HONEYWELL EDP

SOFTWARE MANUAL

SERIES 200

SIMULTANEOUS MEDIA CONVERSION A AND C

GENERAL SYSTEM: SERIES 200/PROGRAMMING SYSTEMS

SUBJECT: Simultaneous Media Conversion A and C: A Group of Independent Coroutines Which Control the Automatic Transfer of Data Between Pairs of Peripheral Devices.

SPECIAL INSTRUCTIONS: This manual supersedes the Honeywell Series 200 SCOPE Manual (DSI-271B).

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FOREWORD

The first three sections of this manual contain the functional and operational descriptions of Simultaneous Media Conversion A and C (SCOPE). Section IV describes the own-coding to change SCOPE parameter values and to specialize SCOPE for specific needs in an installation. The operating procedures for the standard SCOPE package and for the dynamic loading of co-routines are contained in Sections V and VI, respectively.

The reader is assumed to be familiar with the following Honeywell publications:

1. H-800 Programmers' Reference Manual, DSI-31 (or H-1800 Programmers' Reference Manual, DSI-170);
2. Series 200 Programmers' Reference Manual, Models 200/1200/2200, File Number 113.0005.0000.00.00;
3. Series 200 Equipment Operators' Manual (Model 200), DSI-294; and
4. Equipment Operators' Manual for the H-800 card reader and card punch, DSI-83 and DSI-123.

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SECTION I
INTRODUCTION

Simultaneous Media Conversion A and C (SCOPE), as implemented for the Series 200, consists of a group of independent coroutines to control the automatic transfer of data between magnetic tape and punched cards or paper tape, and from magnetic tape to printed copy. SCOPE operates using either 3/4-inch tapes (204A), 1/2-inch tapes (204B), or both 3/4- and 1/2-inch tapes, provided that the appropriate tape control units are included in the system.

This manual describes SCOPE as packages of independent routines, each one coded by Honeywell for use in a certain equipment configuration. SCOPE may also control conversions involving paper tape equipment. However, SCOPE/Link paper tape coroutines are coded as macro routines for specialization by either Library Processor B or Library Processor C. For an explanation of Library Processor B (which is used with the Basic Programming System) refer to either Easycoder 4K Operating Procedures (DSI-243) or Easycoder B Assembly System (File No. 123.1105.000B.0-011). An explanation of Library Processor C (used with the Operating System-Mod 1) may be found in Library Processor C (File No. 122.1605.001C.00.00).

This publication is confined to a description of card-to-tape, tape-to-punch, and tape-to-printer conversions. Up to three of these independent input/output (I/O) conversion operations can be performed simultaneously, and the capability of own-coding is provided to enable editing of data during the I/O conversion processes. Extra memory, however, is required for these editing routines. Both alphanumeric and direct transcription mode reading and punching operations are available as an option with most units of the Series 200.

SCOPE is modular in design and construction, thus permitting the assembly of its elements in many combinations to control various peripheral equipment configurations. After being loaded into memory, SCOPE is controlled through SENSE switch settings and manual entries by the operator at the control panel.

When a given combination of SCOPE routines is assembled to control particular Series 200 peripheral devices, the resulting program is called a "version" of SCOPE. Each version includes a main control routine and a number of peripheral device coroutines. The main control routine selects the coroutine to be entered (to activate a particular peripheral device) and transfers control to the coroutine to perform the conversion. Each coroutine directs one terminal device (i.e., a card reader, a card punch, or a printer) or a tape control unit (TCU). A version

of SCOPE may consist of up to three terminal device coroutines and one TCU coroutine. Versions which control 1/2-inch tape drives function similarly to 3/4-inch tape versions, except that Series 200 record format and tape conventions are used. SCOPE operations in both 1/2-inch and 3/4-inch tape systems are described herein.

For compatibility in installations where a Series 200 processor is used in conjunction with a Honeywell 800/1800 system, 3/4-inch tape versions of SCOPE control the Series 200 hardware so as to simulate the operations of H-800/1800 off-line media conversion systems. This simulation implements the functions normally obtained in an H-800/1800 system from the settings of certain manual switches on card devices.

COMPONENTS OF SCOPE

SCOPE consists of a monitor (main control routine), an initialization routine, and two or more terminal device input/output coroutines. They communicate with each other by setting and interrogating control information stored in a common status table (see Figure 1-1). In order for a device which is controlled by SCOPE to be assigned to perform a particular operation, the device must be in a condition (as indicated by the status table) which allows it to perform the operation. For example, a device must first be "off-line" and "active" before an independent conversion can be performed.

Monitor Routine

Upon completion of an operation, each of the coroutines in SCOPE involved in a conversion transfers control to the monitor routine. The primary function of the monitor is to select the coroutine which should be entered, based upon conditions existing in the system at that point (as reflected by the status table), and to transfer control to that coroutine for performing the necessary operations during a peripheral conversion.

Initialization Routine

Under the direction of control messages entered by the operator at the control panel, the initialization routine controls the activation of the various I/O coroutines for the performance of media conversion operations. This routine transforms the information entered at the control panel into data that is stored in the status table for use by SCOPE and, in addition, initiates the deactivation of I/O coroutines as directed and decides which read/write channel the tape control unit (TCU) coroutine will use.

Input/Output Coroutines

Each peripheral device has an associated coroutine which performs the reading or writing for that particular device as well as the communication with the initialization and monitor routines.

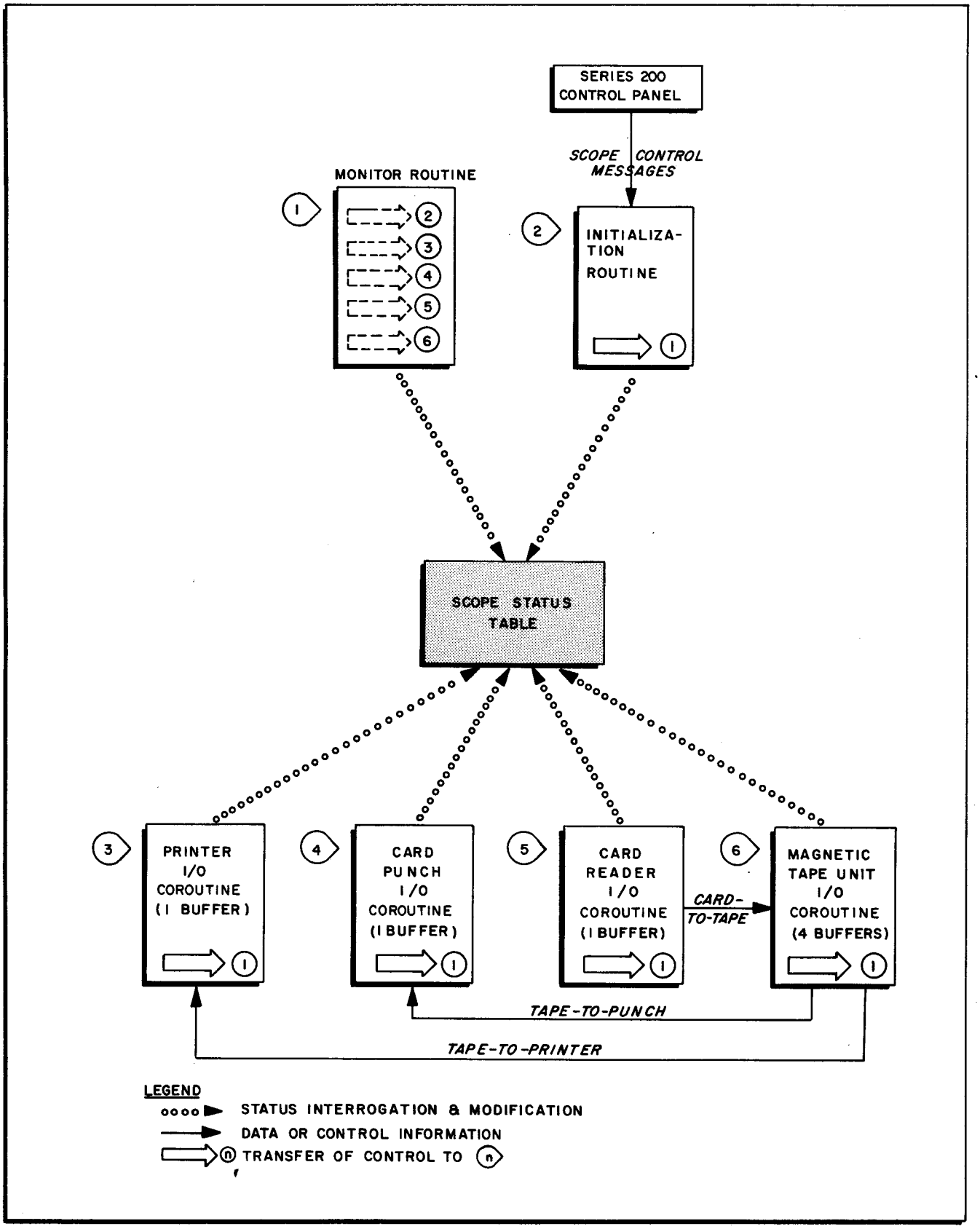

Figure 1-1. Interrelationships of SCOPE Routines

SCOPE includes one of these input/output (I/O) coroutines for each peripheral device involved in a conversion process. All magnetic tape operations (which may involve up to three tape drives) are controlled by a single tape coroutine. Each I/O coroutine maintains a separate buffer for each peripheral device which it controls.

The primary function of all SCOPE I/O coroutines is to initiate the transfer of data between the coroutine buffer(s) and the peripheral device(s) which they control. In addition, an I/O coroutine which controls a terminal device performs the necessary data transfers between the buffer of the terminal device coroutine and the associated buffer of the tape coroutine during an independent conversion operation.

Anticipatory read operations are performed in preparation for subsequent transfers to output buffers. That is, a request for data from an input device activates both the transfer of the data and another read instruction to that device. However, anticipatory reading takes place only if the last instruction to the device was a read forward instruction and a read-error check indication is not set. Write operations are performed by a coroutine after its buffer is filled with data from an input device.

The coroutines continually scan the status area to determine what operations are necessary. A particular bit configuration in the status table indicates that a certain operation should be performed. The monitor routine (which parcels out central processor time to the coroutines) then exits to a coroutine which remains in control for approximately one millisecond during the indicated operation. Finally, the coroutine sets the status area to reflect the operation it just performed and returns control to the monitor.

The terminal device coroutines, which are entered by and exit to the monitor routine, are divided logically into two functional levels. Level one can be thought of as an interrogation state where the coroutines scan the status table to determine if any operations are required by a peripheral device (the coroutines are activated and deactivated according to the dynamic settings of particular bits in the status table). If an operation is not required, the coroutine returns control to the monitor. The second level is an action state in which, if an operation is required, an internal switch (bit configuration in the coroutine) is set to level two, and the necessary PDT instruction is issued to perform the data transfer. For level two to be entered, the associated read/write channel must be free and the necessary error checks on the previous PDT instruction must have been made. After data transfer is completed, the coroutine resets the status area to reflect the change (i.e., that the data in the appropriate buffer has been moved), the coroutine is reset to level one, and an exit to the monitor routine is effected.

EQUIPMENT REQUIREMENTS

Minimum Equipment Required by SCOPE

The following is the minimum equipment configuration under which SCOPE will operate:

1. A Series 200 central processor with a minimum of 4,096 main memory locations;
2. One magnetic tape unit and control (either 1/2-inch or 3/4-inch tape systems are operable under SCOPE); and
3. One terminal device and control (i.e., a card reader, a card punch, a printer, a paper tape reader, or a paper tape punch).

Additional Equipment Usable by SCOPE

SCOPE can be assembled to direct a tape control unit (TCU) in regulating up to three 1/2-inch or 3/4-inch magnetic tape units, plus three terminal devices and their respective controls. The terminal devices may consist of any combination of card reader(s), card punch(es), printer(s), and paper tape device(s) for a total of up to three devices. Table 1-1 specifies the maximum amount of equipment which can be used by any specific version of SCOPE (one line of the table may be considered as a version of SCOPE). The figures given in the table are for the three standard terminal devices (i.e., the card reader, card punch, and the printer) and apply for both normal and transcription mode card reading and punching.

Table 1-1. Maximum Equipment Usable by Versions of SCOPE

	Card Reader	Card Punch	Printer	Magnetic Tapes (Type 204-A or 204-B)
Number Of Devices	0	0	3	3
	0	3	0	3
	0	2	1	3
	0	1	2	3
	1	0	2	3
	1	2	0	3
	1	1	1	3
	2	0	1	3
	2	1	0	3
	3	0	0	3

SIMULTANEOUS OPERATIONS

SCOPE can be assembled to direct a Series 200 computer in the simultaneous performance of any combination of one, two, or three of the following media conversion operations (see Figure 1-2): card-to-tape, tape-to-punch, and tape-to-printer. When two conversions are being performed

simultaneously, they proceed at the rated speeds of the terminal devices involved. If three independent conversions are being performed simultaneously, two of them proceed at the rated speeds of the devices, while the third device may proceed at a somewhat slower rate. Which conversion is slowed down, and by what factor, depends on the particular combination of operations being performed and the speed (data transfer rate) of the tape drives being used in the system.

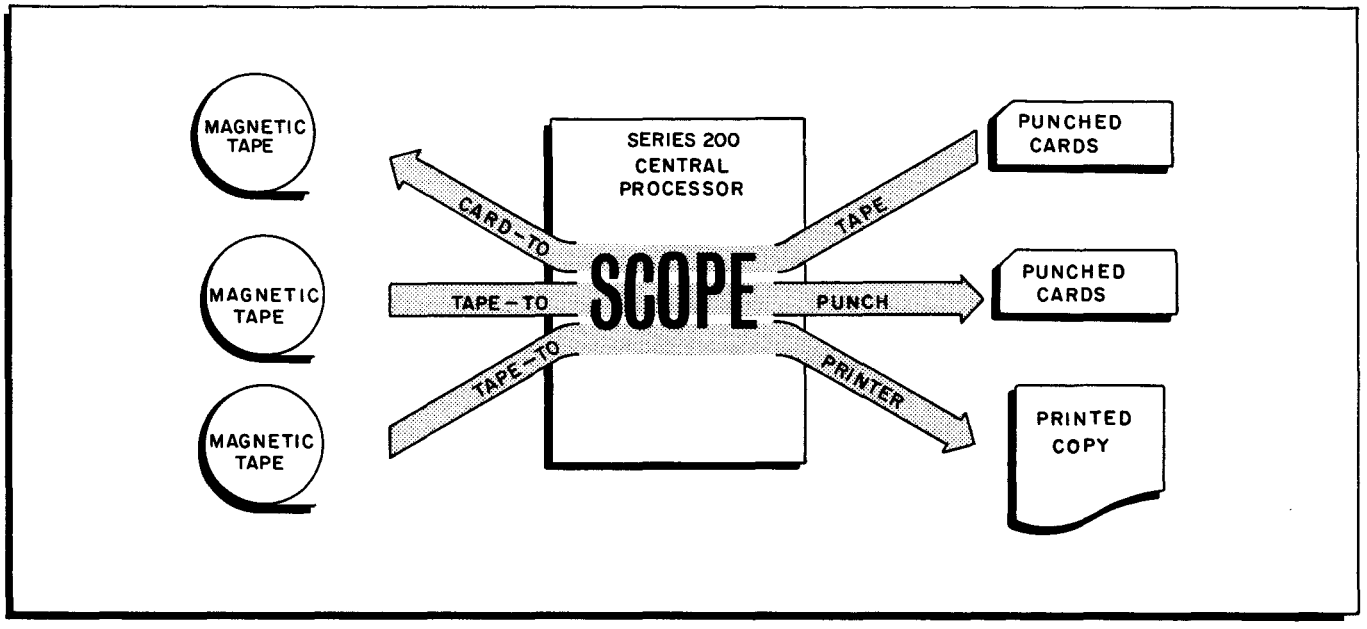

Figure 1-2. Types of Media Conversions Possible Using SCOPE

SCOPE can perform various combinations of the following jobs at the same time, as outlined in Table 1-1. (Note that a given peripheral device can be used in only one conversion operation at one time. The three operations below assume that three tape drives are included in the system.)

1. Card reader to one tape drive;
2. One tape drive to a printer; and
3. One tape drive to a card punch.

The operator uses a numeric device code to identify each piece of peripheral equipment, and each device code can reference only one device. The standard device codes are listed below in Table 1-2. The assignment of device codes 1, 2, and 3 can be changed, if desired, when SCOPE is assembled (see Section V). It should be noted that device codes 5, 6, and 7 refer to logical tape drives rather than physical tape drives.

Table 1-2. Numeric Codes for Peripheral Devices

Numeric Code	Peripheral Device
1	Card Reader
2	Printer
3	Card Punch
5	Logical Tape Drive 1
6	Logical Tape Drive 2
7	Logical Tape Drive 3

Each conversion operation uses a fixed logical tape drive, i.e., device 1 uses logical drive 1, device 2 uses logical drive 2, and device 3 uses logical drive 3. The standard version of SCOPE for 1/2-inch tapes reads and writes tape in the odd-parity mode and employs 3/4-inch interrecord gaps. These parameters for tape, however, may be changed independently either by own-coding or when SCOPE is assembled (see Section IV).

CONTROLLING SCOPE

All operations are initiated by control messages (see Section V) which are entered at the control panel by the operator. Such a message specifies the type of conversion operation to be performed and other operating elements such as the settings of programmable switches in any card equipment used. When SCOPE receives a control message requesting the initiation of a conversion, immediate steps are taken by SCOPE to begin the indicated operation. The operator should ensure that neither of the devices to be used in the conversion is currently engaged in another operation. Separate control messages are required to set the status of each pair of devices involved in a conversion.

SCOPE control messages are used to perform the following operations:

1. To initiate and terminate media conversion operations.
2. To specify the operational mode and the procedures to be followed when errors are detected in card reading or punching operations. In a 3/4-inch tape system, this function comprises the specification of H-800/1800 card equipment switch positions to be simulated.
3. To initiate media conversion restarts.

SECTION II
SCOPE OPERATIONS

As indicated in Section I, SCOPE can be assembled to provide facilities for up to three of the following media conversion operations, in any combination: card-to-tape, tape-to-punch, and tape-to-printer. All versions of SCOPE are available for either 3/4-inch or 1/2-inch tape systems. The purpose of this section is to describe in detail the three different types of media conversion operations available for both types of systems.

INITIATING MEDIA CONVERSION OPERATIONS

The activation of a SCOPE operation by a control message is described in Section V. Such a message specifies the type of operation to be performed and such other elements as the settings of programmable switches for any card equipment used. When SCOPE receives a control message which requests initiation of a media conversion, immediate steps are taken to begin the indicated operation.

GENERAL PATTERN OF CONVERSION OPERATIONS

All media conversions performed by SCOPE follow the general path outlined here; exceptions pertaining to individual operations are discussed below. First, the programmable switches of the terminal device are set as specified by the initiating control message. Then, the tape on the unit specified is rewound to its logical beginning. If the output medium is magnetic tape, labels are treated as described below in the discussions of card-to-tape operations. Then a data transfer process is performed, consisting of successive repetitions of the following operations:

1. The I/O coroutine controlling the input device reads a record into its buffer; and
2. The I/O coroutine controlling the terminal (non-tape) device transfers the record to the buffer of the I/O coroutine controlling the output device; the latter coroutine (which may be the same one which moved the data from the input buffer) then directs the writing of the record at the same time that a new record is being read into the buffer of the input coroutine.

The transfer process continues, unless interrupted by an error condition, until one of the following conditions occurs:

1. SCOPE detects in the input data the appropriate end-run configuration for the type of operation being performed;
2. In a 1/2-inch tape-to-printer or tape-to-punch operation, a tape mark (octal 17) is encountered; in all other operations, the end of tape is detected; and

3. SCOPE receives a control message which specifies termination of the operation.

The occurrence of any of these conditions terminates the transfer of data and initiates a rewind of the magnetic tape involved. If the operation being terminated by either condition (1) or (2) is a card-to-tape conversion, two additional records are written before rewinding the tape. These records will contain an end-run configuration, as follows:

1/2-inch tape - 1ERIΔ in positions 1-5.

3/4-inch tape - 00004+00 in positions 1-8.

In a system using 3/4-inch tape, the rewind stops at the logical beginning of tape; 1/2-inch tapes are interlocked. Upon initiation of the rewind, both I/O coroutines involved in the conversion operation are set to the inactive status.

MEDIA CONVERSIONS IN 3/4-INCH TAPE SYSTEM

The media conversions performed in a 3/4-inch tape system simulate quite closely the operations performed by the corresponding H-800/1800 off-line systems which are described in the H-800/1800 Equipment Operators' Manuals for the printer, card reader, and card punch.

Header and Trailer Record Configurations

No special header record (labeling) conventions need to be followed when performing conversions in a system using 3/4-inch magnetic tape. However, in order to effect automatic termination of a media conversion, it is necessary to end the input file with a trailer or terminating record containing an end-run configuration. For tape-to-printer and tape-to-punch operations, this configuration is the standard one used for the corresponding H-800/1800 off-line operation, i.e., ones in bits 13 and/or 14 of the control word.

A card-to-tape operation is terminated if SCOPE reads a card containing the proper end-run configuration for the conversion mode and character code being used. End-run punches for each mode and code are outlined in Tables 5-6 and 5-7, page 5-15.

Card-to-3/4-Inch-Tape Conversion

Card reading conversion mode and character code are specified by the initiating SCOPE control message. (In an H-800/1800 system, this function is under the control of the card reader CODE switch.) Alphanumeric mode reading (either H-800/1800 full or Series 200 standard code) can be selected; transcription mode reading is available as an option.

As each card is read, a comparison is made of the data derived from hole-count information obtained at each of two reading stations. Also, each card is checked for illegal punches.

Errors are treated as specified by the initiating SCOPE control message. (In an H-800/1800 system, this function is under the control of the CHECK PROCESS and ILLEGAL PUNCH PROCESS switches on the card reader, see Table 5-3, page 5-10.)

Any identification record present on the output tape is not preserved, i.e., data is written from the logical beginning of the tape. SCOPE automatically erases tape from the end of the first record to the beginning-of-tape window, so that only one record is written between the logical beginning of tape and the window.

SCOPE performs the operations necessary to produce 14-word (alphanumeric mode) or 24-word (transcription mode) card-image output records which are similar to those produced by an H-800/1800 off-line card-to-tape system. That is, SCOPE automatically generates a control word, two Orthotronic words, and an end-of-record (EOR) word for each card image and appends these to the card data for writing on tape. Bits 15 and 16 of the control word are set according to H-800/1800 conventions to indicate the outcome of the card read operation, i.e., whether or not the card was read correctly.

If a tape write error occurs, the operation stops. Tape write errors are not indicated in control word bits 23-26 as they are on a tape produced by an H-800/1800 off-line system.

Tape-to-Punch Operations in 3/4-Inch Tape System

The configuration of records to be punched by SCOPE in a 3/4-inch tape system is the same as that used in an H-800/1800 system. However, punch conversion mode and code are not specified in bits 16 and 17 of the control word as they are for an H-800/1800 punch. These bits are ignored by SCOPE, and the desired mode and code are selected by the SCOPE control message which initiates the operation (see page 5-9). Both H-800/1800 full code and Series 200 standard alphanumeric punching codes are available; Series 200 transcription mode punching is available as an option.

Each card image read is checked for frame parity error. If an error is detected, SCOPE attempts channel correction on the record. If channel parity is correct, channel correction entails rereading the record eight times, suppressing each data channel once until the orthocount checks. If the error is not corrected, the tape-to-punch operation stops.

After a card is punched, it is checked for hole-count errors (optional). Errors are treated as specified by the initiating SCOPE control message. (This function is under control of the CHECK PROCESS switch on an H-800/1800 card punch, as shown in Table 5-3, page 5-10.)

Tape-to-Printer Operations in 3/4-Inch Tape System

The configuration of records to be printed by SCOPE is the same as that used in an H-800/1800 system. There is a slight difference between the way SCOPE interprets bits 6-12 of the control word and the way these bits are interpreted by an H-800/1800 printer control. The SCOPE and H-800/1800 interpretations are the same when bit 6 does not specify sensing for end of form, and also when bit 6 does specify sensing for end of form and the condition is met. However, if sensing for end of form is specified but the condition is not met, the paper is advanced the number of lines specified in bits 7-12, up to a maximum of 15 lines. If the end of the form is not encountered and more than 15 lines have been specified in bits 7-12, the number of lines to be spaced is reduced by SCOPE to 15.

The preceding description of the treatment of tape read errors in a 3/4-inch tape-to-punch operation applies equally well to tape-to-printer operations. On the output (printer) side, if a cycle check is detected by the printer control, the tape-to-printer operation stops. Section V contains operating procedures suggested for use when errors are encountered.

MEDIA CONVERSIONS IN 1/2-INCH TAPE SYSTEM

One-half inch tapes are read and written in odd-parity mode. The first record on tape is the header label record, and the last record is the trailer label record which designates the end of reserved information. Similarly, in card-to-tape conversions, the first card in the deck to be read must be the header (1HDRΔ) record, and the last card in the deck must be the trailer (1ERIΔ) record.

Header Record Configuration

The Series 200 labeling conventions for 1/2-inch tapes, to which SCOPE adheres, require that the first record on tape be a header label record having the identification characters 1HDRΔ in positions one through five. Section III shows the format of the information in the header label records and the specific control character values presently required by SCOPE for the three types of 1/2-inch conversion operations.

In SCOPE, as presently specified, the data records are unblocked (i.e., one tape record per card or print line) and may contain one or more control characters. The format and the positions of the control characters within the record are defined in Section V for each conversion type. In order to allow future expansion, SCOPE requires that the header label record contain information describing the record format.

Trailer Record Configuration

As indicated above in the discussion of the general course of media conversion operations,

it is possible to effect automatic termination of operations by ending the input file with a trailer or termination record containing an end-run configuration. The end-run configuration (1ERIΔ) for all SCOPE conversion operations in a 1/2-inch tape system is the following octal equivalent of central processor code:

01	25	51	31	15
1	E	R	I	Δ

If the input to a conversion run is a card deck punched with Series 200 standard code or a magnetic tape containing print lines or the images of cards punched with Series 200 standard code, the termination record of the card or tape file must contain the alphanumeric characters 1ERIΔ in positions one through five.

Card-to-1/2-Inch Tape Conversions

The input and output functions of this operation are considered separately.

INPUT: Card reading conversion mode and character code are selected by the initiating SCOPE control message. Alphanumeric mode reading (either H-800/1800 full or Series 200 standard code) are available; transcription mode reading is optional.

As each card is read, a comparison is made of the data derived from hole-count information obtained at each of two reading stations. Also, each card is checked for illegal punches. Errors are treated as specified by the initiating SCOPE control message (see page 5-12). Message configurations are available to specify one or more of the following procedures:

1. Ejection of cards containing either hole-count or illegal-punch errors;
2. Setting the card reader to busy status upon detection of a card containing either a hole-count or an illegal-punch error; and
3. Bypassing (i.e., not transferring to tape) cards containing hole-count or illegal-punch errors.

Section V contains a table of operating procedures suggested for use when errors are encountered.

OUTPUT: SCOPE assumes that the output tape contains the header label record required by Series 200 tape conventions. It combines the output tape serial number with the data from the input header card in the following manner: The first card is read in Series 200 standard alphanumeric code. Characters 6-10 (serial number) of the tape record are transferred to the corresponding positions in the card input buffer, the tape is rewound, and the generated header card image is written as the first record on tape.

SCOPE constructs either 80- or 81-character records for cards read in alphanumeric mode and either 160- or 161-character records for cards read in transcription mode. The last character of an 81- or 161-character record is a control character generated by SCOPE as specified in

the input deck header card. This character indicates the mode, code, and outcome of the corresponding card-read operation. If column 78 of the header card contains a 1 (see page 3-6), SCOPE produces a six-bit character for each record and places it immediately after the last character of card-image data. The bits in this control character are described in Section V, page 5-14. Neither Orthotronic nor end-of-record data is included in card-image records on 1/2-inch tape.

During the writing of each card image, a read-after-write check is performed. If an error is detected, SCOPE first makes three tries to write the record again. If the attempts are unsuccessful, the card-to-tape operation stops. Section V contains a table of operating procedures suggested for use when errors are encountered.

Tape-to-Punch Operations in 1/2-Inch Tape System

A record to be punched in alphanumeric mode should contain 80 data characters; 160 characters should be present in records for transcription mode punching. A control character, such as that generated by a SCOPE card-to-tape operation (see above), may be present in the 81st or 161st position if so specified in the input file header record (see page 3-7ff). If control characters are present, they are ignored by SCOPE. H-800/1800 control and end-of-record words should not be used.

Each card image read is checked for frame and channel parity errors. If an error is detected, SCOPE makes three more attempts to read the record. If a successful read is not obtained, the tape-to-punch operation stops.

Card punching conversion mode and code are selected by the initiating SCOPE control message. Alphanumeric mode punching (either H-800/1800 full or Series 200 standard code) is available; transcription mode punching is optional.

After a card is punched, it is checked for hole-count errors (optional). Errors are treated as specified by the initiating SCOPE control message (see page 5-10). Message configurations are available to specify either one or both of the following procedures:

1. Ejection of cards containing hole-count errors; or
2. Stopping punching operations upon detection of a card containing a hole-count error.

Section V contains operating procedures for use when errors are encountered.

Tape-to-Printer Operations in 1/2-Inch Tape System

Records to be printed by SCOPE in a 1/2-inch tape system normally contain a control character in the first position (see exception in next paragraph). This character controls the

manner in which the record (line) is printed (see page 5-7). The header record of a 1/2-inch tape should indicate the number of control characters present in the conversion record for 1/2-inch tape-to-printer operations (see page 3-9). H-800/1800 control and end-of-record words should not be used.

A tape file whose records do not contain control characters, e.g., a card-image tape, can be printed normally by including in the initiating SCOPE control message an additional six-bit character beyond the two normally required (see page 5-7). This character should have the binary configuration 10nnnn. When this procedure is followed, each record is printed, followed by nnnn line spaces.

The description on page 2-6 for the treatment of tape read errors in a 1/2-inch tape-to-punch operation is also applicable to tape-to-printer operations. On the output (printer) side, if a cycle check is detected by the printer control, the tape-to-printer operation stops. Section V contains operating procedures suggested for use when errors are encountered.

SECTION III
TAPE FORMATS

The item formats for card and print image records may be in the standard H-800/1800 format or in the Series 200 format. The desired format is specified when SCOPE is assembled. In H-800/1800 item format, the data and control words follow H-800/1800 conventions (see Honeywell 800 Programmers' Reference Manual, DSI-31). An exception to this rule for punch image items, however, is noted on page 5-11 of this manual. Series 200 item formats for each device are described in this section.

Since SCOPE can handle both 3/4-inch and 1/2-inch tapes, the user must be aware that tape format conventions vary between the two. Generally, 3/4-inch tapes employ H-800/1800 format conventions. The basic information unit of the H-800/1800 is a word which consists of eight 6-bit alphanumeric characters. The general contents of each tape record are described in this section.

3/4-INCH TAPE FORMATS

As described in Section II, no special header record (labeling) conventions need to be followed when performing conversions in a system using 3/4-inch magnetic tape. However, to effect automatic termination of a conversion, the input file must be ended with a trailer or terminating record containing an end-run configuration.

For tape-to-printer and tape-to-punch operations, the terminating record is the standard one used for the corresponding H-800/1800 off-line operation, i.e., ones in bits 13 and/or 14 of the control word (see Section V). A card-to-tape operation is terminated if SCOPE reads a card containing the proper end-run configuration for the conversion mode and character code being used. End-run punches are outlined on page 5-15. Because SCOPE reads the next card before writing the image of the current card, the end-run card must be followed by at least three blank cards to allow the writing of the end-run card.

The data and control word format for 3/4-inch tapes conforms to H-800/1800 conventions for independent conversion tapes. An exception to this rule is when card images on tape are printed. In this case, the information from each tape record is printed verbatim, spacing nnnn lines after printing (as specified in a control message from the operator). Orthotronic characters and end-of-record (EOR) characters within H-800/1800 words are generated by SCOPE for card-image 3/4-inch tapes. In special cases, EOR words may be absent on punch or print image records.

Card-to-Tape Conversions

When reading cards during an independent conversion on a Series 200 computer, each card is read, converted and checked in the same manner as in response operation (Link) reading, and then written on tape as a record. In alphanumeric (normal) mode, each record consists of ten information words, one control word, two Orthotronic words, and one end-of-record (EOR) word, in that order (see Figure 3-1). When reading in the transcription mode, the data portion of the record contains 20 information words.

The control word contains eight characters, only one of which is significant to SCOPE. Bits 13-18 of the control word form the significant third character (p). Bits 13 and 14 of this control word are ignored by SCOPE. The configuration of bits 15 and 16 of the control word registers the existence of error conditions detected in the card images being written on tape, and, conversely, also notes the correct reading of a card. Bits 17 and 18 are also ignored by SCOPE. All unused portions of the control word are filled with valid zeros. The control word, the two Orthotronic words, and the EOR word are all automatically generated by SCOPE.

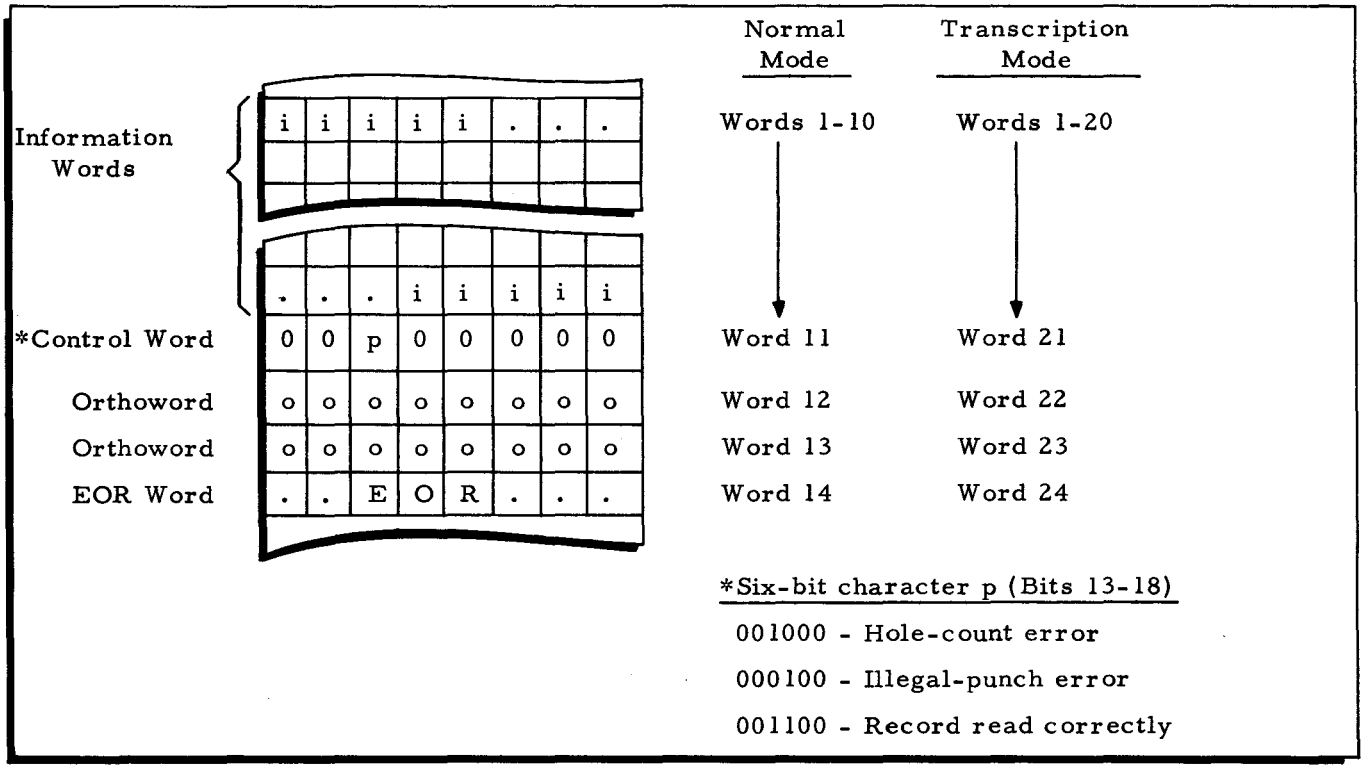

Figure 3-1. Card-to-3/4-Inch-Tape Conversion Record Format

Tape-to-Printer Conversions

For printing, each tape record has a control word containing three characters, fifteen information words, two Orthotronic words, and an end-of-record (EOR) word, in that order (see Figure 3-2). The 3-character control word governs the vertical formatting of the paper

during a tape-to-printer conversion and terminates operations when the end-run configuration is sensed in bits 13 and 14 of the third (control) character.

Character one (c) of the control word (bits 1-6) specifies vertical formatting control for the printer. When the high-order bit of this character (bit 1) is a one, the paper is advanced to the head of the next form. If the low-order bit of this character (bit 6) is a one, the print tape is inspected for an end-of-form indicator during printing operations. The four remaining bits of this character are not significant to SCOPE. Character two (b) of the control word (bits 7-12) specifies the number of lines to be spaced after the line in process is completed. Finally, character three (s), which has only two significant bits (bits 13 and 14), is an end-run character. If these bits are other than zeros, the printer conversion stops.

Values of bit positions other than those described above are ignored by SCOPE, thus making it possible to edit a record for listing.

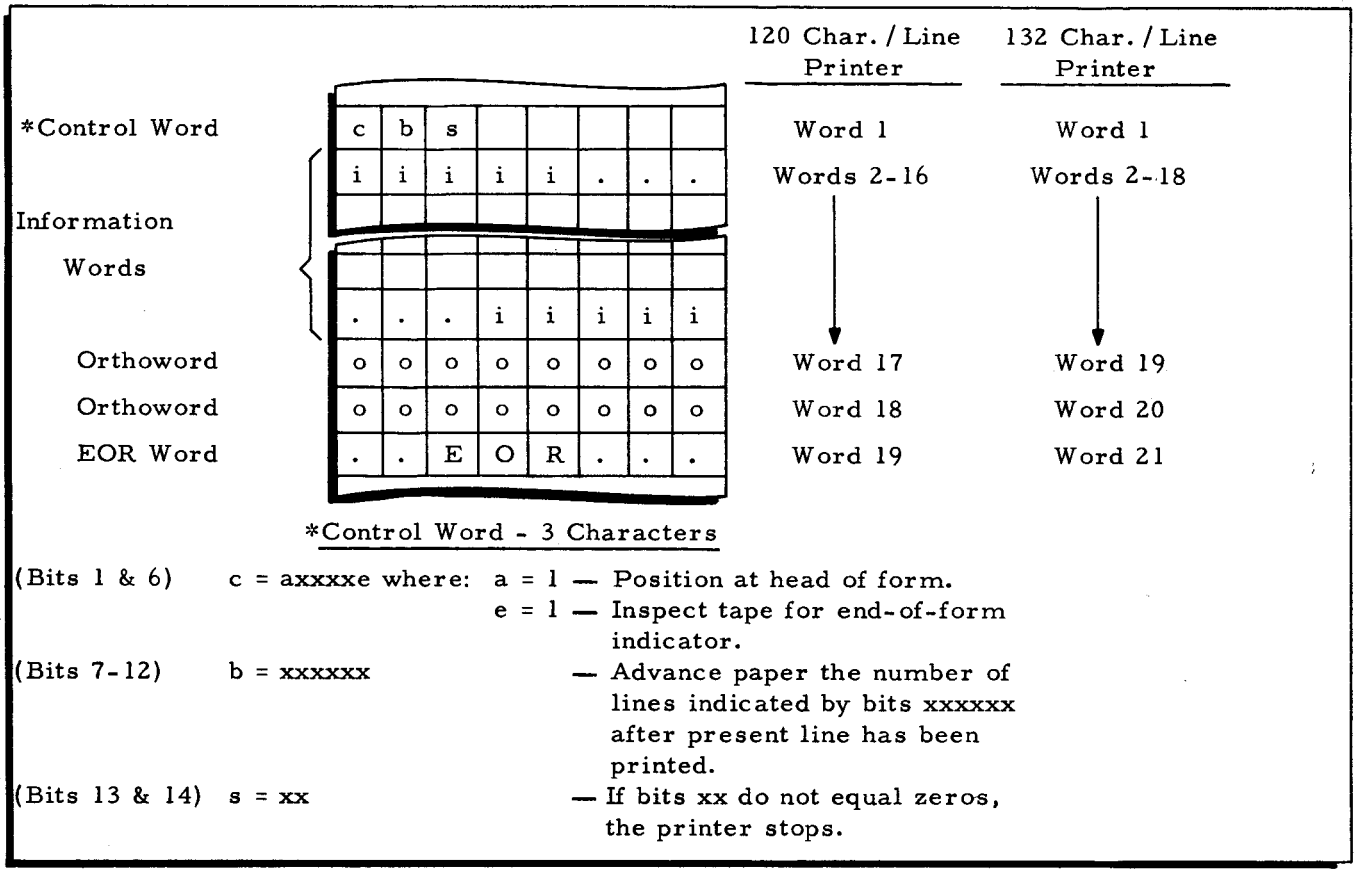

Figure 3-2. 3/4-Inch Tape-to-Printer Conversion Record Format

Tape-to-Punch Conversions

For either normal or transcription mode tape-to-punch conversions, each record contains

a control word, either ten or twenty information words (depending on the punching mode specified), two orthowords, and one end-of-record (EOR) word, as shown in Figure 3-3.

The first word of a tape-to-punch conversion record is the eight-character control word (00C00000) in which only bits 13 and 14 and bits 16 and 17 of the third character (C) are significant to SCOPE. Bits 13 and 14 are the end-of-run bits: if these bits contain zeros, card punching continues; ones in these bits indicate the end of the run and cause the card punch to stop immediately after punching the accompanying information in the record. Bits 16 and 17 indicate the decoding mode to be used. Zeros in these bits indicate normal mode, and ones indicate transcription mode. However, bits 16 and 17 are normally ignored by SCOPE, since their function is replaced by the third character of the control message that is entered into memory by the operator when initiating the tape-to-punch conversion (see page 5-9). Bits 15 and 18 are not significant to SCOPE.

The next ten words of the record are information words for the alphanumeric (normal) mode of punching, or, if the transcription mode of card punching is specified, the next twenty words are information words. The remaining portion of the conversion record contains the two orthowords and the EOR word.

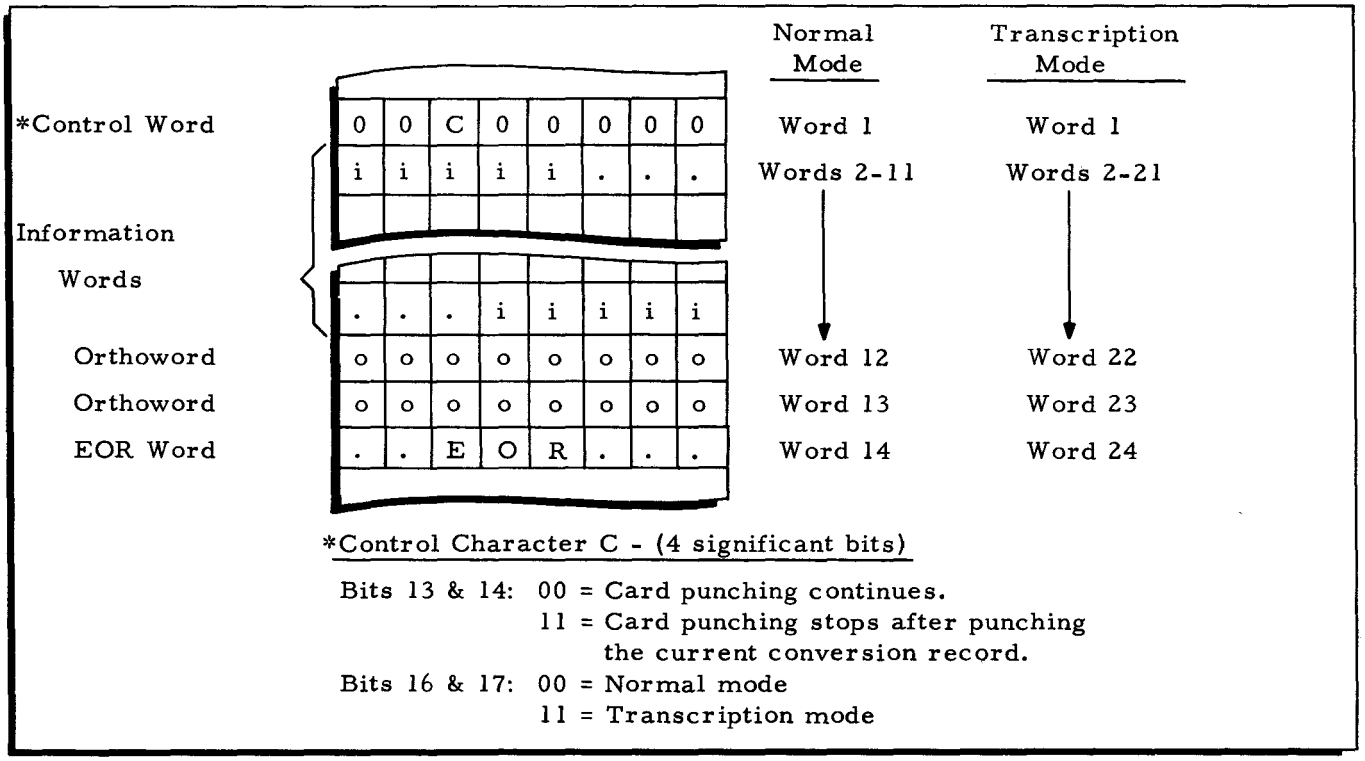

Figure 3-3. 3/4-Inch Tape-to-Punch Conversion Record Format

1/2-INCH TAPE FORMATS

One-half inch tapes are read and written in odd parity mode, unless the relevant coroutine is modified at assembly time or by own-coding at object run time. The first record on a conversion tape is the header label record (1HDRΔ) which contains information describing the record format, and the last record is the trailer label record (1ERIΔ) which marks the end of information. Similarly, in card-to-tape conversions, the first and last cards in the deck to be read must be the corresponding 1HDRΔ and the 1ERIΔ record cards, respectively. It should be noted that in 1/2-inch card-to-tape conversions, neither Orthotronic words nor end-of-record (EOR) words are included in the card-image records on the tape.

Data records are unblocked (i.e., one tape record per card or print line) and may contain one control character. The format of the control character and its position within the record are defined for each type of conversion.

Card-to-Tape Conversions

The first card in the deck must be the header label card in the format illustrated in Figure 3-4 and described below. Beginning on page 3-7, the format of the card images after being written on tape are described under the tape-to-punch and the tape-to-printer conversions.

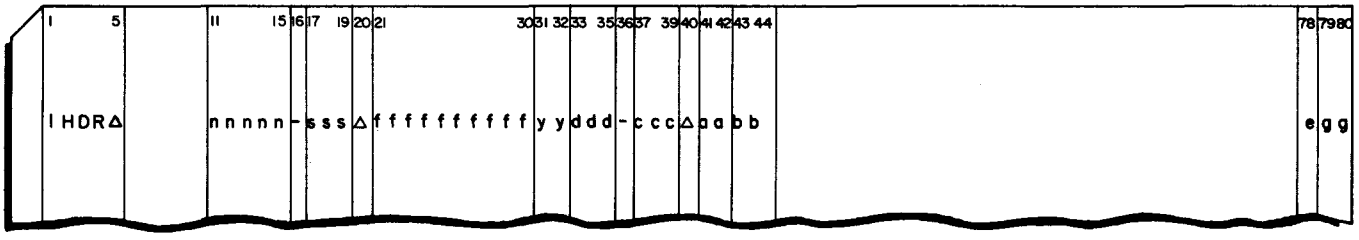

Figure 3-4. Format of Header-Label Card for 1/2-Inch Tape

Columns 1-5:	1HDRΔ is always punched in these columns.
Columns 11-15:	Contain five digits in the range 00000 ≤ nnnnn ≤ 99999 representing the number of the file to be identified by this record.
Column 16:	A minus (-) sign is always punched in this column.
Columns 17-19:	Contain three decimal digits in the range 001≤ sss ≤ 999 to specify the number of a reel within a tape file.
Column 20:	This column always contains a blank (Δ).
Columns 21-30:	Contain ten alphanumeric characters that identify the file, i.e., the file name.
Columns 31 & 32:	Contain two decimal digits in the range 01≤ yy ≤ 99 specifying the year the file was created.
Columns 33-35:	Contain three decimal digits in the range 001 ≤ ddd ≤ 366 specifying the day the file was created.

Column 36: A minus (-) sign is always punched in this column.

Columns 37-39: Contain three decimal digits in the range 000 ≤ ccc ≤ 999 specifying the retention cycle for the file in days.

Column 40: This column always contains a blank (Δ).

Columns 41 & 42: These columns designate the number of characters in the item and must have one of the values below. The larger value should be used when a control character is present in the conversion record.

Tape Mode	Characters Punched	Octal Equivalent	Decimal Equivalent
Normal - No control character	1 R, 0	0120	80
Normal - Control character	1 A	0121	81
Transcription - No control character	1 X, 0	0240	160
Transcription - Control character	2 J	0241	161

Columns 43 & 44: These columns specify that each record contains one item and must have the decimal values 0 and 1, respectively.

Column 78: This column specifies the number of optional control characters present in the conversion record, as follows:

0 = No control character

1-4 = Number of control characters

Columns 79 & 80: When column 78 contains a number of 1 through 4, columns 79 and 80 must specify the position of the leftmost control character within the conversion record, as follows:

Tape Mode	Characters Punched	Position (Octal)	Position (Decimal)
Normal	1 A	0121	81
Transcription	2 J	0241	161

The last card in the card-to-tape conversion deck must be the trailer label card in which 1ERIΔ is always punched in columns 1-5. The contents of columns 6-80 are immaterial to SCOPE.

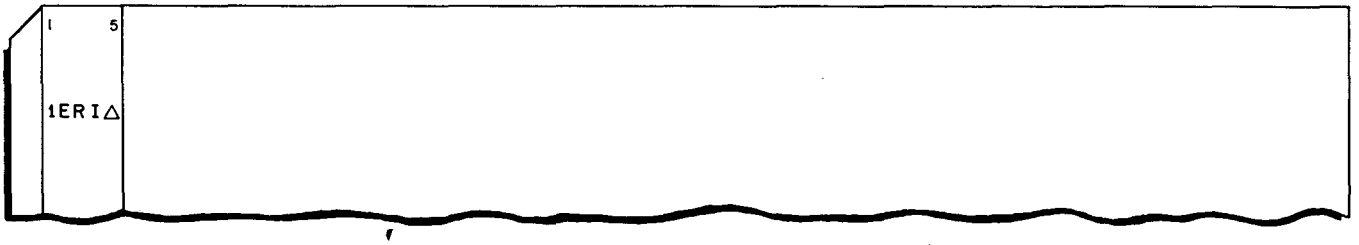

Figure 3-5. Format of Trailer-Label Card for 1/2-Inch Tape

It should be noted that the binary equivalents of the values for the header and trailer records must appear in memory when the record is read. For cards, it is necessary only to punch the Series 200 standard alphanumeric code equivalent of the octal value. The cards will then be read in the normal mode, standard code.

After the card-to-tape conversion is completed, the first and last records on the tape used in the conversion will appear as described below for tape-to-punch and tape-to-printer conversions.

Tape-to-Punch Conversions

The first record on a 1/2-inch tape to be used for a tape-to-punch conversion must be a header record in the format shown in Figure 3-6. For simplicity, the characters depicted on the tape are grouped in 5-character arrays across the width of the tape. It should be kept in mind that such a grouping does not conform to the actual pattern of recorded information on 1/2-inch tapes. Rather, each character occupies one transverse array of bits on the tape (i. e., six data bits, plus a parity bit), and subsequent characters follow in serial fashion. For example, the first five characters of the header label record (viz., 1HDRΔ) would occupy the first five frames (transverse arrays) on the tape.

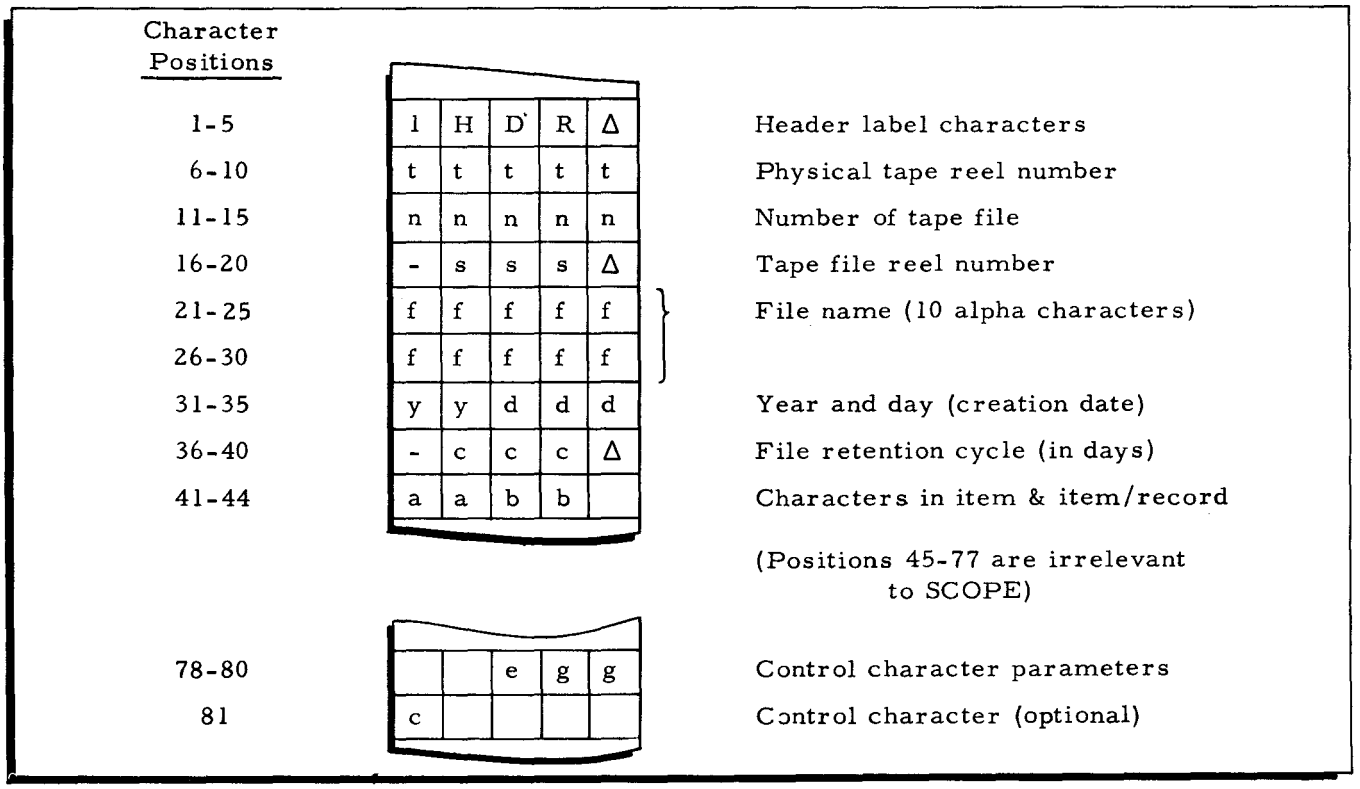

Figure 3-6. 1/2-Inch Tape-to-Punch Header Label Format

The contents of each character position of the header label record in a 1/2-inch tape-to-punch conversion are identical to that outlined on page 3-5, except that character positions six through ten now contain the following:

Positions 6-10: Contain the physical tape reel number in the range 00000 ≤ ttttt ≤ 99999.

The manner in which positions six through ten are generated by SCOPE when the conversion input deck is read and transferred to tape is described in the following paragraph.

When the first (header label) card in the input deck is read, SCOPE assumes that the conversion tape contains the header label record required by Series 200 tape conventions. SCOPE combines the tape serial number of the tape header label with the data from the header label card of the input deck. This is accomplished in the following manner: The first record on tape is read; then the first card in the input deck is read in standard Series 200 alphanumeric mode. Characters six through ten (tape serial number) of the tape header label are transferred by SCOPE to the corresponding positions in the card input buffer. The tape is then rewound, and the generated header-card image is written on the tape as the first record.

The last (trailer label) record for tape-to-punch conversions using 1/2-inch tapes is the terminating record with the format shown in Figure 3-7. If read, a tape mark (octal 17) also terminates a tape-to-punch operation in the same manner as the 1ERIΔ record.

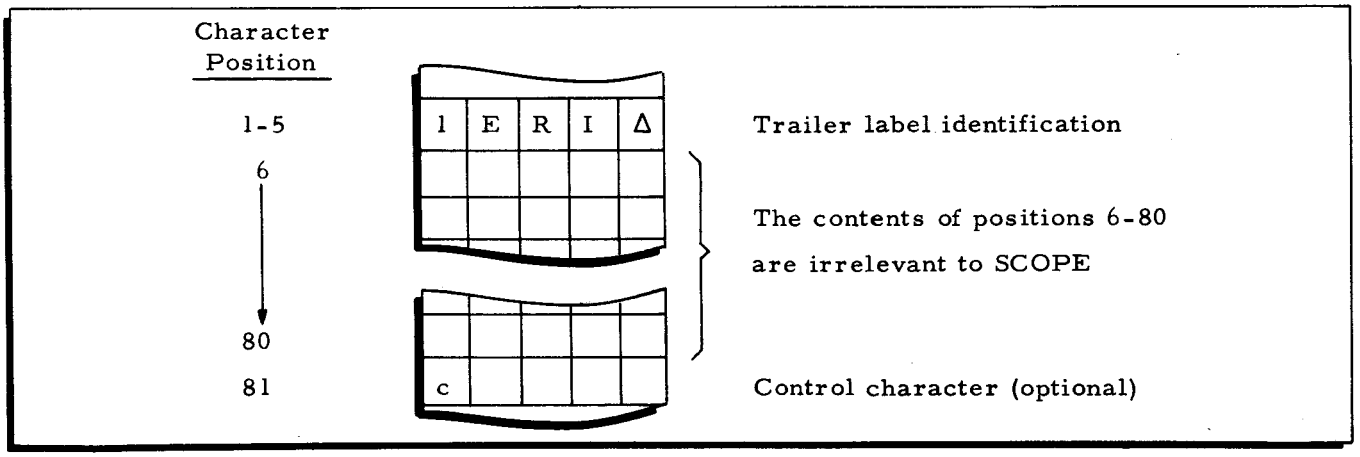

Figure 3-7. 1/2-Inch Tape-to-Punch Trailer Label Format

Tape-to-Printer Conversions

The formats of the header and trailer label records for 1/2-inch tape-to-printer conversions are identical to that described above for tape-to-punch conversions, except for the differences noted below for the header label record.

In a tape-to-printer conversion, characters 41 and 42 of the header label record (designating the number of characters in the item) must be one of the following values:

Number of Print Positions	Octal Value	Decimal Value
120-position line[1]	0171	121
132-position line[2]	0205	133

[1] For a 120-position printer, characters 41 and 42 can have the octal values 171, 172, 173, or 174, or decimal values 121, 122, 123, or 124.

[2] For a 132-position printer, characters 41 and 42 can have the octal values 205, 206, 207, or 210, or the decimal values 133, 134, 135 or 136.

Character 78 of the header label record (which specifies the number of control characters in the conversion record for tape-to-printer operations) can be 1, 2, 3, or 4 in standard SCOPE versions. In other versions, this value may be greater.

Print records must normally contain at least one control character, except when line spacing is controlled by the initiating SCOPE control message (see page 5-7). SCOPE will accept 120 or 132 data characters (132 only if option 031 is present). The values above are for one control character. If more than one control character is present, the values tabulated above should be increased accordingly. Up to four control characters may be present. It should be noted, however, that the last three control characters serve only to define the length of the control character field. In SCOPE, as presently specified, only the first control character is significant.

When character 78 of the header label record contains an octal 01, 02, 03, or 04, characters 79 and 80 (which designate the position of the leftmost control character) must contain either an octal 0001 or a decimal 01.

SECTION IV
SPECIALIZATION OF SCOPE

The standard version of SCOPE, as described in Section I, handles a card reader as device one, a printer as device two, and a card punch as device three. There are, however, a substantial number of other machine configurations for which SCOPE must be specialized. If another configuration is desired, a specific version of SCOPE can be obtained by combining the symbolic decks of the desired coroutines with the decks of the main control routine and the loading and starting control routine (X7). The resulting symbolic program may then be assembled to form the new SCOPE version. In certain special cases, it may be necessary to change one or more of the symbolic cards within a routine. The purpose of this section is to describe this specialization process.

READ/WRITE CHANNEL ASSIGNMENTS

Prior to any description of SCOPE specialization, it should be recalled that in some instances a SCOPE operation will be performed at a somewhat slower speed. This is due, in part, to the fact that the three read/write channels must be shared by four devices, viz., the three terminal devices (card reader, printer, and card punch) and a tape drive. It can be seen from Table 4-1, which lists the read/write channel assignments, that with the system fully loaded (i.e., with three conversions operating simultaneously) device code 2 operations will be slowed down due to the use of read/write channel 2 for both printer and magnetic tape operations.

Table 4-1. Read/Write Channel Assignments

Peripheral Device	Standard Device Code	Read/Write Channel
Card Reader	1	1
Printer	2	2
Card Punch	3	3
Magnetic Tape Drives	5-7	2

If there is a read/write channel which is not assigned to a terminal device (i.e., fewer than three terminal devices are currently being used), a magnetic tape drive will use the unassigned channel. Otherwise, magnetic tape drives normally use read/write channel 2. However, this decision is made at execution time rather than at assembly time.

In most instances, it is desirable to follow standard procedure and assign the printer as device 2 because the printer has the shortest cycle time of the three terminal devices. Therefore, there will be more time to perform tape operations if the tapes share a read/write channel with the printer. For example, if the punch were being used and assigned as device 2, tape records could be read or written only after the completion of the physical processing interval of the card punch. If a card-to-tape conversion were also in progress, this would have the net effect of slowing the card reader down to card punch speed.

SCOPE ROUTINES

As previously noted, specialization of SCOPE requires combining the symbolic decks of the desired coroutines with the compulsory main control routine and the loading and starting control routine. The two compulsory routines and each of the device coroutines are assigned one or more identification numbers which are used as the first two digits of the number field of the symbolic cards. Thus, it is necessary for a routine which is too large to have all of its card numbers identical in the first two digits to be assigned more than one identification number. In this case, the notation xx is used to denote the routine whose cards are all numbered beginning with xx, and xx-yy is used to denote the routine whose card numbers range from xx000 to yy999. Table 4-2 lists the various SCOPE routines, their identification numbers, and their uses.

Table 4-2. SCOPE Routines

Identification Number	Routine	Use
00 - 04	Main Control Routine	The main control routine is always included in the basic SCOPE deck.
00	EQU's and CEQU's	
01	Tape buffers	
02	Monitor	
03	Constants	
04	Initialization	
05 - 06	Routine for one 3/4-inch TCU	One, but only one, of these coroutines must be included if SCOPE is to use any tapes.
07 - 08	Routine for one 1/2-inch TCU	
18 - 20	Routine for more than one TCU; may be a combination of 1/2- and 3/4-inch TCU's.	

Table 4-2 (cont). SCOPE Routines

Identification Number	Routine	Use
11 or A1*	Card Reader routine (H-800/1800 item format)	One, but only one, of these coroutines must be included if SCOPE is to use a terminal device designated as device 1. This terminal device will use tape 1 if it is involved in an independent conversion operation.
21	Printer routine (H-800/1800 item format)	
31 or C1*	Card Punch routine (H-800/1800 item format)	
15 or A5*	Card Reader routine (Series 200 item format)	
25	Printer routine (Series 200 item format)	
35 or C5*	Card Punch routine (Series 200 item format)	
12 or A2*	Card Reader routine (H-800/1800 item format)	One, but only one, of these coroutines must be included if SCOPE is to use a terminal device designated as device 2. This terminal device will use tape 2 if it is involved in an independent conversion operation.
22	Printer routine (H-800/1800 item format)	
32 or C2*	Card Punch routine (H-800/1800 item format)	
16 or A6*	Card Reader routine (Series 200 item format)	
26	Printer routine (Series 200 item format)	
36 or C6*	Card Punch routine (Series 200 item format)	
13 or A3*	Card Reader routine (H-800/1800 item format)	One, but only one, of these coroutines must be included if SCOPE is to use a terminal device designated as device 3. This terminal device will use tape 3 if it is involved in an independent conversion operation.
23	Printer routine (H-800/1800 item format)	
33 or C3*	Card Punch routine (H-800/1800 item format)	
17 or A7*	Card Reader routine (Series 200 item format)	
27	Printer routine (Series 200 item format)	
37 or C7*	Card Punch routine (Series 200 item format)	
X7	Loading and Starting control routine	This routine is always included in the basic SCOPE deck.

*Card read and punch routines 1x and 3x include transcription mode reading and punching, whereas Ax and Cx do not.

CHANGING SCOPE PARAMETER VALUES

The SCOPE routines use "standard" values for parameters such as control unit numbers, tape gap sizes, buffer sizes, etc. In addition to combining the symbolic decks of the required coroutines with the two compulsory routines, a non-standard peripheral configuration may require an additional step. It may at times be necessary to change the parameter value of one or more of the symbolic cards within a SCOPE coroutine. These changes may be made as outlined in Table 4-3.

If SCOPE is to be loaded by the Series 200/Operating System - Mod 1, it must be assembled in 3-character addressing mode with the Clear card moved to the front of the program. In this case, line number 01000 must be changed to reflect the following:

```
ORG    1340
```

This change is necessary since the Tape Loader-Monitor C occupies main memory locations 64 through 1339.

Table 4-3. Permissible Changes for SCOPE Parameters

Parameter	Present Instruction		Reason For Change	Permissible Changes	
	Operation Code	Operand		Line Number	Change Operand To:
Address Mode	ADMODE EQU ADMODE ADMODE	2 2 2 2	To change from 2- to 3-character addressing mode.	00002 00010 03300 04870	3 3 3 3
Tape control number for single TCU (used with routines 05-06 and 07-08 only)	CEQU	#1C40	To change the address of a tape control.	00070	Tape control number[2] with high-order 1 bit.
	CEQU	#1C00		00080	Tape control number[2] with high-order 0 bit.
Tape control number for multiple TCU's (used with routine 18-20 only)	DCW	#1C40	To change the address of a tape control.	03022	Tape control number for tape 0 with high-order 1 bit (punch L in Mark column if 1/2-inch tape).
	DCW	#1C40		03023	Tape control number for tape 1 with high-order 1 bit (punch L in Mark column if 1/2-inch tape).
	DCW	#1C40		03024	Tape control number for tape 2 with high-order 1 bit (punch L in Mark column if 1/2-inch tape).

Table 4-3 (cont). Permissible Changes for SCOPE Parameters

Parameter	Present Instruction		Reason For Change	Permissible Changes	
	Operation Code	Operand		Line Number	Change Operand To:
	DCW	#1C40		03025	Tape control number for tape 3 with high-order 1 bit (punch L in Mark column if 1/2-inch tape).
Parity and gap size for 1/2-inch tapes. (NOTE: Do not change for 3/4-inch tapes.)	DC	#460606060	To change parity and/or record gap size.	03030	#4C$x_0$0$x_1$0$x_2$0$x_3$0: where x_i specifies parity and gap size for drive i: x_i = 2: Short gap, odd parity x_i = 3: Short gap, even parity x_i = 6: Standard gap, odd parity x_i = 7: Standard gap, even parity
Card reader control unit (CRCU) number.	CEQU	#1C41	To change the address of a peripheral device.	cr001[1]	CRCU number
Card Punch control unit (CPCU) number.	CEQU	#1C01		cp001[1]	CPCU number
Printer control unit (PRCU) number.	CEQU	#1C02		pr001[1]	PRCU number
Tape buffer sizes. (NOTE: See "Changing Tape Buffer Sizes" below.)	RESV RESV RESV RESV DSA	192 192 192 192 191	To change the tape buffer size.	01020 01050 01080 01110 03870	Buffer size-tape 3 Buffer size-tape 2 Buffer size-tape 1 Buffer size-tape 0 Size of smallest buffer minus one.
Rewind used when terminating runs.	SST Omitted[3] Omitted[3]	FL, *CM+5, 03	Change only if coroutine 18-20 is being used.	04070 04071 04072	FL, *+CM3+2, 03 KPA-4, *+CM+CM4 +6, 37 FL, *+CM3+5, 03

[1] In this and subsequent tables: cr = Reader routine identification number (1x or Ax); pr = Printer routine identification number (2x); and cp = Punch routine identification number (3x or Cx).

[2] PCU numbers are written exactly like C2 control characters for peripheral instructions; each TCU requires two addresses for input and output, as distinguished by the high-order bit.

[3] Cards must be added with these line parameters.

CHANGING TAPE BUFFER SIZES

It may at times be desirable to shorten (or eliminate entirely) one or more of the tape buffers to make more memory available for own-coding. Assuming that memory is available, tape buffers may also be lengthened in order to process records longer than 192 characters.

If any tape is not to be used, its buffer size may be specified as zero. For some configurations, one tape buffer must be specified as zero. Any buffer may be increased or decreased in size if the records for that tape are larger or smaller than 192 characters. Each buffer, however, must be a multiple of eight characters in length. Only the first n characters of a tape buffer are cleared of record marks by SCOPE, where n is defined in line 03870 of Table 4-3 above. Buffers for tapes involved in independent conversions must be at least as large as indicated in Table 4-4.

Table 4-4. Minimum Tape Buffer Sizes for Independent Conversions

Routine Used	Minimum Buffer Size
11, 12, 13	112 - Normal mode 192 - Transcription mode
A1, A2, A3	112 (Normal mode only)
21, 22, 23	144
31, 32, 33	88 - Normal mode 168 - Transcription mode
C1, C2, C3	88
15, 16, 17	80+8C[1] - Normal mode 160+8C[1] - Transcription mode
A5, A6, A7	80+8C[1]
25, 26, 27	137
35, 36, 37	80+8C[1] - Normal mode 160+8C[1] - Transcription mode
C5, C6, C7	80+8C[1]

[1]C = 1 if a control character is present,
0 otherwise.

OWN-CODING

In a SCOPE deck to be assembled, own-coding may be added to perform such functions as editing and unblocking tape records. Memory for own-coding may be made available in several ways. In some special cases, it is provided by including fewer than three terminal device coroutines or by shortening or eliminating one or more tape buffers (as described above).

In most cases, however, own-coding requires 8K of memory. If 8K of memory is available, there are two ways in which own-coding may be added, depending on the memory space available

after SCOPE, including coroutines and buffers, has been loaded. In all cases, it is recommended that the user assemble SCOPE for the desired configuration without own-coding so that the exact memory space available can be determined. Own-coding can be added as follows:

1. This method should be used if it is possible to load all SCOPE routines without exceeding 4,096 characters. The SCOPE routines are assembled in the two-character addressing mode (as they are in the standard decks), with linkage to the own-coding inserted at the appropriate points as described below. Own-coding should be assembled above location 4,095 and preferably in the 3-character addressing mode (unless an item such as a tape buffer is eliminated), thus enabling the buffers to be easily addressed. The linkage could consist of the following entries:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS	
	1 2 3 4 5	6	7	8 14	15 20	21 62	63 80
1					ADMODE	3	
2					CAM	ØØ	
3					B	OWNCD,	
4					SW	*	
5					CAM	2Ø	
6					ADMODE	2	

Note that the Branch instruction must be executed in the 3-character addressing mode. When method one is used, all of SCOPE, including coroutines and buffers, must reside in the first 4,096-character memory module. Thus, if there is no space to insert the linkages without exceeding 4,096 characters, method two must be chosen.

2. The second method should be used if SCOPE, when used, exceeds 4,096 characters in length. In this case, make the changes indicated above under "Changing SCOPE Parameter Values" to change SCOPE to the 3-character addressing mode. Then either the own-coding itself or linkages to it may be inserted at the appropriate points. Using this method, SCOPE may exceed 4,096 characters. It is recommended that the user assemble SCOPE for the desired configuration without own-coding in order to determine the available memory space. He can then determine the best method for adding the own-coding.

The remainder of this section deals with some of the specific applications of SCOPE own-coding.

Own-Coding to Perform Editing

It may be desirable at times to edit records coming from or going to the various terminal devices. To accomplish this, it is possible to insert own-coding into each of the terminal device coroutines at the points indicated below:

Card Reader: Own-coding may be inserted during independent operations after each card has been read and checked for errors, or before ortho is computed and the record is written on tape.

Printer: Own-coding may be inserted after each record has been read from tape, checked for errors, and moved to the print buffer, but before the vertical formatting information is interpreted and the record is printed.

Punch: Own-coding may be inserted after each record has been read from tape, checked for errors, and moved to the punch buffer, but before the record is punched.

The own-coding routines can address the various buffers by employing the tag BD, where D is the numeric device code assigned, as follows:

Device Code	Device Buffer
1	Device one
2	Device two
3	Device three
5	Logical Tape 1
6	Logical Tape 2
7	Logical Tape 3

If own-coding is to be executed for independent operations, the coding (or linkages to it) must be inserted in two places, as indicated in Table 4-5. A return to the following line in the table must be made (i. e., the second line for each routine).

Table 4-5. Placement of Own-Coding

Routine	Insert Own-Coding After These Line Numbers:
Reader routine - H-800/1800 item format	cr301
Reader routine - Series 200 item format	cr351
Printer routine - H-800/1800 item format	pr111
Printer routine - Series 200 item format	pr111
Punch routine - H-800/1800 item format[1]	cp172
Punch routine - Series 200 item format[1]	cp171
Punch routine H-800/1800 item format[2]	cp161
Punch routine - Series 200 item format[2]	cp151
[1]Normal mode [2]Transcription mode	

Own-Coding for Selective Printing or Punching

If records for various reports are interspersed on a tape to be printed or punched, own-coding can, in any given run, select the records to be printed or punched.

The simplest way to bypass the printing or punching of a record is to move a NOP instruction to the location normally containing the PDT instruction. To print or punch a bypassed record, simply restore the PDT instruction. The line numbers wherein the PDT instruction can be located in the routines are shown below:

Routine	PDT Line Number
Printer routine - H-800/1800 item format	pr390
Printer routine - Series 200 item format	pr260
Punch routine - H-800/1800 item format	cp220
Punch routine - Series 200 item format	cp220

Own-Coding for Unblocking Printer and Punch Tapes

If output tapes are blocked, or if the records otherwise do not follow the formats described for reader, printer, and punch conversions, own-coding may be incorporated to perform the following functions:

1. Move each item from the tape buffer to the printer or punch buffer;
2. Set up the vertical formatting character in the first position of the printer buffer;
3. Check for end of data and set an internal switch to enable SCOPE to terminate the run; and
4. Set an internal switch for the tape control coroutine when another record is available for reading.

The first location of the buffer may be referred to by the tag BD, where D is the device code assigned to the terminal device (see page 1-7).

At the end of data on tape, the following instruction should be performed:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE ___ . ___ PAGE ___ OF ___

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62	63 ... 80
				SST	K4,S3,+d+4,,77

When the last (or only) item in the tape buffer has been moved to the printer or punch buffer, the following instruction should be performed so that SCOPE will read another record:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE ___ . ___ PAGE ___ OF ___

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62	63 ... 80
				MCW	K42,S2+d+4

The coding in SCOPE which performs similar functions must be removed and replaced by the own-coding, and return to SCOPE must be made according to Table 4-6 below.

Table 4-6. Coding Removed and Replaced by Own-Coding

Routine	Remove Line Numbers	Return to Line Number
Printer - H-800/1800 item format	pr110 - pr180 pr540 - pr590	pr260
Printer - Series 200 item format	pr110 - pr170 pr350 - pr380	pr250
Punch - H-800/1800 item format	cp110 - cp180	cp220
Punch - Series 200 item format	cp110 - cp180	cp220

OWN-CODING FOR SPECIFIC NEEDS IN INSTALLATION

Included here are some changes to be made to SCOPE coding to fit specific needs in an installation.

Multi-File Tape to Terminal Device (Printer)

In this case, it is desired to print a multi-file tape, stalling after each file is printed and printing the next file by entering 2t40 into memory as control characters (t = d+4, where d is the terminal device number). Printing a multi-file tape is accomplished by the coding changes outlined below:

Table 4-7. Permissible Changes for Multi-File Tape Printing

Parameter	Present Instruction		Reason For Change	Permissible Changes	
	Operation Code	Operand		Line Number	Change Operand To:
Multi-file tape control.	SST	K4, S3+1+4, 77	To permit printing of multi-file tape.	21150	K54, S2+4+d, 17 (Where d is the device number.)
	SST	K4, S3+2+4, 77		22150	
	SST	K4, S3+3+4, 77		23150	
	SST	K4, S3+1+4, 77		25140	
	SST	K4, S3+2+4, 77		26140	
	SST	K4, S3+3+4, 77		27140	
Multi-file tape terminating control.	B	ZP	To terminate following multi-file tape printing. Terminate as usual, but do not rewind tape.	21080	K70-CM-CM-1
	B	ZP		22080	
	B	ZP		23080	
	B	ZP		24080	
	B	ZP		25080	
	B	ZP		26080	
	B	ZP		27080	

Buffers and Records of Unequal Length

When changing tape buffers (which are presently of equal length) to buffers of unequal length, only the low-order portions of the larger tape buffers are cleared. If the system includes the Advanced Programming Instructions Feature, remove line numbers 04480 through 04570 and substitute the following coding:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
	1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62
1	ØØ48Ø				SST	FL,*+CM3+2,Ø7
2	ØØ49Ø				MCW	S4+ØØ,*+CM3+1
3	ØØ5ØØ				LCA	SA+ØØ,12
4	ØØ51Ø				MCW	KBL-7,1+X3
5	ØØ52Ø				EXM	1+X3,2+X3,35
6	ØØ53Ø				SI	
7	ØØ54Ø				SI	
8	ØØ55Ø				CW	

To remove the restriction in SCOPE that the tape records should be the same length in the area of backspacing on the tape, also insert the above coding prior to line 05240, 07170, or 18280.

Operating With 3/4-Inch Tapes in H-400/1400 Item Format

If the 3/4-inch tapes being read do not have an H-800/1800 end-of-record (EOR) word but do have Orthotronic words (i.e., the tape is from a Honeywell 400/1400), the following two line numbers must be changed if the record on tape is to be channel corrected:

Line Numbers	Change	
	Op Code	Operand
06610	From BS	K9, 0H+CM
19520	To BS	K1, 0H+CM

SECTION V
SCOPE OPERATING PROCEDURES

SCOPE conversion operations may be started and terminated by the operator independently of each other. The SCOPE program is activated by setting SENSE Switch 4 on the control panel to ON. Further, if a SCOPE operation is being performed, SENSE Switch 3 must be OFF.

A restriction observed by SCOPE is that only two peripheral devices may be involved in one given conversion operation (e. g. , a card-to-tape conversion). In other words, three independent peripheral conversions may be in process, but the two peripheral devices being used by each conversion are unique to the particular version of SCOPE being used and cannot, therefore, be used by any other conversion. When it is desirable to operate using a different version of SCOPE, the SCOPE program may be reassembled and reloaded to conform to one of a number of possible desired peripheral configurations, as outlined in Table 1-1, page 1-5.

Honeywell is prepared to supply the specific version of SCOPE required by each user. Whether or not each installation receives the complete SCOPE package depends on the peripheral device configuration existing in that installation. For example, an installation which does not employ a printer in its data processing applications obviously cannot make use of a printer coroutine. Therefore, the symbolic SCOPE program deck supplied to each user is "tailored" to the needs of the installation. That is, it includes only the compulsory portions of the SCOPE program deck (viz. , the main control routine and the loading and starting control routine) and those additional coroutines enabling the user to manipulate the particular peripheral devices in his system. It should be noted also that a tape control unit (TCU) coroutine must be included in the deck, since all SCOPE conversions employ magnetic tape.

COMPOSITION OF SCOPE COROUTINES

Through the use of the routine identification numbers listed in Table 4-2, page 4-2, the user may request the desired SCOPE coroutines for a specific machine configuration. Each SCOPE coroutine has the format illustrated in Figure 5-1.

It should be noted that there are two special cards included with each SCOPE routine or coroutine, the CORT card and the COEND card.

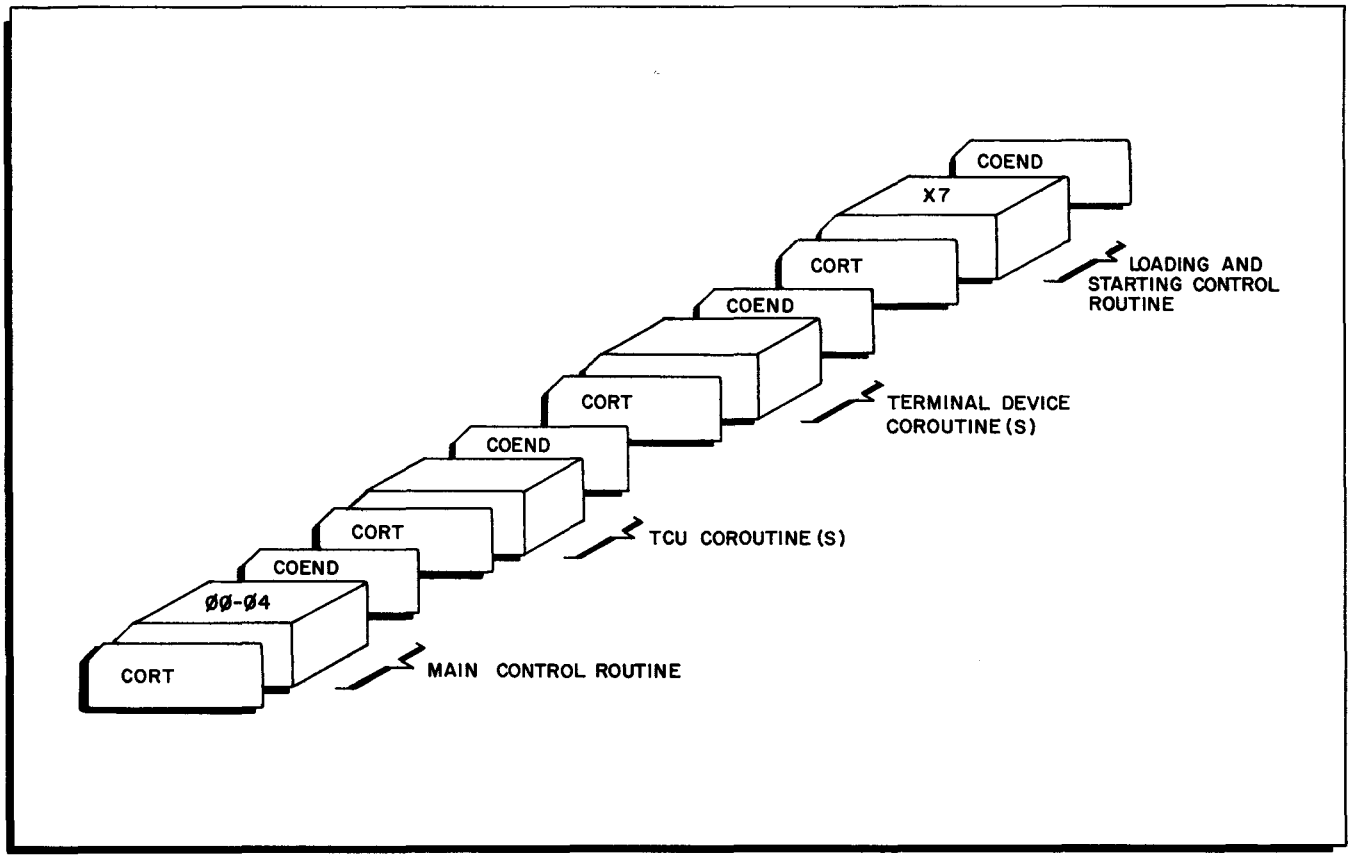

Figure 5-1. Format of SCOPE (Co)Routines

CORT

This card is placed at the beginning of each routine or coroutine and is punched as follows:

Column 6: Contains an asterisk(*) to denote that this is an Easycoder remarks statement.

Column 7: Contains the letter "T" to indicate that a "hash" total is desired for this (co)routine.

Columns 15-18: Contain the label CORT.

Columns 21-22: Contain the routine identification number, which is the same as that indicated in Table 4-2, page 4-2. Note, however, that when more than one identification number is assigned to a particular routine, only the first number is listed (e.g., the main control routine with its identification number 00-04 will have 00 in columns 21-22).

Columns 27-29: Should remain blank.

Columns 30-35: Contain the name of the subsystem. This will appear as CORT plus the identification number of the particular routine or coroutine. For example, the name for the 3/4-inch tape control coroutine will appear as CORT05, and similarly, CORT00 will specify the name of the main control routine.

Columns 73-80: Should remain blank.

COEND

This card is placed at the end of each routine or coroutine deck and is punched as follows:

Column 6: Contains an asterisk(*) to denote that this is an Easycoder remarks statement.

Columns 15-19: Contain the label COEND.

Columns 60-62: Contain the "hash" total. This total, through the use of the program Card 200 Symbolic Update, will enable a check to be made on each routine, thus ensuring that cards have not been erroneously left in or removed from the deck.

COMPOSITION OF SCOPE SYMBOLIC PROGRAM DECK

The customer receives each (co)routine in the format described and illustrated above. When making up the SCOPE program deck, the physical arrangement of the SCOPE (co)routines should conform to that shown in Figure 5-2.

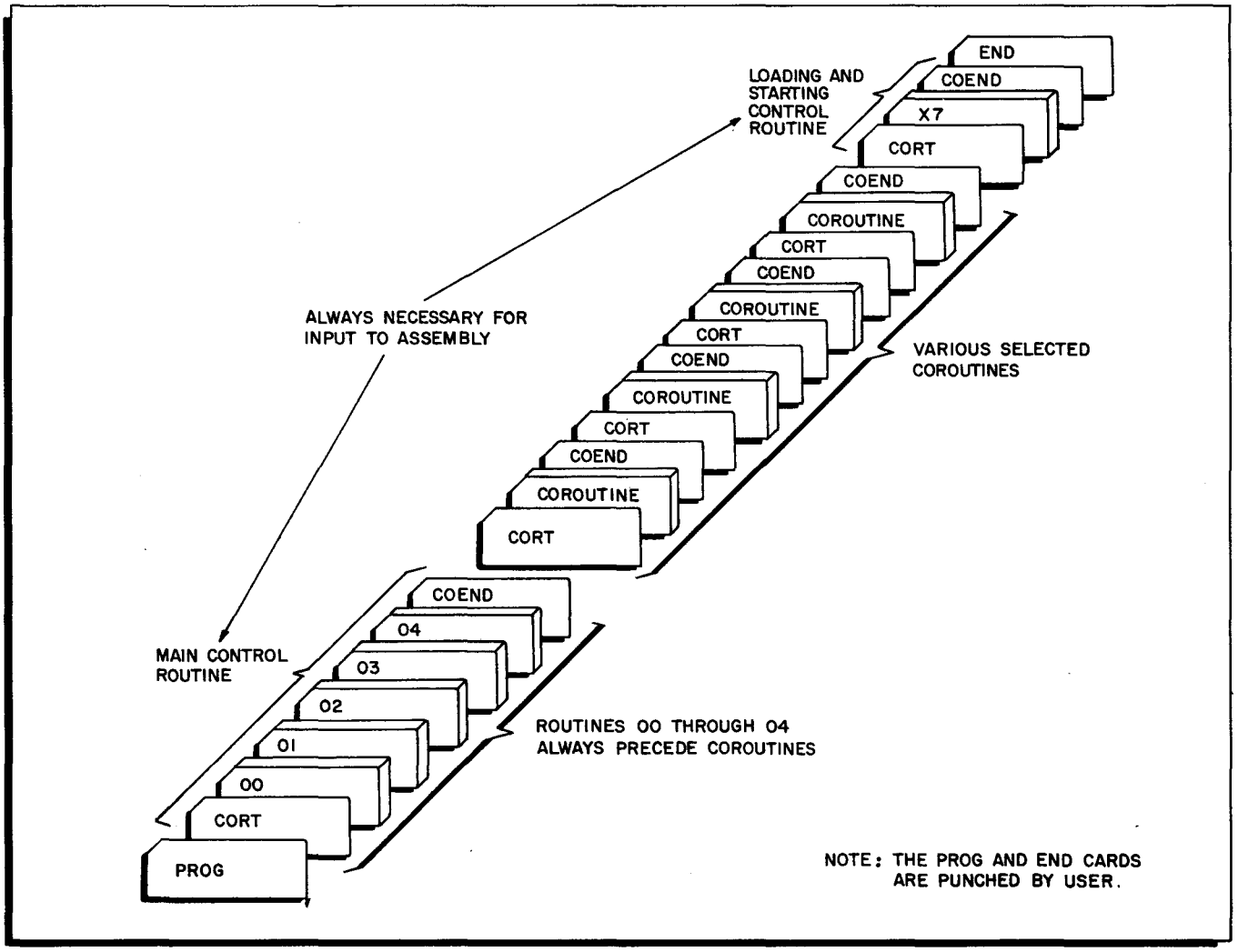

Figure 5-2. SCOPE Deck for Input to Assembly

The PROG card is always the first card and the END card is always the last card in the symbolic source program deck. They are coded as usual, except that the letter "T" must not be punched in column seven. The reason for this restriction is that although the "hash" total may be obtained for each individual coroutine, it may not be obtained for the entire program. The PROG (program header) and END cards are coded and punched by the user, according to the requirements of the Easycoder Assembler to be used. Regardless of which Easycoder Assembler is used, a programmer-defined name for the symbolic SCOPE program is punched on the PROG card.

ASSEMBLING THE SCOPE SYMBOLIC DECK

The initial setup procedures for assembling a SCOPE symbolic program deck include the selection of the desired coroutines for the input/output devices to be used and the energizing and loading of the selected devices. The specific procedures to accomplish initial setup depend on which combination of input/output devices is to be used. In each case, however, the corresponding peripheral devices must be energized and prepared to receive read and write instructions.

When SCOPE runs in the Basic Programming System, it is known as Simultaneous Media Conversion A. Under this system, SCOPE may be assembled by Easycoder Assembler A or Easycoder Assembler B. When SCOPE runs in the Operating System - Mod 1, it is known as Simultaneous Media Conversion C. Under this system, SCOPE may be assembled by Easycoder Assembler C or Easycoder Assembler D. Consult the pertinent Easycoder operating procedures manual for assembly instructions.

LOADING THE SCOPE OBJECT PROGRAM

In the Basic Programming System, the SCOPE object deck or SLT is loaded by Card Loader A, Card Loader B, or Tape Loader/Search A. Operating procedures for the Basic Programming System loaders may be found in Easycoder 4K Operating Procedures (DSI-243) and Easycoder B Assembly System (File No. 123.1105.000B.0-011). In the Operating System - Mod 1, the SCOPE object program may be loaded by any of the Mod 1 loaders (e.g., Tape Loader-Monitor C, Card Loader-Monitor B, Floating Tape Loader-Monitor C), as described in the appropriate publication. The console call name for the SCOPE object program is identical to the user-defined name punched on the PROG card.

SENSE Switch 4 must be ON when the SCOPE object program is loaded, regardless of operating environment. The SENSE Switch setting causes the SCOPE program to halt after loading. The operator must then enter control messages into memory to initiate any desired conversion operation. These procedures are outlined below.

INITIATING AND TERMINATING CONVERSION OPERATIONS

Initiating, terminating, restarting, and mode of performance of SCOPE operations are controlled by means of control messages whose octal values are entered into the control panel by the operator. One of these messages is entered into main memory for each media conversion operation to be performed. Each character in a SCOPE control message is composed of six bits. It is possible to enter into memory as many as four characters. However, in the fourth character the high-order bit (bit 19) is the only bit significant to SCOPE; bits 20-24 are ignored. The first 12 bits (characters one and two) serve the functions of activating and deactivating conversion operations. Bits 13-18 (character 3) specify error-handling control, mode of operation, and the character code in card operations. The first and second characters are interpreted as follows (characters are represented in octal notation).

The parameter d is a unique numeric device code (see Table 1-2, page 1-7) referring to a particular terminal device under SCOPE's control. This code is assigned when SCOPE is assembled. Table 1-2 contains the standard device codes used by SCOPE; however, device codes 1, 2, and 3 may be changed, if desired, when SCOPE is assembled.

CONTROL MESSAGE			ACTION
Bit Position	1→6	7→12	Initiate a media conversion operation using terminal device d and the tape unit whose logical address is d.
Binary Value	100xxx	111100	
Octal Value	4 d	7 4	
	Char. 1	Char. 2	
Bit Position	1→6	7→12	Terminate the in-process media conversion operation using device d and the tape unit whose logical address is d.
Binary Value	100xxx	000100	
Octal Value	4 d	0 4	
	Char. 1	Char. 2	

Up to seven additional bits beyond the first twelve are included in each SCOPE control message which activates either a card-to-tape or a tape-to-punch operation. Bits 13-18 constitute the third control character, and bit 19 is the high-order bit of the fourth control character (bits 20-24 of this character are not significant to SCOPE). These seven additional bits specify the mode and character code of card reading or punching and the procedures to be followed upon detection of errors.

ENTERING SCOPE CONTROL MESSAGES

Beginning with location 00001, data is entered left-justified into consecutive main memory locations from the control panel one six-bit character at a time. Thus, the length of a SCOPE control message must be a multiple of six bits; low-order zeros should be added where necessary.

General Procedure

The general procedure for entering a SCOPE control message into main memory follows:

1. Set SENSE Switch 4 ON and wait for the programmed halt to occur;
2. Beginning with the leftmost control message character, enter the characters into as many ascending character locations as are required by the message. The first character is entered into location 00001, the second character into location 00002, etc. If no more control messages are to be entered, set SENSE Switch 4 OFF and depress the RUN button. If, and only if, more than one control message is to be entered, leave SENSE Switch 4 ON and depress the RUN button. After entering each control message, depress the RUN button. SCOPE will then perform the requested action and come to a programmed halt; and
3. Following the last entry, set SENSE Switch 4 OFF and depress the RUN button.

Starting and Terminating Conversions

Conversion operations may be started and terminated independently of each other by the operator.

The termination of independent operations is, in most cases, automatically effected upon detection by SCOPE of the terminating record, as described for each of the terminal devices in the following pages. Manual termination may be used to stop the conversion before the terminating record is reached or when the terminating record is not present in the conversion data.

When a conversion is terminated automatically, the tape is rewound, and the other operations in progress proceed uninterrupted. When an operation is terminated manually, the tape is not rewound, and the other operations are halted for the duration of the manual intervention at the operator's control panel (i.e., while the machine is in the STOP mode).

The procedures for manually starting and terminating conversions follow:

1. To start an independent conversion operation using terminal device d (d is the numeric device code outlined in Table 1-2, page 1-7);
   a. Set SENSE Switch 4 ON and wait for the programmed halt to occur;
   b. After the halt has occurred, enter the two octal starting-control characters into main memory. The first octal character has the format 4d and is entered into location 00001; the second octal character is 74 and is entered into location 00002;
   c. One or two additional octal characters may have to be entered into locations 00003 and 00004, respectively, to define the desired peripheral conversion further. These additional characters depend on the type of operation being started and the particular peripheral devices involved. The additional control characters necessary to define conversions using the terminal devices (i.e., the printer, the card punch, and the card reader) are described separately beginning on page 5-7;
   d. Set SENSE Switch 4 OFF;
   e. Depress the RUN button.

2. To terminate an independent conversion operation using terminal device d:

   a. Depress the STOP button;

   b. Set SENSE Switch 4 ON;

   c. Depress the RUN button and wait for the programmed halt to occur;

   d. After the halt has occurred, enter the terminating-control characters into main memory. The first and second characters have the octal format 4d and 04 and are entered into main memory locations 00001 and 00002, respectively (d is the numeric device code assigned to the particular terminal device being used in the conversion);

   e. Set SENSE Switch 4 OFF;

   f. Depress the RUN button. It should be noted that the conversions which were operating at the time of the manual intervention by the operator will now proceed as before.

Starting Tape-to-Printer Conversions

To start a tape-to-printer operation, normally only two characters (as described on page 5-6 for starting conversions) need to be entered into main memory, since no mode or error-handling information is necessary. (NOTE: The printer always stops on print errors.) Vertical formatting is controlled by control information within each print record.

A special option is provided to enable tapes which are not true print tapes (e. g., a card-image tape) to be printed in independent operations. To exercise this option, a third character in the binary form 10nnnn may be entered into location 00003 of main memory. The printer coroutine will then print each record (up to 120 or 132 print positions) and space nnnn lines after printing. No control information is necessary in the records when using this option.

When 120-character print images in H-400/1400 or H-800/1800 item format are being printed on a 132-position printer, the octal value 40 may be entered into location 00004 of main memory as the fourth character to prevent the Orthotronic words from being printed in positions 121-132. Word 19 of a standard H-800/1800 120-character print-image record is an end-of-record word (see Figure 3-2). The end-of-record word is optional for an H-400/1400 120-character print-image record. Whenever word 19 of a 120-character print-image record is an end-of-record word, the fourth control character need not be entered. For such records, SCOPE automatically uses only 120 character positions of a 132-position printer. NOTE: The print tape is always rewound at the beginning of a print conversion run.

Control Information:

The control word for 3/4-inch tape in H-800/1800 item format is the first word of each record and must follow H-800/1800 conventions. If the control word specifies end-of-form

sensing, a maximum of 15 lines will be spaced after printing, unless the printer detects the end of form. When control words are not present on a 3/4-inch tape, automatic termination of the conversion does not occur.

The control character(s) for 1/2-inch tapes in Series 200 item format is the first character in each record. The number of control characters is specified by character 78 of the 1HDRΔ (header label) record. These n characters appear immediately preceding the print image. This value can be 1, 2, 3, or 4, depending on the number of control characters present. The first (or only) control character is assumed to be the third character (C3) of the PDT instruction for printing that line (see Tables 5-1 and 5-2). The remaining control characters of the PDT instruction are not interpreted by SCOPE.

Table 5-1. Line-Spacing Parameters for Type 206 Printer

PDT Control Character C3 Configuration	Interpretation
00nnnn[1]	Print, then space the number of lines specified by nnnn (0001 ≤ nnnn 1111).
01nnnn[1]	Print, then space to head of form, if the end of form is sensed; otherwise, space the number of lines specified by nnnn (0001 ≤ nnnn ≤ 1111).
11nnnn[1]	Do not print; space the number of lines specified by nnnn (0001 ≤ nnnn ≤ 1111).
100011	Print, then space to head of form.
101111	Do not print; space to head of form.
[1]nnnn is a binary number	

Automatic Termination of Printer Operations:

The printer operation is terminated upon detection of either the terminating record (see below) or the end of the tape. The terminating record (or the record causing the end-of-tape signal) is printed, the tape is rewound, and the appropriate conversion routine is deactivated (i. e., set to the inactive status).

The terminating record for 3/4-inch tapes is the record containing the end-run bits (bits 13 and 14) in the control word. If either of these bits is a "1", the conversion is terminated. When a control word is not present, there will not be a terminating record for 3/4-inch tapes.

The terminating record for 1/2-inch tape is the record containing 1ERIΔ in characters one through five. Also, a record containing a tape mark (octal 17) will terminate the conversion. Character one of the trailer label record (1ERIΔ) is the control character that terminates the conversion, or it may be the first data character, if the optional third control character was not entered by the operator at the time the initiating SCOPE control message was entered (see page 5-7).

Table 5-2. Line-Spacing Parameters for Type 222 Printers[1]

PDT Control Character C3 Configuration	Interpretation
00nnnn[2]	Print, then space the number of lines specified by nnnn (0000 ≤ nnnn ≤ 1111).
01nnnn[2]	Print, then space to channel one of the format tape (HOF), if channel two of the format tape (EOF) is sensed; otherwise, space the number of lines specified by nnnn (0000 ≤ nnnn ≤ 1111).
11nnnn[2]	Do not print; space the number of lines specified by nnnn (0000 ≤ nnnn ≤ 1111).
100xxx	Print, then space to channel xxx.
101xxx	Do not print; space to channel xxx.
000	Channel 3
001	Channel 4
010	Channel 5
011	Channel 1 (Head of form)
100	Channel 6
101	Channel 7
110	Channel 8
111	Channel 1 (Head of form)

[1] The 222 printers may print only one-half inch tapes under SCOPE conversions. Records containing control information for the 222 printer may not be printed on the 206 printer.

[2] nnnn is a binary number.

Starting Card Punch Conversions

To start a tape-to-punch conversion, it is necessary to enter three characters into main memory. The format of the first two characters and the locations into which they are entered are the same as that described on page 5-6 for starting conversions. The third character (bits 13-18 of the initiating SCOPE control message), which is entered into location 00003, takes the binary form mmpqxx where:

Bits 13 & 14: Specify the conversion mode and the character code of a card punching operation.

mm = 01 - Series 200 transcription mode (format differs from that of card reader transcription mode).

10 - Alphanumeric mode, Series 200 standard code.
11 - Alphanumeric mode, H-800/1800 code.

Bits 15 & 16: Specify the treatment of hole-count errors detected while punching cards.

pq = 00 - Do not eject hole-count error cards.
1x - Eject hole-count error cards.
x0 - Do not stop[1] punching cards after detecting hole-count error.
x1 - Stop[1] punching cards after detecting hole-count error.

Bits 17 & 18: These bits are not used.

xx = 00 - These bits are always set to zeros.

The tape is always rewound at the beginning of the conversion. Direct transcription mode data format follows Series 200 conventions, not H-800/1800 conventions. Note that the positions of the CHECK PROCESS switch on an H-800/1800 card punch device may be closely simulated by using the appropriate combinations of values in bits 15 and 16. The bit configurations corresponding to each switch position are given in Table 5-3. Note also that the function normally controlled in H-800/1800 off-line tape-to-punch systems by the punch record control word (i.e., specification of conversion mode and character code) is performed by bits 13 and 14 of the SCOPE control message.

Table 5-3. Control Messages Simulating H-800/1800 Card Device Switches

H-800/1800 Device	Switch	Switch Position	Corresponding SCOPE Control Message Char. 3	Char. 4
CARD READER	CODE	FULL	11xxxx	--
		TRANSCRIBE	01xxxx	--
	CHECK PROCESS	NORMAL	xx00xx	--
		EJECT	xx10xx	--
		DISCARD	xx10x0	100000
		STOP	xx11xx	--
	*ILLEGAL PUNCH PROCESS	NORMAL	xxxx00	--
		EJECT	xxxx10	--
		DISCARD	xxx010	100000
		STOP	xxxx11	--
CARD PUNCH	CODE	FULL	11xxxx	--
		TRANSCRIBE	01xxxx	--
	CHECK PROCESS	RUN	xx0000	--
		STOP	xx01xx	--

*Not active in transcription mode

[1] For independent operations, this is a simulated card punch stop (i.e., the punch does not become busy, but will not resume the conversion until the operator takes appropriate action). The control message configurations for simulating H-800/1800 card punch switch settings are summarized in Table 5-3.

Table 5-4 summarizes the SCOPE control messages for the card punch. The control message characters are shown in octal notation.

Table 5-4. Control Message Characters for Card Punch

Simulated Switch Settings	Reader Code		
CHECK PROCESS	H-800/1800	Series 200	Transcription
RUN	43 74 60	43 74 40	43 74 20
EJECT	43 74 70	43 74 50	43 74 30
STOP	43 74 64	43 74 44	43 74 24

Control Information:

The control word (word one of each record) for 3/4-inch tape in H-800/1800 item format follows H-800 conventions, except that bits 16 and 17 (which specify normal or transcription mode for H-800 tapes) are not interpreted by SCOPE. Instead, the mode is established by the operator in the first two bits (mm above) of the third character in the control message when the conversion is initiated. In installations where transcription mode punching is available, this mode is normally used.

Orthotronic correction of tape read errors is performed by SCOPE in 3/4-inch tape-to-punch operations.

A control character for 1/2-inch tapes in Series 200 item format is optional on punch image tapes. If this character is present, it is the last character of the record. However, it performs no function in SCOPE as presently specified. The presence of a control character probably indicates that the tape was created by a SCOPE card-to-tape conversion.

Only odd-parity 1/2-inch tapes may be used as input to tape-to-punch operations, unless the relevant coroutine is modified at assembly time or by own-coding at object run time.

Automatic Termination of Punch Operations:

The punch conversion is terminated upon detection of either the terminating record or the end of tape. The terminating record (or the record containing the end-of-tape signal) is punched, the tape is rewound, and the conversion routine is set to the inactive status.

The terminating record for 3/4-inch tape is the record containing the end-run bits (bits 13 and 14) in the control word. If either of these bits contains a "1", the conversion operation is terminated.

The terminating record for 1/2-inch tape is the record containing 1ERIΔ in characters one through five. A tape mark in the record (octal 17) will also terminate the conversion.

Starting Card Reader Conversions

To start a card reader operation, the operator must enter three or four characters into main memory, depending on the desired operations. The format of characters one and two (bits one through twelve) and the locations into which they are entered are the same as that described in the general starting procedure outlined on page 5-6. The format of characters three (bits 13-18) and four (bits 19-24), which are entered into locations 00003 and 00004, respectively, is described below.

Character three takes the binary form mmpqrs where:

Bits 13 & 14: Specify the conversion mode and the character code of the card-read operation.

- mm = 01 - Transcription mode
- 10 - Alphanumeric mode, Series 200 standard code
- 11 - Alphanumeric mode, H-800/1800 code

Bits 15 & 16: Specify the treatment of hole-count errors detected while reading cards.

- pq = 00 - Do not eject cards containing hole-count errors.
- 1x - Eject cards containing hole-count errors.
- x0 - Do not set card reader to busy status after detecting hole-count error.
- x1 - If hole-count error is detected, set card reader to busy status.

Bits 17 & 18: Specify the treatment of illegal punches detected while reading cards (see also bit 19 below).

- rs[1] = 00 - Do not eject cards containing illegal punches.
- 1x - Eject cards containing illegal punches.
- x0 - Do not set card reader to busy status after detecting illegal-punch card.
- x1 - If an illegal punch is detected, set card reader to busy status.

Note that the setting of pq in the control message character corresponds to the setting of the CHECK PROCESS switch, and that the setting of rs corresponds to the ILLEGAL PUNCH PROCESS switch on an 827 card reader (see Table 5-3).

One other option is available for processing cards with hole-count or illegal-punch errors. This option allows error cards to be bypassed, i.e., not written on the conversion tape. If it is exercised, a fourth character having a "1" in bit 19 (i.e., an octal 40) must be entered into location 00004 of main memory. The option applies to both hole-count and illegal-punch errors, and it should be noted that it (in conjunction with the pq and rs bits when they equal 10) corresponds to the DISCARD mode of the 827 card reader (see Table 5-3).

[1] Not checked if mm = 01 (transcription mode)

Bit 19: Specifies the treatment of both hole-count and illegal-punch errors detected while reading cards.

x = 1 - Bypass card images containing either hole-count errors or illegal punches.
0 - Do not bypass card images (i.e., transfer all images to tape).

Bit 19 (the high-order bit in the fourth control character) is assumed to be zero, unless a "1" is entered for it; therefore, the zero value (and thus a fourth six-bit character) need not be entered into memory, unless it is desired to bypass card images.

By using various settings of bits 13 through 19 in different combinations, positions of the H-800/1800 card reader switches CODE, CHECK PROCESS, and ILLEGAL PUNCH PROCESS may be closely simulated. The bit configurations corresponding to each position are given in Table 5-3.

Table 5-5 below is a summary of the SCOPE control messages for the card reader. The control message characters are shown in octal notation.

Table 5-5. Control Message Characters for Card Reader

Simulated Switch Settings		Reader Code		
ILLEGAL PUNCH PROCESS	CHECK PROCESS	H-800/1800	Series 200	Transcription
Normal	Normal	41 74 60	41 74 40	41 74 20
Eject	Normal	41 74 62	41 74 42	
Stop	Normal	41 74 63	41 74 43	
Normal	Eject	41 74 70	41 74 50	41 74 30
Eject	Eject	41 74 72	41 74 52	
Stop	Eject	41 74 73	41 74 53	
Normal	Stop	41 74 74	41 74 54	41 74 34
Eject	Stop	41 74 76	41 74 56	
Stop	Stop	41 74 77	41 74 57	
Discard	Discard	41 74 72 40	41 74 52 40	41 74 32 40

Initialization of Card Reader Operations:

In the case of 3/4-inch tape, the conversion tape is first rewound and the first card is read in the specified mode (as determined by the setting of the mm bits, i.e., bits 13 and 14, of character three in the initiating SCOPE control message) and written on tape as the first record. Any previous identification record existing on the tape is not preserved, i.e., data is written from the logical beginning of tape. The next card is written with a skip-write instruction during which SCOPE automatically erases tape from the end of the first record to the beginning-of-tape window, so that only one record is written between the logical beginning of tape and the tape window (i.e., in the tape label area).

SCOPE performs the operations necessary to produce 14-word (normal mode) or 24-word (transcription mode) card-image records on tape. SCOPE automatically generates a control word, two Orthotronic words, and an end-of-record word for each card image. These words are automatically appended to the card data when writing on tape. Bits 15 and 16 of the control word (see page 3-2) are set according to H-800/1800 conventions to indicate the outcome of the card-read operation (i. e. , whether or not illegal-punch or hole-count errors in the card were detected). Tape-write errors, however, are not indicated in the control word.

In a system employing 1/2-inch tape for a card-to-tape conversion, SCOPE assumes that the tape contains the header label record required by Series 200 conventions. SCOPE combines the tape serial number of this header label with the data from the header card of the input deck in the following manner: The first record on tape is read; then the first card is read in standard Series 200 alphanumeric mode. Characters 6-10 (tape serial number) of the tape header label are transferred to the corresponding positions in the card input buffer. The tape is then rewound, and the generated header card image in the card input buffer is written as the first record on tape. Neither Orthotronic words nor end-of-record data are included in card-image records on 1/2-inch tape.

Control Information:

With 3/4-inch tapes in H-800/1800 item format, the control word (word 11 for normal and word 21 for transcription mode) is set according to H-800/1800 conventions.

In the case of 1/2-inch tapes in Series 200 item format, the presence of a control character is optional for SCOPE operations. If a control character is present, it is inserted as the last character of the record (character 81 or 161 for normal or transcription mode, respectively) and has the binary format mmxxee where:

mm = 01 - Card has been read in the direct transcription mode
10 - Card has been read in the normal mode, standard code
11 - Card has been read in the normal mode, H-800/1800 code

xx = 00 - Not used

ee = 01 - Illegal punch detected in card
10 - Hole-count error detected in card
11 - Card was read correctly

Automatic Termination of Card Reader Operations:

The card-to-tape conversion is terminated upon detection of either the terminating card (see Tables 5-6 and 5-7) or the end of the tape. In the case of a terminating card, this card is written on tape. In either case, two additional terminating records are written, the tape is rewound, and the card-to-tape conversion routine is set to an inactive status.

When read into location A in a card-to-3/4-inch-tape conversion (as specified by the PDT instruction initiating the move), a card which sets the first eight character positions (locations A through A+7) to octal 00 00 00 00 04 20 00 00 terminates the conversion. Thus, both the mode and code determine the external format of the terminating card, as outlined in Table 5-6. Because SCOPE reads the next card before writing the image of the current card, the end-run card must be followed by at least one blank card to allow the writing of the end-run record.

Table 5-6. End-Run Punches for Card-to-3/4-Inch-Tape Conversion

Mode and Code	Column(s)	Contents
Normal mode, standard code	1 through 4 5 6 7 and 8	0000 4 R, 0 00
Normal mode, H-800/1800 code	1 through 4 5 6 7 and 8	0000 4 R 00
Transcription mode	1 through 4 5 6 7 and 8	Blank 6 8 Blank

In a card-to-1/2-inch tape conversion, a card which (when read into location A) sets the first five character positions (locations A through A+4) to 1ERIΔ terminates the conversion. Thus, the reading mode determines the external format of the terminating card, as shown in Table 5-7. Since SCOPE reads the next card before writing the image of the current card, the end-run card must be followed by at least one blank card to allow the writing of the end-run record.

Table 5-7. End-Run Punches for Card-to-1/2-Inch-Tape Conversion

Mode	Column(s)	Contents
Normal Mode	1 through 5	1ERIΔ
Transcription Mode	1 2 3 4 5	4 8, 6, 4 9, 7, 4 8, 7, 4 7, 6, 4

ERROR PROCEDURES IN SCOPE OPERATIONS

When a conversion operation stops, the operator must determine the reason for the stop. (NOTE: Only the particular devices associated with a given conversion will stop, not the Series 200 computer itself.) If the tape associated with the conversion has been rewound, the operation

has been terminated normally and automatically. If the tape is not rewound after a conversion stops, an error condition may exist. The control panel indicators of the individual peripheral units usually define the stop condition. The error condition may be one of the following:

1. An empty feed hopper in either the reader or the punch;
2. A full output stacker in the reader/punch;
3. Printer paper supply depleted;
4. Card jam condition in either the reader or the punch;
5. Error condition on peripheral device (e.g., hole-count error, illegal-punch error);
6. Conversion tape not mounted;
7. Conversion tape in the PROTECT status; or
8. Uncorrectable tape read/write error.

Before stopping on a tape read/write error, the conversion routine has attempted the following:

Error Condition	Corrective Action
3/4-Inch Tapes	
Read Error	Tried to channel-correct without success. In the process, if the parity channel was correct, the record has been reread eight times.
Write Error	No action.
1/2-Inch Tapes	
Read Error	Reread the record three times.
Write Error	Tried to rewrite the record three times, skipped the area on tape, and tried to rewrite the record three more times.

SCOPE provides several options for continuing after an error condition occurs. In some cases, the run can be continued simply by "cycling-up" the offending peripheral device. In other cases, it is necessary to enter two octal characters into memory. The options for continuing after an error condition has occurred are given in Table 5-8. (Refer to page 5-5 for the method of entering characters into main memory.) Detailed information for action to be various error conditions is given in Table 5-9.

The parameter Z is equal to the sum of four and the numeric device code of the terminal device involved in the affected operation. For example, in order to clear an error condition in a card-to-tape operation and continue, the SCOPE control message 2Z40 (see Table 5-8) can be entered into memory. The parameter Z, in this case, is the sum of four and the standard numeric device code of the card reader, which is 1, thus yielding a control message of 2540 (octal).

Table 5-8. Options for Continuing Following Error Conditions

Octal Characters (Z = 4+d)	Action
2Z40	Clear error condition and continue.
2Z60	Clear error condition, backspace tape one[1] record and continue.
2Z20	Clear error condition, backspace tape two[1] records and continue.
3Z60	Rewind tape with interlock and continue when tape drive is "cycled-up."[2]
7Z60	Rewind tape with interlock and continue.[2]

[1] If SCOPE has read one record beyond the last one printed or punched, one extra record will be backspaced.
[2] Do not use for card-to-tape conversion, since initialization will not be repeated.

Table 5-9. Error Procedures

Error Condition	Status of Conversion	Action
Card reader not ready for operation (card jam, illegal punch, etc.).	The last card read has been written on tape.	(a) If the last card was read correctly (e.g., busy status caused by empty feed hopper), "cycle-up" the card reader and continue. (b) If the last card read was in error (e.g., illegal punch), correct the card, reposition the cards in the hopper to reread this card enter 2Z60 into memory to backspace the tape, and "cycle-up" the reader to continue. If the card reader is set in the DISCARD mode of card checking and an illegal-punch or hole-count error causes the card reader to become busy, the card in error is not written on tape.
Tape-write error on card-image tape.	The card following the one on which the write error occurred has been read.	(a) If the tape is in the PROTECT status, change to PERMIT status and restart the operation. (b) To ignore the error and continue, enter the 2Z40 into memory (bad record remains on tape). (c) To try writing the record again: 1. Depress the STOP button on the reader; 2. Enter 2Z40 into memory (to write the following card on tape); 3. Enter 2Z20 into memory to backspace two records, reposition cards in the hopper, and "cycle-up" the reader to continue.

Table 5-9 (cont). Error Procedures

Error Condition	Status of Conversion	Action
Punch or printer not ready for operation (e.g., out of cards or paper, jam condition, etc.).	This is a record in memory to be printed or punched.	(a) If the last record printed or punched was correct (e.g., busy status caused by full stacker), "cycle-up" the printer or punch to continue. (b) To reprint or repunch the last record, enter 2Z60 into memory and "cycle-up" the printer or punch to continue. (c) To reprint or repunch the last two records, enter 2Z20 into memory and "cycle-up" the printer or punch to continue.
Tape-read error on punch or print tape.	The bad record has not been printed or punched.	(a) Enter 2Z40 into memory to ignore the error (i.e., print or punch the bad record and continue). (b) Enter 2Z60 into memory to backspace and try to read again.
Hole-count error on card punch.	One card beyond the error card has been punched.	(a) Enter 2Z40 into memory to ignore the character. (b) Enter 2Z20 into memory to repunch the error card and the following card.

SECTION VI
DYNAMIC LOADING OF SCOPE COROUTINES

INTRODUCTION

As described in previous sections, a user who has three or fewer terminal devices and a tape control unit (TCU) attached to a Series 200 processor assembles a SCOPE package containing the appropriate coroutines for handling his particular peripheral configuration. The actual devices being run simultaneously and the type of conversion operation being performed can be changed dynamically without disturbing the status of the other devices.

Consider now the user who has more than three terminal devices. Since SCOPE, as previously described, handles a maximum of three devices and a TCU at any one time, the implication is that such a user would have as many "versions" of SCOPE as he has combinations of devices to be run simultaneously. Assume that this is the case, and that while one of these versions is operating three terminal devices, one of the operations terminates. Assume further that the user wants to start an operation on a fourth device (i. e. , one that is not handled by the SCOPE package currently operating). He must wait until the two active operations terminate before loading a version of SCOPE capable of handling the fourth device.

To avoid this situation, the SCOPE coroutines can be set up as separate programs on a self-loading tape (SLT) or a binary run tape (BRT) from which a coroutine can be loaded, thus overlaying a coroutine no longer needed without disturbing other operations in progress (except to halt them while loading takes place).

This section describes the method for performing this "dynamic loading" of SCOPE coroutines. Setting up coroutines in this manner is somewhat more complicated than the simple collection and assembly process and, therefore, is not recommended to users who have no need for it. A user who has more than three devices, or one who needs several versions of one coroutine for own-coding (editing) purposes will find this method of setting up the coroutines useful.

Setting up the coroutines for dynamic loading is a three-step process:

1. Initial assembly of the fixed (non-overlay) portion of SCOPE. This portion includes the main control routine, the status table, the tape buffers, and the TCU coroutine. The fixed portion is assembled to determine its memory requirements (i. e. , its size), so that memory for the overlay areas can be allocated.

2. Final assembly of the fixed portion and assembly of the individual coroutines. After memory has been allocated during step 1 above, the coroutines are assembled to occupy the desired overlay areas. The fixed portion is assembled again to establish the necessary communication with the coroutines (i.e., the fixed portion must know the location of each of the coroutines, as determined during step 1).
3. Placement of the fixed portion of SCOPE and the coroutines on an SLT or a BRT.

All of these steps are described in the following pages.

MEMORY ALLOCATION

Since dynamic loading of coroutines implies that coroutines may overlay each other in memory, the available memory must be allocated so that overlaying is possible. The memory (4K or more) is divided into three areas:

1. Parameters, index registers, and loading area;
2. Fixed (non-overlay) portion of SCOPE; and
3. Coroutine area.

Parameters, Index Registers, and Loading Area

When loading from an SLT, the loading area contains the Search program and the bootstrap area, all of which occupies memory locations 25-306 (decimal). For a BRT, the loading area contains Tape Loader-Monitor C and occupies memory locations 64-1339. The parameter area occupies memory locations 1-5. When using a BRT, locations 6-24 (index registers 2-6) and locations 25-63 are available for use by own-coding.

Fixed (Non-Overlay) Portion of SCOPE

This portion of SCOPE consists of the main control routine (identification numbers 00-04), the status area, tape buffers, and a TCU coroutine (identification numbers 05-06, 07-08, or 18-20). A description of the coroutines is contained in Table 4-2, page 4-2). The size of the fixed portion of SCOPE is variable depending on the addressing mode used and the particular coroutines included in the symbolic deck. The combination of coroutines desired must be assembled to determine its length (i.e., the amount of memory it occupies). The length of the fixed portion is designated as n and occupies memory from the first location x following the loading area through x+n-1. The values of x are 307 for an SLT and 1340 for a BRT.

Coroutine Area

This area is further divided into three sections each of which contains one terminal device coroutine and its associated own-coding (if any). The coroutine area begins at location x+n (as described above) and may extend to the end of memory. This area (or as much of it as needed)

is divided into three sections numbered 1 through 3. Section 1 contains a coroutine which handles a device designated device 1 and uses logical tape 1 for independent conversions; section 2 contains a coroutine which handles device 2 and uses logical tape 2; and section 3 handles device 3 and uses logical tape 3. For complete flexibility, the sections should be of equal size (the size of the largest coroutine). Three coroutines should be included on the program tape (one to occupy each section, having the proper numeric device code d and using the proper logical tape). If this is done, a coroutine for a particular device can then dynamically replace a coroutine for any other device and use the tape which was being used by the replaced coroutine. However, it is not absolutely necessary that the sections be of equal size. If it is not possible to have sections of equal size because of memory limitations, the user may assign different sizes, assuming that he restrict himself as to which coroutines can replace other coroutines.

ASSEMBLY PROCESS

Initial Assembly of Fixed (Non-Overlay) Portion

This portion is assembled to determine its size. The symbolic deck is made up as shown in Figure 6-1. The PROG card may contain any desired name. The CORT and COEND cards must precede and follow, respectively, all of the cards in the symbolic coroutine decks. Some of the symbolic cards in the coroutine decks must be changed, or other cards must be added to permit dynamic loading of coroutines. These changes are outlined below.

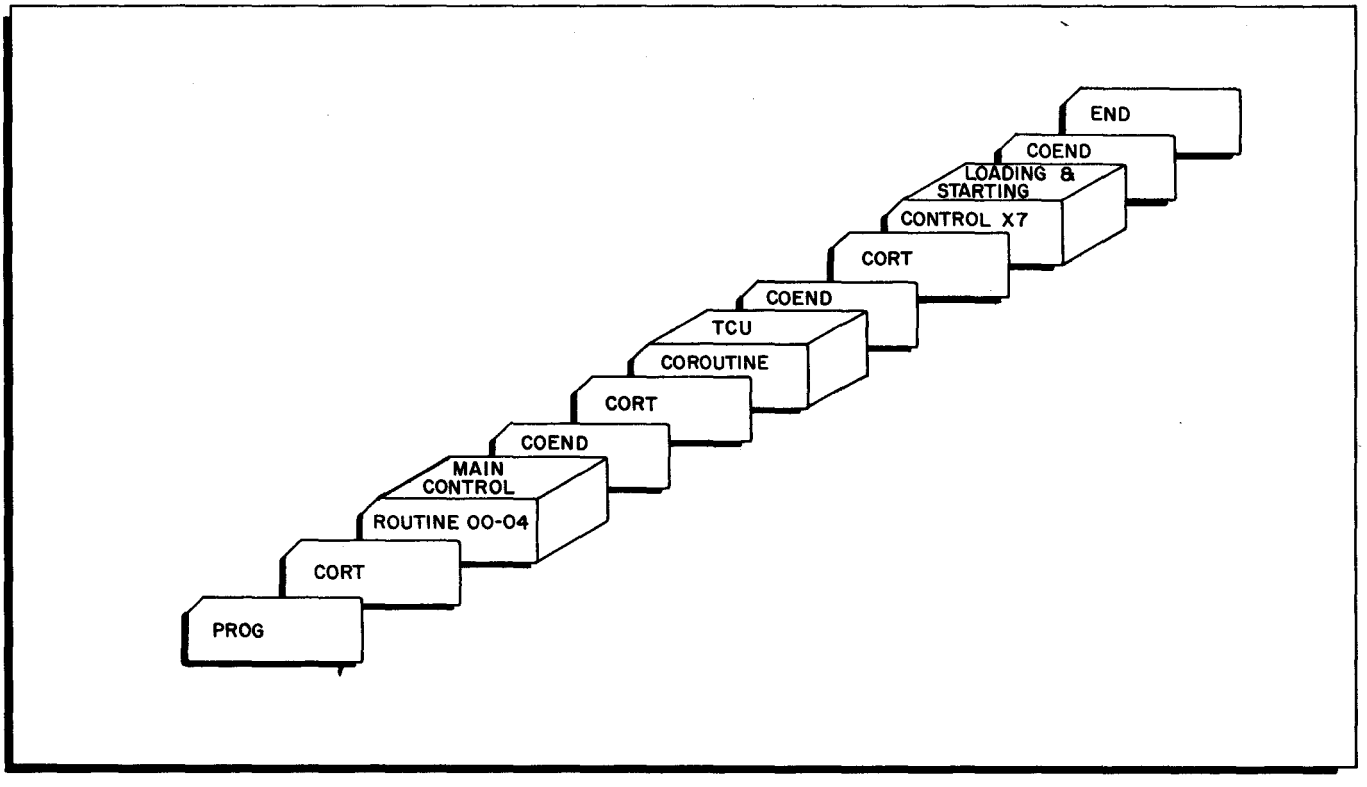

Figure 6-1. Initial Input Deck for Dynamic Loading

The main control routine (identification numbers 00-04) with the following indicated changes must follow the PROG card:

1. Line number 01000 must be changed to:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1	01000				ORG	X

where x is equal to 307 when loading from a self-loading tape (SLT) or 1340 when loading from a binary run tape (BRT).

2. A line which contains the following must be inserted after line 04400 (for identification, the line being inserted will be arbitrarily designated as 04401 in the coding example):

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1	04401				BCC	y,FL,IM

where y is the entry to the loader (y = 89 when loading from an SLT or 130 when loading from a BRT.

3. If SCOPE is to operate in 3-character addressing mode, the following four lines (a through d below) must be changed:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

		CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
(a)	1	00002				ADMODE	3
	2						
(b)	3	00010				EQU	3
	4						
(c)	5	03300				ADMODE	3
	6						
(d)	7	04870				ADMODE	3

If SCOPE is to be loaded from a BRT, it must be assembled in 3-character addressing mode. It is also necessary to use 3-character mode when the memory required for the three coroutine areas (as described on page 6-2ff) will exceed 4,096 characters.

4. Other desired changes must be made, as outlined in Section IV, for altering control unit numbers, gap size, buffer size, etc. The sizes of the tape buffers must be large enough to accommodate records for any coroutine which will use them.

A tape control unit (TCU) coroutine (identification numbers 05-06, 07-08, or 18-20) must follow the main control routine. No changes, however, are required in this coroutine.

The loading and starting control routine (X7) must be changed, as follows:

1. Delete line numbers X7020 through X7030.
2. Change the line numbers X7040 and X7770, as shown below:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS	
	1 2 3 4 5	6	7	8 14	15 20	21 62	63 80
1	X7Ø4Ø			START	LCA	STA,FL+3	
2							
3	X777Ø			2Ø3	END	START	
4							

These cards are assembled using either Easycoder A, B, or C. The address x+n (as described on page 6-2) can be determined by examining the line immediately preceding the loading and starting control lines (i.e., the last line of the TCU coroutine). The tags B1, B2, B3, D1, D2, D3, D4, D5, and D6 are unassigned; they will be fixed in subsequent assemblies as described in the following pages. The machine-language output of this assembly need not be saved, since a final assembly (see below) must be performed before the fixed portion of SCOPE is placed on a program tape.

FINAL ASSEMBLIES

The individual corroutines and the fixed portion of SCOPE are assembled to occupy their assigned memory locations (as described below). When using Easycoder C, all of these assemblies may be done in one batch, thus producing a binary run tape (BRT) which can be used for dynamic loading of SCOPE. As an alternative, the assembly output BRT may be used to update an existing BRT (see page 6-10). When using either Easycoder A or Easycoder B, the assemblies are done separately and card (not tape) output in either condensed or single instruction format must be obtained. These cards are used to create or update a self-loading tape (SLT), as described on page 6-10.

Final Assembly of Corroutines

Each terminal device coroutine must be assembled with the main control routine, since the coroutines refer to many locations within the main control routine and the status area.

Using the value of x+n (determined as described on page 6-2), a value must be assigned for the starting location of each section of area 3 in memory (i.e., the coroutine area, which is divided into three parts, one part for each terminal device coroutine). If the memory size is designated as m and the three sections in area 3 are to be of equal size, then each coroutine

(with its own-coding) may occupy $\frac{m-(x+n)}{3} = s$ memory locations. Thus, if the beginning location of each section is specified in the form b_d, then sections 1 through 3, respectively, may be designated, as follows:

$$b_1 = x+n$$

$$b_2 = x+n+s$$

$$b_3 = x+n+2s$$

The user must ensure that each section is large enough to accommodate all of the coroutines which are to occupy that section. The size of the standard coroutines for the card reader, the card punch, and the printer can be determined by examining assembly listings of these coroutines. In a 4K machine, there will be enough memory for the loader when using an SLT (but not a BRT), the main control routine and tape buffers, TCU coroutine, and any three of the standard terminal device coroutines. The deck for assembling a coroutine is made up as shown in Figure 6-2. A description of the principal cards in the deck follows.

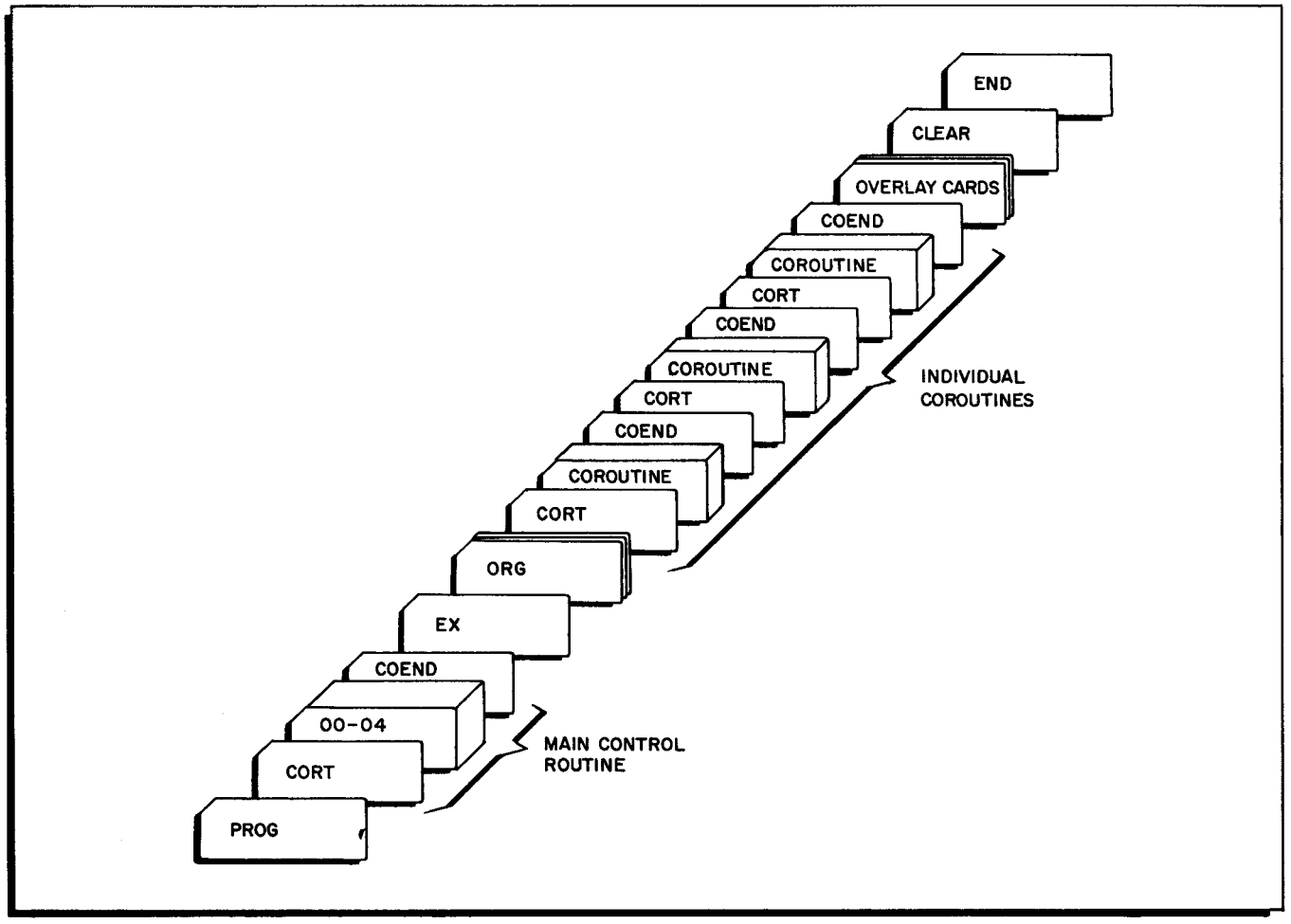

Figure 6-2. Input Deck for Final Assembly of Coroutines

1. The PROG card must precede all other cards in the input deck for final assembly. Any desired name may be used, but all coroutines and the fixed (non-overlay) portion of SCOPE must have different names.

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62 / 63 ... 80
1				PROG	(Progname)

2. The main control routine (identification numbers 00-04) containing the four modifications outlined beginning on page 6-4 must follow the PROG card. Note that CORT and COEND cards precede and follow, respectively, the cards constituting the main control routine.

3. An Execute card is included next only as a means of identifying this point in the machine-language deck. The EX card must contain a card (or line) number in columns 61-65.

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62 / 63 ... 80
1				EX	XXXXX

4. Three ORG cards, one per coroutine section in area 3 (coroutine area) of memory, must be included in the deck in the format:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62 / 63 ... 80
1				ORG	b_1
2				ORG	b_2
3				ORG	b_3

where b_d is the beginning location of each coroutine section (see page 6-5ff).

5. Next, the three terminal device coroutines, along with any associated own-coding, are included. Also, CORT and COEND cards in their proper places must accompany each coroutine deck.

6. Following the coroutines, cards to overlay two address constants within the main control routine must be included. These DSA's contain unassigned tags in the main control routine and must be overlaid with the proper values for each of the three terminal device coroutines in area 3 of memory. The coding for each of these cards follows:

Coroutine 1

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1				ORG	SA-CM+1
2				DSA	B1
3				ORG	ZJ
4				DSA	D4

Coroutine 2

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1				ORG	SA-CM+5
2				DSA	B2
3				ORG	ZJ+CM
4				DSA	D5

Coroutine 3

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1				ORG	SA-CM+9
2				DSA	B3
3				ORG	ZJ+CM+CM
4				DSA	D6

7. A CLEAR card with the format below must be included for the terminal device buffer:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ___ OF ___

CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
1				CLEAR	Bd, Bd+m-1,

where B_d is the beginning location of the terminal device coroutine, and m is the size of the buffer.

8. Finally, beginning with the first section of area 3 in memory, an End card for each of the three terminal device coroutines (a through c below) must be included:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
	1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62
(a) 1				2Ø3	END	D4
2						
(b) 3				2Ø3	END	D5
4						
(c) 5				2Ø3	END	D6

Final Assembly of Fixed Portion

The final assembly includes the fixed portion of SCOPE as described on page 6-2. The purpose of this assembly is to assign an absolute value to the beginning location (b_d) of each of the terminal device coroutines (as defined on page 6-5ff). The deck includes all of the cards listed in Figure 6-2, page 6-6 and, in addition, three Equals cards which may be inserted immediately following the PROG card. The format of the three cards is shown in the coding below:

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS
	1 2 3 4 5	6	7	8 ... 14	15 ... 20	21 ... 62
1				D1	EQU	b_1
2						
3				D2	EQU	b_2
4						
5				D3	EQU	b_3

where b_1, b_2, and b_3 are the beginning locations in memory of the three terminal device coroutines.

If desired, up to three terminal device coroutines (one for each value of d) may be included in this assembly. This may be desirable if there is one combination which is used more often than the others or if one coroutine is always present in any combination. In this way, the coroutines assembled with the fixed portion of SCOPE are brought into memory without a separate loading procedure. If a coroutine is assembled with the fixed portion of SCOPE, the corresponding Equals card for the coroutine (see the coding above) may be omitted. The ORG card for the coroutine and the coroutine itself are inserted immediately preceding the loading and starting control (X7) routine. The overlay cards, the Clear card, and the End card (described in 6, 7, and 8 above) are not included in the deck in this case.

The program resulting from this assembly is referred to in the following pages as the "basic SCOPE program."

CREATING OR UPDATING THE PROGRAM TAPE

Self-Loading Tape (SLT)

The self-loading tape (SLT) is used when the programs have been assembled by either Easycoder A or Easycoder B. The SLT employs the Update program which is a Honeywell-supplied card deck used to create and maintain a file of programs on an SLT. The basic SCOPE program is placed on the SLT under the control of a card deck (called the control deck) which contains an action director card for each program present on the old SLT and for each program (SCOPE in this case) to be inserted in creating the new SLT. The outputs of Update are a self-loading tape file of the input programs and a printed directory of the programs contained on the SLT. Both the Easycoder 4K Operating Procedures Manual (DSI-243) and the Easycoder B Assembly System Manual (File No. 123.1105.000B.0-011) contain a description of the Update program and the pertinent operating procedures.

Before placing the SCOPE machine language deck on the SLT, the following must be done for each coroutine:

1. Retain the Bootstrap, Clear, and Load cards (identified by 1, 2, and 3 in columns 80, respectively);
2. Remove the cards up to and including the Execute card. The Execute card is identified by its line number which is punched in columns 61-65; and
3. Retain the remaining cards.

The resulting deck is placed on the SLT as described in the manuals referenced above.

Binary Run Tape (BRT)

The binary run tape (BRT) is used when the programs have been assembled by Easycoder C. If all the final assemblies (see page 6-5ff) were done in one batch, the assembly output BRT may be used as the SCOPE BRT. Alternatively, the units assembled may be placed on an existing BRT, as described in the bulletin Update and Select C and D (File No. 122.3305.001C.00.00). Note that the "unit name" of the basic SCOPE program as described in this manual is the six-character program name followed by two segment identification characters 01. This segment identification can be overridden if desired by using a SEG card (see Series 200 Programmers' Reference Manual, Models 200/1200/2200, File No. 113.0005.0000.00.00). For the individual coroutines, only the second "segment" or "unit" need be placed on the BRT. The name of this unit is the six-character program name followed by the segment identification 02. Again, a SEG card can be used to override this identification.

OPERATING PROCEDURES

In general, the operating procedures for the dynamic loading of SCOPE coroutines is the same as those outlined in Section V, except for the starting procedure. The exceptions are noted below.

Running With an SLT

When running with an SLT, the tape is mounted on tape drive 0, and the basic SCOPE program is loaded by the Search routine, which is a routine in the Update program that locates and initiates the loading of a program stored on tape in Easycoder self-loading format.

If the required coroutine is already in memory, either because it was assembled with the basic program or because it has been called in previously and has not been overlaid, the procedures for starting a SCOPE conversion are exactly as outlined in Section V.

If the required coroutine is not in memory when the SENSE Switch 4 halt occurs after depressing the RUN button, enter the name of the required coroutine into locations 145-152 (octal). Proceed with the starting procedure as outlined on page 5-6, but enter an item mark with the first control character into location 00001.

Running With a BRT

The BRT is mounted on drive 0, and the basic SCOPE program is loaded as described in the bulletin PLUS-Tape Loader-Monitor (DSI-327).

If the required coroutine is already in memory, the procedure for starting an operation is the same as that outlined on page 5-6.

If the required coroutine is not in memory when the SENSE Switch 4 halt occurs, enter the unit name of the coroutine into locations 104-111 (octal). Proceed as outlined on page 5-6 but enter an item mark with the first control character into location 00001.

COMPUTER-GENERATED INDEX

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