

minIni

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MININI是一个在嵌入式系统中用来读"INI"文件的程序库，MININI使用少量资源，拥有一个确定的内存占用而且可以被配置于不同的I/O库。

对于MININI最重要的目标是可以被用于嵌入式RTOS(甚至不用任何操作系统)。MININI要求系统提供一种存储方式和文件和流 I/O，但是它并不要求文件和流 I/O与C/C++标准库兼容—事实上，标准库对于嵌入式系统来说常常过于累赘且造成资源不够用。

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商标

“Linux”是Linus Torvalds所注册的商标

“Microchip”是Microchip Technology Inc. 所注册的商标

“Microsoft”和“Microsoft Windows”是Microsoft Corporation所注册的商标

“Unicode”是Unicode Inc. 所注册的商标

“wxWidgets”是由Julian Smart和Robert Roebing所领导的公众项目

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电子邮件: info@compuphase.com; 主页: <http://www.compuphase.com>

MININI库的部分来源于Joseph J.Graf在1994年3月的Dobb博士期刊上发表的文章“Multiplatform.INI文件”。

本手册中的示例和程序具有指导价值。它们经过仔细测试，但不保证适用于所有场合。

介绍

MININI是一个用来读写简单的与"INI"文件格式兼容的配置的库。MININI库功能的代码很少而且它只需要一点点内存(e.g. RAM)。因此它适用于(小型的)嵌入式系统

INI文件在Microsoft Windows上最为所知, 它的函数 `GetProfileString`与`WriteProfileString` 是用读写 INI 文件的。MININI 中的函数是以Windows SDK为原型, 但是它们并不是完全的与 (Windows SDK中的)它们兼容。

尽管 MININI 最突出的是它的体积小,但是它也拥有一些其他功能:

- ◊ MININI 支持读取不属于任何节的键, 因此它支持不使用节的配置文件 (但是其他方面需要与 INI 文件相兼容)。
- ◊ 支持列举键与节。
- ◊ 你可以使用一个冒号分开键名和键值; 冒号等价于等于号。换个说法, 字符串“Name: Value” 与 “Name=Value” 是一个意思
- ◊ 末端注释 (i.e. 在一对键名/键值 的同一行) 是可以的. 哈希符 (“#”) 是可以替代冒号就行一个解释。
- ◊ 当一个键值包含注释符(“;” or “#”)时, 键值将会自动地将其放入一对双引号之间; 当编写键值这些引号将排除在外。当双引号自身出现在其中时, 这些符号将会避开它。
- ◊ 灵活的有理数支持, 支持定点数与浮点数。
- ◊ 因为在闪存(SD/MMC cards, USB memory sticks)中写入速度大大低于读取速度, MININI 缓存“文件写入”用于获得最好的性能, 而且这样的方式不需要额外的内存。
- ◊ 内存占用是固定的。不需要分配动态内存。

局限性

MININI 力求做到在尽可能少的固定内存中拥有更多功能。它并不追求速度。在对表达敏感的代码中, 我建议提前读取所需的任何值或设置, 并将其存储在 变量中。

详细的说, MININI 并不会存储任何从INI文件中读取的键名/键值对。它不会在两次访问之间保持INI文件处于打开状态; MININI 会在每一次读写操作完成后关闭文件

当写入INI文件时, MININI 将复制源文件并创建一个临时文件(和修改)成功完成操作后, 它会删除源文件并重命名临时文件并取而代之。如果必须更改多个设置, 则每个设置都会重复此循环。

这没有内置防止多个应用程序访问同一个INI文件(或线程, 或任务)的文件锁定机制。如果一个INI文件被共享到多个程序/线程/任务, 选择与建议请看第10面章节[多重任务处理](#)。

INI文件语法

一个INI文件在文本文件中有一个简单的 键名/键值 语法。每一个键名都要是独特的(在每一节中)而且与之配对的键值必须在同一行。一个INI文件通常都被分成几个节——在 MININI, 这只是可选的。一个节的名字需在两个中括号之间,如“[Network]”在下面的示例列表中。

列表: INI 文件示例

```
[Network]
hostname = My Computer
address = dhcp
dns = 192.168.1.1
```

在 API 和这篇文章中, “name”表示为键名。键值和键名被等号(“=”)分开。MININI 支持用冒号(“:”)替代等号分隔键名/键值。

在MININI 节和键名不区分大小写(与在 Microsoft Windows API情况一样)。因此, 在INI文件中“DNS = 192.168.1.1”等同于“dns = 192.168.1.1”。

在键值和键名后的空格会被一处。如果你想在值里面添加空格。请把值放在两个双引号中间。

[ini_gets](#) 函数会将双引号除去再返回。如果值包含空格(或特殊字符) [ini_puts](#) 函数会将其添入双引号中。

MININI 会忽略 “=” 或 “:” 两旁的空格,节两旁的 “[” 和 “]” 一样会忽略空格。它并不会删除键与节中的空格。因此键与节中间可以添加空格。

INI中的注释前必须要有分号(“;”) 或一个哈希符 (“#”), 而且结尾也一样。一段注释可以另起一行, 也可以跟在一对 键名/键值 后。

INI文件只有一个层次结构: 节与键。

使用 minIni

使用MININI的第一步是确保它能够编译。该库只由一个C文件和两个头文件组成，所以要配置的量很少。如果你不能使用 C/C++ 标准库，这个就是。然而，还是有一些配置文件（或“胶水”文件）你必须制作；this file is explained in the next section. The MININI distribution comes with a default configuration file that maps to the standard C library (specifically the file I/O functions from the “stdio” package) and example glue files for a few embedded file system libraries for embedded systems —see [appendix A](#) of this manual.

Once you have a good glue file, you can add the source file of MININI to your project and include the header file “minIni.h” in your source code files. In your source code, you can then use the functions in the MININI library to read text and values from INI files and to write text and values to an INI file. See the [Function reference](#) for details.

MININI uses string functions from the standard C/C++ library, including one function that is not in the ANSI C standard: `strnicmp`. On the Unix and Linux platforms, this function is usually called `strncasecmp`. If you are using a GNU GCC compiler, but you are not compiling for a Linux or “BSD” platform, you may need to define `strnicmp` as `strncasecmp` in the glue file (see below). If your compiler provides neither `strnicmp` nor `strncasecmp`, you can use a portable implementation in MININI by defining the macro `PORTABLE_STRNICMP` in the glue file (or on the compiler command line).

A notable limitation of MININI is that there is a (fixed) maximum length of a line that can be read from an INI file. This maximum length is configurable (at compile-time, not at run-time) and it may be short on embedded systems —see [page 6](#).

When running in an Unicode environment or when moving the INI file across platforms, there may be other considerations concerning the use of MININI — see the relevant sections in this chapter, specifically the section on Unicode on [page 8](#).

The glue file

The MININI library must be configured for a platform with the help of a so-called “glue file”. This glue file contains macros (and possibly “inline” functions) that map file reading and writing functions used by the MININI library to those provided by the operating system. The glue file must be called “minGlue.h”.

One general configuration is whether internal error checking via “assertions” is active. The MININI library uses the `assert` macro to help catch errors in the MININI library and/or catch errors in how the application interfaces with the MININI library. To build a release version, one typically recompiles all source code with the `NDEBUG` macro set.

In the case that your (embedded) platform lacks an `assert.h` file, you may want to define `NDEBUG` in the `minGlue.h` file.

• I/O functions

The MININI source code requires functions from a file I/O library to perform the actual reading and writing. This can be any library; MININI does not rely on the availability of a standard C library, because embedded operating systems may have limited support for file I/O. Even on full operating systems, separating the file I/O from the INI format parsing carries advantages, because it allows you to cache the INI file and thereby enhance performance.

The functions that you need to implement, or map to standard file I/O functions are:

LISTING: Functions to map in the “glue file”

```
int ini_openread(const char *filename, INI_FILETYPE *file)
int ini_openwrite(const char *filename, INI_FILETYPE *file)
int ini_close(INI_FILETYPE *file)
int ini_read(char *buffer, size_t size, INI_FILETYPE *file)
int ini_write(char *buffer, INI_FILETYPE *file)
int ini_rename(const char *source, const char *dest)
int ini_remove(const char *filename)
int ini_tell(INI_FILETYPE *file, INI_FILEPOS *pos)
int ini_seek(INI_FILETYPE *file, INI_FILEPOS *pos)
```

All functions should return zero on failure and a non-zero value on success. For examples of “implementations” for the above functions, see appendix A on [page 24](#).

The `ini_remove` function is redundant if `ini_rename` overwrites an existing destination file. When using GCC and Glibc as the C library, you may use the behaviour of the `rename` function (from Glibc) to overwrite the destination if it exists. Removing the original file before renaming the new file to the original name is then redundant, and the definition of `ini_remove` is then likewise redundant. When not using GCC and Glibc, you should consult the documentation for your compiler and library; standard C defines the behaviour of `rename` in this condition as implementation-defined.

The `INI_FILETYPE` type used in the above “glue” functions, must also be defined in the glue file. If you are using the standard C/C++ file I/O library, this is the “`FILE*`” type of the standard C/C++ file I/O library. On embedded systems with a different I/O library, chances are that you need a different handle or “structure” to identify the storage. For example:

```
#define INI_FILETYPE    HANDLE
```

The `MININI` functions will declare variables of the `INI_FILETYPE` type and pass these variables to sub-functions (including the glue interface functions) by reference.

For read-only support of INI files, only the macros/functions `ini_openread`, `ini_close` and `ini_read` are needed (see also [page 7](#)). The other functions are only needed for writing support. The type that holds the “file position” (for functions `ini_tell` and `ini_seek`) must be declared as well. For applications that use the standard C/C++ file I/O library functions `fgetpos` and `fsetpos`, this is the `fpos_t` type.

```
#define INI_FILEPOS      fpos_t
```

Function `ini_openread` is for opening an existing file, and for opening it for reading only. Function `ini_openwrite` must create a new file, or delete and re-create an existing file. The definition of the function `ini_openrewrite` is optional; if available, it is used to open an existing file for writing, but without truncating the file (many libraries call this “read + write mode”). Function `ini_openrewrite` allows for an optimization in the special case that an update of a setting does not cause the file length to be changed.

On Microsoft Windows and DOS, files can be opened in either “text mode” or in “binary mode”, and this relates mostly on the line termination translation. Despite INI files being text files, it is advised to open the INI file in binary mode.

See see appendix A on [page 24](#) for examples of glue files for various file systems.

• Buffer size (maximum line length)

Another item that needs to be configured is the buffer size. The functions in the `MININI` library allocate this buffer on the stack, so the buffer size is directly related to the stack usage. In addition, the buffer size determines the maximum line length that is supported in the INI file and the maximum path name length for the temporary file (for writing support). For example, `minGlue.h` could contain the definition:

```
#define INI_BUFFER_SIZE 512
```

The above macro limits the line length of the INI files supported by MININI to 512 characters.

The buffer size declared here is also the size of the “write cache” that MININI uses to optimize performance on file writes.

• Read-only support

In its default configuration, MININI supports both reading and writing INI files. If your application does not require write support, you can add a setting to the `minGlue.h` file to strip out the unneeded code.

```
#define INI_READONLY
```

When writing a setting to an INI, MININI writes it to a temporary file, copies the other sections and keys from the original INI file, and then deletes the original file and renames the temporary file to the name of the original file. This approach uses the least amount of memory. The disadvantage is that writes to an INI file are slow, especially on large INI files.

Furthermore, when writing to the temporary file, MININI repeatedly looks ahead in the source INI and jumps back to a position that it marked earlier. The goal of this design is to minimize the number of individual “write actions” to the file, because on Flash memory (and EEPROM memory), writing is an order of magnitude slower than reading.

The path name of the temporary file is the same as the input file, but with the last character set to a tilde (“~”).

• Browsing support

An efficient way to scan through the complete INI file and read all settings, is with `ini_browse`, see [page 11](#). Browsing support may be excluded from the MININI library by defining the `INI_NOBROWSE` definition.

• Rational number support

MININI can be configured to support reading and writing single-precision floating point values —see the functions `ini_getf` and `ini_putf`. Embedded processors may lack floating point hardware and software emulation of floating-point operations may be too costly in resources (memory). For these platforms, alternatives are to switch to a fixed-point representation or, when rational numbers are not relevant for the project, to disable the rational number support in MININI altogether.

To enable rational number support, a macro for the type and macros or interface functions for number-to-text conversions must be added to `minGlue.h`. For the standard C/C++ library, you can add the following definitions to the glue file:

```
#define INI_REAL float
#define ini_ftoa(string,value) sprintf((string),"%f", (value))
#define ini_atof(string) (INI_REAL)strtod((string),NULL)
```

For a different representation of rational numbers, only the definitions in `minGlue.h` have to change. The following example is based on the “fixedptc” library by Ivan Voras.

```
#define INI_REAL fixedpt
#define ini_ftoa(string,value) fixedpt_str((value), (string))
#define ini_atof(string) fixedpt_val((string))
```

To disable rational number support, remove the declaration for the `INI_REAL` type from the `minGlue.h` file.

• Unicode (启用/禁用)

MININI can be compiled with Unicode support, but it delegates storing the actual characters to the “glue” routines. Although you can use standard Unicode file reading and writing routines to create and query INI files in Unicode text format, it is advised to keep the INI file format as ASCII, for best compatibility with other implementations. To store Unicode characters in the ASCII file, convert the Unicode data to (and from) UTF-8 (the MININI library does not provide functions for this conversion).

It is advised to keep the section and key names as ASCII or ANSI Latin-1; only the “values” of each key should be encoded as UTF-8.

Currently, all distributions of Linux lack a header file called `tchar.h` which adds a portability layer for source code that can be compiled as ASCII or as Unicode. MININI relies on `tchar.h` when compiling for Unicode. Therefore, when compiling a Unicode application under Linux, you have two options: create a minimal version of `tchar.h` yourself, or compile MININI for the 8-bit ANSI character set, while the remainder of the application is Unicode. To force-compile MININI for ANSI, add the definition `INI_ANSIONLY` in the glue file (“`minGlue.h`”). For example:

```
#define INI_ANSIONLY /* ignore UNICODE or _UNICODE macros, compile as ASCII/ANSI */
```

• Line termination

On Microsoft Windows and DOS, lines of text files are usually terminated by a CR-LF character pair (“\r\n” in C/C++ terminology). On Linux and Unix (and macOS), the line terminator is only the LF character.

The line termination convention is not important when reading from INI files, because MININI strips off all trailing white space (and control characters such as carriage-return and line-feed are considered white space). The line termination convention is also not important when the INI file is only accessed by MININI. Finally, if you use the standard C/C++ library as the back-end for reading and writing files, this standard C/C++ library may already handle the platform-dependent line termination for you.

However, if you wish to read and adjust the INI files with other applications, across platforms —e.g. edit the INI file with a simple text editor as Notepad on Microsoft Windows and then store it on an embedded device with a Linux-based operating system, then it may be advantageous to tell MININI the line termination characters to use. To do so, define the macro `INI_LINETERM` in the file “minGlue.h” and set it to the character or characters to use. For example:

```
#define INI_LINETERM    "\r\n"
```

• Summary of configuration macros

<code>INI_ANSIONLY</code>	If this macro is defined, INI files are forced to be written with 8-bit characters (ASCII or ANSI character sets), regardless of whether the remainder of the application is written as Unicode. See page 8 .
<code>INI_BUFFER_SIZE</code>	The maximum line length that is supported, as well as the maximum path length for temporary file (if write access is enabled). The default value is 512. See page 6 .
<code>INI_FILEPOS</code>	The type for a position in a file. This is a <i>required setting</i> if writing support is enabled.
<code>INI_FILETYPE</code>	The type for a variable that represents a file. This is a <i>required setting</i> . See page 6 .
<code>INI_LINETERM</code>	This macro should be set to the line termination character (or characters). If left undefined, the default is a line-feed character. Note that the standard file I/O library may translate a line-feed character to a carriage-return/line-feed pair (this depends on the file I/O library). See page 9 .

<code>INI_NOBROWSE</code>	Exclude the <code>ini browse</code> function from the <code>MININI</code> library.
<code>INI_READONLY</code>	If this macro is defined, write access is disabled (and the code for writing INI files is stripped from the <code>MININI</code> library. See page 7
<code>INI_REAL</code>	The type for a variable that represents a rational number. If left undefined, rational number support is disabled. See page 7 .
<code>NDEBUG</code>	If defined, the <code>assert</code> macro in the <code>MININI</code> source code is disabled. Typically developers build with assertions enabled during development and disable them for a release version. If your platform lacks an <code>assert</code> macro, you may want to define the <code>NDEBUG</code> macro in the <code>minGlue.h</code> file.
<code>PORTABLE_STRNICMP</code>	If defined, <code>MININI</code> uses an internal, portable <code>strnicmp</code> function. This is required for platforms that lack this function —note that <code>MININI</code> already handles the case where this function is called <code>strncasecmp</code> . See page 4 .

Multi-tasking

The `MININI` library does not have any global variables and it does not use any dynamically allocated memory. Yet, the library should not be considered “thread-safe” or re-entrant, because it implicitly uses a particular shared resource: the file system.

Multiple tasks reading from an INI file do not pose a problem. However, when one task is writing to an INI file, no other tasks should access this INI file —neither for reading, nor for writing. It might be easier, in the implementation, to serialize *all* accesses of the INI file.

The first advise in protecting resources from concurrent access in a multi-tasking environment is to avoid sharing resources between tasks. If only a single task uses a resource, no semaphore protection is necessary and no priority inversion or deadlock problems can occur. This advise also applies to the `MININI` library. If possible, make a single task the “owner” of the INI file and create a client/server architecture for other tasks to query and adjust settings.

If access to the INI file must be shared between tasks (and at least one of the tasks writes to the INI file), you need to write wrappers around the functions of the `MININI` library that block on a mutex or binary semaphore, or that use the file locking mechanism in the operating system. See the next sections for tips specific to an operating systems.

• Linux

An option in Linux (and other Unix-like environments) is to use an advisory lock on the calls to open the INI file. In the snippet below, the glue function `ini_openread` sets a “shared” file lock (allowing others to also open the file for reading), but `ini_openwrite` sets an “exclusive” lock on the file.

The lock can only be set after opening the file, which is why `ini_openwrite` first attempts to open an existing file, and creates a new file if no existing file can be opened. If it had started by creating a new file, the call to `fopen` with the mode “w” would have truncated the file *before* acquiring the lock—thereby possibly truncating a locked file. If an existing file was indeed opened, and the lock acquired, it must now be explicitly truncated.

The `flock` function is blocking by default, meaning that it does not proceed if it cannot acquire the lock. It thereby implicitly functions as a kind of semaphore.

LISTING: Glue function using file locking

```
static inline int ini_openread(const char *filename, INI_FILETYPE *file) {
    if ((*file = fopen((filename), "r")) == NULL)
        return 0;
    return flock(fileno(*file), LOCK_SH) == 0;
}

static inline int ini_openwrite(const char *filename, INI_FILETYPE *file) {
    if ((*file = fopen((filename), "r+")) == NULL
        && (*file = fopen((filename), "w")) == NULL)
        return 0;
    if (flock(fileno(*file), LOCK_EX) < 0)
        return 0;
    return ftruncate(fileno(*file), 0) == 0;
}
```

Note that no “unlock” request is needed: the file is implicitly unlocked when the file is closed.

Browsing through the file contents

The “browse” function `ini_browse` processes the complete INI file and invokes a callback function for every setting that it reads from the file.

An alternative to browsing through the INI file is by enumerating the sections and the keys, see the next section. Browsing is more efficient when the whole INI file must be processed, enumeration allows you to scan only through specific sections.

Key and section enumeration

MININI can list all sections in an INI file and all keys in a section, but in a different way than the function `GetProfileString` from the Microsoft Windows API. To list all sections, call function `ini_getsection` with an incremental “index” number until it fails. Similarly, to list all keys in a section, call `ini_getkey` with an incremental “index” number (plus the name of the section) until it fails.

LISTING: Browsing through all keys and all sections in “config.ini”

```
int s, k;
char section[40], key[40];
for (s = 0; ini_getsection(s, section, sizeof section, "config.ini") > 0; s++) {
    printf("[%s]\n", section);
    for (k = 0; ini_getkey(section, k, key, sizeof key, "config.ini") > 0; k++)
        printf("\t%s\n", key);
} /* for */
```

函数说明

In addition to the functions in plain C, minIni comes with a C++ class. When creating a variable of the `minIni` class, you pass in the name of the INI file once, so that this name does not need to be passed to every other function. The class exists for the standard C++ string library and for wxWidgets, using the `wxString` type. The function reference only lists the methods with the `std::string` type, but these are replaced by versions that use `wxString` when compiling for wxWidgets.

minIni::minIni	class constructor
-----------------------	-------------------

The `minIni` constructor creates an instance of the `minIni` class.

C++: `minIni(const std::string& filename)`

`filename` The full file name of the INI file to use for all reads and writes, through this instance. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library.

Example: Creating a class instance to read a setting (C++ only):

```
minIni ini("config.ini");
std::string username = ini.gets("Users", "admin");
```

ini_browse / minIni::browse	Browse through all settings
------------------------------------	-----------------------------

`ini_browse` runs through the file and invokes a callback on every setting.

C: `int ini_browse(INI_CALLBACK Callback, void *UserData, const char *Filename)`

C++: `bool browse(INI_CALLBACK Callback, void *UserData)`

`Callback` The function that is invoked on every setting, see the notes below.

`UserData` A general-purpose application-defined value that is passed to the callback function.

Filename The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: 1/true on success, 0/false on failure.

Notes: The callback function is defined as:

```
int Callback(const char *Section, const char *Key,
             const char *Value, void *UserData);
```

The `Section` string may an empty string, for the settings that are outside any section. The `UserData` parameter is the same as what is passed to the `ini_browse` function.

The callback function should return a non-zero value on success, or zero to abort further browsing through the INI file.

The callback function should not write into the INI file.

See also: `ini_getkey`, `ini_getsection`

`minIni::del` Delete a section or a key

Delete a key or an entire section.

```
C++:    bool del(const std::string& Section,
               const std::string& Key)
```

```
C++:    bool del(const std::string& Section)
```

Section The name of the section.

Key The name of the key.

Returns: true on success, false on failure.

Notes: This method is the equivalent of `ini_puts` with the parameter `Key` and/or `Value` parameters to `NULL`.

This function is unavailable if `MININI` is configured as a read-only library (page 7).

See also: `ini_puts`

ini_getbool / minIni::getbool

Read a “truth” flag

`ini_getbool` returns zero for false or one for true, depending on the value that is found in the given section and at the given key.

```
C:      int ini_getbool(const char *Section, const char *Key,
                        int DefValue, const char *Filename)
```

```
C++:      bool getbool(const std::string& Section,
                    const std::string& Key, bool DefValue=false)
```

Section	The name of the section. If this parameter is <i>NULL</i> or an empty string, the <code>Key</code> is searched outside any section.
---------	---

Key	The name of the key. This parameter may not be <i>NULL</i> .
-----	--

DefValue The default value, which will be returned if the key is not present in the INI file. Even though it is declared as an “int” in the C interface, it should be either 0 (zero) or 1 (one).

Filename	The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.
----------	---

Returns: The true/false flag as interpreted from the value read at the given key, or `DefaultValue` if the key is not present in the given section (or if it cannot be interpreted to either a “true” or a “false” flag).

Specifically, the return value depends on the first letter of the value read at the key. If that first character is:

- ◊ “Y”, “T” or “1”, the function returns `true` (or 1);
- ◊ “N”, “F” or “0”, the function returns `false` (or 0);
- ◊ anything else, the function returns parameter `DefaultValue`.

Notes: To set a boolean value in the C++ interface, use `minIni::put`; For the C interface, use either `ini_putl`. Alternatively, you can store texts like “Yes” and “No” at the key using `minIni::put` and `ini_puts`.

See also: `ini_getl`

ini_getf / minIni::getf

Read a rational number

`ini_getf` returns the numeric value that is found in the given section and at the given key. The value may have a fractional part (i.e. rational numbers).

[illegible]

```
C++:      INI_REAL  getf(const std::string& Section,
                        const std::string& Key, INI_REAL DefValue=0)
```

Section	The name of the section. If this parameter is <i>NULL</i> or an empty string, the <code>Key</code> is searched outside any section.
---------	---

Key	The name of the key. This parameter may not be <i>NULL</i> .
-----	--

DefValue	The default value, which will be returned if the key is not present in the INI file.
----------	--

Filename	The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.
----------	---

Returns: The value read at the given key, or `DefValue` if the key is not present in the given section.

Notes: Rational number support must have been *enabled* to use the function —see [page 7](#). The type for the rational numbers (the `INI_REAL` type), depends on the configuration of `MINI`.

See also: `ini_getl`, `ini_putf`

ini_getkey / minIni::getkey

Enumerate keys

Read the name of an indexed key inside a given section.

```
C:      int ini_getkey(const char *Section, int Index,
                    char *Buffer, int BufferSize,
                    const char *Filename)
```

```
C++:    str::string getkey(const std::string& Section, int Index)
```

Section The name of the section. If this parameter is *NULL* or an empty string, the keys outside any section are enumerated.

Index	The zero-based index of the key to return.
Buffer	The buffer into which this function will store the key name.
BufferSize	The size of the buffer in parameter <code>Buffer</code> . This is the maximum number of characters that will be read and stored.
Filename	The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: The C function returns the number of characters that were read, or zero if no (more) keys are present in the specified section. The C++ method returns the name of the key in a string.

Example: Enumerating keys in section “Devices”:

```
int k;
char name[20];
for (k = 0; ini_getkey("Devices", k, name, 20, "config.ini") > 0; k++)
    printf("%s\n", name);
```

See also: [ini_browse](#), [ini_getsection](#), [ini_haskey](#)

ini_getl / minIni::getl

Read a numeric value

`ini_getl` returns the integer value (a “whole number”) that is found in the given section and at the given key.

C: `long ini_getl(const char *Section, const char *Key,
 long DefValue, const char *Filename)`

C++: `long getl(const std::string& Section,
 const std::string& Key, long DefValue=0)`

C++: `int geti(const std::string& Section,
 const std::string& Key, int DefValue=0)`

Section The name of the section. If this parameter is *NULL* or an empty string, the `Key` is searched outside any section.

Key The name of the key. This parameter may not be *NULL*.

DefValue The default value, which will be returned if the key is not present in the INI file.

Filename The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: The value read at the given key, or `DefValue` if the key is not present in the given section.

If the key is present, but it does not represent a decimal number, this function may return zero or an incorrect value.

Notes: The number must be in decimal or in hexadecimal format. For hexadecimal values, the value must be preceded with “0x”; for example, 0x1234 stands for the decimal value 4660.

See also: `ini getf`, `ini gets`, `ini putl`

`ini_gets / minIni::gets`

Read a string

`ini_gets` reads the textual value that is found in the given section and at the given key.

C:

```
int ini_gets(const char *Section, const char *Key,
            const char *DefValue, char *Buffer,
            int BufferSize, const char *Filename)
```

C++:

```
std::string gets(const std::string& Section,
                const std::string& Key,
                const std::string& DefValue="")
```

Section The name of the section. If this parameter is *NULL* or an empty string, the `Key` is searched outside any section.

Key The name of the key. This parameter may not be *NULL*.

DefValue The default value, which will be returned (in parameter `Buffer`) if the key is not present in the INI file.

Buffer The buffer into which this function will store the data read.

BufferSize The size of the buffer in parameter `Buffer`. This is the maximum number of characters that will be read and stored.

Filename The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: The C function returns the number of characters that were read. The C++ method returns the string read at the given key, or `DefaultValue` if the key is not present in the given section.

See also: `ini_getl`, `ini_puts`

ini_getsection / minIni::getsection

Enumerate sections

`ini_getsection` reads the name of an indexed section.

C: `int ini_getsection(int Index, char *Buffer, int BufferSize, const char *Filename)`

C++: `std::string getsection(int Index)`

Index The zero-based index of the section to return.

Buffer The buffer into which this function will store the section name.

BufferSize The size of the buffer in parameter `Buffer`. This is the maximum number of characters that will be read and stored.

Filename The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: The C function returns the number of characters that were read, or zero if no (more) sections are present in the INI file. The C++ method returns the name of the section in a string.

Example: Enumerating all sections in file “config.ini”:

```
int s;
char name[20];
for (s = 0; ini_getsection(s, name, 20, "config.ini") > 0; s++)
    printf("%s\n", name);
```

See also: [ini_browse](#), [ini_getkey](#), [ini_hassection](#)

ini_haskey / minIni::haskey

Check whether a key exists

`ini_haskey` checks whether a key exists in a section(without returning its value).

C: `int ini_haskey(const char *Section, const char *Key,
 const char *Filename)`

C++: `bool haskey(const std::string& Section,
 const std::string& Key)`

Section The name of the section. If this parameter is *NULL* or an empty string, the *Key* is searched outside any section.

Key The name of the key. This parameter may not be *NULL*.

Filename The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: 1/true if the key is present, 0/false otherwise.

See also: [ini_getkey](#), [ini_hassection](#)

ini_hassection / minIni::hassection

Check whether a section exists

`ini_hassection` checks whether a key exists in a section(without returning its value).

C: `int ini_hassection(const char *Section,
 const char *Filename)`

C++: `bool hassection(const std::string& Section)`

Section The name of the section. This parameter may not be *NULL*.

Filename	The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.
----------	---

Returns: 1/true if the section is present, 0/false otherwise.

See also: `ini getsection`, `ini haskey`

ini_putf / minIni::put

Store a rational number

`ini_putf` stores the numeric value that in the given section and at the given key. The numeric value is written as a rational number, with a “whole part” and a fractional part.

```
C:      int ini_putsf(const char *Section, const char *Key,
                    INI_REAL Value, const char *Filename)
```

```
C++:    bool put(const std::string& Section,
            const std::string& Key, INI_REAL Value)
```

Section	The name of the section. If this parameter is <i>NULL</i> or an empty string, the <code>Key</code> is stored outside any section (i.e. above the first section, if the <code>INI</code> file has any sections).
---------	---

Key	The name of the key. This parameter may not be <i>NULL</i> .
-----	--

Value	The value to write at the key and the section.
-------	--

Filename	The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.
----------	---

Returns: 1/true on success, 0/false on failure.

Notes: This function is unavailable if `MININI` is configured as a read-only library (page 7). It is also unavailable if rational number support has *not* been enabled (page 7).

The type for the rational numbers, `INI_REAL`, depends on the configuration of `MININI`.

See also: `ini getf`, `ini putl`

ini_putl / minlni::put

Store a numeric value

`ini_put1` stores the numeric value that in the given section and at the given key.

```
C:      int ini-putl(const char *Section, const char *Key,
              long Value, const char *Filename)
```

```
C++:    bool put(const std::string& Section,
              const std::string& Key, long Value)
```

Section	The name of the section. If this parameter is <i>NULL</i> or an empty string, the <code>Key</code> is stored outside any section (i.e. above the first section, if the INI file has any sections).
---------	--

Key	The name of the key. This parameter may not be <i>NULL</i> .
-----	--

Value	The value to write at the key and the section.
-------	--

Filename	The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.
----------	---

Returns: 1/true on success, 0/false on failure.

Notes: This function is unavailable if MININI is configured as a read-only library (page 7).

See also: `ini getl`, `ini puts`

ini_puts / minIni::put

Store a string

`ini_puts` stores the text parameter that in the given section and at the given key.

```
C:      int ini_puts(const char *Section, const char *Key,
                  const char *Value, const char *Filename)
```

```
C++:      bool put(const std::string& Section,
                  const std::string& Key,
                  const std::string& Value)
```

```
C++:      bool put(const std::string& Section,
                  const std::string& Key, const char* Value)
```

- Section** The name of the section. If this parameter is *NULL* or an empty string, the `Key` is stored outside any section (i.e. above the first section, if the INI file has any sections).
- Key** The name of the key. If this parameter is *NULL*, the function erases all keys (and their associated values) from the section.
- Value** The text to write at the key and the section. This string should not contain carriage-return or line-feed characters.
If this parameter is *NULL*, the function erases the key/value pair.
- Filename** The name of the INI file. The filename format and specifications, and whether or not this parameter may include a path, depends on the underlying file I/O library. The C++ class uses the filename specified in the class constructor.

Returns: 1/true on success, 0/false on failure.

Notes: This function can also be used to delete entries or sections, by setting the `Key` or `Value` parameters to *NULL*.

This function is unavailable if MININI is configured as a read-only library ([page 7](#)).

See also: `ini gets`, `ini put1`

Example glue files

• stdio (standard C/C++ library)

On Microsoft Windows or DOS, it is advised to open the INI file in binary mode, despite INI files being *text* files. If text mode is unavailable on your platform, change "rb" and "wb" to "r" and "w" respectively.

```
/* map required file I/O types and functions to the standard C library */
#include <stdio.h>

#define INI_FILETYPE FILE*
#define ini_openread(filename,file) ((*file) = fopen((filename),"rb")) != NULL
#define ini_openwrite(filename,file) ((*file) = fopen((filename),"wb")) != NULL
#define ini_openrewrite(filename,file) ((*file) = fopen((filename),"r+b")) != NULL
#define ini_close(file) (fclose(*file) == 0)
#define ini_read(buffer,size,file) (fgets((buffer),(size),*file)) != NULL
#define ini_write(buffer,file) (fputs((buffer),*file)) >= 0
#define ini_rename(source,dest) (rename((source),(dest)) == 0)
#define ini_remove(filename) (remove(filename) == 0)

#define INI_FILEPOS long int
#define ini_tell(file,pos) (*pos) = ftell(*file))
#define ini_seek(file,pos) (fseek(*file), *pos, SEEK_SET) == 0)

/* for floating-point support, define additional types and functions */
#define INI_REAL float
#define ini_ftoa(string,value) sprintf((string),"%f", (value))
#define ini_atof(string) (INI_REAL)strtod((string),NULL)
```

• CCS FAT library (<http://www.ccsinfo.com>)

```
#define INI_BUFFER_SIZE 256 /* maximum line length, maximum path length */

#ifndef FAT_PIC_C
#error FAT library must be included before this module
#endif

#define const /* keyword not supported by CCS */

#define INI_FILETYPE FILE
#define ini_openread(filename,file) (fatopen((filename), "r", (file)) == GOODEC)
#define ini_openwrite(filename,file) (fatopen((filename), "w", (file)) == GOODEC)
#define ini_close(file) (fatclose((file)) == 0)
#define ini_read(buffer,size,file) (fatgets((buffer), (size), (file)) != NULL)
#define ini_write(buffer,file) (fatputs((buffer), (file)) == GOODEC)
#define ini_remove(filename) (rm_file((filename)) == 0)

#define INI_FILEPOS fatpos_t
#define ini_tell(file,pos) (fatgetpos((file), (pos)) == 0)
#define ini_seek(file,pos) (fatsetpos((file), (pos)) == 0)

#ifndef INI_READONLY
/* CCS FAT library lacks a rename function, so instead we copy the file to the
 * new name and delete the old file
```

```

*/
static int ini_rename(char *source, char *dest)
{
    FILE fr, fw;
    int n;

    if (fatopen(source, "r", &fr) != GOODEC)
        return 0;
    if (rm_file(dest) != 0)
        return 0;
    if (fatopen(dest, "w", &fw) != GOODEC)
        return 0;

    /* With some "insider knowledge", we can save some memory: the "source"
     * parameter holds a filename that was built from the "dest" parameter. It
     * was built in a local buffer with the size INI_BUFFERSIZE. We can reuse
     * this buffer for copying the file.
     */
    while (n=fatread(source, 1, INI_BUFFERSIZE, &fr))
        fatwrite(source, 1, n, &fw);

    fatclose(&fr);
    fatclose(&fw);

    /* Now we need to delete the source file. However, we have garbled the buffer
     * that held the filename of the source. So we need to build it again.
     */
    ini_tempname(source, dest, INI_BUFFERSIZE);
    return rm_file(source) == 0;
}
#endif

```

• EFSL (<http://www.efsl.be/>)

```

#define INI_BUFFERSIZE 256          /* maximum line length, maximum path length */
#define INI_LINETERM    "\r\n"    /* set line termination explicitly */

#include "efs.h"
extern EmbeddedFileSystem g_efs;

#define INI_FILETYPE           EmbeddedFile
#define ini_openread(filename,file) (file_fopen((file), &g_efs.myFs, \
                                                (char*)(filename), 'r') == 0)
#define ini_openwrite(filename,file) (file_fopen((file), &g_efs.myFs, \
                                                (char*)(filename), 'w') == 0)
#define ini_close(file)        file_fclose(file)
#define ini_read(buffer,size,file) (file_read((file), (size), (buffer)) > 0)
#define ini_write(buffer,file) (file_write((file), strlen(buffer), \
                                                (char*)(buffer)) > 0)
#define ini_remove(filename)    rmfile(&g_efs.myFs, (char*)(filename))
#define INI_FILEPOS            uint32
#define ini_tell(file,pos)      (*(pos) = (file)->FilePtr)
#define ini_seek(file,pos)      file_setpos((file), (*pos))

#if ! defined INI_READONLY
/* EFSL lacks a rename function, so instead we copy the file to the new name
 * and delete the old file
 */
static int ini_rename(char *source, const char *dest)

```

```

{
    EmbeddedFile fr, fw;
    int n;

    if (file_fopen(&fr, &g_efs.myFs, source, 'r') != 0)
        return 0;
    if (rmfile(&g_efs.myFs, (char*)dest) != 0)
        return 0;
    if (file_fopen(&fw, &g_efs.myFs, (char*)dest, 'w') != 0)
        return 0;

    /* With some "insider knowledge", we can save some memory: the "source"
     * parameter holds a filename that was built from the "dest" parameter. It
     * was built in buffer and this buffer has the size INI_BUFFERSIZE. We can
     * reuse this buffer for copying the file.
     */
    while (n=file_read(&fr, INI_BUFFERSIZE, source))
        file_write(&fw, n, source);

    file_fclose(&fr);
    file_fclose(&fw);

    /* Now we need to delete the source file. However, we have garbled the buffer
     * that held the filename of the source. So we need to build it again.
     */
    ini_tempname(source, dest, INI_BUFFERSIZE);
    return rmfile(&g_efs.myFs, source) == 0;
}
#endif

```

• FAT Filing System (<http://www.embedded-code.com/>)

```

#define INI_BUFFERSIZE 256          /* maximum line length, maximum path length */
#include <mem-ffs.h>

#define INI_FILETYPE                FFS_FILE*
#define ini_openread(filename,file) ((*file) = ffs_fopen((filename),"r")) != NULL)
#define ini_openwrite(filename,file) ((*file) = ffs_fopen((filename),"w")) != NULL)
#define ini_close(file)             (ffs_fclose(*(file)) == 0)
#define ini_read(buffer,size,file)  (ffs_fgets((buffer),(size),*(file)) != NULL)
#define ini_write(buffer,file)      (ffs_fputs((buffer),*(file)) >= 0)
#define ini_rename(source,dest)     (ffs_rename((source), (dest)) == 0)
#define ini_remove(filename)        (ffs_remove(filename) == 0)

#define INI_FILEPOS                 long
#define ini_tell(file,pos)           (ffs_fgetpos(*(file), (pos)) == 0)
#define ini_seek(file,pos)           (ffs_fsetpos(*(file), (pos)) == 0)

```

• FatFs (<http://elm-chan.org/>)

```
#define INI_BUFFERSIZE 256          /* maximum line length, maximum path length */

/* You must set _USE_STRFUNC to 1 or 2 in the include file ff.h (or tff.h)
 * to enable the "string functions" fgets() and fputs().
 */
#include "ff.h"                    /* include tff.h for Tiny-FatFs */

#define INI_FILETYPE      FIL
#define ini_openread(filename,file) (f_open((file), (filename), \
                                             FA_READ+FA_OPEN_EXISTING) == FR_OK)
#define ini_openwrite(filename,file) (f_open((file), (filename), \
                                             FA_WRITE+FA_CREATE_ALWAYS) == FR_OK)
#define ini_close(file) (f_close(file) == FR_OK)
#define ini_read(buffer,size,file) f_gets((buffer), (size), (file))
#define ini_write(buffer,file) f_puts((buffer), (file))
#define ini_remove(filename) (f_unlink(filename) == FR_OK)

#define INI_FILEPOS      DWORD
#define ini_tell(file,pos) (*pos) = f_tell((file))
#define ini_seek(file,pos) (f_lseek((file), *(pos)) == FR_OK)

static int ini_rename(TCHAR *source, const TCHAR *dest)
{
    /* Function f_rename() does not allow drive letters in the destination file */
    char *drive = strchr(dest, ':');
    drive = (drive == NULL) ? dest : drive + 1;
    return (f_rename(source, drive) == FR_OK);
}
```

• “Memory Disk Drive” file system (Microchip)

```
#define INI_BUFFERSIZE 256          /* maximum line length, maximum path length */

#include "MDD File System\fsio.h"
#include <string.h>

#define INI_FILETYPE      FSFILE*
#define ini_openread(filename,file) ((*file) = FSfopen((filename),FS_READ)) != NULL)
#define ini_openwrite(filename,file) ((*file) = FSfopen((filename),FS_WRITE)) != NULL)
#define ini_openrewrite(filename,file) ((*file) = fopen((filename),FS_READPLUS)) != NULL)
#define ini_close(file) (FSfclose(*file) == 0)
#define ini_write(buffer,file) (FSfwrite((buffer), 1, strlen(buffer), (*file)) > 0)
#define ini_remove(filename) (FSremove((filename)) == 0)

#define INI_FILEPOS      long int
#define ini_tell(file,pos) (*pos) = FSftell(*file)
#define ini_seek(file,pos) (FSfseek(*file, *(pos), SEEK_SET) == 0)

/* Since the Memory Disk Drive file system library reads only blocks of files,
 * the function to read a text line does so by "over-reading" a block of the
 * of the maximum size and truncating it behind the end-of-line.
 */
static int ini_read(char *buffer, int size, INI_FILETYPE *file)
{

```

```

size_t numread = size;
char *eol;

if ((numread = FSfread(buffer, 1, size, *file)) == 0)
    return 0; /* at EOF */
if ((eol = strchr(buffer, '\n')) == NULL)
    eol = strchr(buffer, '\r');
if (eol != NULL) {
    /* terminate the buffer */
    *++eol = '\0';
    /* "unread" the data that was read too much */
    FSfseek(*file, - (int)(numread - (size_t)(eol - buffer)), SEEK_CUR);
} /* if */
return 1;
}

#ifdef INI_READONLY
static int ini_rename(const char *source, const char *dest)
{
    FSFILE* ftmp = FSfopen((source), FS_READ);
    FSrename((dest), ftmp);
    return FSfclose(ftmp) == 0;
}
#endif

```

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