

Database Independent Abstraction Layer for C

libdbi Programmer's Guide

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Database Independent Abstraction Layer for C: libdbi Programmer's Guide

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Document revision: \$Id: programmers-guide.sgml,v 1.13 2008/01/15 00:18:22 mhoenicka Exp \$ Edition

Published \$Date: 2008/01/15 00:18:22 \$

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libdbi implements a database-independent abstraction layer in C, similar to the DBI/DBD layer in Perl. Writing one generic set of code, programmers can leverage the power of multiple databases and multiple simultaneous database connections by using this framework.

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Chapter 1. Introduction

1.1. Description

libdbi provides application developers with a database independent abstraction layer for C. It handles the database-specific implementations for each type of database, so that you can use the same exact code with any type of database server that libdbi supports. You can initiate and use multiple database connections simultaneously, regardless of the types of database servers you are connecting to. The driver architecture allows for new database drivers to be easily added dynamically.

1.2. libdbi Concepts and Terminology

In this guide, the terms “user” and “programmer” are used interchangeably, since the target audience is the software developer using libdbi in his program. The libdbi architecture provides several “drivers”, one for each type of database server. All drivers are loaded into memory upon libdbi initialization and are made available to the programmer. Once a driver is *instantiated*, it represents a distinct database session and is called a “connection”. Multiple connections may exist for a single driver, and all will function independently of each other. A star character (*) represents a wildcard matching any letters. For example, “dbi_conn_*” would represent all functions beginning with “dbi_conn_”.

1.3. Modifications and redistribution of libdbi

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1.4. Contact Info

Please email us with any bugs, ideas, feature requests, or questions. The libdbi website has the latest version of this documentation and the libdbi software, as well as a central database of third-party drivers.

- <http://libdbi.sourceforge.net>
- David Parker <david@neongoat.com>
- Mark Tobenkin <mark@brentwoodradio.com>
- Markus Hoenicka <markus@mhoenicka.de>

Chapter 2. libdbi in a Nutshell (Quickstart Guide)

2.1. Quick Overview

libdbi uses a plugin system that allows various databases to be supported simultaneously, and can dynamically load or unload drivers that are supplied by libdbi or a third party. The library is initialized by calling `dbi_initialize` and a connection instance is started by calling either `dbi_conn_new` or both `dbi_driver_open` and `dbi_conn_open`.

The connection's options (username, password, hostname, etc.) are set with `dbi_conn_set_option` and `dbi_conn_set_option_numeric`. Once all options are set, `dbi_conn_connect` will connect to the database, waiting to handle a `dbi_conn_query`. A query is a string containing a valid SQL statement. libdbi provides several functions to automatically quote any characters that might screw up the query string. The preferred functions are `dbi_conn_quote_string` and `dbi_conn_quote_string_copy` as they take into consideration the character encoding used by the current connection. The legacy functions `dbi_driver_quote_string` and `dbi_driver_quote_string_copy` are still supported but should be avoided in new code. After a successful query, you can retrieve rows with `dbi_result_first_row`, `dbi_result_last_row`, `dbi_result_prev_row`, `dbi_result_next_row`, and `dbi_result_seek_row`.

String data may be sent to and retrieved from a database using character encodings if they contain characters not covered by the ASCII character set. Most database engines support character encodings like ISO-8859-1, suitable for many European languages, or even the multibyte Unicode character sets like UTF-8. The character set used to store your data in your database is usually set by the **CREATE DATABASE** command, which you have to take care of yourself. libdbi uses the connection option "encoding" to select a particular character encoding for the current connection. If you set the value to "auto", libdbi will automatically use the database character encoding as the connection encoding. If you request a different character encoding, as defined by its IANA (<http://www.iana.org>) name, libdbi will convert the data on the fly.

There are two methods for fetching field data, and two ways to perform each method. You can either "pull" the data from DBI using the `dbi_result_get_*` family of functions, or have DBI automatically "push" the data into predefined variables with the `dbi_result_bind_*` family of functions. Both families of functions are as strongly typed as most SQL database engines are. That is, you must use the `dbi_result_get_*` or `dbi_result_bind_*` function that matches the type of the requested field. Table 2-1 shows an overview of these functions sorted by the field type they retrieve.

Pulling the data from the database can be done with one of the "get" functions such as `dbi_result_get_long` or `dbi_result_get_string`, which simply return the data in the field you asked for. You should run the function `dbi_conn_error_flag` immediately after each call to a "get" function to check for errors. You can also get more than one field at a time with `dbi_result_get_fields`, which uses a printf-like syntax.

If you want DBI to automatically fill your program's variables with field values whenever a new row is fetched, you can "bind" fields to your variables. Bindings are set up with `dbi_result_bind_long`, `dbi_result_bind_string`, and the rest of the bind family of functions. Like the associated "get" function, you can set up multiple bindings at once with the `dbi_result_bind_fields` function.

String data can be safely included into query strings by using the `dbi_conn_quote_string` and `dbi_conn_quote_string_copy` functions. Binary data can be included into query strings by using the

dbi_conn_quote_binary_copy function. All of these functions return zero-terminated strings enclosed in the appropriate quoting characters. Binary strings are returned in their binary representation. That is, they may contain null bytes and other non-printable characters. It is mandatory to use the dbi_result_get_field_length or dbi_result_get_field_length_idx functions to determine the number of bytes contained in the binary string.

Caveats:

- For fields holding integers (not fractional numbers), DBI differentiates between signed and unsigned variables. By default, DBI returns signed values. If you want an unsigned value, prepend a "u" to the name of the target type. For example, dbi_result_bind_short becomes dbi_result_bind_ushort.
- You must set up any bindings *after* a successful query but *before* you fetch any rows. Even if you are using field bindings, you can still use the dbi_result_get_* functions as usual. (actually, I lied... setting up a binding should theoretically work at any time, but don't plan on this behavior in future versions)
- All string and binary data returned or bound from DBI is *read-only*. If you want your own local copy that can be modified at will, use dbi_result_get_string_copy, dbi_result_get_binary_copy, dbi_result_bind_string_copy, or dbi_result_bind_binary_copy. You will be responsible for freeing the memory allocated by these functions.

dbi_result_next_row and the other row-seeking functions will return zero when there are no more rows available. Before the next database operation is performed, you must call dbi_result_free. Before the program terminates, the connection must be disconnected and unloaded with dbi_conn_close and libdbi must be unloaded with dbi_shutdown.

Table 2-1. get* and bind* functions sorted by field type

field type	get by name	get by field index	bind
signed char	dbi_result_get_char	dbi_result_get_char_idx	dbi_result_bind_char
unsigned char	dbi_result_get_uchar	dbi_result_get_uchar_idx	dbi_result_bind_uchar
short	dbi_result_get_short	dbi_result_get_short_idx	dbi_result_bind_short
unsigned short	dbi_result_get_ushort	dbi_result_get_ushort_idx	dbi_result_bind_ushort
int	dbi_result_get_int	dbi_result_get_int_idx	dbi_result_bind_int
unsigned int	dbi_result_get_uint	dbi_result_get_uint_idx	dbi_result_bind_uint
long long	dbi_result_get_longlong	dbi_result_get_longlong_idx	dbi_result_bind_longlong
unsigned long long	dbi_result_get_ulonglong	dbi_result_get_ulonglong_idx	dbi_result_bind_ulonglong
float	dbi_result_get_float	dbi_result_get_float_idx	dbi_result_bind_float
double	dbi_result_get_double	dbi_result_get_double_idx	dbi_result_bind_double
character string	dbi_result_get_string, dbi_result_get_string_copy	dbi_result_get_string_idx, dbi_result_get_string_copy_idx	dbi_result_bind_string
binary string	dbi_result_get_binary, dbi_result_get_binary_copy	dbi_result_get_binary_idx, dbi_result_get_binary_copy_idx	dbi_result_bind_binary

field type	get by name	get by field index	bind
date/time	dbi_result_get_datetime	dbi_result_get_datetime_idx	dbi_result_bind_datetime

2.2. Generic Example Program

The following listing shows how to establish a connection to a MySQL database server and retrieve the results of a SQL query. Only a small number of functions offered by libdbi are shown here. For a more extensive example check out the test program `tests/test_dbi.c` in the libdbi-drivers (<http://libdbi-drivers.sourceforge.net>) source tarball.

```
#include <stdio.h>
#include <dbi/dbi.h>

int main() {
    dbi_conn conn;
    dbi_result result;

    double threshold = 4.333333;
    unsigned int idnumber;
    const char *fullname;

    dbi_initialize(NULL);
    conn = dbi_conn_new("mysql");

    dbi_conn_set_option(conn, "host", "localhost");
    dbi_conn_set_option(conn, "username", "your_name");
    dbi_conn_set_option(conn, "password", "your_password");
    dbi_conn_set_option(conn, "dbname", "your_dbname");
    dbi_conn_set_option(conn, "encoding", "UTF-8");

    if (dbi_conn_connect(conn) < 0) {
        printf("Could not connect. Please check the option settings\n");
    }
    else {
        result = dbi_conn_queryf(conn, "SELECT id, name FROM coders "
                                   "WHERE hours_of_sleep > %0.2f", threshold);

        if (result) {
            while (dbi_result_next_row(result)) {
                idnumber = dbi_result_get_uint(result, "id");
                fullname = dbi_result_get_string(result, "name");
                printf("%i. %s\n", idnumber, fullname);
            }
            dbi_result_free(result);
        }
        dbi_conn_close(conn);
    }
}
```

```

    dbi_shutdown();

    return 0;
}

```

Compile with: `gcc -lm -ldl -ldbi -o foo foo.c`

Note: The `-ldl` option is not required on systems that implement the dynamic linking in their libc (like FreeBSD). You may also have to throw in something like `-I/usr/local/include` and `-L/usr/local/lib` to help gcc and ld find the libdbi headers and libraries.

Of course, a complete program should check for errors more thoroughly. This example keeps error-checking at a minimum for the sake of clarity. There are also other ways to retrieve data after a successful query. Keep reading on to see the rest.

2.3. Loading libdbi at runtime

The generic example shown in the previous section assumed that the program is linked against libdbi. This is in fact the recommended way to add libdbi functionality to your programs. However, there are situations where this approach will not work. Some programs are designed to load modules at runtime to extend their capabilities. A well-known example is the web server Apache, which uses loadable modules to custom-tailor its capabilities. If such a module were to use libdbi, we'd look at the following pattern:

Parent => `dl_open(module)` => `dl_open(driver)`

The dynamically loaded module is linked against libdbi whereas the parent application is not. For this pattern to work, the drivers are linked against libdbi by default. This avoids "undefined symbol" errors at runtime, but may cause problems under arcane conditions or on equally arcane operating systems. If you should ever encounter such problems, you can switch off linking the drivers against libdbi like this:

```
~/libdbi-drivers #./configure --disable-libdbi --with-mysql
```

2.4. Adding libdbi to your project

If your project uses autoconf to manage the build process on the target machine, you should add some tests to your `./configure` script to check for the presence and usability of libdbi. The following example shows how this can be done:

```

dnl check for dynamic linking functions
AC_CHECK_LIB(dl,dlopen)

```

```
dnl check for the libdbi library
AC_CHECK_LIB(dbi,dbi_initialize)

dnl to check for the availability and function of a particular
dnl driver we need a runtime check (since the driver is loaded
dnl dynamically). This example checks for the mysql driver
AC_MSG_CHECKING("for libdbi mysql driver (dynamic load)")
AC_RUN_IFELSE(
  [AC_LANG_PROGRAM(
    [[dbi_initialize(0); return(dbi_conn_new("mysql") ? 0 : 1);]],
    [AC_MSG_RESULT("yes")],
    [AC_MSG_FAILURE("mysql driver not installed?")])
```

The first two tests add the appropriate flags to the `LIBS` variable to link against the required libraries.

In addition, you have to make sure that both the directory which contains the libdbi header file directory (usually `/usr/include` or `/usr/local/include`) as well as the directory which contains the libdbi library (usually `/usr/lib` or `/usr/local/lib`) are accessible to the compiler and to the linker by using the `-I` and `-L` compiler flags, respectively.

Chapter 3. Error Handling

Applications should check all libdbi function calls for errors and respond appropriately to avoid entering an undefined status. libdbi uses two mechanisms to indicate errors:

Function return values

Essentially all libdbi functions return a value, a concept not unfamiliar to the seasoned C programmer. For example, the `dbi_initialize` function returns the number of loaded drivers, or -1 if an error occurred. In this case checking the return value is sufficient to detect an error condition. However, other functions like the family of "getters" cannot indicate error conditions with a return value. Consider e.g. the `dbi_result_get_string` function which is used to retrieve strings from a database. If there was an error in accessing the value, the function will return the string "ERROR". However, this string is a legal value of such a field (the problem is the same for any other conceivable return value, including the empty string and the NULL pointer). Therefore we need an additional mechanism to report errors.

Error numbers and error messages

Connections store the status of the most recent operation which can be queried by the accessor function `dbi_conn_error`. This is equivalent to the `errno` variable of the standard C library which is used by most system calls and can be printed in human-readable form by the `perror` system call. This mechanism implies that your program queries the status right after each operation, as the values will be overwritten by subsequent operations.

The return values of all libdbi functions are listed in the reference chapter below. The error numbers will be briefly discussed in the following sections.

3.1. Connection error numbers and messages

If your application has successfully opened a connection to a database, all operations on this connection may cause errors. There are two classes of errors:

Client library errors

libdbi retrieves and stores the error codes of the database engine client library if it provides error codes in a suitable format. If the client library does not support error numbers as positive integers, the value `DBI_ERROR_CLIENT` indicates an error status instead. In addition a string may be provided which describes or further elaborates the error status. The possible values of error number and error message depend on the database engine used for the connection.

libdbi errors

A number of errors may occur within the libdbi framework or within a database driver, e.g. if your program queries nonexistent columns or attempts to read past the last row of a result set. The possible error numbers and error messages are predefined by libdbi.

Use the function `dbi_conn_error` to access the error number and error message of the most recent connection operation.

3.2. Error numbers

`dbi_conn_error` returns `DBI_ERROR_NONE` (internally 0) if the last operation was successful, and a nonzero value if not. Client library errors use positive error numbers, whereas `libdbi` errors use negative error numbers as listed in the following table:

Table 3-1. libdbi error numbers

value	description
<code>DBI_ERROR_USER</code>	This indicates an error status set by the application itself, see <code>dbi_conn_set_error</code>
<code>DBI_ERROR_BADOBJECT</code>	invalid connection or result structure
<code>DBI_ERROR_BADTYPE</code>	the accessor function does not match the actual column type
<code>DBI_ERROR_BADIDX</code>	out-of-range index
<code>DBI_ERROR_BADNAME</code>	incorrect column or option name
<code>DBI_ERROR_UNSUPPORTED</code>	feature not supported by driver
<code>DBI_ERROR_NOCONN</code>	no valid connection
<code>DBI_ERROR_NOMEM</code>	out of memory
<code>DBI_ERROR_BADPTR</code>	invalid pointer
<code>DBI_ERROR_NONE</code>	no error occurred
<code>DBI_ERROR_CLIENT</code>	client library error

Chapter 4. libdbi API Reference

4.1. Core Library Functions

4.1.1. `dbi_initialize`

```
int dbi_initialize(const char *driverdir);
```

Locates all available database drivers and loads them into memory.

Arguments

driverdir: The directory to search for drivers. If NULL, DBI_DRIVER_DIR (defined at compile time) will be used instead.

Returns

The number of drivers successfully loaded, or -1 if there was an error.

4.1.2. `dbi_shutdown`

```
void dbi_shutdown(void);
```

Frees all loaded drivers and terminates the DBI system. You should close each connection you opened before shutting down, but libdbi will clean up after you if you don't.

4.1.3. `dbi_version`

```
const char *dbi_version(void);
```

Requests the version of libdbi as a read-only string. The calling program must not attempt to free the returned string.

Returns

A string containing the library's name and version.

4.2. Driver Infrastructure

4.2.1. dbi_driver_list

```
dbi_driver dbi_driver_list(dbi_driver Current);
```

Enumerates all loaded drivers. If *Current* is NULL, the first available driver will be returned. If *Current* is a valid driver, the next available driver will be returned.

Arguments

Current: The current driver in the list of drivers.

Returns

The next available driver, or NULL if there is an error or no more are available.

4.2.2. dbi_driver_open

```
dbi_driver dbi_driver_open(const char *name);
```

Locate the driver with the specified name.

Arguments

name: The name of the driver to open.

Returns

The requested driver, or NULL if there is no such driver.

4.2.3. dbi_driver_is_reserved_word

```
int dbi_driver_is_reserved_word(dbi_driver Driver, const char *word);
```

Looks for the specified word in the list of reserved words. The result of this function may vary between databases. Case does not matter.

Arguments

Driver: The target driver.

word: The word to check against the reserved word list.

Returns

-1 if an error occurs, 0 if the word is not reserved, 1 otherwise.

4.2.4. dbi_driver_specific_function

```
void *dbi_driver_specific_function(dbi_driver Driver, const char *name);
```

Returns a function pointer to the specified custom function. This can be used to access database-specific functionality, but it will restrict your code to one particular database, lessening the benefits of using libdbi.

Arguments

Driver: The target driver.

name: The name of the custom function.

Returns

If the custom function is found, a pointer to that function. If not, returns NULL.

4.2.5. dbi_driver_quote_string

```
int dbi_driver_quote_string(dbi_driver Driver, char **orig);
```

Encloses the target string in the types of quotes that the database expects, and escapes any special characters. The original string will be freed and *orig* will point to a newly allocated one (which you still must free on your own). If an error occurs, the original string will not be freed.

Note: This function is deprecated. Use `dbi_conn_quote_string` instead.

Arguments

Driver: The target driver.

orig: A pointer to the string to quote and escape.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. The length of a quoted empty string is 2 bytes.

4.2.6. `dbi_driver_quote_string_copy`

```
int dbi_driver_quote_string_copy(dbi_driver Driver, char **orig, char **newstr);
```

Encloses the target string in the types of quotes that the database expects, and escapes any special characters. The original string will be left alone, and *newstr* will point to a newly allocated string containing the quoted string (which you still must free on your own). In case of an error, *newstr* is an invalid pointer which you must not attempt to deallocate.

Note: This function is deprecated. Use `dbi_conn_quote_string_copy` instead.

Arguments

Driver: The target driver.

orig: A pointer to the string to quote and escape.

newstr: After the function returns, this pointer will point to the quoted and escaped string.

Returns

The quoted string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. The length of a quoted empty string is 2 bytes.

4.2.7. dbi_driver_encoding_from_iana

```
const char *dbi_driver_encoding_from_iana(dbi_driver Driver, const char
*iana_encoding);
```

Requests the database engine specific name of the character encoding identified by its name as known to IANA (<http://www.iana.org>). Use this function to pass the database engine specific encoding name to SQL queries , e.g. as part of a **CREATE DATABASE** command.

Arguments

`Driver`: The target driver.

`iana_encoding`: The IANA name of the character encoding.

Returns

A string containing the database engine specific encoding name. If the encoding name cannot be translated, the IANA name is returned without translation.

4.2.8. dbi_driver_encoding_to_iana

```
const char *dbi_driver_encoding_to_iana(dbi_driver Driver, const char *db_encoding);
```

Requests the IANA (<http://www.iana.org>) name of the character encoding identified by its database engine specific name. Use this function to convert the database engine specific name returned by SQL queries to the corresponding common name.

Arguments

`Driver`: The target driver.

`db_encoding`: The database engine specific name of the character encoding.

Returns

A string containing the IANA encoding name. If the encoding name cannot be translated, the database engine specific name is returned without translation.

4.2.9. Driver Information

4.2.9.1. dbi_driver_get_name

```
const char *dbi_driver_get_name(dbi_driver Driver);
```

Requests the name of the specified driver. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

Returns

A string containing the driver's name.

4.2.9.2. dbi_driver_get_filename

```
const char *dbi_driver_get_filename(dbi_driver Driver);
```

Requests the filename of the specified driver. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

Returns

A string containing the driver's full path and file name.

4.2.9.3. dbi_driver_get_description

```
const char *dbi_driver_get_description(dbi_driver Driver);
```

Requests a description of the specified driver. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

Returns

A string containing the driver's description. It will be one or two short sentences with no newlines.

4.2.9.4. dbi_driver_get_maintainer

```
const char *dbi_driver_get_maintainer(dbi_driver Driver);
```

Requests the maintainer of the specified driver. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

Returns

A string containing the driver maintainer's full name and email address.

4.2.9.5. dbi_driver_get_url

```
const char *dbi_driver_get_url(dbi_driver Driver);
```

Requests the maintainer's URL for the specified driver. This is useful for drivers maintained by a third party. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

4.2.9.6. dbi_driver_get_version

```
const char *dbi_driver_get_version(dbi_driver Driver);
```

Requests the version of the specified driver. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

Returns

A string containing the driver's version.

4.2.9.7. dbi_driver_get_date_compiled

```
const char *dbi_driver_get_date_compiled(dbi_driver Driver);
```

Requests the compilation date of the specified driver. The calling program must not attempt to free the returned string.

Arguments

Driver: The target driver.

Returns

A string containing the date the driver was compiled.

4.3. Connection Infrastructure

4.3.1. dbi_conn_new

```
dbi_conn dbi_conn_new(const char *name);
```

Creates a connection instance of the driver specified by "name". This is a shortcut for calling `dbi_driver_open()` and passing the result to `dbi_conn_open()`.

Arguments

name: The name of the desired driver.

Returns

A connection instance of the specified driver, or NULL if there was an error.

4.3.2. dbi_conn_open

```
dbi_conn dbi_conn_open(dbi_driver Driver);
```

Creates a connection instance of the specified driver. This connection can be used to perform queries and set options.

Arguments

`Driver`: The target driver.

Returns

A connection instance of the specified driver, or NULL if there was an error.

4.3.3. dbi_conn_close

```
void dbi_conn_close(dbi_conn Conn);
```

Disconnects the specified connection connection from the database and cleans up the connection session.

Arguments

`Conn`: The target connection.

4.3.4. dbi_conn_get_driver

```
dbi_driver dbi_conn_get_driver(dbi_conn Conn);
```

Returns the driver type of the specified connection.

Arguments

`Conn`: The target connection.

Returns

The driver type of the target connection.

4.3.5. dbi_conn_set_option

```
int dbi_conn_set_option(dbi_conn Conn, const char *key, char *value);
```

Sets a specified connection option to a string value.

Arguments

Conn: The target connection.

key: The name of the target setting. Must only contain alphanumerics and the underscore character.

value: The string value of the target setting.

Returns

-1 on error, 0 on success. In case of an error, the error number is DBI_ERROR_NOMEM.

4.3.6. dbi_conn_set_option_numeric

```
int dbi_conn_set_option_numeric(dbi_conn Conn, const char *key, int value);
```

Sets a specified connection option to a numeric value.

Arguments

Conn: The target connection.

key: The name of the target setting. Must only contain alphanumerics and the underscore character.

value: The numeric value of the target setting.

Returns

-1 on error, 0 on success. In case of an error, the error number is DBI_ERROR_NOMEM.

4.3.7. dbi_conn_get_option

```
const char *dbi_conn_get_option(dbi_conn Conn, const char *key);
```

Retrieves the string value of the specified option set for a connection if available.

Arguments

`Conn`: The target connection.

`key`: The name of the target setting.

Returns

A read-only string with the setting, or NULL if it is not available. It is not considered an error if the setting is not available.

4.3.8. dbi_conn_require_option

```
const char *dbi_conn_require_option(dbi_conn Conn, const char *key);
```

Retrieves the string value of the specified option set for a connection and throws an error if the option was not set.

Arguments

`Conn`: The target connection.

`key`: The name of the target setting.

Returns

A read-only string with the setting, or NULL if it is not available. In the latter case, the error number is DBI_ERROR_BADNAME.

4.3.9. dbi_conn_get_option_numeric

```
int dbi_conn_get_option_numeric(dbi_conn Conn, const char *key);
```

Retrieves the integer value of the specified option set for a connection if available.

Arguments

`Conn`: The target connection.

`key`: The name of the target setting.

Returns

The value of the setting, or -1 if it is not available. It is not considered an error if the option has not been set.

4.3.10. dbi_conn_require_option_numeric

```
int dbi_conn_require_option_numeric(dbi_conn Conn, const char *key);
```

Retrieves the integer value of the specified option set for a connection and throws an error if it is not available.

Arguments

Conn: The target connection.

key: The name of the target setting.

Returns

The value of the setting, or -1 if it is not available. In the latter case, the error number is DBI_ERROR_BADNAME.

4.3.11. dbi_conn_get_option_list

```
const char *dbi_conn_get_option_list(dbi_conn Conn, const char *current);
```

Enumerates the list of available options for a connection. If current is NULL, the first available option will be returned. If current is a valid option name, the next available option will be returned.

Arguments

Conn: The target connection.

current: The key name of the target option.

Returns

The key name of the next option, or NULL if there are no more options or if there was an error. In the latter case the error number is set to DBI_ERROR_BADPTR.

4.3.12. dbi_conn_clear_option

```
void dbi_conn_clear_option(dbi_conn Conn, const char *key);
```

Removes the target option setting from a connection. It is not considered an error if the requested option was not set before.

Arguments

`Conn`: The target connection.

`key`: The name of the target setting.

4.3.13. `dbi_conn_clear_options`

```
void dbi_conn_clear_options(dbi_conn Conn);
```

Removes all option settings from a connection.

Arguments

`Conn`: The target connection.

4.3.14. `dbi_conn_get_socket`

```
int dbi_conn_get_socket(dbi_conn Conn);
```

Obtain the file descriptor number for the backend connection socket.

Arguments

`Conn`: The target connection

Returns

-1 on failure, the file descriptor number on success

4.3.15. `dbi_conn_get_encoding`

```
const char *dbi_conn_get_encoding(dbi_conn Conn);
```

Requests the character encoding used by the current connection. This may be different from the encoding requested when the connection was opened, most notably if the connection option was set to "auto".

Arguments

`Conn`: The current encoding.

Returns

A string containing the IANA (<http://www.iana.org>) name of the connection encoding. If the encoding option was set to "auto", the function returns the encoding the database was created with. In all other cases, the current connection encoding is returned, which may be different from the database encoding. Use the `dbi_driver_encoding_from_iana` function to translate the encoding name to that of the currently used database engine if necessary.

4.3.16. `dbi_conn_get_engine_version_string`

```
char *dbi_conn_get_engine_version_string(dbi_conn Conn, char *versionstring);
```

Requests the version of the database engine that serves the current connection as a string.

Arguments

`Conn`: The current connection.

`versionstring`: A string buffer that can hold at least `VERSIONSTRING_LENGTH` bytes.

Returns

A string representation of the version. This will be something like "4.1.10". The result is written to the buffer that `versionstring` points to. If successful, the function returns a pointer to that buffer. If the version cannot be determined, the function returns the string "0".

Note: This string is useful to display the version to the user. In order to check for particular version requirements in your program, `dbi_conn_get_engine_version` is the better choice.

4.3.17. `dbi_conn_get_engine_version`

```
unsigned int dbi_conn_get_engine_version(dbi_conn Conn);
```

Requests the version of the database engine that serves the current connection in a numeric form.

Arguments

Conn: The current connection.

Returns

A numeric representation of the version. String representations of the version (e.g. "4.1.10") do not lend themselves to an easy comparison in order to find out whether a particular engine feature is already implemented. For example, a string comparison would claim that "4.1.9" is a later version than "4.1.10". Therefore libdbi computes a numeric representation of the version number $[[[A.]B.]C.]D.]E[.]$ according to the formula $E + D*100 + C*10000 + B*1000000 + A*100000000$. The resulting integers (40109 and 40110 in the example above) will be sorted correctly. Returns 0 if the version number cannot be retrieved.

4.3.18. Error Handling

4.3.18.1. dbi_conn_error

```
int dbi_conn_error(dbi_conn Conn, const char **errmsg_dest);
```

Returns a formatted message with the error number and description resulting from the previous database operation.

Arguments

Conn: The target connection.

errmsg_dest: The target string pointer, which will point to the error message. If NULL, no error message will be created, but the error number will still be returned. This string is managed by libdbi, so it must not be modified or freed. The pointer to the string is only valid until the next call to this function, so make a copy in time if you need to keep the error message.

Returns

The error number of the most recent database operation if it resulted in an error. If not, this will return DBI_ERROR_NONE. See Chapter 3 for further information.

4.3.18.2. dbi_conn_error_handler

```
void dbi_conn_error_handler(dbi_conn Conn, dbi_conn_error_handler_func function, void *user_argument);
```

Registers an error handler callback to be triggered whenever the database encounters an error. The callback function should perform as little work as possible, since the state in which it is called can be uncertain. The actual function declaration must accept two parameters (and return nothing):

- `dbi_conn Conn`: the connection object that triggered the error, from which `dbi_conn_error()` can be called, and
- `void *user_argument`: a pointer to whatever data (if any) was registered along with the handler.

To remove the error handler callback, specify `NULL` as the function and `user_argument`.

Arguments

`Conn`: The target connection.

`function`: A pointer to the function to call when the error handler should be triggered.

`user_argument`: Any data to pass along to the function when it is triggered. Set to `NULL` if unused.

4.3.18.3. `dbi_conn_error_flag`

```
dbi_error_flag dbi_conn_error_flag(dbi_conn Conn);
```

The libdbi query functions set an error flag in order to distinguish e.g. the return value "0" from a "0" returned due to an error condition. Use this function after each query that may fail to read out the error status.

Arguments

`Conn`: The target connection.

Returns

0 means the previous query finished without errors. A value larger than zero means an error occurred.

Note: This function is deprecated. Use `dbi_conn_error` instead. Both functions return the same error code to maintain backwards compatibility.

4.3.18.4. `dbi_conn_set_error`

```
int dbi_conn_set_error(dbi_conn Conn, int errnum, const char *formatstr, ...);
```


Applications may set an error status and an error message which are accessible through the libdbi error API function `dbi_conn_error`.

Arguments

`Conn`: The target connection.

`errnum`: An application-defined error code. Applications should use only positive nonzero integers to indicate errors.

The remainder of the argument list is interpreted using a `printf(3)`-like syntax to define an error message.

Returns

The length of the error message in bytes, or 0 if there was an error.

4.4. SQL and Database Infrastructure

4.4.1. `dbi_conn_connect`

```
int dbi_conn_connect(dbi_conn Conn);
```

Connects to the database using the options (host, username, password, port, (etc.) set with `dbi_conn_set_option` and related functions. See the documentation for each specific database driver for the options it recognizes and requires.

Arguments

`Conn`: The target connection.

Returns

0 (zero) on success, less than zero on failure. In the latter case, the error number may be `DBI_ERROR_NOMEM`, `DBI_ERROR_NOCONN`, or one of the driver-specific values.

4.4.2. `dbi_conn_get_db_list`

```
dbi_result dbi_conn_get_db_list(dbi_conn Conn, const char *pattern);
```

Queries the list of available databases on the server.

Arguments

`Conn`: The target connection.

`pattern`: A string pattern (SQL regular expression) that each name must match, or NULL to show all available databases.

Returns

A query result object, which will contain database names in the first field (for use with the by-index field functions). In case of an error, the function returns NULL and sets the error number to a database engine-specific nonzero value.

4.4.3. dbi_conn_get_table_list

```
dbi_result dbi_conn_get_table_list(dbi_conn Conn, const char *db, const char
*pattern);
```

Queries the list of available tables in a particular database.

Arguments

`Conn`: The target connection.

`db`: The target database name.

`pattern`: A string pattern (SQL regular expression) that each name must match, or NULL to show all available tables.

Returns

A query result object, which will contain table names in the first field (for use with the by-index field functions). In case of an error, the function returns NULL and sets the error number to a database engine-specific nonzero value.

4.4.4. dbi_conn_select_db

```
int dbi_conn_select_db(dbi_conn Conn, const char *db);
```

Switches to a different database on the server.

Arguments

`Conn`: The target connection.

`db`: The target database name.

Returns

-1 on failure, zero on success. In case of an error, the error number may be `DBI_ERROR_UNSUPPORTED` or a database engine-specific nonzero value.

4.5. Managing Queries

4.5.1. `dbi_conn_query`

```
dbi_result dbi_conn_query(dbi_conn Conn, const char *statement);
```

Execute the specified SQL query statement.

Arguments

`Conn`: The target connection.

`statement`: A string containing the SQL statement.

Returns

A query result object, or NULL if there was an error. In the latter case the error number is a database engine-specific nonzero value.

4.5.2. `dbi_conn_queryf`

```
dbi_result dbi_conn_queryf(dbi_conn Conn, const char *formatstr, ...);
```

Execute the specified SQL query statement.

Arguments

`Conn`: The target connection.

`formatstr`: The format string for the SQL statement. It uses the same format as `printf()`.

ARG: (...) Any variables that correspond to the printf-like format string.

Returns

A query result object, or NULL if there was an error. In the latter case the error number is a database engine-specific nonzero value.

4.5.3. dbi_conn_query_null

```
dbi_result dbi_conn_query_null(dbi_conn Conn, const unsigned char *statement, unsigned
long st_length);
```

Execute the specified SQL query statement, which may contain valid NULL characters.

Note: This function is not implemented by all database drivers. For a portable way of including binary strings into SQL queries, see the function `dbi_conn_quote_binary_copy`.

Arguments

Conn: The target connection.

statement: The SQL statement, which may contain binary data.

st_length: The number of characters in the non-null-terminated statement string.

Returns

A query result object, or NULL if there was an error. In the latter case the error number is a database engine-specific nonzero value.

4.5.4. dbi_conn_sequence_last

```
unsigned long long dbi_conn_sequence_last(dbi_conn Conn, const char *name);
```

Requests the row ID generated by the last **INSERT** command. The row ID is most commonly generated by an auto-incrementing column in the table. Use the return value to address the dataset that was last inserted.

Arguments

`Conn`: The current database connection.

`name`: The name of the sequence, or NULL if the database engine does not use explicit sequences.

Note: You may have noted that this function does not sufficiently encapsulate the peculiarities of the underlying database engines. You must keep track of sequence names yourself if your target database engine does use sequences.

Returns

An integer value corresponding to the ID that was created by the last **INSERT** command. If the database engine does not support sequences, the function returns 0 (zero) and sets the error number to `DBI_ERROR_UNSUPPORTED`.

4.5.5. dbi_conn_sequence_next

```
unsigned long long dbi_conn_sequence_next(dbi_conn Conn, const char *name);
```

Requests the row ID that would be generated by the next **INSERT** command. The row ID is most commonly generated by an auto-incrementing column in the table.

Note: Not all database engines support this feature. Portable code should use `dbi_conn_sequence_last` instead.

Arguments

`Conn`: The current database connection.

`name`: The name of the sequence, or NULL if the database engine does not use explicit sequences.

Note: You may have noted that this function does not sufficiently encapsulate the peculiarities of the underlying database engines. You must keep track of sequence names yourself if your target database engine does use sequences.

Returns

An integer value corresponding to the ID that was created by the last **INSERT** command, or 0 if the database engine does not support this feature. In the latter case, the error number is DBI_ERROR_UNSUPPORTED

4.5.6. dbi_conn_ping

```
int dbi_conn_ping(dbi_conn Conn);
```

Checks whether the current connection is still alive. Use this function to decide whether you must reconnect before running a query if your program is designed to keep connections open over prolonged periods of time.

Arguments

Conn: The current database connection.

Returns

1 if the connection is alive. Otherwise the function returns 0.

Note: Database drivers may attempt to reconnect automatically if this function is called. If the reconnect is successful, this function will also return 1, as if the connection never had gone down.

4.5.7. dbi_conn_quote_string

```
size_t dbi_conn_quote_string(dbi_conn Conn, char **orig);
```

Escapes any special characters in a string and places the string itself in quotes so the string can be sent to the database engine as a query string, using either `dbi_conn_query` or `dbi_conn_queryf`. The original string will be freed and *orig* will point to a newly allocated one (which you still must free on your own). If an error occurs, the original string will be left alone. This function is preferred over `dbi_driver_quote_string` because it takes the character encoding of the current connection into account when performing the escaping.

Arguments

Conn: The current database connection.

orig: A pointer to the string to quote and escape.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. The length of a quoted empty string is 2 bytes. In case of an error the error number is DBI_ERROR_BADPTR or DBI_ERROR_NOMEM.

4.5.8. dbi_conn_quote_string_copy

```
size_t dbi_conn_quote_string_copy(dbi_conn Conn, char *orig, char **newstr);
```

Escapes any special characters in a string and places the string itself in quotes so the string can be sent to the database engine as a query string, using either `dbi_conn_query` or `dbi_conn_queryf`. The original string will be left alone, and `newstr` will point to a newly allocated string containing the quoted string (which you still must free on your own). If the function fails, `newstr` is an invalid pointer that must not be freed. This function is preferred over `dbi_driver_quote_string_copy` because it takes the character encoding of the current connection into account when performing the escaping.

Arguments

`Conn`: The current database connection.

`orig`: A pointer to the string to quote and escape.

`newstr`: After the function returns, this pointer will point to the quoted and escaped string.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. Possible error numbers are DBI_ERROR_BADPTR and DBI_ERROR_NOMEM.

4.5.9. dbi_conn_quote_binary_copy

```
size_t dbi_conn_quote_binary_copy(dbi_conn Conn, char *orig, size_t from_length, char **newstr);
```

Escapes any special characters, including null bytes, in a binary string and places the resulting string in quotes so it can be used in an SQL query. The original string will be left alone, and `newstr` will point to a newly allocated string containing the quoted string (which you still must free on your own). If an error occurs, `newstr` is an invalid pointer which must not be freed.

Arguments

`Conn`: The current database connection.

`orig`: A pointer to the string to quote and escape.

`from_length`: The length of the binary string in bytes.

`newstr`: After the function returns, this pointer will point to the quoted and escaped string.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. Possible error numbers are `DBI_ERROR_BADPTR` and `DBI_ERROR_NOMEM`.

4.5.10. dbi_conn_escape_string

```
size_t dbi_conn_escape_string(dbi_conn Conn, char **orig);
```

Works like `dbi_conn_quote_string` but does not surround the resulting string with quotes.

Arguments

`Conn`: The current database connection.

`orig`: A pointer to the string to quote and escape.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. The length of a quoted empty string is 2 bytes. In case of an error the error number is `DBI_ERROR_BADPTR` or `DBI_ERROR_NOMEM`.

4.5.11. dbi_conn_escape_string_copy

```
size_t dbi_conn_escape_string_copy(dbi_conn Conn, char *orig, char **newstr);
```

Works like `dbi_conn_quote_string_copy` but does not surround the resulting string with quotes.

Arguments

`Conn`: The current database connection.

`orig`: A pointer to the string to quote and escape.

newstr: After the function returns, this pointer will point to the quoted and escaped string.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. Possible error numbers are DBI_ERROR_BADPTR and DBI_ERROR_NOMEM.

4.5.12. dbi_conn_escape_binary_copy

```
size_t dbi_conn_escape_binary_copy(dbi_conn Conn, char *orig, size_t from_length, char **newstr);
```

Works like `dbi_conn_quote_binary_copy` but does not surround the resulting string with quotes.

Arguments

Conn: The current database connection.

orig: A pointer to the string to quote and escape.

from_length: The length of the binary string in bytes.

newstr: After the function returns, this pointer will point to the quoted and escaped string.

Returns

The new string's length in bytes, excluding the terminating zero byte, or 0 in case of an error. Possible error numbers are DBI_ERROR_BADPTR and DBI_ERROR_NOMEM.

4.6. Managing Results

4.6.1. dbi_result_get_conn

```
dbi_conn dbi_result_get_conn(dbi_result Result);
```

Returns the connection belonging to the specified result object.

Arguments

Result: The target query result.

Returns

The connection belonging to the target query result. If an error occurs, the return value is NULL, and the error number is set to DBI_ERROR_BADPTR.

4.6.2. dbi_result_free

```
int dbi_result_free(dbi_result Result);
```

Frees the result's query, disables all stored field bindings, and releases internally stored variables.

Arguments

Result: The target query result.

Returns

-1 on failure, zero on success. If a failure was caused by the database client library, the error number is set to the database engine-specific nonzero error code.

4.6.3. dbi_result_seek_row

```
int dbi_result_seek_row(dbi_result Result, unsigned long long rowidx);
```

Jump to a specific row in a result set.

Arguments

Result: The target query result.

rowidx: The ordinal number of the row to seek to. The first row is at position 1, not zero.

Returns

1 if successful, or 0 if there was an error. In the latter case, the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADIDX, or a database engine-specific nonzero value.

4.6.4. dbi_result_first_row

```
int dbi_result_first_row(dbi_result Result);
```

Jump to the first row in a result set.

Arguments

Result: The target query result.

Returns

1 if successful, or 0 if there was an error. In the latter case, the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADIDX, or a database engine-specific nonzero value.

4.6.5. dbi_result_last_row

```
int dbi_result_last_row(dbi_result Result);
```

Jump to the last row in a result set.

Arguments

Result: The target query result.

Returns

1 if successful, or 0 if there was an error. In the latter case, the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADIDX, or a database engine-specific nonzero value.

4.6.6. dbi_result_prev_row

```
int dbi_result_prev_row(dbi_result Result);
```

Jump to the previous row in a result set.

Arguments

Result: The target query result.

Returns

1 if successful, or 0 if there is an error. In the latter case, the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADIDX, or a database engine-specific nonzero value.

4.6.7. dbi_result_next_row

```
int dbi_result_next_row(dbi_result Result);
```

Jump to the next row in a result set.

Arguments

Result: The target query result.

Returns

1 if successful, or 0 if there was an error. In the latter case, the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADIDX, or a database engine-specific nonzero value.

4.6.8. dbi_result_get_currenrow

```
unsigned long long dbi_result_get_currenrow(dbi_result Result);
```

Returns the ordinal number of the current row in the specified result set.

Arguments

Result: The target query result.

Returns

The ordinal number of the row, or 0 if there was an error. The first row has the number 1. In case of an error, the error number is DBI_ERROR_BADPTR.

4.6.9. dbi_result_get_numrows

```
unsigned long long dbi_result_get_numrows(dbi_result Result);
```

Returns the number of rows in the specified result set.

Arguments

Result: The target query result.

Returns

The number of rows in the result set, which may be 0 if the query did not return any datasets, or DBI_ROW_ERROR in case of an error. In that case, the error number is DBI_ERROR_BADPTR.

4.6.10. dbi_result_get_numrows_affected

```
unsigned long long dbi_result_get_numrows_affected(dbi_result Result);
```

Returns the number of rows in the specified result set that were actually modified. Note that not all database servers support this, in which case it will always be zero. See the documentation for each specific driver for details.

Arguments

Result: The target query result.

Returns

The number of modified rows in the result set which may be 0 if no row was affected by the previous query. Also returns 0 if the database engine does not support this feature. The return value will be DBI_ROW_ERROR in case of an error. In case of an error, the error number is DBI_ERROR_BADPTR.

4.7. Retrieving Field Meta-data**4.7.1. dbi_result_get_field_length**

```
size_t dbi_result_get_field_length(dbi_result Result, const char *const char
*fieldname);
```

Returns the length of the value stored in the specified field which contains a string or a binary string.

Arguments

Result: The target query result.

fieldname: The name of the target field.

Returns

The length in bytes of the target field data, excluding the terminating zero byte, or DBI_LENGTH_ERROR in case of an error. The return value is 0 for field types other than string or binary string. In case of an error the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADOBJECT, or DBI_ERROR_BADIDX.

4.7.2. dbi_result_get_field_length_idx

```
size_t dbi_result_get_field_length_idx(dbi_result Result, unsigned int idx);
```

Returns the length of the value stored in the specified field which contains a string or a binary string.

Arguments

Result: The target query result.

idx: The index of the target field (starting at 1).

Returns

The length in bytes of the target field data, excluding the terminating zero byte, or DBI_LENGTH_ERROR in case of an error. The return value is 0 for field types other than string or binary string. In case of an error the error number is one of DBI_ERROR_BADPTR, DBI_ERROR_BADOBJECT, or DBI_ERROR_BADIDX.

4.7.3. dbi_result_get_field_size

```
size_t dbi_result_get_field_size(dbi_result Result, const char *fieldname);
```

Returns the size in bytes of the value stored in the specified field.

Note: This function is deprecated. Use `dbi_result_get_field_length` instead.

4.7.4. dbi_result_get_field_size_idx

```
size_t dbi_result_get_field_size_idx(dbi_result Result, unsigned long idx);
```

Returns the size in bytes of the value stored in the specified field.

Note: This function is deprecated. Use `dbi_result_get_field_length_idx` instead.

4.7.5. `dbi_result_get_field_idx`

```
unsigned int dbi_result_get_field_idx(dbi_result Result, const char *fieldname);
```

Given a field's name, return that field's numeric index.

Arguments

`Result`: The target query result.

`fieldname`: The name of the target field.

Returns

The index (starting at 1) of the target field, or 0 in case of an error. In that case, the error number is `DBI_ERROR_BADPTR`.

4.7.6. `dbi_result_get_field_name`

```
const char *dbi_result_get_field_name(dbi_result Result, unsigned int idx);
```

Given a field's numeric index, return that field's name.

Arguments

`Result`: The target query result.

`idx`: The index of the target field (starting at 1).

Returns

The target field's name, or NULL in case of an error. In that case the error number is one of `DBI_ERROR_BADPTR`, `DBI_ERROR_BADOBJECT`, or `DBI_ERROR_BADIDX`.

4.7.7. dbi_result_get_numfields

```
unsigned int dbi_result_get_numfields(dbi_result Result);
```

Returns the number of fields in the query result.

Arguments

Result: The target query result.

Returns

The number of fields in the query result, or DBI_FIELD_ERROR in case of an error.

4.7.8. dbi_result_get_field_type

```
unsigned short dbi_result_get_field_type(dbi_result Result, const char *fieldname);
```

Returns the target field's data type. The constants returned by this function are defined in dbi.h with the prefix "DBI_TYPE_".

Arguments

Result: The target query result.

fieldname: The target field's name.

Returns

The target field's data type, or DBI_TYPE_ERROR in case of an error. In the latter case the error number is DBI_ERROR_BADPTR, DBI_ERROR_BADOBJECT, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.7.9. dbi_result_get_field_type_idx

```
unsigned short dbi_result_get_field_type_idx(dbi_result Result, unsigned int idx);
```

Returns the target field's data type. The constants returned by this function are defined in dbi.h with the prefix "DBI_TYPE_".

Arguments

Result: The target query result.

idx: The index of the target field (starting at 1).

Returns

The target field's data type, or `DBI_TYPE_ERROR` in case of an error. In the latter case the error number is `DBI_ERROR_BADPTR`, `DBI_ERROR_BADOBJECT`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.7.10. dbi_result_get_field_attr

```
unsigned int dbi_result_get_field_attr(dbi_result Result, const char *fieldname,
unsigned int attribmin, unsigned int attribmax);
```

Returns the target field's data type attributes in the specified range. The constants returned by this function are defined in `include/dbi/dbi.h` with the prefix "DBI_", followed by the name of the field's datatype.

Arguments

Result: The target query result.

fieldname: The target field's name.

attribmin: The first attribute value in the range of attributes to extract.

attribmax: The last attribute value in the range of attributes to extract. This may be the same as `attribmin` if you are only trying to extract a single attribute value.

Returns

The target field's requested attribute range, or `DBI_ATTRIBUTE_ERROR` in case of an error. In the latter case the error number is `DBI_ERROR_BADPTR`, `DBI_ERROR_BADOBJECT`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.7.11. dbi_result_get_field_attr_idx

```
unsigned int dbi_result_get_field_attr_idx(dbi_result Result, unsigned int idx,
unsigned int attribmin, unsigned int attribmax);
```

Returns the target field's data type attributes in the specified range. The constants returned by this function are defined in `dbi.h` with the prefix "DBI_", followed by the name of the field's datatype.

Arguments

Result: The target query result.

idx: The index of the target field (starting at 1).

attribmin: The first attribute value in the range of attributes to extract.

attribmax: The last attribute value in the range of attributes to extract. This may be the same as **attribmin** if you are only trying to extract a single attribute value.

Returns

The target field's requested attribute range, or `DBI_ATTRIBUTE_ERROR` in case of an error. In the latter case the error number is `DBI_ERROR_BADPTR`, `DBI_ERROR_BADOBJECT`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.7.12. dbi_result_get_field_attribs

```
unsigned int dbi_result_get_field_attribs(dbi_result Result, const char *fieldname);
```

Returns the target field's data type attributes. The constants returned by this function are defined in `dbi.h` with the prefix "DBI_", followed by the name of the field's datatype.

Arguments

Result: The target query result.

fieldname: The target field's name.

Returns

The target field's attributes, or `DBI_ATTRIBUTE_ERROR` in case of an error. In case of an error the error number is `DBI_ERROR_BADPTR`, `DBI_ERROR_BADOBJECT`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.7.13. dbi_result_get_field_attribs_idx

```
unsigned int dbi_result_get_field_attribs_idx(dbi_result Result, unsigned int fieldidx);
```

Returns the target field's data type attributes. The constants returned by this function are defined in `dbi.h` with the prefix "DBI_", followed by the name of the field's datatype.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The target field's attributes, or DBI_ATTRIBUTE_ERROR in case of an error. In that case the error number is DBI_ERROR_BADPTR, DBI_ERROR_BADOBJECT, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.7.14. dbi_result_field_is_null

```
int dbi_result_field_is_null(dbi_result Result, const char *fieldname);
```

Determines whether the indicated field contains a NULL value.

Arguments

Result: The target query result.

fieldname: The name of the target field.

Returns

1 if the field contains a NULL value, otherwise 0, or DBI_FIELD_FLAG_ERROR in case of an error. In the latter case the error number is DBI_ERROR_BADPTR, DBI_ERROR_BADOBJECT, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.7.15. dbi_result_field_is_null_idx

```
int dbi_result_field_is_null_idx(dbi_result Result, unsigned int fieldidx);
```

Determines whether the indicated field contains a NULL value.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

1 if the field contains a NULL value, otherwise 0, or DBI_FIELD_FLAG_ERROR in case of an error. In the latter case the error number is DBI_ERROR_BADPTR, DBI_ERROR_BADOBJECT, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.8. Retrieving Field Data by Name

4.8.1. dbi_result_get_fields

```
unsigned int dbi_result_get_fields(dbi_result Result, const char *format, ...);
```

Fetch multiple fields from the current result set, using a printf-like syntax. The formatter string specified field names and types, and each field's associated destination variable is passed as an argument following the format string. Fields in the formatter string are separated by spaces, and follow the format "a.%b", where "a" is the name of the field, and "b" is the field type specifier. Make sure you pass the destination variables' memory addresses by prepending the & operator to each variable's name.

Field type specifiers:

- %c / %uc: A signed/unsigned character (1-byte)
- %h / %uh: A signed/unsigned short integer (2-byte)
- %l / %ul: A signed/unsigned integer (4-byte)
- %i / %ui: A signed/unsigned integer (4-byte)
- %L / %uL: A signed/unsigned long long integer (8-byte)
- %f: A floating point number
- %d: A double-precision number
- %s: A read-only string
- %S: A local copy of a string (must be freed by program)
- %b: A read-only pointer to binary data
- %B: A local copy of binary data (must be freed by program)
- %m: A time_t value representing a DATE and/or TIME

Example usage: `dbi_result_get_fields(result, "idnum.%ul lastname.%s", &id_number, &name)`

Arguments

`Result`: The target query result.

`format`: The field format string as described above.

`ARG`: (...) Pointers to the destination variables corresponding with each field in the format string.

Returns

The number of fields fetched, or `DBI_FIELD_ERROR` if there was an error. If an invalid field name was specified it will not raise an error, and the other fetched fields will work as usual.

4.8.2. dbi_result_bind_fields

```
unsigned int dbi_result_bind_fields(dbi_result Result, const char *format, ...);
```

Bind multiple fields in the current result set, using a printf-like syntax. See `dbi_result_get_fields` for a detailed explanation of the syntax.

Arguments

`Result`: The target query result.

`format`: The field format string as described above.

`ARG`: (...) Pointers to the destination variables corresponding with each field in the format string.

Returns

The number of field binding set up, or `DBI_FIELD_ERROR` if there was an error.

4.8.3. dbi_result_get_char

```
signed char dbi_result_get_char(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a character (a 1-byte signed integer). This is the default for the "char" type on the x86 platform, as well as on Mac OS X.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.8.4. dbi_result_get_uchar

```
unsigned char dbi_result_get_uchar(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains an unsigned character (1-byte unsigned integer). This is the default for the "char" type on Linux for PowerPC.

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.8.5. dbi_result_get_short

```
short dbi_result_get_short(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a short integer (2-byte signed integer).

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.6. dbi_result_get_ushort

```
unsigned short dbi_result_get_ushort(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains an unsigned short integer (2-byte unsigned integer).

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.7. dbi_result_get_int

```
int dbi_result_get_int(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains an integer (4-byte signed integer).

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.8. dbi_result_get_uint

```
unsigned int dbi_result_get_uint(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains an unsigned integer (4-byte unsigned integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.9. dbi_result_get_long

```
int dbi_result_get_long(dbi_result Result, const char *fieldname);
```

This is the same as `dbi_result_get_int`. The use of this function is deprecated as the name implies the wrong return type on 64-bit platforms.

4.8.10. dbi_result_get_ulong

```
unsigned int dbi_result_get_ulong(dbi_result Result, const char *fieldname);
```

This is the same as `dbi_result_get_uint`. The use of this function is deprecated as the name implies the wrong return type on 64-bit platforms.

4.8.11. dbi_result_get_longlong

```
long long dbi_result_get_longlong(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a long long integer (8-byte signed integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.12. dbi_result_get_ulonglong

```
unsigned long long dbi_result_get_ulonglong(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains an unsigned long long integer (8-byte unsigned integer).

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.13. dbi_result_get_float

```
float dbi_result_get_float(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a floating-point number.

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field, which contains a fractional number, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME..

4.8.14. `dbi_result_get_double`

```
double dbi_result_get_double(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a double-precision fractional number.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is `DBI_ERROR_BADTYPE`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.8.15. `dbi_result_get_string`

```
const char *dbi_result_get_string(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a zero-terminated string.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field, which is a zero-terminated string. If the field contains a NULL value, the function returns a NULL pointer. The string may not be modified, and may not necessarily persist between row fetches. In case of an error, this function returns the string "ERROR". In the latter case the error number is `DBI_ERROR_BADTYPE`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.8.16. `dbi_result_get_string_copy`

```
char *dbi_result_get_string_copy(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a zero-terminated string, and return it in an allocated buffer.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field as a zero-terminated allocated string. If the field contains a NULL value, the function returns a NULL pointer, and no memory is allocated. The newly allocated string may be modified by the host program, but the program is responsible for freeing the string. In case of an error, this function returns an allocated string reading "ERROR". In that case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.8.17. dbi_result_get_binary

```
const unsigned char *dbi_result_get_binary(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains binary data.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to fetch.

Returns

The data stored in the specified field. The binary data may contain zero bytes and non-printable characters. Use `dbi_result_get_field_length` or `dbi_result_get_field_length_idx` to determine the number of bytes contained in the resulting binary string. The data may not be modified, and may not necessarily persist between row fetches. If the field contains a NULL value, the function returns a NULL pointer. In case of an error, this function returns the string "ERROR". In that case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.8.18. dbi_result_get_binary_copy

```
unsigned char *dbi_result_get_binary_copy(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains binary data, and return it in an allocated buffer.

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field. The binary data may contain zero bytes and non-printable characters. Use `dbi_result_get_field_length` or `dbi_result_get_field_length_idx` to determine the number of bytes contained in the resulting binary string. The newly allocated memory may be modified by the host program, but the program is responsible for freeing the data. If the field contains a NULL value, the function returns a NULL pointer. In case of an error, this function returns the string "ERROR". In that case the error number is `DBI_ERROR_BADTYPE`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.8.19. `dbi_result_get_datetime`

```
time_t dbi_result_get_datetime(dbi_result Result, const char *fieldname);
```

Fetch the data stored in the specified field, which contains a DATE and/or TIME value.

Arguments

Result: The target query result.

fieldname: The name of the field to fetch.

Returns

The data stored in the specified field as a `time_t` value. To convert this into human-readable dates or times, use the C library functions `gmtime` (3) and `localtime` (3). In case of an error this function returns 0 (zero) which resolves to the Unix epoch when converted. In case of an error the error number is `DBI_ERROR_BADTYPE`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.8.20. `dbi_result_bind_char`

```
int dbi_result_bind_char(dbi_result Result, const char *fieldname, char *bindto);
```

Bind the specified variable to the specified field, which holds a character (a 1-byte signed integer). This is the default for the "char" type on the x86 platform, as well as on Mac OS X.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.21. dbi_result_bind_uchar

```
int dbi_result_bind_uchar(dbi_result Result, const char *fieldname, unsigned char
*bindto);
```

Bind the specified variable to the specified field, which holds an unsigned character (1-byte unsigned integer). This is the default for the "char" type on Linux for PowerPC.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.22. dbi_result_bind_short

```
int dbi_result_bind_short(dbi_result Result, const char *fieldname, short *bindto);
```

Bind the specified variable to the specified field, which holds a short integer (2-byte signed integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.23. dbi_result_bind_ushort

```
int dbi_result_bind_ushort(dbi_result Result, const char *fieldname, unsigned short *bindto);
```

Bind the specified variable to the specified field, which holds an unsigned short integer (2-byte unsigned integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.24. dbi_result_bind_int

```
int dbi_result_bind_int(dbi_result Result, const char *fieldname, long *bindto);
```

Bind the specified variable to the specified field, which holds an integer (4-byte signed integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.25. dbi_result_bind_uint

```
int dbi_result_bind_uint(dbi_result Result, const char *fieldname, unsigned long
*bindto);
```

Bind the specified variable to the specified field, which holds an unsigned long integer (4-byte unsigned integer).

Arguments

Result: The target query result.

fieldname: The name of the field to bind to.

bindto: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.26. dbi_result_bind_long

```
int dbi_result_bind_long(dbi_result Result, const char *fieldname, long *bindto);
```

The same as dbi_result_bind_int. The use of this function is deprecated as the name implies the wrong return type on 64-bit platforms.

4.8.27. dbi_result_bind_ulong

```
int dbi_result_bind_ulong(dbi_result Result, const char *fieldname, unsigned long
*bindto);
```

The same as `dbi_result_bind_uint`. The use of this function is deprecated as the name implies the wrong return type on 64-bit platforms.

4.8.28. `dbi_result_bind_longlong`

```
int dbi_result_bind_longlong(dbi_result Result, const char *fieldname, long long
*bindto);
```

Bind the specified variable to the specified field, which holds a long long integer (8-byte signed integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, `DBI_BIND_ERROR` if there was an error. Possible error numbers are `DBI_ERROR_BADPTR`, `DBI_ERROR_NOMEM`, and `DBI_ERROR_BADNAME`.

4.8.29. `dbi_result_bind_ulonglong`

```
int dbi_result_bind_ulonglong(dbi_result Result, const char *fieldname, unsigned long
long *bindto);
```

Bind the specified variable to the specified field, which holds an unsigned long long integer (8-byte unsigned integer).

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, `DBI_BIND_ERROR` if there was an error. Possible error numbers are `DBI_ERROR_BADPTR`, `DBI_ERROR_NOMEM`, and `DBI_ERROR_BADNAME`.

4.8.30. dbi_result_bind_float

```
int dbi_result_bind_float(dbi_result Result, const char *fieldname, float *bindto);
```

Bind the specified variable to the specified field, which holds a floating-point number.

Arguments

Result: The target query result.

fieldname: The name of the field to bind to.

bindto: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.31. dbi_result_bind_double

```
int dbi_result_bind_double(dbi_result Result, const char *fieldname, double *bindto);
```

Bind the specified variable to the specified field, which holds a double-precision fractional number.

Arguments

Result: The target query result.

fieldname: The name of the field to bind to.

bindto: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.32. dbi_result_bind_string

```
int dbi_result_bind_string(dbi_result Result, const char *fieldname, const char  
**bindto);
```

Bind the specified variable to the specified field, which holds a string. The string must not be modified.

Arguments

Result: The target query result.

fieldname: The name of the field to bind to.

bindto: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.33. dbi_result_bind_binary

```
int dbi_result_bind_binary(dbi_result Result, const char *fieldname, const unsigned
char **bindto);
```

Bind the specified variable to the specified field, which holds binary BLOB data. The data must not be modified.

Arguments

Result: The target query result.

fieldname: The name of the field to bind to.

bindto: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.34. dbi_result_bind_string_copy

```
int dbi_result_bind_string_copy(dbi_result Result, const char *fieldname, char
**bindto);
```

Bind the specified variable to the specified field, which holds a string. The newly allocated string may be modified by the host program, but the program is responsible for freeing the string.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.35. dbi_result_bind_binary_copy

```
int dbi_result_bind_binary_copy(dbi_result Result, const char *fieldname, unsigned
char **bindto);
```

Bind the specified variable to the specified field, which holds binary BLOB data. The newly allocated data may be modified by the host program, but the program is responsible for freeing the data.

Arguments

`Result`: The target query result.

`fieldname`: The name of the field to bind to.

`bindto`: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.8.36. dbi_result_bind_datetime

```
int dbi_result_bind_datetime(dbi_result Result, const char *fieldname, time_t
*bindto);
```

Bind the specified variable to the specified field, which holds a DATE and/or TIME value.

Arguments

Result: The target query result.

fieldname: The name of the field to bind to.

bindto: A pointer to the variable that will be updated with the specified field's value.

Returns

0 upon success, DBI_BIND_ERROR if there was an error. Possible error numbers are DBI_ERROR_BADPTR, DBI_ERROR_NOMEM, and DBI_ERROR_BADNAME.

4.9. Retrieving Field Data by Index

4.9.1. dbi_result_get_char_idx

```
signed char dbi_result_get_char_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a character (a 1-byte signed integer). This is the default for the "char" type on the x86 platform, as well as on Mac OS X.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.2. dbi_result_get_uchar_idx

```
unsigned char dbi_result_get_uchar_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains an unsigned character (1-byte unsigned integer). This is the default for the "char" type on Linux for PowerPC.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.3. dbi_result_get_short_idx

```
short dbi_result_get_short_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a short integer (2-byte signed integer).

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.4. dbi_result_get_ushort_idx

```
unsigned short dbi_result_get_ushort_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains an unsigned short integer (2-byte unsigned integer).

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.5. dbi_result_get_int_idx

```
int dbi_result_get_int_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains an integer (4-byte signed integer).

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.6. dbi_result_get_uint_idx

```
unsigned int dbi_result_get_uint_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains an unsigned integer (4-byte signed integer).

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.7. dbi_result_get_long_idx

```
int dbi_result_get_long_idx(dbi_result Result, unsigned int fieldidx);
```

Same as `dbi_result_get_int_idx`. This function is deprecated as the name implies the wrong return type on 64bit platforms.

4.9.8. dbi_result_get_ulong_idx

```
unsigned int dbi_result_get_ulong_idx(dbi_result Result, unsigned int fieldidx);
```

Same as `dbi_result_get_uint_idx`. This function is deprecated as the name implies the wrong return type on 64bit platforms.

4.9.9. dbi_result_get_longlong_idx

```
long long dbi_result_get_longlong_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a long long integer (8-byte signed integer).

Arguments

`Result`: The target query result.

`fieldidx`: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is `DBI_ERROR_BADTYPE` or `DBI_ERROR_BADIDX`.

4.9.10. dbi_result_get_ulonglong_idx

```
unsigned long long dbi_result_get_ulonglong_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains an unsigned long long integer (8-byte unsigned integer).

Arguments

`Result`: The target query result.

`fieldidx`: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.11. dbi_result_get_float_idx

```
float dbi_result_get_float_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a floating-point number.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.12. dbi_result_get_double_idx

```
double dbi_result_get_double_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a double-precision fractional number.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field, or 0 (zero) if an error occurs. In the latter case the error number is DBI_ERROR_BADTYPE or DBI_ERROR_BADIDX.

4.9.13. `dbi_result_get_string_idx`

```
const char *dbi_result_get_string_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a zero-terminated string.

Arguments

`Result`: The target query result.

`fieldidx`: The index of the target field (starting at 1).

Returns

The data stored in the specified field. If the field contains a NULL value, the function returns a NULL pointer. The string may not be modified, and may not necessarily persist between row fetches. In case of an error, this function returns the string "ERROR". In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.9.14. `dbi_result_get_string_copy_idx`

```
char *dbi_result_get_string_copy_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a zero-terminated string, and return it in an allocated buffer.

Arguments

`Result`: The target query result.

`fieldidx`: The index of the target field (starting at 1).

Returns

The data stored in the specified field. If the field contains a NULL value, the function returns a NULL pointer, and no memory is allocated. The newly allocated string may be modified by the host program, but the program is responsible for freeing the string. In case of an error, this function returns an allocated string reading "ERROR". In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.9.15. `dbi_result_get_binary_idx`

```
const unsigned char *dbi_result_get_binary_idx(dbi_result Result, unsigned int
fieldidx);
```

Fetch the data stored in the specified field, which contains binary data. The data may not be modified, and may not necessarily persist between row fetches. If the field contains a NULL value, the function returns a NULL pointer. In case of an error, this function returns the string "ERROR".

Arguments

`Result`: The target query result.

`fieldidx`: The index of the target field (starting at 1).

Returns

The data stored in the specified field. The binary data may contain zero bytes and non-printable characters. Use `dbi_result_get_field_length` or `dbi_result_get_field_length_idx` to determine the number of bytes contained in the resulting binary string. The data may not be modified, and may not necessarily persist between row fetches. If the field contains a NULL value, the function returns a NULL pointer. In case of an error, this function returns the string "ERROR". In the latter case the error number is `DBI_ERROR_BADTYPE`, `DBI_ERROR_BADIDX`, or `DBI_ERROR_BADNAME`.

4.9.16. `dbi_result_get_binary_copy_idx`

```
unsigned char *dbi_result_get_binary_copy_idx(dbi_result Result, unsigned int
fieldidx);
```

Fetch the data stored in the specified field, which contains binary data, and return it in an allocated buffer. The newly allocated memory may be modified by the host program, but the program is responsible for freeing the data. If the field contains a NULL value, the function returns a NULL pointer. In case of an error, this function returns the string "ERROR".

Arguments

`Result`: The target query result.

`fieldidx`: The index of the target field (starting at 1).

Returns

The data stored in the specified field. The newly allocated memory may be modified by the host program, but the program is responsible for freeing the data. If the field contains a NULL value, the function returns a NULL

pointer. In case of an error, this function returns the string "ERROR". In the latter case the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

4.9.17. dbi_result_get_datetime_idx

```
time_t dbi_result_get_datetime_idx(dbi_result Result, unsigned int fieldidx);
```

Fetch the data stored in the specified field, which contains a DATE and/or TIME value.

Arguments

Result: The target query result.

fieldidx: The index of the target field (starting at 1).

Returns

The data stored in the specified field as a `time_t` value. To convert this into human-readable dates or times, use the C library functions `gmtime` (3) and `localtime` (3). In case of an error this function returns 0 (zero) which resolves to the Unix epoch when converted. In case of an error the error number is DBI_ERROR_BADTYPE, DBI_ERROR_BADIDX, or DBI_ERROR_BADNAME.

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Version 1.1, March 2000

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