

IDENTIFICATION

Product Code: DEC-10-RSCB-D
Product Name: PDP-8 Scanner For PDP-10
Date Created: March 12, 1968
Maintainer: Software Service's Group

SCN680 OR SCN689*
PDP-8 SCANNER FOR PDP-10

1. REQUIREMENTS

1.1 Core Storage on the PDP-8

SCN680 is a PDP-8 program which performs the same functions as a PDP-10 hardware scanner, such as the 630 DCS or the DC10. The program includes the 680 8-bit character assembly subroutines (described in Digital-8-35-S-B), which have been slightly modified; the modifications have not expanded the routines beyond their existing pages, so their effective size remains $422_8 + 7n$. The main program occupies two pages of core - locations 200 through 377 and 400 through 577; it also utilizes 32_8 additional locations on page 0 including location 0 and the remaining auto-index registers. The total size of the program is then $1054_8 + 7n$, where n is the number of Teletype lines to the next even multiple of eight lines.

1.2 Hardware and Software

The minimum requirement for the system is:

- a. A minimum configuration PDP-8
- b. 680 Data Communication System Hardware
- c. DA10 PDP-10 to PDP-8 interface
- d. PDP-10 with time-sharing monitor, whose scanner service routine is properly interfaced with DA10/SCN680 package. (See below.)

2. OPERATION OF THE PDP-8 SCN680 PROGRAM

2.1 Loading

a. SCN680 exists on paper tape in BIN format. Starting from scratch the user must toggle the RIM loader into core starting at location 7756; this process should not have to be repeated unless the PDP-8 is used for some purpose other than scanning lines which would destroy these locations.

b. The BIN loader is then placed in the reader, the switch register is set at 7756, the operator presses LOAD ADDRESS and then START. The paper tape reader switch must be in the START position. As long as only SCN680 is used in the PDP-8, this process should only have to be done once.

*The term 680 and 689 are used interchangeably.

c. After the BIN loader is in core, the SCN680 tape is placed in the reader, the switches are set to 7777, and LOAD ADDRESS is pressed; the switches are then set to 4000 if the slow (Teletype) paper tape reader is used, or to 0000 if the fast reader is used. START is pressed and the tape is read in. If the accumulator indicator lights are nonzero after the tape has stopped reading in, there is a checksum error.

Steps a, b and c should not have to be repeated as long as the PDP-8 is not used for some other purpose which may destroy the relevant core locations; reloading or reinitializing the PDP-10 monitor has no effect on the SCN680 program running on the PDP-8.

2.2 Initializing and Starting

a. Before starting SCN680, it must be ascertained that the highest numbered physical Teletype connected to the 680 hardware is reflected in location 377. The current version assembles with this number (\underline{m})* equal to 10_8 ; if m for a given installation is generally constant, it would be worthwhile to reassemble SCN680 to assign a new permanent value m_1 . Otherwise, the operator may load the value \underline{m} into location 377 as follows (assume $m = 5$).

- (1) Set switch register to 377.
- (2) Press LOAD ADDRESS.
- (3) Set switch register to 5.
- (4) Elevate DEPOSIT.

SCN680 will now assume physical line numbers 0 through 5 to be on the 680 hardware. The PDP-8 console Teletype will always be given the line number $m + 1$ (in this case, line number 6), and will be usable in the same manner as the Teletypes on the 680. 680 line numbers which are less than \underline{m} but have no Teletypes, will act in the same manner as disconnected Teletypes in a hardware scanner; i.e., as far as the monitor or program is concerned, the Teletype is there and functions properly. Currently the PDP-10 monitor must be built to accept $m + 1$ physical scanner lines (since the PDP-8 console Teletype will have line number $m + 1$ as far as the PDP-10 is concerned).

The starting address for SCN680 is 200_8 . Once started, the program may run indefinitely even if the PDP-10 monitor is stopped and restarted. The starting procedure is as follows:

- (1) Set switches to 200.
- (2) Press LOAD ADDRESS.
- (3) Press START.

The PDP-8 is now functioning as a line scanner for the PDP-10; the Teletypes connected to the 680 system as well as the PDP-8 console Teletype are now the TTY's of the PDP-10.

When restarting or reloading the PDP-10 monitor, it may be advisable to restart the PDP-8 at 200_8 in order to clear all buffers of partially transmitted or received characters. The line number in location 377, however, is never altered by the program; it need only be toggled in after loading SCN680 and then only if the assembled quantity in location 377 differs from the actual highest line number on the 680.

*It should be noted that \underline{m} must be the highest 680 line number which has a Teletype connected to it, which is not necessarily the number of actual Teletypes.

NOTE

The initialization process which begins at location 200 in the SCN680 program dynamically creates all line-number dependent portions of the program - both buffers and IOT instructions - from the argument in location 377. Therefore, even if a new PDP-10 monitor with a different amount of line numbers is loaded, or if the physical line number assignments are altered on the 680 hardware, a reload of SCN680 is not necessary; it is sufficient to toggle the new value of the highest line number into location 377 and then restart at 200.

3. PDP-10 PROGRAMMING FOR THE DA10/PDP-8

The coding methods described in the following discussion are implemented in that version of the scanner service routine which utilizes the DA10/SCN680 system as a line scanner. The discussion is included for the benefit of those who may wish to program the DA10/SCN 680 system as if it were a device, or for those who may wish to make any alterations or modifications in the current PDP-10/DA10 interface.

3.1 Setting Initial Conditions

The DA10/SCN680 system must be initialized to a virgin state where any previously caused conditions are effectively erased, and to where the system is ready to process interrupts from the Teletype lines. The initial conditions are as follows:

- a. All conditions that may cause interrupts on the PDP-10 and the PDP-8 must be cleared.
- b. A PI channel must be assigned for the PDP-10.
- c. The PDP-8 program, SCN680, must be informed that the PDP-10 may receive interrupts.

The following instruction sequence will accomplish this:

```
MOVEI  TAC,SCNCHN    ;PI channel number.  
CONO   14,2510(TAC) ;sets conditions.
```

This last instruction:

- a. Clears the From-10-Buffer Full flag (bit 25).
Clears the From-10-Buffer Empty flag (bit 27).
Clears the To-10-Buffer Full flag (bit 29).
- b. Assigns PI channel number in bits 33 through 35.
- c. Sets to-10-Buffer Empty flag (bit 32), which will cause SCN680 to set a flag indicating that information can now be passed to the PDP-10.

3.2 Processing Interrupts

Two conditions will cause an interrupt on the PDP-10: the To-10-Buffer Full flag being set and the From-10-Buffer Empty flag being set. The From-10-Buffer Empty flag is set whenever the PDP-8

program SCN680 has input the data in the low-order 12 bits of the From-10-Buffer of the DA10. There is no way for the PDP-10, however, to detect what the contents of the From-10-Buffer were, or whether this interrupt is an indication that the character that was input by SCN680 has been transmitted - hence, it is not a true "transmit interrupt" and it should be dismissed as follows:

```

CONSO      14, 200          ;From-10-Buffer empty?
(see if char. received or transmitted) ;No
(save TAC)                               ;Yes
MOVEI      TAC, SCNCHN     ;Channel number
CONO       14, 400 (TAC)   ;Clear flag
(restore TAC and dismiss int.)

```

If the To-10-Buffer Full flag caused the interrupt, the following code must be executed.

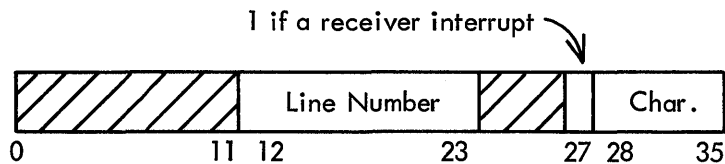
```

...
CONSO      14, 40          ;To-10-Buffer full?
(dismiss int. condition) ;No
DATAI      14, TAC        ;Sets To-10-Buffer Empty
...                               ;flag clears To-10-Buffer Full
...                               ;flag

```

3.3 Transmitting and Receiving Characters

The format for data transmitted to or received from the DA10 buffers is as follows:



a. To transmit a character on a line, the following instruction is used:

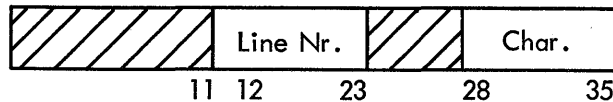
```

DATAO      14, CHAR

```

where

CHAR/



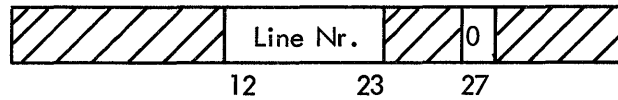
b. If the following sequence is executed,

```

CONSO      14, 40          ;To-10-Buffer Full flag?
(dismiss int.) ;No
DATAI      14, CHAR        ;Yes

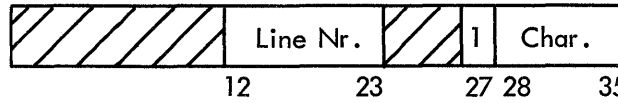
```

CHAR may be



Transmit interrupt
on indicated line
number.

or



Character received
on indicated line
number.

After determining that the To-10-Buffer Full flag caused the interrupt, the following sequence must be performed:

```
DATAI      14, CHAR
TRNN       CHAR, 400      ;Receiver interrupt?
(transmit interrupt; get next char.) ;No
(receiver routine)       ;Yes
```

ASSEMBLING INSTRUCTIONS

SCN680 may be assembled for any of 4 possible clocks in the 680 hardware. These clocks are called Clock 1, Clock 2, Clock 3 and Clock 4.

In order to assemble SCN680 for clock n, the operator must create a on-line file defining the clock number as follows:

```
CLOCK = n ↵
```

This file must be assembled with the SCN680 source.

Example:

Suppose file Clock 2 consists of the single line,

```
CLOCK = 2 ↵
```

and is placed on the disk. Running PALX with the following command sequence will then work:

```
*PTP:, LPT: ←DSK:CLOCK2, DTA3:SCN680.SRC ↵
```

An analogous process may be used with the PAL III or PAL D assembler on the PDP-8.