

# **IDOS kernel manual**

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## Section 1: Building the IDOS kernel

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To build only the kernel and sharer, the following tools are needed:

- bash shell
- GNU make, or compatible
- perl to process comload.lst listing file
- gcc to compile sumspace tool
- gcc-ia16 to compile patchini/patldos.com
- sumspace tool (source text shipped in repo)
- Netwide Assembler, a recent version needed (at least v2.15)
- dosemu2 to run DOS tools
- WarpLink linker (DOS tool, public domain)
- x2b2 tool (DOS tool, public domain)
- comtoexe tool (DOS tool, MIT license)
- lzexe tool (DOS tool, MIT license)

The DOS tools have to be found in the DOS path.

The following components are expected in sister directories to the repo:

- lmacros
- ldosboot
- scanptab
- kernwrap
- patchini (must be built separately using the mak.sh, with gcc-ia16, or provided in binary form)
- instsect (must be built separately using this repo's makinst.sh)
- inicom (if to use compression support), also needs one of the compression tools:
  - brieflz (blzpack)
  - lz4

- snappy (snzip)
- exomizer
- x-compressor
- heatshrink
- lzip
- lzop
- lzs -- default choice, one of the fastest depackers
- apultra
- bzipack
- lzexedat

## Section 2: Starting the IDOS kernel

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The IDOS current release build includes four different kernel files in the `bin/` subdirectory: `ldos.com`, `ldos.sys`, `ldospak.com`, and `ldospak.sys`. Any single one of these four files contains the complete kernel.

The `.com` files are called iniload variants, as they are wrapped in the IDOS `iniload.asm` (initial loader) stage. They are valid DOS MZ application executables and can be loaded as a number of different kernel formats.

The `.sys` files are called drload variants, from the stage named `drload.asm` (originally created for the IDOS flavour of the Enhanced DR-DOS kernel). They are only valid to be loaded as FreeDOS kernel (typically named `kernel.sys`) or as EDR-DOS kernel (typically named `drbio.sys`). The advantage is that they are smaller than the iniload variants.

The `ldos` files are uncompressed. The advantage is faster load time and being able to patch the kernel image.

The `ldospak` files are compressed. The advantage is, again, the smaller file size.

### 2.1 Booting IDOS

The IDOS kernel can boot off diskette drives (`fda`, `fdb`, `fdc`, `fdd`) or FAT16 or FAT12 partitions on MBR-partitioned hard disk drives. Both primary and logical partitions are supported.

Loading off logical partitions may require loaders that support this at all and a correct (unit absolute) value for hidden sectors, either hardcoded into the boot sector loader or automatically detected at boot time. `ldosmbr's altmbr`, `ldosboot boot.asm`, and `lDebug` all do support this.

The default drive at boot time may be any drive that matches the boot partition, that is it may be different than `A:` or `C:`. If the exact partition cannot be identified from the load unit plus hidden sectors, then the first drive that is logged in on the same unit is selected as the default drive. If no such drive exists, then either drive `A:` or the first hard disk drive (`C:`, `D:`, or `E:`) is selected, depending on whether the load unit is  $< 128$  or  $\geq 128$ . The configuration files are searched for in the root directory of the default drive unless the kernel command line specifies pathnames that include a drive specification.

### 2.2 Installing boot sector loader using INSTSECT

The recommended choice is to install a boot sector loader using the `instsect` application. This application is found both in `instsect.com` and in the COMLOADER multi-executable tool which is embedded in `ldos.com`, using the command program name `instsect`.

The default filename for `instsect's` loaders is `ldos.com`. Note that the loaders use the IDOS load protocol. Trying to load `ldos.sys` or `ldospak.sys` using these loaders will fail with a check 'V'alue error (letter 'V' displayed at boot time).

The instsect online help can be accessed using the / ? switch. Redirect to a file or to a tool like 'more' to read all of it.

## Section 3: Supported file systems

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IDOS currently supports the following file systems:

- Diskette drives (up to 4)
- MBR-partitioned hard disks
- CHS or LBA access on int 13h units
- Primary partitions
- Logical partitions (in extended partitions of type 5, 0Fh, or 85h)
- FAT12 or FAT16 file systems
- Partition types 0Eh (FAT16 LBA) and 0Fh (Extended LBA) only supported if HDD is accessed using LBA extensions
- Cluster sizes that are a power of two between 1 and 64 sectors
- Cluster size of 128 sectors (MSW NT extension)
- Cluster size of 256 sectors (Enhanced DR-DOS extension)
- Int 13h unit must use a sector size of 512 Bytes.
- Kernel is LFN aware, that is it doesn't mistake LFNs for volume label entries. It doesn't support LFNs.
- FAT32 and FAT+ are not supported. (IDOS iniload can boot off a FAT32 drive but it won't be logged in and supported by the kernel after boot time.)



## Section 4: IDOS configuration

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There are four inputs to the IDOS configuration:

- IDOS iniload query patch site, modified using patchqry
- ICFG block, modified using patchpro, patchdeb, and patchsca
- IDOS kernel command line, can be passed using bootable lDebug to chainload IDOS
- Configuration file

### 4.1 Query patch

The query patch site determines whether the initial loader uses CHS or LBA access, and whether it queries the CHS geometry using int 13h function 08h. This is accessed using the patchqry tool.

The query patch site is not passed along to the IDOS kernel yet.

### 4.2 ICFG block

The ICFG block currently contains three configuration choices:

First, the inicom depack progress display choice. This allows to choose none, dots, percentage, bar, or bar with percentage. This is accessed using the patchpro tool. Supported values are displayed by running patchpro without parameters.

Second, the debugger detection choice. This indicates conditions for detecting a resident debugger in order to avoid overwriting its int 1 and int 3 handlers. This is accessed using the patchdeb tool. Supported values are displayed by running patchdeb without parameters.

Third, the partition scan mode choice. This specifies several options on which partitions to log in and in what order. This is accessed using the patchsca tool. Supported values are displayed by running patchsca without parameters.

#### 4.2.1 Supported patchpro values

```
$ ./patchpro
Usage: patchpro ldebug.com [APP|DEVICE|BOOT] [number]
```

Supported progress types:

- 0: None
- 1: Dots
- 2: Percentage
- 3: Bar

4: Bar with percentage

There is a special flag, with value 16. This is only supported for APP and DEVICE modes. If set, then the selected progress choice is written to stdout even when stdout is redirected to a file. If clear, using a redirected stdout forces the progress display disabled. (As the IDOS kernel inicom payload only supports boot mode, this flag is never supported by the kernel.)

## 4.2.2 Supported patchdeb values

```
$ ./patchdeb
Usage: patchdeb edrdos.com [number]
```

Supported flags:

- 1: Check
- 2: Assume
- 4: Check only valid
- 8: Check only IISP

## 4.2.3 Supported patchsca values

```
$ ./patchsca
Usage: patchsca ldos.com [number]
```

Supported flags:

- 1|2: Ext5 setting
- 4|8: Ext15 setting
- 16|32: Ext85h setting
- 64: Ignore subsequent nested
- 128: Ignore subsequent logical
- 256: Ignore subsequent primary
- 512: Traditional order logical
- 1024: Active priority
- 2048: Subsequent primary after
- 8192: Ignore FAT32
- 16384: Ignore LBA
- 32768: DLA sort disable

Supported ext settings:

- 0 = follow all
- 1 = ignore all
- 2 = follow first of any ext
- 3 = follow first of this type

## 4.3 Kernel command line

The kernel command line is a text string of up to 255 bytes that can be passed to the kernel from the prior loader. Bootable lDebug allows to pass a command line when loading a kernel using the RxDOS.2, RxDOS.3, IDOS, FreeDOS, or EDR-DOS load protocols. (The latter two need to enable this using a CMDLINE=1 parameter.)

The commands of the command line are separated by semicolons. A semicolon immediately following another semicolon is parsed as an escaped semicolon. The following command names are recognised:

## CONFIG

Highest priority configuration file override. This file is tried first. Default is empty.

## ALTCONFIG

Second configuration file override. This file is tried second. Default is 'ldos.ini'.

## OLDCONFIG

Third configuration file override. This file is tried last. Default is 'config.sys'.

## PREPEND

Prepend the following line to the configuration file contents.

## APPEND

Append the following line to the configuration file contents.

## CHECKDEBUGGER

Modify check debugger value from ICFG block. Refer to section 4.2.2 for supported values. Numbers may be prepended by '+' plus sign to OR number into the variable, or by '-' minus sign to AND the bitwise NOT of the number. Otherwise the number will rewrite the entire variable to the number. Numbers default to decimal format, unless leading '0x' or trailing 'h' is specified. Multiple numbers may be specified separated by commas.

## SCANMODE

Modify scan mode value from ICFG block. Refer to section 4.2.3 for supported values. Numbers may be prepended by '+' plus sign to OR number into the variable, or by '-' minus sign to AND the bitwise NOT of the number. Otherwise the number will rewrite the entire variable to the number. Numbers default to decimal format, unless leading '0x' or trailing 'h' is specified. Multiple numbers may be specified separated by commas.

',' (dot)

Command ignored, possibly used for future optional extensions.

## 4.4 Configuration file

If a configuration file is found, its length is checked. The length should not exceed 56 KiB. Then a buffer is allocated and the entire file is read. Too long file contents may be truncated. The command line PREPEND and APPEND lines are also stored in the buffer.

Aside all the usual MS-DOS v4 level configuration directives, some additional directives are supported:

### DEVICEHIGH

Like DEVICE but attempt to load into the UMA

### INSTALLHIGH

Like INSTALL but attempt to load into the UMA

## INSTALLLAST, INSTALLLASTHIGH

Like INSTALL, INSTALLHIGH but after final DOSDATA and DOSCODE relocation

## SHELLHIGH

Like SHELL but attempt to load into the UMA

## COMPAT

List comma-separated compatibility options. The following options are recognised:

### (NO)ALTAH

Control allocation of a compatible ALTAH (CON device driver look-ahead buffer) that should be found at the segmented address 70h:61Bh.

### (NO)DOSDATAFIRST

Control relocation of DOSDATA segment first, before loading any device drivers. This means the segment will be allocated in the Low Memory Area.

### (NO)DOSDATAEARLY

Control relocation of DOSDATA segment early, after any device driver. The segment is relocated after the first device driver load that provides DOS with a sufficiently large (ca 6 KiB) Upper Memory Block. If no such UMB is provided at all then the DOSDATA segment is eventually relocated into the Low Memory Area at the default end relocate time.

### (NO)BOUNCEHMACHS

Control bouncing CHS disk accesses involving the HMA through the Low Memory Area (DOSEENTRY) disk sector buffer. This slows down the access but may be required if the access won't work in the HMA.

### (NO)BOUNCEHMALBA

Control bouncing LBA disk accesses involving the HMA through the Low Memory Area (DOSEENTRY) disk sector buffer. This slows down the access but may be required if the access won't work in the HMA. (Appears to be needed for qemu.)

## AUTOBOUNCEHMACHS

Enable automatic determination of bouncing CHS disk access involving the HMA. This is done by reading all DOS-internal CHS accessed nonremovable drives' boot sectors to the HMA shortly after it is allocated, but before DOSCODE is installed into it. If any of them are written to an A20-wrapped address into the disk sector in the DOSEENTRY section which is in the Low Memory Area, bouncing is enabled for all CHS accesses. A message indicating the first drive that needs this is then displayed. Specifying either BOUNCEHMACHS or NOBOUNCEHMACHS disables this automatic detection.

## AUTOBOUNCEHMALBA

As above but for LBA accessed nonremovable drives.

#### (NO)BOUNCEUMACHS

Control bouncing CHS disk accesses involving the UMA, or HMA. If enabled, all accesses to the UMA (typically starting at segment A000h) and also the HMA will be bounced through the LMA (DOSENTRY) disk sector buffer. If disabled, UMA accesses are not bounced but HMA accesses still may be.

#### (NO)BOUNCEANYCHS

If enabled, bounce any CHS disk access through the DOSENTRY disk sector buffer. If disabled, LMA accesses are not bounced but UMA and HMA accesses still may be.

#### (NO)BOUNCEUMALBA

#### (NO)BOUNCEANYLBA

As above but for LBA accessed drives.

#### (NO)HIDEDOSENTRY

Controls hiding of the first MCB, which is for the DOSENTRY segment. This MCB typically is located at segment 60h. Some programs such as FreeDOS MEM with its /D switch may not expect the entry segment and its device driver headers to appear in an MCB. If this is enabled, the first MCB in the DOS list of lists is changed to point past the DOSENTRY MCB.

#### (NO)HIDEDOSDATAFIRST

Controls hiding of the DOSDATA MCB. This only takes effect if DOSDATAFIRST is enabled. The DOS list of lists first MCB field is changed to point past the final DOSDATA MCB after the relocation, then. This implies that the DOSENTRY MCB is hidden as well. The ALTAH MCB may also be hidden due to this, if the ALTAH option is enabled.

## Section 5: Additional usage conditions

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The kernel executables can be compressed with a choice of different compressors. The files then contain a decompression stub. Some of these stubs have their own usage conditions. The following stub usage conditions apply, if one of these stubs is used.

### 5.1 BriefLZ depacker usage conditions

BriefLZ - small fast Lempel-Ziv

8086 Assembly IDOS iniload payload BriefLZ depacker

Based on: BriefLZ C safe depacker

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### 5.2 LZ4 depacker usage conditions

8086 Assembly IDOS iniload payload LZ4 depacker

by E. C. Masloch, 2018

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### 5.3 Snappy depacker usage conditions

8086 Assembly IDOS iniload payload Snappy depacker

by E. C. Masloch, 2018

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## **5.4 Exomizer depacker usage conditions**

8086 Assembly IDOS iniload payload exomizer raw depacker

by E. C. Masloch, 2020

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## **5.5 X compressor depacker usage conditions**

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## **5.6 Heatshrink depacker usage conditions**

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## 5.7 Lzd usage conditions

Lzd - Educational decompressor for the lzip format

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## 5.8 LZO depacker usage conditions

8086 Assembly IDOS iniload payload LZO depacker

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## 5.9 LZSA2 depacker usage conditions

8086 Assembly IDOS iniload payload LZSA2 depacker

by E. C. Masloch, 2021

based on:

decompress\_small.S - space-efficient decompressor implementation for 8088

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## 5.10 aPLib depacker usage conditions

8086 Assembly IDOS iniload payload aPLib depacker

by E. C. Masloch, 2021

based on:

aplib\_8088\_small.S - size-optimized aPLib decompressor for 8088 - 145 bytes

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## 5.11 bzipack depacker usage conditions

8086 Assembly IDOS iniload payload bzipack depacker

by E. C. Masloch, 2021

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## Source Control Revision ID

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<https://hg.pushbx.org/ecm/msdos4/rev/a56bd9a5aa7b>