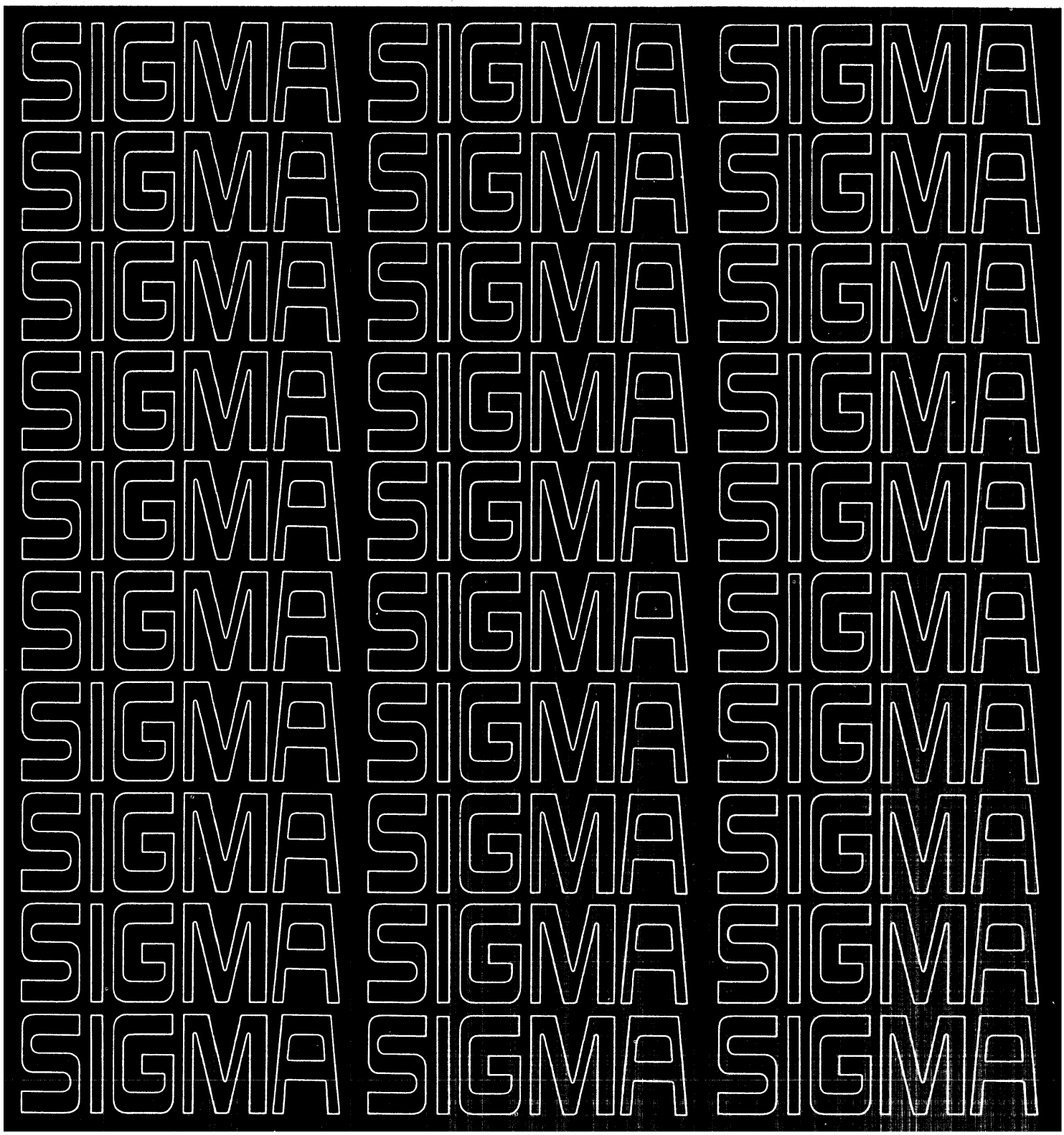
SDS SIGMA PAPER-TAPE INPUT/OUTPUT SYSTEM

MODEL 7060

Reference Manual

SCIENTIFIC DATA SYSTEMS



PAPER TAPE SYSTEM ORDER CODES

Code (Hexadecimal)	Function
00	Stop
01	Punch
02	Read Ignoring Leader Frames
82	Read Immediate

Price: $.75

PAPER-TAPE INPUT/OUTPUT SYSTEM

MODEL 7060

REFERENCE MANUAL

for

SDS SIGMA COMPUTERS

90 09 83B

October 1968

SDS

SCIENTIFIC DATA SYSTEMS/701 South Aviation Boulevard/El Segundo, California 90245

Printed in U.S.A.

REVISION

This publication, 90 09 83B, is a minor revision of the SDS Sigma Paper-Tape Input/Output System Reference Manual, 90 09 83A. Changes to the previous manual are indicated by a vertical line in the margin of the affected page.

RELATED PUBLICATIONS

Title	Publication No.
SDS Sigma 2 Computer Reference Manual	90 09 64
SDS Sigma 5 Computer Reference Manual	90 09 59
SDS Sigma 7 Computer Reference Manual	90 09 50
SDS Sigma 5/7 Symbol and Meta-Symbol Reference Manual	90 09 52
SDS Sigma 2 Symbol Reference Manual	90 10 51

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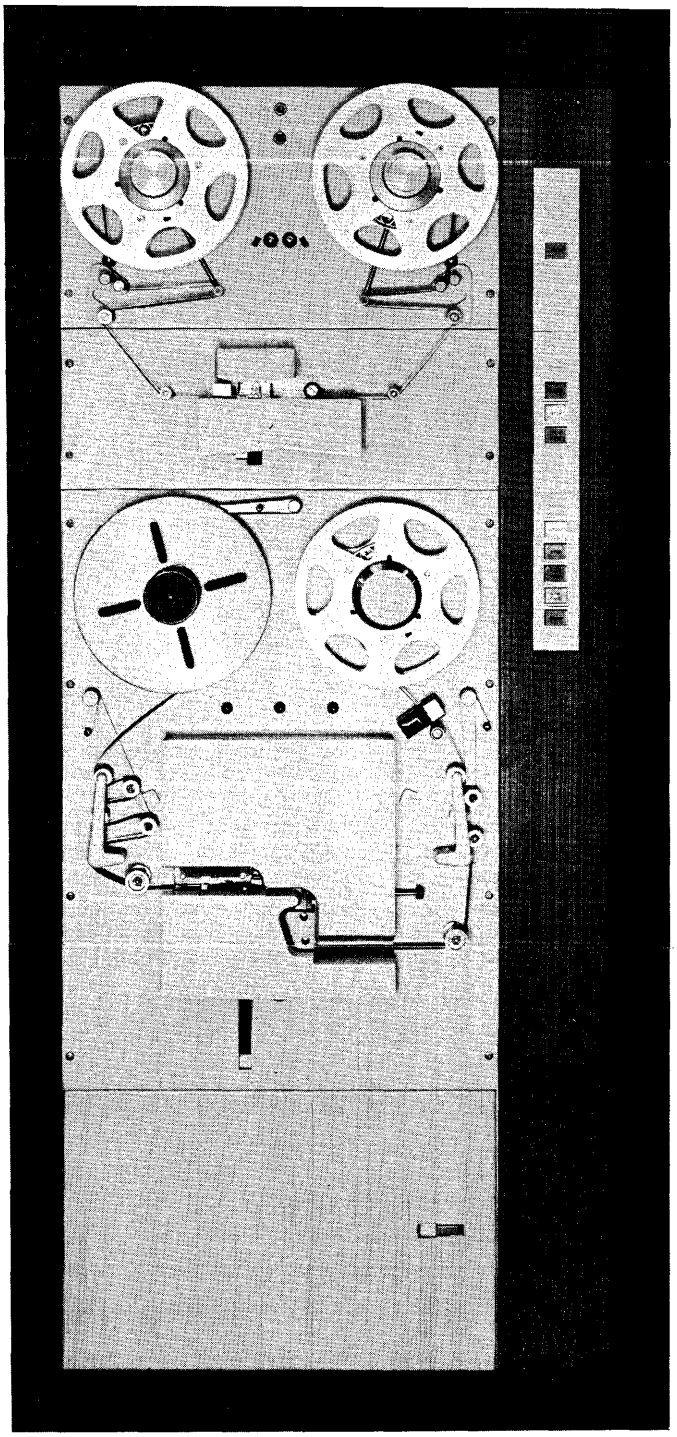

Model 7060 Paper Tape System

1. GENERAL DESCRIPTION

SDS MODEL 7060 PAPER TAPE SYSTEM

The SDS Model 7060 paper tape input/output system includes a Model 7061 Paper-Tape Rack, a Model 7062 Paper-Tape Reader, a Model 7063 Paper-Tape Punch, and a Model 7064 Spooler. All units of the system, including the controller, are rack-mounted in one cabinet together with the necessary power supplies. The paper-tape equipment communicates with the Sigma computer through an I/O channel that controls its operation.

The paper-tape reader photoelectrically reads paper or Mylar tape at a speed of 300 characters per second. The punch, which includes a take-up and supply reel mechanism, allows tape to be punched at a speed of 120 characters per second. Both reader and punch accommodate tape widths of 11/16, 7/8 and 1 inch. The tape format is eight-level, without parity bit generation or checking, and any combination of eight punches in a frame of data is valid.

Table 1. Specifications

Operating Characteristics	
Reading Speed	300 char./sec
Punching Speed	120 char./sec
Rewind Speed/Fast Forward	200 in./sec
Start Time (Reading)	Less than 6 msec
Stop Time (Reading)	Less than 1 msec

Physical Dimensions	
Height	62.5 in.
Width	29.5 in.
Depth	28.5 in.
Weight	650 lbs
Environmental Characteristics	
Ambient Temperature	55° to 90° F
Relative Humidity	20% to 80%
Power Requirements	115 vac ± 10%, 60 Hz ± 2%, single-phase, 11.5 amps
Tape Characteristics	
Type	Paper or Mylar
Width	11/16, 7/8, or 1 in.
Spooler Capacity	1000 ft
Thickness	0.0025 to 0.008 in.
Hole Dimensions and Spacing	Per EIA Standard RS227

2. FUNCTIONAL DESCRIPTION

DATA REPRESENTATION

Each frame of information on the tape represents an 8-bit byte image (see Figure 1). When a tape is read in the Ignore Leader Frames read mode (see Chapter 3), leading null bytes (00_{16}) are ignored, and the transmission of data begins with the first non-null byte. When a tape is read in the Immediate read mode, leader frames are not ignored but are transmitted as zero bytes.

TAPE READER/PUNCH STATES

The initial state of the reader or punch aepends on its power status. The complete absence of power to the 7060 subsystem (i.e., the absence of primary ac power or system dc power) effectively removes the reader and punch from the controlling system. Any attempts to access either unit then result in a response of "no input/output address recognition" to the I/O instruction. Furthermore, no status indications are supplied if status is requested by the I/O instruction. In the absence of ac power, the presence of system dc power will enable address recognition, but the reader/punch assumes a "not operational" condition. Likewise, the failure of internal power supplies causes the 7060 subsystem to assume a "not operational" condition.

OPERATIONAL STATES

The four operational states of the 7060 subsystem are:

1. Ready manual.
2. Busy manual.
3. Ready automatic.
4. Busy automatic.

The 7060 subsystem will assume one of these four states if ac and dc power are present.

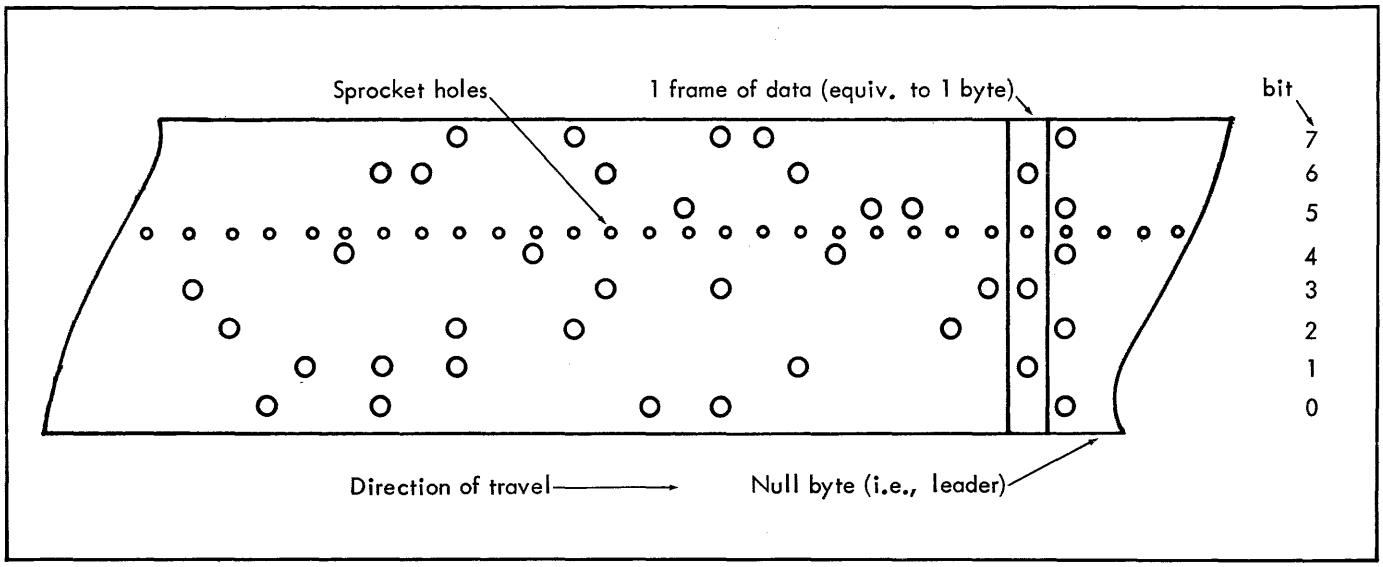

Figure 1. Tape Data Format

The four operational states that the 7060 may assume reflect one of two possible device conditions ("ready" or "busy") and one of two possible operating modes ("manual" or "automatic").

The exact condition and mode status of the reader/punch at any given time is returned to the CPU in response to such I/O instructions as SIO, HIO, and TIO. AIO and TDV instructions result in additional specific status indications. A brief explanation of the possible conditions and modes is presented below.

CONDITIONS

Ready. In the "ready" condition, the reader/punch is capable of accepting an SIO instruction, provided that no interrupt is pending. To be in the "ready" condition, the reader/punch must be operational and must not be executing an order or chain of orders.

Busy. In the "busy" condition, the reader/punch has accepted an SIO instruction, and no new order will be accepted until the current order or chain of orders have been completed.

MODES

Manual. The reader/punch assumes the "manual" mode when any condition arises that requires operator intervention before the subsystem can function normally. The "manual" mode may be forced by the operator by depressing the RESET switch or either of the STOP switches at the 7060 subsystem control panel. The reader/punch can accept an SIO instruction from the controlling system in this mode, but will not act on it until the "automatic" mode (see below) is entered.

Automatic. The reader enters the "automatic" mode when the LOAD/RUN switch is in the RUN position and the START pushbutton on the reader has been depressed. The punch enters the "automatic" mode when the tape is threaded in the punch, all tape transport interlock conditions are satisfied, and the START pushbutton on the punch has been depressed. The "automatic" mode signaled on the status response lines is a combination of reader and punch "automatic".

TRANSITIONS BETWEEN STATES

The allowable reader/punch device state transitions and the conditions causing the reader/punch to change from one state to another are summarized in Table 2.

DATA TRANSFER

The read/punch operation is initiated by the controlling system with a START INPUT/OUTPUT (SIO) instruction that transmits a read/punch order to the reader/punch if the following conditions are satisfied:

1. I/O address recognition exists.
2. The reader/punch is in the "ready" condition.
3. No interrupt is pending.

If the reader/punch is in the "automatic" mode after accepting the SIO instruction, it will request an order from the controlling system. The reader can accept three types of orders: Read Immediate, Read Ignoring Leader Frames, and Stop. The punch can accept only two types of orders: Punch and Stop.

After accepting a valid read/punch order, the tape image for one frame is transmitted to (read) or accepted from (punch) the controlling system. The tape is then automatically upspaced by one frame. Bytes are read or punched until the byte count in the I/O control doubleword is satisfied.

Table 2. Reader/Punch State Transitions

Present State \ Next State	Not Operational	Ready Manual	Busy Manual	Ready Automatic	Busy Automatic
Not Operational	——	Power on.	Not possible.	Not possible.	Not possible.
Ready Manual	Unit power failure or power off	——	SIO accepted.	START switch is operated and operator intervention is not required.	Not possible.
Busy Manual	Unit power failure or power off	HIO received, or device RESET switch is operated.	——	Not possible.	START switch is operated and operator intervention is not required.
Ready Automatic	Unit power failure or power off	STOP switch or device RESET switch is operated.	Not possible.	——	SIO accepted.
Busy Automatic	Unit power failure or power off	STOP switch is operated. Execution is completed[t] and a manual operation is required. Device RESET switch is operated.	STOP switch is operated. Execution is pending but a manual operation is required. Device RESET switch is operated.	Execution completed, HIO received, or Stop order received.	——

[t] No new execution is pending.

3. PROGRAM INTERFACE

READ ORDERS

Valid read orders are listed below.

Order	Action
X'00'	Stop
X'02'	Read Ignoring Leader Frames
X'82'	Read Immediate

PUNCH ORDERS

Valid punch orders are listed below.

Order	Action
X'00'	Stop
X'01'	Punch

KEY EVENTS

The key events that occur during a read/punch operation are described below. No chronological order should be assumed from the order of presentation. Timing information is discussed under "Programming Considerations".

START INPUT/OUTPUT

A read/punch operation is initiated with the execution of a START INPUT/OUTPUT instruction by the controlling system. If I/O address recognition exists and the reader/punch is in the "ready" condition with no interrupt pending, the controlling system sets its "I/O address recognition" and "SIO accepted" indicators. Meanwhile, the reader/punch advances from the "ready" to the "busy" condition. If operating in the "automatic" mode, the subsystem then requests an order byte from the controlling system and waits

for the requested byte to arrive. Note that "SIO accepted" does not mean that the reader/punch has started to read or punch tape, but only that it has acknowledged the I/O address and is in the "ready" condition with no interrupt pending.

UNUSUAL END CONDITIONS

Detecting any of the following conditions after an order is received causes the reader/punch to return an "unusual end" indication to the controlling system:

1. Occurrence of a "not operational" condition during an I/O operation.
2. Reception of a HALT I/O command from the controlling system.†
3. LOAD/RUN switch is placed in the LOAD position during a read operation.
4. RESET button depressed while "busy".
5. Specified device is not available.

CHANNEL END CONDITIONS

After receiving a valid order from the controlling system, the reader/punch signals "channel end" to the controlling system following the receipt of the last byte ("count done").

FAULT CONDITIONS

In general, a fault condition is any condition that causes a device to report a "not operational" condition in response to an SIO, HIO, or TIO instruction. A power failure in the 7060 subsystem will cause the reader/punch to become "not operational".

I/O INSTRUCTION STATUS BITS

The execution of an I/O instruction (SIO, HIO, TIO, TDV, or AIO) by the computer provides two bits of immediate information pertaining to the general condition of the addressed I/O device and its controller. This status information is received and retained by the computer in a form that allows for conditional branching based on the response of the device (and its controller) to the I/O instruction. Table 3 lists the response information provided by the execution of each type of I/O instruction.

STATUS RESPONSE

In addition to the status bits discussed above, the reader/punch is capable of returning various other status flags in response to computer-executed I/O instructions. Detailed explanations of the I/O instructions that request device status and operational status are contained in the reference manuals for the Sigma computers. The following material explains the significance of each status flag returned to the controlling system by the reader/punch.

DEVICE STATUS BYTE

The following eight bits of information are made available to the controlling system in the Device Status Byte in response to the execution of an I/O instruction.

STATUS RESPONSE FOR SIO, TIO, AND HIO

Bit 0: Device Interrupt Pending. If this bit is a 1, an interrupt call is pending (i.e., issued but not yet acknowledged by an AIO instruction). The device will not accept a new order until the interrupt is cleared. The interrupt may be cleared by executing an AIO or HIO instruction or by manual intervention (by performing an I/O reset operation from the computer control panel).

Bits 1-2: Reader/Punch Condition. A combination of these two flags indicates the current condition of the device.

Flags	Condition
00	Device Ready – the device is capable of accepting an SIO instruction if no interrupt is pending.
01	Device Not Operational – primary power is off or a device power failure exists. Manual intervention is necessary to clear the "not operational" condition.
10	Device Unavailable – this condition is not applicable to the reader/punch.
11	Device Busy – the reader/punch is currently engaged in executing a previous order.

Bit 3: Reader/Punch Mode. If this bit is a 0, the reader or punch is in the "manual" mode, necessitating manual intervention. If this bit is a 1, the reader and punch are in the "automatic" mode and manual intervention is not required.

Bit 4: Device Unusual End. If this bit is a 1, execution of the previous order was terminated due to an abnormal condition (see "Unusual End Conditions", above).

Bits 5-6: Device Controller Condition. A combination of these two flags indicates the current condition of the device controller.

Flags	Condition
00	Device Controller Ready – the device controller can accept an SIO instruction if an interrupt is not pending.
01	Device Controller Not Operational – primary power is off or a device power failure exists. Manual intervention is necessary to clear the "not operational" condition.
10	Device Controller Unavailable – this condition is not applicable to the device controller.
11	Device Controller Busy – the device controller is currently engaged in performing an operation.

†Sigma 5/7 only.

Table 3. Reader/Punch I/O Instruction Execution Response

Instruction	Code				IOP Type			Address/ Interrupt Recognition	Operation Accepted	Status Returned to CPU Registers	Significance
	CC-1 (Σ5/7)	Overflow (Σ2)	CC-2 (Σ5/7)	Carry (Σ2)	Multiplexor	Integral	Selector				
SIO	0		0		Yes	Yes	Yes	Yes	Yes	Yes	Device was "ready", now "busy".
	0		1		Yes	Yes	Yes	Yes	No	Yes	Device was "not ready".
	1		0		No	No	Yes	Yes	No	No	Selector IOP was "busy" (not applicable to Σ2).
	1		1		Yes	Yes	Yes	No	No	No	I/O address not recognized.
HIO	0		0		Yes	Yes	Yes	Yes	Yes	Yes	Device (and selector IOP) was "not busy".
	0		1		Yes	Yes	Yes	Yes	Yes	Yes	Device (and/or selector IOP) was "busy".
	1		0		No	No	No	No	No	No	Invalid code.
	1		1		Yes	Yes	Yes	No	No	No	I/O address not recognized.
TIO	0		0		Yes	Yes	Yes	Yes	Yes	Yes	Device is "ready".
	0		1		Yes	Yes	Yes	Yes	Yes	Yes	Device is "not ready".
	1		0		No	No	Yes	Yes	No	No	Selector IOP is "busy" (not applicable to Σ2).
	1		1		Yes	Yes	Yes	No	No	No	I/O address not recognized.
TDV	0		0		Yes	Yes	Yes	Yes	Yes	Yes	Normal response.
	0		1		No	No	No	No	No	No	Invalid code.
	1		0		No	No	Yes	Yes	No	No	Selector IOP is "busy" (not applicable to Σ2).
	1		1		Yes	Yes	Yes	No	No	No	I/O address not recognized.
AIO	0		0		Yes	Yes	Yes	Yes	Yes	Yes	Normal interrupt recognition.
	0		1		Yes	Yes	Yes	Yes	Yes	Yes	Abnormal interrupt recognition.
	1		0		No	No	No	No	No	No	Invalid code.
	1		1		Yes	Yes	Yes	No	No	No	No interrupt recognition.

Bit 7: Unassigned. This status bit is currently unassigned and is always reset to a 0.

STATUS RESPONSE FOR TDV

Bit 0: Data Overrun. Not used.

Bit 1: Punch, Tape Low. If this bit is a 1, the tape supply is low on the tape transport of the punch.

Bit 2: Punch, Manual Mode. If this bit is a 1, the punch is in the "manual" mode.

Bit 3: Reader, Manual Mode. If this bit is a 1, the reader is in the "manual" mode.

Bits 4-7: Not used. These bits are not used.

STATUS RESPONSE FOR AIO

No status response is supplied during the AIO function.

OPERATIONAL STATUS BYTE

In addition to the information contained in the device Status Byte, the following indicators are made available to the controlling system in the Operational Status Byte:

Channel End. If this flag is a 1, it indicates that I/O conditions have been terminated.

Unusual End. If this flag is a 1, execution of the previous order was terminated due to an abnormal condition (see "Unusual End Conditions", above).

PROGRAMMING CONSIDERATIONS

TIMING INFORMATION

The time required for the tape reader to reach operating speed from the rest position is less than 6 msec.

The punch cycle time is 8.33 msec.

SEQUENCE OF ACTIVITY

Figure 2 illustrates the sequential relationship of the key events that occur during a read/punch operation.

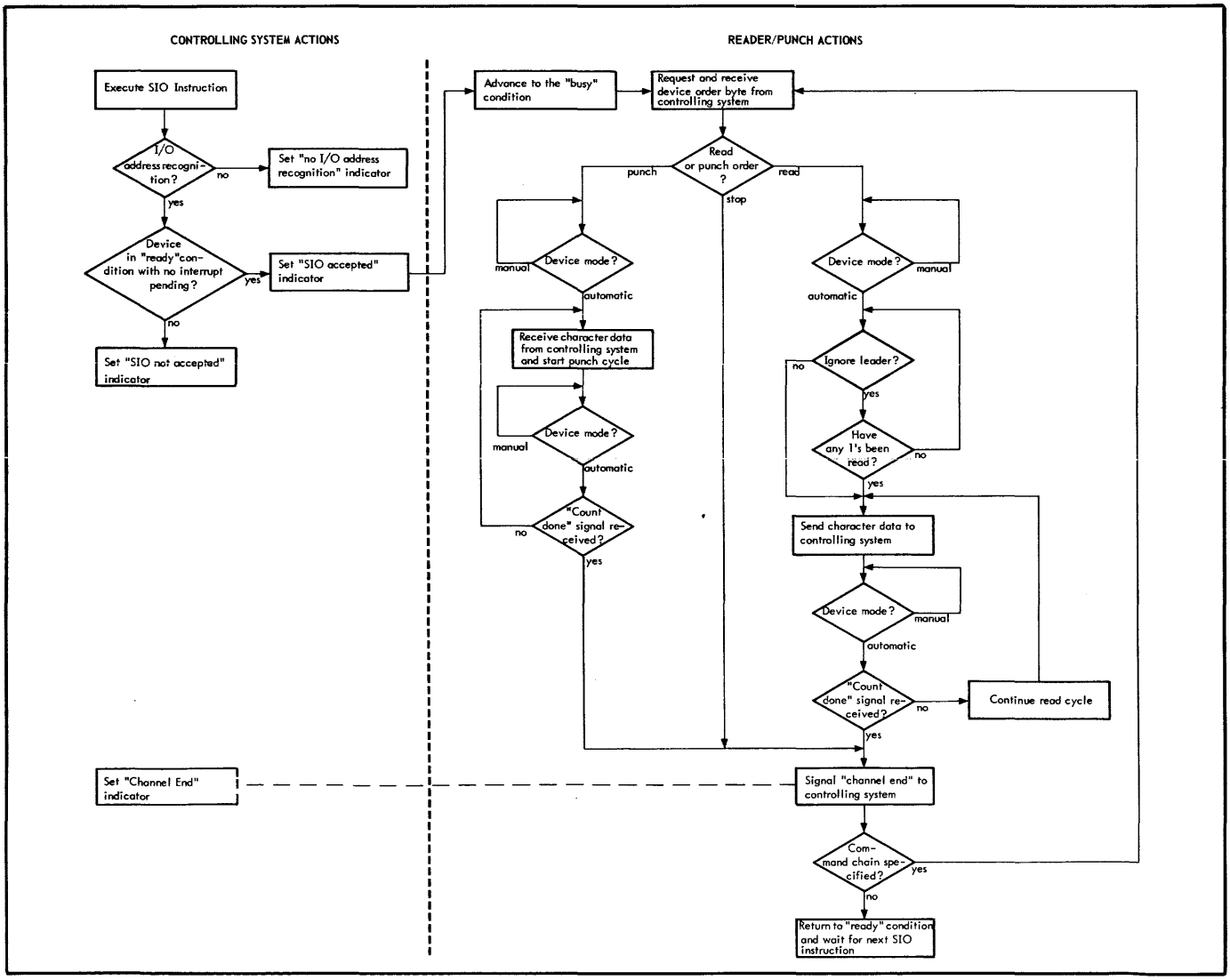

Figure 2. Controlling System and Reader/Punch Actions

4. OPERATIONS

OPERATOR CONTROLS

The control panel for the 7060 subsystem contains the switches and indicators shown in Figure 3.

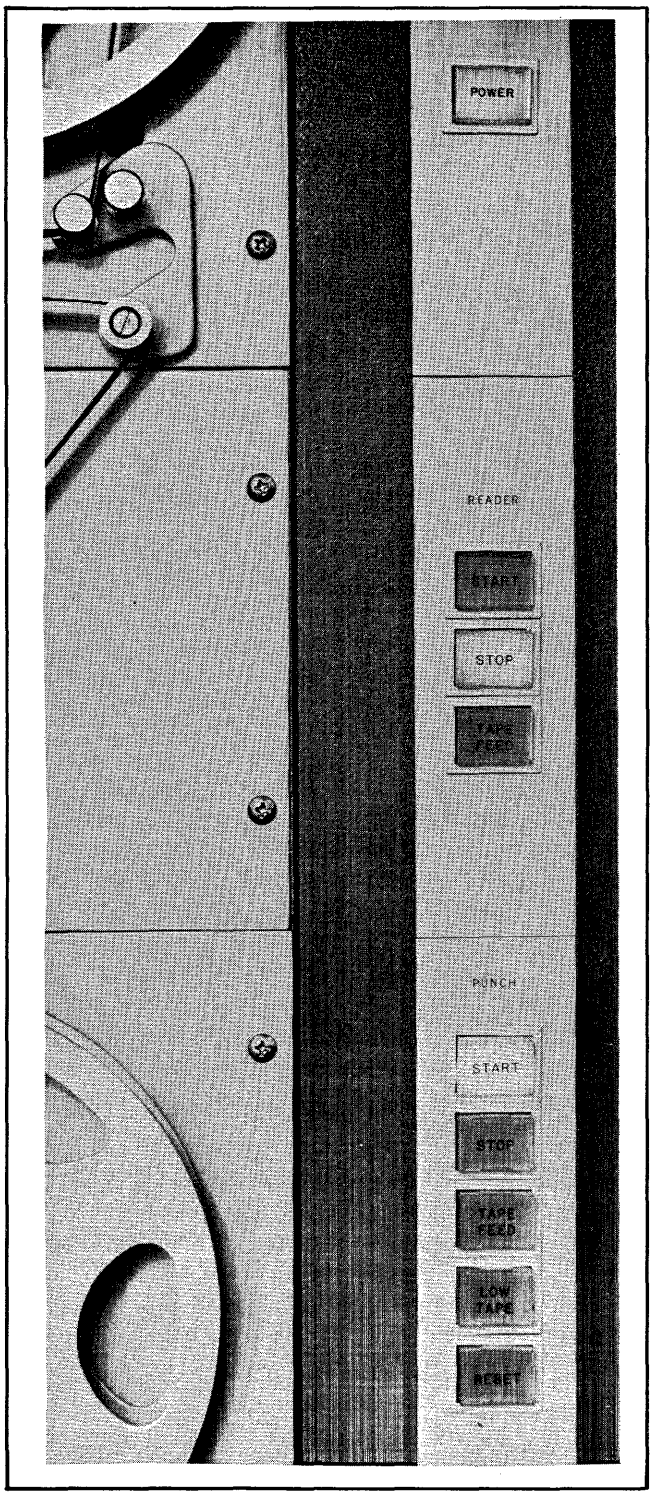

Figure 3. 7060 Subsystem Controls

POWER SWITCH-INDICATOR

This is a push-on/push-off switch-indicator that controls all primary power to the 7060 subsystem. The indicator remains illuminated as long as power is applied. When the switch is momentarily pressed, ac power is applied or removed from the subsystem.

READER CONTROLS

The tape reader portion of the control panel contains the three controls discussed below.

START

This is a switch-indicator used to control and indicate the "automatic" mode of the tape reader. Pressing this switch causes the tape reader to enter the "automatic" mode if the RUN/LOAD switch on the spooler is in the RUN position. The indicator remains illuminated as long as the tape reader is in the "automatic" mode.

STOP

This is a switch-indicator used to stop tape motion by causing the tape reader to enter the "manual" mode. The indicator remains illuminated as long as the tape reader is in the "manual" mode.

TAPE FEED

This is a switch-indicator used to cause the tape reader to pass tape forward (without reading) under control of the drive capstan as long as the pushbutton is pressed. This control is operative only when the reader is in the "manual" mode.

PUNCH CONTROLS

The tape punch portion of the control panel contains the controls and indicators discussed below.

START

This is a switch-indicator used to control and indicate the "automatic" mode of the tape punch. Pressing this switch causes the tape punch to enter the "automatic" mode if tape is properly threaded in the punch. The indicator remains illuminated as long as the tape punch is in the "automatic" mode.

STOP

This is a switch-indicator used to stop tape motion by causing the punch to enter the "manual" mode. It remains illuminated as long as the punch is in the "manual" mode.

TAPE FEED

This is a switch-indicator used to cause the tape punch to generate blank frames of tape (leader) as long as the push-button is pressed. This control is operative only when the punch is in the "manual" mode.

LOW TAPE

This is an indicator that is illuminated automatically when the tape supply reel of the tape punch is nearly empty.

RESET

This is a momentary switch used to reset the control logic for the operation in progress (either a read or punch operation). Activation of this switch also forces the 7060 subsystem to enter the "manual" mode and places the device controller in the "ready" condition.

SPOOLER CONTROLS

REV/FWD

This is a spring-loaded switch that is normally in the "off" (center) position. When held in the REV position, it causes tape to rewind at 200 in./sec. When held in the FWD position, it causes tape to feed in the forward direction at 200 in./sec. This control is operative only when the reader is in the "manual" mode and the spooler RUN/LOAD switch is in the RUN position.

RUN/LOAD

This is a two-position switch used to control the application of ac power to the spooler drive motor. When in the RUN position, the spooler is capable of either "manual" or "automatic" operation. When in the LOAD position, the spooler is inoperative, allowing the operator to change tape reels.

LOADING PROCEDURE

Tape loading procedures for the reader and punch are given below.

LOADING THE READER

1. Press the STOP pushbutton on the tape reader sub-control panel.
2. Place the RUN/LOAD switch (on the spooler) in the LOAD position.
3. Mount the reel to be read on the left-hand hub of the spooler so that tape unrolls as the reel rotates counterclockwise, then thread the tape around the guide rollers and sensing arms and through the tape transport (on the reader) as shown in the frontispiece illustration.
4. Manually wind the reels so that both sensing arms are approximately in the center of their range of travel.
5. Place the RUN/LOAD switch (on the spooler) in the RUN position.
6. Raise the RUN/LOAD switch (on the reader) to the RUN position.
7. Press the START pushbutton on the tape reader sub-control panel.

LOADING THE PUNCH

1. Press the STOP pushbutton on the tape punch sub-control panel.
2. Pull the flange from the supply reel shaft (i.e., the left-hand reel) and raise and latch the supply sensing arm.
3. Place a roll of blank tape (either oiled or dry, paper or paper-Mylar-paper) on the supply roll hub so that the tape unrolls as the reel rotates clockwise.
4. Replace the flange on the supply reel shaft by pushing it firmly onto the shaft.
5. Rotate the supply control arm clockwise to the latched position at the left of the supply idlers and pull out the tape guide knob (at the right of the punch head assembly).
6. Pull several feet of tape from the supply reel and thread the tape between the supply control arm and the supply idlers, under the adjustable idler at the left of the punch head, and through the punch head.
7. Form the tape supply loops by depressing the left-hand latch release button (above the punch head cover). Then push in the tape guide knob.
8. Disengage the supply sensing arm from its latch by depressing the center latch release button.
9. Rotate the take-up control arm counterclockwise to the latched position at the right of the take-up idlers.
10. Mount a take-up reel on the right-hand shaft.
11. Thread the tape coming from the right-hand side of the punch head so that it passes under the adjustable idler at the right of the punch head, between the take-up control arm and the take-up idlers, between the tape brake solenoid and tape brake shoe assemblies, and onto the left side of the take-up reel.
12. Insert the tape into the reel slot and manually rotate the reel a few turns in the clockwise direction.
13. Form the tape take-up loop by depressing the right-hand latch release button.
14. Press the START pushbutton on the tape punch sub-control panel.

APPENDIX. PROGRAM EXAMPLES

SIGMA 5/7 PROGRAMMING EXAMPLES

The following coding sequence illustrates a paper-tape reader program for use with an SDS Sigma 5/7 Computer. The program will perform a read operation and return to the main program. This program is written as a subroutine entered by a Branch and Link instruction using register 15 (i.e., BAL, 15 RDTAPE).

Label	Command	Argument	Comments
RDTAPE	LI, 0	DA(IOCDR)	Load general register 0 with the doubleword address of the I/O control doubleword for the read operation
STARTIOR	SIO, 10	5	Start the Reader for device 5 on IOP 0.
	BCS, 8	NIOAR	Branch to the no-I/O-address-recognition routine (not shown).
	BCS, 4	BUSY	Branch to the "busy" routine (not shown) if the reader is busy or an interrupt is pending.
TESTIOR	TIO, 10	5	Test the Reader's status (general register 11 will contain the status response).
	CW, 11	L(X'20000000')	Compare bit 1 for a "busy" condition.
	BCS, 4	TESTIOR	Branch to TESTIOR if the Reader is "busy".
	CW, 11	L(X'2AFE0000')	Compare status for error.
	BCS, 4	ERRORR	Branch to ERRORR routine (not shown) if a fault condition exists.
	BCR, 0	*15	Return to the main program.
	BOUND	8	
IOCDR	GEN, 8, 24 GEN, 8, 24	X'2', BA(TABLER) X'8', 100	These two directives define the I/O command doubleword: – Read ignoring leading null frames – Halt on transmission error – Byte count 100
TABLER	RES	25	Reserve 25 words for storing message.

The following coding sequence illustrates a paper-tape punch program for use with an SDS Sigma 5/7 Computer. The program will perform a punch operation and return to the main program. This program is written as a subroutine entered by a Branch and Link instruction using register 15 (i.e., BAL, 15 PNTAPE).

Label	Command	Argument	Comments
PNTAPE	LI, 0	DA(IOCDP)	Load general register 0 with the doubleword address of the I/O control doubleword for the punch operation.
STARTIOP	SIO, 10	5	Start the Punch for device 5 on IOP 0.
	BCS, 8	NIOAR	Branch to the no-I/O-address-recongition routine (not shown).
	BCS, 4	BUSY	Branch to "busy" routine (not shown) if the punch is busy or an interrupt is pending.
TESTIOP	TIO, 10	5	Test the status of the Punch (general register 11 will contain the status response).
	CW, 11	L(X'20000000')	Compare bit 1 for a "busy" condition.
	BCS, 4	TESTIOP	Branch to TESTIOP if the Punch is "busy".
	CW, 11	L(X'AFE0000')	Compare status for error.
	BCS, 4	ERRORP	Branch to ERRORP routine (not shown) if a fault condition exists.
	BCR, 0	*15	Return to the main program.
	BOUND	8	
IOCDP	GEN, 8, 24 GEN, 8, 24	X'1', BA(TABLEP) X'8', 100	These two directives define the I/O command doubleword: – Punch – Halt on transmission error – Byte count 100
TABLEP	RES	25	Reserve 25 words for storing message.

SIGMA 2 PROGRAMMING EXAMPLE

The following coding sequence illustrates a paper-tape program for use with an SDS Sigma 2 Computer. The program will perform a read or punch operation and return to the main program. It is written as a subroutine entered by a Register Copy and Increment instruction (RCPYI P, L) followed by a branch to either ENTERP (punch), ENTERI (read ignoring leader), or ENTERL (read including leader).

Label	Command	Argument	Comments
ERRCHK	DATA	X'1000'	
BZTEST	DATA	X'2000'	
PUNCH	DATA	X'01'	Order code
READI	DATA	X'02'	Order code
READL	DATA	X'82'	Order code
ORDER	RES	1	
IMAGE	RES	40	
IOCD1	ADRL	ORDER	
IOCD2	DATA	81	Byte count
P	EQU	1	Link to main program
L	EQU	2	Link to main program
T	EQU	3	
A	EQU	7	
ENTERP	LDA	PUNCH	Punch entry
	STA	ORDER	
	B	BEGIN	
ENTERI	LDA	READI	Read-ignoring-leader entry
	STA	ORDER	
	B	BEGIN	
ENTERL	LDA	READL	Read-including-leader entry
	STA	ORDER	
BEGIN	LDA	IOCD1	Load address of order
	WD	X'A'	
	LDA	IOCD2	Load byte count
	WD	X'B'	
	LDA	=X'21'	Use device 33

Label	Command	Argument	Comments
TEST1	TIO		Test device status
	BNC	$+3	Branch if ready for SIO
	WD	X'DO'	Set wait FF to 1
		TEST1	Repeat test if device not ready
	SIO		Start I/O
TEST2	TIO		Test device status
	RCPY	A,T	
	LDA	BZTEST	
	RAND	*T,A	Reset busy indicator if busy
	BAZ	TEST2	Branch if busy
	RD	X'A'	Read operational status byte
	CP	ERRCHK	Error check
	BNC	ERROR	Branch on error
	RD	X'B'	Read error flag
	BAN	ERROR	Branch on error
	RCPY	L,P	Exit to main program
ERROR	B	ERR	Branch to error-recovery routine
	ADRL	ERR	