

NAME

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mifare_desfire_connect,                mifare_desfire_disconnect.
mifare_desfire_authenticate,           mifare_desfire_authenticate_aes,
mifare_desfire_authenticate_iso,       mifare_desfire_change_key_settings,
mifare_desfire_get_key_settings,        mifare_desfire_change_key,
mifare_desfire_get_key_version,         mifare_desfire_create_application,
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mifare_desfire_free_application_ids,    mifare_desfire_get_df_names,
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mifare_desfire_set_ats,                 mifare_desfire_get_card_uid,
mifare_desfire_get_file_ids,            mifare_desfire_get_iso_file_ids,
mifare_desfire_get_file_settings,       mifare_desfire_change_file_settings,
mifare_desfire_create_std_data_file,
mifare_desfire_create_std_data_file_iso,
mifare_desfire_create_backup_data_file,
mifare_desfire_create_backup_data_file_iso,
mifare_desfire_create_value_file,
mifare_desfire_create_linear_record_file,
mifare_desfire_create_linear_record_file_iso,
mifare_desfire_create_cyclic_record_file,
mifare_desfire_create_cyclic_record_file_iso,
mifare_desfire_delete_file,             mifare_desfire_read_data,
mifare_desfire_read_data_ex,            mifare_desfire_write_data,
mifare_desfire_write_data_ex,           mifare_desfire_get_value,
mifare_desfire_get_value_ex,            mifare_desfire_credit,
mifare_desfire_credit_ex, mifare_desfire_debit, mifare_desfire_debit_ex,
mifare_desfire_limited_credit,          mifare_desfire_limited_credit_ex,
mifare_desfire_write_record,            mifare_desfire_write_record_ex,
mifare_desfire_read_records,            mifare_desfire_read_records_ex,
mifare_desfire_clear_record_file,       mifare_desfire_commit_transaction,
mifare_desfire_abort_transaction, — Mifare DESFire Manipulation Functions

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LIBRARY

Mifare card manipulation library (libfreefare, -lfreefare)

SYNOPSIS

```

#include <freefare.h>

int
mifare_desfire_connect(MifareTag tag);

int
mifare_desfire_disconnect(MifareTag tag);

int
mifare_desfire_authenticate(MifareTag tag, uint8_t key_no,
    MifareDESFireKey key);

int
mifare_desfire_authenticate_aes(MifareTag tag, uint8_t key_no,
    MifareDESFireKey key);

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int
mifare_desfire_authenticate_iso(MifareTag tag, uint8_t key_no,
    MifareDESFireKey key);

int
mifare_desfire_change_key_settings(MifareTag tag, uint8_t settings);

int
mifare_desfire_get_key_settings(MifareTag tag, uint8_t *settings,
    uint8_t *max_keys);

int
mifare_desfire_change_key(MifareTag tag, uint8_t key_no,
    MifareDESFireKey new_key, MifareDESFireKey old_key);

int
mifare_desfire_get_key_version(MifareTag tag, uint8_t key_no,
    uint8_t *version);

int
mifare_desfire_create_application(MifareTag tag, MifareDESFireAID aid,
    uint8_t settings, uint8_t key_no);

int
mifare_desfire_create_application_aes(MifareTag tag,
    MifareDESFireAID aid, uint8_t settings, uint8_t key_no);

int
mifare_desfire_create_application_3k3des(MifareTag tag,
    MifareDESFireAID aid, uint8_t settings, uint8_t key_no);

int
mifare_desfire_create_application_iso(MifareTag tag,
    MifareDESFireAID aid, uint8_t settings, uint8_t key_no,
    int want_iso_file_identifiers, uint16_t iso_file_id,
    uint8_t *iso_file_name, size_t iso_file_name_len);

int
mifare_desfire_create_application_3k3des_iso(MifareTag tag,
    MifareDESFireAID aid, uint8_t settings, uint8_t key_no,
    int want_iso_file_identifiers, uint16_t iso_file_id,
    uint8_t *iso_file_name, size_t iso_file_name_len);

int
mifare_desfire_create_application_aes_iso(MifareTag tag,
    MifareDESFireAID aid, uint8_t settings, uint8_t key_no,
    int want_iso_file_identifiers, uint16_t iso_file_id,
    uint8_t *iso_file_name, size_t iso_file_name_len);

int
mifare_desfire_delete_application(MifareTag tag, MifareDESFireAID aid);

int
mifare_desfire_get_application_ids(MifareTag tag,
    MifareDESFireAID *aids[], size_t *count);

void
mifare_desfire_free_application_ids(MifareDESFireAID aids[]);

int
mifare_desfire_get_df_names(MifareTag tag, MifareDESFireDF *dfs[],
    size_t *count);

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int
mifare_desfire_select_application(MifareTag tag, MifareDESFireAID aid);

int
mifare_desfire_format_picc(MifareTag tag);

int
mifare_desfire_get_version(MifareTag tag,
    struct mifare_desfire_version_info *version_info);

int
mifare_desfire_free_mem(MifareTag tag, uint32_t *size);

int
mifare_desfire_set_configuration(MifareTag tag, bool disable_format,
    bool enable_random_uid);

int
mifare_desfire_set_default_key(MifareTag tag, MifareDESFireKey key);

int
mifare_desfire_set_ats(MifareTag tag, uint8_t *ats);

int
mifare_desfire_get_card_uid(MifareTag tag, char **uid);

int
mifare_desfire_get_file_ids(MifareTag tag, uint8_t *files[],
    size_t *count);

int
mifare_desfire_get_iso_file_ids(MifareTag tag, uint16_t *files[],
    size_t *count);

int
mifare_desfire_get_file_settings(MifareTag tag, uint8_t file_no,
    struct mifare_desfire_file_settings *settings);

int
mifare_desfire_change_file_settings(MifareTag tag, uint8_t file_no,
    uint8_t communication_settings, uint16_t access_rights);

int
mifare_desfire_create_std_data_file(MifareTag tag, uint8_t file_no,
    uint8_t communication_settings, uint16_t access_rights,
    uint32_t file_size);

int
mifare_desfire_create_std_data_file_iso(MifareTag tag, uint8_t file_no,
    uint8_t communication_settings, uint16_t access_rights,
    uint32_t file_size, uint16_t iso_file_id);

int
mifare_desfire_create_backup_data_file(MifareTag tag, uint8_t file_no,
    uint8_t communication_settings, uint16_t access_rights,
    uint32_t file_size);

int
mifare_desfire_create_backup_data_file_iso(MifareTag tag,
    uint8_t file_no, uint8_t communication_settings,
    uint16_t access_rights, uint32_t file_size, uint16_t iso_file_id);

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int
mifare_desfire_create_value_file(MifareTag tag, uint8_t file_no,
    uint8_t communication_settings, uint16_t access_rights,
    int32_t lower_limit, int32_t upper_limit, int32_t value,
    uint8_t limited_credit_enable);

int
mifare_desfire_create_linear_record_file(MifareTag tag,
    uint8_t file_no, uint8_t communication_settings,
    uint16_t access_rights, uint32_t record_size,
    uint32_t max_number_of_records);

int
mifare_desfire_create_linear_record_file_iso(MifareTag tag,
    uint8_t file_no, uint8_t communication_settings,
    uint16_t access_rights, uint32_t record_size,
    uint32_t max_number_of_records);

int
mifare_desfire_create_cyclic_record_file(MifareTag tag,
    uint8_t file_no, uint8_t communication_settings,
    uint16_t access_rights, uint32_t record_size,
    uint32_t max_number_of_records, uint16_t iso_file_id);

int
mifare_desfire_create_cyclic_record_file_iso(MifareTag tag,
    uint8_t file_no, uint8_t communication_settings,
    uint16_t access_rights, uint32_t record_size,
    uint32_t max_number_of_records, uint16_t iso_file_id);

int
mifare_desfire_delete_file(MifareTag tag, uint8_t file_no);

ssize_t
mifare_desfire_read_data(MifareTag tag, uint8_t file_no, off_t offset,
    size_t length, void *data);

ssize_t
mifare_desfire_read_data_ex(MifareTag tag, uint8_t file_no,
    off_t offset, size_t length, void *data, int cs);

ssize_t
mifare_desfire_write_data(MifareTag tag, uint8_t file_no, off_t offset,
    size_t length, void *data);

ssize_t
mifare_desfire_write_data_ex(MifareTag tag, uint8_t file_no,
    off_t offset, size_t length, void *data, int cs);

int
mifare_desfire_get_value(MifareTag tag, uint8_t file_no, int32_t *value);

int
mifare_desfire_get_value_ex(MifareTag tag, uint8_t file_no,
    int32_t *value, int cs);

int
mifare_desfire_credit(MifareTag tag, uint8_t file_no, int32_t amount);

int
mifare_desfire_credit_ex(MifareTag tag, uint8_t file_no, int32_t amount,
    int cs);

```



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int
mifare_desfire_debit(MifareTag tag, uint8_t file_no, int32_t amount);

int
mifare_desfire_debit_ex(MifareTag tag, uint8_t file_no, int32_t amount,
    int cs);

int
mifare_desfire_limited_credit(MifareTag tag, uint8_t file_no,
    int32_t amount);

int
mifare_desfire_limited_credit_ex(MifareTag tag, uint8_t file_no,
    int32_t amount, int cs);

ssize_t
mifare_desfire_write_record(MifareTag tag, uint8_t file_no,
    off_t offset, size_t length, void *data);

ssize_t
mifare_desfire_write_record_ex(MifareTag tag, uint8_t file_no,
    off_t offset, size_t length, void *data, int cs);

ssize_t
mifare_desfire_read_records(MifareTag tag, uint8_t file_no,
    off_t offset, size_t length, void *data);

ssize_t
mifare_desfire_read_records_ex(MifareTag tag, uint7_t file_no,
    off_t offset, size_t length, void *data, int cs);

int
mifare_desfire_clear_record_file(MifareTag tag, uint8_t file_no);

int
mifare_desfire_commit_transaction(MifareTag tag);

int
mifare_desfire_abort_transaction(MifareTag tag);

```

DESCRIPTION

The **mifare_desfire_***() functions allows management of Mifare DESFire tags.

Card-level operations

The **mifare_desfire_connect()** and **mifare_desfire_disconnect()** functions activates and deactivates the provided *tag*. All **mifare_desfire_***() functions that operates on a *tag* require it to be on activated.

After activation, the selected application is the master application. It is possible to select another application using the **mifare_desfire_select_application()** function (see bellow).

The **mifare_desfire_get_version()** function retrieve various information about the provided *tag*, including UID, batch number, production date, and hardware and software information. Refer to the `freemfare.h` header file for details about the *version_info* field.

The **mifare_desfire_free_mem()** functions returns the *size* of the free memory on the PICC (in bytes).

The **mifare_desfire_set_configuration()** function can be used to deactivate the format function when setting *disable_format* to a value different from 0, or switch the card to use random UDI setting *enable_random_uid* to a non-zero value.



The `mifare_desfire_set_default_key` function sets the *key* argument as the default key for new applications.

The `mifare_desfire_set_ats` function replace the ATS bytes returned by PICC when it is selected.

The `mifare_desfire_get_card_uid` function can be used with a PICC configured for using random UID to retrieve the original UID of the target.

The `mifare_desfire_format_picc()` function resets *tag* to factory defaults. For this function to work, a previous authentication with the card master key is required.

Application-level operations

The `mifare_desfire_select_application()` function makes the application identified by *aid* the active one. Further file operations will be performed in the context of this application. After a call to `mifare_desfire_connect`, the default application is the card master application. It can be selected again calling the `mifare_desfire_select_application()` function either with an *aid* with all its fields set to 0, or by providing the NULL *aid*.

The `mifare_desfire_authenticate()` function performs an authentication using the key number *key_no* on the card and the *key* (3)DES key on *tag*.

The `mifare_desfire_authenticate_aes()` function performs an authentication using an AES *key*.

The `mifare_desfire_authenticate_iso()` function performs an ISO authentication using either a 3DES or a 3K3DES *key*.

The `mifare_desfire_get_key_settings()` function, returns the *settings* and the number of keys *max_keys* of the selected application.

The `mifare_desfire_change_key_settings()` function changes the selected application settings to *settings*. The application number of keys cannot be changed after the application has been created.

The `mifare_desfire_change_key()` changes the key *key_no* from *old_key* to *new_key* on *tag*. Depending on the application settings, a previous authentication with the same key or another key may be required.

The `mifare_desfire_get_key_version()` function retrieves the *version* of the key with number *key_no* of the selected application.

The `mifare_desfire_create_application()` function, creates an application with AID *aid*, the *settings* key settings and *key_no* authentication keys. Authentication keys are set to 0 after creation.

The `mifare_desfire_create_application_3k3des()` and `mifare_desfire_create_application_aes()` functions acts as the `mifare_desfire_create_application()` function except that the whole application is configured to use 3K3DES or AES keys. It is possible to achieve the same result using the `mifare_desfire_create_application()` function and ORing the *key_no* argument with `APPLICATION_CRYPT0_3K3DES` or `APPLICATION_CRYPT0_AES` respectively.

The `mifare_desfire_create_application_iso()` acts as the `mifare_desfire_create_application()` function but allows one to specify if the created files within the application shall have an ISO file identifier setting *want_iso_file_identifiers* to a non-NULL value, a DF can be provided using *iso_file_id*, as long as an optional file name *iso_file_name* of length *iso_file_name_len* (in bytes).

The `mifare_desfire_create_application_3k3des_iso()` and `mifare_desfire_create_application_aes_iso()` function acts as the regular `mifare_desfire_create_application_3k3des()` and `mifare_desfire_create_application_aes()` functions, providing the same extensions ISO parameters of `mifare_desfire_create_application_iso()`.



The **mifare_desfire_delete_application()** deletes the application identified by AID *aid*.

The **mifare_desfire_get_application_ids()** function returns a list of all applications of the card. The *aids* array has to be freed after usage calling **mifare_desfire_free_application_ids()**.

The **mifare_desfire_get_df_names()** retrieves the list of DF *dfs* from *tag* and set *count* to the number of items in the allocated array. Memory has to be freed by the user using **free(3)**.

File-level operations

The **mifare_desfire_get_file_ids()** function returns the list of *count* files in the selected application as *files*. The memory allocated for *files* has to be reclaimed using **free(3)**.

The **mifare_desfire_get_iso_file_ids()** function returns the list of *count* file ISO identifiers as *files*. The memory allocated for *files* has to be reclaimed using **free(3)**.

The **mifare_desfire_get_file_settings()** function retrieves the *settings* of the file *file_no* of the selected application of *tag*.

The **mifare_desfire_change_file_settings()** function change the *communication_settings* and *access_rights* of the file *file_no* of the selected application of *tag*.

The **mifare_desfire_create_***() family of functions create a new file *file_no* with the provided *communication_settings* and *access_rights* on *tag*.

mifare_desfire_create_std_data_file()
creates a standard data file of size *file_size*.

mifare_desfire_create_backup_data_file()
creates a backup data file of size *file_size*.

mifare_desfire_create_value_file()
creates a value file of value *value* constrained in the range *lower_limit* *upper_limit*, and with the *limited_credit_enable* settings.

mifare_desfire_create_linear_record_file()
creates a linear record file that can hold *max_number_of_records* records of size *record_size*.

mifare_desfire_create_cyclic_record_file()
creates a cyclic record file that can hold *max_number_of_records* records of size *record_size*.

The **mifare_desfire_create_*_iso()** family of functions acts as the functions without the *_iso* suffix but provide an additional argument *iso_file_id*.

The **mifare_desfire_delete_file()** removes the file *file_no* from the selected application of *tag*.

Data-level operations

The **mifare_desfire_read_data()** function reads *length* bytes of data from offset *offset* of the file *file_no* and copies it to *data*. If *length* is set to 0, the file is read to end. The function returns the number of bytes read.

The **mifare_desfire_write_data()** function writes *length* bytes of data from offset *offset* of the file *file_no* and copies it to *data*. The function returns the number of bytes written.

The **mifare_desfire_get_value()** reads the *value* of the file *file_no* of the selected application.

The **mifare_desfire_credit()** function adds *amount* to the value of the file *file_no* of the selected application.



The **mifare_desfire_debit()** function subtracts *amount* to the value of the file *file_no* of the selected application.

to the value of the file *file_no* of the selected application.

The **mifare_desfire_limited_credit()** function adds *amount* to the value of the file *file_no* of the selected application.

The **mifare_desfire_write_record()** function writes *length* records starting at record *offset* of *data* in the file *file_no* and returns the number of bytes written.

The **mifare_desfire_read_records()** function reads *length* records starting at record *offset* from the file *file_no* and copy them to *data*, returning the number of bytes read.

The **mifare_desfire_clear_record_file()** function erase all records from the file *file_no* of the selected application.

The **mifare_desfire_commit_transaction()** validates the set of pending changes on the *tag*, while the **mifare_desfire_abort_transaction()** rollbacks the changes.

All data-manipulation functions that read data from and write data to files come with an ***_ex()** variant (e.g. **mifare_desfire_read_data_ex()**) which accepts an extra parameter *CS* that defines the communication settings to use. If not provided, the library will try to read-out this value from the file's configuration. Because reading this information may be denied, the ***_ex()** variant of functions still allows using the library for advanced usage.

RETURN VALUES

Unless stated otherwise, all other functions return a value greater than or equal to 0 on success or -1 on failure.

SEE ALSO

freefare(3)

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