Martin's PTDOS Utilities

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This paper introduces a suite of useful programs and device drivers for Processor Technology's PTDOS, and explains how to get these programs loaded onto a PTDOS disk. Many of these programs include a help function, which can be viewed by typing the program name, followed by a question mark.

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Section 1 - Loading Software onto a PTDOS disk

Getting Started with a Bare-Bones PTDOS System

PTDOS does not provide any tools for loading software via the Sol-20's serial port. (Processor Technology expected software to be distributed and loaded primarily via floppy disk.) With the Internet, it is now more practical to distribute files electronically, and load them onto PTDOS disk via the serial port, which is connected to a more modern computer that has Internet connectivity.

This section describes how to load software onto PTDOS disk via the serial port, assuming a bare-bones PTDOS system. Connect the Sol-20's (RS-232) serial port to a PC or similar computer that running a communications program (such as Hyperterm) that can send and receive plain ASCII text files, as well as send and receive files using the XModem protocol.

You need to be somewhat familiar with the following PTDOS topics, all described in the PTDOS User's Manual, Version 1.5 (Manual part number 731029).

- COPY command (2-9)
- IMAGE command (2-24)
- KILL command (2-26)
- READ command (page 2-32)
- RETYPE command (page 2-36)
- How to use Device Drivers (page 5-2 and section 9.1 on page 9-1)
- What are Image Files (page 5-2 and 5-8)

The first program you need to load onto PTDOS is a device driver that can receive files via the Sol-20 serial port. RXMODEM is a stripped-down receive-only XModem-protocol device driver that is designed to be easy to load, as the first step for bootstrapping device drivers into PTDOS. Once you have finished this step, you will never again need to load files using the peculiar, slow, and unreliable "ENT" file method. Here is how you get RXMODEM onto your PTDOS disk:

1. Set the Sol-20 serial port to 1200 baud , 8 data bits, no parity, 1 stop bit, full duplex:
   - S4-1 off (even parity)
   - S4-2 off (8 bits)
   - S4-3 off (8 bits)
   - S4-4 on (1 stop bit)
   - S4-5 off (no parity)
   - S4-6 off (full duplex)
   - S3-6 on, all other S3 switches off (1200 baud)

(1200 baud is the fastest the Sol-20 can receive an ENT file without any handshaking.)

2. Connect the Sol-20 serial port to your PC's serial port, and configure that port for 1200 baud, 8 bits, no parity, no handshaking.
3. Make sure the Sol-20's LOCAL key is off!
4. Test serial port transmit connectivity by setting Solos's output to the serial port:

   >SE O=1

   Start a terminal emulator program (e.g. Hyperterm) on your PC, and type on the Sol-20 keyboard. Your typed characters should appear in your terminal emulator window.

   >SE O=0

will return output to the Sol-20 screen.

5. Test serial port receive connectivity by setting Solos's input to the serial port:

>SE I=1

Typing in the terminal emulator window should appear on the Sol-20 screen.

>SE I=0

will return input to the Sol-20 keyboard.

6. Use Solos to load RXMODEM.ENT:
   a. Select the Sol-20 serial port for input:

   >SE I=1
   b. Use e.g. Hyperterm to send (as a text file) the file "RXMODEM.ENT" to the Sol-20 serial port
7. Boot PTDOS:

   >BO

8. Create an Image file of the loaded program on the PTDOS disk:

   *IMAGE RXMODEM CAB4,CBA2,CAB4

7. Convert the Image file to a Device Driver

   *RETYPE RXMODEM,D

Loading Programs using COPY and RXMODEM

You should now have a device driver called RXMODEM on your PTDOS disk. With this utility, you no longer need to use Solos to load "ENT" files for PTDOS, though the process of making a file executable is still a little clumsy. (This will be improved in the next step.)

You can use this device driver with PTDOS's COPY command to load more useful programs and drivers. A good program to load now is HEX2IMG, which will allow you to load hex files created by external assemblers, such as Digital Research's ASM.

1. Set the Sol-20 serial port to 9600 baud , 8 data bits, no parity, 1 stop bit, full duplex:
   - S4-1 off (even parity)
   - S4-2 off (8 bits)
   - S4-3 off (8 bits)
   - S4-4 on (1 stop bit)
   - S4-5 off (no parity)
   - S4-6 off (full duplex)
   - S3-8 on, all other S3 switches off (9600 baud)
2. Connect the Sol-20 serial port to your PC's serial port, and configure that port for 9600 baud, 8 bits, no parity, no handshaking.
3. Make sure the Sol-20's LOCAL key is off!
4. Use e.g. Hyperterm to send (with XMODEM protocol) the file "HEX2IMG" to the Sol-20 serial port
5. Use PTDOS's COPY command to receive the file:

   *COPY RXMODEM,TEMP

6. Load the file into memory, and note the file length provided by PTDOS

   *READ TEMP,0

* EOF * LOAD COUNT: 0700H

7. Save the file as an image file, using the LOAD COUNT (file length - 700 in this example). Also set the load and execution addresses to 100h:

   *IMAGE HEX2IMG,0,700,:100,100

8. Delete the temporary file:

   *KILL TEMP

Loading Programs using HEX2IMG and RXMODEM

You should now have an executable image file on PTDOS disk called HEX2IMG. Now the process of loading programs onto your PTDOS disk via the serial port is a lot easier.

As an example, you can load the program GETTAPE.HEX using HEX2IMG together with the stripped-down RXMODEM device driver this way:

1. Connect to your PC the same as above, and send the file GETTAPE.HEX (via XModem protocol) to the Sol-20
2. Receive the file using HEX2IMG and the RXMODEM device driver:

   *HEX2IMG RXMODEM,GETTAPE

You should now have an executable program called GETTAPE on your PTDOS disk.

Use HEX2IMG whenever you want to load a hex file into PTDOS as an executable image file, a device driver, or a non-executable image file (a data file).

Loading Device Drivers using HEX2IMG and RXMODEM

Loading a device driver with HEX2IMG is similar to loading a program. The only difference is that you must tell HEX2IMG that the file is supposed to be a device driver. As en example, load the full XMODEM device driver, using the stripped-down RXMODEM device driver:

3. Connect to your PC the same as above, and send the file XMODEM.HEX (via XMODEM protocol) to the Sol-20
4. Receive the file using HEX2IMG and the RXMODEM device driver:

   *HEX2IMG RXMODEM,XMODEM,T=D

You should now have a device driver called XMODEM on your PTDOS disk.

Loading Programs and Device Drivers using HEX2IMG and XMODEM

Once you have the XMODEM device driver loaded and tested, you can delete RXMODEM, as XMODEM does everything RXMODEM does, and a whole lot more. Note that your Sol-20 must have RAM in the address range D000h through DFFFh for XMODEM to run.

As an example, you can load the program GETTAPE this way:

5. Connect to your PC the same as above, and send the file GETTAPE.HEX (via XMODEM protocol) to the Sol-20
6. Receive the file using HEX2IMG and the XMODEM device driver:

   *HEX2IMG XMODEM,GETTAPE

You should now have an executable program called GETTAPE on your PTDOS disk.

Section 2 - Programs

FORMAT

Format will format a raw disk for use with PTDOS, capable of the following:

1. Initializing and then formatting a data disk, the equivalent of PTDOS's "DISKCOPY /1,S=I" followed by "DISKCOPY /1,S=F" (For older versions, "DISKCOPY /1,S=C" followed by "DISKCOPY /1,S=F")
2. Formatting as above, and then installing PTDOS onto the new disk, with several options for which PTDOS programs to include.
3. Reinstalling PTDOS onto a disk that already contains PTDOS

You can also specify read-back verify on writes, and you can set the date and name on the disk.

Type "FORMAT ?" for a help screen.

HEX2IMG

HEX2IMG is a PTDOS program that converts an Intel hex file (such as the output of many assemblers) into a PTDOS-executable Image file or Device Driver file. Its input can be a file, or (importantly) a device driver, such as RXMODEM or XMODEM. Together with such a device driver, HEX2IMG can be used to load programs that were assembled externally.

HEX2IMG eliminates the steps you would otherwise need to take to convert a binary file to an image file, or to a device driver.

One additional advantage of using HEX2IMG instead of loading a binary using COPY (as above) is that HEX2IMAGE will create a file that is exactly the right size, whereas COPY (together with an XMODEM driver) will create a file that is an integer number of 256-byte pages. (This is because the XModem protocol always sends 256-byte pages.)

Type "HEX2IMG ?" for instructions, and see example in Section 1 above.

IMG2HEX

IMG2HEX is a program that will create an Intel hex file from a PTDOS Image file. You can use it together with the XMODEM device driver to upload an Image for distribution to others. For example, you could distribute the PTDOS program TREK80 this way:

1. Initiate transfer using IMG2HEX and XMODEM

    *IMG2HEX TREK80,XMODEM

2. Receive the file TREK80.HEX on your PC using e.g. Hyperterm, using the XModem protocol

If the file you wish to upload is a device driver, then you must first convert it to an image file. For example, to upload a device driver called SERIAL, you would do the following:

1. *RETYPE SERIAL,I
2. *IMG2HEX SERIAL,XMODEM
3. Receive the file SERIAL.HEX on your PC using e.g. Hyperterm, using the XModem protocol
4. *RETYPE SERIAL,D

Type IMG2HEX ?" for instructions.

GETTAPE

GETTAPE reads a Solos-compatible cassette tape file and saves it as a PTDOS Image file. Note that many Solos programs will not run correctly under PTDOS, because PTDOS does not call a loaded program in the same way that Solos does. (See RUNSOLOS below.)

Type "GETTAPE ?" for instructions.

RUNSOLOS

RUNSOLOS will run an image file of a Solos-compatible program that would otherwise not work correctly under PTDOS. If the Solos-compatible program has a RETURN function, it will return to PTDOS, rather than to Solos. (This is useful for loading files into programs like MUSIC.)

RUNSOLOS runs in Solos's cassette tape buffer, and leaves its jump table in Solos's User Area. This way, it should not interfere with any PTDOS or Solos programs.

Type "RUNSOLOS ?" for instructions.

MAKETAPE

MAKETAPE creates Solos-compatible cassette tapes with multiple files on them, from PTDOS image files. It is intended primarily for making distribution tapes, where you want to put several different files on a tape in an automated fashion.

Type "MAKETAPE ?" for instructions.

HEXER

HEXER is an exerciser program for the Helios Disk Memory System, which is useful for repairing and aligning the Persci 277 disk drives within the Helios system. It is also useful for repairing blocks on a PTDOS disk, by allowing you to read, edit and write blocks and their headers, as well as uploading and downloading block data in Intel hex format. You can also format PTDOS disks with HEXER.

HEXER actually runs under Solos, though it can be loaded from disk as well as cassette. (This is so that you can use HEXER to repair your Helios system even when it won't boot PTDOS.)

Section 3 - Device Drivers

PTDOS device drivers may serve as the input or output to most programs. For example, the program HEX2IMG normally takes an Intel hex file as its input, and produces an Image file:

    *HEX2IMG MYPROG.H,MYPROG

The source for HEX2IMG can instead be a device driver, such as XMODEM:

    *HEX2IMG XMODEM,MYPROG

This will receive an XModem-encoded Intel hex file from the Sol-20 serial port, convert it to an Image file, and save it as MYPROG.

Similarly,

    *IMG2HEX MYPROG,XMODEM

will convert the PTDOS program MYPROG into an Intel hex file, encode it for XModem communication, and send it out the Sol-20 serial port.

RXMODEM

RXMODEM is a stripped-down receive-only XModem device driver that is intended to be used during this bootstrapping process. It runs in Solos's tape buffer memory, and so will not be wiped out when PTDOS boots, and will not conflict with most PTDOS programs, including (importantly) COPY and HEX2IMG.

XMODEM

XMODEM is a full bidirectional PTDOS device driver that supports both the original XModem protocol with checksums, and the XModem-CRC protocol.

The XMODEM device driver runs in RAM from D000h through DFFFh (4K bytes). Your Sol-20 must have RAM in this range to use the XMODEM device driver.

Once you have the XMODEM device driver on PTDOS disk, you do not need to use the stripped-down RXMODEM.

TXTMODEM

TXTMODEM is a full bidirectional PTDOS device driver that supports both the original XModem protocol with checksums, and the XModem-CRC protocol.

The TXTMODEM device driver runs in RAM from D000h through DFFFh (4K bytes). Your Sol-20 must have RAM in this range to use the TXTMODEM device driver.

TXTMODEM is similar to XMODEM, but is designed specifically for uploading and downloading text files between PTDOS and a PC. When downloading to PTDOS, TXTMODEM converts text files to be compatible with PTDOS, by removing linefeed characters and MSDOS end-of-file characters. When uploading to MSDOS, TXTMODEM converts text files to be compatible with MSDOS, inserting linefeeds after carriage returns and inserting an MSDOS end-of-file character.

SERIAL

SERIAL is a very simple bi-directional PTDOS device driver, for sending and receiving via the Sol-20 serial port, with no encoding and no flow control. It is up to you to make sure the data rate is low enough that characters are not dropped.

SERIAL runs in Solos's User Area. As such, it should not interfere with most other PTDOS programs.