

**NAME**

RSA\_public\_encrypt, RSA\_private\_decrypt - RSA public key cryptography

**SYNOPSIS**

```
#include <openssl/rsa.h>
```

The following functions have been deprecated since OpenSSL 3.0, and can be hidden entirely by defining **OPENSSL\_API\_COMPAT** with a suitable version value, see **openssl\_user\_macros(7)**:

```
int RSA_public_encrypt(int flen, const unsigned char *from,  
                      unsigned char *to, RSA *rsa, int padding);
```

```
int RSA_private_decrypt(int flen, const unsigned char *from,  
                      unsigned char *to, RSA *rsa, int padding);
```

**DESCRIPTION**

Both of the functions described on this page are deprecated. Applications should instead use **EVP\_PKEY\_encrypt\_init\_ex(3)**, **EVP\_PKEY\_encrypt(3)**, **EVP\_PKEY\_decrypt\_init\_ex(3)** and **EVP\_PKEY\_decrypt(3)**.

**RSA\_public\_encrypt()** encrypts the **flen** bytes at **from** (usually a session key) using the public key **rsa** and stores the ciphertext in **to**. **to** must point to **RSA\_size(rsa)** bytes of memory.

**padding** denotes one of the following modes:

**RSA\_PKCS1\_PADDING**

PKCS #1 v1.5 padding. This currently is the most widely used mode. However, it is highly recommended to use **RSA\_PKCS1\_OAEP\_PADDING** in new applications. SEE WARNING BELOW.

**RSA\_PKCS1\_OAEP\_PADDING**

EME-OAEP as defined in PKCS #1 v2.0 with SHA-1, MGF1 and an empty encoding parameter. This mode is recommended for all new applications.

**RSA\_NO\_PADDING**

Raw RSA encryption. This mode should *only* be used to implement cryptographically sound padding modes in the application code. Encrypting user data directly with RSA is insecure.

**flen** must not be more than **RSA\_size(rsa) - 11** for the PKCS #1 v1.5 based padding modes, not more than **RSA\_size(rsa) - 42** for **RSA\_PKCS1\_OAEP\_PADDING** and exactly **RSA\_size(rsa)** for

**RSA\_NO\_PADDING**. When a padding mode other than **RSA\_NO\_PADDING** is in use, then **RSA\_public\_encrypt()** will include some random bytes into the ciphertext and therefore the ciphertext will be different each time, even if the plaintext and the public key are exactly identical. The returned ciphertext in **to** will always be zero padded to exactly **RSA\_size(rsa)** bytes. **to** and **from** may overlap.

**RSA\_private\_decrypt()** decrypts the **flen** bytes at **from** using the private key **rsa** and stores the plaintext in **to**. **flen** should be equal to **RSA\_size(rsa)** but may be smaller, when leading zero bytes are in the ciphertext. Those are not important and may be removed, but **RSA\_public\_encrypt()** does not do that. **to** must point to a memory section large enough to hold the maximal possible decrypted data (which is equal to **RSA\_size(rsa)** for **RSA\_NO\_PADDING**, **RSA\_size(rsa) - 11** for the PKCS #1 v1.5 based padding modes and **RSA\_size(rsa) - 42** for **RSA\_PKCS1\_OAEP\_PADDING**). **padding** is the padding mode that was used to encrypt the data. **to** and **from** may overlap.

## RETURN VALUES

**RSA\_public\_encrypt()** returns the size of the encrypted data (i.e., **RSA\_size(rsa)**).

**RSA\_private\_decrypt()** returns the size of the recovered plaintext. A return value of 0 is not an error and means only that the plaintext was empty.

On error, -1 is returned; the error codes can be obtained by **ERR\_get\_error(3)**.

## WARNINGS

Decryption failures in the **RSA\_PKCS1\_PADDING** mode leak information which can potentially be used to mount a Bleichenbacher padding oracle attack. This is an inherent weakness in the PKCS #1 v1.5 padding design. Prefer **RSA\_PKCS1\_OAEP\_PADDING**.

## CONFORMING TO

SSL, PKCS #1 v2.0

## SEE ALSO

**ERR\_get\_error(3)**, **RAND\_bytes(3)**, **RSA\_size(3)**

## HISTORY

Both of these functions were deprecated in OpenSSL 3.0.

## COPYRIGHT

Copyright 2000-2021 The OpenSSL Project Authors. All Rights Reserved.

Licensed under the Apache License 2.0 (the "License"). You may not use this file except in compliance with the License. You can obtain a copy in the file **LICENSE** in the source distribution or at <https://www.openssl.org/source/license.html>.