and 7702 Magnetic Tape Transmission Terminals

IBM 7710 Data Communication Units

Other IBM 7740 Communication Control Systems

IBM 7750 Programmed Transmission Control

Attached to the 7740 is a 1050 console from which the 7740 may be controlled independently of the host computer. This console is treated by the 7740 as another terminal device; it may be used to originate output messages for remote TP devices serviced by the PTC unit, and to alter the 7740's stored program.

The IBM-supplied stored program for the 7740 is called the Communication Control Package; it is described in the publication *IBM 7740 Communication Control Package*, Form C28-6903.

IBM 7750 Programmed Transmission Control

The IBM 7750 is a Tele-processing system unit that links a central computer with remote terminals, via communications-company toll or leased lines. It directs and controls the flow of data between the host computer and the communications network. Like the 7740, it controls message traffic by polling sending terminals, addressing receiving terminals, checking communications lines, and queueing messages; it assembles and distributes messages, transfers data to and from the attached data processing system, and performs message protection, error checking, code conversion, and editing functions. Messages are relayed to and from remote terminals or the attached 1410 or 7010. Unlike the 7740, the 7750 cannot be operated independently of the host computer; it must be connected directly to a 1410 or 7010. The 7750 can communicate with any or all of the following types of devices:

Telegraph terminals

IBM 65 and 66 Data Transceivers

IBM 1009 Data Transmission Units

IBM 1013 Card Transmission Terminals

IBM 1050 Data Communications Systems

IBM 7701 and 7702 Magnetic Tape Transmission Terminals

IBM 7710 and 7711 Data Communication Units

IBM 7740 Communication Control Systems

The IBM-supplied stored program for the 7750 is called the Data Control Package; it is described in the publication *IBM 7750 Data Control Package*, Form C28-8140.

IBM 1440 Data Processing System

The IBM 1440, when used with an IBM 1448 Transmission Control Unit and employing as a stored program the IBM-supplied Intersystem IOCS, performs the func-

tions of a programmed transmission control. These functions include: assembly and distribution of data characters; transfer of data to and from the host computer; message accounting, editing, switching and queueing; code translation; and communications line control.

The 1440-1448 can be connected to an IBM 1410 or 7010, and can communicate with data communications systems such as the IBM 1030, 1050, and 1060.

The IBM-supplied program for the 1440 is described in the publication *Intersystem IOCS Specifications, IBM 1440 with IBM 1410 or 7010 (Communications IOCS)*, Form C24-3051.

IBM 1414 Input/Output Synchronizer, Models 4 and 5

The IBM 1414, Model 4 or 5, can connect the IBM 1009 Data Transmission Unit, the IBM 1014 Remote Inquiry Unit, the IBM 1015 Inquiry Display Terminal, the IBM 1050 Data Communications System, the IBM 7770 Audio Response Unit, and telegraph terminal units, to the 1410 or 7010. (In addition, the 1414 Model 4 can connect the IBM 1402, Model 2, Card Read Punch and the IBM 1403 Printer to the 1410 or 7010; the 1414 Model 5 can connect only the above telecommunications devices.) Essentially the purpose of the 1414 is to provide buffers and to control data transfer between the TP devices and the 1410 or 7010. Each 1414 has six 80-character buffers. To these are attached the specific device adapters appropriate to the user's input/output devices. Any or all of the buffers may receive input from the attached input/output devices simultaneously, but only one buffer at a time can be sending data to or receiving data from 1410 or 7010 core storage. For 1014 and telegraph devices, the 1414 also performs appropriate code translation.

IBM 1009 Data Transmission Unit

The IBM 1009 connects an IBM data processing system to communications-company facilities to provide a high-speed, two-way communications link between the data processing system and remote terminal devices or a remote data processing system. It contains the circuitry necessary for synchronizing data movement between the two. The 1009 can be connected to a 1410 or 7010 via a 1414 Input/Output Synchronizer, Model 4 or 5. The 1009 can communicate with another 1009, a 7740, 7750, or an IBM 7701 or 7702 Magnetic Tape Transmission Terminal, an IBM 1013 Card Transmission Terminal, or an IBM 7710 or 7711 Data Communication Unit. Transmission speeds range from 75 to 300 characters per second, depending on type and grade of communication channel (see the *Data Com-*

munications Concepts and Communications Facilities publication for a discussion of channel types and grades).

IBM 1014 Remote Inquiry Unit

The IBM 1014 is a two-way communications terminal by which the user has access to the contents of 1410 or 7010 core storage, and consequently, to tape and disk files within the system. It also permits the user to request services to be rendered by the processing center and to influence or control operations executed by the entire system. The unit consists of a keyboard-printer combination. Input is by means of manual keyboard entry; output appears on the 1014's console printer. The 1014 can be connected to or communicate with a 1410 or 7010 via a 1414 Input/Output Synchronizer. The permissible distance between the 1014 and the 1414 is limited. When they are connected by a direct cable, without the use of signal conversion, the length of the cable cannot exceed 50 feet. When they are connected by communications-company facilities or a private cable, where signal conversion is performed, the length of the circuit connecting them may not exceed eight miles. The maximum transmission speed is 12.5 characters per second for inquiry requests (i.e., originated by the 1014), and 15.5 characters per second for inquiry replies (i.e., received by the 1014).

IBM 1015 Inquiry Display Terminal

The IBM 1015 provides for visual display of information. This permits immediate access to up-to-date records for customer inquiry and many applications where no hard copy is required. The terminal consists of a keyboard, for entering inquiries into the computer, and a display unit, on which output from the computer appears. The display unit contains a cathode-ray tube on which data appears as a dark image on a light background. The display area, or screen, permits display of up to 30 lines of 40 characters each. The terminal operator enters inquiries via the keyboard; the message appears simultaneously on the screen. The response, or output message, from the computer appears on the screen at a maximum rate of 650 characters per second.

Up to 60 terminals can be connected to an IBM 1410/7010 via an IBM 1414 Input/Output Synchronizer. The 1015 and the 1414 are connected by a cable whose length may not exceed 2,500 feet.

IBM 1050 Data Communications System

The IBM 1050 is a versatile communications system that can send data to and receive data from similar systems and/or a central data processing system. Depending on the user's requirements, system components are

available to provide any or all of these input/output media: manual keyboard entry, printed page output, punched-card input and output, paper-tape input and output, and edge-punched document input and output. In addition to transmitting and receiving over communication lines, the 1050 is capable of local off-line operations, such as source recording, media converting, document writing, automatic typing, printing of transmitted data, and preparation of machine-readable media for transmission. The 1050 can communicate over communications-company toll- or leased-line networks with an IBM 1410 or 7010 via an IBM 1414 Input/Output Synchronizer, or a programmed transmission control (IBM 1440, 7740, or 7750). The maximum transmission rate is 14.8 characters per second.

IBM 7770 Audio Response Unit

The IBM 7770 provides an audio response to inquiries made from telephones, or punched-card input via an IBM 1001 Data Transmission System. When the telephone is used, input is entered by dialing or keying a sequence of digits, and output is in the form of pre-recorded voice answers. The 7770 can be connected to a 1410 or 7010 via an IBM 1414 Input/Output Synchronizer, and can communicate over common-carrier or private-line circuits with telephone-type terminal devices, the 1001, or other similar terminals.

TP and the Operating System

Program Components

A data processing installation that includes TP facilities and operates within the IBM 1410/7010 Operating System uses several programming components that a non-TP installation does not require. These are the Supervisor, the Executive, TP programs, and PTC programs. The first three of these together comprise the *TP complex* of an installation, and are required by all such installations. PTC programs are used only by installations whose TP device configurations include a PTC unit. The purpose of the TP complex is to handle all input/output operations involving TP devices, and to process TP input/output data.

Certain of the input/output operations are repetitive. Their use is either common to all TP operations or unvarying for a specific TP device. In other words, each time an operation of this type is required for a particular device, it is performed in a like manner regardless of the way in which the data will be processed. Such operations are performed by IBM-supplied Supervisor modules. At System Generation the user selects, and incorporates into the Resident Monitor, those modules that are required for his installation's TP configuration. These modules are supplied by IBM as part of the Operating System Master file. When in-

corporated into the Resident Monitor, these modules are collectively known as the *TP Supervisor*.

Other input/output operations will vary according to the requirements of the individual installation. The programming needed to carry out these and other operations cannot therefore be supplied as Supervisor modules, but must be written by the user. These various routines are collectively known as the *Executive* program. This, too, is incorporated into the Resident Monitor at System Generation. (The Executive program will be subsequently referred to as "the Executive.")

The programs that process the data received from, or to be transmitted to, the TP devices must be written by the user, to meet his individual requirements. Such programs are called *TP programs*.

The Supervisor and the Executive together act to control and coordinate all TP operations. A means of communication must be provided between the various routines within the TP complex. A routine in one element of the complex may branch to a routine in either of the other elements. This is accomplished through a system of linkage symbols. Some of these, for linking Supervisor and Executive routines, are pre-established by IBM. Others, for linking the Supervisor or the Executive with TP programs, are established by the user. If a TP program is to be entered from the Executive, this may be done directly; the Executive simply branches to the linkage symbol for the TP program's entry point. If a TP program is to be entered from the Supervisor, the Supervisor must first obtain from the Executive the address of the desired TP program, and then branch to that program. In this sense, the Executive provides liaison between the Supervisor and TP programs. Aside from this, there is little real distinction between the Supervisor and the Executive, except that the one consists of IBM-supplied routines, and the other, of user-written routines. When the two are incorporated into the Resident Monitor, the Executive becomes effectively part of the Supervisor. However, it is still necessary, in discussing their functions, to consider them as separate entities.

An additional programming element is related to a Tele-processing system: those programs that are being executed during the time the installation is ready to receive input from TP devices (but are not necessarily related to the processing of that input). These programs are known as *main-line* programs. For example, if a sort program is being executed when input from a TP device interrupts processing, control is taken from the sort program and given to the TP Supervisor. After the Supervisor and other elements of the TP complex have completed their functions, control is returned to the sort program at the point of interruption. In this

example, the sort program is considered as the main-line program in relation to the TP complex.

Location of TP-Complex Elements

The Supervisor and the Executive reside permanently in core storage as part of the Resident Monitor. The TP programs are located on a file called the *TP Library file*, which may be in absolute or relocatable form and may reside on either tape or disk. TP programs are then loaded into core storage before execution.

At System Generation, the user has the option of reserving a portion of core storage for loading of the TP programs. If he does reserve an area, he may also elect to load some, or all, of the TP programs into this reserved area at the initialization of the TP complex; the programs remain there as long as the complex is open. Among the factors the user should consider in making these two decisions are the number and length of the TP programs, the frequency with which they are called, the amount of core storage available for main-line programs, and the amount of core storage available for TP programs. The advantage of having TP programs permanently in core storage is that the Supervisor and Executive have direct access to them, obviating the necessity of loading them from the TP Library file every time they are needed.

If the user does *not* elect to reserve an area for TP programs, each of them must be loaded anew into the *main-line* program area each time it is needed. Because the TP program will partially overlay the main-line program, the user must in this case specify at System Generation the Supervisor module with the "save and restore" feature, so that the main-line program can be saved on a tape or disk file established for this purpose. When the TP program has completed its execution, the main-line program can be reloaded into core storage before control is returned to it. The "save and restore" feature is also needed if there is a possibility that the reserved area, minus that portion of it occupied by the TP programs located there permanently, will not be large enough to accommodate any TP program which may be loaded from the TP Library file by the Supervisor or Executive.

NOTE: The preceding discussion assumes that the user wishes to perform main-line processing and TP operations concurrently, which is the usual situation. An alternative mode of operation is discussed later in this publication, under "TP-Only Operation."

Core-Storage Layout of the TP Complex

The core-storage relationships of the various elements of the TP complex are shown in Figure 1. As indicated, the Supervisor and the Executive are located after the Resident iocs. The TP program reserved area, if any, is located between the remaining Resident Monitor

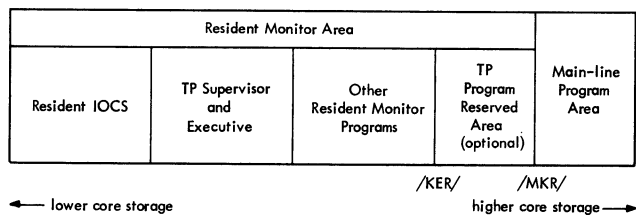


Figure 1. Core-Storage Layout of the TP Complex

programs and the main-line program area. (The TP programs are not themselves *part* of the Resident Monitor; they are simply located *part* of the Resident Monitor's core-storage area.)

The actual number of core-storage positions required for the TP complex can be estimated from the list given in the *System Generation* publication.

Loading PTC Control Packages

In TP installations using a PTC unit, the PTC must be loaded with its associated stored-program package before the TP complex is opened. This is accomplished by a special subprogram that is incorporated into a main-line program during processing by the Linkage Loader. Because the programming required to load the program into the PTC is not needed during the time the unit is ready to receive input, the loading subprogram should be incorporated into a main-line program to be executed before the TP complex is opened.

System Generation

System Generation for installations requiring use of the TP complex is accomplished as explained in the *System Generation* publication, with the user specifying which Supervisor modules and Library Generators he requires by means of the appropriate CALL, PHASE, and CREAT cards. In addition, certain other information relative to construction of the Resident Monitor must be provided, by means of appropriate system description control cards.

Tele-processing Modules

The following is a complete list, by function, of IBM-supplied TP modules from which the user must select those that are appropriate for his installation's particular TP device configuration and mode of operation. Most of the items in the list are the names of modules that perform various input/output functions. The user specifies that these modules be included in the Supervisor by entering their names as the operands of CALLN cards that he places in the System Generation control-card deck. The remaining items in the list are in three categories. (1) Items marked with one asterisk (*) are Create packet names, which cause certain modules to be included in the Supervisor. (2) Items marked

with two asterisks (**) are actual names of modules, but these modules serve only to specify the inclusion of one or more *other* modules. In this they are similar to Create packets. (3) Items marked with three asterisks (***) are also names of modules, but the user does not specify them by name. Rather, they are included in the Supervisor as a result of the user's selecting the appropriate CALLN card or Create packet name, or by means of embedded calls in other modules. (See the *System Monitor* and *System Generation* publications for details on the use of CALLN cards and Create packets.)

This list gives the general functions for each of the several groups; within each of these group descriptions is given the section of the publication in which detailed descriptions are presented.

Supervisor Control Modules

These modules comprise the nucleus of the Supervisor in that they contain those routines that control and coordinate device module, loader, Executive, and TP program routines. (See "The TP Supervisor" section for details.)

TPSUPER**
 TPSUPERDR**
 TPSUPERDDR**
 TPSUPERTPO**
 TPBASSUPER***
 TPTAPEDUMP***
 TPDISKDUMP***
 TPNLY***

Supervisor TP Loader Modules

These modules contain routines for loading TP programs from the TP Library into core storage. (See "The TP Supervisor" section for details.)

TPTAPELDRA
 TPTAPELDRR
 TPDISKLDRA
 TPDISKLDRR
 TPLDRRPROC***
 TPLDRDEP***

Supervisor Device Modules

These modules contain routines for performing input/output operations within the TP devices to which they apply. (See "The TP Supervisor" section for details.)

TPSTARTCH1
 TPSTARTCH2
 TPENDCH1
 TPENDCH2
 TP1009CH1
 TP1009CH2
 TP1014CH10
 TP1014CH11
 TP1014CH20
 TP1014CH21

TP1015CH1
TP1015CH2

TP1050CH10
TP1050CH11
TP1050CH20
TP1050CH21

TP7770CH1
TP7770CH2

TPTELCH10
TPTELCH11
TPTELCH12
TPTELCH20
TPTELCH21
TPTELCH22

TPPTCCH1
TPPTCCH2

TP Library Generator Modules

These modules serve to build a TP Library Directory, create records of the installation's TP programs, and

place the TP Library, consisting of the Directory and the TP Programs, on the TP Library work file (MW3). (See "TP Library Generation" for details.)

TPATLIBGEN
TPADLIBGEN
TPLIBGENXT***
TPLIBGENXD***
TPLIBGENXP***
LINKLOADRJ*
LINKLOADRT*
LINKLOADTD*
LINKLOADDT*

PTC Loader Modules

These modules are used to load the IBM-supplied or user-written stored program into a PTC unit prior to opening the TP complex (not to be confused with the LDPTC macro-instruction.) (See "Macro-Instructions for PTC Units" for details.)

TPLDDCP1
TPLDDCP2

The TP Complex

Operation of the TP Complex

This section explains the overall logical operation of the TP complex, showing the interaction of its elements. TP operation may be divided into two categories: operations that occur when input data from a remote TP device is received by a PTC unit or the IBM 1414 and operations that occur when the host computer has output data to be sent to a remote TP device. These two categories are discussed under "Input Logic" and "Output Logic," respectively. TP open and close operations are explained under "Opening and Closing the TP Complex."

Input Logic

Figure 2 shows the general sequence of operations that occurs when input from a TP device (hereafter referred to simply as input) causes the program currently being executed to be interrupted.

When the interrupt occurs, the Resident IOCS saves the status of the current program and then branches to the Supervisor. The Supervisor determines which TP device caused the interrupt, reads the input data from the 1414 or PTC input buffer into an area that the user has established in the Executive, and checks this operation for read errors. If one or more errors have occurred the Supervisor inserts the appropriate indicator(s) (depending on the type of error) into the input area's control field. The Supervisor then determines whether the interrupted program was a main-line program or a program within the TP complex (Supervisor, Executive, or TP program). If the program was one within the TP complex, the Supervisor adds the address of the input area to its input data chain and branches back to the IOCS so that the interrupted program can be resumed. (The IOCS restores the status of the program and branches to it at the point of interruption.)

If the interrupted program was a main-line program, the TP operations continue as follows. The Supervisor places in its current input area address field (/TS1/) the address of the input area, and then branches to the Executive. The Executive analyzes the input, including the error indicator, if any, to determine which TP program is needed to process it. (Alternatively, the user may, in writing his programs, arrange to have the Executive itself do the processing of the input.) The Executive places in the Supervisor the name and origin point of the required TP program, and then branches to

the Supervisor. At this point the Supervisor determines whether or not the requested TP program is already in core storage. If it is, the Supervisor determines whether the data files for that TP program are already open (see next paragraph below). If the program is not already in core storage, the Supervisor locates it on the TP Library file and determines whether or not it is too large to fit into the TP reserved area in core (if the user has provided such an area). If the program is too large, or if the user hasn't provided a reserved area, the Supervisor first unloads onto a pre-established temporary storage file (tape or disk) the entire main-line program, to make room for the TP program. (The user must have provided for the TP save and restore function at System Generation.) The Supervisor then loads the TP program starting at the origin point specified.

At this point the TP program is located in core storage, and the Supervisor now determines whether the data files for that program are already open. The user may have caused them to be opened at initialization or they may previously have been opened by the same program. If they are already open the Supervisor branches to the TP program at the point at which input processing begins. If the data files are not open the Supervisor branches to that point in the TP program at which it performs the opening function. After opening the files, the TP program branches back to the Supervisor so the latter may set in the memory map an indicator showing that the files are open. Then the Supervisor branches back to the TP program at the point at which input processing begins. Depending on the results of the processing, one of three exits may be taken. If processing was successfully completed, the user may wish either to simply release the input area, or to both release the input area and close the data files for that TP program; and then allow the interrupted program to be resumed, or the next TP input, if any, to be processed. Two of the exits mentioned provide this choice. If during processing the need is found for another TP program to complete the processing, the user may select the third type of exit. This consists of placing in the Executive the name and origin point of the new TP program (the same function as was performed by the Executive in specifying the original TP program), and then branching to the Supervisor at the point at which it determines whether the TP program is in core storage. This third type of exit may recur any

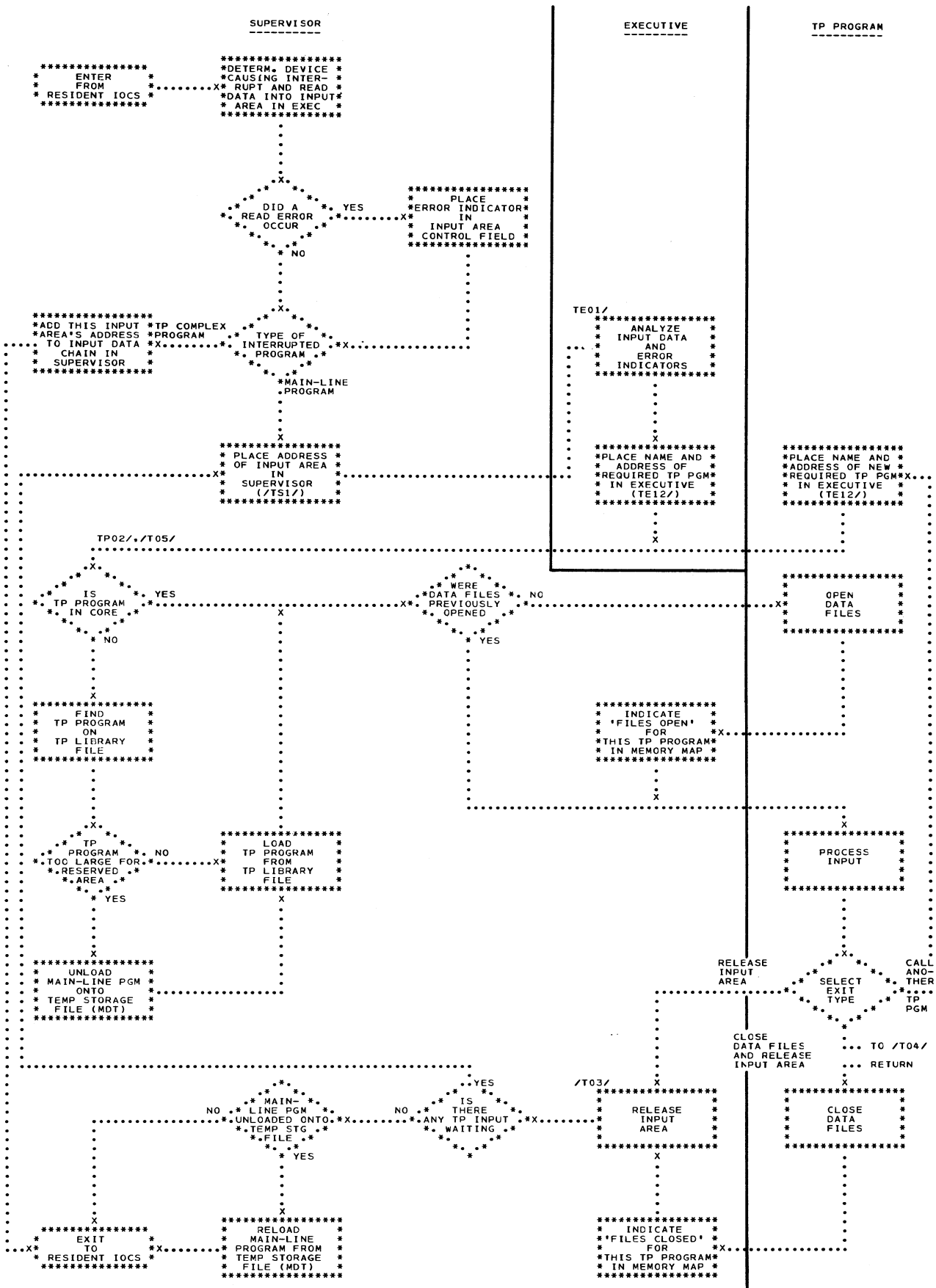


Figure 2. Input Logic of the TP Complex

number of times until the current input is successfully completed.

After input processing has been successfully completed, the Supervisor checks the input data chain to determine whether there is more TP input waiting to be processed (i.e., there have been any more TP interrupts since the main-line program was originally interrupted). If there is more such input the Supervisor branches to that point in itself at which it places in its current input area address field (/TS1/) the address of the new input area. The subsequent operations in that routine are performed as before. This cycle continues until the Supervisor finds that there is no more input to be processed. At this point it branches back to the Resident IOCS for resumption of the main-line program.

Output Logic

Figure 3 shows the general sequence of operations that occurs when an output data message has been assembled and is ready to be written to a TP device.

After the Executive, main-line or TP program has constructed the output message, the same program checks to see if an output area is available (the area is in the same program). If an area is not available, the program should loop at this point; when an area becomes available, the program exits from the loop and issues a linkage sequence to the output routine in the Supervisor for the TP device to which the message is to be sent. This linkage sequence, which includes the address of the output area from which the message is to be written, constitutes a write request, which the Supervisor adds to its list of such requests for that device. The Supervisor then sets two indicators: one in the output area's control field, to indicate that that area is not available for further use (by another output message); and one in the Resident IOCS to indicate that output is available for writing to the TP device. The Supervisor then branches to the IOCS to determine if the channel is free — if it is not, control is returned to the same program that constructed the output message. If the channel is free, control returns to the Supervisor, which writes the output to the proper TP device. It then checks for errors; if any exist, the write operation is retried, a maximum of two times. If the error persists, the Supervisor sets the proper indicator in the output area control field, then branches to the Executive, which analyzes the error and determines if the write operation should be retried more times; if the operation should be retried, the Executive returns control to the Supervisor's write routine, and the cycle repeats.

If no error occurred after the Supervisor's first, second or third attempt, or if the Executive determines that the write should not be retried, the Supervisor releases the output area and returns control to the IOCS.

The user should keep in mind that the foregoing descriptions of the logic of input and output operations are general; more complete explanations of the individual routines that comprise input and output operations appear in a later section, "The TP Supervisor." Certain linkage and system symbols appear within the charts of Figures 2 and 3. These are provided for the user's convenience of cross reference from the charts and explanations of the individual routines.

Opening and Closing the TP Complex

TP operations can be carried out only after certain preparatory functions have been performed. These functions, which are performed at one time, comprise the *opening*, or initialization, of the TP complex. Once the TP complex has been opened, all normal TP operations can be performed until the user *closes* the TP complex. Both opening and closing functions involve various housekeeping functions.

The user causes the TP complex to be opened or closed by entering the appropriate control information by a control card or a console inquiry.

To open or close the TP complex by a control card, the user places the card in the Standard or Alternate Input Unit, among the Monitor control cards. It may appear anywhere after the first JOB card of a main-line program, but must precede the input unit's Monitor END card.

The card formats are:

6	16	21
MON\$\$	TP	AOPEN
MON\$\$	TP	ACLOSE

If the user opens or closes the TP complex by a control card, the Transitional Monitor, which analyzes the card's contents, transfers control to the Supervisor's OPEN or CLOSE routine. When the routine has completed execution, control is returned to the Transitional Monitor.

To open or close the TP complex by a console inquiry, the user enters the appropriate message, whose format is given below, on the computer console. Because the message is a Class A message it may be entered at any time.

The message formats are:

```
$90bAOPEN
$90bACLOSE
```

If the user opens or closes the TP complex by a console inquiry, the Resident Monitor, which analyzes the message, transfers control to the Supervisor's OPEN or CLOSE routine. When the routine has completed execution, control is returned to the Resident Monitor.

For further information on Monitor control cards and console inquiries, see the *System Monitor and Operator's Guide* publications.

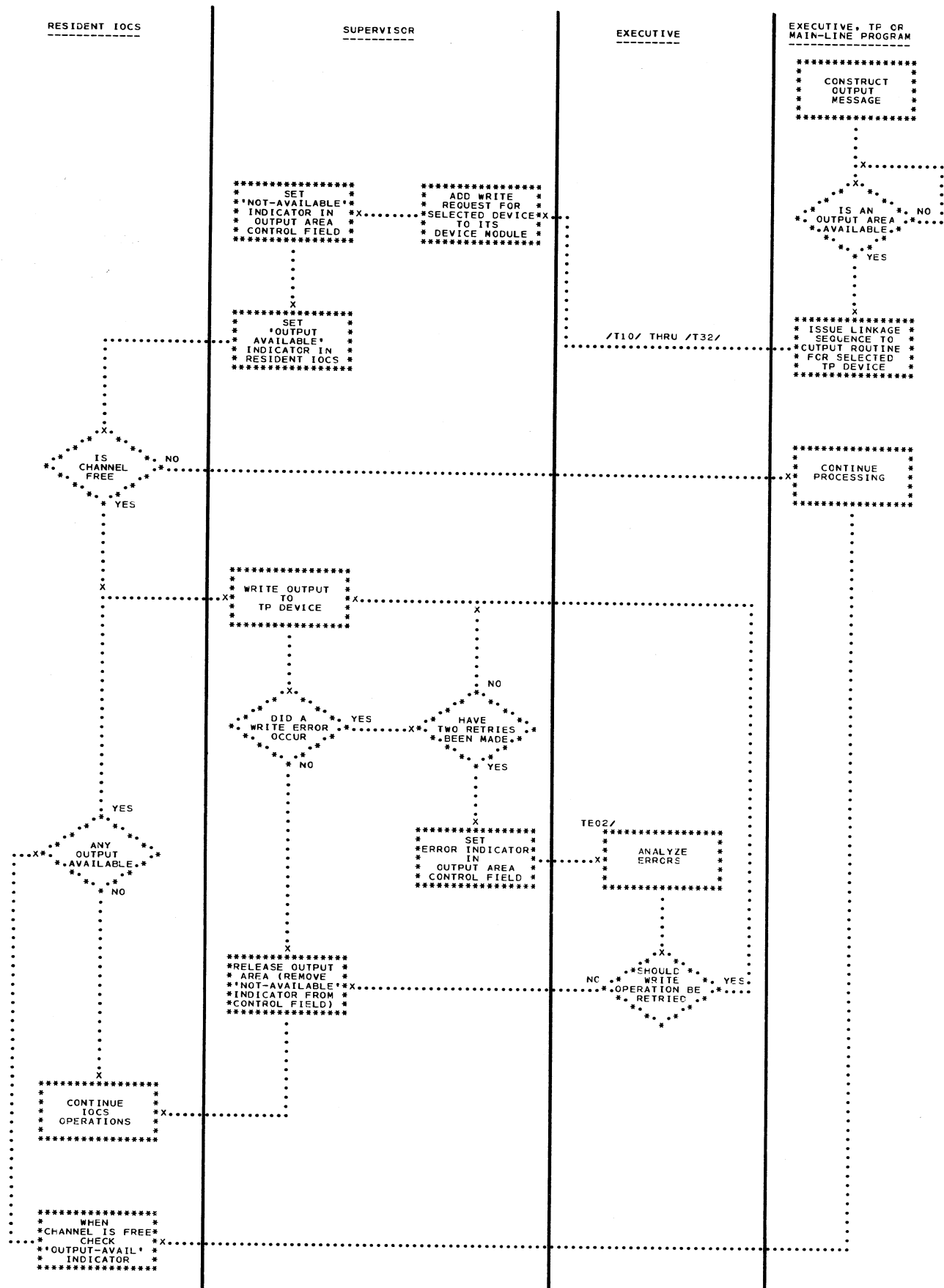


Figure 3. Output Logic of the TP Complex

Opening the TP Complex

The sequence of events that occurs during opening of the TP complex is shown in Figure 4.

When the Supervisor receives the OPEN message from a control card or a console inquiry, it sets an 'open-in-progress' indicator in itself. Then it initializes the various input/output routines and performs other housekeeping functions, such as saving the contents of the main-line program's index registers. A branch to the Executive allows the user to perform any initialization functions he requires; these include opening of any data files that are common to all TP programs, and the loading into core storage of any TP programs he may wish to be resident in core storage at all times when the TP complex is open. Control is then returned to the Supervisor, which checks for any error that may have occurred in opening the complex. If an error occurred, the Supervisor writes the appropriate error message on the console, and returns control to the Transitional Monitor or Resident Monitor. If no error occurred, the Supervisor performs various other initialization functions. At the conclusion of these functions, the 'open-in-progress' indicator is cleared, and the 'TP-complex-open' indicator is set. Control is then returned to the Transitional Monitor or Resident Monitor. From this time until the TP complex is closed, the TP input messages will be accepted and processed, and output messages can be sent.

Closing the TP Complex

The sequence of events that occurs during closing of the TP complex is shown in Figure 5.

Upon receiving the CLOSE message, the Supervisor sets in itself a 'close-in-progress' indicator. From this time on, no further TP input will be accepted from TP devices; however, pending input will be processed. If a PTC unit is included in the TP configuration, hold orders for the PTC's input/output lines will be issued, to prevent its accepting any more input. Processing of all pending input is then performed; output messages, when required, are written. Upon completion of these functions, the 'close-in-progress' indicator is cleared and the 'TP-complex-not-open' indicator is set. A branch to the Executive permits the user to close the common data files and perform such other housekeeping as he requires. A branch to the Supervisor permits it to perform *its* housekeeping functions, at the conclusion of which control is returned to the Transitional Monitor or the Resident Monitor.

The TP Supervisor

This section describes the functions of the Supervisor modules and the detailed input/output processing steps performed by the Supervisor device module routines.

Functions of the Modules

The following paragraphs list and explain the functions of each of the individual Supervisor control, device, and TP loader modules listed under "Tele-processing Modules" in the Introduction to this publication, and indicates how the user selects the modules. Further details concerning the order in which the user must specify the modules appears in the section "System Generation."

Supervisor Control Modules

The first four modules described in this section perform the actual control functions required for TP operations. One or two of these must be specified, at System Generation, for inclusion in the Supervisor. The user effects this inclusion by calling, by a CALLN card, the appropriate one of the remaining four modules in the following list.

TPBASSUPER (Basic Supervisor)

This is the largest of the control modules and is basic to any TP complex. Its functions are as follows:

1. Determines which other Supervisor modules are included in the TP complex and passes control to them as required.
2. (a) Sets up chained areas for addresses of input data, (b) keeps track of all the addresses on the chain and gives them to the Executive in the order of their arrival (except for PTC service messages, which take priority), and (c) clears input areas for reuse after the input they contain has been processed.
3. Keeps track of all pending reads and writes within device modules.
4. Passes control to all modules sequentially, for performance of opening and closing functions.
5. Determines where entries to TP programs should be made for open, close, and input processing routines.
6. Passes to the TP loader the name and origin point obtained from the Executive, so that the loader may locate and load at the proper point in core storage the TP program required to process the current input.
7. Keeps track of the status of TP operations by means of program switches. Settings of these switches are used by other Supervisor modules to determine whether the TP complex is open, whether data files are open, whether the program currently being executed is a main-line program or a program within the TP complex, etc.

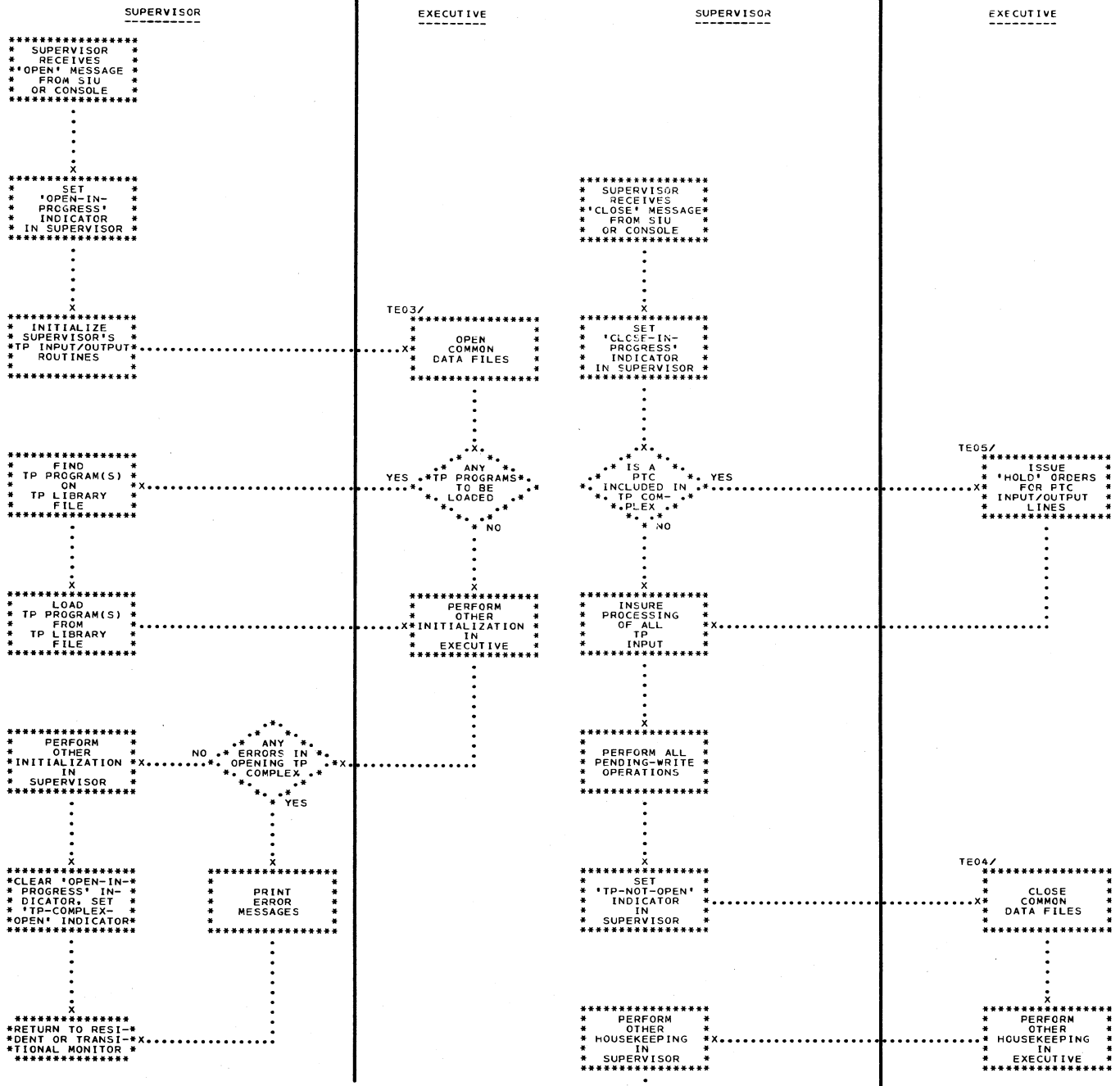


Figure 4. Opening the TP Complex

Figure 5. Closing the TP Complex

8. Controls the return to the Resident Monitor and the IOCS upon completion of a TP processing operation.

TPTAPEDUMP (TP Save and Restore, Tape)

This module contains routines to unload the contents of the main-line program area onto a *tape* file when a TP program is to be loaded into that area, and to reload the contents back into the main-line area after the TP operation has been completed.

TPDISKDUMP (TP Save and Restore, Disk)

This module contains routines to unload the contents of the main-line program area onto a *disk* file when a TP program is to be loaded into that area, and to reload the contents back into the main-line area after the TP operation has been completed.

TPONLY (Tele-processing Only)

This module is included in the TP complex when the user wishes to do no main-line processing once the TP complex has been opened. (This subject is discussed in detail in "TP-Only Operation.") TPOONLY routines cause the Supervisor to branch to the Monitor's wait loop when all pending TP operations have been completed, thus waiting for the next TP interrupt.

TPSUPER

The user specifies this module to cause only the TPBASSUPER module to be included in the Supervisor. When the TPSUPER module is selected, no provision is made for TP-only operation or for the save and restore option.

TPSUPERDR

The user specifies this module to cause the TPBASSUPER and TPTAPEDUMP modules to be included in the Supervisor.

TPSUPERDDR

The user specifies this module to cause the TPBASSUPER and TPDISKDUMP modules to be included in the Supervisor.

TPSUPERTPO

The user specifies this module to cause the TPBASSUPER and TPOONLY modules to be included in the Supervisor.

Supervisor Device Modules

This group of modules contains the input/output routines for specific devices; the user makes his selection of the appropriate modules on the basis of his installation's TP device configuration. The required modules are specified by CALLN cards.

Modules for Devices Attached to the IBM 1414

For each channel the corresponding START and END modules must be included, and for each device on the channel the appropriate module must be included.

Selection is made from the following list. The module name indicates the type of device, the channel, and the adapter, if any, to which the device is attached. (The final digit, where the module name has two digits at the end, is the adapter number.) For example, if the user's TP device configuration includes a telegraph unit attached to adapter 2, on a channel-1 1414, he must specify inclusion of the TPTELCH12 module in the Supervisor.

TPSTARTCH1
TPSTARTCH2
TPENDCH1
TPENDCH2

TP1009CH1
TP1009CH2

TP1014CH10
TP1014CH11
TP1014CH20
TP1014CH21

TP1015CH1
TP1015CH2

TP1050CH10
TP1050CH11
TP1050CH20
TP1050CH21

TP7770CH1
TP7770CH2

TPTELCH10
TPTELCH11
TPTELCH12
TPTELCH20
TPTELCH21
TPTELCH22

Modules for PTC Units

The user must select either the TPPTCCH1 or the TPPTCCH2 module, but not both, since the user's device configuration can include only one PTC unit if it is to operate under the TP Supervisor.

Supervisor TP Loader Modules

This group of modules provides routines necessary to load TP programs from external storage into core storage. This may be done either at initialization of the TP complex or during TP operations, as requested by the Executive. The user must at System Generation select the TP loader module that is appropriate for the medium on which his TP Library file resides (tape or disk) and for the nature of the file (relocatable or absolute). Selection is made by a CALLN card. The modules and their functions are as follows:

MODULE	FUNCTION
TPTAPELDRR	Loading relocatable TP programs from tape
TPDISKLDRR	Loading relocatable TP programs from disk
TPTAPELDRA	Loading absolute TP programs from tape
TPDISKLDRRA	Loading absolute TP programs from disk

The TP loader module selected must reside in core storage whenever the TP complex is open; this is necessary for communication between the Supervisor and the TP loader. When it is to load a TP program, the TP loader receives the program's name and origin point from the Executive, locates that program on the TP Library file, and loads it into core storage at the origin specified. The loader also indicates to the Executive any failure to load the TP directory or TP programs.

The two remaining TP loader modules are the TPLDRDEF (Loader Dependency) and the TPLDRPROC (Relocatable Loader Processor) modules. These are not selected by the user himself but are included in the Supervisor as a result of embedded calls in one of the user-selected modules listed above.

The TPLDRDEF module is called by each of the modules that the user can select. Its functions are as follows:

1. Upon receiving a request from the Executive to load a TP program, the TPLDRDEF module determines if there is enough room in core storage, between the origin point specified by the Executive and the end of the TP reserved area, to accommodate the program.

2. It closes any program in core storage that will be overlaid (whether the program is a main-line or a TP program).

3. It determines whether or not a called program is already in core storage. Programs already residing in core storage are thus not reloaded from the TP Library file.

The TPLDRPROC module is called by only the two relocatable loader modules; its function is to determine the type of card images to be loaded and the relocation factors to be used.

Supervisor Operation

The Supervisor is a collection of modules that control and coordinate input/output operations for the Teleprocessing system. The actual read and write commands for devices attached to a PTC unit are issued by the stored program in the PTC; the reader should consult the appropriate publication (see list in the Introduction) for the specific type of PTC unit, for information on the performance of these operations.

The actual read and write commands for devices attached to a 1414 are issued by the device modules within the Supervisor.

Input/output operations are performed by five routines, which are common to all the device modules. (See Figure 6.) Entry to these routines is governed by the status of various indicators, and by channel conditions.

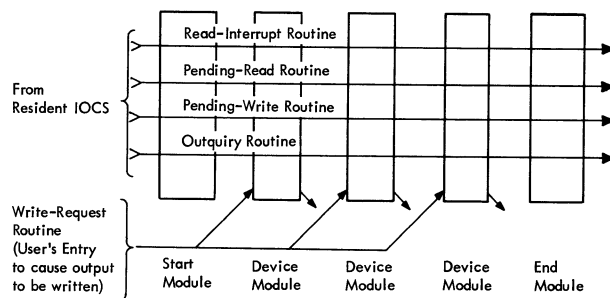


Figure 6. Device Module Routines

The general steps performed in each routine are described below.

The Read-Interrupt routine is entered when the 1414 buffer which has received data from a specific TP device signals that it has input ready to be sent to the CPU. This routine determines which device caused the interrupt, and issues the read command.

The Pending-Read routine is entered when a 1414 buffer is waiting to transmit data, and an area in the Executive has just become available for the data to be read into. This routine determines which device module has a read pending, and branches to that portion of the Read-Interrupt routine that reads the data into the Executive's input area.

The Write-Request routine is entered when the user's program (main-line, Executive, or TP) has constructed an output message and requests the Supervisor to write it to the intended device. This routine sets up indicators to be used later by the Pending-Write routine.

The Pending-Write routine is entered when the channel becomes free, and the IOCS determines that a write request has not been fulfilled because the channel was busy at the time the request was issued. This routine performs the write operation.

The Outquiry routine is entered when a device to which an output message has been written signals that it has received the message; the routine checks for errors for each module that has written an output message.

These various routines are not executed in any specific time sequence; they are executed in response to various channel and operating conditions.

Read-Interrupt Routine

When a channel interrupt is caused by notification from a 1414 buffer that it has input ready (attention signal), the IOCS enters the Supervisor's Read-Interrupt routine (see Figure 7) through the control and start modules. Each of the device modules is entered in turn until the one for the device which caused the interrupt is encountered. (A check is first made to determine if a

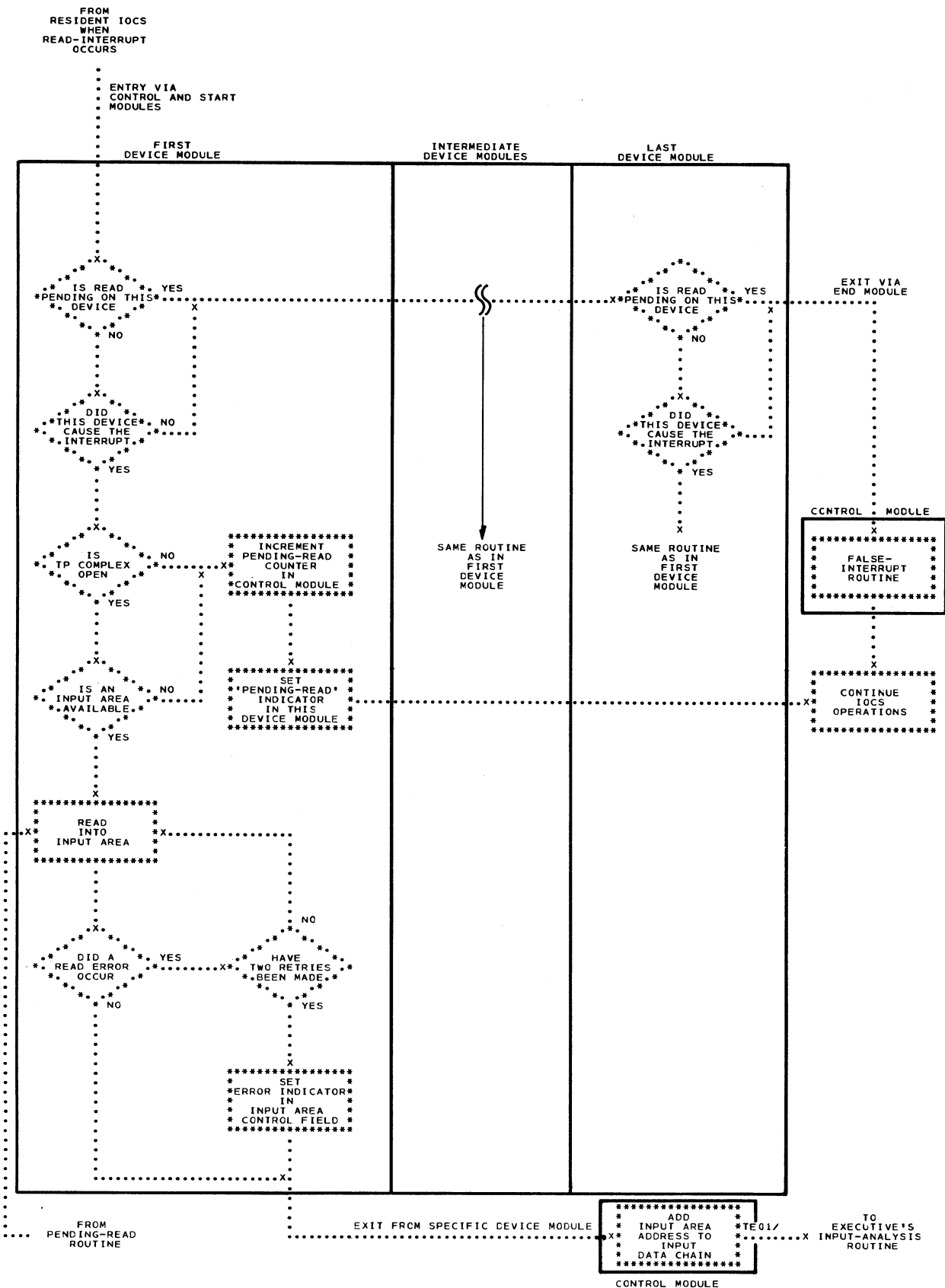


Figure 7. Read-Interrupt Routine

read operation is already pending on that device; if so, its interrupt has already been serviced, and the next module in turn is checked.)

When the device responsible for the interrupt is determined, its module checks whether the TP complex is open and an input area is available. If either of these conditions is not met, a pending-read counter in the Supervisor control module is incremented by 1, a pending-read indicator in the device module is set, and control is returned to the control module. If both conditions are met, the input is read into the input area in the Executive, and a check is made for read errors. Read errors include those occurring during data transfer (1) between the TP device and the 1414 buffer, and (2) between the 1414 buffer and the Executive's input area. If an error occurred two retries are made. If the error persists, the appropriate indicator is set in the input area's control field. At this point, or if no read error occurred, the device module branches directly (not via other device modules) to the control module, which adds the input area's address to its input data chain. The control module then branches to the Executive to allow it to analyze the input, including its error indicator, if present.

If all of the device modules are checked without the one being found that caused the interrupt, the last device module branches, via the end module, to the control module's false interrupt routine. When five such false interrupts have occurred, a false attention message is typed on the computer's console to warn the user of possible machine trouble.

Pending-Read Routine

When an input area becomes available, the Resident iocs enters the Pending-Read routine (see Figure 8) via the control and start modules. As in the Read-Interrupt routine, each of the device modules is entered in turn until the one for the device having a read pending is encountered (i.e., the module has had to wait to issue a read command because no input area was available at the time the read interrupt occurred). When that device module is encountered, a check is made to see if an input area is available. If no area is available, the next module is checked, and similarly all device modules are checked until one is found that has a pending read *and* for which the Executive has an available input area. When this occurs, that module's pending-read indicator is cleared, and the pending-read counter in the control module is decremented by 1. Then the same module's Read-Interrupt routine is

entered at the "Read into Input Area" instruction, and reading and error checking proceeds as described in the explanation for that routine.

Write-Request Routine

Upon completion of processing the TP input, the Executive or the TP program usually forms an output message for transmission to the TP device that originated the input. The user may also wish to have output generated by a main-line program, i.e., not in response to TP input. The main-line, Executive, or TP program may construct output messages. The message is then placed into an output area in the same program (if no area is available, the program should loop until one is available). The program must then issue a linkage sequence to the Write-Request routine (see Figure 9) in the specific module for the intended device. (See Appendix A for specific entry points.)

When the device module is so entered, it sets the following indicators: a pending-write indicator within itself; a not-available indicator in the output area's control field, and a pending-write indicator in the Resident iocs. It then branches to the iocs to determine whether or not the channel is free. If it is not, control is returned to the same program that constructed the message and issued the write request. The various indicators having been set, the write operation will occur when the channel does become available. If the channel is free, the Pending-Write routine is entered.

Pending-Write Routine

When a channel-free interrupt occurs and the iocs finds that its pending-write indicator is set, the Pending-Write routine (Figure 10) is entered, via the control and start modules. The device modules are entered in turn to determine those that have writes pending (i.e., a write request has been issued). For each device that does have a write pending, the routine sets an outquary indicator (for later use by the Outquary routine), issues a write command, and checks for errors occurring during data transfer between the computer and the 1414 buffer for that device. If an error occurred, the write operation is retried a maximum of two times, after which control is given to the Executive's error routine. If the Executive determines not to retry the write operation, or if no write error occurred, the next module is entered. When all devices have been serviced, the Pending-Write routine branches, via the end module, to the control module, which clears the pending-write indicator in the iocs. Control is then returned to the iocs.

NOTE: Device modules for devices other than the IBM 7770 include an Outquiry routine to check for errors in data transfer between the 1414 buffer and the device (see below). For the 7770, all error checking is done by the Pending-Write routine, after the output message has reached the remote device.

Outquiry Routine

After a write command has been issued by the Pending-Write routine, and the operation has been completed, the remote TP device signals, by means of an outquiry interrupt, that it has received the output message.

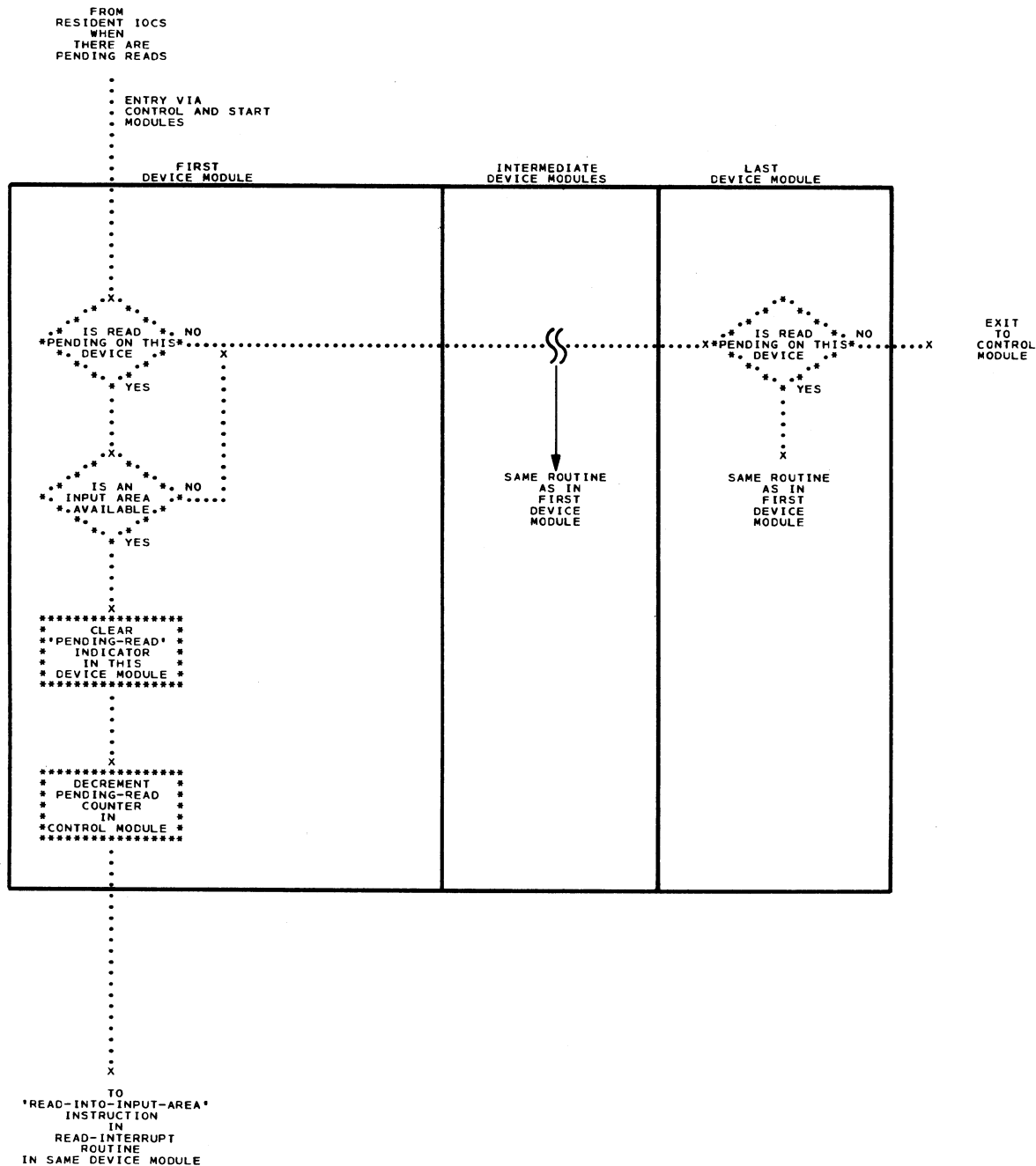


Figure 8. Pending-Read Routine

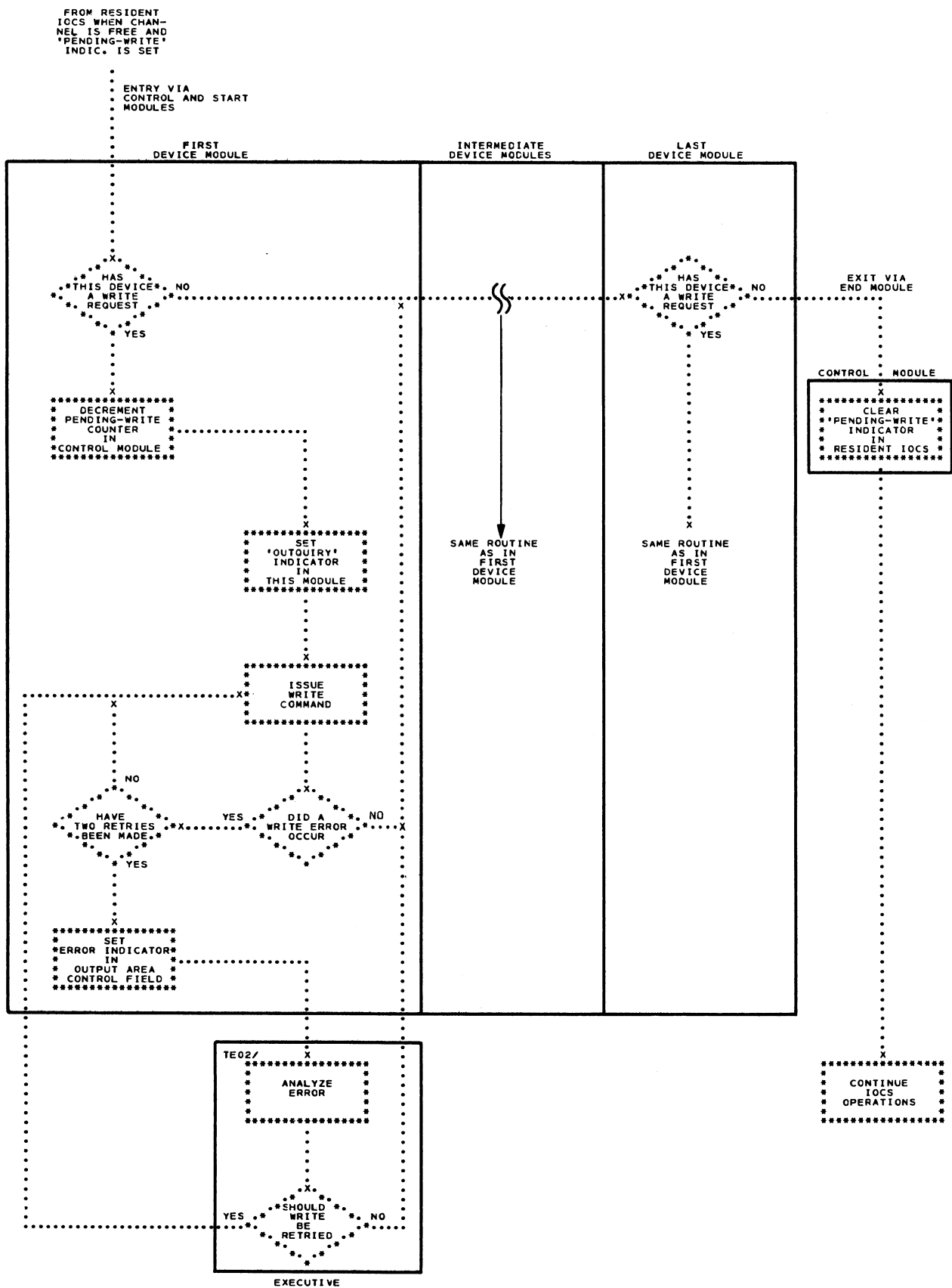


Figure 10. Pending-Write Routine

When this occurs, the IOCS enters the Outquiry routine (Figure 11) via the control and start modules. The Outquiry routine enters each of the device modules in turn until it encounters the one whose outquiry indicator is set. If it is set, the routine checks whether the device is busy. If it is busy, this indicates that the write operation which caused its outquiry indicator to be set is still in progress, and therefore this device did not cause the outquiry interrupt. If the device is not busy, the write operation has been completed, and the Outquiry routine checks for errors in data transfer between the 1414 buffer and the device. If no write error occurred (i.e., the operation was successful), the module's pending-write and outquiry indicators are cleared, and the routine then branches to the next module in line.

If a write error did occur, the appropriate error indicator is set in the output area's control field, and the routine branches, via the control module, to the Executive's error routine at TE02/. The error routine determines whether the write operation should be retried. If not, the device module's Outquiry routine is re-entered, and the module's pending-write and outquiry indicators are cleared. This prevents the write operation from being repeated the next time the Pending-Write routine is entered. If the Executive determines that the write operation *should* be retried, the Outquiry routine is re-entered at the point where the next device module is entered, thus leaving the current module's indicators set. Then, when the Pending-Write routine is re-entered, the write operation will be repeated. The user may wish to include in his Executive error routine provision for counting the number of re-entries into the Pending-Write routine, as a basis for determining when not to retry the operation.

Since each device module is entered in turn, regardless of whether the previous device module needed checking of a completed operation, all the modules are serviced each time an outquiry interrupt occurs.

NOTE: IBM 7770 device modules have no Outquiry routine, because all error checking is performed by the Pending-Write routine, as explained under "Pending-Write Routine."

The Executive Program

This section contains the information necessary for the user to write an Executive that meets the requirements of the Supervisor and the installation's particular Teleprocessing system.

Because the Executive serves as a liaison between the Supervisor and individual TP programs, certain rules of format must be observed in its creation. For the most part these rules involve the definition of spe-

cific linkage symbols to represent data areas and entry points to routines within the Executive, and the use of branches from the Executive to entry points in the Supervisor. (Both linkage symbols and system symbols are used to represent entry points to Supervisor routines.) At System Generation the various symbols are converted by the Linkage Loader into actual machine addresses, thus establishing communication between the Executive and the Supervisor.

If the user wishes, he may place all of his TP programs in the Resident Monitor by including them in his source deck, following the Executive, at System Generation. If this is done, no TP loader need be provided in the Supervisor.

NOTE: Any user-written program included in the Resident Monitor at System Generation cannot include an END card with a start address.

The Executive is a collection of user-written routines to perform those input/output processing functions unique to the specific installation and which therefore cannot be supplied in Supervisor modules. Certain of these functions are required in all instances. When such functions are to be carried out, the Supervisor branches to a predetermined linkage symbol which represents the first instruction in a routine written by the user to perform that function. Other functions are optional and the user may elect not to provide routines for them. In this case he must still provide the linkage symbol, but define it as a blank. The Supervisor tests the contents of the address represented by the linkage symbol; if it finds a blank, it does not branch to that symbol.

The first section below describes the general responsibilities of the Executive. The second section lists the linkage symbols to be defined and explains the specific functions that are required to meet these responsibilities.

Responsibilities of the Executive

Opening the TP Complex

The Executive must contain an entry point to which the Supervisor can branch when the TP complex is opened. At this entry point the Executive can open data files, request the loading of any or all TP programs, and perform any other initialization functions the user may require.

Input to the TP Complex

The Executive must create and contain all input areas for TP devices, and must supply the Supervisor with their addresses.

The Executive must contain an entry point to which the Supervisor can branch when the Supervisor has

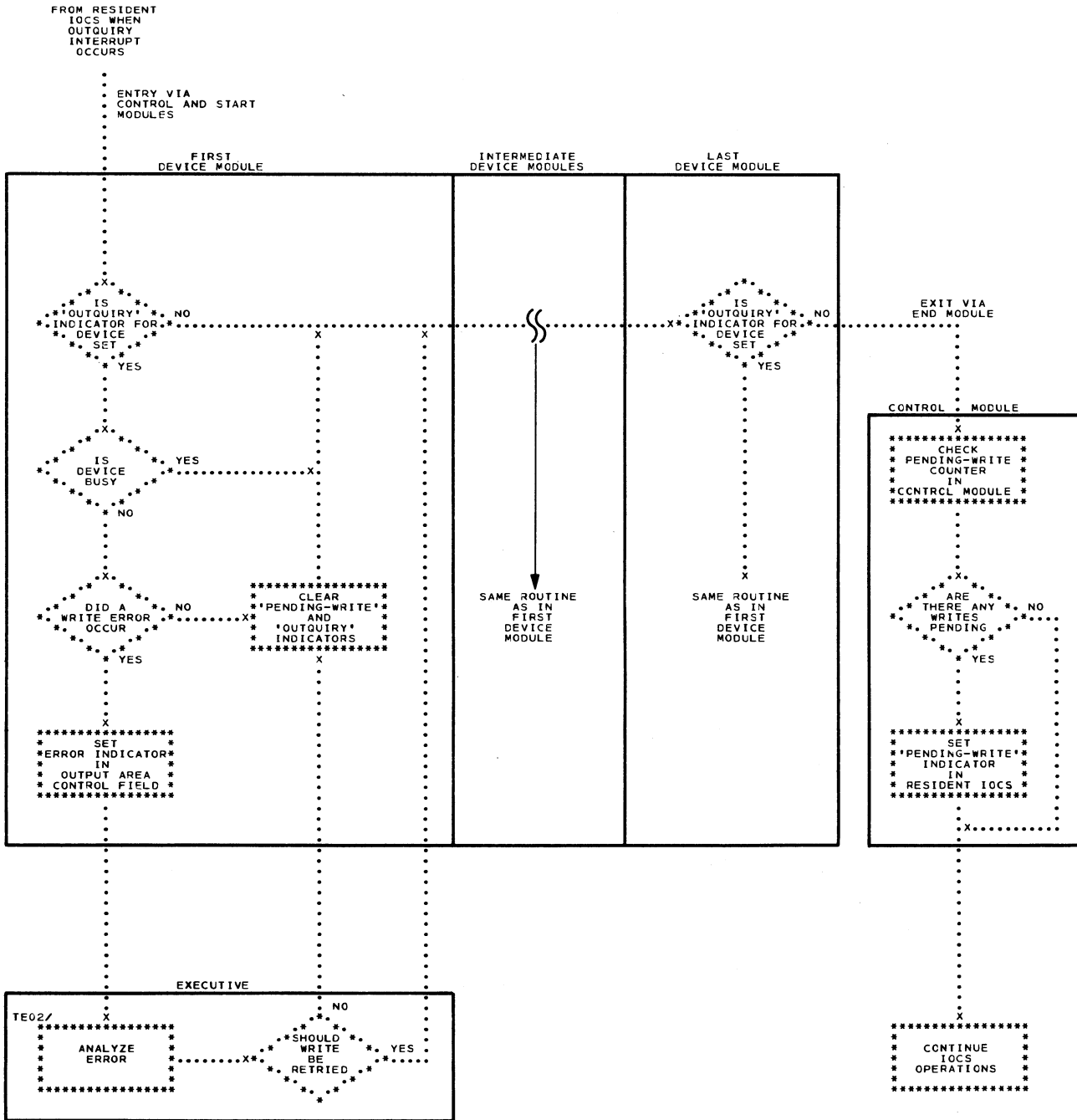


Figure 11. Outquiry Routine

input available for processing. At this entry point the Executive gets the address of the input area, checks for error indicators set in the input area's control field by the Supervisor, and analyzes the input data to determine which TP program is needed to process that data. The Executive then supplies the Supervisor with the name of that program and the origin point in core storage at which it is to be loaded. (The Supervisor checks the memory map before loading the program, to see if the program is already in core storage; if it is, the Supervisor does not reload it, but branches to it at the proper time.)

Output from the TP Complex

The Executive must contain an entry point to which the Supervisor can branch when an output operation is unsuccessful. At this point the Executive gets the address of the output area from the Supervisor, analyzes the error indicators, if any, which the Supervisor has set, and then informs the Supervisor whether the output operation should be attempted again.

Control Cards and Console Inquiries

The Executive can contain entry points to which the Supervisor can branch when either control cards or console inquiries for the Executive are read by other elements of the System Monitor.

Closing the TP Complex

The Executive must contain an entry point to which the Supervisor can branch when the TP complex is to be closed. At this point the Executive can close data files and perform other housekeeping functions. If the TP complex includes a PTC unit, the Executive must also contain an entry point to which the Supervisor can branch during closing, in order to permit the Executive to issue HOLD orders for the PTC unit's lines.

Entry Points and Data Areas

The following linkage symbols must be defined in the Executive in order to create data areas and entry points to routines within the Executive. Where appropriate, the descriptions below include references to following portions of this publication containing more detailed information about the use of these data areas and entry points. The function of the routine or data area is listed first, followed by the linkage symbol that must be defined.

NOTE: The Supervisor must not operate in priority-alert mode. The user must therefore use the `BXPA` (Branch and Exit from Priority Alert) instruction whenever the Supervisor is entered from the Executive or a TP program.

Input Available (TE01/)

The Supervisor branches to TE01/ when it has completed reading input into an available input area. (PTC input includes both data and service messages.) This branch is executed regardless of whether the input data contained errors. (Detailed information concerning functions to be performed by the Executive at TE01/ is contained in this section under "Requesting TP Programs." See also "Creation and Use of Input Areas.")

Output Error (TE02/)

The Supervisor branches to TE02/ when an error has occurred in writing output to a Tele-processing device. (See "Errors and Error Procedures.")

Opening Functions (TE03/)

The Supervisor branches to TE03/ to permit the Executive to open data files (not files for Tele-processing devices). Such files would include, for example, those used by more than one TP program. The branch to TE03/ is executed each time the TP complex is opened. At the time the data files are opened, the Executive can also request the Supervisor to load TP programs into storage. Output requests to TP terminals cannot be issued until all opening functions have been completed. (Opening data files is discussed in this section under "Opening and Closing Data Files." Loading TP programs during initialization of the TP complex is also discussed in that topic.)

NOTE: Write requests cannot be issued to the PTC or 1414 devices in this routine, or when the TP complex is not open.

Closing Functions (TE04/)

The Supervisor branches to TE04/ to permit the Executive to close data files. These must be the same data files that were opened by the branch to TE03/. This branch is executed each time the TP complex is closed. (See "Opening and Closing Data Files.")

The Executive should ensure that all closing functions have been completed before it returns control to the Supervisor. For example, the user must be sure that a PTC unit has completed all its processing.

Hold PTC Lines (TE05/)

The Supervisor branches to TE05/ (if TE08/ is used) to permit the Executive to issue HOLD orders for input lines of a PTC unit (7740, 7750, or 1440). This branch is executed each time the TP complex is closed. If the Executive does not include a routine to perform this function, this linkage symbol must be assigned to a blank character. In this case, the branch is not executed. (Control orders for PTC units are discussed in

the "Macro-Instructions for PTC Units" section, under "The IOCTL Macro-Instruction.")

Address of First 1014, 1015, 1050, 7770 and Telegraph Input Area (TE06/)

The Supervisor refers to TE06/ to obtain the address of the first input area for data from any or all of the following devices: the IBM 1014, 1015, 1050, 7770, and/or telegraph units. When writing the Executive program, the user must define TE06/ as the low-order position of a five-character field containing this first input-area address. This input area, and all input areas in the chain (see "Creation and Use of Input Areas") in which it resides, can receive messages from the 1014, 1015, 1050, 7770 and/or telegraph units. If the installation's Teleprocessing system does not include any of the aforementioned devices, a blank character must be assigned to this linkage symbol.

Address of First 1009 Input Area (TE07/)

This linkage symbol is used in the same manner as TE06/, except that it refers to the first input area for the IBM 1009. If the 1009 is not included in the installation, then this linkage symbol must be assigned to a blank character. (See "Creation and Use of Input Areas.")

Address of First PTC Input Area (TE08/)

This linkage symbol is used in the same manner as TE06/ and TE07/, except that it refers to the first input area for PTC units. If a PTC unit is not included in the installation, this linkage symbol must be assigned to a blank character. (See "Creation Use of Input Areas.")

Executive Control Cards (TE10/)

The Supervisor branches to TE10/ if a control card that is read from the Standard Input Unit contains information for the Executive. If the Executive does not contain a routine to accept such control card information, this linkage symbol must be assigned to a blank character. (Control information supplied to the Executive through control cards or console inquiries is discussed in this section under "Control Information for the Executive.")

Executive Console Inquiries (TE11/)

The Supervisor branches to TE11/ if control information entered by means of a console inquiry is intended for the Executive. If the Executive does not contain a routine to handle such console inquiries, this linkage symbol must be assigned to a blank character.

Request for TP Program (TE12/)

The Supervisor refers to this linkage symbol to obtain the name and the origin of the TP program that is re-

quired to process the input currently available. (The origin is the location at which the Supervisor is to begin loading the TP program.) TE12/ must refer to the low-order position of the ten-character field that the Executive uses to specify the name and origin of the required TP program. (The name of the program must be placed in the five high-order positions; the origin of the program must be placed in the five low-order positions of the field, unsigned.)

For TP complexes that do not have a resident loader included in the Supervisor, the five low-order positions of TE12/ must contain the address of the TP program's entry sequence (see "Format of TP Programs").

The Supervisor will branch to the open routine if there is a sign in the low-order position of the control field. If there is no sign, the Supervisor will not branch to that routine.

Error Conditions (TE13/)

The Supervisor branches to this linkage symbol to indicate that an error condition exists that is associated with loading the TP Library Directory or a TP program. The error condition indicator is placed at TP31/ by the Supervisor. The possible indicator characters are:

INDICATOR	CONDITION	RESULT
A	Directory failed to load.	TP complex cannot be opened.
B	TP program not in the Directory.	
C	No room in memory map. (Attempted to load more programs than were requested in TPDIR macro; see the section "Requesting TP Programs.")	Message areas associated with program are cleared.
D	TP program failed to load.	
E	TP program exceeds core storage.	
F	TP program attempted to use a file for which there was no assignment.	

This indicator may be interrogated, placed into a message, etc., but it must not be altered. A branch (BXPA) to TP30/ returns control to the Supervisor.

The message areas will be cleared by the Supervisor after a branch to TP30/. Prior to the branch, the user may take steps to save information in these areas.

Creation and Use of Input Areas

Format and Arrangement

The first eight positions of every input area are used by the Supervisor as a control field to specify information to the Executive. This control information applies to the input currently available in the area and may

not be altered by the user. Input is read into the area beginning at the ninth position. This portion of the input area is called the message portion. Every input area must be followed by a group mark with word mark.

The input areas must be arranged in sequences such that the first area contains the address of the second, the second area contains the address of the third, and so on. These sequences are called chains, and the technique of linking the areas together is known as chaining.

The user may set up in the Executive any or all of three types of input-area chains, depending on which TP devices are in his installation. The types of input areas are:

1. Input areas for the IBM 1014, 1015, 1050, 7770, and/or telegraph devices. Input areas in the chain must be 88 characters plus a group mark with word mark; these areas can receive 80-character input only.
2. Input areas for the IBM 1009. Input areas in this chain can receive input of any length, but each area must be defined as a multiple of 80.
3. Input areas for PTC units. Input areas in this chain can receive input of any length, but each area must be long enough to receive the maximum length record expected from the PTC unit.

Symbolic addresses of the first input area for each type are given under "Linkage Symbols."

Use of the Control Field

The Supervisor determines the status of any input area by testing for the absence (or presence) of a word mark over the first position of the control field for that area. A word mark (set by the Supervisor) in the first position indicates in subsequent testing that the area contains input ready for processing (or a service message from a PTC unit). When a TP program, or the Executive program, indicates to the Supervisor that the area is available for further input, the Supervisor clears the word mark. Thus, during the time that the area is available, there is no word mark present over the first position.

The first position of the control field is also used by the Supervisor to indicate the source of the input. The following alphabetic characters define the possible sources:

DEVICE (AND ADAPTER)	CHARACTER FOR	CHARACTER FOR
	CHANNEL 1 DEVICES	CHANNEL 2 DEVICES
1009	A	J
1014-0	B	K
1014-1	C	L
Telegraph-0	D	M
Telegraph-1	E	N
Telegraph-2	F	O
PTC Unit	G	P

DEVICE (AND ADAPTER)	CHARACTER FOR	CHARACTER FOR
	CHANNEL 1 DEVICES	CHANNEL 2 DEVICES
1050-0	H	Q
1050-1	I	R
7770	S	T
1015	U	V
PTC Unit Macro- Instruction Error	Z	Y

NOTE: The character Z or Y indicates that a PTC macro-instruction (DUMP, LDPTC, or ENLDL) was not successfully completed.

The second and third positions of the control field are used by the Supervisor to indicate errors. A detailed discussion of the meanings of the indicators, and the steps that the user may take, are presented in this section, under "Errors and Error Procedures."

The fourth through eighth positions of the control field are used for chaining the input areas together. The Executive must establish the addresses used for chaining; the Supervisor refers to them in order to locate the input areas for read operations.

The control field of each input area must be established as follows:

1. The first three positions must be blank.
2. The next five positions must contain the high-order address of the next input area in the chain. A word mark must be set over the first of these five characters.

Figure 12 illustrates the use of Autocoder statements to construct an input-area chain for 1014, 1015, 1050, 7770, and/or telegraph input. Lines 01, 04, and 07 define the first three positions of the control fields. (Note that the labels are indented one position to cause them to refer to the high-order position of the three-character field.) Lines 02, 05, and 08 define the five positions of the control fields that contain the chaining addresses. (Note that this portion of the last input area [line 08] contains blanks to indicate that this is the end of the chain.) Lines 03, 06, and 09 define the message portion of the input area.

Line	Label	Operation
3	9	15
16	20	21
25	30	35
40		
01	l a b e l a	DC @ b b b @
02		DCW l a b e l b
03		DA 1 x 8 0 , G
04	l a b e l b	DC @ b b b @
05		DCW l a b e l c
06		DA 1 x 8 0 , G
07	l a b e l c	DC @ b b b @
08		DCW @ b b b b b @
09		DA 1 x 8 0 , G
10		

• Figure 12. Chaining of Input Areas

Release of Input Areas

The user provides for release of input areas after the data they contain has been processed. The Supervisor causes the actual release, but it must be directed to do so either by the TP program that processed the input (this is the usual case), or by the Executive. The Executive may perform this function only if it is the program that determines when the data in the input area is no longer required.

The Supervisor contains two entry points for the release of input areas: /T03/ and /T04/.

1. A branch to /T03/ causes the Supervisor to release the last input area that was processed. (The address of the high-order position of the input area currently being processed is stored in the Supervisor in a five-character field represented by the system symbol, /TS1/. A branch to /T03/ causes the Supervisor to release that area.)

2. A branch to /T04/ causes the Supervisor to release the input area just processed, and also results in the transfer of control to a routine in the TP program that closes any data files associated with that program. The Executive does not normally use this branch. (The functions of this branch are discussed in more detail in the section "TP Programs.") This branch cannot be used if the TP program was not loaded by a TP loader and the Executive (not the Supervisor) entered the TP program.

The release of an input area indicates to the Supervisor that the TP complex has completed all its required functions for the last input. If no other input areas are waiting with input to be processed, the Supervisor, through the Resident IOCS, returns control to the main-line program.

Creation and Use of Output Areas

Format of Output Areas

The format of output areas is identical to the format of input areas (except for the IBM 1015): an eight-position control field, followed by the message portion, followed by a group mark with word mark. However, the five positions used for chaining are entirely under the control of the Supervisor. The Executive does not specify any addresses to be placed in those positions when the output area is created. In the case of the IBM 1015, the control field is as described above, but the message portion can be of any desired length that is a multiple of 80 positions, up to a maximum of 1,120 positions. The desired output area must be followed by a group mark with word mark. The last character of the body of an input message must be the end-of-inquiry character ✓ (tape mark -- C, 8, 4, 2, 1 bits) to

cause release of the 1015 terminal. This end-of-inquiry character is followed by blanks to complete the last 80-character field.

NOTE: See "TP Program Special Considerations -- IBM 7770," under "TP Programs."

Linkage Sequence for Output Operations

The Supervisor contains output routines for each type of device included in the installation's TP device configuration. The entry point to each routine has a specific linkage symbol by which the user has access to that routine. To request that output be written to a specific device, the user's main-line, Executive, or TP program must contain a linkage sequence. This sequence always consists of a BXPA instruction whose operand is the appropriate Supervisor linkage symbol, followed by a DCW statement defining the high-order position of the output area from which the output data is to be written.

The linkage symbols that must be used in the linkage sequences for output for various devices are as follows:

DEVICE (AND ADAPTER)	SYMBOL FOR	SYMBOL FOR
	CHANNEL 1 DEVICES	CHANNEL 2 DEVICES
1009	/T10/	/T20/
1014-0	/T11/	/T21/
1014-1	/T12/	/T22/
Telegraph-0	/T13/	/T23/
Telegraph-1	/T14/	/T24/
Telegraph-2	/T15/	/T25/
1050-0	/T16/	/T26/
1050-1	/T17/	/T27/
7770	/T18/	/T28/
1015	/T19/	/T29/
PTC Unit	/T31/	/T32/

Figure 13 illustrates the use of Autocoder statements to construct a linkage sequence that makes an output request to the routine related to a PTC unit on channel 2. OUTAREA is the label assigned to the high-order position of the output area.

Use of the Control Field

The Supervisor uses the presence or absence of a word mark over the first position of the control field to indicate the availability of the output area. When a linkage sequence is issued to one of the Supervisor's output routines, the routine sets the word mark over the first position to indicate that the output area is not currently available for further use. The output routine clears the word mark after the write operation has been successfully completed, indicating that the area is available for further use.

NOTE: The program that issues an output request must always first check for the presence of a word

Line	Label	Operation
3	5	15
20	25	30
35	40	
0.1		BXP.A
0.2		DCW
0.3		
		/T32/
		OUTAREA

• Figure 13. Example of Linkage Sequence for an Output Request

mark over the first position of the output area to be used. This is the only way to determine whether the area contains output that has not yet been written.

The first position of the control field is also used to identify the device to which the output is to be written. The Supervisor places the alphabetic character representing the device into this position. (The characters for the various devices are listed under "Creation and Use of Input Areas.")

The second and third characters of the control field are used by the Supervisor to indicate errors, if any, resulting from the write operation. (Detailed information is presented in "Errors and Error Procedures.")

The fourth through eighth positions of the control field are used by the Supervisor's output routines to chain the output areas together (in accordance with the sequence of output requests for that particular device). Programs that issue output requests to TP devices should not alter the contents of these positions.

The control field of each output area must be established as follows:

1. The first three positions must be blank.
2. The next five positions must be blank, with a word mark over the first of these five positions. (These positions are used for chaining output requests.)

Requesting TP Programs

The following information applies to the loading of TP programs after the TP complex has been opened. (Instructions for loading programs during the opening of the TP complex are included under "Opening and Closing Data Files.")

NOTE: For the discussion, the following assumptions are made:

1. The input was free of errors, or the Executive chose to ignore the errors.
2. If the input was from a PTC unit, the message was a data message rather than a service message.

When the Supervisor has input ready for processing, it places the high-order address of the current input area into a five-character field represented by the system symbol /TS1/. (This symbol refers to the low-order position of the five-character field.) The address in this field remains unchanged until the input area is released.

After placing the input-area address into the /TS1/ field, the Supervisor branches to entry point TE01/ in the Executive. At this point the Executive must have a routine for analyzing input messages accepted from a 1414 buffer or the PTC buffer, to determine which TP program is required to process the data. (This analysis includes checking the control field of the input area for error indicators.) The Executive places the name and origin of the required TP program into a ten-position field represented by the linkage symbol, TE12/. The Executive then branches to the Supervisor at the entry point represented by linkage symbol TP02/. At this point the Supervisor performs the functions of locating the TP program, loading it if necessary, causing data files to be opened if necessary, and initiating processing of the input; these operations are explained in "Input Logic," under "Operation of the TP Complex."

If the Executive finds that no processing is required, it can simply return control to the Supervisor at /T03/, which causes release of the input area.

The user can obtain the name and origin of the TP program from a printed memory map, or the Executive can supply this information from the TP Directory (TPDIRECTORY) and the TP Memory Map. The user must not alter either of these areas after they have been established. They are located in adjacent areas of core storage and have the format shown in Figure 14.

At System Generation, the user reserves, by means of the TPDIR macro-instruction, the appropriate amount of core storage to accommodate the TP Directory and TP Memory Map. When this area is being used, however, it is not always completely filled. In the example above, there are entries for five Tele-processing programs in the directory. The TP Memory Map indicates that the second, fourth, and fifth programs have been read into core storage.

NOTE: The entries in the TP Directory are stored in ascending sequence; those in the TP Memory Map, in descending sequence.

TP Directory

The TP Directory contains a 14-character entry for each program in the TP Library (Entries 1, 2, 3, 4, and 5 in Figure 14). The first parameter of the TPDIR macro-instruction specifies the total number of TP programs in the TP Library.

Each entry of the directory has the following format:

Record Address	Size	Name
4 Char.	5 Char.	5 Char.

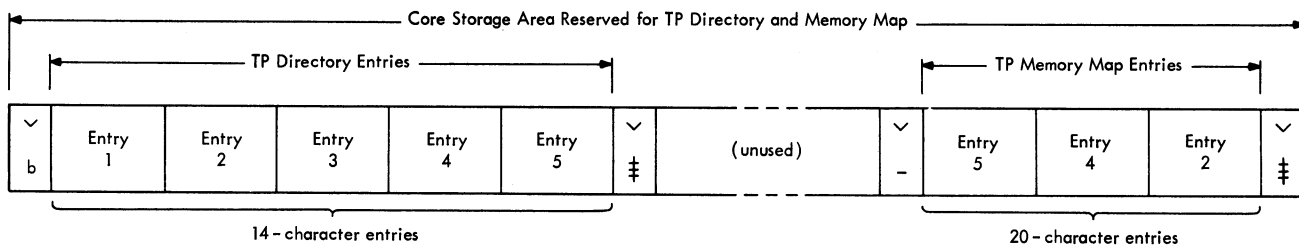


Figure 14. TP Directory and Memory Map

The record address is the consecutive record number on the Library tape; the size is the number of characters in the program; and the name is the five-character name given to the program by the user.

After the Tele-processing files have been put in OPEN status, a five-position field, TPDR/, contains the address of the low-order position of the directory.

TP Memory Map

A reference list of those TP programs that are currently in core storage is kept in the TP Memory Map. The TP Memory Map contains one entry for each of these programs (Entries 5, 4, and 2 in Figure 14 above). A minus sign with a word mark is put in the next position to the left of the last entry to indicate the end of the TP Memory Map. The low-order position of the map is designated TMMS/. The second parameter of the TPDIR macro-instruction specifies the maximum number of TP programs that will be in core storage at any time.

Each 20-character entry has the following format:

Upper Limit	Start Address	Name	Origin
5 Char.	5 Char.	5 Char.	5 Char.

The origin is the address the program is loaded into (lowest address in core storage). The name is the five-character name assigned to the program. The start address is the address of the first executable instruction in the TP program. The upper limit is the origin plus the program size (the upper limit of the program in core storage).

A minus bit in the low-order position of the Start Address entry indicates that the files for the program are closed.

Errors and Error Procedures

When read or write operations are performed, the Supervisor device module involved checks for a variety of possible errors. If any error has occurred, the device module places the appropriate indicator in the control

field of the affected input or output area. In the case of input (i.e., a read operation), the Supervisor *always* branches to TE01/. At this point the Executive must analyze the input data, including the error indicator, if one is present. In the case of output (i.e., a write operation), the Supervisor branches to the Executive at TE02/ *only* if the Supervisor has determined that a write error has occurred. For both read and write operations, error indicators are set, and the branches made, only after the Supervisor has retried the operation twice. Error indicators set for input errors are cleared by the Supervisor; indicators for output errors must be cleared by the Executive.

Error Indicators

The error indicators appear in the second or third positions of the input or output area control field, depending on the type of error. (For information on the sequence of steps performed in setting the indicators, see "Read-Interrupt Routine" and "Outquiry Routine," under "Supervisor Operation.")

Indicators in the Second Position

Characters placed in the second position of the control field indicate unsuccessful PTC operations, other than regular read and write operations. The particular operations for which indicators may be set, and the specific characters used, are as follows:

OPERATION	INDICATOR CHARACTER FOR CHARACTER FOR	
	CHANNEL 1	CHANNEL 2
Sense Read	A	J
Write Dynamic Load	B	K
Write Dump Parameter	C	L
Read Dumped Data	D	M

Indicators in the Third Position

Characters placed in the third position indicate unsuccessful read and write operations for PTC and/or 1414 units. Given under "Device" in the following list is the type of unit to which the indicator applies - PTC, 1414, or both.

DEVICE	INDICATOR	ERROR
PTC	1	Invalid control information was received.

DEVICE	INDICATOR	ERROR
PTC	2	Output to the PTC was longer than maximum specified buffer; or read operation from the PTC was terminated by the computer before PTC reached end of record.
PTC	3	Output queue of the channel designated in the message just written is full. No more output messages for this channel should be sent to the PTC until the PTC sends a service message indicating the queue is available. This indicator is not set if the PTC device is a 7740 using IBM 1311 disk drives.
PTC	4	The channel designated in the output message just sent to the PTC is in Hold status. This indicator is not set if the PTC device is a 7740 using IBM 1311 disk drives.
Both	5	1410/7010 I/O channel parity error.
PTC	6	The operation in progress was terminated before completion because the channel failed to respond to a service request.
1414	7	Wrong-length-record error.
1414	8	Error between 1414 buffer and terminal unit.
1414	9	Error between 1414 buffer and the computer.
Both	A	Device is not ready.
1414	B	Applies only to data transmission to the 1050. An end-of-block control character has been sent by the 1414 to the 1050 control unit(s), and a Longitudinal Record Check (LRC) occurred in the transmission of the data in that block. At the time the B indicator is available to the Executive program for analysis, an End of Transmission (EOT) indication has already been sent to disconnect the terminal.
PTC	C	Condition check.
PTC	D	No transfer.
1414	E	Substitute record message from 1009.

False Interrupts

A count is made, within the Supervisor, of the number of times a false interrupt occurs. An interrupt is false when the Supervisor has checked every buffer in the 1414 and found that none of them contains input. When five such interrupts have occurred since the TP complex was opened, a message — FALSE ATT CH 1 or FALSE ATT CH 2 — is typed on the console printer to warn the user of possible machine trouble. (See "Read-Interrupt Routine" under "Supervisor Operation.")

Input-Error Procedures

If an error indicator is set in the control field of an input area, the Executive analyzes the error and determines whether the input can be accepted. If the Executive determines that the input can be used, it issues a request to the Supervisor, at TP02/, for the TP program

required to process the input. If the Executive determines that the input is *not* acceptable, the Executive's input-error procedures must be terminated by returning control to the Supervisor at entry point /T03/. This releases the input area for further use.

NOTE: (1) When the Executive determines that an input message from the IBM 1015 is not acceptable, it must send an end-of-inquiry character to the transmitting terminal before returning control to the Supervisor at /T03/. If this character is not sent, the terminal is interlocked, i.e., is unable to send or receive messages. (2) The IBM 7770 will not accept two sequential inquiries; each inquiry must be answered before the next one is accepted. Therefore, some response, such as "Redial," must be made when an input error has occurred

The Executive's error procedures may, at the user's option, include such functions as writing messages to the operator and placing the unacceptable input on a file specified for this purpose.

Although it is recommended that error procedures be written as part of the Executive, it is permissible to write the error procedure in the form of a TP program. Such a program can be requested by the Executive in the same manner as TP programs that perform normal processing functions. However, it should be noted that this procedure requires extra time, which is usually a critical factor in Tele-processing systems.

Output-Error Procedures

When an error occurs in an output operation for a TP device, the Supervisor sets the appropriate error indicator in the control field of the output area affected. The Supervisor also places the high-order address of the output area into a five-character field represented by system symbol/TS2/(/TS2/ refers to the low-order position of this five-character field). The Supervisor then branches to entry point TE02/ in the Executive.

NOTE: The instruction located at entry point TE02/ must be a Store B-Address Register (SBR). (This can be accomplished by means of the normal Autocoder labeling technique, in combination with an Autocoder DEFIN statement.)

The Executive, in addition to performing any error functions, such as writing a message to the operator, indicates to the Supervisor whether the output request should be cancelled or whether the write operation should be attempted again. This indication is given by means of the word mark over the first position of the output area's control field. If the Executive resets the word mark, the Supervisor will initiate a retry of the write operation. If the Executive clears the word mark, the Supervisor will cancel the output request and release the output area for further use.

The Supervisor assumes that the channel on which the error occurred does not have an overlapped operation in progress. For this reason, the user must not, in writing this routine, use I/O operations of the DEFER type, nor otherwise cause the channel to be busy at the time the routine returns control to the Supervisor.

NOTE: In the case of the IBM 1015 and 7770 the user cannot retry the write operation. For the 1015, the Executive must clear the word mark over the first position of the output area's control field. For the 7770, the Supervisor automatically clears the word mark. Clearing of the word mark cancels the output request and releases the output area for further use.

The Executive's output-error procedures must be terminated by returning control to the Supervisor at the address that was stored by the Store B-Address instruction. At this point the Supervisor checks for the word mark over the first position of the output area's control field, and proceeds accordingly.

The Executive *must clear the error indicator*, if any, before returning control to the Supervisor.

TP Loader Error Routine

If a TP Loader is included in the Supervisor, an error routine must be provided at TE13/ to analyze errors occurring during loading of the TP Directory or TP programs. The Supervisor places the error indicator at TP31/. After analyzing the error, and clearing the indicator, the Executive returns to the Supervisor at TP30/.

Opening and Closing Data Files

If the TP complex requires data files that are used by more than one TP program, it is advantageous to have the routines for opening and closing those files incorporated into the Executive. (The Executive must also include the DTF statements for the files.) This eliminates the need for each TP program to duplicate the opening and closing of these common files. Furthermore, the Executive itself could require data files. For example, a file used to record unacceptable input would normally be under the control of the Executive.

For these opening and closing functions, the Executive contains two entry points: TE03/ (for opening functions), and TE04/ (for closing functions). Each time the TP complex is opened, either by control card or console inquiry, the Supervisor branches to TE03/. Each time the TP complex is closed, the Supervisor branches to TE04/. The instruction represented by each of these linkage symbols must be a Store B-Address instruction, to provide for the return to the Supervisor at the completion of the opening or closing functions.

NOTE: If the installation's Executive does not perform opening or closing functions, the linkage sym-

bols must still be assigned to entry points in the Executive. In this case, the Store B-Address instruction can place the B-address into the next sequential instruction, which would be a branch instruction. This would effect an immediate return to the Supervisor.

Loading TP Programs During Opening of the TP Complex

When the Supervisor branches to the Executive at TE03/, the Executive can, in addition to opening data files, request the Supervisor to load TP programs in core storage.

The Executive places the name and origin of the requested TP program into TE12/, as in the case of requesting TP programs after the TP complex has been opened (see "Requesting TP Programs"). The Executive then branches to the Supervisor at TS99/. The Supervisor loads the requested program from the TP Library file and returns control to the Executive at the instruction immediately following the branch to TS99/. The Executive can repeat this procedure for each TP program that is to be loaded during the opening of the TP complex.

NOTE: The Executive must not, in this routine, request any TP program that would cause the main-line program to be unloaded onto the Temporary Storage file (MDT).

Control Information for the Executive

In addition to the type of control information that is supplied to the Executive by the Supervisor, the Executive can also receive control information from control cards placed in the Standard (or Alternate) Input Unit and from console inquiries by the operator.

NOTE: The routines provided at TE10/ and TE11/ are intended to handle control cards and console inquiries for the TP Executive. These routines are not protected from interrupts by the Supervisor. Therefore they must be written as subroutines which will not be affected by a TP input or output message interrupt.

Control Cards

Control cards directed to the Executive use a format similar to that of control cards for opening and closing the TP complex. The Executive-information card format is:

6	16	21
MON\$\$	TP	Information for the Executive

Columns 21 through 72 of the card can contain the information to be communicated to the Executive. Column 21 of this card, however, cannot contain an "A"; this character would indicate that the information in the card is directed to the Supervisor.

When the Supervisor is informed by the Transitional Monitor that a control card directed to the TP complex has been read, the Supervisor checks column 21 for an A, in order to determine whether the card is directed to the Supervisor (i.e., a card for opening or closing the TP complex). If column 21 does not contain an A, the Supervisor branches to the Executive at entry point TE10/. (The address of the field containing the contents of the card is stored in a five-character field in the Communication Region of the Resident Monitor. The system symbol /CRD/ refers to the low-order position of this five-character field.)

The instruction located at the entry point represented by the symbol TE10/ must be a Store B-Address Register instruction. After processing the control card, the Executive must return control to the Supervisor at the address stored by this instruction.

Control cards for the Executive can be placed in the Standard (or Alternate) Input Unit immediately following a JOB card or preceding the input unit's END card.

Console Inquiries

Console inquiries directed to the Executive use the same format as the console inquiries for opening and closing the TP complex. (See the *Operator's Guide* publication for the procedure for entering console inquiries.) The format is:

\$90binformation

The information for the Executive must not exceed 16 characters, making a maximum message length of 20 characters. Also, the first character of the information for the Executive (the fifth character of the total message) must not be an A; this would indicate that the message is directed to the Supervisor for either opening or closing the TP complex.

When the Resident Monitor informs the Supervisor that a console message directed to the TP complex has been read, the Supervisor checks the fifth character of the message for an A. If the fifth character is not an A, the Supervisor branches to the Executive at entry point TE11/ (if this is not a blank). The first position of the total message is at the location represented by the linkage symbol /RIQ/. (If the fifth character is a blank, no branch is made to TE11/.)

The instruction located at the entry point represented by the linkage symbol TE11/ must be a Store B-Address Register instruction. After processing the console message, the Executive must return control to the Supervisor at the address stored by this instruction.

Service Messages from PTC Units

The control programs residing in PTC units prepare service messages to inform the Supervisor of conditions that have arisen in the course of the PTC unit's operation. These messages are treated by the Supervisor in the same manner as data messages. However, within the Supervisor and PTC unit, service messages awaiting transmission have priority over data messages.

After reading a message into an available input area, the Supervisor informs the Executive, via a branch to TE01/, that input is available. Upon determining that the input is from a PTC unit, the Executive program must also analyze the message to decide whether it is a service or a data message. Service messages never contain a B-bit as part of the first character.

Response action to a service message, such as issuing a control order to the particular PTC unit, should be performed by the Executive program rather than by a TP program. As in the case of error procedures, response by the Executive program requires the least amount of time. The control orders that may be issued are described under "Macro-Instructions for PTC Units."

The service messages that can be issued by PTC units are shown below. Complete descriptions of these messages are included in the publications that describe the control programs for the particular PTC units (see the list of prerequisite literature in the Introduction to this publication).

The following service messages can be sent only by the control program resident in the 7740 (the 7740 Communication Control Package):

MESSAGE	CONDITION CAUSING MESSAGE	MEANING OF VARIABLE CHARACTERS	REMARKS
Wnnnxxx	Invalid message format, segment sequence check, or invalid message segment type	nnn is the probable input sequence number (xxx not applicable).	This message is issued only from a disk-oriented 7740 system (i.e., a 7740 that uses 1311 disk drives for storage).
Snnnxxx	Invalid input sequence number	nnn is the incorrect input sequence number (xxx not applicable).	This message is issued only from a disk-oriented 7740 system.
6nnnxxx	Invalid origin mnemonic	nnn is the input sequence number. xxx is the incorrect origin mnemonic.	This message is issued only from a disk-oriented 7740 system.

MESSAGE	CONDITION CAUSING MESSAGE	MEANING OF VARIABLE CHARACTERS	REMARKS	MESSAGE	CONDITION CAUSING MESSAGE	MEANING OF VARIABLE CHARACTERS
Unnnxxx	Invalid destination mnemonic	nnn is the input sequence number. xxx is the incorrect destination mnemonic.	This message is issued only from a disk-oriented 7740 system.	Y2xx	Channel placed in Hold due to machine-detected error	xx is the BCD identification of the affected channel.
Vnnnxxx	Invalid segment-type code	nnn is the input sequence number. xxx is the line number.	This message is issued only from a disk-oriented 7740 system.	Y3xx	Channel placed in Hold in response to control message	xx is the BCD identification of the affected channel.
Tnnnxxx	Invalid console message	Neither nnn nor xxx is applicable.	The 7740 received a console message from the 1410 or 7010 at a time when the 1410 or 7010 had not been designated as a console.	Y4xx	Channel placed in Hold in response to a program-detected error	xx is the BCD identification of the affected channel.
Z1nnn	Channel queue available	nnn is the line number (in octal) of the channel now available.	This message is issued only from a host-oriented 7740 system (i.e., a 7740 system with no attached 1311).	Z1xx	Channel queue available	xx is the BCD identification of the affected channel.

The following messages can be sent only by the control program resident in the 7750 (the 7750 Data Control Package):

MESSAGE	CONDITION CAUSING MESSAGE	MEANING OF VARIABLE CHARACTERS
X1nnnn	Process storage parity error	nnnn is the number of errors of this type that have occurred since the last error indication.
X2nnnn	Control storage parity error	nnnn is the number of errors of this type that have occurred since the last error indication.
X3nnnn	Full-word "transfer" error	nnnn is the number of errors of this type that have occurred since the last error indication.

The following messages can be sent only by the control program resident in the 7750 or the control program in the 1440 (the Intersystem Input/Output Control System):

MESSAGE	CONDITION CAUSING MESSAGE	MEANING OF VARIABLE CHARACTERS
Y1xxnnnn	High-speed channel error	xx is the BCD identification of the affected channel. nnnn is the remaining number of errors that can occur before the channel is placed in hold status. (The user originally specifies a maximum number of errors for nnnn.)

Executive Program Considerations for Specific Devices

Certain TP units — the IBM 1050, 7740, and 7770 — require that the user observe special cautions when writing Executive routines for processing input from these devices. These considerations are described in this section. (See also "TP Program Special Considerations.")

IBM 1050

The user of the IBM 1050 Data Communications System under the Operating System should take steps to ensure that (1) messages in the input buffer in the IBM 1414 Input/Output Synchronizer, Models 4 and 5, are not overlaid before they are read into the computer for processing; and (2) an input area is always available for messages from the IBM 1050.

To ensure that messages in the input buffer are not overlaid, an end-of-block character can be used. This character should be included in the data when more than 80 characters are sent from a terminal during the time that the transmission line is open to that terminal. If the automatic polling method is used (see *IBM 1414 Model 4 or 5 with IBM 1050 Data Communications System for IBM 1410/7010 Systems*, Form A22-6769), this character should be the 80th character sent for the first buffer fill, and the 81st character sent for each subsequent buffer fill. (If the automatic polling method is not used, the 80th character sent for the first buffer fill need not be an end-of-block character.) The position after the last data character in the last block should contain an end-of-transmission character.

The reason for the end-of-block character is as follows. Because of the interaction between mainline input/output operations and operations of the TP complex, there is a possibility that an inquiry in the 1414 buffer might not be read during the allotted 67 milliseconds. If the inquiry is not read during that time,

and no end-of-block character has been sent, the next 80-character block will enter the buffer and the previous message will be lost. If the end-of-block character has been sent, no subsequent message will enter the buffer until current data is read into the computer.

The user must also be sure that an input area is always available to receive data from the 1050 buffer in the 1414. The necessity for the continuous availability of an input area stems from the following. Transmission to and from the 1050 terminals is in the half-duplex mode; one line is used to send and receive messages. If the 1050 terminal is transmitting to the computer, no message can simultaneously be sent from the computer over the same line. If the 1414 input buffer is filled and cannot be emptied, the line is locked in transmit-from-1050 status, with the resend indicator on. Until the buffer is emptied, no write operation can be executed from the output buffer.

Thus an impasse results if: (1) the input buffer is filled; (2) no input areas are available; and (3) a write instruction has been issued. The write cannot be completed because the line is in transmit-from-1050 status.

To avoid an impasse of this type, the user must be sure that a pending output operation does not prevent the release of an input area to the TP Supervisor. This means that a TP program cannot hold up the release of an input area any longer than is necessary to process the inquiry and form an output message, if a response is required. As soon as the output message is formed, the input area must be released. One method of guaranteeing the release of an input area requires that the user:

1. Establish output areas that cannot be overlaid. The output must be passed to the Executive so that the write operation can take place.

2. Include within the Executive program a routine that will ensure the availability of an output area at all times. This routine should provide a method of transferring messages in the output areas to tape or disk if no output areas are available, and queueing the messages on that medium; when areas again become available, the routine must retrieve the messages.

IBM 7740

The output message constructed by the user's TP program, main-line program, or Executive must conform to certain message format specifications in order to be accepted by the 7740 Communication Control Package. The message format for each of the two types of 7740 PTC systems (disk-oriented and host-oriented) differ slightly from each other.

A disk-oriented 7740 system is one in which a 1311 disk drive is used by the 7740 for storage of messages

and programs. In a host-oriented system, there is no 1311 disk drive attached to the 7740.

Each 7740 output data message generated by the user's TP, main-line, or Executive program must be segmented, or divided into parts. Two or more segments must be used, depending on the message length. Each segment must be sent in a separate write operation; consequently, the user must not place any two segments in the same output area at the same time.

There are three types of segments: header, intermediate, and last. Each of these requires an eight-position header known as the systems header. Each complete message, sent with at least two write operations, must contain at least a header segment and a last segment. If the data portion, or text, of the message is 80 or fewer characters long, only the header segment and last segment are required. The length of the last segment, in this case, is the data portion plus eight. If the data portion is more than eighty characters, one or more intermediate segments, each containing exactly 90 characters (including the systems header) must be sent before the last segment. Any number of intermediate segments may be used.

A complete description of the format for each of the message segments, indicating the information that must be placed in the various fields, can be found in the *IBM 7740 Communication Control Package* publication. Differences in format for messages issued to disk-oriented 7740 systems and those issued to host-oriented 7740 systems are also explained in that publication.

IBM 7770

To facilitate machine testing of the 7770, the user should include in his Executive a subroutine that analyzes each 7770 input message to determine whether it consists of one character followed by a group mark. If this is the case, it is a test message entered from the CE panel.

With the 7770 it is possible to test one input line while others are performing their normal functions. The disable switch for that line may be turned on to disconnect the input line from its associated communications line. The test message may then be entered from the CE panel.

Upon recognizing the test message, the user's Executive subroutine need only move it from the input area to an output area and issue a linkage sequence to write the same message to the 7770. No processing of the message is required. By using this test method, the customer engineer can determine whether or not the 7770 and/or communications line is functioning normally.

Additional operating considerations for the 7770 are discussed under "Errors and Error Procedures" and "TP Program Special Considerations."

TP Programs

The individual TP programs, like the Executive, must follow certain rules of format to permit the establishment of effective linkages between all the elements of the TP complex. This section defines some of the functions that can be performed by TP programs, the programming format required for their performance, and certain special operating conditions.

Format of TP Programs

All TP programs, whether loaded from the TP Library file or permanently residing in core storage, must (with the one exception noted below) have a four-step set of instructions pertaining to data file open and close functions, followed by either the first instruction of the processing routine or a branch to that instruction. One of the two sequences shown below must be used.

1. If the TP program is to *include* routines for opening and closing data files, this sequence must be used:

```

6          16      21
START     SBR      OPENEXIT+5
          B        OPEN ROUTINE
          SBR      CLOSEEXIT+5
          B        CLOSE ROUTINE
          (First instruction for processing the input, or
          a branch thereto)
          .
          .
          .
          END     START

```

2. If the TP program is to *omit* routines for opening and closing data files, this sequence must be used:

```

6          16      21
START     SBR      *+6
          BXPA     *-6
          SBR      *+6
          BXPA     *-6
          (First instruction for processing the input, or
          a branch thereto)
          .
          .
          .
          END     START

```

NOTE: (1) If the program is to be loaded by the TP Loader, the END card must have as an operand the label of the first instruction (in these examples, START). Otherwise, the operand must be omitted. (2) If the TP program permanently resides in core storage, and the Executive does not place the name and origin of the TP program in TE12/ but rather enters the TP program itself, the four-step instruction sequence is *not* used.

The above instruction sequences need not be the first instructions in the TP program, but they must be the first *executed* instructions.

When the TP program is processed by the TP loader routine, a control record is created, which gives the Supervisor the address of the first SBR instruction in the above sequence. From this address, the Supervisor calculates the location of the other instructions in the sequence.

Although the TITLE card for a TP program can contain a ten-character name, only the first five characters are recognized and incorporated in the TP Directory. These five characters must be the same as those in the TE12/ field when the TP program is requested, therefore, this five-character name must not be used elsewhere.

Interaction with the Supervisor

Opening and Closing Data Files

After the Supervisor has been instructed by the Executive to initiate execution of particular TP program, the Supervisor branches to a routine in the TP program to enable that program to open any data files that it requires. (The files are opened by use of the IOCS macro-instruction IOCTL OPEN.) After completing any required opening functions, the TP program returns control to the Supervisor at the address stored by the SBR instruction immediately preceding the branch to the opening routine (see the above sequence of instructions). Control is then returned to the TP program for its processing functions.

When the TP program has completed its processing, it returns control to the Supervisor. This return can be made at one of three entry points in the Supervisor: /T03/, /T04/, or /T05/ (see Figure 2).

/T03/

A branch to /T03/ causes only the release of the input area.

/T04/

A branch to /T04/ causes the release of the input area, and causes the Supervisor to return control to the TP program to close its data files.

If the Executive branches to /T04/, the Supervisor re-enters the TP program at the second SBR instruction in the TP program's required sequence of instructions. (See the preceding required instruction sequences.) After closing its data files, the TP program returns control to the Supervisor at the address stored by that SBR instruction.

If the TP program resides permanently in core storage and the Executive does not place the TP program's name and origin in TE12/, control cannot be returned to the Supervisor at /T04/.

If a TP program completes its processing with a branch to /T03/, and further input requires the Supervisor to bring another TP program into storage, the Supervisor determines whether the second TP program must overlay the first. If such an overlay will occur, the Supervisor returns control to the first TP program to close its data files before the second TP program is brought into core storage. The Supervisor also makes this check before reloading a main-line program from the Temporary Storage file.

If the TP program does not open and close any data files, the SBR instructions can place the B-address into the branch instructions immediately following them. This effects immediate return to the Supervisor.

/T05/

A branch to /T05/ indicates that another TP program is required to complete the processing of the current input. Before the branch is made to /T05/, the name and origin of the required TP program must be placed into TE12/.

The branch to /T05/ does not cause release of the current input area. In the event that the TP program requested by the branch to /T05/ will overlay the first TP program, the Supervisor returns control to the first TP program to close its data files.

Under some circumstances, a TP program may need to ensure that its output has been written before control is returned to the Supervisor at one of the three entry points above. Specifically, if an area containing output for a TP device is contained within a TP program, and if that TP program is subject to being overlaid, the program should not return control to the Supervisor until the word mark has been cleared from the first position of the output area's control field. The check for this word mark could be made in the TP program's closing routine, since the Supervisor always branches to that routine before overlaying the TP program.

Entry Point for Processing the Input

After the necessary preliminary functions, such as opening data files, are completed, the Supervisor initiates execution of the TP program's processing functions. This control is given to the TP program at the first instruction after that program's required four-step sequence of instructions.

Completion of a TP Program

A TP program returns control to the Supervisor when it has completed processing the last input message

(and closed its data files, if necessary). The Supervisor then determines whether more input is available. If more input is available, the Executive informs the Supervisor which TP program is required to process the input. In the event that the input is to be processed by the TP program just completed, the Supervisor again initiates execution of that program, including reopening the data files, if necessary.

Storage of TP Programs

TP programs are kept on the TP Library file (MLT), which may be in absolute or relocatable format, and may reside on tape or disk, regardless of the storage medium used by other elements of the Operating System. However, if the file is on tape, it must be the *only* file on that tape. The file must be generated by the same sor that will use it. The TP Library file consists of a TP Directory and the TP programs; the TP Directory speeds the location and loading of the TP programs.

Each installation can, as previously pointed out, designate a specific area of core storage to be reserved for TP programs only. This area, located immediately above the Resident Monitor, is delimited by system symbols /KER/ and /MKR/. The most frequently used TP programs can reside permanently in that reserved area. If not all of the installation's TP programs can fit into this area at the same time, the TP Library file is required by the Supervisor only at those times the TP complex is opened. If they cannot all fit in this area, the TP Library file must always be available to the Supervisor.

For installations that must meet heavy demands from TP devices, and that cannot keep the most frequently used TP programs in a reserved area of core storage, it is recommended that the TP Library file be kept in disk storage. This type of storage permits greater speed than magnetic tape in locating and loading TP programs.

Temporary Storage File (MDT)

Installations requiring a TP Library file to be available at all times may require a tape unit or disk area to serve as a Temporary Storage file (MDT).

If the Supervisor includes the capability to save and restore main-line programs (i.e., the TPSUPERDR or TPSUPERDDR module was specified at System Generation), and a situation arises in which the TP program to be loaded would extend from the location specified by the Executive to beyond the reserved area, the Supervisor unloads the entire main-line program onto the MDT. This provides sufficient space for the complete TP program, which can now overlay the main-

line program in core storage. When it is time to return control to the main-line program, the Supervisor re-loads it from the MDT.

If the MDT is on tape, it may exist as the only file on the tape unit, or it may share the tape unit with any or all of the following: the Standard Punch Unit (SPU), Standard Print Unit (SPR), and/or the Core Image file (MDM). This sharing capability is made possible by the system file sharing and device switching feature which can be specified at System Generation. (See the *System Monitor* publication.)

A disk area in IBM 1301 or 2302 Disk Storage may be used for the MDT only if the disk unit has the full cylinder read/write feature. In order to use a disk area for the MDT, the TPDISKDUMP module must be included in the Supervisor (by CALLN TPSUPERDDR) at System Generation. In addition, the following requirements must be met:

1. For the 1301, an entire cylinder must be formatted to provide one 2,165-character record per track in the Load mode. For the 2302, the requirements are the same as for the 1301, except that the area per track provided must be 4,533 characters.

2. The cylinder must be defined by the GEN03, GEN04, GEN05, or GEN06 macro-instructions at System Generation. (See the *System Generation* publication.)

TP Program Special Considerations

Certain considerations must be observed by the user in writing his TP programs, regardless of the type of TP device whose input data the TP programs will process. These considerations are as follows:

1. The Resident Monitor Print and Punch routines, and the devices used by these routines (Standard Print Unit and Standard Punch Unit, respectively), must not be used by TP programs. The Resident Monitor Read routine and the Standard Input Unit must not be used by any program initiated by a machine interrupt (this includes both the Executive program and the TP programs).

2. The requirements that must be met by all dependent programs within the Operating System also apply to TP programs.

3. TP programs must consist of only one phase; that is, all programming that constitutes a given TP program must be loaded into core storage at one time.

The TP complex operates on the basis of one TP program for one message, except when one TP program requests another, via the branch to /T05/. Messages are processed on a first-in, first-out basis, except for PTC service messages, which take precedence over data messages. DCWS and DCWF statements cannot be used.

4. The TP Supervisor can operate with systems containing a maximum of 400 TP programs.

5. Every TP program must have one and only one entry point specified.

In addition to these considerations, other special considerations apply to use of the IBM 1009 and IBM 7770.

IBM 1009

While a TP program is processing input, the input area it is using is not available. This consideration is especially important for input from the IBM 1009, which could be lost if input areas are not made available quickly enough to handle the data rate, frequency of message transmission, and record length used by the installation. Because of this consideration, messages to and from the IBM 1009 should not exceed 160 characters, including double pound signs (##) on output messages. (However, depending upon the user's device configuration, application, and transmission rate, the device module for the IBM 1009 can handle messages of more than 160 characters.)

IBM 7770

The message portion of each IBM 7770 output area must be either forty characters in length followed by a group mark with word mark, or eighty characters in length followed by a group mark with word mark. Positions 1 through 39 of the message area will contain the one-character IBM magnetic drum addresses of the appropriate vocal response words. A group mark, signifying the end of the message portion, may reside anywhere in the second through the 40th position of the message area, depending on the length of the message.

The size of the message portion of the IBM 7770 output area depends on the vocabulary of the magnetic drum. If the magnetic drum has a vocabulary of 63 or fewer words (addresses 0 through 62 on the magnetic drum), the message portion of the output area must be 40 characters in length followed by a group mark with word mark. However, if the magnetic drum has a vocabulary larger than 63 words, the message portion of the output area must be 80 characters in length followed by a group mark with word mark.

For the larger-vocabulary magnetic drum, each character position of the message (positions 1 through 39) has a corresponding modifying character in positions 41 through 79. Character position 40 is reserved for a group mark (in the case of a message occupying all of character positions 1 through 39), and character position 80 must always contain a BCD blank. Character position 41 modifies character position 1, position 42 modifies position 2, etc. The modifying characters in

positions 41 through 79 must be either a BCD blank, indicating no modification, or a BCD 1, indicating that the modification factor of 64 is to be added to its corresponding message character position. For example, to select the drum address 67 in message position 6, the user places a BCD 3 in message position 6 and a BCD 1 in position 46. To select drum address 3 in the same character position, the user places a BCD 3 in position 6 and a BCD blank in position 46. The user should reset to blanks any of the characters in positions 41 through 80 of the output area before constructing his output message. If he fails to do this, a one bit

present in any of these character positions from a previous message will probably make the present message meaningless.

It should be noted that an IBM 1001 Data Transmission Terminal can send the character zero (0) in two forms to the IBM 7770 Audio Response Unit. The TP programs must recognize either of these forms as a valid zero. If the message is originating from push-buttons, the character zero is represented by the presence of a bit in the 8- and 2-position of the character. If the message originates from a card reader, the character zero is represented by the presence of an A bit only.

Additional Information for Use of the TP Complex

Macro-Instructions for PTC Units

The macro-instructions in this section can be used for programming related to PTC units. These macro-instructions are incorporated into programs by the Autocoder processor.

The IOCTL Macro-Instruction

This macro-instruction causes any of nine different control orders to be sent to a PTC unit. It is recommended that this macro-instruction, in its various forms, be issued by the Executive.

NOTE: The IOCTL macro-instruction cannot be used with the 7740.

The first operand of the IOCTL macro-instruction must be the number of the channel to which the PTC unit is attached. The second operand must be the Autocoder mnemonic for the particular control order. This mnemonic must be followed by the two-character identification of the appropriate communication channel. (This identification, indicated in the following list by "xx", is not used for control orders SETTIME and SETINTV.) Other required operands, when used, are noted in the descriptions of the control orders to which they apply.

Figure 15 illustrates the required format for IOCTL macro-instructions using the first five control orders, and three examples of the use of this macro-instruction.

The following list contains the nine Autocoder mnemonics for the various control orders, the function of each control order, and its machine-language format.

KILLMSG,xx (Kill Messages)

This order is used to cancel any messages stacked in the PTC for transmission over a channel that has been placed in Hold status by the PTC unit. The order must not be given until one of the Channel-Placed-in-Hold service messages is sent by the PTC unit, even though

Line	Label	Operation
3	5,6	15,16 20,21 25 30 35 40
0.1		IOCTL c, m m m m m m m m, x x
0.2		
0.3		IOCTL 1, KILLMSG, 22
0.4		IOCTL 2, SETERCT, 22, 050
0.5		IOCTL 2, SETTIME, 10300
0.6		

• Figure 15. Format and Example of the IOCTL Macro-Instruction

an unusual end on a previous write operation may have been the first indication that a channel was held. The Channel-Placed-in-Hold messages are described under "Service Messages from PTC Units." The KILLMSG, xx entry generates an order with a machine-language format of 37xx.

RETMSG,xx (Return Messages)

When a channel has been placed in Hold status by the PTC unit, any messages stacked for that channel will be transferred from the PTC unit as input messages when the RETMSG order is given. As with the KILLMSG order, it must not be given until one of the Channel-Placed-in-Hold (error) service messages is received. The RETMSG,xx entry generates an order with a format of 33xx.

HOLDNOW,xx (Hold Channel Now)

This order immediately places the specified communication channel in Hold status, regardless of whether there are any queued messages. This entry generates an order with a format of 31xx.

HOLDCLR,xx (Hold after Clearing Messages)

This order causes transmission of any messages in the specified PTC channel queue and then puts the channel in Hold status. This entry generates an order with a format of 38xx.

NOTE: Each time the TP complex is closed, the Supervisor branches to an entry point in the Executive (represented by linkage symbol TE05/) to enable the Executive to issue HOLD orders for PTC units. (See the section "Entry Points and Data Areas" under "The Executive Program.") The instruction at the location represented by TE05/ must be a Store B-Address Register instructions to provide for returning control to the Supervisor. Following this SBR instruction the Executive can issue IOCTL macros with operands of HOLDNOW and/or HOLDCLR.

SETFREE,xx (Set Free from Hold)

This order frees the specified channel from Hold status and allows message reception or transmission to take place. This entry generates an order with a format of 34xx.

SETERCT,xyyy (Set Error Count)

The number of allowable errors for the specified channel is set to the value specified by this order. When this error count reaches zero, the channel is placed in Hold status. In the above format, "xx" in-

icates the channel number and “yyy” specifies the error count value, which can be any value except 000. The error count must be an octal number if the control order is sent to the 7750, and a decimal number if the control order is sent to the 1440. This entry generates an order with the format of 71xxyyy.

SETTIME,hhmmq (Set 7750 Time Clock)

This order, which is used only for the 7750, causes the 7750 to reset the time clock to the value specified by “hhmmq”. “hh” specifies the hours; “mm” specifies the minutes; and “q” specifies the quarter-minute (0, 1, 2, or 3). No channel is specified for this order. This entry generates an order with a format of 77hhmmq.

SETINTV,iiii (Set 7750 Interval Timer)

This order, which is used only for the 7750, causes the 7750 to set the interval timer to the number of 15-second intervals specified by “iiii”. An entry of 0000 turns off the interval timer. No channel is specified. This entry generates an order with a format of 73iiii.

SUBCHAN,xxzz (Substitute Channels)

This order substitutes one low-speed channel for another that has been placed in Hold status because of machine-detected errors. In the entry, “xx” indicates the old channel; “zz” specifies the new one. The following requirements must be met in order for the SUBCHAN control order to work properly:

1. The channel being replaced must be in Hold status when the control order is given. No check is made for the status of channel “zz.”
2. The new channel (zz) must be the same type as the old channel (xx). For example, a full-duplex channel must be substituted for a full-duplex channel, and the two channels must be the same speed.
3. For transmission to proceed on the new channel, the SUBCHAN control order must be followed by: (1) a SETERCT for the new channel; and (2) a SETFREE for that channel.

The LDPTC Macro-Instruction

This macro-instruction is used to load information into a PTC unit while that unit is operating, as opposed to the initial loading of the unit. (Loading a PTC unit while it is in operation is termed dynamic loading.)

The first operand of this macro-instruction must be the number of the channel to which the PTC unit is attached. The second operand must be the address of the high-order position of the core-storage area from which the information is to be sent to the PTC unit. Figure 16 shows the format (line 01) and an example (line 03) of the LDPTC macro-instruction.

After the information has been sent to the PTC unit from core storage, control is returned to the program

Line	Label	Operation
3	5/6	15/16 20/21 25 30 35 40
0.1		LDPTC c , a a a a a a a a a a
0.2		
0.3		LDPTC 2 , LOADAREA
0.4		

● Figure 16. Format and Example of the LDPTC Macro-Instruction

that issued the LDPTC macro-instruction. If more information is to be sent to the PTC unit, another LDPTC must be issued. The last LDPTC must be followed by an ENLDL macro-instruction.

The ENLDL Macro-Instruction

This macro-instruction is used to terminate a dynamic load of a PTC unit. ENLDL causes a control order to be sent to the PTC unit to indicate that the PTC unit is to resume its normal processing functions. The ENLDL macro-instruction must be issued after the last LDPTC macro-instruction, and before any other macro-instruction that causes a control order to be sent to the PTC unit (such as one of the forms of the IOCTL macro-instruction). Any control order received by the PTC unit between a LDPTC and an ENLDL macro-instruction will be treated as an ENLDL, and the PTC unit will issue an unusual end for that control order. Figure 17 shows the format (line 01) and an example (line 03) of the ENLDL macro-instruction. “c” specifies the channel to which the PTC unit is attached.

The DUMP Macro-Instruction

This macro-instruction is used to unload into core storage all or a portion of the information in PTC storage. Figure 18 shows the format (line 01) and an example (line 03) of the DUMP macro-instruction.

The first operand, “c”, of this macro-instruction must be the number of the channel to which the PTC unit is attached.

Line	Label	Operation
3	5/6	15/16 20/21 25 30 35 40
0.1		ENLDL c
0.2		
0.3		ENLDL 2
0.4		

Figure 17. Format and Example of the ENLDL Macro-Instruction

Line	Label	Operation
3	5/6	15/16 20/21 25 30 35 40
0.1		DUMP c , P P P P P P P P P P , S S S S S S S S S S
0.2		
0.3		DUMP 2 , PARAMAREA , SAVEAREA
0.4		

Figure 18. Format and Example of the DUMP Macro-Instruction

The second operand, "pppppppppp", must be the label of the high-order position of a field in core storage that contains a PTC address. A group mark with word mark follows the PTC address in the field. The address specifies the area in the PTC to be unloaded. For the 7740, the PTC address area consists of 12 octal characters, left-justified, in 7740 limit word format. For the 7750, the PTC address area consists of 16 octal characters, left-justified, in 7750 word format. For the 1440/1448, the address area consists of six BCD characters specifying the start and stop addresses; they are in 1401/1440 address format.

The third operand, "sssssssss", of the DUMP macro-instruction is the high-order address of an area in core storage into which the information from PTC storage is to be read.

The TPLDDCP Subprogram

This programming, because of the nature of its function, is provided as a relocatable subprogram in the IBMLIBR, rather than as a macro-instruction. It is incorporated into a program during processing by the Linkage Loader, rather than during an Autocoder compilation.

The TPLDDCP subprogram is used for the initial loading of a PTC unit (Communication Control Package for the 7740, Data Control Package for the 7750, Inter-system IOCS for the 1440-1448, or equivalent programs written by the installation). Because the programming required to initially load a PTC unit is needed during the time the unit is ready to receive input, it is recommended that the TPLDDCP subprogram be used as the nucleus of a main-line program. This program can be executed prior to opening the TP complex (by means of a Monitor EXEQ card), and thus, the instructions required to load the PTC unit are in core storage only when needed.

Each TPLDDCP subprogram contains three entry points, represented by linkage symbols TLD0/, TLD1/, and TLD2/.

TLD0/

A branch to TLD0/ causes the initialization of the TPLDDCP subprogram, and also causes it to issue (through the console printer) a message telling the operator to ready the PTC unit. Control is returned to the instruction immediately following the branch to TLD0/.

TLD1/

A branch to TLD1/ causes a write operation to the PTC unit. This branch instruction must be immediately followed by a five-character field containing the address of the high-order position of the area from which the data is to be sent to the PTC unit. Control is returned to the instruction immediately following the five-character field.

NOTE: The TPLDDCP subprogram sends to the PTC unit all information in the specified area, from the high-order location up to the terminating group mark with word mark. Therefore, the program using the TPLDDCP subprogram must ensure that the group mark with word mark is properly set for records of varying length.

TLD2/

A branch to TLD2/ indicates to the TPLDDCP routine that loading of the PTC unit has been completed. This branch causes the routine to reset certain indicators in the Supervisor that had been altered in order to facilitate loading the PTC unit. Control is returned to the instruction immediately following the branch to this entry point.

The TPLDDCP subprogram, if required, must be placed on the System Library file at the time of System Generation. Call cards CALL TPLDDCP1 and CALL TPLDDCP2 are used to incorporate into a program the PTC load routines for PTC units on channel 1 and channel 2, respectively. Figure 19 shows the format and an example of the TPLDDCP1 subprogram.

Line	Label	Operation	OPERAND
3 5 6	15 16	20 21	25 30 35 40 45 50 55 60 65 70
0 1		CALL	TPLDDCP2
0 2	START	BXPA	TLD0/
0 3		GET	DCPFILE
0 4		BXPA	TLD1/
0 5		DCW	AREALABEL
0 6		GET	DCPFILE
0 7		BXPA	TLD1/
0 8		DCW	AREALABEL
0 9		BXPA	TLD2/
1 0		B	/EOP/
1 1		END	START
1 2			

• Figure 19. Sample Coding for the TPLDDCP Subprogram

Line 01 calls the TPLDDCP subprogram (during processing by the Linkage Loader). (A Linkage Loader CALL card could be used instead.) Line 02 causes the initial entry to the TPLDDCP subprogram. Line 03 is the standard IOCS macro-instruction that causes reading of the file that contains the Bootstrap, Loader, and Data Control Package. (This file is represented in the example by the name DCPFILE.) Line 04 causes a branch to the TPLDDCP subprogram to send to the 7750 the data just brought into storage by the GET macro-instruction. The instruction on line 05 creates an address constant of the high-order address of the area containing that information (represented in the example by AREALABEL). The instructions on lines 06-08 repeat the functions of those on lines 03-05. (These functions are repeated as many times as necessary to send all the elements of DCPFILE to the 7750.) Line 09 causes the final entry to the TPLDDCP subprogram to terminate the loading process and reset the Supervisor. Line 10 is the normal End-of-Program branch to return control to the Resident Monitor. Line 11 is the Autocoder END statement, indicating that this subprogram is a primary subprogram. (The TPLDDCP subprogram is a secondary subprogram.)

If an error occurs during loading of the Data Control Package, the TPLDDCP subprogram types a message on the console printer indicating that the loading procedure must be restarted. After the operator restarts the PTC unit, control is again returned to the instruction immediately following the branch to TLD0/.

System Generation

At System Generation the necessary linkages for the various elements of the TP complex — i.e., the Executive and TP programs and the selected Supervisor modules — are generated. Also generated are the necessary linkages and control information for the System Monitor. This section explains the correct sequence in which the user must specify the various Supervisor modules and the Executive. (The section “The TP Supervisor” indicates which modules the user must select, according to his requirements.)

The following discussion covers only those aspects of System Generation pertaining to sequencing the Supervisor modules and the Executive. For complete information regarding System Generation, refer to the *System Generation* publication; special attention should be given to the section “Building Monitors with Teleprocessing Capabilities,” and to the explanations of system description control cards GEN08, GEN11, TPDIR, and DEVDF.

Sequencing the Supervisor Modules

To properly generate the correct configuration of the Supervisor, the user must arrange the CALLN and CREAT cards in a certain sequence, as shown in Figure 20. The Supervisor and the Executive must be placed between the CREAT TMONTP1 and CREAT TMONTP2 cards (for a tape system), or the CREAT DMONTP1 and CREAT DMONTP2 cards (for a disk system). (These cards are

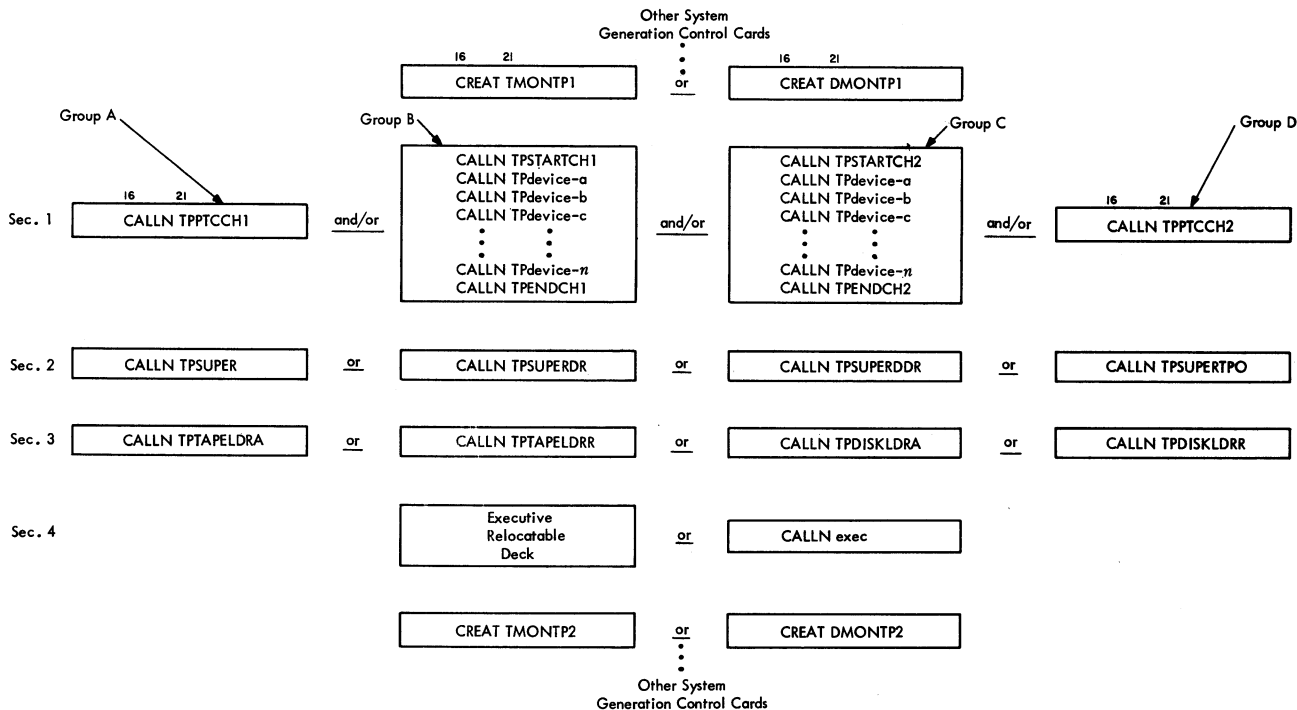


Figure 20. Sequencing the Supervisor Modules

discussed in the *System Generation* publication.) The CALLN cards are grouped in four sections.

The first section consists of all the device module CALLN cards, these are shown in the figure in four groups. One, two, or three of the groups may be used, depending on the user's device configuration; however, groups A and D cannot both be specified. (Only one PTC module may appear, since the Supervisor can control only one PTC unit.) If more than one group is used, the groups may appear in any order. Within the groups for the 1414, groups B and C, the specific device modules may appear in any order, except that the CALLN TPSTART and CALLN TPEND cards must be the first and last in the group, respectively.

The second section consists of a single control module CALLN card. Only one card shown in section 2 of Figure 20 can be used.

The third section consists of a single TP loader card. If no TP loader is to be used, this card is not included. Only one of the cards shown in section 3 can be used.

The fourth section consists of the Executive. This may be included in either of two ways: (1) on the sru, as a relocatable object deck, or (2) by calling it with

a CALLN card. The user may place the relocatable deck or the CALLN card preceding, between, or following the other three (or two) sections; however, the deck or CALLN card must be between the TMONTF or DMONTF cards.

Figures 21 through 24 give examples of control card sequences for typical system generations. In these examples, alternative cards are shown for both absolute and relocatable libraries.

Figure 21 shows the cards required for generating a Supervisor and Executive for an installation having a PTC unit on channel 2, and a 1414 on channel 1, with one or more 1009s attached and provision for TP-only operation (TPSUPERTPO module). A tape sof and tape TP Library file will be used.

Figure 22 shows the cards for an installation having a 1414 on channel 2, with only telegraph units attached (on adapters 0 and 2), and the save and restore option provided. A tape sof and a disk TP Library file will be used.

Figure 23 shows the cards required for an installation having only a PTC, on channel 2, and requiring only

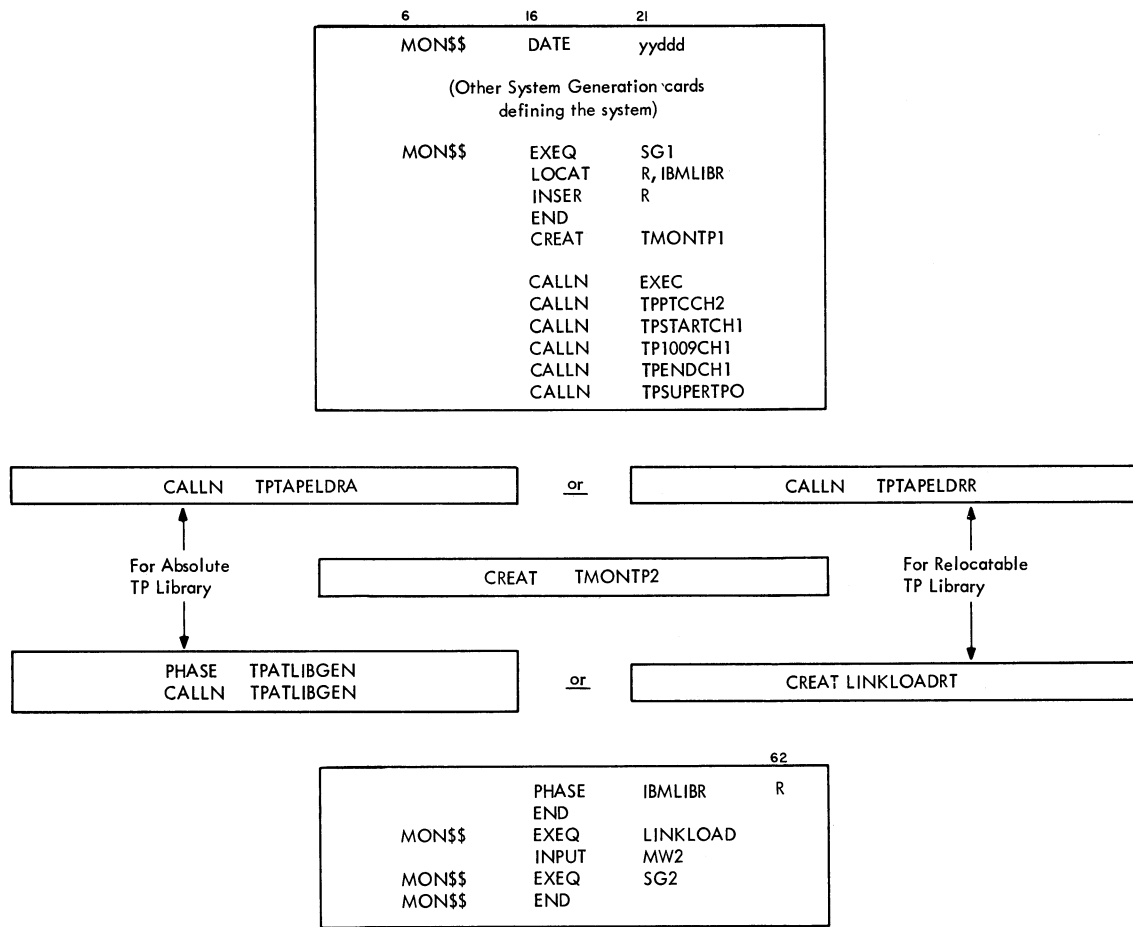


Figure 21. Sample System Generation Control-Card Sequence for a System with a *Tape* System Operating File and a *Tape* TP Library File

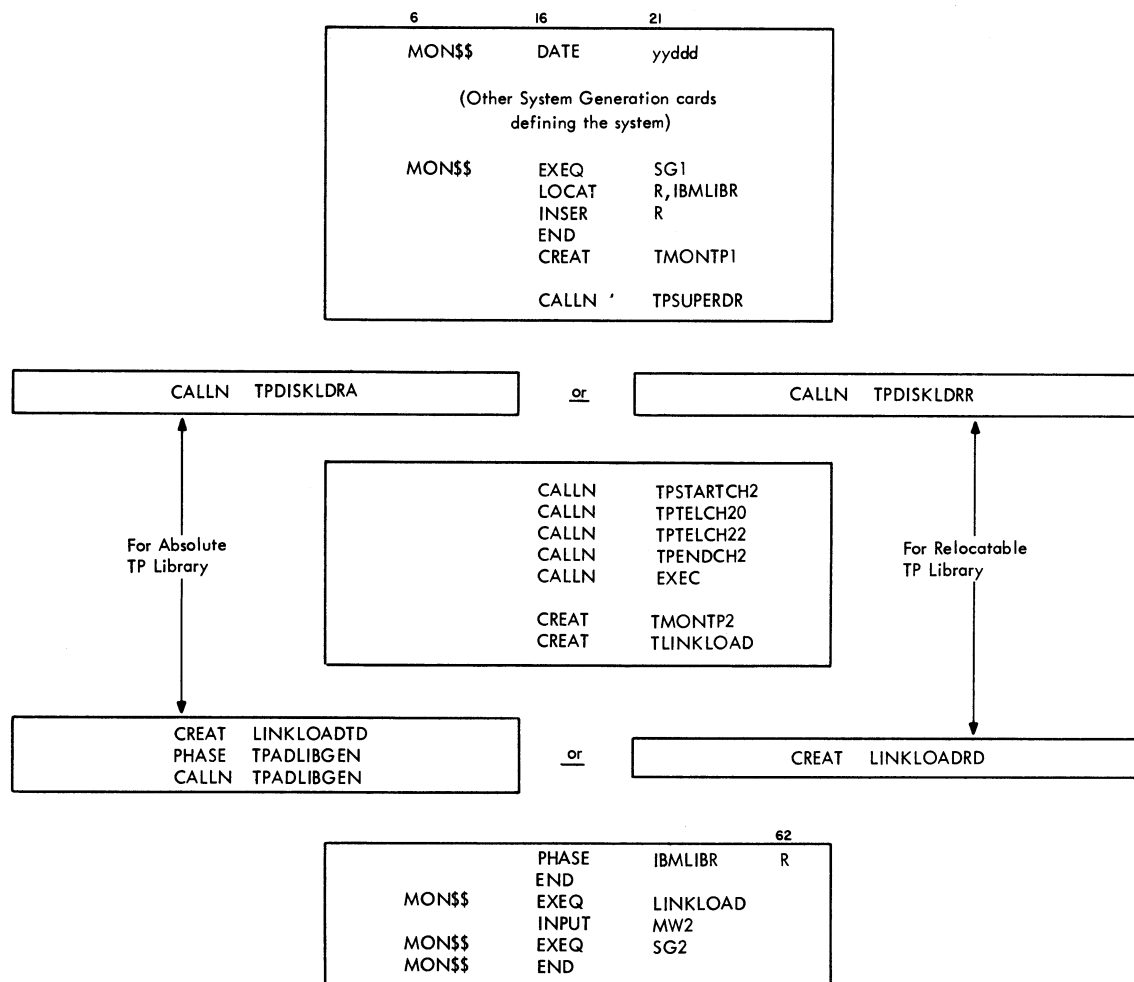


Figure 22. Sample System Generation Control-Card Sequence for a System with a *Tape* System Operating File and a *Disk* TP Library File

the basic Supervisor. Both the *sof* and the *TP* Library file are on disk storage.

Figure 24 shows the cards for an installation having a *PRC* on channel 2; a 1414 on channel 1, attached to which are 1050's on adapters 0 and 1, and a 7770; and a 1414 on channel 2, attached to which are telegraph units on adapters 0, 1, and 2. The *sof* is on disk storage, and the *TP* Library file is on tape.

The *TPDIR* Macro-Instruction

The *TPDIR* macro-instruction provides the Supervisor with the information necessary to reserve sufficient core storage for loading the *TP* Directory. This macro-instruction, which produces a module named *TPDIRECTORY*, must be included among the system description control cards if a *TP* Loader is to be used (see the *System Generation* publication).

Figure 25 illustrates the format (line 01) and an example (line 03) of the *TPDIR* macro-instruction. The

operand are as follows:

“*ttt*” is the total number of *TP* programs residing on the *TP* Library.

“*mmm*” is the maximum number of *TP* programs that will reside in core storage at any one time.

This macro-instruction must be included at System Generation even if “*ttt*” and “*mmm*” are both 001 (i.e., there is only one *TP* program).

TP Library Generation

Because an installation's *TP* Library may be in either absolute or relocatable format and may reside on either tape or disk, four *TP* Library Generators are provided for generating *TP* Library files. Because the *TP* Library must be generated by the *sof* that uses it, in order to obtain the proper system symbol table, the necessary generator must be incorporated into the system's *sof* at System Generation (see the *System Generation* publication).

A relocatable or absolute Library Generator performs these functions:

1. Builds a directory of TP Programs to be included in the completed library.
2. Creates a set of records for the TP programs using Linkage Loader output.
3. Places the TP Library, consisting of the directory and the TP programs themselves, on the tape unit or disk tracks assigned as the TP Library work file (MW3).

General Considerations

The following considerations apply to TP Library generation, whether an absolute or a relocatable TP Library Generator is used.

Only single-phase TP programs may be generated, although phases may consist of more than one module. In any multi-modular phase, the primary module must have the END card with an entry point. If more than one module contains an entry point the primary module must be first in the phase; all subsequent entry points will be ignored. Each TP program must have a

PHASE card with the five-character program name as the operand.

If the user specifies (through a BASE1 card) that any TP program be loaded into core storage at a location lower than that represented by system symbol /MKR/, and wishes also to place one or more TP programs in the main-line area (that is, above /KER/), he must include in the control-card deck a PRTCT card whose operand has the value of /KER/ (or /MKR/). This is necessary to prevent the omission of the symbol /MKR/ from the symbol table, with resulting inability of the Linkage Loader to specify an origin point for that program.

Library generations may be run with the TP complex open, as well as when it is closed. This permits the user to update his TP Library with new or revised programs while at the same time using it for current TP operations.

Absolute Generators

The two TP Library Generators available are TPATLIBGEN, for creating an absolute TP Library on

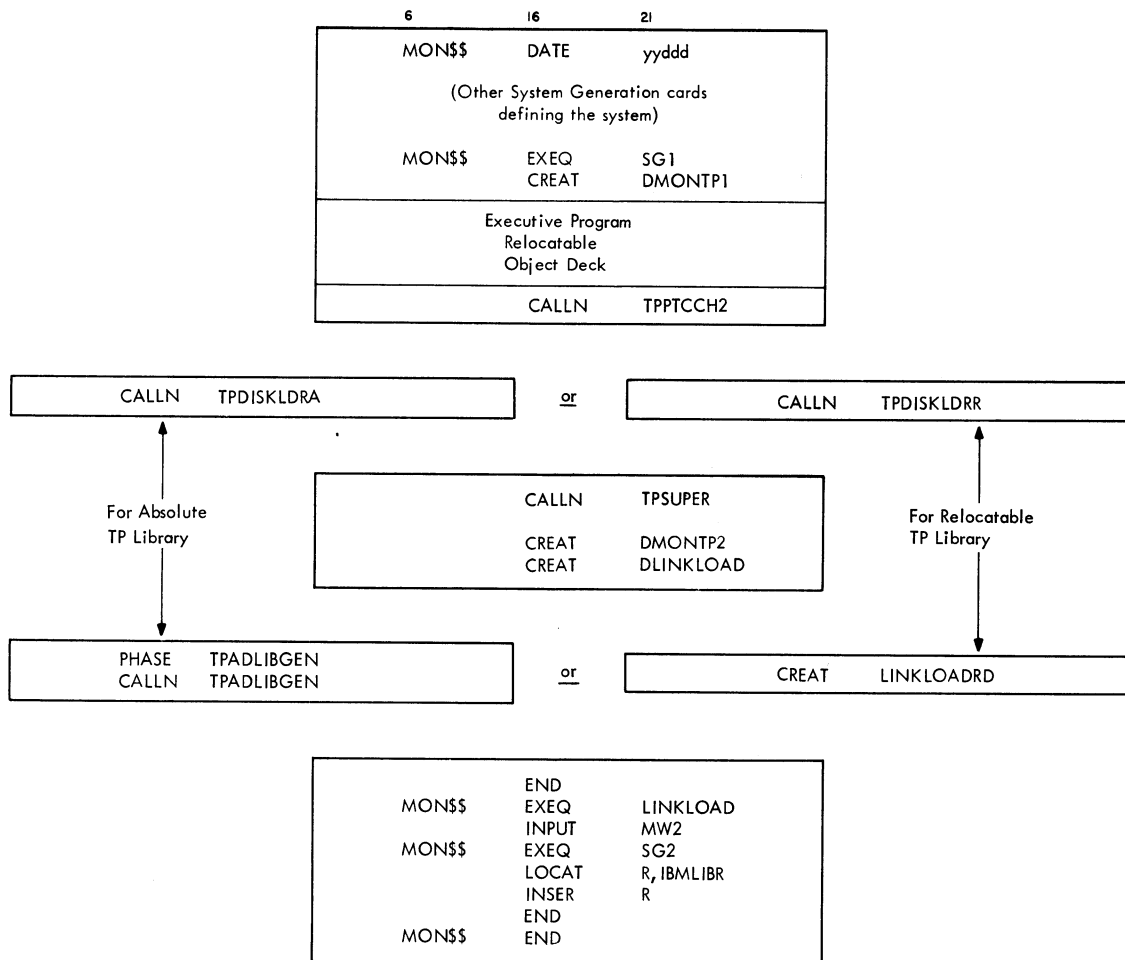


Figure 23. Sample System Generation Control-Card Sequence for a System with a Disk System Operating File and a Disk TP Library File

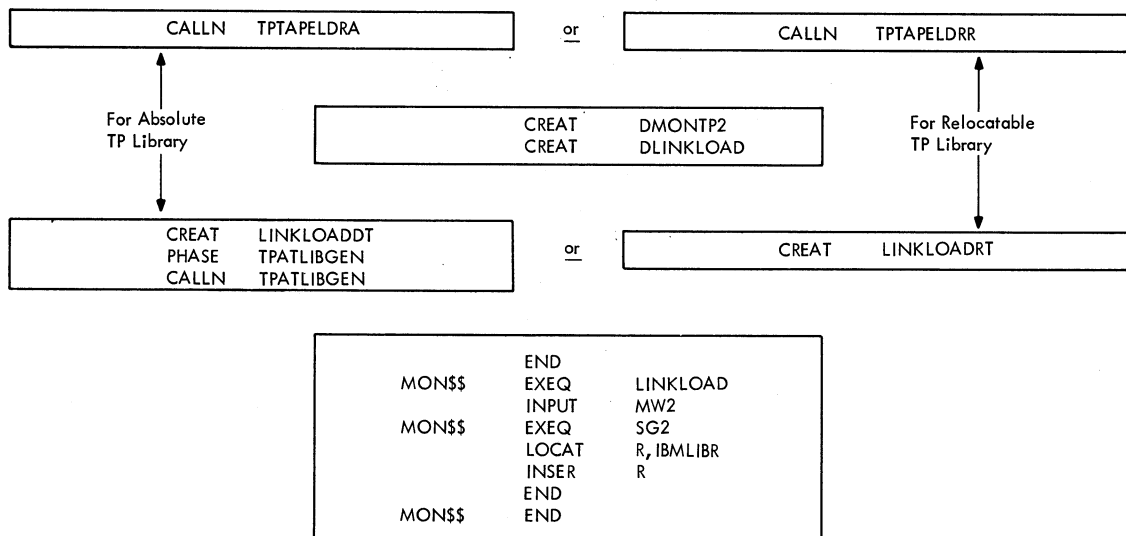
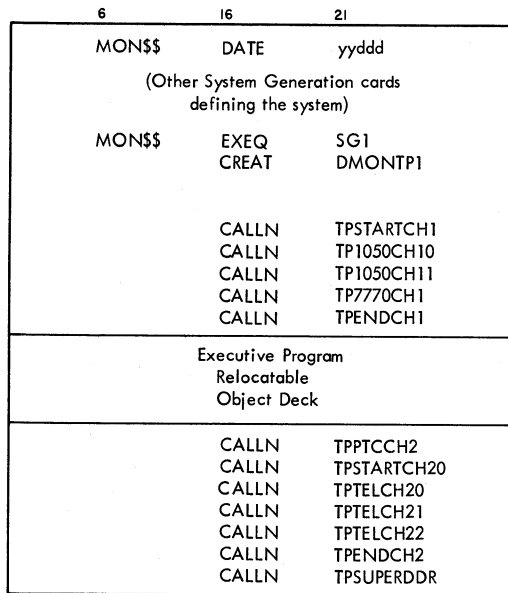


Figure 24. Sample System Generation Control-Card Sequence for a System with a Disk System Operating File and a Tape TP Library File

Line	Label	Operation	OPERAND
3	5,6	15,16	20,21 25 30 35 40
0.1		TPDIR	t t t , m m m
0.2			
0.3		TPDIR	048,012
0.4			

Figure 25. Format and Example of the TPDIR Macro-Instruction

Line	Label	Operation	OPERAND
3	5,6	15,16	20,21 25 30 35 40 45
0.1	MON\$\$	EXEQ	SG1
0.2		CREAT	LINKLOADDT, (or LINKLOADTD)
0.3	MON\$\$	EXEQ	LINKLOAD
0.4		INPUT	MW2
0.5			

Figure 26. System Generation Control-Card Sequence for LINKLOADDT or LINKLOADTD

tape and TPADLIBGEN, for creating an absolute TP Library on disk.

These generators must be placed on the sof in absolute format. Generations are run in sc mode, with the TP complex open or closed.

Programs to be loaded within the TP reserved area must have their origin points specified by a BASE1 card.

If any TP program will originate in or extend into the main-line program area, the user must, at System Generation, specify the Supervisor module with the save and restore capability.

The standard Linkage Loader creates a disk Job file from a disk sof, and a tape Job file from a tape sof. In order for an installation with a tape-oriented System

Monitor to create a disk absolute TP Library and, conversely, for an installation with a disk-oriented System Monitor to create a tape absolute TP Library, two create packets for special Linkage Loaders are provided. The programs created by these packets, and the functions performed by the programs, are as follows:

LINKLOADT creates a tape Job file for generating a tape absolute TP Library with a disk-oriented System Monitor.

LINKLOADD creates a disk Job file for generating a disk absolute TP Library with a tape-oriented System Monitor.

If the user requires either of these special Linkage Loaders for his TP Library generation, he must first incorporate it into the installation's sof at System Generation. The control cards required for this are shown in Figure 26.

The symbolic units required for using absolute TP Library Generators and the functions of the units are shown in Table 1. Examples of control-card sequences required for generation of absolute libraries on tape

and on disk are shown in Figures 27 and 28, respectively. In these figures, "tt" and "dd" appearing as the second operand of ASGN cards indicates that the symbolic unit is assigned to tape or disk, respectively.

Relocatable Generators

The two relocatable TP Library Generators available are LINKLOADRT, for creating a relocatable TP Library on tape, and LINKLOADRD, for creating it on disk. For either generator, only one pass is required, and TP programs are accepted from any input file acceptable to the standard Linkage Loader.

These generators may be placed on the sof in either relocatable or absolute format. Generations may be run with the TP complex open or closed. As in the case of absolute generators, programs to be loaded within the TP reserved area must have their origin points specified by BASE1 cards. If BASE1 cards specifying origin points below /MKR/ are used, Library Generation must be performed in sg mode, since otherwise the Linkage Loader will not process such BASE1 cards.

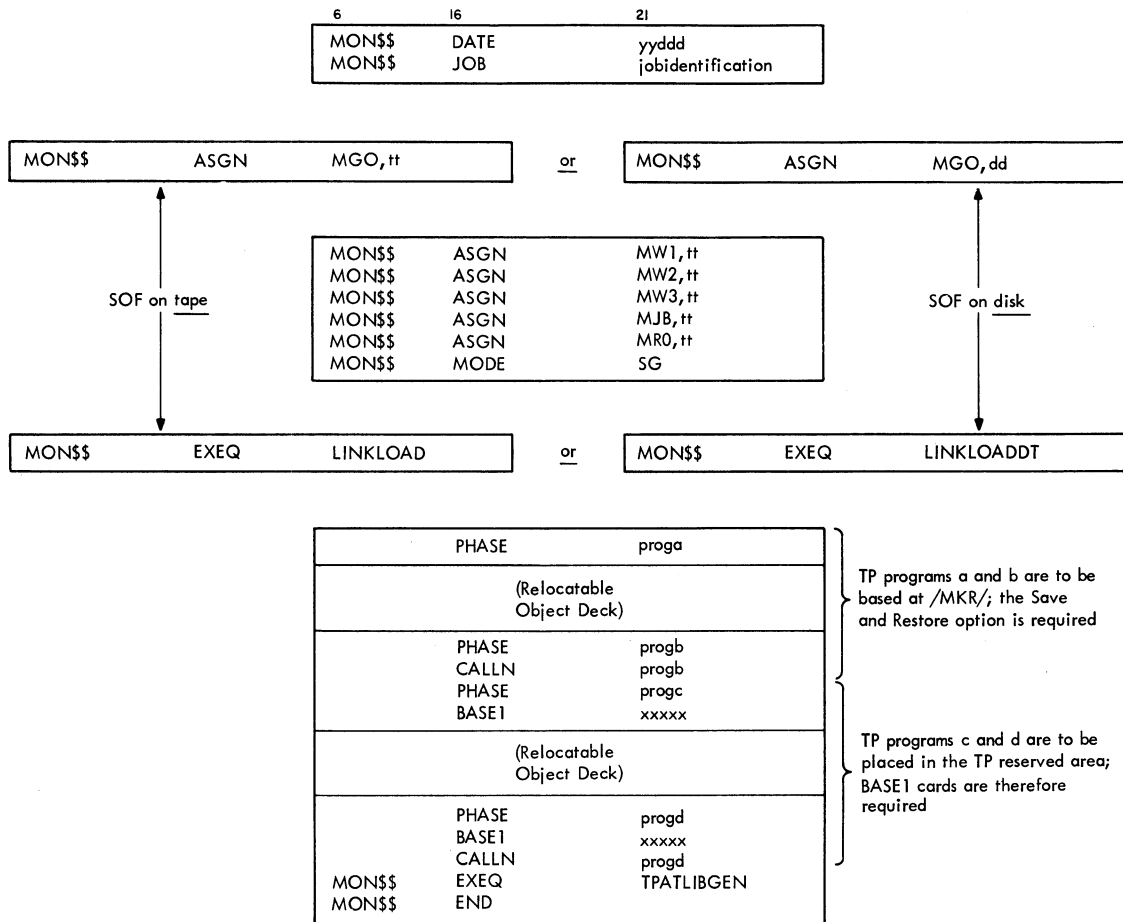


Figure 27. Control-Card Sequence for Generation of an Absolute TP Library on Tape, from a Tape- or Disk-Oriented System

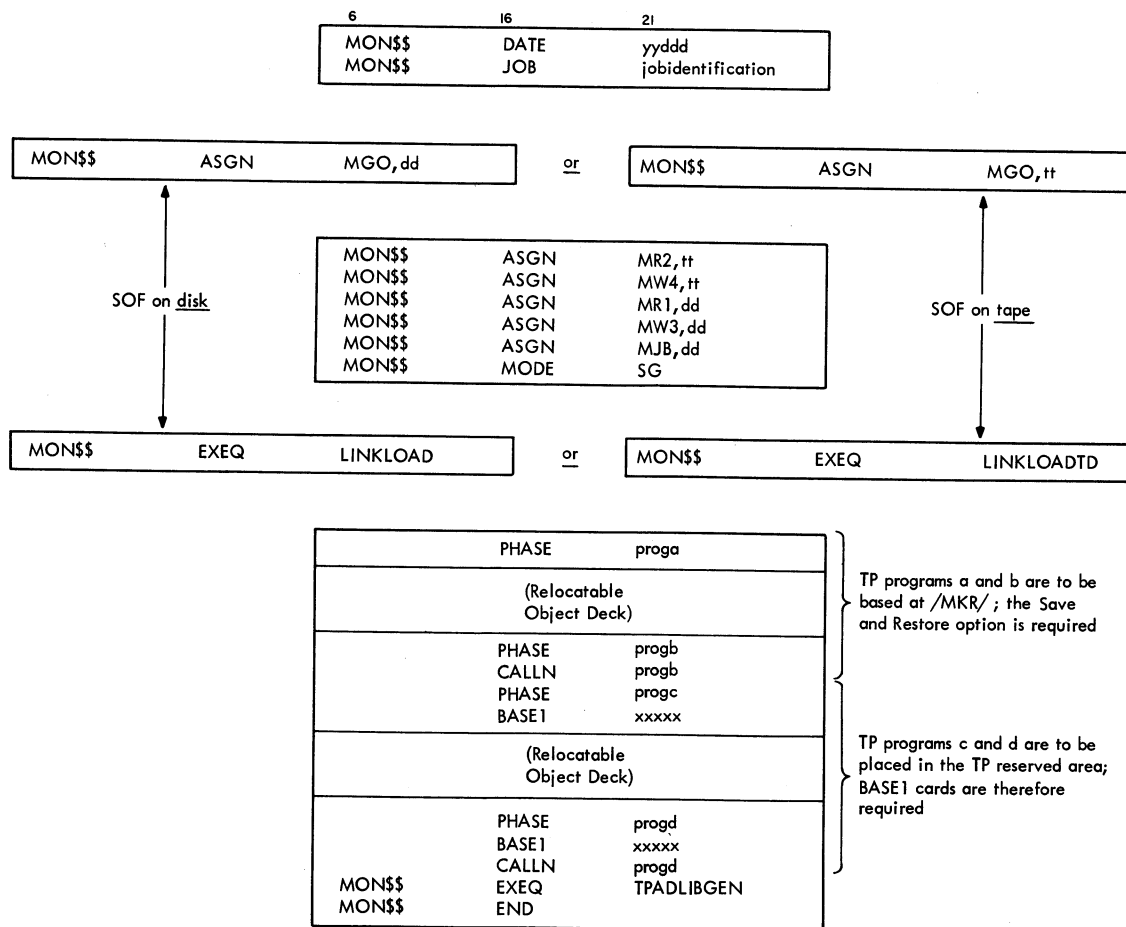


Figure 28. Control-Card Sequence for Generation of an Absolute TP Library on Disk, from a Tape- or Disk-Oriented System

Table 1. Symbolic Units Required for Absolute Generators

SYMBOLIC UNIT	FUNCTION	STORAGE MEDIUM
<i>Required by TPATLIBGEN:</i>		
MW1	Work file for Linkage Loader	tape
MW2	Work file for TP Directory	tape
MR0	Work file for TP Directory	tape
MW3	Output file for TP Library	tape
MJB	Job file	tape
<i>Required by TPADLIBGEN:</i>		
MR2	Work file for updated TP Directory	tape
MW3	Output file for TP Library	disk
MW4	Work file for TP Library	tape
MR1	Work file for basic directory	disk
MJB	Job file	disk

The IBM Relocatable Library (IBMLIBR) modules TPLIBGENXT, TPLIBGENXD, and TPLIBGENXP are called automatically by embedded calls within both the LINKLOADRT and LINKLOADRD modules.

The TP library is created on symbolic unit MW3 to permit a new library to be generated while the TP complex is open and operating with the current library. Before the new library can be used, the tape or disk file containing it must be reassigned to MLT (TP Library

file) by a MON\$\$ ASGN control card (or, if the file is on tape, by physically transferring the tape containing the new TP Library file to the tape unit currently assigned to MLT).

The Create packet for LINKLOADRT assumes that the SOF, MGO, and LIB files are *tape* files; similarly, the packet for LINKLOADRD assumes that these files are *disk* files. If necessary, a LINKLOADRT or LINKLOADRD can be created for an installation having the opposite type of file. Refer to the *System Generation* publication for the required card sequence.

The device assignments required for using relocatable TP Library Generators are shown in Table 2.

Considerations peculiar to each of the relocatable generators are discussed in the following paragraphs.

LINKLOADRT

In the EXEQ LINKLOADRT card, an optional fourth parameter may be used, to specify the name of the relocatable library other than the IBM relocatable library (IBMLIBR). If the parameter does not appear, IBMLIBR is considered the library's name.

Figure 29 shows the control card sequence for the run. "tt" in each of the second operands of the ASGN cards indicates that the symbolic units are assigned to tape units.

6	16	21
MON\$\$	DATE	yyddd
MON\$\$	JOB	jobidentification
MON\$\$	ASGN	MW2,tt
MON\$\$	ASGN	MW3,tt
MON\$\$	ASGN	MGO,tt
MON\$\$	MODE	SG
MON\$\$	EXEQ	LINKLOADRT
	PHASE	proga
(Source Deck)		
	PHASE	progb
	CALLN	progb
	PHASE	progc
	BASE1	xxxxx
(Source Deck)		
	PHASE	progd
	BASE1	xxxxx
	CALLN	progd
MON\$\$	END	

} TP programs a and b are to be based at /MKR/; the Save and Restore option is required

} TP programs c and d are to be placed in the TP reserved area; BASE1 cards are therefore required

• Figure 29. Control-Card Sequence for Generation of a Relocatable TP Library on Tape, from a Tape-Oriented System

LINKLOADRD

The primary output of this program is on the physical disk area assigned to symbolic unit MW3.

Table 2. Symbolic Units Required for Relocatable Generators

SYMBOLIC UNIT	FUNCTION	STORAGE MEDIUM
<i>Required by LINKLOADRT:</i>		
MW2	Work file	tape
MW3	Output file for TP Library	tape
MGO*	Go file	tape
<i>Required by LINKLOADRD:</i>		
MW2	Work file for backup/load option	tape
MW3	Output file for TP Library	disk
MGO*	Go file	disk

*optional

The user may if he wishes cause the generation of a backup tape which contains: (1) an image of the disk TP Library file (but without directory records); and (2) the control records necessary to reload the TP Library file should the file on disk be accidentally destroyed or need to be written on another disk file.

To create the special backup tape, the user must place on the MON\$\$ EXEQ LINKLOADRD card the fifth operand BACKUP. The tape is written on MW2 at the same time the relocatable library is being created on MW3.

To write the contents of the backup tape created on a previous run of LINKLOADRD onto a disk file, the tape must be mounted on the tape unit assigned to MW2, and the fifth operand LOAD must appear on the MON\$\$

EXEQ LINKLOADRD card. This causes the input to be accepted only from the backup tape, and the relocatable TP Library to be reloaded onto the disk file currently assigned to symbolic unit MW3. If the physical disk area currently assigned to MW3 is different from that assigned for the original run, the library records are relocated onto the new area and all directory and other references are corrected automatically. No changes can be made to the library during this run. Figure 30 shows the control card sequence for (1) creating a relocatable TP library on disk with a backup tape; and (2) reloading the disk area from the backup tape. "tt" and "dd" in the second operands of the ASGN cards indicates that the symbolic unit is assigned to tape or disk, respectively.

TP-Only Operation

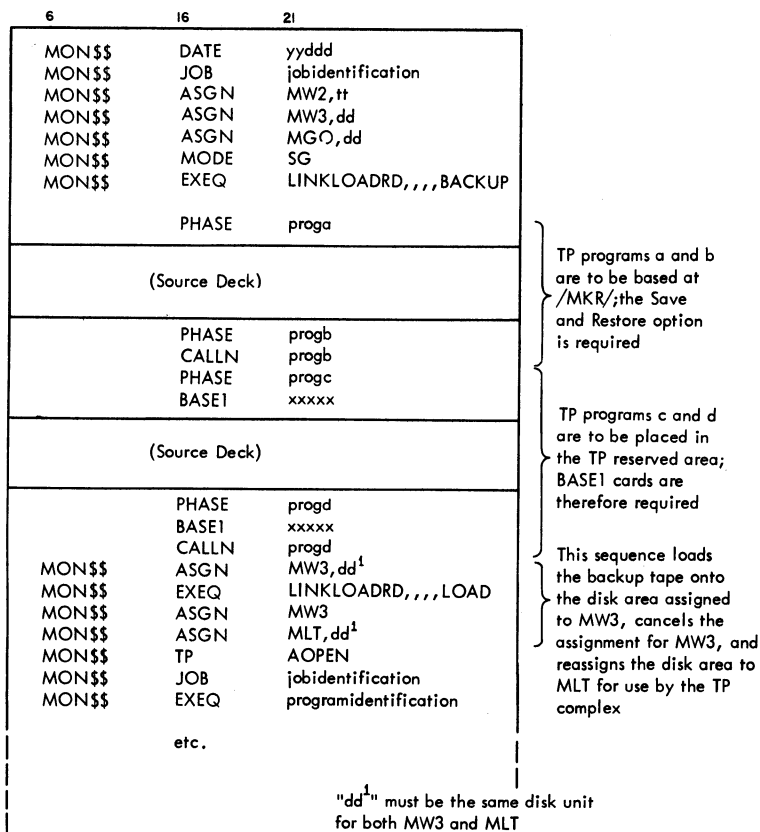
If an installation does not wish to process main-line programs and TP input concurrently, the user may construct a special Resident Monitor capable of reducing its own size when only TP input is to be processed. The advantage of this is that more TP programs can be accommodated in core storage, thus permitting TP input to be processed more rapidly than if the TP programs have to be located and loaded each time they are to be used. The added core storage space is achieved by permitting TP programs to overlay (1) the main-line program area, and (2) that portion of the Resident Monitor that is needed only for processing main-line programs, and not TP input. After this portion of the Resident Monitor has been overlaid, processing of main-line programs cannot be resumed until the system is reinitialized. When TP-only operation is provided for, the usual main-line programs can be processed *until* the time the TP complex is opened; thereafter, only TP input can be processed, and a waiting loop or halt serves as the main-line program.

Figure 31 shows the difference between core storage configurations before and after opening of the TP complex. When the TP complex is opened, these modules are overlaid:

- IBLODFAZ
- SNAPSHOT
- IBBSPTP
- IBSIMTP
- IBABTPM
- IBPRTTP or IBPRTUR
- IBPCHTP or IBPCHUR
- IBPPCOMMON
- IBRDSIU
- IBRDAIU
- IBMENDM

After System Generation the system operates as follows:

1. The Monitor is loaded and initialized.



TP programs a and b are to be based at /MKR/; the Save and Restore option is required

TP programs c and d are to be placed in the TP reserved area; BASE1 cards are therefore required

This sequence loads the backup tape onto the disk area assigned to MW3, cancels the assignment for MW3, and reassigns the disk area to MLT for use by the TP complex

Figure 30. Control-Card Sequence for Generation of a Relocatable TP Library on Disk, from a Disk-Operated System

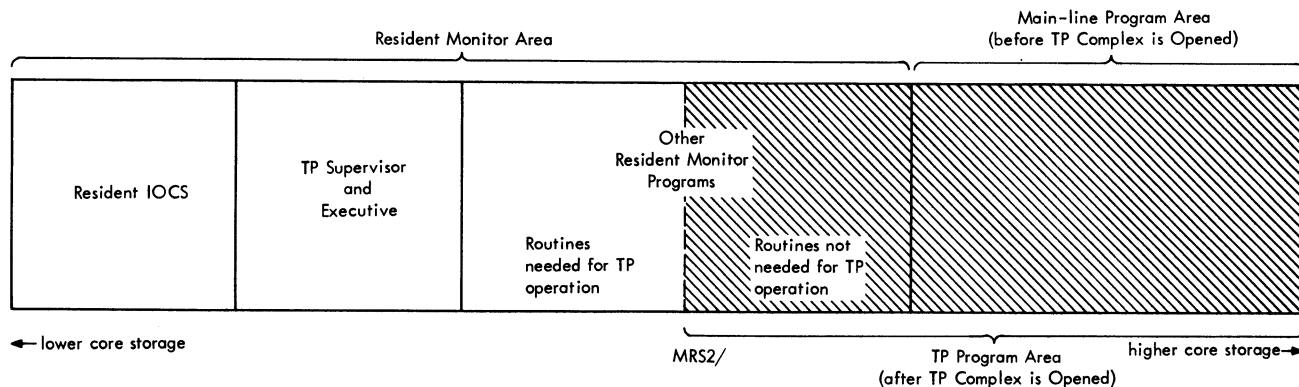


Figure 31. Core-Storage Layout for TP-Only Operation

2. Main-line programs are executed (including such preparatory TP operations as loading the Data Control Package into the PTC, building a TP Library, etc.).

3. When the user wishes to terminate main-line processing and commence TP-only operation, he causes the special TP AONLY card (Figure 32) to be read from the SIU. This causes a Halt to be placed at location 00001, and control to be given to the Supervisor's waiting loop.

(/TPB/ now contains the address (represented by /MRS2/) of the new lower boundary for TP programs.)

4. Using the console, the operator opens the TP complex (see "Opening and Closing the TP Complex").

5. The Executive causes the TP programs to be loaded into core storage between the end of the section of the Resident Monitor containing routines needed for TP processing and the end of core storage.

Line	Label	Operation
3		
0 1	MON \$\$\$	TP AONLY
0 2		

6. Whenever the Supervisor determines that no input is waiting to be processed, control is returned to the Monitor's waiting loop. If a Halt was incorporated in this waiting loop, any TP interrupts that occur during the halt will not be recognized.

• Figure 32. TP AONLY Control Card Format

Appendix A: Summary of Communication Symbols

The following summary is provided to enable the programmer to quickly determine the correct symbols for particular linkages between various elements of the TP complex. Linkages other than those specifically required between the Supervisor, Executive, and TP programs can be established by a number of program techniques. For example the Executive, because it becomes part of the Resident Monitor, can define system symbols to be used as reference points by the TP programs. A word of caution about this technique: the Executive must not duplicate any symbols already defined by other parts of the Resident Monitor.

Symbols in the Supervisor

System Symbols — Input and Output Areas

- /TS1/—Contains address of current input area.
- /TS2/—Contains address of output area with write error.
- /T03/—Entry to routine to release input area.
- /T04/—Entry to routine to release input area, followed by a branch to the TP program's close routine.
- /T05/—Entry to routine to call another TP program to process current input.

System Symbols — Entry Points to Output Routines

DEVICE	SYSTEM SYMBOL SYSTEM SYMBOL	
	FOR DEVICE ON CHANNEL 1	FOR DEVICE ON CHANNEL 2
1009	/T10/	/T20/
1014, adapter 0	/T11/	/T21/
1014, adapter 1	/T12/	/T22/
1015	/T19/	/T29/
Telegraph, adapter 0	/T13/	/T23/
Telegraph, adapter 1	/T14/	/T24/
Telegraph, adapter 2	/T15/	/T25/
1050, adapter 0	/T16/	/T26/
1050, adapter 1	/T17/	/T27/
7770	/T18/	/T28/
PTC	/T31/	/T32/

Linkage Symbols

- TP02/—Entry to routine to request loading and execution of a TP program.
- TP30/—Return to Supervisor from handling of error in loading the TP directory or a TP program. (See next symbol, TP31/.)
- TP31/—Contains error indicator for error occurring in loading TP directory or a TP program.
- TS99/—Entry to routine to request only loading of a TP program (no execution).

Linkage Symbols in Executive

- TE01/—Supervisor branches to this point when input is ready for processing.
- TE02/—Supervisor branches to this point when an error is encountered on a write operation to a TP device.

- TE03/—Supervisor branches to this point for opening functions.
 - TE04/—Supervisor branches to this point for closing functions.
 - TE05/—Supervisor branches to this point for additional closing functions for a PTC unit.*
 - TE06/—Contains address of first input area for 1014, 1015, 1050, 7770, and/or telegraph devices.**
 - TE07/—Contains address of first input area for 1009 units.**
 - TE08/—Contains address of first input area for PTC units.**
 - TE10/—Supervisor branches to this point when a control card for the Executive has been read.*
 - TE11/—Supervisor branches to this point when console input for the Executive has been received.*
 - TE12/—Contains the name and origin point of the TP program requested by the Executive to process the current input.
 - TE13/—Supervisor branches to this point when an error occurs in the loading of the TP directory or a TP program.
- *If the Executive does not have a routine to perform this function, the user must define this symbol as a blank character. In this case, the branch is not executed.
- **If this device is not included in the installation, the user must define this symbol as a blank character.

System Symbols in Resident Monitor

The symbols below are those in the Resident Monitor required by, or related to, the TP complex. The Executive and TP programs may refer to other Monitor symbols, in accordance with the user's needs. For these other Monitor symbols see the *System Monitor* publication.

- /CRD/—Contains address of input area that has control card information for the Executive.
- /KER/—Highest location of total Resident Monitor; therefore, lowest location of TP program reserved area, if any. The machine address represented by /KER/ is contained in /TPB/.
- MRS2/—In TP-only operation, highest location, plus one, of the section of the Resident Monitor containing routines needed for TP operation; therefore, lowest location of TP program area. The machine address represented by MRS2/ is contained in /TPB/.
- /MKR/—Location immediately preceding lowest location of main-line program area; therefore, highest location, plus one, of TP program reserved area, if any. The machine address represented by /MKR/ is contained in /ORG/.
- /ORG/—Field in Resident Monitor's Communication Region containing actual address value of /MKR/ (described above). This address, plus one, is also the Linkage Loader's base zero factor.
- /RIQ/—First position of input area containing input from the console for the Executive.
- /TPB/—Field in Resident Monitor's Communication Region containing address value of /KER/ or MRS2/ (described above).

Linkage Symbols in TPLDDCP Subprogram

- TLD0/—Entry to routine to initialize TPLDDCP and to cause a console message to instruct the operator to ready the PTC unit.
- TLD1/—Entry to routine to cause a write to the PTC unit.
- TLD2/—Entry to routine to terminate loading of TPLDDCP and to reset the Supervisor.

Appendix B: TPBASSUPER Symbols

The following is a complete list of symbols within the TPBASSUPER module, and is intended (when used with a core-storage printout) as a convenience to the user in diagnostic testing and debugging of the TP complex.

Entry Points to Routines

- /T03/—Entry to cause release and clearing of an input area.
- /T04/—Entry to cause closing of a TP program and release of an input area.
- /T05/—Entry to call a second TP program to process the same input data.
- /T1R/—Entry to cause a return to IOCS if the Executive or a TP program has been interrupted, or all input has been processed and control is to be returned to the main-line program. This entry is not used if the Save and Restore routines have control and the main-line program has to be restored before returning to IOCS. (Save and Restore routine has its own routine to cause a return to IOCS.)
- /TP2/—Entry to cause loading and execution of a TP program.
- /TSY/—Entry to process an output error when one is encountered. Entry from device module when it has encountered an output error; causes entry to Executive's error routine.
- TSB7/—Entry to Save and Restore routines if closing of the TP complex is in progress.
- TC09/—Entry to cause clearing of input area for IBM 1009 device modules.
- T001/—Entry to channel 1 false attention routine.
- T002/—Entry to channel 2 false attention routine.
- T011/—Entry to add the address of a new channel 1 input area to the data or service message chain. The address of the input area is in TSA1/.
- T012/—Same as T011/, except for channel 2.
- T111/—Entry from IOCS when processing of input is to be started but could not be done previously because the TP complex was not open. (Input areas are considered unavailable until the TP complex is opened.)
- TP02/—Entry from Executive to cause loading and execution of a TP program.
- TP03/—Entry point used when a TP program is attempting to use an unassigned file. (This point is entered in lieu of the main-line program's /UEP/ routine, which would cause termination of the main-line program.)
- TP10/—Entry to console input message routine.
- TP20/—Entry to card input message routine.
- TPL1/—Entry from IOCS to force writing of messages to channel 1 devices.
- TPL2/—Entry from IOCS to force writing of messages to channel 2 devices.
- TPMG/—Entry to type message deferred routine; the instruction sequence is:
BXPA TPMG/
DCW xxxxx
("xxxxx" is an area in core storage.)
- TPRE/—Address of move instruction from device end modules when no device is awaiting the availability of an input area.
- TPXR/—Address of move instruction to cause restoration of index registers for an interrupted main-line program prior to returning control to that program.
- TPXS/—Entry to save the main-line program index registers before an input area is given to the Executive's TE01/ routine.
- TSA2/—Entry to cause Executive's close routine to be entered.
- TSA4/—Entry to cause return of control to the Monitor from a console or card-input message.

TSA9/—Entry to turn off TP-program-in-operation indicator, and return control to the main-line program. (Not used when Save and Restore routines control the return to IOCS.)

TSAA/—Entry to the clear-area routine.

TSAD/—Entry to cause (1) placement in /TS1/ of the address of the first service message area, followed by (2) entry to the Executive.

TSAE/—Entry to cause placement in /TS1/ of the address of the first data message area, and entry to the Executive.

TXXR/—Entry to reset to zero the value at /KON/ if the main-line program index registers are to be restored and control is to be returned to the main-line program.

Data Areas

- /KON/—Always contains the address of the index register save area which contains the main-line program's index register values.
- /TSX/—Contains address of an output area for which a write error occurred.
- /TS1/—Contains address of current input area when the Executive's TE01/ routine is entered.
- /TS2/—Contains address of current output area when the Executive's TE02/ output error routine is entered.
- TPW1/—Contains a count of the number of 1414 device modules on channel 1 that have output to be written.
- TPW2/—Contains a 1 if the channel 1 PTC device module has an output area to be written.
- TPW3/—Same as TPW1/, except for channel 2.
- TPW4/—Same as TPW2/, except for channel 2.
- TPRA/—Contains a count of the number of 1414 device modules on channel 1 that are awaiting availability of an input area.
- TPRB/—Same as TPRA/, except for channel 2.
- TSA1/—Contains the address of a newly-established input message when the Supervisor is entered.
- TSAB/—Contains the address of the first service message area, if one is waiting to be processed.
- TSIZ/—Work area for the clear-input-area routine.
- TTRX/—Low-order address of the main-line program index register save area.
- TZ09/—Contains the size of the IBM 1009 input areas.
- TZ14/—Contains the size of input messages from devices such as the IBM 1014. This field contains a constant of 80.
- TZPT/—Contains the size of PTC input areas.

Indicators

- /TSZ/—Multiple-error entry indicator.
- SUPW/—*If word mark absent:* Indicates to the Supervisor that a successful write operation is in progress on channel 1, although other output messages are waiting to be written. *If word mark present:* Indicates that a write operation has not been successfully accomplished by any device module having output waiting (this causes the Supervisor to re-enter the write routine).
- TPOP/—TP status indicator: contains a 1 if TP complex is open; contains a 0 if TP complex is not open.
- TPRF/—Contains a branch instruction if the supervisor has entered the device modules when an input area became available. If Supervisor has not entered the device modules, TPRF/ contains a NOP instruction.
- TPRG/—(1414 devices only) Contains a branch instruction if no more input areas are waiting to be processed, and a waiting message was not previously read due to the channel's having been already in use by the IOCS. If this is not the case, TPRG/ contains a NOP instruction.
- TPSW/—Contains a 1 when the program currently being executed is the Executive or a TP program. Contains a zero when the current program is the main-line program.

TSA3/—Contains a 1 if loading *and* execution of a TP program has been requested. Contains a zero if only loading is requested, and control is to be returned to the requesting program.

TSA5/—Contains a 1 if opening or closing of the TP complex is in progress; contains a zero, if not.

TUPW/—Same as SUPW/, except for channel 2.

Appendix C: Console Messages

Those console messages that pertain to Tele-processing operations are listed here for the user's convenience. See the *Operator's Guide* publication for a complete list of messages written by IBM-provided programs within the Operating System. (It is suggested that a similar list of messages for user-written programs be compiled and added to this Appendix.)

System Informational Messages

The following messages are given by the system. The first of the messages occurs because of error condition that cannot be corrected. The latter two messages occur during normal operation of the system. These messages are not accompanied by waiting loops for operator action.

ASGN OP INVALID Tnn

Explanation: The ASGN card operand indicated by "nn" is invalid. The System Monitor rejects the assignment and enters the Unusual-End-of-Program routine, because an attempt was made to assign a Tele-processing system file when the TP complex was open.

Action: No operator action is required by the system unless this message is followed by the "(ASGN card image) INVALID ASSIGNMENT" message. If the latter message does follow, the action indicated for that message should be taken. (See the "Initialization Messages" section in the *Operator's Guide* publication.)

BATCH DUMP

Explanation: The TP Supervisor has put the dependent program on the MDT to process an interrupt. Therefore, class B messages cannot be processed.

Action: Do not enter any class B messages until a "RESTORE" message is typed.

RESTORE

Explanation: The TP Supervisor has brought the Transitional Monitor back into storage after processing an interrupt. Class B messages can now be processed.

Action: Any class B message can now be processed.

Numbered Messages

Whenever operator action is required following a message, the program enters a waiting loop (a user option permits a halt in the waiting loop, if desired). A five-digit identification code preceding each console printer message assists the operator in analyzing the conditions existing when the waiting loop occurs. See the *Operator's Guide* publication for an explanation of the identification code.

00590 MAX FILE SIZE EXCEEDED

a. *Explanation:* The number of disk tracks assigned to the TP Library file, MW3, has been exceeded.

Action: More tracks must be assigned to MW3.

b. *Explanation:* The number of records in the TP Library file exceeds 9999.

Action: The TP Library file must be subdivided into two or more files.

00591 LIBGEN ERROR

Explanation: A serious input error has caused one or more TP programs to be deleted from the TP Relocatable Library during generation. The nature of the error is indicated on the SPR. The generation of the library continues normally. When it is completed, a branch is made to the Monitor EOP routine.

Action: Input errors must be corrected and the library generation repeated.

10570 TP OPEN

Explanation: This message indicates that the TP complex is open.

Action: None.

10571 CTL ERR

Explanation: The TP Supervisor received an improper-control message from the Standard Input Unit or the console. The TP Supervisor ignores the control message and continues processing.

Action: None.

10572 TP CLOSE

Explanation: This message indicates that the TP complex is closed.

Action: None.

10573 FALSE ATT CH n

Explanation: The TP Supervisor has not serviced five interrupts from the I414 Input/Output Synchronizer on the channel indicated by "n", because it has been unable to determine the device that caused the interrupts.

Action: None.

10581 TP xxxxx MSG LOST

Explanation: The TP Supervisor writes this message when the installation chooses not to process an interrupt. "xxxxx" is the name of the TP program needed to process the interrupt. (See the 20580 message.)

Action: None.

10582 TP ONLY

Explanation: This message is written after a Monitor TP ONLY control card is read and the TP Supervisor has been conditioned for only TP processing.

Action: None.

10583 THE TP-LIBRARY FILE PRECEDED BY A DIRECTORY IS NOW ON DISK MODULE/S AT TRACK NUMBERS ASSIGNED TO /MLT/.

Explanation: The disk TP Library file has been generated and is now ready for use.

Action: None.

10586 NO TRACKS AVAILABLE FOR TPLIBFILE

Explanation: The number of tracks assigned for the disk TP Library file is too small.

Action: Re-execute the program with a larger number of tracks assigned for the TP Library file.

10589 RELOCATABLE LIBRARY ON DISK FILE MW3, TRACKS xxxx-yyyy BACKUP TAPE ON zzz

or

10589 RELOCATABLE LIBRARY ON TAPE zzz

Explanation: A TP Relocatable Library has been created on the indicated file and control has been returned to the Resident Monitor's End-of-Program routine. "xxxx" and "yyyy" are track addresses; "xxxx-yyyy" indicates the set of consecutive tracks comprising symbolic unit MW3. "zzz" is the symbolic unit (e.g., MR4). The backup tape message is produced only if the backup tape has been created.

Action: None.

20574 PREPARE PTC FOR INITIAL LOAD

Explanation: Tele-processing Supervisor Message. This message indicates that the operator should prepare the

Program Transmission Control unit (PTC) on channel 1 for initial loading.

Action: On the PTC on channel 1:

1. Press STOP.
2. Press CLEAR.
3. Press LOAD.

20575 ERROR ON INIT LOAD-RESTART PTC

Explanation: Tele-processing Supervisor message. This message indicates that an error occurred during the loading of the PTC on channel 1.

Action: On the PTC on channel 1:

1. Press STOP.
2. Press CLEAR.
3. Press LOAD.

20576 PREPARE PTC FOR INITIAL LOAD

Explanation: Tele-processing Supervisor message. This message indicates that the operator should prepare the PTC on channel 2 for initial loading.

Action: On the PTC on channel 2.

1. Press STOP.
2. Press CLEAR.
3. Press LOAD.

20577 ERROR ON INIT LOAD-RESTART PTC

Explanation: Tele-processing Supervisor message. This message indicates that an error occurred during the loading of the PTC on channel 2.

Action: On the PTC on channel 2:

1. Press STOP.
2. Press CLEAR.
3. Press LOAD.

20580 TP DMP ERR \$3T KILL xxxxx \$3B KILL BATCH

Explanation: Tele-processing Supervisor message. The TP Supervisor has failed to put the dependent program, now being processed, on the MDT in order to process an interrupt. The installation can elect to process the interrupt and thus destroy the dependent program or to continue processing the dependent program and thus lose the interrupt. "xxxxx" is the name of the TP program needed.

Action:

1. Press INQUIRY REQUEST.
2. To process the TP interrupt, enter \$3B on the console. To continue processing the dependent program, enter \$3T on the console.
3. Press INQUIRY RELEASE.

Where more than one page reference is given, the major reference appears first.

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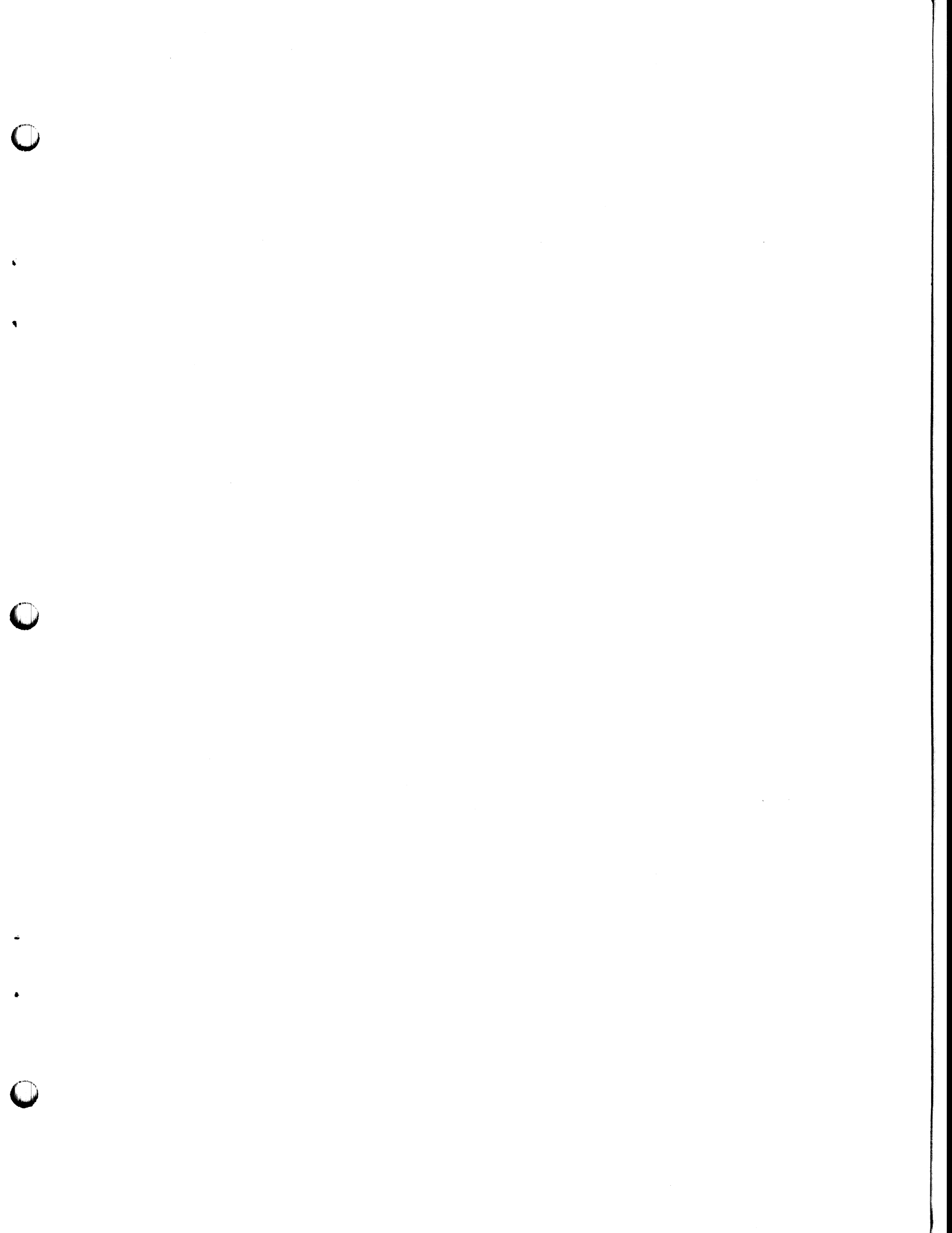
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