

IBM 7070 Simulator Usage

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Introduction

The IBM 7070 was introduced in June 1960, as a replacement to the IBM 650. It had core memory up to 10,000 10 digit words.

The 7072 was introduced November 1962 and the 7074 on November 1961.

The 7074 is a faster version of the 7070 with the addition of memory up to 40,000 10 digit words.

The first 100 memory locations can be used as index registers. Most memory reference instructions allow for a field of digits to be selected to operate on and not modify the rest.

The 7070 is a decimal machine with each word consisting of 10 digits plus a sign. The sign can be plus, minus or alpha. Alpha data is stored 5 characters to a word (2 digits per character).

Simulator Files

To compile the IBM 7070, you must define `USE_INT64` as part of the compilation command line.

<i>Subdirectory</i>	<i>File</i>	<i>Contains</i>
I7000	i7000_defs.h	IBM 7000 simulators general definitions
	i7070_defs.h	IBM 7070 simulator specific definitions
	i7000_chan.c	Generic channel interface.
	i7070_cpu.c	7070 CPU, Channel, interface
	i7070_chan.c	7070 Channel.
	i7070_sys.c	7070 System interface
	i7000_cdr.c	7500 Card reader
	i7000_cdp.c	7550 Card punch
	i7000_com.c	7750 Communications Controller
	i7000_con.c	7551 Inquiry console.
	i7000_dsk.c	1301/2302 disk and 7238 drum controller.
	i7000_ht.c	7340 Hypertape controller.
	i7000_lpr.c	7400 Line printer
	i7000_mt.c	729 Tape controller.
i7000_chron.c	Chrono Clock.	

IBM 7070 Features

The IBM 7070 simulator is configured as follows:

Device Name(s)	Simulates
CPU	7070 CPU with 30KW of memory
CH0	Unit record devices
CH1..4	7504 Tape controller channels
CH5..7	7907 Disk, Hypertape, controller channels
MTA	729 Magnetic Tape Controller
MTB	729 Magnetic Tape Controller
MTC	729 Magnetic Tape Controller
CHRON	Chrono Clock
HTA	7340 Hypertape, default not included.
HTB	7340 Hypertape, default not included.
CDR	7500 Card Reader
CDP	7550 Card Punch
LP	7400 Line Printer
DK	1301/2302/7304 disk.
INQ	7551 Inquiry console.
COM	7750 communications controller.
COML	7750 Communications lines.

If desired individual devices can be removed from the system by editing `i7000_defs.h` and changing the number of “`NUM_DEVS_xxx`” entries. The entry “`NUM_UNITS_xx`” determines the number of individual units for each controller.

Stop conditions

The 7090 simulator implements several unique stop conditions:

- Undefined CPU instruction.
- IO device not ready.
- IO Check error.
- Divide Error
- Field Overflow (CPU enabled).
- Sign Change (CPU enabled).
- Alpha Index Word.
- Invalid message to 7750.
- No buffer storage available for input character on 7750.
- N buffer storage available for output character on 7750.

CPU

The CPU options include setting memory size and CPU type.

```
SET CPU 7070           Sets CPU to emulate 7070.
SET CPU 7074           Sets CPU to emulate 7074.
```

```

SET CPU 5K           Sets memory to 5K
SET CPU 10K          Sets memory to 10K
SET CPU 15K          Sets memory to 15K*
SET CPU 20K          Sets memory to 20K*
SET CPU 25K          Sets memory to 25K*
SET CPU 30K          Sets memory to 30K*
SET CPU NOFLOAT      Disables floating point.
SET CPU FLOAT        Enables floating point.
SET CPU NOEXTEND     Disables extended memory support.
SET CPU EXTEND       Enables extended memory support.
SET CPU TIMER        Enables interval timer and interrupt.
SET CPU NOTIMER      Disables interval timer.

```

* Memory size is 10KW on a standard CPU, extended option must be enabled to use memory sizes over 10KW.

CPU registers include the visible state of the processor as well as the control registers for the interrupt system.

<i>Name</i>	<i>Size(digits)</i>	<i>Comments</i>
IC	5	Program Counter
AC1	10s	Accumulator 1
AC2	10s	Accumulator 2
AC3	10s	Accumulator 3
IND	10	Error indicators
SW1..SW4	1	Sense Switches 1..4
SW	4	Sense Switches

The CPU can maintain a history of the most recently executed instructions.

This is controlled by the SET CPU HISTORY and SHOW CPU HISTORY commands:

```

SET CPU HISTORY      clear history buffer
SET CPU HISTORY=0    disable history
SET CPU HISTORY=n    enable history, length = n
SHOW CPU HISTORY     print CPU history
SHOW CPU HISTORY=n   print first n entries of CPU history

```

Instruction tracing shows the Instruction counter, the generated effective address, the value of memory before and after execution of the instruction and the decoded instruction in symbolic format.

I/O Channels (CH0..CH8)

The 7070 supports up to 8 channels. Channel models include:

7604 standard multiplexer channel
 7907 advanced capabilities channel

Channels are fixed on the 7070.

Channel 0 is a pseudo channel for unit record devices.

Registers

Channels have the following registers:

<i>Name</i>	<i>Size(digits)</i>	<i>Comments</i>
ADDR	6	Channel data address
CMD	2	Channel command (octal)
LIMIT	6	Channel word count
ASM	10s	Channel assembly register
LOCATION	6	Channel location counter
FLAGS	32	Channel status flags (binary)

For meaning of bits in FLAGS see i7000_defs.h.

The command:

SHOW CH Print summary of devices on channel

Unit record devices.

7500 Inquiry Station (INQ)

The inquiry station allows for communications with the operating system.

The station is half duplex and will either print or accept input.

Whenever the computer sends a message it is prefixed with a 'R' character.

When the station is ready to receive input it prompts with a 'I'. Input is buffered until the return character is entered.

Backspace will remove the last character typed.

An <esc> will send an interrupt to the processor to request it read a record from the console.

An <esc> while in input mode will cancel input mode and clear any typed message.

7500 Card Reader (CDR)

The card reader (CDR) reads data from a disk file. Cards are simulated as ASCII lines with terminating newlines. Card reader files can either be text (one

character per column) or column binary (two characters per column). The file type can be specified with a set command:

```
SET CDR FORMAT=TEXT      Sets ASCII text mode
SET CDR FORMAT=BINARY   Sets for binary card images.
SET CDR FORMAT=BCD      Sets for BCD records.
SET CDR FORMAT=CBN      Sets for column binary BCD records.
SET CDR FORMAT=AUTO     Automatically determines format.
```

or in the ATTACH command:

```
ATTACH CDR <file>          Attaches a file
ATTACH CDR -f <format> <file> Attaches a file with the given format.
ATTACH CDR -s <file>       Added file onto current cards to read.
ATTACH CDR -e <file>       At end-of-file, the reader will receive
                             an end of file flag.
```

The card reader can be booted with:

```
BOOT CDR                  Start card reader to read one card.
```

Boot is currently not working.

The 7500 Card reader supported two modes of operation, alpha mode (default), and load mode in which the card had 5 words that were read into storage. To enable this set LCOL non zero.

```
SET CDR LCOL=n           Set load column detection.
```

If LCOL is set to a non-zero value, then on every card read is checked to see if there is a 12 punch in the designated column. If so the card is converted to decimal, every 10th column is used to determine the sign. Zone 12 is +, Zone 11 is -, no zone is Alpha.

The Card reader could single ready on one of two attention lines. To set which one receives the ready signal use the following commands:

```
SET CDR NOATTEN          Don't signal when reader done.
SET CDR ATTENA           Signal on priority channel A.
SET CDR ATTENB           Signal on priority channel B.
```

Error handling is as follows:

error	processed as
not attached	report error and stop
end of file	out of cards

7550 Card Punch (CDP)

The card reader (CDP) writes data to a disk file. Cards are simulated as ASCII lines with terminating newlines. Card punch files can either be text (one

character per column) or column binary (two characters per column). The file type can be specified with a set command:

```
SET CDP FORMAT=TEXT      Sets ASCII text mode
SET CDP FORMAT=BINARY    Sets for binary card images.
SET CDP FORMAT=BCD       Sets for BCD records.
SET CDP FORMAT=CBN       Sets for column binary BCD records.
SET CDP FORMAT=AUTO      Automatically determines format.
```

or in the ATTACH command:

```
ATTACH CDP <file>          Attaches a file
ATTACH CDP -f <format> <file> Attaches a file with the given format.
```

The Card punch could single ready on one of two attention lines. To set which one receives the ready signal use the following commands:

```
SET CDP NOATTEN          Don't signal when punch done.
SET CDP ATTENA           Signal on priority channel A.
SET CDP ATTENB           Signal on priority channel B.
```

Error handling is as follows:

error	processed as
not attached	report error and stop
OS I/O error	report error and stop

7400 Line Printer (LP)

The line printer (LP) writes data to a disk file as ASCII text with terminating newlines. Currently set to handle standard signals to control paper advance.

```
SET LP NO/ECHO           Sets echoing to console of line-printer output.
SET LP LINESPERPAGE=lpp Sets number of lines per page on printer.
```

The Line printer could single ready on one of two attention lines. To set which one receives the ready signal use the following commands:

```
SET LP NOATTEN          Don't signal when printing done.
SET LP ATTENA           Signal on priority channel A.
SET LP ATTENB           Signal on priority channel B.
```

Error handling is as follows:

error	processed as
not attached	report error and stop
OS I/O error	report error and stop

Magnetic Tape devices

729 Magnetic Tape (MTA-C)

These come in groups of 10 units each.

Each individual tape drive support several options: MTA used as an example.

SET MTAn REWIND	Sets the mag tape to the load point.
SET MTAn LOCKED	Sets the mag tape to be read only.
SET MTAn WRITEENABLE	Sets the mag tape to be writable.
SET MTAn LOW	Sets mag tape to low density.
SET MTAn HIGH	Sets mag tape to high density.

Options: Density LOW/HIGH does not change format of how tapes are written. And is only for informational purposes only.

Tape drives can be booted with:

BOOT MTxn	Read in record into location 0.
-----------	---------------------------------

Channel 1 supports the read binary opcode to load binary tapes in octal format.

ChronoClock

Disabled by default. This is a special 729 tape drive which returns the current time. It supports the option of setting the channel and drive that it will occupy.

Note: You must disable the real 729 drive that is replacing.

The clock responds to Read and Backspace commands. A read results in a 10 character buffer being generated that has the Month, Day, Hour, Minutes, Seconds and Milliseconds.

This time is taken from the local computer time.

SET CHRON CHAN=n	Set channel for chrono clock.
SET CHRON UNIT=n	Sets the unit for the chrono clock.

Example: To set Chronoclock to unit A9 do the following:

```
SET MTA9 DISABLE
SET CHRON UNIT=9 CHAN=A
```

7907 Devices

These devices must be attached to a 7907 channel to work.

1301/1302/2302/7320 Disk devices

The 7631 file control supports up to ten devices, which can be 7320 drums, 1301 disks, 1302 disks, or 2302 disks. Unit types are specified with the SET command.


```

SET DKn TYPE=7320          Unit n is a drum
SET DKn TYPE=7320-2       Unit n is a drum (two modules).
SET DKn TYPE=1301         Unit n is a 1301 disk
SET DKn TYPE=1301-2      Unit n is a 1301-2 disk (two modules).
SET DKn TYPE=1302         Unit n is a 1302 disk
SET DKn TYPE=1302-2      Unit n is a 1302-2 disk (two modules).
SET DKn TYPE=2302         Unit n is a 2302 disk

```

Units can be SET ENABLED or DISABLED. In addition, units can be set to enable or disable formatting:

```

SET DKn FORMAT            Enable formatting
SET DKn NOFORMAT         Disable formatting
SET DKn HA2              Enable writing of home address 2
SET DKn NOHA2            Disable writing of home address 2
SET DKn MODULE=n         Sets modules for unit, modules can only be even. 0 to 8.
SET DKn CHAN=n           Sets channel for unit (A-H).
SET DKn SELECT=n         Sets select on channel (0 or 1).

```

Formatting is disabled by default.

Error handling is as follows:

error	processed as
not attached	report error and stop
OS I/O error	report error and stop

Hypertape 7340 Tape drive (HTA)

These come in groups of 10 units each. The controller defines which channel the devices will be on. By default these devices are not installed.

```

SET HTA CHAN=n           Sets channel for unit (A-H).
SET HTA SELECT=n         Sets select on channel (0 or 1).

```

Each individual tape drive support several options: HTA used as an example.

```

SET HTAn LOCKED          Sets the mag tape to be read only.
SET HTAn WRITEENABLE     Sets the mag tape to be writable.

```

NOTE: Hypertape drives may not be working correctly since there is very little documentation available on them.

7750 Communications Controller (COM and COML)

The 7750 is modeled as a terminal multiplexer with 33 lines. It consists of two device: COM is the multiplexer controller, and COML is the individual lines.

For the first 32 lines, the 7750 performs input and output through Telnet sessions connected via a user-specified listening port.

The 33rd line is permanently attached to the simulator console window. The ATTACH command specifies the port to be used for Telnet sessions:

```
ATTACH COM <port>          set up listening port
```

where port is a decimal number between 1 and 65535 that is not being used other TCP/IP activities.

Each line (each unit of COML) can be set to one of twp modes: KSR-35 and KSR-37. In KSR-35 mode, lower case input and output characters are converted automatically to upper case, and parity is ignored. In KSR-37 mode, lower case characters are left alone, and even parity is generated on input. KSR-37 is the default.

Once COM is attached and the simulator is running, the 7750 listens for connections on the specified port. It assumes that any incoming connection is a Telnet connections. The connections remain open until disconnected either by the Telnet client, a SET COM DISCONNECT command, or a DETACH COM command.

```
SET COM DISCONNECT=n      Disconnect line n
SET COM CHAN=n           Set channel for com controller.
```

The 7750 implements the following special SHOW commands

```
SHOW COM CONNECTIONS     Displays current connections to the 7750
SHOW COM STATISTICS      Displays statistics for active connections
```

The 7750 implements the following special SET commands:

```
SET COMLn LOG=filename   Log output of line n to filename
SET COMLn NOLOG          Disable logging and close log file
SET COMLn KSR35          Set line n to ksr-35
SET COMLn KSR37          Set line n to ksr-37
SET COMLn 2741           Set line n to 2741
```

The controller (COM) implements these registers:

<i>Name</i>	<i>Size</i>	<i>Comments</i>
ENABLE	1	Enable flag
STATE	6	Controller state
MSGNUM	12	Input message sequence number

Symbolic Display and Input

The IBM 7070 simulator implements symbolic display and input. Display is controlled by command line switches:

```
-c                      Display/Enter as BCD character
```


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