

**NAME**

EVP\_EC\_gen, EC\_KEY\_get\_method, EC\_KEY\_set\_method, EC\_KEY\_new\_ex, EC\_KEY\_new, EC\_KEY\_get\_flags, EC\_KEY\_set\_flags, EC\_KEY\_clear\_flags, EC\_KEY\_new\_by\_curve\_name\_ex, EC\_KEY\_new\_by\_curve\_name, EC\_KEY\_free, EC\_KEY\_copy, EC\_KEY\_dup, EC\_KEY\_up\_ref, EC\_KEY\_get0\_engine, EC\_KEY\_get0\_group, EC\_KEY\_set\_group, EC\_KEY\_get0\_private\_key, EC\_KEY\_set\_private\_key, EC\_KEY\_get0\_public\_key, EC\_KEY\_set\_public\_key, EC\_KEY\_get\_conv\_form, EC\_KEY\_set\_conv\_form, EC\_KEY\_set\_asn1\_flag, EC\_KEY\_decoded\_from\_explicit\_params, EC\_KEY\_precompute\_mult, EC\_KEY\_generate\_key, EC\_KEY\_check\_key, EC\_KEY\_set\_public\_key\_affine\_coordinates, EC\_KEY\_oct2key, EC\_KEY\_key2buf, EC\_KEY\_oct2priv, EC\_KEY\_priv2oct, EC\_KEY\_priv2buf - Functions for creating, destroying and manipulating EC\_KEY objects

**SYNOPSIS**

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

```
EVP_PKEY *EVP_EC_gen(const char *curve);
```

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)**:

```
EC_KEY *EC_KEY_new_ex(OSSL_LIB_CTX *ctx, const char *propq);
EC_KEY *EC_KEY_new(void);
int EC_KEY_get_flags(const EC_KEY *key);
void EC_KEY_set_flags(EC_KEY *key, int flags);
void EC_KEY_clear_flags(EC_KEY *key, int flags);
EC_KEY *EC_KEY_new_by_curve_name_ex(OSSL_LIB_CTX *ctx, const char *propq,
                                   int nid);
EC_KEY *EC_KEY_new_by_curve_name(int nid);
void EC_KEY_free(EC_KEY *key);
EC_KEY *EC_KEY_copy(EC_KEY *dst, const EC_KEY *src);
EC_KEY *EC_KEY_dup(const EC_KEY *src);
int EC_KEY_up_ref(EC_KEY *key);
ENGINE *EC_KEY_get0_engine(const EC_KEY *eckey);
const EC_GROUP *EC_KEY_get0_group(const EC_KEY *key);
int EC_KEY_set_group(EC_KEY *key, const EC_GROUP *group);
const BIGNUM *EC_KEY_get0_private_key(const EC_KEY *key);
int EC_KEY_set_private_key(EC_KEY *key, const BIGNUM *priv_key);
const EC_POINT *EC_KEY_get0_public_key(const EC_KEY *key);
int EC_KEY_set_public_key(EC_KEY *key, const EC_POINT *pub);
point_conversion_form_t EC_KEY_get_conv_form(const EC_KEY *key);
```

```

void EC_KEY_set_conv_form(EC_KEY *eckey, point_conversion_form_t cform);
void EC_KEY_set_asn1_flag(EC_KEY *eckey, int asn1_flag);
int EC_KEY_decoded_from_explicit_params(const EC_KEY *key);
int EC_KEY_generate_key(EC_KEY *key);
int EC_KEY_check_key(const EC_KEY *key);
int EC_KEY_set_public_key_affine_coordinates(EC_KEY *key, BIGNUM *x, BIGNUM *y);
const EC_KEY_METHOD *EC_KEY_get_method(const EC_KEY *key);
int EC_KEY_set_method(EC_KEY *key, const EC_KEY_METHOD *meth);

int EC_KEY_oct2key(EC_KEY *eckey, const unsigned char *buf, size_t len, BN_CTX *ctx);
size_t EC_KEY_key2buf(const EC_KEY *eckey, point_conversion_form_t form,
    unsigned char **pbuf, BN_CTX *ctx);

int EC_KEY_oct2priv(EC_KEY *eckey, const unsigned char *buf, size_t len);
size_t EC_KEY_priv2oct(const EC_KEY *eckey, unsigned char *buf, size_t len);

size_t EC_KEY_priv2buf(const EC_KEY *eckey, unsigned char **pbuf);
int EC_KEY_precompute_mult(EC_KEY *key, BN_CTX *ctx);

```

## DESCRIPTION

**EVP\_EC\_gen()** generates a new EC key pair on the given *curve*.

All of the functions described below are deprecated. Applications should instead use **EVP\_EC\_gen()**, **EVP\_PKEY\_Q\_keygen(3)**, or **EVP\_PKEY\_keygen\_init(3)** and **EVP\_PKEY\_keygen(3)**.

An **EC\_KEY** represents a public key and, optionally, the associated private key. A new **EC\_KEY** with no associated curve can be constructed by calling **EC\_KEY\_new\_ex()** and specifying the associated library context in *ctx* (see **OSSL\_LIB\_CTX(3)**) and property query string *propq*. The *ctx* parameter may be NULL in which case the default library context is used. The reference count for the newly created **EC\_KEY** is initially set to 1. A curve can be associated with the **EC\_KEY** by calling **EC\_KEY\_set\_group()**.

**EC\_KEY\_new()** is the same as **EC\_KEY\_new\_ex()** except that the default library context is always used.

Alternatively a new **EC\_KEY** can be constructed by calling **EC\_KEY\_new\_by\_curve\_name\_ex()** and supplying the nid of the associated curve, the library context to be used *ctx* (see **OSSL\_LIB\_CTX(3)**) and any property query string *propq*. The *ctx* parameter may be NULL in which case the default library context is used. The *propq* value may also be NULL. See **EC\_GROUP\_new(3)** for a description of curve names. This function simply wraps calls to **EC\_KEY\_new\_ex()** and

**EC\_GROUP\_new\_by\_curve\_name\_ex()**.

**EC\_KEY\_new\_by\_curve\_name()** is the same as **EC\_KEY\_new\_by\_curve\_name\_ex()** except that the default library context is always used and a NULL property query string.

Calling **EC\_KEY\_free()** decrements the reference count for the EC\_KEY object, and if it has dropped to zero then frees the memory associated with it. If *key* is NULL nothing is done.

**EC\_KEY\_copy()** copies the contents of the EC\_KEY in *src* into *dest*.

**EC\_KEY\_dup()** creates a new EC\_KEY object and copies *ec\_key* into it.

**EC\_KEY\_up\_ref()** increments the reference count associated with the EC\_KEY object.

**EC\_KEY\_get0\_engine()** returns a handle to the ENGINE that has been set for this EC\_KEY object.

**EC\_KEY\_generate\_key()** generates a new public and private key for the supplied *eckey* object. *eckey* must have an EC\_GROUP object associated with it before calling this function. The private key is a random integer ( $0 < \text{priv\_key} < \text{order}$ , where *order* is the order of the EC\_GROUP object). The public key is an EC\_POINT on the curve calculated by multiplying the generator for the curve by the private key.

**EC\_KEY\_check\_key()** performs various sanity checks on the EC\_KEY object to confirm that it is valid.

**EC\_KEY\_set\_public\_key\_affine\_coordinates()** sets the public key for *key* based on its affine coordinates; i.e., it constructs an EC\_POINT object based on the supplied *x* and *y* values and sets the public key to be this EC\_POINT. It also performs certain sanity checks on the key to confirm that it is valid.

The functions **EC\_KEY\_get0\_group()**, **EC\_KEY\_set\_group()**, **EC\_KEY\_get0\_private\_key()**, **EC\_KEY\_set\_private\_key()**, **EC\_KEY\_get0\_public\_key()**, and **EC\_KEY\_set\_public\_key()** get and set the EC\_GROUP object, the private key, and the EC\_POINT public key for the *key* respectively. The function **EC\_KEY\_set\_private\_key()** accepts NULL as the *priv\_key* argument to securely clear the private key component from the EC\_KEY.

The functions **EC\_KEY\_get\_conv\_form()** and **EC\_KEY\_set\_conv\_form()** get and set the *point\_conversion\_form* for the *key*. For a description of *point\_conversion\_forms* please see **EC\_POINT\_new(3)**.

**EC\_KEY\_set\_flags()** sets the flags in the *flags* parameter on the EC\_KEY object. Any flags that are already set are left set. The flags currently defined are EC\_FLAG\_NON\_FIPS\_ALLOW and EC\_FLAG\_FIPS\_CHECKED. In addition there is the flag EC\_FLAG\_COFACTOR\_ECDH which is specific to ECDH. **EC\_KEY\_get\_flags()** returns the current flags that are set for this EC\_KEY. **EC\_KEY\_clear\_flags()** clears the flags indicated by the *flags* parameter; all other flags are left in their existing state.

**EC\_KEY\_set\_asn1\_flag()** sets the *asn1\_flag* on the underlying EC\_GROUP object (if set). Refer to **EC\_GROUP\_copy(3)** for further information on the *asn1\_flag*.

**EC\_KEY\_decoded\_from\_explicit\_params()** returns 1 if the group of the *key* was decoded from data with explicitly encoded group parameters, -1 if the *key* is NULL or the group parameters are missing, and 0 otherwise.

**EC\_KEY\_precompute\_mult()** stores multiples of the underlying EC\_GROUP generator for faster point multiplication. See also **EC\_POINT\_add(3)**. Modern versions should instead switch to named curves which OpenSSL has hardcoded lookup tables for.

**EC\_KEY\_oct2key()** and **EC\_KEY\_key2buf()** are identical to the functions **EC\_POINT\_oct2point()** and **EC\_POINT\_point2buf()** except they use the public key EC\_POINT in *ekey*.

**EC\_KEY\_oct2priv()** and **EC\_KEY\_priv2oct()** convert between the private key component of *ekey* and octet form. The octet form consists of the content octets of the *privateKey* OCTET STRING in an *ECPrivateKey* ASN.1 structure.

The function **EC\_KEY\_priv2oct()** must be supplied with a buffer long enough to store the octet form. The return value provides the number of octets stored. Calling the function with a NULL buffer will not perform the conversion but will just return the required buffer length.

The function **EC\_KEY\_priv2buf()** allocates a buffer of suitable length and writes an EC\_KEY to it in octet format. The allocated buffer is written to *\*pbuf* and its length is returned. The caller must free up the allocated buffer with a call to **OPENSSL\_free()**. Since the allocated buffer value is written to *\*pbuf* the *pbuf* parameter **MUST NOT** be NULL.

**EC\_KEY\_priv2buf()** converts an EC\_KEY private key into an allocated buffer.

## RETURN VALUES

**EC\_KEY\_new\_ex()**, **EC\_KEY\_new()**, **EC\_KEY\_new\_by\_curve\_name\_ex()**, **EC\_KEY\_new\_by\_curve\_name()** and **EC\_KEY\_dup()** return a pointer to the newly created EC\_KEY object, or NULL on error.

**EC\_KEY\_get\_flags()** returns the flags associated with the EC\_KEY object as an integer.

**EC\_KEY\_copy()** returns a pointer to the destination key, or NULL on error.

**EC\_KEY\_get0\_engine()** returns a pointer to an ENGINE, or NULL if it wasn't set.

**EC\_KEY\_up\_ref()**, **EC\_KEY\_set\_group()**, **EC\_KEY\_set\_public\_key()**, **EC\_KEY\_precompute\_mult()**, **EC\_KEY\_generate\_key()**, **EC\_KEY\_check\_key()**, **EC\_KEY\_set\_public\_key\_affine\_coordinates()**, **EC\_KEY\_oct2key()** and **EC\_KEY\_oct2priv()** return 1 on success or 0 on error.

**EC\_KEY\_set\_private\_key()** returns 1 on success or 0 on error except when the priv\_key argument is NULL, in that case it returns 0, for legacy compatibility, and should not be treated as an error.

**EC\_KEY\_get0\_group()** returns the EC\_GROUP associated with the EC\_KEY.

**EC\_KEY\_get0\_private\_key()** returns the private key associated with the EC\_KEY.

**EC\_KEY\_get\_conv\_form()** return the point\_conversion\_form for the EC\_KEY.

**EC\_KEY\_key2buf()**, **EC\_KEY\_priv2oct()** and **EC\_KEY\_priv2buf()** return the length of the buffer or 0 on error.

## SEE ALSO

**EVP\_PKEY\_Q\_keygen(3)** **crypto(7)**, **EC\_GROUP\_new(3)**, **EC\_GROUP\_copy(3)**, **EC\_POINT\_new(3)**, **EC\_POINT\_add(3)**, **EC\_GFp\_simple\_method(3)**, **d2i\_ECPKParameters(3)**, **OSSL\_LIB\_CTX(3)**

## HISTORY

**EVP\_EC\_gen()** was added in OpenSSL 3.0. All other functions described here were deprecated in OpenSSL 3.0. For replacement see **EVP\_PKEY-EC(7)**.

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