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## **Red Hat Enterprise Linux Release 9.2 Manual Pages on 'EC\_POINT\_new.3ossl' command**

**\$ man EC\_POINT\_new.3ossl**

EC\_POINT\_NEW(3ossl)            OpenSSL            EC\_POINT\_NEW(3ossl)

### NAME

EC\_POINT\_set\_Jprojective\_coordinates\_GFp, EC\_POINT\_point2buf,  
EC\_POINT\_new, EC\_POINT\_free, EC\_POINT\_clear\_free, EC\_POINT\_copy,  
EC\_POINT\_dup, EC\_POINT\_method\_of, EC\_POINT\_set\_to\_infinity,  
EC\_POINT\_get\_Jprojective\_coordinates\_GFp,  
EC\_POINT\_set\_affine\_coordinates, EC\_POINT\_get\_affine\_coordinates,  
EC\_POINT\_set\_compressed\_coordinates,  
EC\_POINT\_set\_affine\_coordinates\_GFp,  
EC\_POINT\_get\_affine\_coordinates\_GFp,  
EC\_POINT\_set\_compressed\_coordinates\_GFp,  
EC\_POINT\_set\_affine\_coordinates\_GF2m,  
EC\_POINT\_get\_affine\_coordinates\_GF2m,  
EC\_POINT\_set\_compressed\_coordinates\_GF2m, EC\_POINT\_point2oct,  
EC\_POINT\_oct2point, EC\_POINT\_point2bn, EC\_POINT\_bn2point,  
EC\_POINT\_point2hex, EC\_POINT\_hex2point - Functions for creating,  
destroying and manipulating EC\_POINT objects

### SYNOPSIS

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

EC_POINT *EC_POINT_new(const EC_GROUP *group);

void EC_POINT_free(EC_POINT *point);

void EC_POINT_clear_free(EC_POINT *point);

int EC_POINT_copy(EC_POINT *dst, const EC_POINT *src);
```

```

EC_POINT *EC_POINT_dup(const EC_POINT *src, const EC_GROUP *group);
int EC_POINT_set_to_infinity(const EC_GROUP *group, EC_POINT *point);
int EC_POINT_set_affine_coordinates(const EC_GROUP *group, EC_POINT *p,
    const BIGNUM *x, const BIGNUM *y,
    BN_CTX *ctx);
int EC_POINT_get_affine_coordinates(const EC_GROUP *group, const EC_POINT *p,
    BIGNUM *x, BIGNUM *y, BN_CTX *ctx);
int EC_POINT_set_compressed_coordinates(const EC_GROUP *group, EC_POINT *p,
    const BIGNUM *x, int y_bit,
    BN_CTX *ctx);
size_t EC_POINT_point2oct(const EC_GROUP *group, const EC_POINT *p,
    point_conversion_form_t form,
    unsigned char *buf, size_t len, BN_CTX *ctx);
size_t EC_POINT_point2buf(const EC_GROUP *group, const EC_POINT *point,
    point_conversion_form_t form,
    unsigned char **pbuf, BN_CTX *ctx);
int EC_POINT_oct2point(const EC_GROUP *group, EC_POINT *p,
    const unsigned char *buf, size_t len, BN_CTX *ctx);
char *EC_POINT_point2hex(const EC_GROUP *group, const EC_POINT *p,
    point_conversion_form_t form, BN_CTX *ctx);
EC_POINT *EC_POINT_hex2point(const EC_GROUP *group, const char *hex,
    EC_POINT *p, 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)`:

```

const EC_METHOD *EC_POINT_method_of(const EC_POINT *point);
int EC_POINT_set_Jprojective_coordinates_GFp(const EC_GROUP *group,
    EC_POINT *p,
    const BIGNUM *x, const BIGNUM *y,
    const BIGNUM *z, BN_CTX *ctx);
int EC_POINT_get_Jprojective_coordinates_GFp(const EC_GROUP *group,
    const EC_POINT *p,
    BIGNUM *x, BIGNUM *y, BIGNUM *z,

```

```

        BN_CTX *ctx);

int EC_POINT_set_affine_coordinates_GFp(const EC_GROUP *group, EC_POINT *p,
        const BIGNUM *x, const BIGNUM *y,
        BN_CTX *ctx);

int EC_POINT_get_affine_coordinates_GFp(const EC_GROUP *group,
        const EC_POINT *p,
        BIGNUM *x, BIGNUM *y, BN_CTX *ctx);

int EC_POINT_set_compressed_coordinates_GFp(const EC_GROUP *group,
        EC_POINT *p,
        const BIGNUM *x, int y_bit,
        BN_CTX *ctx);

int EC_POINT_set_affine_coordinates_GF2m(const EC_GROUP *group, EC_POINT *p,
        const BIGNUM *x, const BIGNUM *y,
        BN_CTX *ctx);

int EC_POINT_get_affine_coordinates_GF2m(const EC_GROUP *group,
        const EC_POINT *p,
        BIGNUM *x, BIGNUM *y, BN_CTX *ctx);

int EC_POINT_set_compressed_coordinates_GF2m(const EC_GROUP *group,
        EC_POINT *p,
        const BIGNUM *x, int y_bit,
        BN_CTX *ctx);

BIGNUM *EC_POINT_point2bn(const EC_GROUP *group, const EC_POINT *p,
        point_conversion_form_t form, BIGNUM *bn,
        BN_CTX *ctx);

EC_POINT *EC_POINT_bn2point(const EC_GROUP *group, const BIGNUM *bn,
        EC_POINT *p, BN_CTX *ctx);

```

## DESCRIPTION

An `EC_POINT` structure represents a point on a curve. A new point is constructed by calling the function `EC_POINT_new()` and providing the group object that the point relates to.

`EC_POINT_free()` frees the memory associated with the `EC_POINT`. If `point` is `NULL` nothing is done.

`EC_POINT_clear_free()` destroys any sensitive data held within the

EC\_POINT and then frees its memory. If point is NULL nothing is done.

EC\_POINT\_copy() copies the point src into dst. Both src and dst must use the same EC\_METHOD.

EC\_POINT\_dup() creates a new EC\_POINT object and copies the content from src to the newly created EC\_POINT object.

EC\_POINT\_method\_of() obtains the EC\_METHOD associated with point. This function was deprecated in OpenSSL 3.0, since EC\_METHOD is no longer a public concept.

A valid point on a curve is the special point at infinity. A point is set to be at infinity by calling EC\_POINT\_set\_to\_infinity().

The affine co-ordinates for a point describe a point in terms of its x and y position. The function EC\_POINT\_set\_affine\_coordinates() sets the x and y co-ordinates for the point p defined over the curve given in group. The function EC\_POINT\_get\_affine\_coordinates() sets x and y, either of which may be NULL, to the corresponding coordinates of p.

The functions EC\_POINT\_set\_affine\_coordinates\_GFp() and EC\_POINT\_set\_affine\_coordinates\_GF2m() are synonyms for EC\_POINT\_set\_affine\_coordinates(). They are defined for backwards compatibility only and should not be used.

The functions EC\_POINT\_get\_affine\_coordinates\_GFp() and EC\_POINT\_get\_affine\_coordinates\_GF2m() are synonyms for EC\_POINT\_get\_affine\_coordinates(). They are defined for backwards compatibility only and should not be used.

As well as the affine co-ordinates, a point can alternatively be described in terms of its Jacobian projective co-ordinates (for Fp curves only). Jacobian projective co-ordinates are expressed as three values x, y and z. Working in this co-ordinate system provides more efficient point multiplication operations. A mapping exists between Jacobian projective co-ordinates and affine co-ordinates. A Jacobian projective co-ordinate (x, y, z) can be written as an affine co-ordinate as  $(x/(z^2), y/(z^3))$ . Conversion to Jacobian projective from affine co-ordinates is simple. The co-ordinate (x, y) is mapped to (x, y, 1). Although deprecated in OpenSSL 3.0 and should no longer be used,

to set or get the projective co-ordinates in older versions use `EC_POINT_set_Jprojective_coordinates_GFp()` and `EC_POINT_get_Jprojective_coordinates_GFp()` respectively. Modern versions should instead use `EC_POINT_set_affine_coordinates()` and `EC_POINT_get_affine_coordinates()`, performing the conversion manually using the above maps in such rare circumstances.

Points can also be described in terms of their compressed co-ordinates.

For a point  $(x, y)$ , for any given value for  $x$  such that the point is on the curve there will only ever be two possible values for  $y$ . Therefore, a point can be set using the `EC_POINT_set_compressed_coordinates()` function where  $x$  is the  $x$  co-ordinate and  $y\_bit$  is a value 0 or 1 to identify which of the two possible values for  $y$  should be used.

The functions `EC_POINT_set_compressed_coordinates_GFp()` and `EC_POINT_set_compressed_coordinates_GF2m()` are synonyms for `EC_POINT_set_compressed_coordinates()`. They are defined for backwards compatibility only and should not be used.

In addition `EC_POINT` can be converted to and from various external representations. The octet form is the binary encoding of the `ECPoint` structure (as defined in RFC5480 and used in certificates and TLS records): only the content octets are present, the `OCTET STRING` tag and length are not included. `BIGNUM` form is the octet form interpreted as a big endian integer converted to a `BIGNUM` structure. Hexadecimal form is the octet form converted to a `NULL` terminated character string where each character is one of the printable values 0-9 or A-F (or a-f).

The functions `EC_POINT_point2oct()`, `EC_POINT_oct2point()`, `EC_POINT_point2bn()`, `EC_POINT_bn2point()`, `EC_POINT_point2hex()` and `EC_POINT_hex2point()` convert from and to `EC_POINTS` for the formats: octet, `BIGNUM` and hexadecimal respectively.

The function `EC_POINT_point2oct()` encodes the given curve point  $p$  as an octet string into the buffer `buf` of size `len`, using the specified conversion form `form`. The encoding conforms with Sec. 2.3.3 of the SECG SEC 1 ("Elliptic Curve Cryptography") standard. Similarly the function `EC_POINT_oct2point()` decodes a curve point into  $p$  from the

octet string contained in the given buffer buf of size len, conforming to Sec. 2.3.4 of the SECG SEC 1 ("Elliptic Curve Cryptography") standard.

The functions EC\_POINT\_point2hex() and EC\_POINT\_point2bn() convert a point p, respectively, to the hexadecimal or BIGNUM representation of the same encoding of the function EC\_POINT\_point2oct(). Vice versa, similarly to the function EC\_POINT\_oct2point(), the functions EC\_POINT\_hex2point() and EC\_POINT\_point2bn() decode the hexadecimal or BIGNUM representation into the EC\_POINT p.

Notice that, according to the standard, the octet string encoding of the point at infinity for a given curve is fixed to a single octet of value zero and that, vice versa, a single octet of size zero is decoded as the point at infinity.

The function EC\_POINT\_point2oct() 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 still return the required buffer length.

The function EC\_POINT\_point2buf() allocates a buffer of suitable length and writes an EC\_POINT 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. The function EC\_POINT\_point2hex() will allocate sufficient memory to store the hexadecimal string. It is the caller's responsibility to free this memory with a subsequent call to OPENSSL\_free().

## RETURN VALUES

EC\_POINT\_new() and EC\_POINT\_dup() return the newly allocated EC\_POINT or NULL on error.

The following functions return 1 on success or 0 on error:

EC\_POINT\_copy(), EC\_POINT\_set\_to\_infinity(),  
EC\_POINT\_set\_Jprojective\_coordinates\_GFp(),  
EC\_POINT\_get\_Jprojective\_coordinates\_GFp(),

EC\_POINT\_set\_affine\_coordinates\_GFp(),  
EC\_POINT\_get\_affine\_coordinates\_GFp(),  
EC\_POINT\_set\_compressed\_coordinates\_GFp(),  
EC\_POINT\_set\_affine\_coordinates\_GF2m(),  
EC\_POINT\_get\_affine\_coordinates\_GF2m(),  
EC\_POINT\_set\_compressed\_coordinates\_GF2m() and EC\_POINT\_oct2point().  
EC\_POINT\_method\_of returns the EC\_METHOD associated with the supplied  
EC\_POINT.  
EC\_POINT\_point2oct() and EC\_POINT\_point2buf() return the length of the  
required buffer or 0 on error.  
EC\_POINT\_point2bn() returns the pointer to the BIGNUM supplied, or NULL  
on error.  
EC\_POINT\_bn2point() returns the pointer to the EC\_POINT supplied, or  
NULL on error.  
EC\_POINT\_point2hex() returns a pointer to the hex string, or NULL on  
error.  
EC\_POINT\_hex2point() returns the pointer to the EC\_POINT supplied, or  
NULL on error.

#### SEE ALSO

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

#### HISTORY

EC\_POINT\_method\_of(), EC\_POINT\_set\_Jprojective\_coordinates\_GFp(),  
EC\_POINT\_get\_Jprojective\_coordinates\_GFp(),  
EC\_POINT\_set\_affine\_coordinates\_GFp(),  
EC\_POINT\_get\_affine\_coordinates\_GFp(),  
EC\_POINT\_set\_compressed\_coordinates\_GFp(),  
EC\_POINT\_set\_affine\_coordinates\_GF2m(),  
EC\_POINT\_get\_affine\_coordinates\_GF2m(),  
EC\_POINT\_set\_compressed\_coordinates\_GF2m(), EC\_POINT\_point2bn(), and  
EC\_POINT\_bn2point() were deprecated in OpenSSL 3.0.  
EC\_POINT\_set\_affine\_coordinates, EC\_POINT\_get\_affine\_coordinates, and  
EC\_POINT\_set\_compressed\_coordinates were added in OpenSSL 1.1.1.

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