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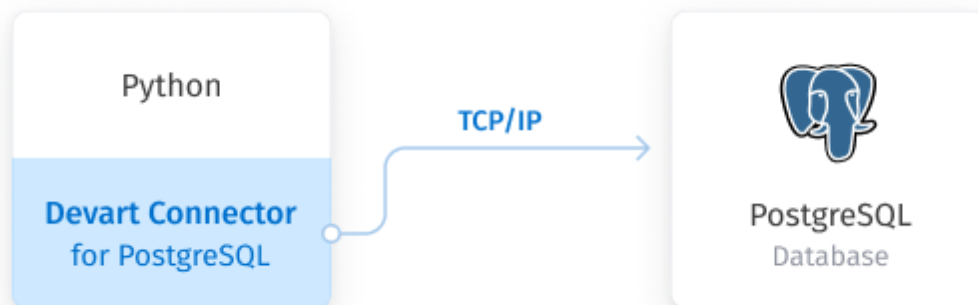
1 Overview

Overview

Python Connector for PostgreSQL is a connectivity solution for accessing PostgreSQL databases from Python applications. It fully implements the Python DB API 2.0 specification. The connector is distributed as a wheel package for Windows, macOS, and Linux.

Direct connection

The connector enables you to establish a direct connection to PostgreSQL from a Python application via TCP/IP, eliminating the need for the database client library. A direct connection increases the speed of data transmission between the application and PostgreSQL database server. It also streamlines the deployment process since you don't have to distribute any client libraries with the application.



Secure communication

The connector supports encrypted communications using SSL/TLS, SSH tunneling, and HTTP/HTTPS tunneling.

Compatibility

- Python versions from 3.7 to 3.12
- PostgreSQL versions:
 - PostgreSQL server from 8.0 to 15.0

- Microsoft Azure Database for PostgreSQL
 - Amazon RDS for PostgreSQL
 - Amazon Aurora
 - Google Cloud for PostgreSQL
 - Heroku Postgres
-
- SQLAlchemy
 - pandas
 - petl

Supported platforms

- Windows 32-bit and 64-bit
- Windows Server 32-bit and 64-bit
- macOS 64-bit and ARM (Apple M1 and M2)
- Linux 64-bit

Note: For details on supported OS versions, check the compatibility page of your Python version.

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2 What's new

Python Connector for PostgreSQL 1.0

- Initial release of Python Connector for PostgreSQL
- Added support for Windows 32-bit and 64-bit
- Added support for Windows Server 32-bit and 64-bit
- Added support for macOS 64-bit and ARM (Apple M1 and M2)
- Added support for Linux 64-bit

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3 Install the connector

3.1 Windows

Install the connector on Windows

1. [Download](#) the zip archive.
2. Extract the contents of the archive.
3. Open Command Prompt.
4. Verify that you have the pip package installer on your system using the `py -m pip --version` command. If you don't have it, run the following command to install pip.

```
python -m ensurepip --upgrade
```

5. In Command Prompt, navigate to the directory that contains the extracted wheel packages.
6. Install the package:

- Windows 32-bit

```
pip install devart_postgresql_connector-1.0.1-cp312-cp312-win32.whl
```

- Windows 64-bit

```
pip install devart_postgresql_connector-1.0.1-cp312-cp312-win_amd64.whl
```

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3.2 Linux

Install the connector on Linux

1. [Download](#) the zip archive.
2. Extract the contents of the archive.
3. Open a terminal window.
4. Verify that you have the pip package installer on your system using the `py -m pip --version` command. If you don't have it, run the following command to install pip.

```
python -m ensurepip --upgrade
```

5. In terminal, navigate to the directory that contains the extracted wheel package.
6. Install the package.

```
pip install devart_postgresql_connector-1.0.1-cp312-cp312-manylinux_2_34_x86
```

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3.3 macOS

Install the connector on macOS

1. [Download](#) the zip archive.
2. Extract the contents of the archive.
3. Open a terminal window.
4. Verify that you have the pip package installer on your system using the `python -m pip --version` command. If you don't have it, run the following command to install pip.

```
python -m ensurepip --upgrade
```

5. In terminal, navigate to the directory that contains the extracted wheel package.
6. Install the package.

```
pip install devart_postgresql_connector-1.0.1-cp312-cp312-macosx_10_9_univer
```

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4 Using the module

Using the module

To retrieve data from a database:

1. Import the module.

```
import devart.postgresql
```

2. Connect to a database using the [connect\(\)](#) module method and obtain a [connection](#)

object.

```
my_connection = devart.postgresql.connect(  
    Server="your_server",  
    Database="your_database",  
    UserId="your_username",  
    Password="your_password"  
)
```

3. Create a [cursor](#) object using the [cursor\(\)](#) connection method.

```
my_cursor = my_connection.cursor()
```

4. Execute the SQL statement using the [execute\(\)](#) cursor method.

```
my_cursor.execute("SELECT * FROM employees")
```

5. Retrieve the result set using one of the [fetch*\(\)](#) cursor methods.

```
for row in my_cursor.fetchall():  
    print(row)
```

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5 Connection parameters

Connection parameters

The following table lists PostgreSQL connection parameters you can use in the [connect\(\)](#) module method.

Parameter	Description
Server	The server name or IP address
Port	(Optional) The port number. The default value is 5432.
UserId	The name of the database user
Password	The password of the database user

Database	The name of the database
Schema	(Optional) The schema search path. The default value is <code>public</code> .
Protocol	(Optional) The version of the PostgreSQL messaging protocol. The possible values are <code>pvAuto</code> , <code>pv30</code> , and <code>pv20</code> . The default value is <code>pvAuto</code> .

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6 Connection pooling

Connection pooling

Connecting to a database server typically consists of several time-consuming steps. Connection pooling can significantly improve the performance and scalability of an application by reducing the number of times that new database connections must be opened. This is particularly useful for applications that involve many connect/disconnect operations. Connection pooling uses a cache of database connections, which enables an application to reuse a connection from a pool instead of opening a new connection when future requests to the database are required.

When you close a connection object using the `close()` method, the connection remains alive and is added to a pool. When a new connection object is created with the `connect()` method, the module returns an existing connection from the pool if the connection pooler hasn't detected the severed connection and marked it as invalid. A new connection will be established if the pool is empty or doesn't have a valid connection.

To enable connection pooling, set the value of the `connection_pool.enabled` module attribute to `True`. Additional options include `connection_pool.min_size`, `connection_pool.max_size`, `connection_pool.lifetime`, and `connection_pool.validate`. For more information about these attributes, see the [connection pool](#) class.

The following example sets the attributes for the default connection pool, which implicitly has the ID `0`.

```
devart.postgresql.connection_pool.min_size = 0
devart.postgresql.connection_pool.max_size = 1000
devart.postgresql.connection_pool.lifetime = 60000
devart.postgresql.connection_pool.validate = True
devart.postgresql.connection_pool.enabled = True
```

You can define several connection pools with different settings. To define settings for a connection pool with a particular ID, use the syntax `connection_pool[pool_id: int]`, where `pool_id` is the ID of the pool. You can also pass the `PoolId` connection string parameter to specify which connection pool will be used for a particular connection.

```
devart.postgresql.connection_pool[42].max_size = 100
devart.postgresql.connection_pool[42].lifetime = 120000
devart.postgresql.connection_pool.enabled = True
my_connection = devart.postgresql.connect("Server=your_server;Database=your_
```

Database connections belong to the same pool when they have identical parameters in the connection string. Two connections with different connection string parameters will be placed into separate pools with the same identifiers. The connector creates a separate pool when a new connection has the same pool ID as an existing pool but different connection parameters.

The `connection_pool.enabled` attribute is global. If pooling is enabled, all new connections will be pooled. Pooling can be disabled for a particular connection using the `DisablePooling=True` connection string parameter.

```
my_connection = devart.postgresql.connect("Server=your_server;Database=your_
```

Database connections in a pool are validated every 30 seconds to ensure that a broken connection won't be returned from the pool when a connection object is constructed. Invalid connections are destroyed. The connection pooler also validates connections when they are added or released back into the pool (for example, when you call the `connection.close()` method).

If you set the `validate` attribute to `True`, connections will also be validated when they're drawn from the pool. In the event of a network issue, all connections to a database may become broken. Therefore, if a fatal error is detected in one connection from the pool, the pooler will validate all connections in the pool.

The pooler removes a connection from the pool after it's been idle for approximately 4 minutes. If no new connections are added to the pool during this time, it becomes empty to save the resources. If you set the `min_size` attribute to a non-zero value, the pool won't destroy all idle connections and become empty unless the remaining connections are marked

as invalid.

The `max_size` pool attribute limits the number of connections that can be stored in a pool at the same time. When the maximum number of connections in a pool is reached, all future database connections will be destroyed once the connection object releases them.

You can limit the connection lifetime using the `lifetime` attribute. When a connection object is closed, and a database connection is returned to the pool, the creation time of the connection is compared with the current time, and the connection is destroyed if that timespan exceeds the lifetime value. This technique serves for load balancing.

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7 Data types

Data types

The following table describes the supported PostgreSQL data types and their mapping to the Python data types. The type codes returned in the [description](#) cursor attribute can be used in the [addtypecast\(\)](#) cursor method.

PostgreSQL data type	Type code	Python data type
character	507	str
character varying	508	str
text	517	str
smallint	515	int
integer	511	int
bigint	501	int
serial	516	int
bigserial	502	int
real	514	float
double precision	510	float
numeric	513	numeric

date	509	datetime.date
time	518	datetime.time
time with time zone	519	datetime.time
timestamp	520	datetime.datetime
timestamp with time zone	521	datetime.datetime
bytea	506	binary
point	562	point
lseg	559	lseg
line	558	line
path	561	path
polygon	563	polygon
box	553	box
circle	555	circle

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8 Class reference

8.1 Module class

Module class

The `module` class provides [methods](#), [global properties](#), [exceptions](#), [constructors](#), and [type objects](#) to be used by all connections created in the module.

- [Methods](#)
 - [connect\(\)](#)
- [Globals](#)
 - [apilevel](#)
 - [threadsafety](#)
 - [paramstyle](#)

- [Exceptions](#)
 - [Warning](#)
 - [Error](#)
 - [InterfaceError](#)
 - [DatabaseError](#)
 - [DataError](#)
 - [OperationalError](#)
 - [IntegrityError](#)
 - [InternalError](#)
 - [ProgrammingError](#)
 - [NotSupportedError](#)
- [Constructors](#)
 - [Date\(\)](#)
 - [Time\(\)](#)
 - [Timestamp\(\)](#)
 - [DateFromTicks\(\)](#)
 - [TimeFromTicks\(\)](#)
 - [TimestampFromTicks\(\)](#)
 - [Binary\(\)](#)
 - [PostgreSQL-specific constructors](#)
- [Type objects](#)
 - [STRING](#)
 - [BINARY](#)
 - [NUMBER](#)
 - [DATETIME](#)
 - [ROWID](#)
 - [binary](#)

- [NaN](#)
- [Infinity](#)
- [PostgreSQL-specific type objects](#)

Methods

`connect(connection string|connection parameters)`

Creates a new connection to the database.

Arguments

`connection string`

A string literal of form "parameter=value;parameter=value"

`connection parameters`

A sequence of named parameters

Connection parameters

For the full list of supported connection parameters, see [Connection parameters](#).

Return value

Returns a [connection](#) object.

Code sample

```
# establishing a connection using a connection string
connection1 = devart.postgresql.connect("Server=your_server;Database=your_da
# establishing a connection using named parameters
connection2 = devart.postgresql.connect(
    Server="your_server",
    Database="your_database",
    UserId="your_username",
    Password="your_password"
)
```

Globals

`apilevel`

Indicates the DB API level supported by the module. Returns a string value "2.0".

threadsafety

Indicates the thread safety level of the module. Returns an integer value 2 that means that threads may share the module and connections.

paramstyle

Indicates the type of parameter marker formatting expected by the module. Returns a string value "named" that means that the module supports named style parameters, for example, `...WHERE name=:name`.

Exceptions

The module provides the following exceptions to make all error information available.

Warning

This exception is raised for important warnings like data truncations while inserting, etc. The Warning exception is a subclass of the Python [Exception](#) class.

Error

This exception is the base class of all error exceptions. You can use it to catch all errors with a single `except` statement. The Error exception is a subclass of the Python [Exception](#) class.

InterfaceError

This exception is raised for errors that are related to the database interface rather than the database itself. The InterfaceError exception is a subclass of Error.

DatabaseError

This exception is raised for errors that are related to the database. The DatabaseError exception is a subclass of Error.

DataError

This exception is raised for errors caused by issues with the processed data like division by zero, numeric value out of range, etc. The DataError exception is a subclass of DatabaseError.

OperationalError

This exception is raised for errors that are related to the database operation and not necessarily under the control of the developer, for example, an unexpected disconnect occurs, the data source name isn't found, a transaction couldn't be processed, a memory allocation error occurred during processing, etc. The OperationalError

exception is a subclass of DatabaseError.

IntegrityError

This exception is raised when the relational integrity of the database is affected, for example, a foreign key check fails. The IntegrityError exception is a subclass of DatabaseError.

InternalError

This exception is raised when the database encounters an internal error, for example, the cursor isn't valid anymore, the transaction is out of sync, etc. The InternalError exception is a subclass of DatabaseError.

ProgrammingError

This exception is raised for programming errors, for example, table not found or already exists, syntax error in the SQL statement, wrong number of parameters specified, etc. The ProgrammingError exception is a subclass of DatabaseError.

NotSupportedError

This exception is raised when a method or database API isn't supported by the database, for example, requesting a [rollback\(\)](#) on a connection that doesn't support transactions or has transactions turned off. The NotSupportedError exception is a subclass of DatabaseError.

The complete exception inheritance tree looks as follows.

[Exception](#)

Warning

Error

InterfaceError

DatabaseError

DataError

OperationalError

IntegrityError

InternalError

ProgrammingError

NotSupportedError

Constructors

The module provides the following constructors for creating date/time objects. The created date/time objects are implemented as Python [datetime](#) module objects.

`Date(year, month, day)`

Creates an object that holds a date value.

Arguments

`year`

`month`

`day`

Values of type `int` that specify the year, month, and day.

Return value

Returns a `datetime.date` object.

`Time(hour, minute, second[, timezone])`

Creates an object that holds a time value.

Arguments

`hour`

`minute`

Values of type `int` that specify hours and minutes.

`second`

An `int` value that specifies seconds or a `float` value that specifies seconds and

microseconds.

`timezone`

(Optional) A value of type `datetime.tzinfo` that specifies a timezone. The value can be `None`.

Return value

Returns a `datetime.time` object.

`Timestamp(year, month, day[, hour[, minute[, second[, timezone]]])`

Creates an object that holds a timestamp value.

Arguments

`year`

`month`

`day`

Values of type `int` that specify the year, month, and day.

`hour`

`minute`

(Optional) Values of type `int` that specify hours and minutes.

`second`

(Optional) An `int` value that specifies seconds or a `float` value that specifies seconds and microseconds.

`timezone`

(Optional) A value of type `datetime.tzinfo` that specifies a timezone. The value can be `None`.

Return value

Returns a `datetime.datetime` object.

`DateFromTicks(ticks)`

Creates an object that holds a date value from the given ticks value (the number of seconds since the Unix epoch). For more information, see the [time](#) module in the standard Python documentation.

Arguments

`ticks`

A value of type `float` that specifies number of seconds since the Unix epoch.

Return value

Returns a `datetime.date` object.

`TimeFromTicks(ticks)`

Creates an object that holds a time value from the given ticks value (number of seconds since the Unix epoch). For more information, see the [time](#) module in the standard Python documentation.

Arguments

`ticks`

A value of type `float` that specifies number of seconds since the Unix epoch.

Return value

Returns a `datetime.time` object.

`TimestampFromTicks(ticks)`

Creates an object that holds a timestamp value from the given ticks value (number of seconds since the Unix epoch). For more information, see the [time](#) module in the standard Python documentation.

Arguments

ticks

A value of type `float` that specifies number of seconds since the Unix epoch.

Return value

Returns a `datetime.datetime` object.

The module provides the following additional constructors.

Binary(value)

Creates an object that holds binary data.

Arguments

value

A value of type `str`, `bytes`, `bytearray`, `array.array`, or a [binary](#) object.

Return value

Returns a [binary](#) object.

PostgreSQL-specific constructors

Additional [constructors](#) for handling PostgreSQL-specific database types.

Type objects

The module provides the following type objects to create mapping between the PostgreSQL database types and Python types. You can use these type objects as arguments for the [addtypecast\(\)](#) cursor method to define a data type cast rule to use when fetching data from the [cursor](#). They can also be used to determine the Python types of the result columns returned by the [execute*\(\)](#) cursor methods.

STRING

This type object describes string-based columns in a database (for example, `character varying`).

BINARY

This type object describes binary columns in a database (for example, `bytea`).

NUMBER

This type object describes numeric columns in a database.

DATETIME

This type object describes date/time columns in a database.

ROWID

This type object describes the `row ID` column in a database.

Code sample

```
cursor.execute("select column1 from table1")
# check if the first column in the result set is string-based so that its va
if cursor.description[0].type_code in postgresql.STRING:
    # do something
```

The module provides the following additional type objects.

binary

This type object describes an object that holds binary data. By default, this type object is used to fetch BLOB-based columns from the [cursor](#). You can also create a `binary` object using the [Binary\(\)](#) constructor.

Attributes

`value`

A value of type `bytes` that represents binary data. This is a read/write attribute that accepts values of type `str`, `bytes`, `bytearray`, `array.array`, and `binary`.

NaN

This type object describes a special numeric value `not-a-number` that can be used in operations with [numeric](#) objects.

Remarks

NaN can be interpreted as an undefined or non-representable value. It doesn't support comparison operators except `==` and `!=`.

Infinity

This type object describes a special numeric value `positive infinity` that is larger than any natural number. It can be used in operations with [numeric](#) objects.

Remarks

The connector doesn't provide any special type object for `negative infinity` that represents the smallest number. For negative infinity, use a `-Infinity` value.

PostgreSQL-specific type objects

Additional [type objects](#) for handling PostgreSQL-specific database types.

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8.2 Module additions

Module additions

The module provides several additional constructors and type objects for handling PostgreSQL-specific database types.

- [Constructors](#)
 - [Numeric\(\)](#)
 - [Point\(\)](#)
 - [Lseg\(\)](#)

- [Line\(\)](#)
- [Path\(\)](#)
- [Polygon\(\)](#)
- [Box\(\)](#)
- [Circle\(\)](#)
- [Type objects](#)
 - [numeric](#)
 - [point](#)
 - [lseg](#)
 - [line](#)
 - [path](#)
 - [polygon](#)
 - [box](#)
 - [circle](#)

Constructors

`Numeric(weight, scale, sign, digits|value)`

Creates an object that holds a number with a very large number of digits.

Arguments

`weight, scale, sign, digits`

Corresponding values for the [numeric](#) object attributes.

`value`

A value of type `str`, `int`, `float`, or a [numeric](#) object.

Return value

Returns a [numeric](#) object.

Remarks

The value argument can also contain special values [Infinity](#), [-Infinity](#), and [NaN](#) (or their string representations). These are adapted from the IEEE 754 standard, and represent the positive infinity, negative infinity, and not-a-number, respectively.

Point(x, y|value)

Creates an object that holds coordinates of a point on a plane.

Arguments

x, y

Values of type `int` or `float` that specify the coordinates of the point.

value

A string literal of form `(x, y)` where `x` and `y` are the respective coordinates, or a [point](#) object.

Return value

Returns a [point](#) object.

Lseg(start, end|startx, starty, endx, endy|value)

Creates an object that holds information about a line segment.

Arguments

start, end

Values of type [point](#) that specify the endpoints of the segment.

startx, starty, endx, endy

Values of type `int` or `float` that specify the coordinates of the endpoints.

value

A string literal of form `[(x1, y1), (x2, y2)]` where `(x1, y1)` and `(x2, y2)` are the respective endpoints, or a [lseg](#) object.

Return value

Returns a [lseg](#) object.

`Line(a, b, c|value)`

Creates an object that holds information about a line.

Arguments

`a, b, c`

Values of type `int` or `float` that specify the coefficients of the linear equation $ax + by + c = 0$ that describes the line.

`value`

A string literal of form `{a, b, c}` where `a`, `b`, and `c` are the respective coefficients, or a [line](#) object.

Return value

Returns a [line](#) object.

Remarks

The `a` and `b` arguments must not both be zero.

`Path(points|value)`

Creates an object that holds an array of connected line segments.

Arguments

`points`

A list of [point](#) objects that specify the endpoints of the segments that form the path.

value

A string literal of form `[(x1, y1), ..., (xn, yn)]` where `(xn, yn)` are sequential endpoints of all the segments, or a [path](#) object.

Return value

Returns a [path](#) object.

`Polygon(points|value)`

Creates an object that holds information about a polygon.

Arguments

points

A list of [point](#) objects that specify the vertexes of the polygon.

value

A string literal of form `((x1, y1), ..., (xn, yn))` where `(xn, yn)` are sequential coordinates of all the vertexes of the polygon, or a [polygon](#) object.

Return value

Returns a [polygon](#) object.

`Box(upperright, lowerleft|upperrightx, upperrighty,
lowerleftx, lowerlefty|value)`

Creates an object that holds information about the rectangle.

Arguments

upperright, lowerleft

Values of type [point](#) that specify the upper right and lower left corners of the rectangle.

`upperrightx, upperrighty, lowerleftx, lowerlefty`

Values of type `int` or `float` that specify the coordinates of the rectangle corners.

`value`

A string literal of form `((x1, y1), (x2, y2))` where `(x1, y1)` and `(x2, y2)` are coordinates of two opposite corners of the rectangle, or a [box](#) object.

Return value

Returns a [box](#) object.

Remarks

There are no strict requirements that the input values must be exactly upper right and lower left corners. Any two opposite corners can be supplied, but you should keep in mind that when saved into a database, the values will be reordered as needed to store the upper right and lower left corners, in that order. Therefore, on subsequent reading of the stored value, you may get an object that doesn't match the one that was written.

`Circle(center, radius|centerx, centery, radius|value)`

Creates an object that holds information about a circle.

Arguments

`center`

A value of type [point](#) that specifies the center point of the circle.

`radius`

A value of type `int` or `float` that specifies the radius of the circle.

`centerx, centery, radius`

Values of type `int` or `float` that specify coordinates of the center point of the circle and its radius, respectively.

`value`

A string literal of form `<(x, y), r>` where `x` and `y` are the center point coordinates and `r`

is the radius, or a [circle](#) object.

Return value

Returns a [circle](#) object.

Type objects

`numeric`

This type object describes an object that holds numbers with a very large number of digits. By default, this type object is used to fetch `numeric` or `decimal` columns from the [cursor](#). You can also create a `numeric` object using the [Numeric\(\)](#) constructor.

Attributes

`digits`

A tuple of integers that specifies all the digits of a `numeric` object. Each element of the tuple contains four digits.

`weight`

The index of the last `digits` element that refers to the integer part of a `numeric` object.

`scale`

The number of digits in the fractional part of a `numeric` object.

`sign`

Specifies whether a `numeric` object is positive or negative, or has a special value. The possible values are:

- `0x0000` – The `numeric` value is positive.
- `0x4000` – The `numeric` value is negative.
- `0xC000` – The `numeric` is [NaN](#).
- `0xD000` – The `numeric` value is [Infinity](#).
- `0xF000` – The `numeric` value is [-Infinity](#).

Examples

```
num1 = devart.postgresql.Numeric('-12345678.1234')
repr(num1)
'<devart.postgresql.numeric object at 0x...; weight=1, scale=4, sign=16384,
```

The value 12345678.1234 is split into four-digit groups, which are then converted to integers. In this example, there are three digits elements: 1234, 5678, and 1234. The first two digits elements contain the integer part of the value, so the weight is 1. The fractional part of the value consists of four digits, so the scale is 4. Since the value is negative, the sign is 0x4000.

```
>>> num2 = devart.postgresql.Numeric('NaN')
repr(num2)
'<devart.postgresql.numeric object at 0x...; weight=0, scale=0, sign=49152,
```

Since the value is [NaN](#), the numeric object contains no data other than the sign attribute, which is 0xC000.

point

This type object describes an object that holds coordinates of a point on a plane. By default, this type object is used to fetch point columns from the [cursor](#). You can also create a point object using the [Point\(\)](#) constructor.

Attributes

x

y

The coordinates of the point.

lseg

This type object describes an object that holds information about a line segment. By default, this type object is used to fetch lseg columns from the [cursor](#). You can also create a lseg object using the [Lseg\(\)](#) constructor.

Attributes

start

end

The endpoints of the line segment.

line

This type object describes an object that holds information about a line. By default, this type object is used to fetch line columns from the [cursor](#). You can also create a `line` object using the [Line\(\)](#) constructor.

Attributes

`a`

`b`

`c`

The coefficients of the linear equation $ax + by + c = 0$ that describes the line.

path

This type object describes an object that holds an array of connected line segments. By default, this type object is used to fetch path columns from the [cursor](#). You can also create a path object using the [Path\(\)](#) constructor.

Attributes

`points`

A list of endpoints of all the segments of the path.

polygon

This type object describes an object that holds information about a polygon. By default, this type object is used to fetch polygon columns from the [cursor](#). You can also create a polygon object using the [Polygon\(\)](#) constructor.

Attributes

points

A list of coordinates of all the vertexes of the polygon.

box

This type object describes an object that holds information about a rectangle. By default, this type object is used to fetch `box` columns from the [cursor](#). You can also create a `box` object using the [Box\(\)](#) constructor.

Attributes

upperright

lowerleft

The opposite corners of the rectangle.

circle

This type object describes an object that holds information about a circle. By default, this type object is used to fetch `circle` columns from the [cursor](#). You can also create a `circle` object using the [Circle\(\)](#) constructor.

Attributes

center

The center point of the circle.

radius

The radius of the circle.

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8.3 Connection class

Connection class

The `connection` class encapsulates a database session. It provides methods for [creating cursors](#), [type casting](#), and [transaction handling](#). Connections are created using the [`connect\(\)`](#) module method.

- [Methods](#)
 - [`cursor\(\)`](#)
 - [`commit\(\)`](#)
 - [`rollback\(\)`](#)
 - [`addtypecast\(\)`](#)
 - [`cleartypecast\(\)`](#)
 - [`close\(\)`](#)
- [Attributes](#)
 - [`connectstring`](#)
- [Exceptions](#)

Methods

`cursor()`

Creates a new cursor object, which is used to manage the context of fetch operations.

Arguments

This method has no arguments.

Return value

Returns a [`cursor`](#) object.

`commit()`

Commits any pending transaction to the database.

Arguments

This method has no arguments.

rollback()

Causes the database to roll back any pending transaction.

Arguments

This method has no arguments.

Remarks

[Closing](#) a connection without first committing changes causes an implicit rollback.

addtypecast(database type|module type object|column name|description|dictionary[, Python type])

Defines a data type cast rule to use when fetching data from the [cursor](#).

Arguments

database type

An int value that specifies the database [data type code](#). You can also pass multiple data type codes in a tuple or list.

module type object

A [module type object](#) that specifies the family of the database data types.

column name

A string literal that specifies the name of the database column. You can also pass multiple string literals in a tuple or list.

description

A [description](#) object that describes the column in a rowset. You can also pass multiple objects in a tuple or list.

dictionary

A dictionary of pairs `column name:Python type` that specifies individual cast rules for a set of columns. The method argument `Python type` can be omitted.

Python type

A Python type object that specifies the target type to which to cast the database type, or an int value which means that the column will be of type `str` and defines its maximum

length.

Code sample

```
connection = devart.postgresql.connect("Server=your_server;Database=your_dat
# all database columns with data type code 511 (PostgreSQL database type INT
connection.addtypecast(511, int)
# all numeric database columns will be fetched as strings
connection.addtypecast(devart.postgresql.NUMBER, str)
# data of "column1" will be fetched as a string
connection.addtypecast("column1", str)
# data of "column2" will be fetched as `int` and data of "column3" will be f
connection.addtypecast({"column2":int, "column3":50})
```

Remarks

The cast rule affects all cursors created within the connection. To define a cast rule for a particular cursor, use the [addtypecast\(\)](#) cursor method. The type code of a database column can be obtained from the `type_code` attribute of the corresponding element of the [description](#) cursor attribute.

cleartypecast()

Removes all data type cast rules defined for the connection.

Arguments

This method has no arguments.

Remarks

This method doesn't remove cast rules defined for a particular cursor using the [addtypecast\(\)](#) cursor method.

close()

Closes the connection.

Arguments

This method has no arguments.

Remarks

The connection becomes unusable after calling this method. The [InterfaceError](#) exception is raised if any operation is attempted with the connection. The same applies

to all cursor objects trying to use the connection. Closing a connection prior to committing changes causes an implicit rollback.

Attributes

connectstring

A read-only attribute that returns a string literal of the form "parameter=value;parameter=value" that contains the [parameters](#) for the current connection.

Exceptions

The `connection` class provides a set of exception classes that exactly match the [module exceptions](#). This simplifies error handling in environments with multiple connections.

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8.4 Cursor class

Cursor class

The `cursor` class represents a database cursor, which is used to manage the context of fetch operations. This class provides methods for [executing SQL statements](#) and [operating rowsets](#). Cursors are created using the [`cursor\(\)`](#) connection method.

- [Methods](#)
 - [setinputsizes\(\)](#)
 - [execute\(\)](#)
 - [executemany\(\)](#)
 - [fetchone\(\)](#)
 - [fetchmany\(\)](#)
 - [fetchall\(\)](#)
 - [next\(\)](#)
 - [scroll\(\)](#)

- [addtypecast\(\)](#)
- [cleartypecast\(\)](#)
- [close\(\)](#)
- [setoutputsizes\(\)](#)
- [Attributes](#)
 - [connection](#)
 - [arraysize](#)
 - [description](#)
 - [rowcount](#)
 - [rownumber](#)
 - [lastrowid](#)

Methods

`setinputsizes([sizes])`

Predefines the types of parameters for the further call to the [execute*\(\)](#) method.

Arguments

`sizes`

(Optional) A sequence (list or tuple) with one item for each input parameter. The item should be a type object that defines the type of the input parameter, or an integer value specifying the maximum length of the string parameter. If the item is None, the parameter type is determined by the value provided in the [execute*\(\)](#) method.

Remarks

Once set, the types of parameters are retained on subsequent calls to the [execute*\(\)](#) method until the cursor is closed by calling [close\(\)](#). To clear the set parameter types, call the method with no arguments.

Code sample

```
cursor = connection.cursor()  
# in the further call to cursor.execute() the supplied parameters will be tr
```

```
cursor.setinputsizes(int, float, 20)
```

```
execute(operation[, parameters])
```

Prepares and executes a database operation.

Arguments

`operation`

A string literal that specifies the database command (SQL statement) to be executed.

`parameters`

(Optional) A sequence (list or tuple) of values to be bound to the corresponding parameters of the operation.

Code sample

```
cursor = connection.cursor()
cursor.execute("create table test_table(column1 integer, column2 integer)")
cursor.execute("insert into test_table(column1, column2) values(:parameter1,
```

Remarks

The types of the input parameters can be pre-specified using the [setinputsizes\(\)](#) method. To execute a batch operation that affects multiple rows in a single operation, use the [executemany\(\)](#) method.

```
executemany(operation[, sequence of parameters])
```

Prepares and executes a batch database operation.

Arguments

`operation`

A string literal that specifies the database command (SQL statement) to be executed.

`parameters`

(Optional) A sequence (list or tuple) of sequences of values, each of which is to be bound to the corresponding parameter of the operation.

Code sample

```
cursor = connection.cursor()
cursor.execute("create table test_table(column1 integer, column2 integer)")
cursor.executemany("insert into test_table(column1, column2) values(:paramet
```

Remarks

The types of the input parameters can be pre-specified using the [setinputsizes\(\)](#) method. This method is significantly faster than executing the [execute\(\)](#) method in a loop.

fetchone()

Fetches the next row of a query result set.

Arguments

This method has no arguments.

Return value

Returns a single `tuple` that contains values for each queried database column, or `None` when no more data is available.

Remarks

The [ProgrammingError](#) exception is raised if the previous call to the [execute*\(\)](#) method didn't produce any result set, or no call was made yet.

fetchmany([size=cursor.arraysize])

Fetches the next set of rows of a query result.

*Arguments***size**

(Optional) The number of rows to fetch per call. If the number isn't specified, the [arraysize](#) attribute determines the number of rows to be fetched.

Return value

Returns a list of tuples for each result row. Each tuple contains values for each queried database column. An empty list is returned when no more rows are available.

Remarks

The [ProgrammingError](#) exception is raised if the previous call to the [execute*\(\)](#) method didn't produce any result set, or no call was made yet.

fetchall()

Fetches all remaining rows of a query result.

Arguments

This method has no arguments.

Return value

Returns a list of tuples for each result row. Each tuple contains values for each queried database column. An empty list is returned when no more rows are available.

Remarks

This method returns as many rows as are left in the result set, regardless of the [arraysize](#) value. The [ProgrammingError](#) exception is raised if the previous call to the [execute*\(\)](#) method didn't produce any result set or no call was made yet.

next()

Returns the next row from the currently executed SQL statement.

Arguments

This method has no arguments.

Return value

Returns a single tuple that contains values for each queried database column.

Remarks

This method uses the same semantics as [fetchone\(\)](#), except that the standard

StopIteration exception is thrown if no more rows are available.

```
scroll(value[, mode='relative'])
```

Scrolls the cursor in the result set to a new position.

Arguments

value

An int value that specifies the new cursor position.

mode

(Optional) The value can be either `relative` or `absolute`. If the mode is `relative` (the default value), the value is taken as offset to the current position in the result set. If the mode is set to `absolute`, the value states an absolute target position.

Remarks

The `IndexError` exception is raised in case a scroll operation attempts to access an item beyond bounds of the result set. In this case, the cursor position is left unchanged.

```
addtypecast(database type|module type object|column name|  
description|dictionary[, Python type])
```

Defines a data type cast rule to use when fetching data from the cursor.

Arguments

database type

An int value that specifies the database [data type code](#). You can also pass multiple data type codes in a tuple or list.

module type object

A [module type object](#) that specifies the family of the database data types.

column name

A string literal that specifies the name of the database column. You can also pass multiple string literals in a tuple or list.

description

A [description](#) object that describes the column in a rowset. You can also pass multiple objects in a tuple or list.

dictionary

A dictionary of pairs `column name:Python type` that specifies individual cast rules for a set of columns. The method argument `Python type` can be omitted.

Python type

A Python type object that specifies the target type to which to cast the database type, or an `int` value which means that the column will be of type `str` and defines its maximum length.

Remarks

The cast rule affects only the current cursor. To define the cast rule for all cursors created within the connection, use the [addtypecast\(\)](#) connection method. The type code of a database column can be obtained from the `type_code` attribute of the corresponding element of the [description](#) attribute.

Code sample

```
cursor = connection.cursor()
# all database columns with data type code 511 (PostgreSQL database type `int`
cursor.addtypecast(511, int)
# all numeric database columns will be fetched as strings
cursor.addtypecast(postgresql.NUMBER, str)
# data of "column1" will be fetched as a string
cursor.addtypecast("column1", str)
# data of "column2" will be fetched as `int` and data of "column3" will be f
cursor.addtypecast({"column2":int, "column3":50})
```

cleartypecast()

Removes all data type cast rules defined for the cursor.

Arguments

This method has no arguments.

Remarks

This method doesn't remove cast rules defined for the entire connection using the [addtypecast\(\)](#) connection method.

close()

Closes the cursor.

Arguments

This method has no arguments.

Remarks

The cursor becomes unusable after calling this method. The [InterfaceError](#) exception is raised if any operation is attempted with the cursor.

```
setoutputsize(int size[, int column])
```

This method is provided for compatibility with the [DB API 2.0](#) specification. It currently does nothing but is safe to call.

Attributes

`connection`

A read-only attribute that specifies the [connection](#) object to which the cursor belongs.

`arraysize`

A read/write attribute that specifies the number of rows to fetch at a time with the [fetchmany\(\)](#) method.

Remarks

The default value of the attribute is 1 meaning to fetch a single row at a time.

`description`

A read-only attribute that describes the columns in a rowset returned by the cursor.

Return value

Returns a tuple of `description` objects with the following attributes:

`name`

The name of the column in the rowset

type_code

The [database type code](#) that corresponds to the type of the column

display_size

The actual length of the column in characters for a character column, None otherwise

internal_size

The size in bytes used by the connector to store the column data

precision

The total number of significant digits for a numeric column, None otherwise

scale

The number of digits in the fractional part for a numeric column, None otherwise

null_ok

Py_True if the corresponding database column accepts NULL values, Py_False otherwise

Remarks

The attribute is None for operations that don't return rows or if no operation has been invoked for the cursor via the [execute\(\)](#) method yet. The type_code attribute can be used in the [addtypecast\(\)](#) method to define a data type cast rule for the corresponding column.

rowcount

A read-only attribute that specifies the number of rows that the last [execute\(\)](#) call produced by a SELECT statement or affected by UPDATE or INSERT statements.

Remarks

The value of this attribute is -1 if no [execute\(\)](#) call has been made on the cursor or the rowcount of the last operation cannot be determined.

rownumber

A read-only attribute that indicates the current 0-based index of the cursor in the result set.

Remarks

The next [fetch*\(\)](#) method fetches rows starting with the index in the rownumber. The attribute initial value is always 0, regardless of whether the [execute\(\)](#) call returned a rowset or not.

lastrowid

This read-only attribute is provided for compatibility with the [DB API 2.0](#) specification. It currently returns `None`.

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8.5 Connection pool class

Cursor class

The `connection_pool` class is used to manage the [connection pooling](#) mechanism. This class provides properties for enabling and configuring pooling.

- [Properties](#)
 - [enabled](#)
 - [max_size](#)
 - [min_size](#)
 - [lifetime](#)
 - [validate](#)

Properties

enabled

Enables connection pooling.

Remarks

Set `enabled` to `True` to enable connection pooling. The default value is `False`.

Syntax

```
enabled = False | True
```

max_size

The maximum number of connections allowed in the pool

Remarks

When the maximum number of connections in the pool is reached, new database connections will be destroyed instead of released back into the pool after you close them. The default value of `max_size` is 100.

If no pool ID (`pool_id`) is specified, the maximum number of connections is set for the default connection pool. If the pool ID is specified, the maximum number of connections is set for the pool with the given ID.

Syntax

```
max_size = int  
max_size[pool_id: int] = int
```

min_size

The minimum number of connections maintained in the pool

Remarks

Set this property to a non-zero value to prevent removing all connections from the pool after they have been idle for a long time. The default value of `min_size` is 0.

If no pool ID (`pool_id`) is specified, the minimum number of connections is set for the default connection pool. If the pool ID is specified, the minimum number of connections is set for the pool with the given ID.

Syntax

```
min_size = int  
min_size[pool_id: int] = int
```

lifetime

The maximum time (in milliseconds) during which a database connection will be kept in the connection pool

Remarks

The creation time of a connection is compared with the current time, and the connection is destroyed if that timespan exceeds the lifetime. If `lifetime` is set to `0` (by default), the lifetime of a connection is infinite.

If no pool ID (`pool_id`) is specified, the connection lifetime is set for the default connection pool. If the pool ID is specified, the maximum number of connections is set for the pool with the given ID.

Syntax

```
lifetime = int  
lifetime[pool_id: int] = int
```

validate

Specifies whether to validate a connection when it's returned from the pool.

Remarks

If the value of `validate` is `False`, the pool will validate a connection only when it's added to the pool. If the value is `True`, the pool will validate a connection when it's added or drawn from the pool. The default value is `False`.

If no pool ID (`pool_id`) is specified, the validation rule is set for the default connection pool. If the pool ID is specified, the rule is set for the pool with the given ID.

Syntax

```
validate[pool_id: int] = False | True
```

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9 Support

Support

This page describes the support options and programs available for users of Python Connector for PostgreSQL.

Support options

The following support options are available for users of Python Connector for PostgreSQL:

- Annual maintenance and support service through the Python Connector for PostgreSQL Subscription program
- Community assistance and technical support through the [community forum](#).
- Advanced technical support from the product developers through the Python Connector for PostgreSQL Priority Support program.

Subscriptions

The Python Connector for PostgreSQL Subscription program is an annual maintenance and support service that provides the following benefits:

- Support through the Priority Support program
- Access to new versions of the product
- Access to nightly builds with hotfixes (on demand)
- Notifications about new product versions

Priority Support

Python Connector for PostgreSQL Priority Support is an advanced product support service from the product developers. Devart staff will provide a response to the customer via email within two business days from the date of receipt. Priority Support is available for users with an active subscription.

If you need assistance with our product, send us an email at support@devart.com with the following details:

- The license number of your product
- The version and edition of your product
- The version of your PostgreSQL server
- A detailed description of the issue
- (Optional) Scripts for creating and populating the database objects

If you have any questions regarding licensing or subscriptions, send us an email at

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10 Licensing

Licensing

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11 Uninstall the connector

Uninstall the connector

To uninstall the connector, run the following command.

```
pip uninstall devart-postgresql-connector
```

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