



## ***Rocky Enterprise Linux 9.2 Manual Pages on command 'crypt\_rn.3'***

**C:\>man crypt\_rn.3**

CRYPT(3) BSD Library Functions Manual CRYPT(3)

### NAME

crypt, crypt\_r, crypt\_rn, crypt\_ra ? passphrase hashing

### LIBRARY

Crypt Library (libcrypt, -lcrypt)

### SYNOPSIS

```
#include <crypt.h>
```

```
char *
```

```
crypt(const char *phrase, const char *setting);
```

```
char *
```

```
crypt_r(const char *phrase, const char *setting, struct crypt_data *data);
```

```
char *
```

```
crypt_rn(const char *phrase, const char *setting, struct crypt_data *data, int size);
```

```
char *
```

```
crypt_ra(const char *phrase, const char *setting, void **data, int *size);
```

### DESCRIPTION

The crypt, crypt\_r, crypt\_rn, and crypt\_ra functions irreversibly ?hash? phrase for storage in the system password database (shadow(5)) using a cryptographic ?hashing method.? The result of this operation is called a ?hashed passphrase? or just a ?hash.? Hashing methods are described in crypt(5).

setting controls which hashing method to use, and also supplies various parameters to the chosen method, most importantly a random ?salt? which ensures that no two stored

hashes are the same, even if the phrase strings are the same.

The data argument to `crypt_r` is a structure of type `struct crypt_data`. It has at least these fields:

```
struct crypt_data {
    char output[CRYPT_OUTPUT_SIZE];
    char setting[CRYPT_OUTPUT_SIZE];
    char phrase[CRYPT_MAX_PASSPHRASE_SIZE];
    char initialized;
};
```

Upon a successful return from `crypt_r`, the hashed passphrase will be stored in `output`. Applications are encouraged, but not required, to use the `phrase` and `setting` fields to store the strings that they will pass as `phrase` and `setting` to `crypt_r`.

This will make it easier to erase all sensitive data after it is no longer needed.

The `initialized` field must be set to zero before the first time a `struct crypt_data` object is first used in a call to `crypt_r()`. We recommend zeroing the entire object, not just `initialized` and not just the documented fields, before the first use. (Of course, do this before storing anything in `setting` and `phrase`.)

The data argument to `crypt_rn` should also point to a `struct crypt_data` object, and `size` should be the size of that object, cast to `int`. When used with `crypt_rn`, the entire data object (except for the `phrase` and `setting` fields) must be zeroed before its first use; this is not just a recommendation, as it is for `crypt_r`. Otherwise, the fields of the object have the same uses that they do for `crypt_r`.

On the first call to `crypt_ra`, `data` should be the address of a `void *` variable set to `NULL`, and `size` should be the address of an `int` variable set to zero. `crypt_ra` will allocate and initialize a `struct crypt_data` object, using `malloc(3)`, and write its address and `size` into the variables pointed to by `data` and `size`. These can be reused in subsequent calls. After the application is done hashing passphrases, it should deallocate the `struct crypt_data` object using `free(3)`.

## RETURN VALUES

Upon successful completion, `crypt`, `crypt_r`, `crypt_rn`, and `crypt_ra` return a pointer to a string which encodes both the hashed passphrase, and the settings that were used to encode it. This string is directly usable as `setting` in other calls to `crypt`, `crypt_r`, `crypt_rn`, and `crypt_ra`, and as `prefix` in calls to `crypt_gensalt`,

crypt\_gensalt\_rn, and crypt\_gensalt\_ra. It will be entirely printable ASCII, and will not contain whitespace or the characters ?:?, ?;?, ?\*?, ?!?, or ?\?. See crypt(5) for more detail on the format of hashed passphrases.

crypt places its result in a static storage area, which will be overwritten by subsequent calls to crypt. It is not safe to call crypt from multiple threads simultaneously.

crypt\_r, crypt\_rn, and crypt\_ra place their result in the output field of their data argument. It is safe to call them from multiple threads simultaneously, as long as a separate data object is used for each thread.

Upon error, crypt\_r, crypt\_rn, and crypt\_ra write an invalid hashed passphrase to the output field of their data argument, and crypt writes an invalid hash to its static storage area. This string will be shorter than 13 characters, will begin with a ?\*?, and will not compare equal to setting.

Upon error, crypt\_rn and crypt\_ra return a null pointer. crypt\_r and crypt may also return a null pointer, or they may return a pointer to the invalid hash, depending on how libcrypt was configured. (The option to return the invalid hash is for compatibility with old applications that assume that crypt cannot return a null pointer.

See PORTABILITY NOTES below.)

All four functions set errno when they fail.

## ERRORS

**EINVAL** setting is invalid, or requests a hashing method that is not supported.

**ERANGE** phrase is too long (more than CRYPT\_MAX\_PASSPHRASE\_SIZE characters; some hashing methods may have lower limits).  
crypt\_rn only: size is too small for the hashing method requested by setting.

**ENOMEM** Failed to allocate internal scratch memory.  
crypt\_ra only: failed to allocate memory for data.

## ENOSYS or EOPNOTSUPP

Hashing passphrases is not supported at all on this installation, or the hashing method requested by setting is not supported.

These error codes are not used by this version of libcrypt, but may be encountered on other systems.

## PORTABILITY NOTES

crypt is included in POSIX, but crypt\_r, crypt\_rn, and crypt\_ra are not part of any standard.

POSIX does not specify any hashing methods, and does not require hashed passphrases to be portable between systems. In practice, hashed passphrases are portable as long as both systems support the hashing method that was used. However, the set of supported hashing methods varies considerably from system to system.

The behavior of crypt on errors isn't well standardized. Some implementations simply can't fail (except by crashing the program), others return a null pointer or a fixed string. Most implementations don't set errno, but some do. POSIX specifies returning a null pointer and setting errno, but it defines only one possible error, ENOSYS, in the case where crypt is not supported at all. Some older applications are not prepared to handle null pointers returned by crypt. The behavior described above for this implementation, setting errno and returning an invalid hashed passphrase different from setting, is chosen to make these applications fail closed when an error occurs.

Due to historical restrictions on the export of cryptographic software from the USA, crypt is an optional POSIX component. Applications should therefore be prepared for crypt not to be available, or to always fail (setting errno to ENOSYS) at runtime.

POSIX specifies that crypt is declared in <unistd.h>, but only if the macro \_XOPEN\_CRYPT is defined and has a value greater than or equal to zero. Since libcrypt does not provide <unistd.h>, it declares crypt, crypt\_r, crypt\_rn, and crypt\_ra in <crypt.h> instead.

On a minority of systems (notably recent versions of Solaris), crypt uses a thread-specific static storage buffer, which makes it safe to call from multiple threads simultaneously, but does not prevent each call within a thread from overwriting the results of the previous one.

## BUGS

Some implementations of crypt, upon error, return an invalid hash that is stored in a read-only location or only initialized once, which means that it is only safe to erase the buffer pointed to by the crypt return value if an error did not occur.

struct crypt\_data may be quite large (32kB in this implementation of libcrypt; over 128kB in some other implementations). This is large enough that it may be unwise to

allocate it on the stack.

Some recently designed hashing methods need even more scratch memory, but the crypt\_r interface makes it impossible to change the size of struct crypt\_data without breaking binary compatibility. The crypt\_rn interface could accommodate larger allocations for specific hashing methods, but the caller of crypt\_rn has no way of knowing how much memory to allocate. crypt\_ra does the allocation itself, but can only make a single call to malloc(3).

## ATTRIBUTES

For an explanation of the terms used in this section, see attributes(7).

??

?Interface ? Attribute ? Value ?

??

?crypt ? Thread safety ? MT-Unsafe race:crypt ?

??

?crypt\_r, crypt\_rn, ? Thread safety ? MT-Safe ?

?crypt\_ra ? ? ?

??

## HISTORY

A rotor-based crypt function appeared in Version 6 AT&T UNIX. The ?traditional? DES-based crypt first appeared in Version 7 AT&T UNIX.

crypt\_r originates with the GNU C Library. There's also a crypt\_r function on HP-UX and MKS Toolkit, but the prototypes and semantics differ.

crypt\_rn and crypt\_ra originate with the Openwall project.

## SEE ALSO

crypt\_gensalt(3), getpass(3), getpwent(3), shadow(3), login(1), passwd(1), crypt(5), passwd(5), shadow(5), pam(8)

Openwall Project

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Openwall Project