S O N Y

EXTERNAL COMPUTER INTERFACE MANUAL

LDP-1000A Videodisc Player
SFA-1000 Still-Frame Audio Adaptor

TABLE OF CONTENTS

IV. LDP-1000A Commands (Continued)

I. Introduction

This manual is intended to aid systems integrators with connections of the LDP-1000A Videodisc Player to an external computer. A working knowledge of computers is assumed and no efforts are made to teach the fundamentals of computer hardware and software.

This reference manual is the primary documentation concerning the characteristics of the LDP-1000A Videodisc Player and SFA-1000 Still-Frame Audio Adaptor when used under external computer control. Explanations of the operation of the LDP-1000A and SFA-1000 in the stand-alone mode will be made only as required to describe the external-computer interface.

There are several PROM revisions for both the LDP-1000A and the LDP-1000. This manual describes the most recent PROM version. Deviations from this PROM revision are explained in section V.

Unless otherwise specified, all references to EXT CPU should be translated to mean external computer.

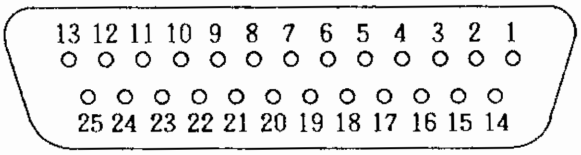
Unless otherwise specified, all references to LDP-1000 is a reference to LDP-1000A and vice versa.

II. Communications Link

A. Connector, Pin Assignment and Signals on LDP-1000A

The connector used for the RS232-C port on the Sony Videodisc Player is the standard D-sub 25 pin socket. A matching male connector must be used. Most electronics suppliers will recognize this and should be able to supply you with a suitable connector.

RS232-C



Top view

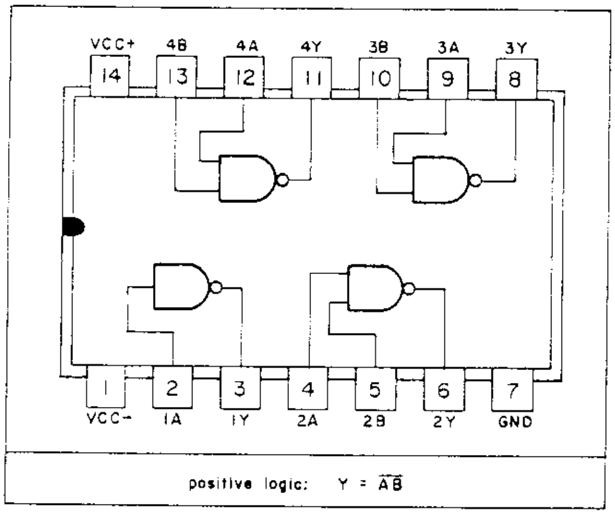
Pin No.	Signal	Description	Signal Direction
1	--	unused	-
2	T x D	Transmitted Data	LDP --->
3	R x D	Received Data	LDP <---
4	$\overline{RTS}$	Request to Send Data	LDP --->
5	$\overline{CTS}$	Clear to Send Data	LDP <---
6	$\overline{DSR}$	Data Set Ready	LDP <---
7	GND	Signal Ground	-
8-19		Unused	
20	$\overline{DTR}$	Data Terminal Ready	LDP --->
21-25		Unused	-

LDP ---> outgoing signal from videodisc player
LDP <--- incoming signal to videodisc player

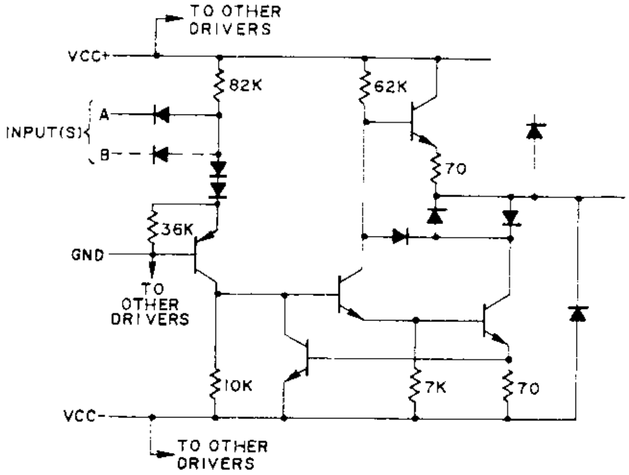
* This pin is needed only for long cables - 12 feet is the usual definition of a long cable. It should be attached to a metal shield that encloses all the other wires in the cable and grounded to a neutral ground (not a signal ground) at both ends of the cable. The purpose of the shield is to prevent stray magnetic fields from inducing false data in the other wires. Although this pin is rarely needed, it is defined as distinct from the signal ground attached to pin 7. The LDP-1000A treats these two signals separately.

B. RS232-C Driver/Receiver Signal Levels

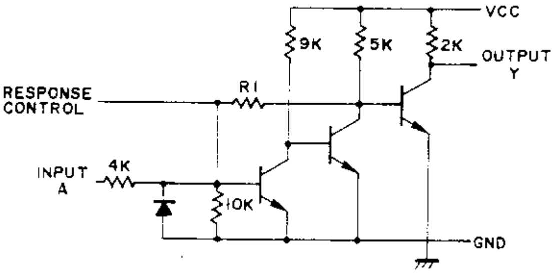
TYPE SN75188
QUADRUPLE LINE DRIVER



Schematic (each driver)

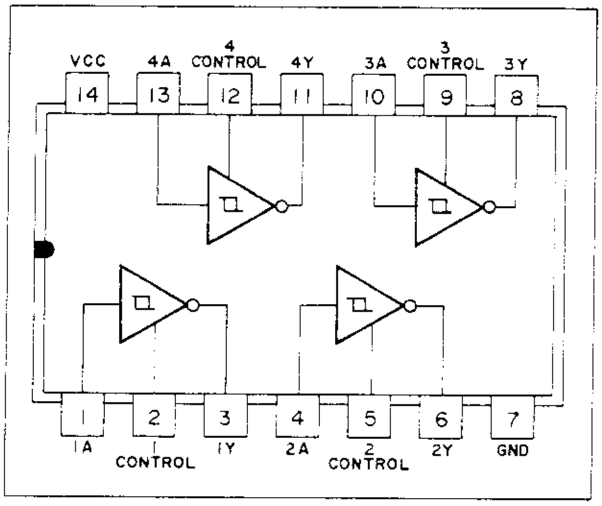


TYPES SN75189, SN75189A
QUADRUPLE LINE RECEIVERS

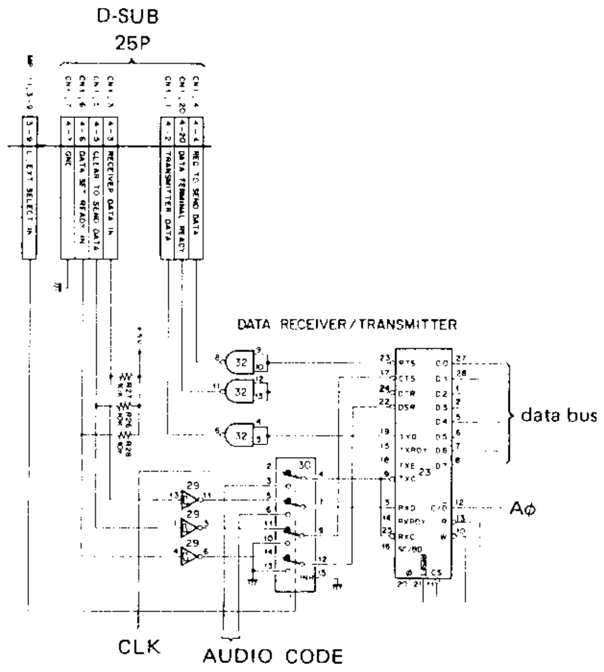


	SN75189	SN75189A
R1	10K	2K

Resistor values shown are nominal and in ohms.



RS232-C LOGIC



NOTATION	INTERCHANGE VOLTAGE	
	NEGATIVE	POSITIVE
BINARY STATE	1	0
SIGNAL CONDITION	MARKING	SPACING
FUNCTION	OFF	ON

ELECTRICAL CHARACTERISTICS

1. Driver

a.	Maximum Output Voltage	25V (absolute)
b.	Minimum Output Voltage	5V (absolute, at 3K-7K ohms)
c.	Minimum Output Resistance at Power Cutoff	300 ohms
d.	Maximum Ouput Current when Short-Circuited	500 mA (absolute)
e.	Throughput Rate	30V/us max

2. Receiver

a.	Input Resistance	3-7K ohms
b.	Input Threshold	3V (absolute)
c.	Input Voltage	25V max (absolute)

C. Standard and "Null Modem" Cable

The LDP-1000A has been setup to appear as a terminal to the EXT CPU's serial interface. The cable requirements are determined by whether the external computer can choose to be connected to a modem (DCE=Data Communications Equipment) or (DTE=Data Terminal Equipment), as is the case with the SMC-70. (Please refer to page 3-1, "Signal direction selector setting".)

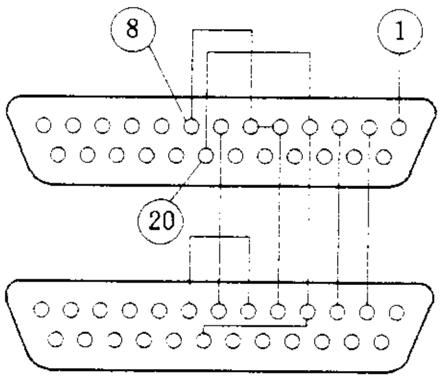
In RS232-C connections for communications, pins 2,3, and 7 are absolutely required.

Pins 4 and 20 are both used to show that the terminal is ready. Because of this redundancy, some manufacturers use either 20 or 4 (but not both). In the case of the LDP-1000A, pin 20 is used. This line is high at all times when the player is powered-on and the EXT CPU switch is set to ON.

Pins 5, 6, and 8 are all used to show the terminal (videodisc player) that the connected device is ready to communicate. Some manufacturers use one or two, but not all signals to flag this state. The LDP-1000A uses pin 6.

i. Standard Cable

Below are standard cables, which assume that the EXT CPU is in terminal mode. (For SMC-70 users, a standard RS232-C cable is provided as an optional accessory: SMK-0031.)
The "universal" serial cable will work for devices using any one of the handshake lines in either set (described below.)



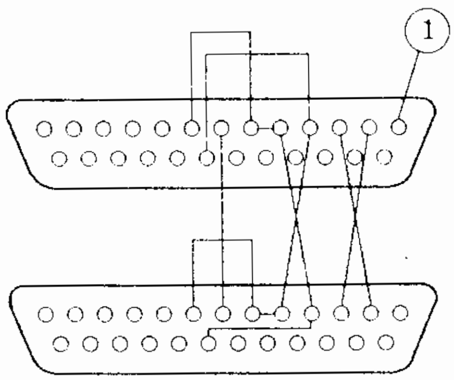
"Universal" Cable

The minimum configuration standard cable is as follows.

External CPU			LDP-1000A	
FG	1	————	1	frame ground
RxD	2	<————	2	transmitted data
TxD	3	————>	3	received data
CTS	4		4	request to send
RTS	5		5	clear to send
DTR	6	————>	6	data set ready
DSR	20	<————	20	data terminal ready
GND	7	————	7	GND

ii. "Null Modem" Cable

If the external computer assumes it is communicating with a modem, then a "null modem" cable is required. It is so called because there is no modem in the link. This cable is different from the standard cable in that certain lines are wired to cross the needed pins. The practical result is that the videodisc player appears as a terminal to the EXT CPU. A "null modem" modification of the "universal" data cable is shown below.



Null Modem Cable

The minimum configuration "null modem" cable is as follows.

External CPU			LDP-1000A	
FG	1	————	1	frame ground
TxD	2		2	transmitted data
RxD	3		3	received data
RTS	4		4	request to send
CTS	5		5	clear to send
DSR	6		6	data set ready
DTR	20		20	data terminal ready
GND	7	————	7	GND

D. Intel 8251A and Factory Pre-Settings

The LDP-1000A uses as its serial interface the Intel 8251A chip, the industry standard Universal Synchronous/Asynchronous Receiver Transmitter (USART). The USART accepts data characters in parallel format from the Z80A CPU in the videodisc player and then converts them into a continuous serial data stream for transmission to an external computer. Simultaneously, it can receive serial data streams from the external computer and convert them into parallel data characters for the videodisc player. The USART will signal the videodisc player whenever it can accept a new character for transmission or whenever it has received a character from the external computer.

The 8251A chip on the LDP-1000A is preset at the factory as listed below.

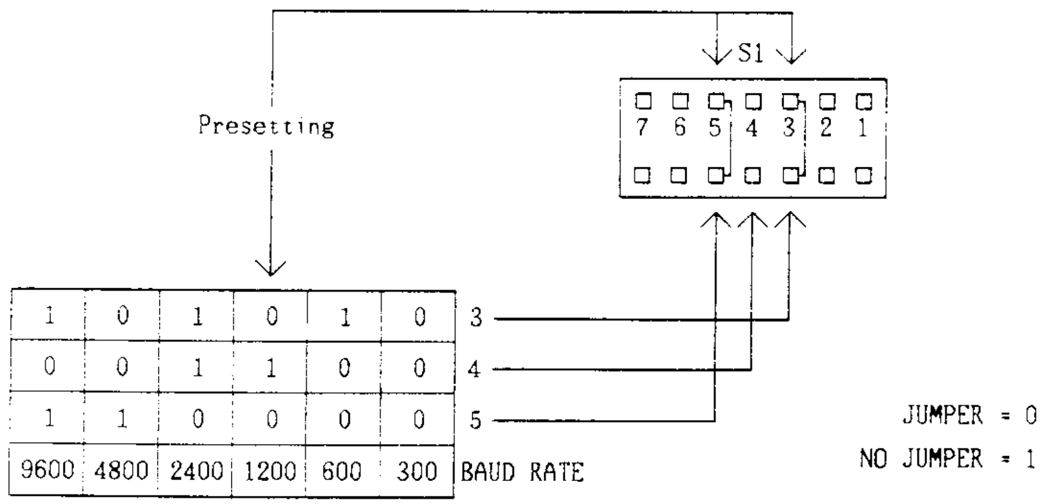
Mode:	Asynchronous
Word Length:	8 bits
Baud Rate:	1200 bits/second
Baud Rate Factor:	16 times
Parity Check:	None
Stop Bit:	1

E. How to Change Factory Pre-Settings

The mode, word length, baud rate factor and parity check are fixed and can not be changed.

i. Baud Rate

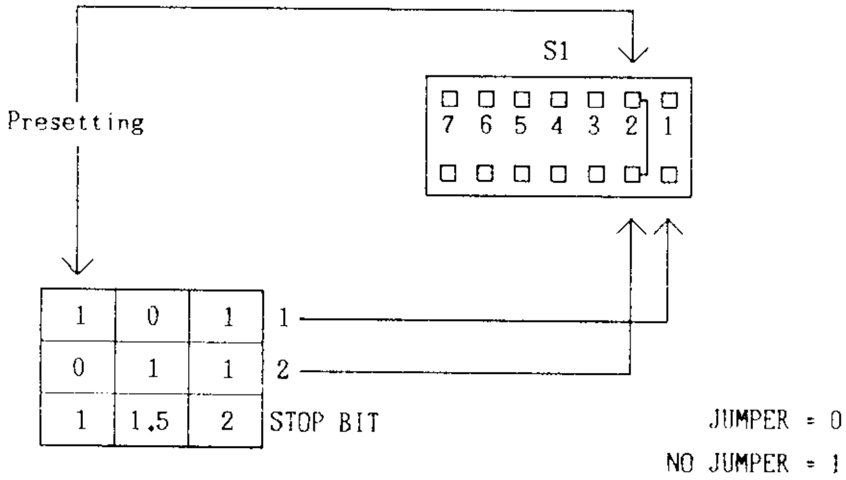
The baud rate on the videodisc player is hardware selectable. The possible baud rate settings are: 300, 600, 1200, 2400, 4800, and 9600. The factory-set baud rate may be changed by rearranging jumper wires in S1 on the MP-11 board. In order not to void your warranty, refer this modification to your Sony authorized dealer or Sony Factory Service Center.



1	0	1	0	1	0	3
0	0	1	1	0	0	4
1	1	0	0	0	0	5
9600	4800	2400	1200	600	300	BAUD RATE

ii. Stop Bits

The number of stop bits on the videodisc player is hardware selectable. The possible number of stop bits is: 1, 1½, or 2. The factory-set stop bit may be changed by rearranging jumper wires in S1 on the MP-11 board. In order not to void your warranty, refer this modification to your Sony authorized dealer or Sony Factory Service Center.



F. How to Connect the SFA-1000

1. Cable connection.

HOST COMPUTER	#	#	
	1	1	
TxD	2	2	TxD
RxD	3	3	RxD
*RTS	4	4	N.C
*CTS	5	5	N.C
DSR	6	6	DSR
DTR	20	20	DTR
GND	7	7	GND

EXT TERMINAL

SFA-1000	#		#	LDP-1000A
	1	——	1	
RxD	2	<——	2	TxD
TxD	3	——>	3	RxD
	4	<——	4	RTS
	5	——>	5	CTS
DTR	6	——>	6	DSR
DSR	20	<——	20	DTR
GND	7	——	7	GND

LDP TERMINAL

*NOTE: Connect host computer pins 4 and 5 to each other when the host computer puts out a signal on them.

2. When the SFA-1000 is connected to the LDP-1000A with the RS-232C cable, the EXT CPU/REMOTE switch operates as follows:

   i. When using the RM-1002 and with the switch set at REMOTE, the LDP-1000A can be operated by the command sensor through the REMOTE terminal.

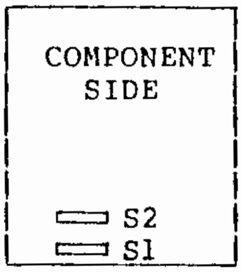
   ii. When the switch is set at EXT CPU, and with an RS232-C cable connected to the EXT CPU terminal, the LDP-1000A and the SFA-1000 can be operated by the external CPU.

   The switch will initiate the mode in which it is set.

CAUTION: When the SFA-1000 is connected to the LDP-1000A with the RS232-C cable, and the LDP-1000A is used in the EXT CPU ON mode, avoid stopping the header (the first frame) of the SFA data. Otherwise, the CPU within the SFA will stop and control of the LDP-1000A will be lost.

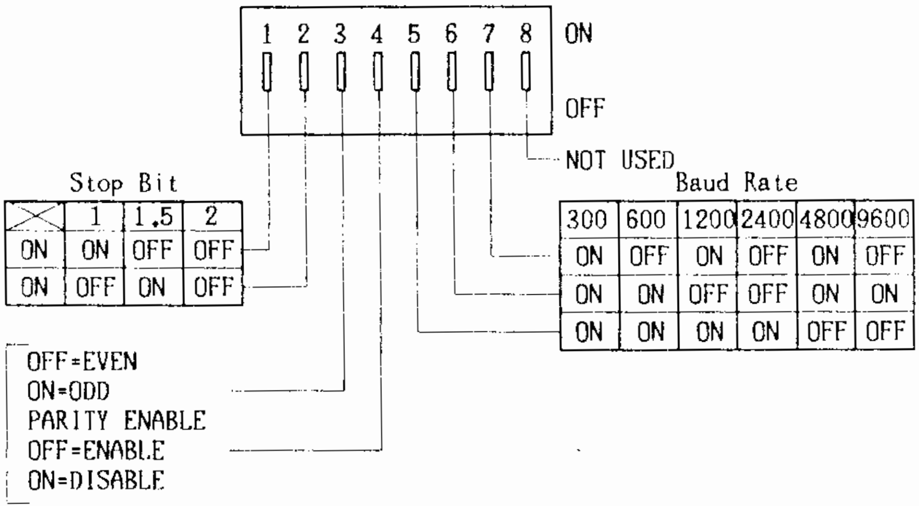
3,4. SFA-1000 Stop bit, baud rate setting

MP-20 Board



S1: Preset switch for external CPU
S2: Preset switch for the LDP-1000A

(S 1) PRE-SETTING SW FOR EXTERNAL CPU



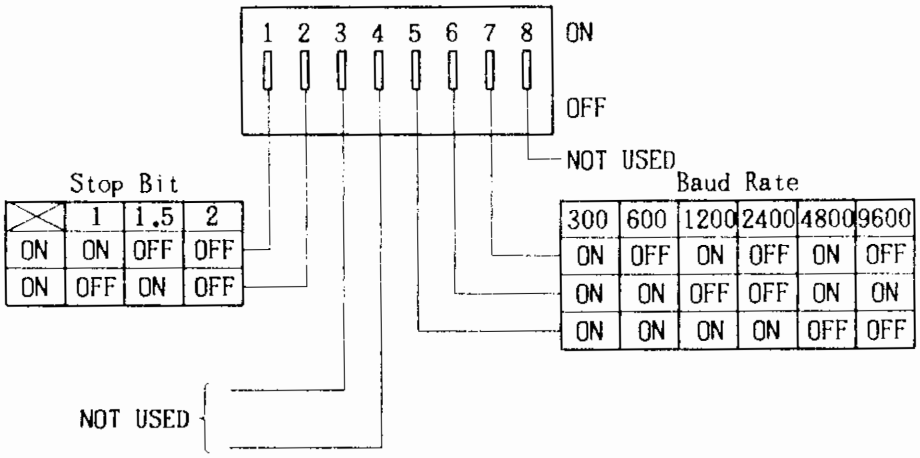
Stop Bit

	1	1.5	2
ON	ON	OFF	OFF
ON	OFF	ON	OFF

Baud Rate

300	600	1200	2400	4800	9600
ON	OFF	ON	OFF	ON	OFF
ON	ON	OFF	OFF	ON	ON
ON	ON	ON	ON	OFF	OFF

(S 2) PRE-SETTING SW FOR LDP



Stop Bit

	1	1.5	2
ON	ON	OFF	OFF
ON	OFF	ON	OFF

Baud Rate

300	600	1200	2400	4800	9600
ON	OFF	ON	OFF	ON	OFF
ON	ON	OFF	OFF	ON	ON
ON	ON	ON	ON	OFF	OFF

G. Power On Procedures and Trouble Shooting

i. Power On Procedures

(a) Initialize the external computer RS232-C. The external computer must set DSR to high ("1").
(b) Set the EXT CPU switch on the back panel of the LDP-1000A to the ON position.
(c) Power up the LDP-1000A, press the COVER OPEN switch on the front panel, and insert the videodisc. The cover on the videodisc player will not open unless EXT CPU switch is set to ON and Data Set Ready (DSR) is set high ("1").
(d) Once the disc is inserted, the player will come up to speed within 15 seconds approximately. If the disc contains audio control data, then the player will download the program from the disc to the internal microprocessor RAM and begin to execute it. If there is no audio control data, then the player will simply display frame number 1 in STILL mode. The player is now ready to receive commands from the external computer.
(e) If the audio control program is to be ignored, then initially send a C.L. command HEX(56) before sending other commands.

In order to switch between EXT CPU ON/OFF without powering down (OFF) the player, the following is the recommended procedure.

EXT CPU OFF to EXT CPU ON

1) Set the EXT CPU switch to ON
2) Press the C.L. key on the commander.
3) RS232-C communications should be possible.

EXT CPU ON to EXT CPU OFF

1) Set the EXT CPU switch to OFF.
2) Send a C.L. command HEX(56) from the external computer to the player.
3) Operations from the remote commander keypad should be possible.

ii. Trouble Shooting

1. Tester for the RS232-C Communications Line:

   Tektronix Model 834, 834R
   This is an extremely powerful and low-cost Programmable Data Communications Tester. It can be purchased for approximately $6,000.

2. When the above tester is not available:

   i. Confirm that the baud rate, stop bit, character length and baud rate factor are set correctly.
   ii. Check the voltage of the TxD and RxD line. It should be less than -8V.
   iii. Check the voltage of the DTR, DSR, CTS and RTS lines. It should be greater than +8V.
   iv. Transmit data from the computer, check the voltage of the TxD and RxD lines. It should be greater than +8V.

3. Check the status of the LDP-1000A or the host computer when it is idle.

   Check the voltage of the DTR, DSR, CTS and RTS lines. It should be greater than +8V.

   When a pulsating voltage is present at the RTS and CTS lines of the LDP-1000A, the LDP-1000A is waiting for the DSR line to become +8V.

   Versions 1.7, 2.1, 3.1 and higher of the LDP-1000A initialize the 8251A regardless of the DTR line.

III. An Example of an External Computer Interface
The Sony SMC-70 Microcomputer

The SMC-70 has a built-in serial interface conforming to EIA RS232-C specifications. The interface consists of an Intel 8251A and is set for asynchronous communications.

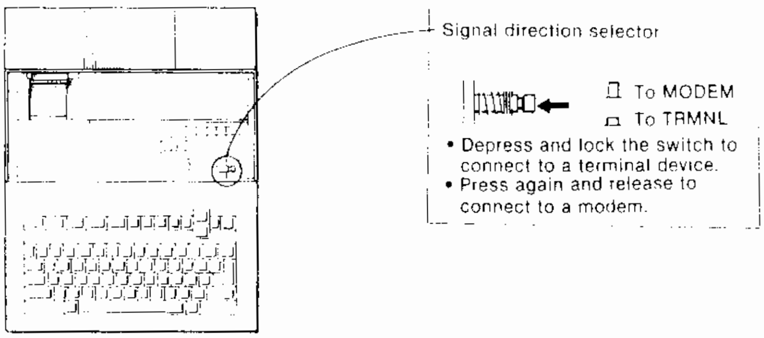
Although not all LDP-1000A Videodisc Player-based systems will be tied to an SMC-70, this section should be of value as a reference to all systems integrators. Program examples written in Z80A Assembly Language have been provided. For a complete treatment on the hardware and software specifications of the 8251A, please refer to Intel's data sheets. (Place to write on page 6-1.) For information on the interface for a particular EXT CPU please refer to the manufacturer-supplied information.

Unlike the rest of this manual, this section assumes the perspective of the EXT CPU looking out to connected devices. Care must be taken to avoid confusing references to the 8251A chip on the SMC-70 and the 8251A chip on the LDP-1000A. This section takes a look at the 8251A chip on the SMC-70; the remaining sections refer to the 8251A chip on the LDP-1000A.

A. Preparation for Communication

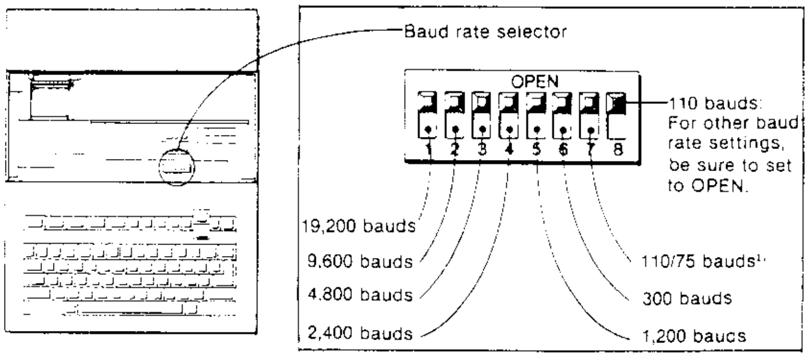
i. Signal direction selector setting

Signal flow must be reversed when the SMC-70 is connected to a modem or accoustic coupler or when it is connected to a terminal device such as a printer, character display or videodisc player. The internal switch should be set according to the attached device. The LDP-1000A is a terminal device.



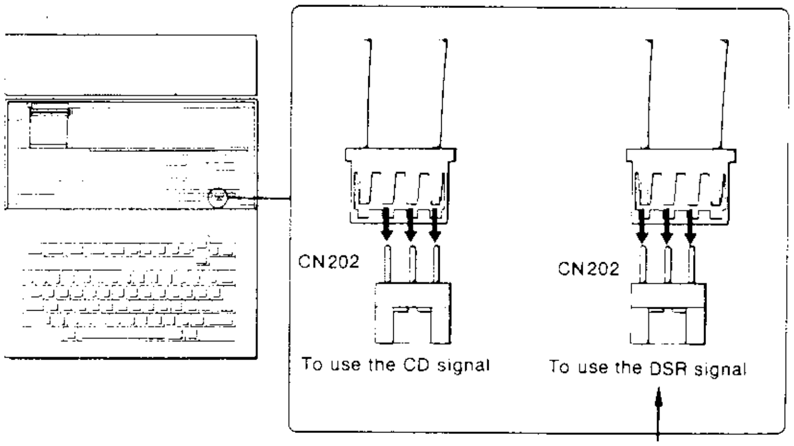
ii. Baud rate setting

The baud rate must be the same between the transmitter and the receiver. The baud rate of the SMC-70 is selectable from 75, 110, 300, 1200, 2400, 4800, 9600, 19200 baud (bits/ second) and is factory-preset to 300 baud. Set the DIP switch to match the baud rate of the connected device. Set only one of switches 1 through 7 to ON at any one time. The LDP-1000A is factory preset to 1200 baud.



iii. Selection of the CD or DSR input

Either the CD (carrier detect) signal or DSR (Data Set Ready) signal can be used to check the status of the connected equipment. Set the internal connector(CN-202) as follows to select which signal is to be used. This connector is set at the factory for the CD signal. The LDP-1000A requires a Data Set Ready signal.



Select this one.

B. Ports Used

The built-in RS232-C interface is controlled through the following ports:

i. Transmitted/received data: Port 26H

D_7	D_7
D_6	D_6
D_5	D_5
D_4	D_4
D_3	D_3
D_2	D_2
D_1	D_1
D_0	D_0

ii. Mode setting, control instruction, status data: Port 27H

1 Mode setting: Writing

Bit		
b_7	S_1	Number of stop bits
b_6	S_0	
b_5		Even parity
b_4		Parity enable
b_3	L_1	Character length
b_2	L_0	
b_1	B_1	Baud rate
b_0	B_0	

2 Control instruction: Writing

Bit	
*	
b_6	Internal resetting
b_5	RTS
b_4	Error resetting
b_3	Break character output
b_2	Receiver enable
b_1	DTR
b_0	Transmitter enable

3 Status data: Reading

Bit	
b_7	DSR
b_6	Break character detect
b_5	Framing error
b_4	Overrun error
b_3	Parity error
b_2	T_xE
b_1	R_xRDY
b_0	T_xRDY

iii. Interrupt control: Port 1EH or 1FH (either port may be used)

*	
*	
*	
*	
*	
*	
*	
D_0	Interrupt enable, "0": Enable

C. Making the Cmmunication Line Available

The RS232-C interface is made available for communication by determining general operation specifications and making the interface ready for transmitting and receiving data. This operation is known as initialization and is accomplished by the following procedure:

Mode setting	--	Command writing

In the system Monitor, the Z command processing routine performs initialization by specifying the operation of parity check, stop bit length, and character length. If initialization by your own program is required, proceed as follows just afer resetting the SMC-70.

i. Mode Setting

The mode setting data must be output to port 27H according to the following bit assignment:

	MSB							LSB
Bit No.	7	6	5	4	3	2	1	0
Port 27_H	S_1	S_0	EP	PEN	L_1	L_0	B_1	B_0

Number of stop bits

Baud rate/operation mode

Even parity

Character length

Parity enable

Baud rate/operation mode (Bit 1 and 0)

Two bits of bit 0 and bit 1 are used for operation mode switching between synchronous and asynchronous, and for selection of the basic clock frequency for the baud rate. The relationship between the data values and mode setting is as follows:

Data value B_1 B_0	Operation mode/baud rate
0 0	Synchronous mode (inoperable)
0 1	Asynchronous mode/no frequency division
1 0	Asynchronous mode/frequency division by 16
1 1	Asynchronous mode/frequency division by 64

The built-in interface cannot operate in the synchronous mode. In general, set this data to "10" since this interface is designed for operation based on basic clock frequency divided by 16. The actual baud rate is selected by operating an internal DIP switch. (See "Baud rate setting" on page 3-2 for details.) "10" are the required data for use with the LDP-1000A.

Character length (Bit 2 and 3)
Two bits of bit 2 and bit 3 are used to indicate the number of bits for representing each character. The LDP-1000A transmits and receives 8 bit characters.

Data value L_1 L_0	Character length
0 0	5 bits
0 1	6 bits
1 0	7 bits
1 1	8 bits ←

Parity enable (Bit 4)
Bit 4 is used to determine whether parity check should be performed as follows:

0: Parity check disable
1: Parity check enable

The LDP-1000A has no parity check.

Even parity (Bit 5)
Bit 5 is used to determine whether parity check should be performed based on even or odd parity in the parity check enable state (when bit 4 is set to "1") as follows:

0: Odd parity
1: Even parity

The SMC-70 generates parity bits to follow data bits when sending data according to the specification of this bit. When receiving data the SMC-70 checks whether the error has occurred according to the specification of this bit. This bit is ignored when bit 4 is set to 0. This bit is irrelevant for the LDP-1000A since the parity check is disabled.

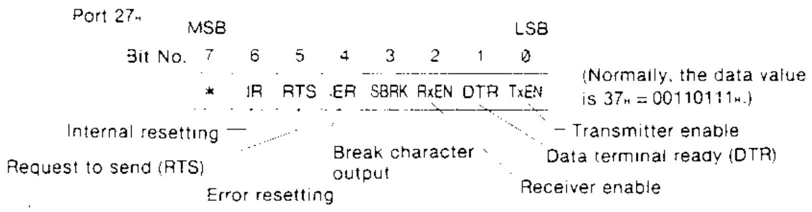
Number of stop bits
Two bits of bit 6 and bit 7 are used to determine the length of a stop bit as shown in the following table:

Data value S_1 S_0	Number of stop bits
0 0	—— (inoperable)
0 1	1 bit ←
1 0	$1\frac{1}{2}$ bits
1 1	2 bits

The LDP-1000A utilizes 1 stop bit.

ii. **Command Writing**

After mode setting, command data must be written to make the system ready for transmitting and receiving data.
The bit assignment for command data is as follows. Any data written to port 27H after mode setting is regarded as command data.



Transmitter enable (Bit 0)
This bit is a flag that makes the SMC-70 ready for sending data. The bit values are defined as follows:

0: Transmitter disable
1: Transmitter enable

Data terminal ready (Bit 1)
This bit is used for control of the DTR output of the 8251A chip. This bit notifies the unit connected to the SMC-70 whether the SMC-70 is ready for sending and receiving data. This bit sets the DTR or CD(or DSR) output on or off according to the signal direction selector setting.

Data value	Signal direction selector setting	
	"TO MODEM"	"TO TRMNL"
0	DTR OFF	CD/DSR OFF
1	DTR ON	CD/DSR ON

Receiver enable (Bit 2)
This bit is a flag that makes the SMC-70 ready for receiving data. The bit values are defined as follows:

0: Receiver disable
1: Receiver enable

Break character output (Bit 3)
This bit is a flag to set all the transmitted data to "0".

0: Normal sending
1: All the transmetted data bits are set to "0"s.

When this bit is set to "1", the break character which is always "0" is output even if the data to be transmitted is written.

Error resetting (Bit 4)
This bit is used for resetting the error flags of the status signals (data read from port 27H).

0: Error resetting not performed.
1: All the error flags are reset.

Request to send (Bit 5)
This bit controls the RTS output signal of the 8251A chip. This bit notifies the connected unit that the SMC-70 is to start transmitting data. This bit sets the RTS or CTS output on or off according to the signal direction selector setting.

Data value	Signal direction selector setting	
	"TO MODEM"	"TO TRMNL"
0	RTS OFF	CTS OFF
1	RTS ON	CTS ON

Internal resetting (Bit 6)
This bit resets the internal circuit of the interface element 8251A. Once the internal circuit is reset, the previous mode setting is cleared and the interface is ready for receiving new mode setting data.

iii. Initialization Steps
Three dummy data 00H are written to ensure that the 8251A treats the data 40H, an internal reset, as a command. For example, if the 8251A is ready to receive the mode setting data, the first data 00H is received as the mode setting data (synchronous mode), the sequential two 00H's are received as the sync characters and the data 40H is received as a command.

Initialization program example

Set-up values:
Character length...8 bit
Parity check..... None
Stop bit...... 1 bit

Mnemonic representation

```
      LD E,03H
      LD A,00H
RST:  OUT (27H),A
      DEC E                  Internal reset for 8251
      JP NZ,RST
      LD A,40H
      OUT (27H),A
      LD A,040H          }   Output mode setting data
      OUT (27H),A        }    01001110
      LD A,37H           }   Enable sending and
      OUT (27H),A        }   receiving
```

D. Transmitting and Receiving Data

Data is sent and received through port 26H. During data transfer, check the interface circuit status and confirm the completion of processing each time a character is sent or received.

i. Transmitter/Receiver Status

Status data bit assignment

Port 27_H	MSB 7	6	5	4	3	2	1	LSB 0
27_H	DSR	BD	FE	OE	PE	TxE	RxRDY	TxRDY

Data set ready
Break character detection
Framing error
Overrun error
Parity error
Transmitter empty
Receiver ready
Transmitter ready

Transmitter ready (Bit 0)
This flag indicates whether data exists in the data bus buffer of interface element 8251A. This flag is used to determine whether it is possible to write data for sending from the CPU.

0: Data bus buffer full (not ready for writing)
1: Data bus buffer empty (ready for writing)

This flag is reset when a data is written into 8251A.

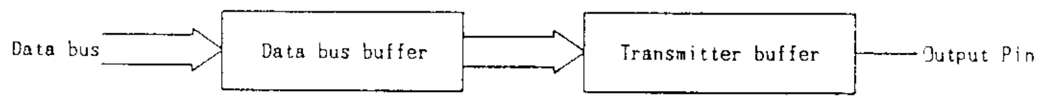
Receiver ready (Bit 1)
This flag indicates whether the received data has been stored in the receiver buffer of the interface element.

0: Data reception is not yet completed (not ready for reading)
1: Data has been stored in the receiver buffer (ready for reading)

Transmitter empty (Bit 2)
This bit indicates the status of the transmitter buffer*, and is used as a flag for confirmation of sending completion.

0: Transmitter buffer full
1: Transmitter buffer empty (sending completed)

*** Difference between the TxE and TxRDY**
Data flow in transmitting is as follows:



The TxE bit indicates the state of the transmitter buffer and the TxRDY bit indicates the state of the data buffer. You can transfer data correctly if you check only the TxRDY flag in the transmission program. The 8251A stops and starts the transmission automatically according to the CTS input. The transmission of data starts when the CTS input becomes low level to indicate that the connected device is ready for receiving data.

Error flags (Bit 3,4 and 5)
The status data includes 3 bits which are set to 1's to indicate received data errors. The three bits of bit 3,4 and bit 5 indicate a parity error, an overrun error, and framing error respectively. A parity error is an error detected during parity check. An overrun error indicates that data was received before the data in the receiver buffer was read by the CPU, thereby destroying the previous data. A framing error indicates that no stop bit was detected. The sending and receiving operations continue without regard to the status of these flags. All these flags are reset to 0's by setting bit 4 of output data to port 27H to "1".

Break character detection (Bit 6)
This bit is set to "1" when a break character is received indicating that the trasmission is suspended. This flag is reset after the break character reception is completed.

Data set ready (Bit 7)
This bit shows whether the connected unit (such as a modem or acoustic coupler) is ready for sending and receiving data. The status of either the CD (or DSR) or DTR input can be checked with this bit depending on the internal signal direction selector status.

Data value	Signal direction selector setting	
	"TO MODEM"	"TO TRMNL"
0	CD/DSR OFF	DTR OFF
1	CD/DSR ON	DTR ON

ii. Transmitting/Receiving Procedure

	Procedure	Method
1	Initialize the interface (by mode setting and command writing).	Write mode setting data, then command data onto port 27H.
2	Check whether the connected unit is ready for sending and receiving data.	Read status data from port 27H, checking bit 7 (0: Ready for sending and receiving).
3	Check whether the SMC-70 is ready for sending and receiving data.	Check the status data from port 27H.
4	Send or receive data.	Write data to or read data from port 26H.
5	Perform error check for received data.	Check bits 5, 4, and 3 of status data from port 27H.

Here is an example of how to transmit data from the SMC-70 to the LDP-1000A.

```
LDP.READY:
         IN       A, (27H)
         BIT      0, A
         jp       Z, LDP.READY

         OUT      (26H),A                     ;at this point, the LDP command
                                               is in the A-reg
```

iii. Data transmitting program example

Mnemonic representation			ANN representation	
	LD HL,1000H	Specify the number of data bytes to be sent.	0100	hl=1000
	LD B,80H		0103	b=80
WAIT:	IN A,(27H)	Check the TxRDY and DSR flags.	0105	a=p(27)
	AND 81H		0107	a=a&81
	XOR 81H		0109	a=a^81
	JR NZ,WAIT		010B	-,0105,[illegible]
	LD C,26H	Send data.	010D	c=26
	OUTI		010F	p(c)= [illegible]
	JR NZ,WAIT	Prepare for sending the next data.	0111	- 0105,[illegible]

iv. Data receiving program example

Mnemonic representation			ANN representation
	LD HL,1000H	Specify the number of data bytes	0100 hl=1000
WAIT:	IN A,(27H)	Conduct error check	0103 a=p(27)
	LD C,A		0105 c=a
	AND 38H		0106 a=a&38
	JP NZ,ERR		0108 =.0150,^0
	LD A,C	Check the RxRDY flag	010B a=c
	BIT 1,A		010C a.1?
	JP Z,WAIT		010E →0103,0
	IN A,(26H)	Input data	0110 a=p(26)
	LD (HL),A	Transfer data to memory	0112 (hl)=a
	INC HL	Prepare for reading the next data	0113 hl+
	JR WAIT		0114 ->0103
ERR:	LD A,37H	Error processing routine	0150 a=37
	OUT (27H),A		0152 P(27)=a
	JP WAIT		0154 =>0103

Here is an example of how to receive data (such as return codes) from the LDP-1000A, into the SMC-70.

```
BUF.EMPTY:
        IN      A,(27H)
        BIT     1, A
        jp      Z, BUF.EMPTY

        IN      A, (26H)                ; at this point, the return code
                                          from the LDP is in the A-reg
```

B. Layout of Video Frames

```
            |___ Active Video
                             Frame Range ___|

   LEAD-IN    |   |     |          |     |   |  LEAD-OUT
------------  | X | X+1 | ........ | Y-1 | Y | ------------
```

First Available Frame
Last Available Frame

X 1; Y 54000

X is the first available video frame. Anything before X is denominated as lead-in and is not accessible by the external computer. Y is the last available video frame. Anything after Y is denominated as lead-out and is not accessible by the external computer. Thus the active video frame range falls between X and Y, inclusive.

C. Return Codes

HEX(00) to HEX(0F) have been reserved as codes returned by either the LDP-1000A or SFA-1000.

i. HEX(01) COMPLETION

This return code is sent by the videodisc player to notify the external computer of either

a) the successful completion of a SEARCH (i.e. the correct frame is displayed in STILL mode after a SEARCH operation.)
b) the completion of a REPEAT operation and the display of the correct target video frame in STILL mode.

Refer to the explanations on NOT TARGET for the complementary return code.

ii. HEX(02) ERROR

(Described on the following page)

iii. HEX(04) PGM END

This code is output when the internal program is finished.

ERROR HEX (02)

There are commands which can be accepted and executed and those which cannot be accepted, depending on the status of the LDP-1000A. The error code HEX (02) is sent in place of ACK HEX (0A) when the LDP-1000A cannot accept the command. When an error occurs, CE HEX (41) or CL HEX (56) is sent and the error state must be cleared. The error HEX (02) is returned for all commands other than CE and CL.

The following commands can be input in the various modes of the LDP-1000A as indicated.

1. NATIVE MODE
   F/R (SCAN, FAST, SLOW, STEP, PLAY) MEMORY, M-SEARCH, PGM, SEG, REPEAT, SEARCH, CH-1, CH-2, INDEX, STOP, CE, CL, MENU.

2. SEARCH INPUT MODE
   0 - 9, ENTER, CE, CL, MENU, MODE

3. REPEAT INPUT MODE
   0 - 9, ENTER, CE, CL, MENU,MODE,
   F (SLOW, STEP, FAST, PLAY).

4. PGM INPUT MODE
   0 - 9, ENTER, CE, CL, MENU, MODE, CH-1, CH-2, INDEX
   F - (FAST, SLOW, STEP, PLAY), STOP,
   J - (SEG), +1 (MEMORY),=(INT), GO TO (RUN)
   -1, (M-SEARCH), INPUT (SKIP)

5. PGM Display
   PGM

6. PGM EXECUTE MODE
   MEMORY, M-SEARCH, INT, END, REVIEW, STOP,
   F/R - (SCAN, FAST, SLOW, STEP, PLAY),
   CH-1, CH-2, INDEX, MENU

   (NOTE) 1 - 9 (only when in the NUMBER INPUT MODE)
   (NOTE) CE, RUN, MODE, and ENTER do not cause and ERROR, but no action occurs.

7. SEGMENT input mode
   0 - 9 ENTER, CE, CL,

   Commands which are input in modes other than those shown above, constitute an ERROR. However, the following RS232-C commands can be input regardless of the mode of the LDP-1000A.

   CH-1 ON, CH-1 OFF, CH-2 ON, CH-2 OFF, DUMP IN, DUMP OUT, SEG MODE, FRAME # MODE, ADDR INQ, CONTINUE, STILL, MOTOR ON, MOTOR OFF, STATUS, DISC ID INQ, CHAPTER # MODE.

iv. **HEX(05) NOT TARGET**

This return code is sent by the videodisc player to the external computer when a COMPLETION code can not be sent. Specifically, it is sent to notify the EXT CPU of either

a) the inability of the player to display the correct frame in STILL mode after a SEARCH to a target <u>within</u> the active video frame range.

b) the inability of the player to display the correct target video frame in STILL mode at the conclusion of a REPEAT operation. The target frame number must be within the active video frame range.

The inability to access frames within the active video frame range may be due to several problems. A persistent inability to search correctly should be checked out. The videodisc itself may be the cause because of faulty mastering or replication. In this case, the frame number may be missing or inaccessible. The videodisc player can also be the culprit. The optics could have too much dust or the focusing and tracking mechanisms may be out of alignment.

v. **HEX(06) NO FRAME**

This return code is sent by the player when a SEARCH is made to a frame number not in the active video frame range. Attempts to access the lead-in or lead-out portions of the disc will force the player to display a frame in STILL mode. For SEARCH to the lead-in, a frame "close" to X, the first active frame, will be displayed. There is no guarantee as to what that frame will be. If an NO FRAME return code is received, check the actual position by executing an ADDR INQ command. Likewise, for a SEARCH to the lead-out, a frame "close" to Y, the last active video frame, will be displayed.

NO FRAME is not returned for REPEAT operations.

The LDP-1000(not LDP-1000A) videodisc player does not support this feature. NOT TARGET HEX (05) is sent.

vi. HEX(0A) ACK

An ACK is sent by the player to notify the EXT CPU of either of two conditions:

a) Acknowledge the fact that a valid command has been received by the player. Valid commands fall in the range of HEX(30) to HEX(69), inclusive. The above statement is not an absolute rule and is dependent on the state in which the player is in.
b) Notify the EXT CPU that the videodisc player is no longer in the STANDBY state. During this STANDBY state, the player is unable to communicate. The player goes into this STANDBY state (STANDBY indicator lights up) when (1) it is first powered ON, the spindle motor comes up to speed and the initialization routine is performed and (2) it receives a MOTOR ON command and the spindle motor comes up to speed. An ACK is sent once the player is ready to receive and execute commands.

An ACK is not necessarily sent to flag an absence of a condition (or the existence of a negative condition) described in the NAK explanation below.

vii. HEX(0B) NAK

NAKs are sent by the player to notify the EXT CPU of the inability to execute several operations. A NAK is not necessarily sent to flag an absence of a condition (or the existence of a negative condition) described in the ACK explanation above.

a) When a command not in the valid range is received, a NAK is returned. The valid command range is HEX(30) to HEX(69), inclusive. A NAK is not sent by the player for an incorrect "string"ing of commands, even though the command may be in the valid command range. Refer to explanations on SEARCH, REPEAT and ERROR.
b) When a DISC ID INQ command is sent to the player and the videodisc has no DISC ID (incorporated at the time of mastering), then a NAK is returned.
c) When the player has been powered down using the MOTOR OFF command, a NAK will be sent for each command other than a MOTOR ON. There are two exceptions to this rule, both are queries to the player. During the powered-down state, the STATUS INQ and DISC ID INQ commands are operational and will not result in NAKs. (Refer to the section V on differences between different PROM versions regarding this feature.)

D. CE and CL OPERATIONS

i. HEX (41) CE (Clear Entry)

1. Used for correction of numerical input in SEARCH, REPEAT, SEGMENT and PROGRAM commands.

   For example: SEARCH 10010
   CE SEARCH 01001

2. Used to clear errors. The equipment returns to the state it was in prior to the error.

3. When CE is sent in cases other than those mentioned above, ACK returns, but no operation is initiated.

ii. HEX (56) CL (Clear All)

All commands currently being executed are cancelled and the equipment returns to the initial state. This command takes top priority.

E. NUMERIC KEYS

Numeric keys have the following applications.

i. SEARCH: Frame # input
Chapter # input (for the LDP-1000A only)
Segment # input

ii. REPEAT: Frame # input
Chapter # input
Segment # input (for the LDP-1000A only)
# of repetitions input

iii. SEGMENT: Start/End frame # input

iv. PROGRAM: Program address input
Segment # input
Frame # input
Register # input
Register value input

v. AUTO STEP: Auto step times input

F. SEARCH AND REPEAT OPERATION

i. HEX (43) SEARCH

The SEARCH procedure is as follows:

```
SEARCH  ---------->
       <----------  ACK
   M1   ---------->            M1 to M5 = Frame #
       <----------  ACK
   M2   ---------->
       <----------  ACK
   M3   ---------->
       <----------  ACK
   M4   ---------->
       <----------  ACK
   M5   ---------->
       <----------  ACK
ENTER   ---------->
       <----------  ACK

        SEARCH EXECUTE

       <----------  COMPLETION  HEX(01)
```

There are three possible results of a search, as follows:

1. The target frame is found. COMPLETION HEX (01) is returned.

2. The approximate location of the frame is found, but the target frame is not found in the allotted time.

   NOT TARGET HEX (05) is returned

3. * A LEAD IN or LEAD OUT signal is detected while the frame is being searched, and the target frame is not found in the allotted time.

   NO FRAME HEX (06) is returned

   * For the LDP-1000A only

The following actions take place when searching for the starting point of a chapter or segment.

1. CHAPTER #

```
CHAPTER MODE   -------->
HEX (69)      <--------   ACK  set chapter mode
  M1           -------->          M1 M2 = CHAPTER #
              <--------   ACK              01 - 79
  M2           -------->
              <--------   ACK
ENTER (40H)    -------->
              <--------   ACK

                          $ EXECUTE SEARCH OPERATION

              <--------   COMPLETION  HEX (01)
                          END OF SEARCH OPERATION
```

2. SEGMENT #
   (for details on segment use, see section M.)

```
SEGMENT # MODE  ------->
               <-------  ACK  set segment # mode
 M1             ------->         M1 M2 = SEGMENT #
               <-------  ACK              01 - 63

 M2             ------->
               <-------  ACK

 ENTER (40H)    ------->
               <-------  ACK

               <-------  EXECUTE SEARCH OPERATION

               <-------  COMPLETION  HEX (01)
                         END OF SEARCH OPERATION
```

Once the search mode has been set, the LDP-1000A will remain in that mode. Therefore, CL HEX (56) and MENU HEX (42) initiate the frame # mode.

When lead in or lead out is detected during playback, the frame # mode is initiated.

ii. HEX (44) REPEAT

The REPEAT command is used to replay a certain part of the disc for a designated number of times. The starting frame is defined as the frame at which the REPEAT command is input, and the end frame is the target frame which is input next.Usually, SEARCH is used to establish the starting frame.

For use of REPEAT with segments, see section M.

The FWD mode is initiated when the end frame no. is greater than or equal to the start frame no., and the REV mode is initiated when the end frame no. is less than the start frame no.

REPEAT PROCEDURE

```
REPEAT   -------> The start frame no. is stored
        <-------  ACK

M1       ------->               M1 to M5 = Frame #
        <-------  ACK           The playback mode can be
                                designated during this
M2       ------->               time.  If it is not, the
        <-------  ACK           player will be set in the
                                X1 play mode.
M3       ------->
        <-------  ACK

M4       ------->
        <-------  ACK

M5       ------->
        <-------  ACK


F FAST   ------->               This sets the Fast Mode.
        <-------  ACK           The direction (FWD or
                                REV) is determined by the
                                start frame and end frame
                                numbers.


ENTER    ------->
        <-------  ACK
```

RETURN CODES

A return code is sent when the designated number of repetitions is finished.

1. Completion HEX (01) is sent when repetitions are completed at the correct end frame.
2. Not target HEX (05) is sent when repetitions are completed after passing the end frame.
3. "Lead Out" is detected without detection of the end frame.

   At present, the player locks up.
   Therefore, be careful not to input a target frame number that is larger than the end frame of the disc used.

OPERATION OF THE REPEAT COMMAND

1. Frame # Mode

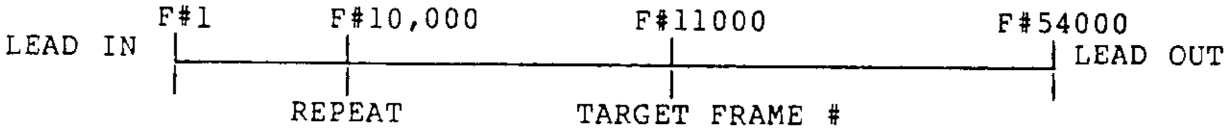
```
RM1     --------->
       <---------   ACK

RM2     --------->
       <---------   ACK

ENTER   --------->
       <---------   ACK
```

RM1 and RM2 = # of repeat times. If the number of repetitions is not input, it will be set at "1". A maximum of "15" repetitions can be designated. When "0" is set, the number of repetitions is unlimited.

```
SM1     --------->
       <---------   ACK

SM2     --------->
       <---------   ACK

SM3     --------->
       <---------   ACK

ENTER   --------->
       <---------   ACK
```

SM1,SM2 and SM3 = step factor. If STEP is selected when in the playback mode, a step factor input is requested. The step factor must be input at 1/SM. Therefore, when SM = 1, the player operates the same as during normal playback. An SM of 1 through 255 can be input.

```
     REPEAT PLAY
      EXECUTE


      <--------- Completion
                 HEX (01)
```



a. The player enters the still mode and awaits the target frame # input.

b. Input the target frame #. The FAST, PLAY, SLOW and STEP modes can be set by mean of the ( ) key. Send ENTER.

c. Input the number of repetitions. Send ENTER. The player will repeat from 1 through 15 times. If 0 is input, it will repeat indefinitely.

The repeat operation is executed at this point when in the FAST, PLAY and SLOW modes. If the STEP mode has been selected, the following additional input is needed.

d. Input the STEP FACTOR (1 through 255). Send ENTER.

"1" mean 1 times the actual speed; "255" means 1/255 times the actual speed of 1 frame every 8.5 seconds.

The auto step operation will be executed.

2. CHAPTER # MODE

The repeat operation for the chapter # mode is differenet from the frame # and segment # modes.

```
LEAD IN  |C#1 |C#2 |                |C#6 |C#7 |              |LEAD OUT
                                     PLAY --------->
                                 SEARCH
```

a. REPEAT

The player enter the still mode and waits for the chapter # input.

b. Input the chapter # (for example, C#6). The mode can then be set just as in the frame # mode. Send ENTER.

c. Input the number of repetitions and send ENTER. The repeat operation will be executed at this point for the FAST, SLOW and PLAY modes.

d. Input the step factor when needed and send ENTER, just as in the Frame # mode.

In the above diagram, the beginning of C#6 is found and then C#6 is repeatd.

3. SEGMENT # MODEL
For details on segment use, see section M.

```
LEAD IN  |S#1                    |S#3 |S#4 |              |LEAD OUT
```

a. REPEAT

The player enters the still mode and waits for the segment # input.

b. Input the segment # just as in the frame # mode and send ENTER.

c. Input the number of repetitions and send ENTER as in the frame # mode.

d. Input the step factor input if needed, and send ENTER, as in the frame # mode.

When the lead in or lead out is detected during the repeat operation, the player will lock up.
Therefore, when generating a control, be careful not to set the target frame # beyond the lead out.

G. AUDIO SWITCHING COMMANDS

i. Toggled Commands

1. **HEX (64)** CH-1
2. **HEX (65)** CH-2

These commands can be input when the player is in the normal mode (when FWD/REV PLAY can be done) such as when repeating, and when in the PGM input and play modes.

For example, when CH-1 is ON:

```
CH-1 HEX (64)  ----->
              <-----  ACK CH-1 OFF
CH-1 HEX (64)  ----->
              <-----  ACK CH-1 ON
```

ii. Absolute Commands

1. **HEX (46)** CH-1 ON, **HEX (47)** CH-1 OFF
2. **HEX (48)** CH-2 ON, **HEX (49)** CH-2 OFF

These are ON-OFF commands for the RS232-C.

For example, when CH-1 is ON:

```
CH-1 ON HEX (46)   ------->
                  <-------  ACK CH-1 ON (no action)
CH-1 OFF HEX (47)  ------->
                  <-------  ACK CH-1 OFF
```

These are direct commands which are executed regardless of the mode the player is in.

CAUTION: If these commands are sent to the player while SEARCH, REPEAT, SEGMENT or PGM is being executed, the audio muting of the player will be affected and noise will occur. Therefore, do not use these commands when in the above modes.

H. PLAYBACK OPERATIONS

i. **HEX (3A)** F-PLAY, **HEX (4A)** R-PLAY
ii. **HEX (3B)** F-FAST, **HEX (4B)** R-FAST
iii. **HEX (3C)** F-SLOW, **HEX (4C)** R-SLOW
iv. **HEX (3D)** F-STEP, **HEX (4D)** R-STEP
v. **HEX (3E)** F-SCAN, **HEX (4E)** R-SCAN

a. PLAY initiates the X1 mode; FAST, the X3 mode, and SLOW, the X 1/5 mode.
b. STEP initiates the auto step function in the X 1/7 mode. When a single frame step is desire, the STILL command HEX (4F) is sent within 33-200ms after the STEP command is designated.
c. When a different step rate is desired, the step rate (1-255) and ENTER HEX (40) will be sent after the STEP command is designated.

```
STEP   ------->                    STEP  ------->
      <-------  ACK                      <-------   ACK
      33-200ms wait                3      ------->
STILL  ------->                          <-------   ACK
      <-------  ACK
Send 1 frame and                   0      ------->
Stop                                     <-------   ACK

                                   ENTER ------->
                                         <-------   ACK

                                   Playback in X 1/30 steps
```

The setting of parameters for the repeat operation is described in the section on repeat commands.

If lead in or lead out is detected during the normal playback operation, frame #1 is searched and ACK is returned.

```
LEAD IN |----------------------------------------| LEAD OUT

   <---- R-PLAY                        F-PLAY ----->
                                                   LEAD OUT
LEAD IN DETECTED____________________________________DETECTED
                 |
                 |
                 v
                Frame #1 is searched and ACK is returned.
```

If lead in or lead out is detected, the equipment returns to the initialize routine and searches for frame #1. Therefore, communication cannot be accomplished until ACK is sent out. Be careful to avoid this situation when making commands.

I. STILL, STOP, CONTINUE OPERATIONS

i. **HEX (3F) STOP**
ii. **HEX (4F) STILL**
iii. **HEX (61) CONTINUE**

a. STOP initiates the still mode in which the video and audio are muted.
b. In the STILL operation, only the audio is muted. The video continues to operate. STILL is also related to the STEP commands. (This is described in the section on playback operation).
c. The CONTINUE command returns the player to the mode it was in before the STILL command was given. If the CONTINUE command is sent without first sending the STILL command, misoperation may result. Therefore, this command must be used with care.

J. QUERY OPERATIONS

i. **HEX (60) ADDR INQ**
The current frame no. of the player is requested.

```
ADDR INQ    -------->
HEX (60)   <--------  M1      M1 - M5 are 5 bytes in ASCII
           <--------  M2
           <--------  M3
           <--------  M4
           <--------  M5
```

For example, when the player is at frame # 01500: 30 (n1, 31 (n2), 35 (n3), 30 (n4) and 30 (n5) are sent.

This command can be sent whenever the player is ready (except when the motor is off) to obtain the frame number.

The five bytes are set when the 24-bit frame number (in the vertical interval) can be read accurately. If the frame number cannot be read accurately (due to dropout etc), the previously read frame is retained in the five bytes.

ii. **HEX (67) STATUS INQ**
This command can be used to determine the current status of the player. The status is composed of 5 bytes. The procedure is:

```
STATUS INQ   ------->
HEX (67)    <-------  1st
            <-------  2nd
            <-------  3rd
            <-------  4th
            <-------  5th
```

This inquiry can be made any time that communication is possible. The contents of each byte are as follows:

A. 1st byte

- D7: = 0
- D6: SEARCH/REPEAT mode
- D5: MOTOR OFF mode (RS232-C CMD)
- D4: INIT FLAG
- D3: LID OPEN
- D2: X
- D1: X
- D0: ERROR

B. 2nd byte (Program status byte)

- D7: X
- D6: MEMORY SEARCH mode
- D5: STOP KEY ON
- D4: DECIMAL mode
- D3: PGM INITIAL mode
- D2: PGM DISPLAY mode
- D1: PGM EXECUTE mode
- D0: PGM INPUT mode

C. 3rd byte (Key Mask Status)

- D7: PGM mode
- D6: NATIVE Mode: F/R PLAY, FAST, SCAN, etc. can be input in this mode. When the SEARCH/REPEAT Key is depressed, D6 and D7 become 0.
- D5: = 0
- D4: = 0
- D3: = 0
- D2: = 0
- D1: = 0
- D0: = 0

D. 4th byte (Key Mode Status)

- D7: STEP NUMBER IN
- D6: NUMBER INPUT mode for PGM EXECUTE
- D5: X
- D4: SEGMENT NUMBER IN
- D3: CMD OUT FOR PICTURE STOP CODE
- D2: REPEAT mode
- D1: SEARCH mode
- D0: NUMBER INPUT - also becomes 1 when STEP NUMBER is input.

E. 5th byte (CMD Status)

- D7: 0 = FWD 1 = REV
- D6: STOP
- D5: X
- D4: SCAN
- D3: STEP
- D2: SLOW
- D1: FAST
- D0: PLAY

Note: D2 and D3 become 1 when in the SLOW mode.

X: This flag is not used.

Below are explanations of the functions of each of the flags.

a. 1st Byte

1. SEARCH/REPEAT mode

   This flag is set when the program is executing SEARCH or REPEAT.

2. MOTOR OFF mode

   This flag is set when MOTOR OFF HEX(63)is received, the player has executed it and the RS232-C handler is active.

3. INIT

   This is set when the player is in its initial state. If power is turned on with the lid open, or if the MOTOR ON command is sent, this flag is set.

4. LID OPEN

   This flag is set whenever the lid is opened.

5. ERROR

   This flag is set whenever an error occures due to an incorrect being receive.

As can be understood from the above explanation, the spindle motor is rotating only when MOTOR OFF = 0 and INIT = 0. In other words, the LDP is active.

b. 2nd Byte (program status byte)

1. MEMORY SEARCH

   This flag is set when in MEMORY SEARCH HEX(58) is received. It is reset when the target location has been reached, and playback starts under a previously received MEMORY command.

2. STOP KEY

   This flag is set when the STOP command is received during program mode.

3. Decimal mode

This mode is set when the progam input or display is shown with a 3 digit decimal. The decimal mode is initiated by: PGM - Program start ADDR-INT-ENTER.

4. Program Initial mode

This mode is set when PGM HEX(57)is received. The player waits for input of the program start ADDR.

5. Program Display mode

This mode is set when ADDR is input (after item 4) and PGM HEX(57)is received. The player is then in the display mode.

6. Program Execute mode

This mode is set when ADDR is input (after item 4) and RUN HEX(58)is received. The player is then in the program execute mode.

7. Program input mode

This mode is set when ADDR is input (after item 4) and ENTER HEX(40) is received. The player is then in the PROGRAM INPUT mode.

c. 3rd Byte (Key Mask Status)

1. PGM mode

This mode is set when in the program mode (INPUT, DISPLAY, EXECUTE).

2. NATIVE mode

This mode is set when the player is in such a state (other than the program mode) where FWD/REV, PLAY can be directly input.

Both flags are reset when in the SEARCH/REPEAT mode (input/execut).

D. 4th Byte (Key Mode Status)

1. Step number in

   This flag is set when the FWD/REV STEP command is received. It is reset by entering other commands or numerals.

2. Number in for PGM execute

   This flag is set when the branching command (NUMBER INPUT) is executed while running the program.

3. Segment number in

   This flag is set when the SEG HEX(45) command is received.

4. CMD out for picture stop code

   This flag is set when the player is automatically stopped by the PICTURE STOP CODE.

5. REPEAT

   This flag is set when REPEAT HEX(44) is received and remains set until the command is executed.

6. SEARCH

   This flag is set when SEARCH HEX(43) is received and remains set until the desire frame is found.

7. NUMBER INPUT

   This flag is set when waiting for numerical input in the SEARCH, REPEAT and PGRM modes.

iii. Disc ID INQ HEX (68)

This command requests the ID of the disc currently being used in the LDP-1000A. The disc ID is a part of the data contained in the audio code.

ASCII code is used for all characters, with ";" indicating the end.
There is a maximum of 40 characters, including colons, commas and semicolons.
Semicolons must not be used midway in the ID code.
SEG # 59 - 63 should be reserved for the disc ID.

One example of a possible disc ID is as below;

"SONY-DISC-ID:EJ"003:300:37500;"

1. Program material ID

   For example, "SONY-DISC-ID"

2. Audio channel language code

   For example, "EJ" means Audio Channel 1 - English, Audio Channel 2 - Japanese.

3. Release number

   For example: 003
   This means that the program material ID is the third version of the disc called "SONY-DISC-ID"

4. First frame containing video information

   For example: 300

5. Last frame containing video information

   For example: 37500

   The frame numbers which contain a valid video signal can be determined by means of (4) and (5).

Communication takes place in the following manner:

COMPUTER ——ID INQ HEX (68)——> LDP-1000

<—— 1st byte —— 1 byte=1 character

<—— 2nd byte ——

<—— 3rd byte ——

<—— 4th byte ——

<—— 5th byte ——

<—— 6th byte ——

-

-

-

-

";" HEX (38) 40th byte

TERMINATE

Communication is terminated when a semicolon is sent from the LDP-1000A to the HOST.

When there is no disc ID, the first byte becomes NAK HEX (0B). Therefore, it is necessary to program the host computer to check the first byte and terminate communication if it is NAK. If this is not done, the host computer could lock up.

K. MOTOR ON/OFF OPERATION

i. HEX (63) Motor Off

This command is generated by the RS232-C and stops the rotation of the disc. When the Motor Off command is received, the LDP-1000A returns the sled to the home position and stops the spindle motor. This occurs with the lid remaining closed.

```
MOTOR OFF  ------------>
               :    The sled is returned to the home
               :    position and the spindle motor is
               :    stopped.
               :      *During this period(about 5 sec.)
               :       no communication is possible.
               :
           <------------  ACK

                    The lid can now be opened.  Only
                    STATUS INQ or MOTOR ON can be
                    performed.  NAK (0B) will be
                    returned for all other commands.
                    (Version 2.1 and higher). Version
                    1.7 will send ACK (0A) and no
                    action will occure.
```

ii. HEX (62) Motor On

This command will re-activate the motor after it has been stopped by HEX (63).

```
MOTOR ON  -------------->
          <--------------  ACK
               :
               :     (Initialize)
               :     The motor is activated, a check is
               :     performed for an audio code, and if
               :     there is no code, the STILL mode is
               :     initiated at frame #1.
               :      *During this period(12 to 15 sec.)
               :       no communication is possible.
               :
          <--------------  ACK
                           Communication Standby
```

The MOTOR ON command can only be executed when the motor is off (for Versions 2.1 and higher).

Version 1.7 player will receive and execute this command when in any state, thus causing a lockup. Therefore, when using the Motor On/Off commands with the Version 1.7 player, it is necessary to first check bit 4 of the first status byte.

L. INDEX DISPLAY OPERATION

i. Toggled Commands

1. **HEX (66) INDEX**

a. This command turns the display on and off. For example, when the index is in the off status:

```
INDEX  ---------------->
(66H)  <----------------  ACK INDEX ON

INDEX  ---------------->
       <----------------  ACK INDEX OFF
```

b. It is used to control INDEX ON/OFF when a program is input. For example, when FUNCTION is displayd in the program input mode:

```
INDEX  ---------------->
 (66)  <----------------  ACK

N      ---------------->
       <----------------  ACK Index control set


                          N = 0:  INDEX OFF
                          N = 1:  INDEX ON
                          N = 2:  TOGGLED
```

ii. Absolute Commands

1. **HEX (50)INDEX ON**

This command turns on the index. No action occurs if the index is already on.

```
INDEX ON  --------------->
 (50H)    <---------------  ACK
```

HEX (50)can be accepted in any mode of the LDP-1000A (except motor off).

2. **HEX (51) INDEX OFF**

This command turns the index off. No action takes place if the index is already off.

```
INDEX OFF --------------->
 (51H)
          <---------------  ACK
```

HEX (51) can be accepted in any mode of the LDP-1000A (except motor off).

M. SEGMENT Playback Operations

- i. SEGMENT Definition — **HEX (45)**
- ii. Execution
  - a) Modes
    - 1) SEGMENT MODE — **HEX (54)**
    - 2) FRAME # MODE — **HEX (55)**
    - 3) CHAPTER MODE — **HEX (69)**
  - b) Speeds
    - 1) PLAY (normal) — **HEX (3A)**
    - 2) FAST — **HEX (3B)**
    - 3) SLOW — **HEX (3C)**
    - 4) STEP — **HEX (3D)**
  - c) Caution on use of start/end points
- iii. Commands during SEGMENT playback
  - a) STILL — **HEX (4F)**
  - b) CONTINUE — **HEX (61)**

These functions can be thought of as using the LDP-1000A's internal CPU and RAM to execute a certain type of subroutine, namely video segments.

This saves interface communication time when, for example, a particular portion of a video program will be played repeatedly. If a portion is to be played more than about 3 times, use of segments will be somewhat quicker due to fewer instructions.

The functions are exactly the same as found on the RM-1002 programmable remote control unit. Input sequencing via RS232-C is done in the same way as for the RM-1002.

Within your application program, the general usage pattern is:

1) Define your segments, early on.
   --segment number
   --start/end points, as videodisc frame numbers
2) Execute these segments, as called for by your application program. On each execution you must:
   --first select SEGMENT MODE
   --send SEARCH and specify the segment number
   --when the player reaches the segment start point, send REPEAT and indicate a speed
   --indicate the number of repetitions
3) During playback, you can interrupt execution by using STILL. (Of course, you can also send C.L. and a new command sequence.)
4) Upon finishing the segment, the LDP-1000A will stop on the segment's end point and send COMPLETION HEX (01).

The segment's audio will play back with whatever audio channels you set up prior to sending SEGMENT MODE HEX (54).

i. SEGMENT Definition HEX (45)

A 'segment' is any portion of the video material on a videodisc, between a start point and an end point. The points are indicated by videodisc frame numbers, which are five-digit numbers between 00001 and 54000. Segments can be as short as one frame (start and end points are the same number) or as long as the whole side.

Up to 63 segments (including the number 00) can be defined. Numbering does not have to start at 00, and can be non-continuous (i.e. random).

Segment definitions can be rewritten at any time. Previous definitions of the same segment number will be lost upon rewrite.

A segment can be played in reverse by defining the start point to be higher than the end point. (Example: if start = frame 02000, end = 01000, the playback will go from frame 02000 to frame 01000.)

Segments are useable only with CAV discs.

The sequence for inputting a SEGMENT definition is:

Ext. CPU			LDP-1000A
SEG		----->	
		<-----	ACK
SEG # 1st digit			(*)
	HEX (30) to (36)	----->	
		<-----	ACK
SEG # 2nd digit			
	HEX (30) to (39)	----->	
		<-----	ACK
ENTER		----->	
		<-----	ACK
IN POINT 1st digit			
	HEX (30) to (35)	----->	(**)
		<-----	ACK
IN POINT 2st digit			
	HEX (30) to (39)	----->	
		<-----	ACK
IN POINT 3rd digit			
	HEX (30) to (39)	----->	
		<-----	ACK
IN POINT 4th digit			
	HEX (30) to (39)	----->	
		<-----	ACK
IN POINT 5th digit			
	HEX (30) to (39)	----->	
		<-----	ACK
ENTER		----->	
		<-----	ACK

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```
   OUT POINT 1st digit
             HEX (30) to (35)  ----->
                              <-----      ACK
   OUT POINT 2st digit
             HEX (30) to (39)  ----->
                              <-----      ACK
   OUT POINT 3rd digit
             HEX (30) to (39)  ----->
                              <-----      ACK
   OUT POINT 4th digit
             HEX (30) to (39)  ----->
                              <-----      ACK
   OUT POINT 5th digit
             HEX (30) to (39)  ----->
                              <-----      ACK
   ENTER                       ----->
                              <-----      ACK
   C.L.                        ----->
                              <-----      ACK
```

If you want to keep putting in segment data in segment numbers which are continuous (i.e. 10, 11, 12, or 45, 46, 47 etc), leave off the C.L. command. The segment number will increment automatically. From the point at (*) above, do as follows:

```
   ENTER                       ----->
                              <-----      ACK
             (player automatically
             enters both digits of
             segment number)
   IN POINT 1st digit....
```

From the IN POINT 1st digit, continue as from (**) above.

Put the C.L. after the last segment data you wish to enter. Failure to put this will cause an ERROR.

For the segment start and end points, please note the comments at the end of part (ii), 'Execution'.

ii. Execution

You execute the segments defined in (i) above, as called for by your application program. On each execution you must:
--first select SEGMENT MODE
--send SEARCH and specify the segment number
--when the player reaches the segment start point,
  send REPEAT and indicate a speed
--indicate the number of repetitions

Let's first discuss modes and speeds.

a) Modes

The LDP-1000A has three different ways to handle indications of video portions of a videodisc:

1) SEGMENT MODE HEX (54)
This is the mode described in (i) above.

2) FRAME # MODE HEX (55)
This uses frame numbers to directly indicate portions to be played back. It is most frequently used with SEARCH/REPEAT operations, STOP operation, etc.

3) CHAPTER MODE HEX (69)
This uses a chapter number encoded on the videodisc (separately from the frame numbers), to access specified portions of video.
It is commonly used with CLV discs on manually-controlled players.

The LDP-1000A automatically switches into FRAME # MODE in any of these conditions:
--at power on
--when C.L. HEX (56) is sent
--when the player goes into the lead-in or lead-out areas on a disc (usually inadvertently)

To get into another mode, one of the above commands must specifically be sent. The LDP-1000A will stay in that mode until another mode command is sent, or one of the above conditions occurs. You will probably use C.L. frequently, and it is sometimes hard to determine whether the player has gone into lead-in or lead-out areas. So you should be prudent and send SEGMENT MODE frequently.

If a SEARCH/REPEAT operation, STOP etc using frame numbers is to be done after a SEGMENT operation, be sure to send FRAME # MODE HEX (55) before the operation itself. Otherwise an ERROR will occur.

b) Speeds

Any of the following speeds may be used:

1) PLAY (normal)	HEX (3A)
2) FAST	HEX (3B)
3) SLOW	HEX (3C)
4) STEP	HEX (3D)

Reverse-direction speed commands are not possible with SEGMENT usage. To get reverse play of a segment, define its start point as higher than its end point as mentioned in (i) above, then specify one of the speed commands just above.

The general sequence for executing a segment is as follows. We will assume a simple example first, namely PLAY forward. A segment has been defined as in (i) above.

```
Ext. CPU                                          LDP-1000A
   SEG MODE                           ----->
                                     <-----       ACK
   SEARCH                             ----->
                                     <-----       ACK
   SEG # 1st digit
              HEX (30) to (36)        ----->
                                     <-----       ACK
   SEG # 2nd digit
              HEX (30) to (39)        ----->
                                     <-----       ACK
   ENTER                              ----->
                                     <-----       ACK
               (Player searches to start
               point; upon reaching it:)
                                     <-----       COMPLETION
   SEG MODE                           ----->                (*)
                                     <-----       ACK
   REPEAT                             ----->
                                     <-----       ACK
   SEG # 1st digit
              HEX (30) to (36)        ----->
                                     <-----       ACK
   SEG # 2nd digit
              HEX (30) to (39)        ----->
                                     <-----       ACK
   PLAY                               ----->               (**)
                                     <-----       ACK
   ENTER                              ----->
                                     <-----       ACK
   REPETITIONS 1st digit                                   (***)
              HEX (30) TO (31)        ----->
                                     <-----       ACK
   REPETITIONS 2nd digit                                   (***)
              HEX (30) TO (39)        ----->
                                     <-----       ACK
   ENTER                              ----->
                                     <-----       ACK
               (Segment is played back;
               upon reaching end point:)
                                     <-----       COMPLETION
```

To use FAST or SLOW in the above, substitute HEX (3B) or HEX (3C) in place of the HEX (3A) used for PLAY.

The SEGMENT MODE instruction at (*) can be deleted if you are sure the player has not gone into a lead-in or lead-out area while searching to the start point.

The portion marked (**) above can be skipped if your speed is PLAY (i.e. default = PLAY).

The portions marked (***) above can be skipped if you want to go through the segment only once this time (i.e. default repetitions = 1.) Maximum repetitions is 15. However, if you specify 00, the segment will be repeated endlessly, until a further command is sent.

To terminate the repetitions before all are done, send C.L. HEX (56). You can then send the sequence you want to do next. You use C.L. to terminate a segment playback even when the "repetition" is 1 (i.e. default value).

Now let's assume you want to step through a segment, in the forward direction.

The frame advance rates can be set anywhere from 1/1 to 1/255 of normal speed. The denominator of the desired rate is entered as data. Fractions of normal speed translate into the following seconds of display per frame:

1/1	=	.033 sec	1/120	=	4.0 sec
1/2		.066	1/150		5.0
1/3		.1	1/180		6.0
1/10		.33	1/210		7.0
1/30		1.0	1/240		8.0
1/60		2.0	1/255		8.5
1/90		3.0			

```
Ext. CPU                                         LDP-1000A
SEG MODE                              ----->
                                     <-----        ACK
SEARCH                                ----->
                                     <-----        ACK
SEG # 1st digit
           HEX (30) to (36)           ----->
                                     <-----        ACK
SEG # 2nd digit
           HEX (30) to (39)           ----->
                                     <-----       ACK
ENTER                                 ----->
                                     <-----       ACK
            (Player searches to start
            point; upon reaching it:)
                                     <-----       COMPLETION
SEG MODE                              ----->                (*)
                                     <-----       ACK
REPEAT                                ----->
                                     <-----       ACK
SEG # 1st digit
           HEX (30) to (36)           ----->
                                     <-----       ACK
SEG # 2nd digit
           HEX (30) to (39)           ----->
                                     <-----       ACK
STEP                                  ----->
                                     <-----       ACK
ENTER                                 ----->
                                     <-----       ACK
REPETITIONS 1st digit                                      (**)
           HEX (30) TO (31)           ----->
                                     <-----       ACK
REPETITIONS 2nd digit                                      (**)
           HEX (30) TO (39)           ----->
                                     <-----       ACK
ENTER                                 ----->
                                     <-----       ACK
RATE 1st digit
           HEX (30) to (32)           ----->
                                     <-----       ACK
RATE 2st digit
           HEX (30) to (39)           ----->
                                     <-----       ACK
RATE 3rd digit
           HEX (30) to (39)           ----->
                                     <-----       ACK
ENTER                                 ----->
                                     <-----       ACK
            (Segment is stepped through;
            upon reaching end point:)
                                     <-----       COMPLETION
```

The SEGMENT MODE instruction at (*) can be deleted if you are sure the player has not gone into a lead-in or lead-out area while searching to the start point.

The portions marked (**) above can be skipped if you want to go through the segment only once this time.

c) Caution on use of start/end points

Please note the following when defining your segments' start and end points:

--For both the start and end points, the player actually sends COMPLETION upon entering the specified frame (around horizontal line 20, to be precise). The player will usually go through one or two rotations (i.e. the frame is displayed for 1/30 sec or 2/30 sec--too short to be noticed) before your external computer can respond with the next commands. What happens next depends on what command you send: the **net** result with PLAY/FAST/SLOW varies slightly from STEP.

--Let's assume that you want to show frames 00095 through 00100 inclusive (i.e. you want to show those two frames, as well as all in between). In Case A, you use PLAY. In Case B, you use STEP. The two cases are illustrated below. Carefully note the different start points needed, and the display of frames.

Case A -- using PLAY

frame no.	specified	interval shown
00093		not shown
00094		not shown
00095	start	shown 1/30 or 2/30 sec
00096		shown 1/30 sec
00097		shown 1/30 sec
00098		shown 1/30 sec
00099		shown 1/30 sec
00100	end	interval depends on command's timing
00101		not shown
00102		not shown

Case B -- using STEP

frame no.	specified	interval shown
00093		not shown
00094	start	shown 1/30 or 2/30 sec (not noticeable)
00095		shown at STEP interval
00096		shown at STEP interval
00097		shown at STEP interval
00098		shown at STEP interval
00099		shown at STEP interval
00100	end	interval depends on command's timing
00101		not shown
00102		not shown

--Start points:
In both cases, the player reaches the start point of the segment specified in your SEARCH command, and sends COMPLETION as it starts playing back this frame. When your next commands are received, the player will begin execution of those commands from the next frame after the specified start point.

If your next command is a PLAY sequence, the player continues forward at normal speed. The one or two rotations while the player waited for your commands, appear to be part of the PLAY action.

If your next command is a STEP sequence, the player starts the stepping interval with the next frame after the specified start point.

--End points:
In both cases, the player reaches the end point of the segment specified in your REPEAT command, and sends COMPLETION as it starts playing back this frame. How long this frame is shown, depends on when your next commands are received.

If the completed segment was done in PLAY, you could send your next commands as soon as you wanted. Even with your fastest command dispatch, the player will have played this last frame 1 or 2 times before your commands arrive. This would fit in with the segment's PLAY timing.

If the completed segment was done in STEP, you will probably want to show this last frame for the same interval as the others in the segment. So you should wait that interval before sending your next command.

iii. Commands during SEGMENT playback

If you send STILL HEX (4F) at any time during a segment's playback, the LDP-1000A will go into still frame on the video frame the player was on at the time the STILL command was received. The player will stay in still on that frame, until you send another command.

At this point, you have three choices of action:

a) send CONTINUE HEX (61). The player will resume execution of the segment, with nothing changed (same speed, etc).

b) send a different speed. The end point will remain the same. For example, let's assume you were in normal PLAY before, and want to go to SLOW:

```
Ext. CPU                                         LDP-1000A
SLOW                          ----->
                             <-----               ACK
             (Player resumes in SLOW;
             upon reaching end point:)
                             <-----               COMPLETION
```

Note that ENTER is not needed.

STEP can also be used, as follows:

```
Ext. CPU                                         LDP-1000A
STEP                          ----->
                             <-----               ACK
RATE 1st digit
        HEX (30) to (32)      ----->
                             <-----               ACK
RATE 2st digit
        HEX (30) to (39)      ----->
                             <-----               ACK
RATE 3rd digit
        HEX (30) to (39)      ----->
                             <-----               ACK
             (Player resumes in STEP;
             upon reaching end point:)
                             <-----               COMPLETION
```

Note that ENTER is not needed.

The player's handling of the end point is the same as explained in part (ii.c) above, "Caution...".

c) terminate the segment playback entirely, and send an entirely new sequence of commands. This is done by sending C.L. HEX (56). You need not take any action on the STILL command that had been sent.

V. PROM REVISION LEVELS

SUMMARY OF ROM Versions

NO.		1.5	1.6	1.7	1.8	2.1	3.1	3.2
1	"ACK" and "NAK" added to ensure correct transmission of data through the RS232-C.	X	0	0	0	0	0	0
2	Commands added to enable programming of "INDEX ON/OFF", "AUDIO CH-1/2 ON/OFF" in the EXT-CPU mode.	x	0	0	0	0	0	0
3	When SEARCH, REPEAT, etc. is sent from the extenal CPU, the display appears automatically and is very poor. Modification was done to prevent automatic display when in the EXT-CPU mode.	X	0	0	0	0	0	0
4	The spindle motor and laser can be turned ON and OFF by the external CPU. Commands added.	X	0	0	0	0	0	0
5	There was no response when "PGM" or "RUN" was sent from an external CPU. "ACK" was added.	X	0	0	0	0	0	0
6	When "not target" resulted from a frame number search, the correct frame number was not reported. Modification was done to prevent stopping at a point where the frame number cannot be read.	X	0	0	0	0	0	0
7	When "PGM-AAA-RUN" is sent from the external CPU, only line no. AAA is executed.	X	0	0	0	0	0	0

NO.		1.5	1.6	1.7	1.8	2.1	3.1	3.2
17	Random numbers are sent when in standby mode.							
18	RS232-C cannot communicate when in the standby mode.							
19	The RAM area of the audio code is dumped in and out.	0	0	0	0	X	X	0
20	Modifications done to prevent 1 - 2 frame overrun in the repeat fast mode.	X	X	X	X	X	X	0 DEC
21	5 dump memory.	X	X	X	X	X	0	0
22	Chapter function. V 3.1 cannot search beyond 20 chapters.	X	X	X	X	X	0	0

LDP-1000A ROM VERSIONS

1. Summary of differences vs LDP-1000
   - 1.1 Frame number reading capability improved
   - 1.2 Chapter capabilities expanded:
     CAV/CLV chapter search, repeat
   - 1.3 CLV disc time code search, repeat capability added
   - 1.4 Audio control code:
     Memory area expanded from 1 Kbyte to 5 Kbytes
     (however, dumps in multiple locations are not possible)
     New commands:
     --input wait
     --extended dump
   - 1.5 RS232-C interface

2. RS232-C improvements

   The following LDP-1000 improvements were made in version 3.1.
   - 2.1 When SEARCH to present frame number, ACK was returned (not COMPLETION), and the ext. computer locked up.

     example: assume present frame is 01000

```
if LDP-1000:
SEARCH 01000 ENTER  ------>
                   <------  ACK
                            no completion

if LDP-1000A:
SEARCH 01000 ENTER  ------>
                   <------  ACK
                   <------  COMPLETION
```

   - 2.2 For REPEAT, same situation as (2.1).
   - 2.3 With no disc, and upon closing the lid, ACK is not output continuously.
   - 2.4 When the RS232-C cable is disconnected, the lid can still not be opened.

3. Added RS232-C command and return code

3.1 Command

--set chapter mode: HEX (69)

This puts the SEARCH and REPEAT into chapter mode.

3.2 Return code

--no frame: HEX (06)

During search, a lead-out condition is checked, and when the search is terminated this code is returned. The LDP-1000 sent HEX (05) (NOT TARGET) in this situation.

VI. SFA-1000 Control Commands

i. RS232-C commands

L \ H	0	1	2	3	4	5	6	7
0		RESET	Reserved	0	ENTER	INDEX ON	ADDR INQ	
1	COMPLETION	REPLAY		1	C.E	INDEX OFF	CONTINUE	
2	ERROR	STATUS SET		2	MENU	DUMP IN LDP→CPU	MOTOR ON	
3		STATUS INQ		3	SEARCH	DUMP OUT LDP→CPU	MOTOR OFF	
4	PGM END	SPLIT PLAY BACK		4	REPEAT	SEG MODE	CH-1	
5	NOT TARGET	Additional commands for SFA		5	SEGMENT	FRAME # MODE	CH-2	
6	NO FRAME #			6	CH-1 ON	C.L	INDEX	
7				7	CH-1 OFF	PGM	STATUS INQ	
8				8	CH-2 ON	RUN	DISCID INQ	
9				9	CH-2 OFF	END	CHAPTER # MODE	
A	ACK			F-PLAY	R-PLAY	MEMORY		
B	NAK			F-FAST	R-FAST	M-SEARCH		
C				F-SLOW	R-SLOW	SKIP		
D	PLAY BACK START	Additional return code for SFA		F-STEP	R-STEP	INT		
E	NORMAL END			F-SCAN	R-SCAN	REVIEW		
F	ERROR END			STOP	STILL	MODE		

ii. Additional commands for SFA control

a) RESET HEX(10): Stops the playback.
b) REPLAY HEX(11): Functions the same as the REVIEW switch of the SFA-1000.
c) STATUS SET HEX(12): Sets the following statuses.
BY transmitting the following data(1 byte) after this command, the status will be Written in the status register.

D7 0 not used
D6 0 not used
D5 RETURN CODE OUTPUT ON
1: At the end of audio playback, NORMAL END HEX (0E) or ERROR END HEX (0F) will be output.
0: NO output
When the power is turned on, the bit is reset to 0.
D4 STILL CMD OUTPUT ON
1: The still command is output to LDP-1000A when reading the SFA audio data from the video signal.
0: No output
When the power is turned on, the bit is reset to 0.

D3 CH-2 ON
1: The SFA audio signal is output to channel 2.
0: No output
When the power is turned on, the bit is reset to 1.

D2 CH-1 ON
1: The SFA audio signal is output to channel 1.
0: No output
When the power is turned on,the bit is reset to 1.

D1 VIDEO MUTE ON
1: Mutes the video signal and output a sync signal only.
0: Muting not performed.
When the power is turned on,the bit is reset to 0.

D0 AUDIO MUTE ON
1: Mutes the audio signal.
0: Muting not performed.
When the power is turned on,the bit is reset to 0.

d) STATUS INQ HEX(13): When the SFA-1000 receives this command,it will send the following status data.

D7-D3 0 not used

D2 STANDBY
indicates that the unit is preparing to read SFA data when the bit is set to 1.

D1 AUDIO PB ON
indicates that the SFA signal is now being output when the bit is set to 1.

D0 ERROR END
indicates that an incorrectable error has occured while SFA data is being decoded when the bit is set to 1.

e) SPLIT PB HEX(14): Outputs the SFA data at the start time you set for a length you set. Input command,start time,and length in this order. Start time and length are set in 0.2 second step by a hexadecimal number.

iii. Additional return code for SFA

When RETURN CODE OUTPUT ON flag is set to the status register, the following return codes are output from the SFA-1000 to the external computer.

1) PB START HEX(0D): When a SFA datum is to be output.
2) NORMAL END HEX(0E): When a SFA datum is decoded normally.
3) ERROR END HEX(0F): When decoding of the SFA data is stopped because of an error.

iV. Commands sequesce

1) Single command

```
CPU                        SFA-1000

RESET        -------->
             <--------     ACK
                             Operation ends.

REPLAY       -------->
             <--------     ACK
                             Operation ends.

PB START     ------->
             <--------     NORMAL END
                             When RETURN CODE
                             OUTPUT ON flag is
                             set to 1.
```

2) Commands followed by data

```
CPU                        SFA-1000

STATUS       -------->
             <--------     ACK
status byte  -------->
             <--------     ACK
                            Operation ends.

STATUS INQ   -------->
             <--------     ACK
status byte  <--------       Operation ends.

SPLIT PB     -------->
             <--------     ACK
start time   -------->
             <--------     ACK
  length     -------->
             <--------     ACK
REPLAY       -------->
             <--------     ACK
                             Operation ends.
```

VII. APPENDIX

A. Places to Write for Specifications

i. EIA RS232-C

2001 Eye Street, N.W.
Washington, D.C. 20006
Telephone: (202) 457-4966

ii. Application Notes for RS232-C

Same as above.

iii. Intel 8251A Programmable Communication Interface

Intel Corporation
Literature Department
3065 Bowers Avenue
Santa Clara, CA 95051

B. RS232-C Commands

H / L	φ	1	2	3	4	5	6	7
φ				φ	ENTER	INDEX ON	ADDR INQ	
1	COMPLETION			1	C.E	INDEX OFF	CONTINUE	
2	ERROR			2	MENU		MOTOR ON	
3				3	SEARCH		MOTOR OFF	
4	PGM END			4	REPEAT	SEG MODE	CH-1	
5	NOT TARGET			5	SEGMENT	FRAME# MODE	CH-2	
6	NO FRAME			6	CH-1 ON	C.L.	INDEX	
7				7	CH-1 OFF	PGM	STATUS INQ	
8				8	CH-2 ON	RUN	DISC ID INQ	
9				9	CH-2 OFF	END	CHAPTER# MODE	
A	ACK			F-PLAY	R-PLAY	MEMORY		
B	NAK			F-FAST	R-FAST	M-SEARCH		
C				F-SLOW	R-SLOW	SKIP		
D				F-STEP	R-STEP	INT		
E				F-SCAN	R-SCAN	REVIEW		
F				STOP	STILL	MODE		

* How to read this chart:

1. Read the column number first, then the row number.
   EX: 40 = ENTER
   01 = COMPLETION
2. Commands relevant to control of the LDP-1000A, are from 30 to 69.
3. The 0x column shows the return codes from the LDP-1000A.
4. a): A small black triangle in a box, indicates that command is only useable via RS232-C.
   b): Commands without the triangle are equivalent to those possible with the RM-1002 keys, and may also be used via RS232-C.

LDP-1000A Command execution time

Time to return ACK/NACK for each command, as measured at player RS232-C port

COMMANDS	EXEC TIME	COMMANDS	EXEC TIME
0～9	1.2mS (4.3mS)	INT	2.5mS (6.0mS)
PLAY	2.0mS (5.5mS)	REVIEW	1.5mS (9.6mS)
FAST		MODE	1.7mS (3.7mS)
SLOW		CH-1	0.47mS (0.53mS)
STEP		CH-2	
STOP		INDEX	0.58mS (0.53mS)
C.E From ERROR	2.0mS (8.0mS)	MOTOR ON	
ENTER	2.6mS (1.3mS)	MOTOR OFF	
MENU	20.0mS (11.5mS)		
SEARCH	2.6mS (9.0mS)		
REPEAT	2.6mS (8.0mS)		
SEG	2.5mS (10.0mS)		
CH-1 ON/OFF	0.43mS (0.4mS)		
CH-2 ON/OFF			
INDEX ON/OFF			
MODE (SEG)			
MODE (FRAME)			
STILL			
C. L.	4.3mS (5.5mS)		
PGM	2.2mS (7.9mS)		
RUN	7.9mS (7.0mS)		
END From PGM	5.6mS (10.5mS)		
MEMORY	0.76mS (0.76mS)		
M-SEARCH	1.0mS (11.1mS)		
SKIP	2.5mS (5.8mS)		

( ) : Used for LDP-1000.

LDP-1000A/SFA-1000
9-966-756-61

Sony Corporation

Printed in Japan
1984. 12 11