

TO: All Basic & Standard Users

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SUBJECT: 700 SERIES COMPUTER OPERATING PROCEDURES  
BASIC & STANDARD SYSTEMS

## BASIC SYSTEM

- I To prepare source tape program (PREP)
- II To assemble the program to produce an object tape (SYM I)
- III To edit the source tape (BASIC SYMED)
- IV To return SYM I/Prep to produce a new object tape from the corrected source tape.
- V To load and run a program
- VI To debug a program with Basic XRAY

## STANDARD SYSTEM

- VII To assemble a program
- VIII To run and object program
- IX To trace and debug a program with Trace/Debug

Legend: (See rotary switch on front panel of the computer)

AC means accumulator register display

IC means the index register display

MB means the memory buffer register

PC means program counter register

TTY means the ASR 33 or ASR 35 teletype unit

In the basic system we prepare a program source tape with PREP of SYM I/PREP DN 390470. The following patch should be manually made in REV. F:

<u>Location</u>	<u>Contents</u>	<u>Correct Contents</u>
0D5F	0800	0820

The program is then assembled to produce an object tape using SYM I of SYM I/PREP.

If the program must be corrected a new source tape is produced by SYMED/Basic DN 390941.

The program is then run and debugged by XRAY/Basic DN 390779.

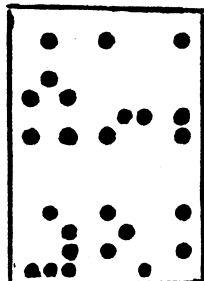
I Step by step outline to prepare source program tape.

1. To start machine hold down RESET button and press ON button, release RESET button after machine is on.
2. On ASR 33 Teletype (TTY), turn PUNCH off.
3. Turn TTY to "line".
4. Turn SELECTOR switch to MB. The ENTER and DISPLAY lights on the front panel of the computer should now be lit also.
5. Manually enter Absolute Bootstrap as listed on 700 programming system (yellow card YLCD) for PTR or HSR
 

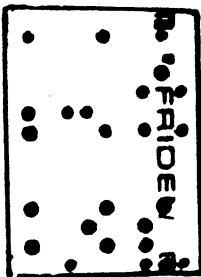
PTR=TTY reader  
 HSR=high speed  
 reader
6. Press RESET button
7. Determine starting address to be entered into index register.

EXAMPLE

Start of SYM I/PREP Tape



WRONG



RIGHT

8A Line Feed beginning of record  
 0002 2 bytes per word  
 05B0 Starting location of program  
 8D Carriage return  
 (End of Record)  
 8A Line feed  
 148C<sub>16</sub> (No. of bytes in program)

SYM I/PREP Starts

double word address 05B0

	0	5	B	0
	0000	0101	1011	0000
2x(05B0) =	0000	1011	0110	0000
subtract 12		0000	0000	I100 (The first 12 lines on tape are not part of the program itself.)
starting address	0000	1011	0101	0100 = 0B54

8. Enter starting address 0B54 into IX after turning DISPLAY SELECTOR on front panel of the computer to IX.
9.
  - (a) (To use reader PTR of TTY)
    1. Press RUN, PTR light on TTY should turn on
    2. Place reader on tape in TTY reader
    3. Turn PTR reader on. Display lights should show the stepping of the index register as soon as the first non-zero byte is read.
  - (b) (To use High speed reader HSR)
    1. Turn on HSR
    2. Press RUN
    3. Press HALT
    4. Load tape, left to right, (sprocket holes toward machine. Support tape with pencil held on nob sloped up. Be sure tape is under the read head and light is on.
    5. Push tape guide up so that "RUN" shows.
    6. Push RUN. The display lights should show the stepping of the index register as soon as the first non-zero byte is read.
10.
  - (a) After tape is through, stop PTR of TTY and press HALT.
  - (b) After tape is through HSR, press HALT.
11. Press RESET (Steps 1-11 are used to load any ABSOLUTE program using the ABSOLUTE BOOTSTRAP.)
12. Set program counter to X'0800', the execution address of SYM I/PREP. Press RUN, TTY will type ?? on the TTY paper. The TTY keyboard light (KBD) should be on. We are now ready to enter directives to SYM I/PREP via the TTY keyboard.
13. Type (L/F) CK, L/F signifies "press line feed button on keyboard". The program executes a carriage return (C/R) and types ?? We now have a choice of an Absolute program (ABSO) or a Relocatable program (RELO).

- 14.
- (a) Type (L/F) PA for ABSO upon entering PREP program
  - (b) Type (L/F) PR for RELO the TTY types 16 spaces.
15. Turn Display Selector switch to AC, for future visual message displays. If the KBD light is OFF or if you don't get 16 spaces at the beginning of every line, you are not entering when you type.

We are now ready to enter a source program. Format of Source program is as follows:

- (a) 60 characters per line.
- (b) Format of Line. (" $\wedge$ " means "space")
  - (L/F) label  $\wedge$  opcode  $\wedge$  operand  $\wedge$  comment (C/R)
  - (L/F) \* Comment (C/R)
  - (L/F)  $\wedge$  opcode  $\wedge$  operand (C/R)
- (c) To delete a line (before entering a C/R) enter a BACK ARROW  $\leftarrow$ . To erase the last character entered. enter a RUBOUT character.
- (d) The first line
  - 1 For Abso, (L/F)  $\wedge$  ORIG  $\wedge$  Starting Location of Program
  - 2 For Relo, (L/F)  $\wedge$  LIBR  $\wedge$  4 letter name for SYM I  
 $\wedge$  8 letter name for SYM II
- (e) Next to last line (Relo only)
  - 1 (L/F) NTRY Name of execution address (C/R)
- (f) Last line
  - 1 Abso (L/F)  $\wedge$  END  $\wedge$  (Label of execution address  
comment (C/R)
  - 2 Relo (L/F)  $\wedge$  END  $\wedge$  of execution address (C/R) (for  
main program  
(L/F)  $\wedge$  END  $\wedge$  (C/R) subroutine

If the program is too long, KBD light will go out and no more source statements can be entered. The AC display will show bits 0-3 blinking and bit 14 on. Then follow steps 15a, 15b, and 15c. Otherwise skip steps 15a, 15b, and 15c and continue with step 16.

- 15a Turn on TTY PUNCH. When punch stops, turn off punch. Do not move the paper tape in the punch.
- 15b Turn on sense switch 3 and then turn it off. (The DOWN position of the switch is the OFF position).
- 15c Proceed to type the rest of source program.
- 16. When (L/F)  $\wedge$  END. . . (C/R) is typed, the AC display will show bits 0-3 blinking and bit 14 on. Turn on the punch.
- 17. Toggle sense switch 3. (Turn it up and then down.) The TTY will type a source listing and the punch will punch a source tape. The AC display will show bits 0-3 blinking and bits 14 and 15 on. Turn off punch. Toggle switch 3. Program types ???

## II To assemble the source tape with SYM I to produce an object tape

1. Type a) (L/F) CT, to read tape on PTR  
b) (L/F) CH, to read tape on HSR
2. Type a) (L/F) SA, for ABSO program  
b) (L/F) SR, for RELO program
3. Load tape (source tape produced by PREP)  
a) Following (I:9a) for PTR  
b) Following (I:9b) for HSR
4. Turn reader off. The AC display will show bits 0-3 blinking and bit 15 on.
5. Toggle switch 3, TTY will type listing: When the listing is finished, the AC display will show bits 0-3 blinking and bit 14 on.
6. Turn punch on.
7. Toggle sense switch 3 object program will be punched. When the punching is finished, the AC display will show bits 0-3 blinking and bits 14 and 15 on.
8. Turn punch off.
9. Toggle switch 3. SYM I types ??

We now have an object tape which is a binary image of our program.

## III To edit the source tape using basic SYMED DN 390941

1. Load Basic XRAY using (I: 1-11) (Put X'24' in IX instead of X'B54')
2. For step (I:12) we enter X'0040' in the program counter (PC). the KBD light should come on. Basic XRAY types no messages.
3. Type (L/F) AL (C/R). PTR light should come on.
4. Load Basic SYMED. Turn PTR on. No message is typed.
5. Enter X'0040' on program counter. KBD light should come on. Press RUN.
6. Type (L/F) ET (C/R) TTY types BE KBD light should come on.

We are now ready to edit.

7. Follow given in SYMED documentation to delete the change statements on the source tape.
8. The last statement to be typed will be (L/F) + E (C/R) and the PTR light will come on.
9. Turn selector to AC.
10. Load source tape and run as per (I:9a, 10).
11. Turn off PTR (Reader)
12. Press HALT.
13. Turn on PUNCH.

14. Clear Accumulator, press clear button on selected display.
15. Press RUN, and the TTY will type a corrected listing. The punch will punch a new source tape. After typing the listing, the AC display will show bits 0-3 blinking and bits 14 and 15 on. Turn off PUNCH. Press HALT. Clear Accumulator. Press RUN. Then the TTY will type BE and you may begin editing another source tape.

To produce a new object tape, return SYM I/PREP.

#### IV SYM I/PREP may be reloaded using basic XRAY.

1. Set PCR at X'40' and hit RUN. PTR light comes on.
2. Type (L/F) AL (C/R)
3. Follow steps I:9a, 10a, 11, 12 then go to II.

At this point we have a corrected object tape.

#### V Loading of Object program.

- A If the program does not use Raytheon I/O software,
1. Follow steps (I:1-10) [Absolute bootstrap loads object tape] or step B1 below.
  2. Start program by setting PC to Initial Address of program.
  3. Press RUN and start program.
- B If program does need Raytheon I/O software, this software resides in basic XRAY.
1. If SYM I/PREP is in the machine, any ABSO program can be loaded.  
First type:  
(L/F) XT (C/R) PTR  
(L/F) XH (C/R) HSR  
and absolute bootstrap is returned
  2. Then use the Absolute Bootstrap to load basic XRAY. (See III:1)
  3. Initiate basic XRAY by
    - a) HALT
    - b) RESET
    - c) set PC to X'0040'
    - d) RUN
  4. a) For an Absolute program load object program with (L/F) AL (C/R)  
b) If a relocatable object program is to be loaded,
    - I Load Relo Loader tape by typing (L/F) AL (C/R)
    - II Load Object Tape of program. Type (L/F) IL (C/R)
    - III To obtain starting address, type (L/F) ET (C/R)
- or

5. HALT/RESET
6. Set PC to starting address
7. Run

VI The Basic system debug is in the Basic XRAY. There is no trace capability in Basic system.

To Debug:

1. HALT/RESET
2. Enter X'0040' on PC RUN keyboard light should come on. Follow debug documentation in Basic XRAY.
3. HALT/RESET/Enter X'0040' on PC/RUN.
4. Type (L/F) P^ xxxx, yyyy (C/R) to obtain a new object tape.

VII The source tape is prepared with the Standard system in the same manner as with the Basic system using the PREP of SYN I/PREP.

To assemble the source tape with SYM II to produce an object tape,

1. Load the initial loader bootstrap, manually following directions on yellow card.
2. Press RESET and set program counter to X'0080'
3. Load Initial Loader DN 393260 following the same directions for loading SYM I/PREP starting at step (I:9).
4. After loading Initial Loader (I:10) load the monitor tape repeating (I:9) & (I:10). The monitor will cause the TTY to type LOAD.
5. Load XRAY Exec/Relocating Loader DN 391305/390013 repeating (I:9) & (I:10). XRAY will type on TTY  
XC  
NEXT
6. XRAY will load the next tape, SYM II. Load SYM II following (I:9) and then type on TTY (L/F) :AL (C/R) and the tape should load then.
7. Follow (I:10) to stop reader. If SYM II is loaded, it will type on TTY, PAS? and the keyboard (KBD) light comes on.

NOTE: The XRAY directives must be prefixed by a colon (:). Only in Basic XRAY is the colon omitted.

8. Enter source tape prepared by PREP and corrected by SYMED. Source tape must make 3 passes to obtain listing and object tape, unless there is at least one additional output device.
9. Mount source tape in reader and turn reader on (I:9).

10. Type (L/F) 1 (C/R) first pass. SYM II types PAS?
11. Mount source tape again and turn punch off.
12. Set sense switch 1 up to obtain TTY listing.
13. Type a) (L/F) B (C/R) for Abso  
or b) (L/F) 2 (C/R) for Relo  
the tape will feed slowly while TTY types listing, then PAS? is typed again.
14. Mount source tape again.
15. Set sense switch 1 off (down) switch 0 on (up):
16. Type a) (L/F) B (C/R) for Abso  
or b) (L/F) 2 (C/R) for Relo  
Object tape will be punched and TTY will type PAS?
17. Object tape will start and end with junk which must be removed.  
We now have an object tape.
18. Put sense switch zero down.

VIII To run object program in standard system, (load by starting at X'78')

1. Use XRAY/RELOLOADER to load program use  
(L/F) :AL (C/R) for Abso programs  
(L/F) :IL (C/R) for Relo programs
2. 2. Run last bell character through a second time. The program must have 2 bell characters in a row to know that it has all information.
3. HALT/RESET/Set PC to initial location/RUN.

IX To use TRACE/DEBUG

1. Make XRAY<sup>\*</sup> resident (L/F)<sup>\*</sup> :XR (C/R)<sup>\*\*</sup>
2. Type (L/F)<sup>\*</sup> :SF, 4 (C/R)<sup>\*\*</sup> to tell relocatable loader to prepare to type out starting addresses for your program and TRACE/DEBUG
3. Type (L/F)<sup>\*</sup> :IL (C/R)<sup>\*\*</sup> . Then load users program or programs.
4. Load TRACE/DEBUG

We are now in TRACE/DEBUG if KBD light comes on. Follow documentation for TRACE/DEBUG package DN 391082.

\* (L/F) means "press LINE FEED button on teletype keyboard."  
\*\*(C/R) means "press RETURN button on teletype keyboard."