

34

00

COMPUTER SYSTEM  
SCOPE  
OPERATING GUIDE

CONTROL DATA  
CORPORATION

# 3400

## COMPUTER SYSTEM SCOPE

OPERATING GUIDE  
VERSION 3.0

**CONTROL DATA**  
CORPORATION

Additional copies of this manual may be obtained  
from the nearest Control Data Corporation Sales  
office listed on the back cover.

**CONTROL DATA CORPORATION**

*Documentation Department*

**3145 PORTER DRIVE**

**PALO ALTO, CALIFORNIA**

December, 1965  
Pub. No. 60134200

© 1965, Control Data Corporation  
Printed in the United States of America

# CONTENTS

---

CHAPTER 1	INTRODUCTION	1-1
	1.1 Switches and Displays	1-2
	1.2 Typewriter Messages	1-8
	1.3 Physical and Logical Units	1-8
	1.4 Tape Labels	1-10
	1.5 Tape Assignment	1-11
	1.6 Continuation Reels	1-12
CHAPTER 2	TURNING POWER ON AND OFF	2-1
	2.1 Power On	2-1
	2.2 Power Off	2-1
CHAPTER 3	OPERATION	3-1
	3.1 Autoload Procedure	3-1
	3.2 Card to Magnetic Tape Procedure	3-2
	3.3 Manual Interrupt	3-3
	3.4 Abnormal Termination	3-4
CHAPTER 4	OPERATOR CONTROL STATEMENTS	4-1
	END-OF-FILE	4-1
	ENDSCOPE	4-1
	ENDREEL	4-1
	SEQUENCE	4-1
	COMMENT	4-2
	NEXT	4-2
	REPEAT	4-2
	PAUSE	4-2
	EQUIP	4-2
	AHT	4-4

CHAPTER 5	MESSAGES	5-1
	Table 1 SCOPE	5-1
	Table 2 COMPASS	5-6
	Table 3 COBOL	5-6
	Table 4 SORT	5-6
	Table 5 GPIO	5-9
	Table 6 Utility Controller	5-10
	Table 7 TAPECOPY	5-11
	Table 8 CARDTAPE	5-11
APPENDIX A	NORMAL AUTOLOAD AND AUTOLOAD RECOVERY EXAMPLE	
APPENDIX B	CONSOLE OUTPUT LISTING EXAMPLE	
APPENDIX C	AVAILABLE HARDWARE TABLE FORMAT	

#### FIGURES

Figure 1-1. Console Controls	1-7
Figure 2-1. Switch Locations For Turning Power On and Off	2-2

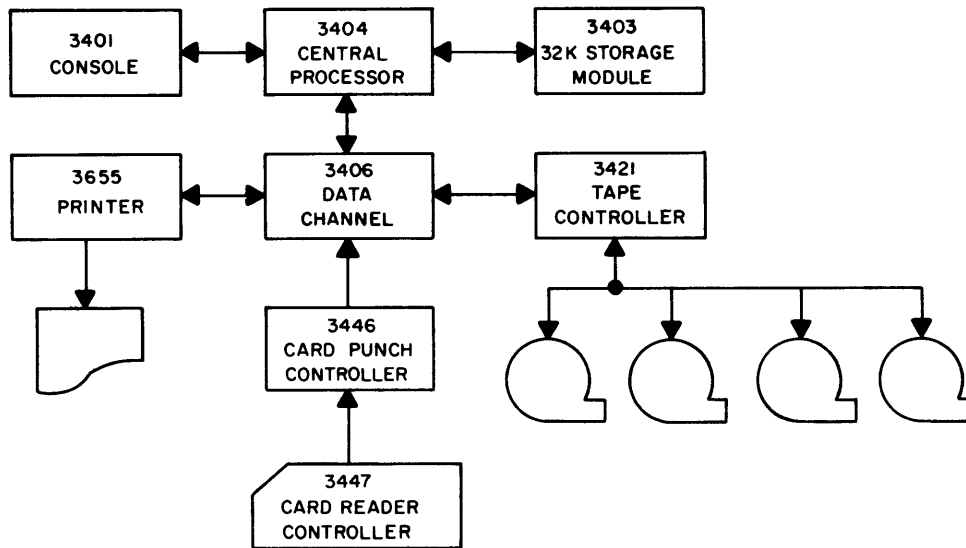
---

The 3400 SCOPE Monitor System maintains the continuity of processing both stacked and non-stacked jobs, sets up logical-to-physical unit assignment, performs unit logging, and provides interrupt processing capabilities. The library tape, in addition to containing the SCOPE programs, contains utility programs which operate under control of SCOPE.

Minimum 3400 computer system configuration for running under SCOPE:

3404	Central Processor
3403	32K Memory
3401	Console with Typewriter
3406	Data Channel
3421	Magnetic Tape Controller (2 RW Control)
604 or 607	Magnetic Tapes (4)
3446	Card Punch Controller with Punch
3447	Card Reader Controller with 405
3655	Printer

This manual describes the operating features of the SCOPE Monitor System, Version 3.0.



## 1.1 SWITCHES AND DISPLAYS

The console switches and functions listed below are illustrated in figure 1-1. Except for the typewriter ON/OFF switch, all the switches illuminate when in the on position. TYPE IN is an indicator; it is not a switch. The switches are Momentary (M) or Locking (L).

<u>Switch</u>		<u>Function</u>
EMERGENCY OFF	M	Removes power from console and all other equipment, including air conditioner.
ON/OFF	L	Permits power to be applied or removed from typewriter.
SYSTEM ACTIVE	L	Activates a running-time meter located in power module. Computer stops when this switch is turned off; I/O activity continues to normal termination. If both this switch and the maintenance mode switch (maintenance panel; not illustrated) are off, all other switches except POWER on maintenance panel (figure 1-2) are locked out.

<u>Switch</u>		<u>Function</u>
INTERRUPT	M	Forces computer into an interrupt routine if: Manual interrupt bit in interrupt mask register is set Interrupt system is active
AUTOLOAD	M	Provides for automatically loading storage with information from a given external equipment.
RESTART	M	Stops all computer and I/O activity. Clears interrupt active. Restarts computer with a return jump to address 00000 <sub>8</sub> .
END OF RECORD	M	Terminates an end-of-record signal to the data channel if typewriter attached to data channel is connected and read, and data signals are present.
SELECT JUMP 1	L	Provides for manual execution of a program jump on selective jump instruction (op code 75).
SELECT JUMP 2	L	
SELECT JUMP 3	L	

The system status display panel indicators and the conditions under which they illuminate are listed below; they are illustrated in figure 1-1. All indicators are active when the condition arises, whether the computer is running or not.

<u>Indicator</u>	<u>Color</u>	<u>Condition When Illuminated</u>
Channel 0 Active Channel 1 Active Channel 2 Active Channel 3 Active	Green	These indicators light when an I/O channel is performing a read or write operation.
Channel 0 Parity Error Channel 1 Parity Error Channel 2 Parity Error Channel 3 Parity Error	Red	Indicate I/O channel transmission parity errors.
Computer Running	Green	Indicates computer is running and/or I/O operations are taking place.



<u>Indicator</u>	<u>Color</u>	<u>Condition When Illuminated</u>
Program Stop	Red	Computer is no longer executing program instructions. (If Computer Running indicator lights and then goes out, but Program Stop indicator does not light, there is an electronic malfunction in the computer.)
Interrupt Active	Orange	Interrupt system is enabled, permitting examination of selected interrupt conditions in an interrupt routine as they occur.
Interrupt Mode	Orange	Computer is processing an interrupt routine.
Arithmetic Overflow	Orange	Absolute value of the sum or difference of two fixed point integers is $\leq 2^{47}$ .
Exponent Overflow	Orange	Value of exponent formed during a floating point add, subtract, multiply, or divide is $> 2^{10}-1$ (1777 <sub>8</sub> ).
Exponent Underflow	Orange	Value of exponent formed during a floating point add, subtract, multiply, or divide is $<$ negative $2^{10}-1$ (-1777 <sub>8</sub> ).
Shift Fault	Orange	A register shift of more than $177_8 = 127_{10}$ places is specified in a shift instruction.
Divide Fault	Orange	1) Absolute value of the quotient resulting from a divide integer instruction is $\geq 2^{47}$ . 2) Fixed point or floating point divide by zero attempted.
Instruction Parity Error	Red	Parity error during reading of a 48-bit instruction word from storage.
Operand Parity Error	Red	Parity error in a word read from storage for use as computer operand or as an output word.

<u>Indicator</u>	<u>Color</u>	<u>Condition When Illuminated</u>
Read Next Instruction	White	Computer is reading a 48-bit instruction word from storage.
Upper Instruction	White	Computer is executing upper instruction of 48-bit word.
Lower Instruction	White	Computer is executing lower instruction of a 48-bit word. (Only the Upper Instruction indicator is illuminated when computer is executing a 48-bit instruction.)
Maintenance Mode	Red	Maintenance Mode switch on maintenance panel is active.
Execute Cycle	White	Computer is executing an instruction which requires no memory reference.
Operand Cycle	White	Computer is executing an instruction which requires memory reference.
Extended Cycle	White	Computer is executing an instruction which requires two cycles.
Jump Condition	Green	Computer is about to execute a jump instruction and the condition for jumping has been met.
Storage Overload 1 Storage Overload 2	Red	Current overload in storage stacks.
Temperature 1 Temperature 2 Temperature 3 Temperature 4	Orange	Temperature in one or more cabinets exceeds the normal range.
Circuit Breaker	Red	A circuit breaker has tripped due to a current overload.
Temperature	Red	Temperature in a section of the system has reached a point where equipment may be harmed. Motor-alternator is turned off.

<u>Indicator</u>	<u>Color</u>	<u>Condition When Illuminated</u>
Interlock Bypassed	Orange	Interlock Bypassed switch on maintenance panel has been pressed. Computation proceeds regardless of temperature in any part of the system.
Terminal Power Fault	Red	Terminator power is fluctuating or has dropped.

CHANNEL 0 ACTIVE	CHANNEL 0 PARITY ERROR	COMPUTER RUNNING	ARITHMETIC OVERFLOW	SHIFT FAULT	READ NEXT INSTRUCTION	EXECUTIVE CYCLE	STORAGE OVERLOAD 1	TEMPERATURE 1	CIRCUIT BREAKER
CHANNEL 1 ACTIVE	CHANNEL 1 PARITY ERROR	PROGRAM STOP	EXPONENT OVERFLOW	DIVIDE FAULT	UPPER INSTRUCTION	OPERAND CYCLE	STORAGE OVERLOAD 2	TEMPERATURE 2	TEMPERATURE
CHANNEL 2 ACTIVE	CHANNEL 2 PARITY ERROR	INTERRUPT ACTIVE	EXPONENT UNDER FLOW	INSTRUCTION PARITY ERROR	LOWER INSTRUCTION	EXTENSION CYCLE		TEMPERATURE 3	INTERLOCK BYPASSED
CHANNEL 3 ACTIVE	CHANNEL 3 PARITY ERROR	INTERRUPT MODE		OPERAND PARITY ERROR	MAINTENANCE MODE	JUMP CONDITION		TEMPERATURE 4	TERMINAL POWER FAULT

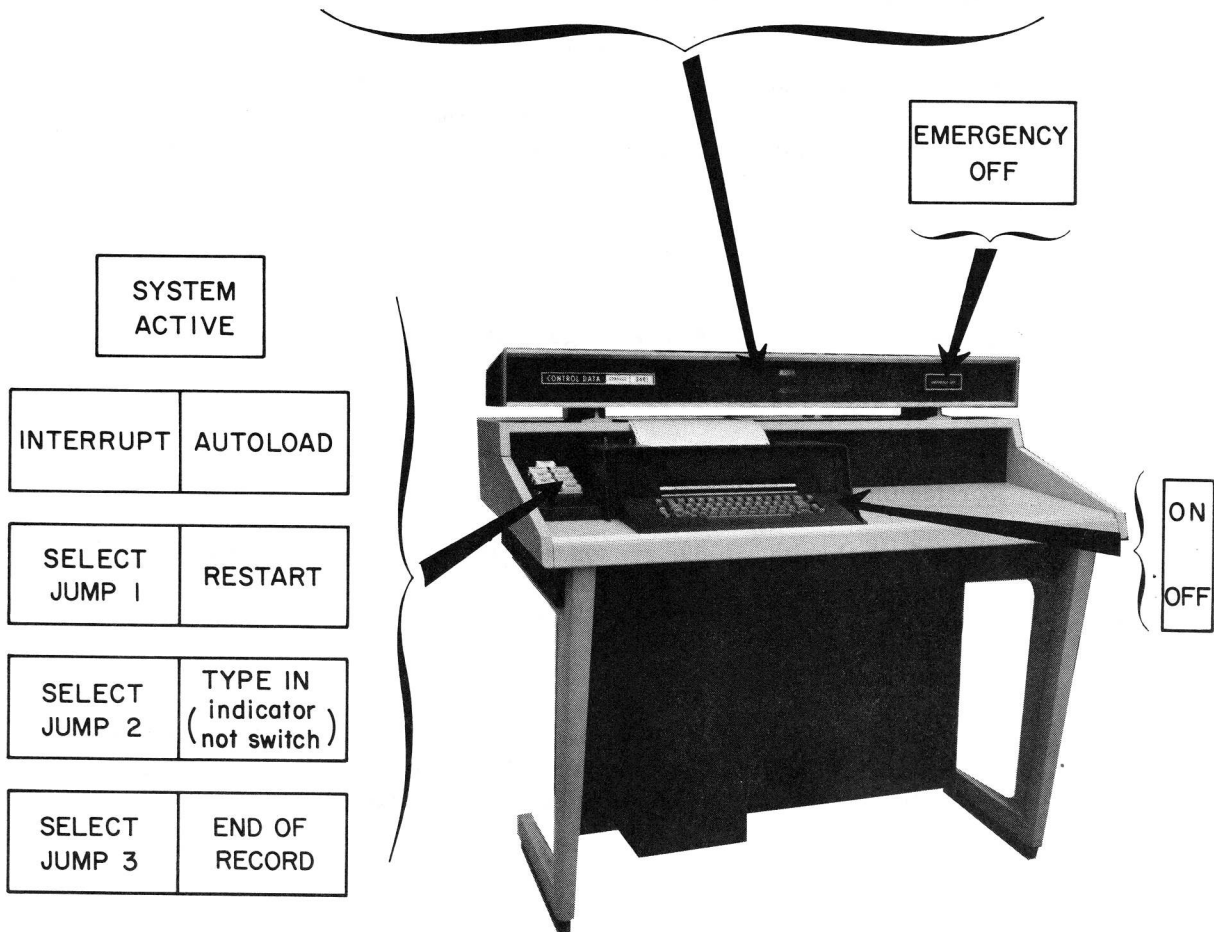


Figure 1-1. Console Controls

## 1.2 TYPEWRITER MESSAGES

When the TYPE IN indicator on the control console lights, the operator may type a control statement followed by a carriage return; SCOPE will process the statement, perform all tasks, and return to the typewriter. The TYPE IN indicator will again light, indicating another operator statement and carriage return may be inserted. SCOPE readiness to accept control statements is terminated by typing OK followed by a carriage return or by typing a period after the last typed control statement.

## 1.3 PHYSICAL AND LOGICAL UNITS

A physical unit is a specific hardware device, such as a magnetic tape unit or a card reader. The physical unit number of a magnetic tape is determined by the selector dial at the top of each unit.

SCOPE locates and assigns physical equipment at run time according to specifications in the control statements and requests. All references to input/output units are by logical unit numbers chosen by the programmer, and independent of any physical unit designation. Logical units are programmer units, scratch units, and system units.

### Programmer Units

These logical units, 1-49, are for general use by the programmer. They are released and rewound at the end of the job. If the tape is to be saved, it will be unloaded when it is released.

### Scratch Units

These logical units, 50-59, are for temporary use by the programmer. They are released and rewound after each run.

### System Units

These logical units, 60-80, are reserved by SCOPE for the job processing tasks listed below. The 3400 SCOPE/COMPASS Reference Manual contains a more detailed description of each logical unit function.

<u>Logical Unit</u>	<u>Mnemonic</u>	<u>Mode</u>	<u>Description</u>
60	INP	binary	Standard Input (labeled if tape)
61	OUT	BCD	Standard Output (labeled if tape)
62	PUN	binary	Standard Output (labeled if tape)
63	ICM	BCD	Input Comment Medium
64	OCM	BCD	Output Comment Medium
65	ACC	BCD	Accounting Record (labeled if tape)
66-68	none	-	Any use causes job termination
69	LGO	binary	Load and Go
70	LIB	binary	SCOPE Library
71-79	none	-	Auxiliary Libraries
80	SCR	binary	Systems Scratch Record

### 1.3.1 PHYSICAL TAPE UNITS

The selector dial at the top of each tape unit determines the physical unit number of the tape. Each dial has nine positions 0-7 and STAND BY. When the dial is positioned to STAND BY, the tape unit is disconnected from the system. Tapes in bank 0 are referred to as 01, 02, . . . , 07, depending on the setting. Tapes in bank 1 are referred to as 10, 11, . . . , 17.

Changing the selector dial value changes the AHT ordinal that describes the physical unit (refer to description of AHT Statement).

**1.4  
TAPE LABELS**

The first record of a tape may be a label which is an 80-character BCD identifier with the following format:

<u>Character Position</u>	<u>Contents</u>
1	Density 2 = 200 bpi 5 = 556 bpi 8 = 800 bpi
2-3	Label identifier: ( )
4-5	Logical unit number or blank
6-8	Retention code
9-22	Name
23-24	Reel number
25-30	Date, written: mmddy
31-32	Edition
33-80	User Information

This is also the format of the label card necessary as the first card of an input deck for 3400 SCOPE or 160-A SIPP Card-to-Tape.

If the units listed below are tapes, they are labeled as indicated.

<u>Unit</u>	<u>Name</u>	<u>Edition</u>	<u>Reel Number</u>	<u>Retention Code</u>
INP	INP	0	1-99	0-999
OUT	OUT	0	1	999
PUN	PUN	0	1	999
ACC	ACC	0	1	999

## 1.5 TAPE ASSIGNMENT

Tape assignment is the linking of a logical unit number and associated declaration information with a physical tape reel. The following considerations govern assignment of tapes by 3400 SCOPE, version 3.0.

- Tapes are defined by an EQUIP statement or a LABEL request. Actual assignment is made concurrently with the first input or output request, except for REWIND, BSPR, BSPF, UNLOAD, and RELEASE.
- All tapes related by an equivalence declaration are assigned concurrently with the first input/output request associated with a member of the chain.
- A tape reel is considered available for output only when it has a write ring, and is either unlabeled or labeled with an expired or zero retention code. Specific operator instruction is required in all other cases.
- If output is requested on a unit which has not been equated to physical hardware, any available unassigned tape (unlabeled or labeled with an expired or zero retention code) is assigned. If no such tape is available, the operator is queried.

### No Input Reel Available

For READ/SKIP Requests:

If a specified input reel cannot be found, the following message is typed:

WHERE IS xx, R label

xx	logical unit number
label	tape label; label is omitted if the tape is not defined or defined as unlabeled

The operator may respond by defining a tape for input with an EQUIP statement or by manually restarting the system (this abandons the job). If a label is typed in the message, and if the tape defined by the EQUIP statement does not have the same label as in the message, the message will be typed out again.

### Duplicate Input Reels

No check is made to determine if two or more reels have identical labels. The first reel which satisfies the identification requirements will be assigned.



### No Output Reel Available

If an available output tape is not known to SCOPE, the following message is typed:

WHERE IS xx, W label

xx	logical unit number
label	tape label; omitted if the tape is not defined or defined as unlabeled

The operator may respond by defining a tape for output with an EQUIP statement or by manually restarting the system (this abandons the job).

If an output tape is defined by an EQUIP statement and the first record of the tape is a label with an unexpired retention code, the operator will be requested to verify the assignment. The tape label will be displayed with the request for verification. At this point, the operator has three options:

Type OK. This completes the assignment.

Manually restart the system. This abandons the job.

Enter an EQUIP statement to define a new tape.

Example:

SCOPE: WHERE IS 11, W label

Operator: 11 = MTnn

SCOPE: OK TO WRITE 11 = MTnn label

Operator: OK

## 1.6 CONTINUATION REELS

If a READ, WRITE, or SKIP request is given after encountering physical or logical end-of-tape on units other than 1-49, 61, 62, and 65, the job will be abandoned. However, if a request is made on 1-49, 61, 62, or 65 after physical or logical end-of-tape, it will be processed as follows:

1. If the request is WRITE, a trailer label will be written on the reel, and the reel unloaded. The logical unit will be declared unlabeled, a new unit or reel will be assigned, and the WRITE will be performed.

2. If the request is READ or SKIP, the reel will be unloaded. The logical unit will be declared unlabeled, a new unit or reel will be assigned, and the READ or SKIP will be performed.
3. If the request is REWIND, BSPR, BSPF, RELEASE, LABEL or UNLOAD, the operation will be performed and the logical end-of-tape condition removed.
4. Any request other than the above will be executed; the logical end-of-tape condition will remain and a subsequent request is treated as 1 through 4.

## 2.1 POWER ON

In the procedure below, except for the card punch switch, pressing a switch will light the associated switch lamp. The switch locations are illustrated in figure 2-1.

1. Turn on the air conditioning system.
2. Sequentially press the ON portion of the power switches, located at the bottom of the maintenance panel, starting with CONTROL POWER and ending with PERIPHERAL.
3. Press the INTERNAL clear switch on the maintenance panel.
4. Press the POWER switch on each tape unit.
5. Press the MAIN POWER and MOTOR POWER switches on the card reader.
6. Press the PRINTER READY switch on the line printer.
7. Flip the switch on the right side of the card punch to the ON position (not illustrated).
8. Let the system warm up for approximately ten minutes before using.

## 2.2 POWER OFF

In the procedure below, except for the card punch switch, pressing a switch will extinguish the associated switch lamp.

1. Flip the switch on the right side of the card punch to the OFF position.
2. Sequentially press the OFF portion of the power switches, starting with PERIPHERAL and ending with CONTROL POWER. The ON switch light will remain illuminated for approximately one minute after the OFF portion of the 60~POWER switch has been pressed. Do not press the CONTROL POWER OFF switch until the 60~POWER ON switch light has extinguished. The CONTROL POWER ON switch light will not extinguish immediately when the OFF portion has been pressed.

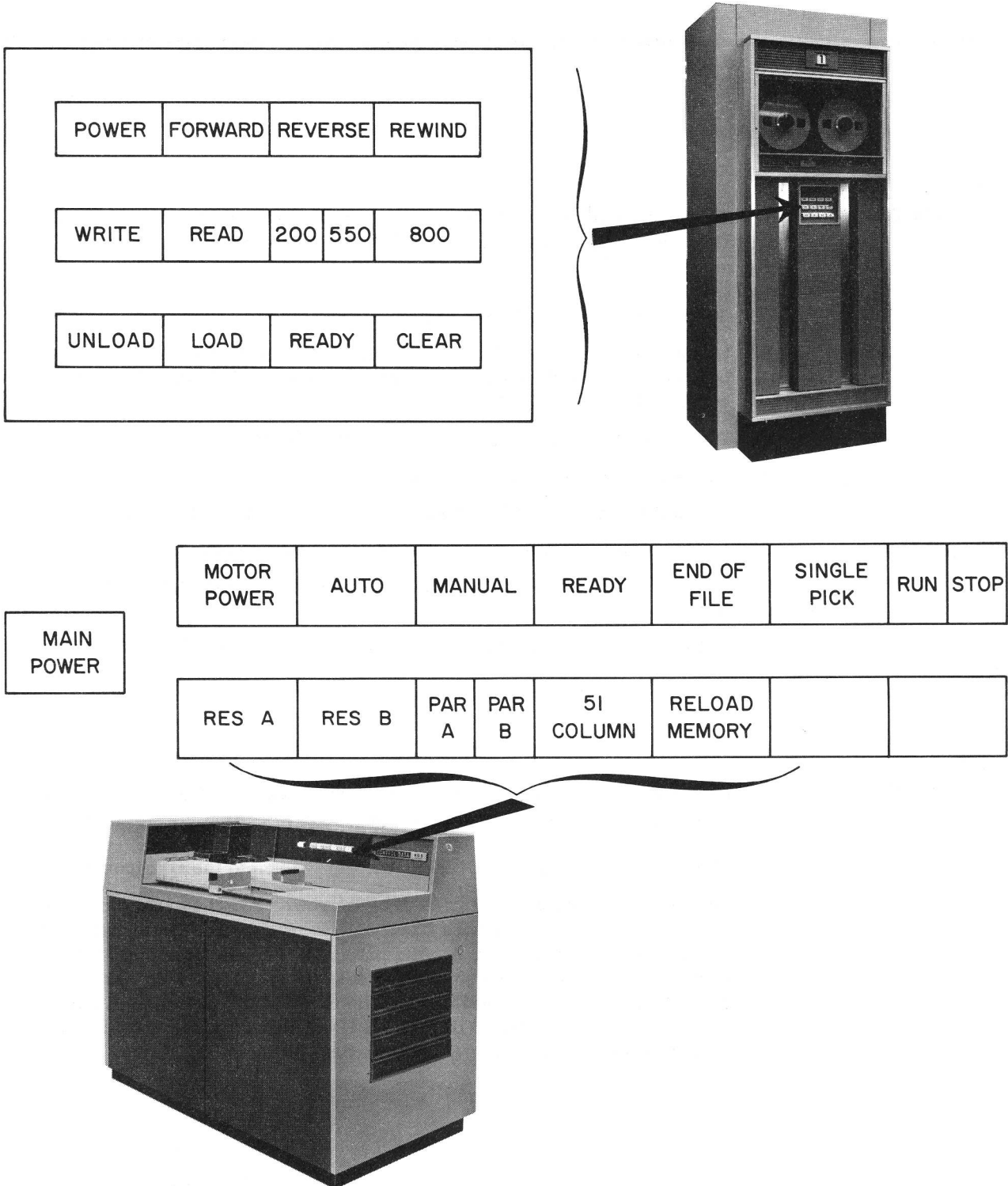


Figure 2-1a. Power Switch Locations  
607 Tape Unit and 405 Card Reader

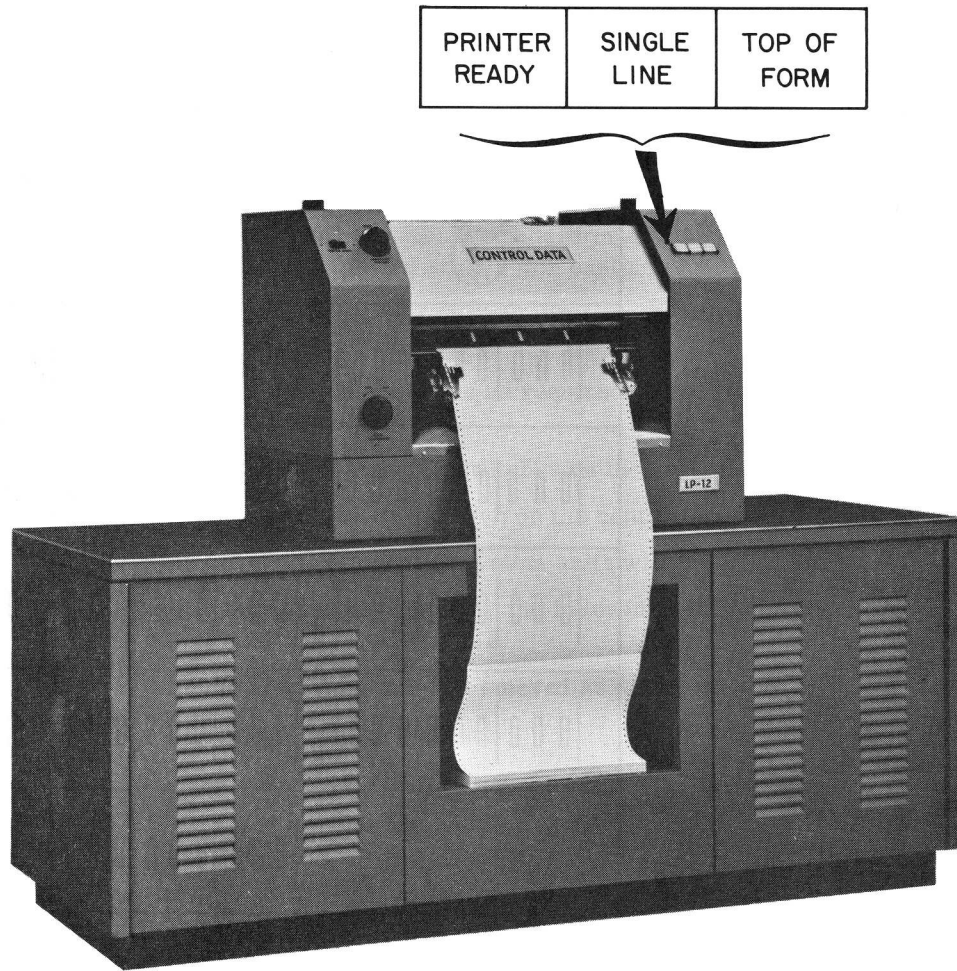
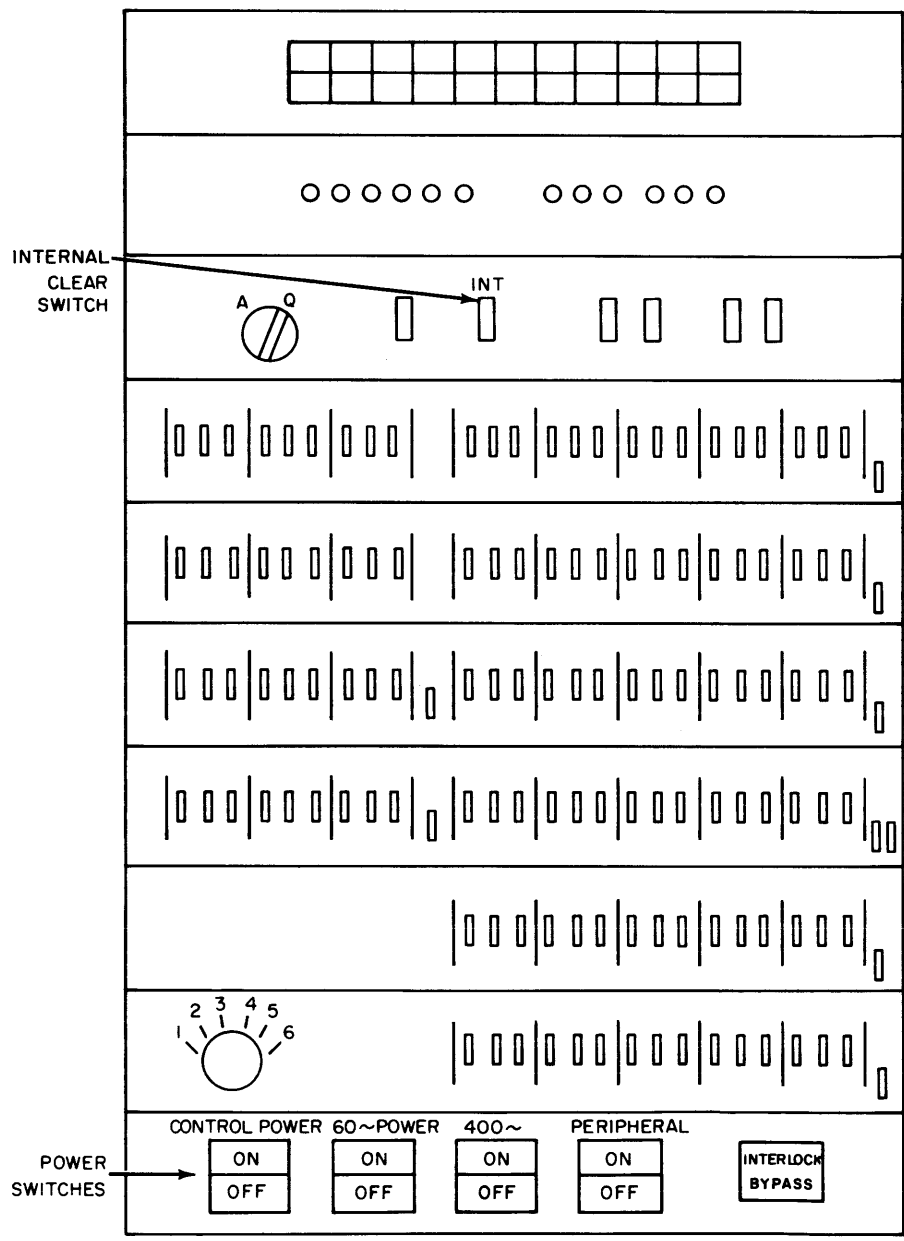


Figure 2-1b. Power Switch Locations  
501 Line Printer



**MAINTENANCE PANEL**

Figure 2-1c. Power Switch Locations  
Maintenance Panel

### 3.1 AUTOLOAD PROCEDURE

Mount magnetic tapes:

1. Mount library tape, with write ring removed, on the autoloader unit.
2. Mount previously prepared standard input tape (for off-line input), or place standard input in card reader (for on-line input).
3. Mount any previously prepared input tapes with write ring removed unless otherwise instructed.
4. Mount as many blank tapes as required by the installation--normally at least two are required.
5. Clear all SELECT JUMP switches on the control console.
6. Press the AUTOLOAD switch on the control console.
7. The initial assignment of system units will be typed out.
8. After the initial assignment, the following will be typed:  
ENTER DATE AND TIME

The date and time must be entered as follows:

carriage return (optional)

mm/dd/yy carriage return

mm = month

dd = day

yy = year

hh/mm/ss/

hh = hour

mm = minutes

ss = seconds

9. INP will be assigned and processing of the first job on it will begin.

The reel number of the label on INP is treated as follows:

At AUTOLOAD, SCOPE seeks reel 1.

When resuming operation from IDLE, SCOPE seeks reel 1.

When continuing after ENDREEL, SCOPE seeks reel  $n + 1$ ;  $n$  is the reel terminated by ENDREEL.

If SCOPE cannot find the reel it is seeking, the following message is typed on the console:

WHERE IS 60, R(INP , ee , rr)

ee = edition number

rr = reel number

The following may be typed in answer to the above:

60 = MTrr

or

60 = (INP, ee, rr) carriage return

ee = edition number

rr = new reel number

INP will be the reel specified by rr.

### 3.2 CARD TO MAGNETIC TAPE PROCEDURE

1. Place a label card (refer to Tape Label) at the beginning of the deck.
2. Place a  $\frac{7}{8}$  (EOF) and  $\frac{7}{9}$ ENDSCOPE card at the end of the deck.
3. Place deck in card reader, 9 edge down and facing into the reader.
4. Mount library tape on autoloader unit.
5. Mount tape and select the physical unit.
6. Press the following switches on the card reader (figure 2-1):

MOTOR POWER  
RELOAD MEMORY  
AUTO  
READY

(Cards will begin feeding into a Control Data 3447 or 3647 card reader.)

7. After ENTER DATE AND TIME has been typed on the console by SCOPE, set all three jump switches on the control console to the on position and enter date and time as described in the Autoloader Procedure.



8. After the Card-to-Tape routine asks for a tape unit on which to write, specify the tape with the jump switches:

<u>Tape</u>	<u>Jump Switch</u>		
	1	2	3
MT10	off	off	off
MT01	off	off	on
MT02	off	on	off
MT03	off	on	on
MT04	on	off	off
MT05	on	off	on
MT06	on	on	off
MT07	on	on	on

After selecting tape with the jump switches, type:

OK carriage return

9. When the Card-to-Tape routine has completed its task, the operator will be requested to reset the jump switches, after which SCOPE initiates job processing.

### 3.3 MANUAL INTERRUPT

If the computer is running and it is necessary to terminate or halt the job in process for any reason, the operator may interrupt SCOPE and choose a new course of action.

1. Press MANUAL INTERRUPT.
2. Wait for TYPE IN indicator to light.
3. When the TYPE IN indicator lights, type one of the following control statements, followed by a carriage return. Wait for the TYPE IN indicator to light after each carriage return before typing in a new statement. The last operator control statement may be followed by a period and a carriage return, after which SCOPE will resume normal operation; or, when all statements have been processed and the TYPE IN indicator lights, type:

OK carriage return

#### REPEAT

Terminates the current job and positions the input tape at the beginning of the same job by backspacing to the beginning of file.

#### NEXT.

Terminates the current job and positions the input tape at the beginning of the job following the current job on the input tape.

#### NEXT, nnn

Terminates the current job and positions the input tape at the job beginning with sequence number nnn.

#### ENDSCOPE

Terminates the current job, and releases all system units except LIB, OCM, ICM, and SCR; SCOPE then goes into an idle state. The operator can resume processing by mounting a new input reel and typing:

OK carriage return

#### OK carriage return

Returns to processing where interrupted.

### 3.4 ABNORMAL TERMINATION

#### 3.4.1 RESTART

A run may be terminated abnormally by pressing the RESTART switch on the control console. If this does not terminate the run, the Autoload Recovery Procedure should be used.

**3.4.2  
AUTOLOAD  
RECOVERY  
PROCEDURE**

This procedure terminates the current job abnormally. A full core dump is taken and SCOPE is completely reloaded. See Appendix A for an example.

1. Set jump switch 2 on.
2. Set jump switch 1 and jump switch 3 off.
3. Press AUTOLOAD - the following message will be typed:  
TYPE IN EQUIPMENT AND UNIT NUMBER FOR CORE DUMP
4. Type the equipment and number of the tape dump (logical unit 80), and press END OF RECORD.

A core dump will be taken.

The following message will be typed:  
TYPE IN LIBRARY UNIT NUMBER

5. Type the equipment and unit number of the library tape and press END OF RECORD. The library unit and the dump unit must be on channel 0. Assignment of system units will be listed on OCM as with a normal auto-load.

The following message will be typed:  
RECOVERY OK. ENTER DATE AND TIME

6. Enter date and time as described in the Autoload Procedure. The core dump previously taken is interpreted and the result is printed on OUT. The following message will then be typed:  
AUTO-LOAD RECOVERY COMPLETED. -NEXT- STATEMENT  
REQUIRED TO CONTINUE
7. Options are available for continuing to process INP without destroying previously-written output on OUT, ACC, and PUN. Press MANUAL INTERRUPT: TYPE IN will light. To proceed to next job on INP, type:  
NEXT. carriage return.

To search for sequence n on INP, type:

NEXT, n. carriage return.

---

Control statements may be entered through the control console or by cards inserted in the job stack. When the control console is used, the format is exactly as described below. When cards are used, each statement except the end-of-file card must begin with a 7,9 punch in column 1.

**END-OF-FILE**  
(INP ONLY)

7  
8

An end-of-file card must be inserted at the end of every job in a stack. For on-line card reader, the end-of-file statement is a 7,8 punch in column 1. Other peripheral processing programs may require a different end-of-file representation.

**ENDSCOPE**

ENDSCOPE

Terminates a SCOPE run and unloads standard output tapes. It must be placed after the last end-of-file in a job stack on INP. ENDSCOPE can be entered on ICM to terminate a SCOPE run at any time.

**ENDREEL**  
(INP ONLY)

ENDREEL

Terminates INP but does not unload standard magnetic tapes. SCOPE releases INP. At the next request for 60, SCOPE looks for the next reel of INP.

**SEQUENCE**  
(INP ONLY)

SEQUENCE, n

Optional; may be inserted before each job. SCOPE uses n for positioning INP when the NEXT, n statement is used.

**COMMENT**  
(INP ONLY)

COMMENT,

Writes in BCD on OCM the information punched in columns 2 to 80.

**NEXT**  
(ICM ONLY)

NEXT, n

Transfers processing to the job preceded by SEQUENCE, n on INP if both n's are identical, including leading zeros. If "n" is omitted, processing resumes with the next job on INP. n may be a sequence number and it may be modified by a decimal constant (NEXT, 036 + 14).

**REPEAT**  
(ICM ONLY)

REPEAT

Restarts the current job. This statement is entered only through ICM and is for use with tape INP only.

**PAUSE**

PAUSE, n

Halts processing when SCOPE encounters a SEQUENCE statement on INP containing the same n, allowing operator to type in control statement. If "n" is omitted, processing will halt at completion of current job.

**EQUIP**

EQUIP, u = d<sub>1</sub>, d<sub>2</sub>, ..., d<sub>n</sub>

Assigns a logical unit number to a specified equipment.

u      logical unit number

d<sub>i</sub>    declaration

### Hardware Declarations

n is the AHT ordinal (Appendix C) of hardware type; if omitted, the next available unit is assigned (except for tape, where the declaration is ignored).

CRn	card reader
PTn	paper tape station
CPn	card punch
DFn	disk file
LPn	line printer
DRn	drum
TYn	typewriter
TVn	display unit (cathode ray tube)
PLn	plotter
MTn	magnetic tape
DPn	disk pack

### Usage Declarations

RW	read/write
BY	bypass
RO	read only

### Density Declarations

LO	low density magnetic tape, 200 bpi
HI	high density magnetic tape, 556 bpi
HY	hyper density magnetic tape, 800 bpi

### Release Declarations (with message to operator)

SV	save tape, at end of job tape will be unloaded automatically
----	--

### Label Declarations

**	unlabeled tape (name, edition, reel, retention code or date)
----	---

defines a tape label. Name may contain no more than 14 characters and cannot be all blank. The other parameters may be omitted.

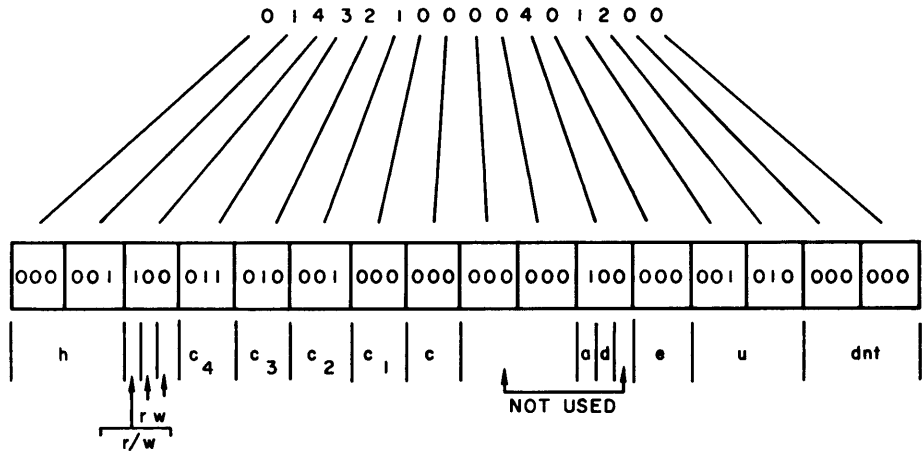


AHT, e, 0000000000000000

Alters entire entry.

e      AHT entry ordinal  
 0000000000000000      AHT replacement in octal

Example: (Appendix C gives AHT format)



- h      hardware type (magnetic tape in this example)
- r/w    tape may be used for both input and output
- r      tape may be used for input only
- w      tape may be used for output only
- c<sub>4</sub>    unit will be connected to channel 3, if channel 3 is inactive, and c<sub>1</sub>, c<sub>2</sub>, and c<sub>3</sub> was active.
- c<sub>3</sub>    unit will be connected to channel 2, if channel 2 is inactive, and c<sub>1</sub> and c<sub>2</sub> was active
- c<sub>2</sub>    unit will be connected to channel 1, if channel 1 is inactive, and c<sub>1</sub> was active
- c<sub>1</sub>    unit will be connected to channel 0, if channel 0 is inactive; if channel number 0 is in any position other than c<sub>1</sub>, it must be inserted as 4.
- c      unit was last connected to channel 0
- a      unit is assigned
- d      driver required
- e      equipment number on controller
- u      unit number of equipment



dnt driver name table ordinal (none required for tape)

To indicate that the unit is to be used for input only would require that  $r/w = 0$  and  $r = 1$ . If the above example is the tenth entry in the AHT, the statement:

AHT, 12, 0123210000401200

would make the necessary change in the AHT.

During job processing, the messages listed in the following tables may be typed on OCM. Messages may be from SCOPE, COMPASS, SORT, GPIO, Utility Controller, TAPECOPY, or CARDTAPE.

Table 1. SCOPE

<u>Message</u>	<u>Meaning</u>
SEQ. NO. xxx	SEQUENCE control card, numbered xxx, has been encountered on INP before a JOB card.
, dddddd, hhmmss	Job has been signed on.  dddddd = first 6 characters of identification field of JOB card hhmmss = hour, minute, second of day
END, dddddd, hhmmss, aaaaaa	Job has been signed off.  aaaaaa = settings of sense switches 1-6 (0 = off, 1 = on). When all sense switches are off, aaaaaa is omitted.
ABN. xx	Job has been terminated abnormally.  xx = code number of diagnostic, as listed below which will be printed on OUT.

<u>Typed on OCM</u>	<u>Printed on OUT</u>
xx = 1	ILLEGAL SCOPE STATEMENT.
2	LOADING INITIATED, BUT NO EXECUTION, EOF OR INVALID STATEMENT PRECEDED RUN CARD.
3	PRINT LIMIT ON RUN CARD ZERO. EXECUTION DELETED.
4	TIME LIMIT ON RUN CARD ZERO. EXECUTION DELETED.
5	EXCESSIVE NUMBER OF DRIVERS CAUSED PRESET ENTRY TABLE OVERFLOW. JOB ABANDONED.
6	BINARY TO HOLL. CONVERSION ERROR ON ABOVE STATEMENT. STATEMENT IGNORED.
8	SYSTEM LIBRARY REQUEST REJECTED. END SCOPE CONDITION INITIATED.

Typed on  
OCM

Printed on OUT

9	I/O EQUIPMENT FAILURE.
10	ILLEGAL PARAMETERS IN SCOPE I/O REQUEST.
11	OPERAND OR INSTRUCTION PARITY. RUN TERMINATED.
12	TIME LIMIT EXCEEDED. RUN TERMINATED.
13	ILLEGAL INSTRUCTION. RUN TERMINATED.
14	ILLEGAL BOUNDS INTERRUPT.
15	SIXTH LEVEL INTERRUPT DETECTED. RUN TERMINATED.
16	ILLEGAL CODE ON SELECT/REMOVE. RUN TERMINATED.
17	ILLEGAL REQUEST FOR A SYSTEM UNIT. RUN TERMINATED.
18	INVALID UNIT ON THE ABOVE STATEMENT. EXECUTION DELETED.
19	2 TRA CARDS ENCOUNTERED... NOT FOLLOWED BY A RUN CARD. EXECUTION DELETED.
20	ERRORS IN LOADING.
21	PRINT LIMIT EXCEEDED. RUN TERMINATED.
22	DRIVER MISSING. RUN TERMINATED.
23	TRANSLATOR ERRORS. EXECUTION DELETED.
24	REPEAT, NEXT OR ENDScope STATEMENT INITIATED RUN TERMINATION.
25	ILLEGAL END-OF-FILE ON SYSTEM UNIT. RUN TERMINATED.
26	UNREADABLE CONTROL STATEMENT ON INP. JOB TERMINATED.
27	TAPE READ REQUEST FOR A LABEL UNKNOWN TO SYSTEM. RUN TERMINATED.
28	ERROR IN THE ABOVE EQUIP STATEMENT. RUN TERMINATED.
29	ERROR IN THE EQUIPMENT TABLES. RUN TERMINATED.
31	NON-EXISTENT PHYSICAL UNIT REQUESTED. RUN TERMINATED.
32	MANUAL RESTART INITIATED, RUN TERMINATED.
33	ERROR ON AHT STATEMENT.
34	END-OF-TAPE ON INP. ENDScope CONDITION INITIATED.
35	UNRECOVERABLE ERROR ON INP. ENDScope CONDITION INITIATED.
36	UTILITY ERRORS. RUN TERMINATED.
37	DRIVERS REQUESTED NOT ON LIBRARY OR REQUESTED AFTER LOADING INITIATED. RUN TERMINATED.
38	ABNORMAL EXIT TAKEN. RUN TERMINATED.

<u>Typed on OCM</u>	<u>Printed on OUT</u>
39	ERROR IN LABEL STATEMENT. RUN TERMINATED.
40	DATE ERROR IN LABEL STATEMENT. RUN TERMINATED.
41	ERROR ON ALT LIBRARY CARD.
42	UNIDENTIFIED INTERRUPT. RUN TERMINATED.

<u>Message</u>	<u>Meaning and Action</u>
nuu=hhaa	<p>An equipment assignment has been made, an assignment has been relinquished, or a tape is to be saved.</p> <p>n = indicator</p> <p style="padding-left: 40px;">A = assigned R = released U = released and unloaded (saved)</p> <p>uu = master logical unit number</p> <p>hh = hardware type</p> <p>aa = AHT ordinal of hardware type</p>

Example: R62=MT06

Logical unit 62 has been released, rewound, but not unloaded.

Logical unit 62 was assigned to the sixth tape unit described by the AHT.

WHERE IS xx y (name, edition, reel)

User program requested an I/O operation on an unassigned unit.

xx = logical unit number in request

y = I/O operation

W = Write unit; SCOPE cannot find an available tape for output

R = Read unit; if typed out, tape with label specified by (name, edition, reel) is required

(name, edition, reel) = significant portion of label in the logical unit request; only for labeled tapes

Action:

The parameters of an EQUIP statement (Chapter 3) must be typed on the console, followed by a carriage return. The mnemonic EQUIP need not be typed in. No other control statement may be entered. The run may be terminated by RESTART or with the Autoload Recovery Procedure.

Message

Meaning and Action

ERROR ON EQUIP STATEMENT. TRY AGAIN

The response to the message WHERE IS xx y contains an error.

Rxx=MTaa

MTaa NO GOOD. WHERE IS IT

First record of an assigned output tape is unreadable or tape has no write ring.

xx = logical unit assigned

aa = AHT ordinal (within hardware type)

Action:

Reply with EQUIP statement in following format:

xx = MTbb carriage return

xx = logical unit previously assigned to MTaa in the message typed out above

bb = AHT ordinal (within hardware type)

OK TO WRITE xx=MTaa

(name, edition, reel)

The first request on a logical unit is a WRITE and the physical reel to which the logical unit has been assigned has a label with an unexpired retention code.

Action:

OK carriage return

If this is typed in answer, SCOPE will proceed with the output operation.

xx=MTbb carriage return

xx = same logical unit

bb = AHT ordinal of new tape

This answer allows writing on the tape specified by bb. If xx specified in the answer is not the same as xx in the message, the following message is typed:

NO GOOD. WHERE IS IT

A new EQUIP statement is required in answer.

BAD LABEL--MTaa Tape label cannot be interpreted; tape specified by aa will be unloaded.

<u>Message</u>	<u>Meaning and Action</u>
<b>BAD LIBRARY TAPE</b>	<p>An irrecoverable parity error was found when SCOPE attempted to call a program from the library tape.</p> <p><b>Action:</b></p> <p>A new library tape must be mounted, and recovery made by autoloading or autoloading recovery.</p>
<b>***PAUSE***</b>	<p>A PAUSE statement has been encountered on INP or a PAUSE, n statement was typed in on a previous job. (Rules for placement of PAUSE cards are described in the 3400 SCOPE/COMPASS Reference Manual.)</p> <p><b>Action:</b></p> <p>Press MANUAL INTERRUPT: TYPE IN will light. Type in a SCOPE statement followed by a period &lt;carriage return&gt; or OK &lt;carriage return&gt; if further processing is desired.</p>
<b>PAUSE, n</b>	<p>A PAUSE was encountered in a FORTRAN program.</p> <p><b>Action:</b></p> <p>Press MANUAL INTERRUPT; TYPE IN will light. When ready to resume operation, type: OK. carriage return</p>
<b>PROCESSING-NEXT-</b>	<p>Self explanatory.</p>
<b>IDLE. hhmss</b>	<p>An ENDScope condition has been reached.</p> <p style="padding-left: 40px;">hhmss = time of day</p> <p><b>Action:</b></p> <p>Press MANUAL INTERRUPT; TYPE IN will light.</p> <p>Type: OK. carriage return</p> <p>Any valid SCOPE control statement may also be typed in.</p>

Table 2. COMPASS

Message, Meaning, and Action

PARITY ON LIBRARY TAPE WHILE READING IN THE MACRO LIBRARY. DEPRESS JUMP SWITCH 1 TWICE TO GO TO NEXT JOB OR ELSE MOUNT NEW TAPE.

PARITY bbb (bbb = logical unit, operator's option as to action)

BAD CONTROL UNIT - STANDARD SUBSTITUTED  
(on COMPASS or FORTRAN card, no action required)

PUNCH ERROR. REMOVE 2 CARDS FROM PUNCH STACKER. SET AND RELEASE JUMP SWITCH 1.  
(for on-line system only)

Table 3. COBOL

Message, Meaning, and Action

TAPE xx (logical unit no. in decimal) UNREADABLE

TAPE xx (logical unit no. in decimal) UNWRITABLE

COMPARE ERROR WHILE PUNCHING CARDS. REMOVE 2 TOP CARDS FROM HOPPER. RESUME OPERATION BY TURNING SELECTIVE JUMP SWITCH 1 ON AND THEN OFF...

ERROR WHILE READING CARD. JOB ABANDONED.....

Table 4. SORT

Message

Meaning and Action

\*BEGIN SORT\* Sort/merge operation has started

\*BEGIN MERGE\* Merge only operation has started

\*END MERGE\* Merge only operation has ended

\*END SORT\* Sort/merge operation has ended

\*BEGIN FINAL PASS\*

Final pass of sort/merge operation has started

END OF INPUT PASS

Internal sort has ended

Message

Meaning and Action

ddddddd RECORDS ddddddd INSERTS ddddddd DELETED ddddddd REPLACED

Total number of records; inserted, deleted, or replaced. Only ddddddd RECORDS is always printed; the other portions of the message are printed only if the corresponding ddddddd is not zero.

ddddddd = decimal digits

xx REMAINS ON. TYPE C WHEN MERGE INPUTS ARE MOUNTED.

This message is typed only during a sort followed by a merge.

Action:

Load required merge inputs on any physical unit except the one on which logical unit xx is mounted.

FILE MARK DETECTED. MOUNT NEXT REEL AND RESET JUMP SWITCH 3.

This message is typed only if Jump Switch 3 is on, indicating a new reel is required for sort input file.

Action:

Unload first reel, mount next reel. Reset jump switch 3; WHERE IS xx? will be typed.

The following errors all cause job termination:

\*SEQUENCE ERROR\*

Sequence error in records.

NUMBER OF KEYS NOT SPECIFIED

An error exists in SORT or MERGE macro call, or SORT control cards.

ILLEGAL NUMBER OF WORK TAPES

Less than three tapes specified for a polyphase or (un)balanced merge, or less than four tapes specified for an overlapped rewind.

ILLEGAL CARD TYPE

Last card is a non-standard control card.

ILLEGAL CHARACTER

Non-standard character on last card.



Message

Meaning, No Action

ILLEGAL FILE USAGE OR FILE TYPE

Either or both of the following:

Usage is not sort, merge, or blank

File type is not input or output

FILE CARD MISSING

One of the following:

Input for sort only

Output for merge or sort/merge

LABEL TYPE ERROR

Illegal label in FILE card field

IDENT ON FILE AND RECORD NOT EQUAL

File names on FILE and RECORD cards do not agree.

RECORD TYPE ERROR

Illegal record field on RECORD card.

ERROR IN KEY

One of the following:

Key is neither ascending nor descending

Character position is zero

Length of key is zero

Key is neither binary nor BCD

LABEL LENGTH ERROR

Length on LABEL card is either 0 or greater than 120.

LABEL CARD MISSING

A non-standard label is specified for an output file on a FILE card but a corresponding LABEL card is missing.

IN FIRST PASS LABEL ILLEGAL PASS EXIT

INRTN, OUTRTN OWN CODE MISSING

Input and/or output parameters present but associated routines missing.

RECORD CARD WITH C OUT OF ORDER

First RECORD card following a FILE card is out of place or has wrong record type (it should not be C).

<u>Message</u>	<u>Meaning, No Action</u>
TOO MANY LABEL OR STDLAB CARDS	<p>One of following:</p> <ul style="list-style-type: none"> <li>Both LABEL and STDLAB cards present</li> <li>More than one STDLAB card</li> <li>More than two LABEL cards (the second LABEL cards (the second LABEL card must have OCC in length position).</li> </ul>

Table 5. GPIO

<u>Message, Meaning, Action</u>
READF PARITY TYPE IN S OR R (STOP OR REPEAT)
WRITEF PARITY TYPE IN S OR R (STOP OR REPEAT)
HARDWARE ERROR, UNIT NOT CONNECTED OR LOAD POINT
UNIT NOT READY, TYPE-IN C TO CONTINUE
WRONG DENSITY, TYPE IN C TO CONTINUE OR S TO STOP
NO WRITE RING. TYPE IN C TO CONTINUE OR S TO STOP
OPENF ATTEMPTED ON OPENED FILE
OPENF ATTEMPTED ON A SHARED BUFFER
OPENF OUTPUT-LOGICAL AREA GREATER BUFFER AREA
CLOSEF ATTEMPTED ON A CLOSED FILE
CLOSEF ATTEMPTED ON A SHARED BUFFER
CLOSEF CALL SEQ. EOR CONFLICTS WITH LABEL EOF
READF ATTEMPTED ON UNOPENED FILE
READF ATTEMPTED ON OUTPUT FILE
READF ATTEMPTED AFTER END OF FILE READ
READF BUFFER LENGTH ERROR
INPUT FILE-SET JSW1 FOR EOT OR JSW2 FOR EOF
READF COULD NOT FIND RECORD MARK CHARACTER
WRITEF ATTEMPTED ON UNOPENED FILE
WRITEF ATTEMPTED ON INPUT FILE
ENDREEL, MOUNT NEXT REEL WITH RING

Message, Meaning, Action

WRITEF COULD NOT FIND RECORD MARK CHARACTER  
COULD NOT ASSIGN THE TAPE  
TWO CONSECUTIVE FILE MARKS  
LABEL DOES NOT HAVE FOLLOWING EOF MARK  
EOT RECORD COUNTS BAD \*\*\*\*\* TYPE C TO CONT.  
TYPE IN UNIT NO. TO COPY RESTART DUMP  
ILLEGAL UNIT NO. FOR COPY  
ILLEGAL UNIT NO. FOR RESTART

Table 6. Utility Controller

<u>Message</u>	<u>Meaning, No Action Possible; Job is Terminated</u>
TOO MANY PARAMETERS	Maximum number of parameters has been exceeded.
ILLEGAL LOG UNIT FOR LIBRARY	Parameter $p_1$ was not 0 or 70-79.
TOO MANY DIGITS IN OCTAL FIELD	More than 16 digits in octal field.
A NON-DIGIT IN DECIMAL FIELD	Non-digit character in a field beginning with a digit.
DECIMAL NUMBER TOO LARGE	Decimal number caused an overflow during conversion.
A NON-OCTAL CHARACTER IN OCTAL FIELD	One digit in octal number was greater than 7.
READ PARITY ON INP	Parity error detected after reading parameter card.
NO PARAMETERS	Parameter card or continuation card contained only utility routine name and $p_1$ .
ERROR IN CONTINUATION CARD	Name and $p_1$ on continuation card do not match those on the preceding parameter card.

Table 7. TAPECOPY

<u>Message</u>	<u>Meaning and Action</u>
WRITE PARITY ERROR	<p>Three unsuccessful attempts have been made to erase six inches of tape and rewrite the record.</p> <p>Action:</p> <p>If operator types: AGAIN -- Three more attempts will be made. If unsuccessful, message will be repeated.</p> <p>If operator types anything else -- the run will terminate with the message:</p> <p style="padding-left: 40px;">WRITE PAR ERROR, RECORD xxxxx IN FILE xxxxx. JOB TERMINATED.</p>

Table 8. CARDTAPE

<u>Message</u>	<u>Meaning and Action</u>
READ PARITY ERROR	<p>Parity error persisted after three successive readings of the same record.</p> <p>This error pertains to card images on tape only. A parity error in reading a card is detected by SCOPE.</p> <p>Action:</p> <p>Operator types: AGAIN -- Three more attempts will be made. If unsuccessful, the same message will be printed.</p> <p>Operator types: OK -- The following message will be printed on OUT, the card image recorded, and the run continued:</p> <p style="padding-left: 40px;">READ PARITY ERROR -- ERROR IGNORED</p> <p>Operator types: anything else -- The run terminates with message:</p> <p style="padding-left: 40px;">READ PARITY ERROR -- JOB IS TERMINATED</p>
WRITE PARITY ERROR	<p>Three unsuccessful attempts have been made to erase six inches of tape and to rewrite the record.</p> <p>Action:</p> <p>Operator types: AGAIN -- Three more attempts will be made. If unsuccessful, the same message will be printed.</p>

Message

Meaning and Action

Operator types: anything else -- the run will be terminated with message:  
WRITE PARITY ERROR -- JOB IS TERMINATED

## **APPENDIX SECTION**

# NORMAL AUTOLOAD AND AUTOLOAD RECOVERY EXAMPLE

A

---

Description of Type Out

Console Type Out

NORMAL AUTOLOAD

A64=TY01  
A70=MT06  
A61=MT01  
A80=MT04  
ENTER DATE AND TIME 03/09/65  
14/18/00  
A60=MT10

Job Sign-on

SEQ. NO. 447  
, RASOR, 141810

PAUSE Card on INP  
Processing of Job

\*\*\* PAUSE \*\*\*                      OK

AUTOLOAD RECOVERY

TYPE IN EQUIPMENT AND UNIT NUMBER FOR CORE DUMP  
0004 < END OF RECORD > (leading zeros not required)  
TYPE IN LIBRARY UNIT NUMBER  
0006 < END OF RECORD > (leading zeros not required)  
A64=TY01  
A70=MT06  
A60=MT10  
A61=MT01  
A80=MT04  
RECOVERY OK    ENTER DATE AND TIME 03/09/65  
14/19/00  
AUTO-LOAD RECOVERY COMPLETED.  
-NEXT- STATEMENT REQUIRED TO CONTINUE.  
NEXT.  
END    (\*\*\*\*\*)141930

# CONSOLE OUTPUT LISTING EXAMPLE

B

---

```
1st Job Processed      SEQ. NO. 447
                      , RASOR, 141933
                      *** PAUSE ***           NEXT, 696.
                      PROCESSING -NEXT-

Job Sign-off          END   , RASOR, 142006

2nd Job Processed    SEQ. NO. 696
                    , CDC   , 142008
                    A20=MT11
                    A69=MT03
                    R69=MT03

Comment Card on INP  COMMENT, OPERATOR-PUT REEL 15 ON LOGICAL TAPE 1.
                    WHERE IS 01 R           01=MTR
                    ERROR ON EQUIP STATEMENT. TRY AGAIN
                    01=MT7, RO, SV
                    A01=MT07 THIS IS A USER PROGRAM TYPEOUT
                    TYPE IN MY PARAMETER 4F69T2U
                    SSON, ALL.
                    ABN. 13
                    R01=MT07
                    R20=MT11
                    END   , CDC           , 142133, 111111

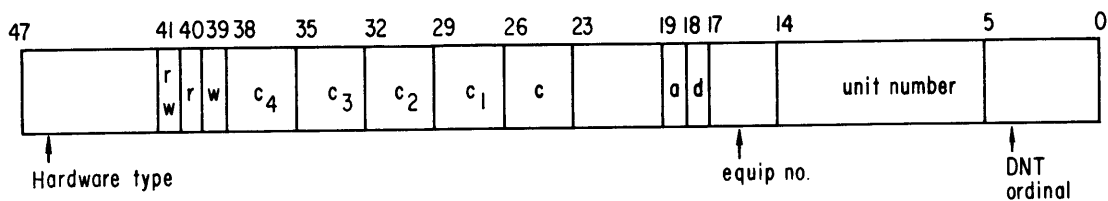
ENDSCOPE             R60=MT10
                    U61=MT01
                    IDLE. 142136
```



# AVAILABLE HARDWARE TABLE FORMAT

C

The available Hardware Table is a directory of all peripheral devices that may be driven under the control of SCOPE. The table, contained in SCOPE is ordered by hardware type. Each peripheral device such as a magnetic tape is represented by an entry in AHT. The format of the entry is as follows:



- 0-5 Driver name table ordinal - used by SCOPE to locate driver for peripheral device. Tapes do not require a special driver (blank).
- 5-14 Physical unit number (on dial) of device
- 15-17 Equipment or controller number
- 18 If set; unit is down
- 19 If set; unit is assigned
- 20-23 Not used
- 24-26 Last channel to which equipment was connected
- 27-29 )
- 30-32 ) Channel to which this equipment may be connected; connection is first attempted to c<sub>1</sub>,
- 33-35 ) then c<sub>2</sub>, then c<sub>3</sub>, then c<sub>4</sub>. If all are active transfer is to reject address.
- 36-38 )
- 39 If set, this is an output only unit
- 40 If set, this is an input only unit
- 41 If set, this unit is capable of output and input
- 42-47 Hardware - each type of peripheral device is identified by a code:
 

01 = magnetic tape	10 = typewriter
02-03 = not used	11 = disk file
04 = card reader	12 = drum
05 = card punch	13 = display unit
06 = line printer	14 = plotter
07 = paper tape	15 = disk pack

**CONTROL DATA**

C O R P O R A T I O N

**COMMENT AND EVALUATION SHEET**

**3400 COMPUTER SYSTEM**

**SCOPE Operating Guide, Version 3.0**

**Pub. No. 60134200**

**December, 1965**

**YOUR EVALUATION OF THIS MANUAL WILL BE WELCOMED BY CONTROL DATA CORPORATION. ANY ERRORS, SUGGESTED ADDITIONS OR DELETIONS, OR GENERAL COMMENTS MAY BE MADE BELOW. PLEASE INCLUDE PAGE NUMBER REFERENCE.**

**FROM**

**NAME :** \_\_\_\_\_

**BUSINESS  
ADDRESS :** \_\_\_\_\_

**NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.**

FOLD ON DOTTED LINES AND STAPLE

STAPLE

STAPLE

FOLD

FOLD

FIRST CLASS  
PERMIT NO. 8241  
  
MINNEAPOLIS, MINN.

**BUSINESS REPLY MAIL**  
NO POSTAGE STAMP NECESSARY IF MAILED IN U.S.A.

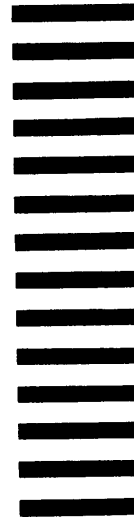
POSTAGE WILL BE PAID BY

**CONTROL DATA CORPORATION**

*Documentation Department*

3145 PORTER DRIVE

PALO ALTO, CALIFORNIA



FOLD

FOLD

**CONTROL DATA SALES OFFICES**

ALAMOGORDO • ALBUQUERQUE • ATLANTA • BILLINGS • BOSTON • CAPE  
CANAVERAL • CHICAGO • CINCINNATI • CLEVELAND • COLORADO SPRINGS  
DALLAS • DAYTON • DENVER • DETROIT • DOWNEY, CALIFORNIA • GREENS-  
BORO, NORTH CAROLINA • HONOLULU • HOUSTON • HUNTSVILLE • MIAMI  
MONTEREY, CALIFORNIA • INDIANAPOLIS • ITHACA • KANSAS CITY, KANSAS  
LOS ANGELES • MADISON, WISCONSIN • MINNEAPOLIS • NEWARK • NEW  
ORLEANS • NEW YORK CITY • OAKLAND • OMAHA • PALO ALTO • PHILA-  
DELPHIA • PHOENIX • PITTSBURGH • SACRAMENTO • SALT LAKE CITY  
SAN BERNARDINO • SAN DIEGO • SANTA BARBARA • SAN FRANCISCO  
SEATTLE • ST. LOUIS • TULSA • WASHINGTON, D. C.

AMSTERDAM • ATHENS • BOMBAY • CANBERRA • DUSSELDORF • FRANK-  
FURT • HAMBURG • JOHANNESBURG • LONDON • LUCERNE • MELBOURNE  
MEXICO CITY • MILAN • MONTREAL • MUNICH • OSLO • OTTAWA • PARIS  
TEL AVIV • STOCKHOLM • STUTTGART • SYDNEY • TOKYO (C. ITOH ELEC-  
TRONIC COMPUTING SERVICE CO., LTD.) • TORONTO • ZURICH

8100 34th AVE. SO., MINNEAPOLIS, MINN. 55440

