

**NAME**

EC\_POINT\_add, EC\_POINT\_dbl, EC\_POINT\_invert, EC\_POINT\_is\_at\_infinity,  
 EC\_POINT\_is\_on\_curve, EC\_POINT\_cmp, EC\_POINT\_make\_affine, EC\_POINTS\_make\_affine,  
 EC\_POINTS\_mul, EC\_POINT\_mul, EC\_GROUP\_precompute\_mult,  
 EC\_GROUP\_have\_precompute\_mult - Functions for performing mathematical operations and tests on  
 EC\_POINT objects

**SYNOPSIS**

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

```
int EC_POINT_add(const EC_GROUP *group, EC_POINT *r, const EC_POINT *a,
                const EC_POINT *b, BN_CTX *ctx);
int EC_POINT_dbl(const EC_GROUP *group, EC_POINT *r, const EC_POINT *a, BN_CTX *ctx);
int EC_POINT_invert(const EC_GROUP *group, EC_POINT *a, BN_CTX *ctx);
int EC_POINT_is_at_infinity(const EC_GROUP *group, const EC_POINT *p);
int EC_POINT_is_on_curve(const EC_GROUP *group, const EC_POINT *point, BN_CTX *ctx);
int EC_POINT_cmp(const EC_GROUP *group, const EC_POINT *a, const EC_POINT *b, BN_CTX *ctx);
int EC_POINT_mul(const EC_GROUP *group, EC_POINT *r, const BIGNUM *n,
                const EC_POINT *q, const BIGNUM *m, BN_CTX *ctx);
```

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 EC_POINT_make_affine(const EC_GROUP *group, EC_POINT *point, BN_CTX *ctx);
int EC_POINTS_make_affine(const EC_GROUP *group, size_t num,
                        EC_POINT *points[], BN_CTX *ctx);
int EC_POINTS_mul(const EC_GROUP *group, EC_POINT *r, const BIGNUM *n, size_t num,
                const EC_POINT *p[], const BIGNUM *m[], BN_CTX *ctx);
int EC_GROUP_precompute_mult(EC_GROUP *group, BN_CTX *ctx);
int EC_GROUP_have_precompute_mult(const EC_GROUP *group);
```

**DESCRIPTION**

EC\_POINT\_add adds the two points **a** and **b** and places the result in **r**. Similarly EC\_POINT\_dbl doubles the point **a** and places the result in **r**. In both cases it is valid for **r** to be one of **a** or **b**.

EC\_POINT\_invert calculates the inverse of the supplied point **a**. The result is placed back in **a**.

The function EC\_POINT\_is\_at\_infinity tests whether the supplied point is at infinity or not.

EC\_POINT\_is\_on\_curve tests whether the supplied point is on the curve or not.

EC\_POINT\_cmp compares the two supplied points and tests whether or not they are equal.

The functions EC\_POINT\_make\_affine and EC\_POINTs\_make\_affine force the internal representation of the EC\_POINT(s) into the affine coordinate system. In the case of EC\_POINTs\_make\_affine the value **num** provides the number of points in the array **points** to be forced. These functions were deprecated in OpenSSL 3.0 and should no longer be used. Modern versions automatically perform this conversion when needed.

EC\_POINT\_mul calculates the value generator \* **n** + **q** \* **m** and stores the result in **r**. The value **n** may be NULL in which case the result is just **q** \* **m** (variable point multiplication). Alternatively, both **q** and **m** may be NULL, and **n** non-NULL, in which case the result is just generator \* **n** (fixed point multiplication). When performing a single fixed or variable point multiplication, the underlying implementation uses a constant time algorithm, when the input scalar (either **n** or **m**) is in the range [0, ec\_group\_order).

Although deprecated in OpenSSL 3.0 and should no longer be used, EC\_POINTs\_mul calculates the value generator \* **n** + **q[0]** \* **m[0]** + ... + **q[num-1]** \* **m[num-1]**. As for EC\_POINT\_mul the value **n** may be NULL or **num** may be zero. When performing a fixed point multiplication (**n** is non-NULL and **num** is 0) or a variable point multiplication (**n** is NULL and **num** is 1), the underlying implementation uses a constant time algorithm, when the input scalar (either **n** or **m[0]**) is in the range [0, ec\_group\_order). Modern versions should instead use EC\_POINT\_mul(), combined (if needed) with EC\_POINT\_add() in such rare circumstances.

The function EC\_GROUP\_precompute\_mult stores multiples of the generator for faster point multiplication, whilst EC\_GROUP\_have\_precompute\_mult tests whether precomputation has already been done. See EC\_GROUP\_copy(3) for information about the generator. Precomputation functionality was deprecated in OpenSSL 3.0. Users of EC\_GROUP\_precompute\_mult() and EC\_GROUP\_have\_precompute\_mult() should switch to named curves which OpenSSL has hardcoded lookup tables for.

## RETURN VALUES

The following functions return 1 on success or 0 on error: EC\_POINT\_add, EC\_POINT\_dbl, EC\_POINT\_invert, EC\_POINT\_make\_affine, EC\_POINTs\_make\_affine, EC\_POINTs\_make\_affine, EC\_POINT\_mul, EC\_POINTs\_mul and EC\_GROUP\_precompute\_mult.

EC\_POINT\_is\_at\_infinity returns 1 if the point is at infinity, or 0 otherwise.

EC\_POINT\_is\_on\_curve returns 1 if the point is on the curve, 0 if not, or -1 on error.

EC\_POINT\_cmp returns 1 if the points are not equal, 0 if they are, or -1 on error.

EC\_GROUP\_have\_precompute\_mult return 1 if a precomputation has been done, or 0 if not.

### SEE ALSO

**crypto(7)**, **EC\_GROUP\_new(3)**, **EC\_GROUP\_copy(3)**, **EC\_POINT\_new(3)**, **EC\_KEY\_new(3)**, **EC\_GFp\_simple\_method(3)**, **d2i\_ECPKParameters(3)**

### HISTORY

**EC\_POINT\_make\_affine()**, **EC\_POINTs\_make\_affine()**, **EC\_POINTs\_mul()**, **EC\_GROUP\_precompute\_mult()**, and **EC\_GROUP\_have\_precompute\_mult()** were deprecated in OpenSSL 3.0.

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