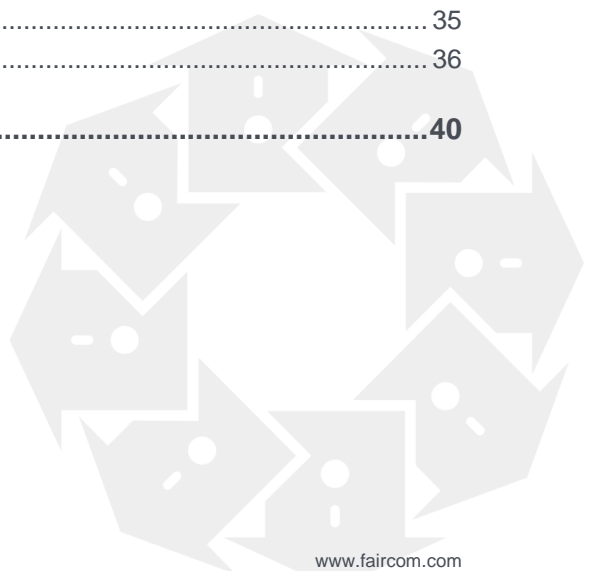




Developer Guide  
**dbExpress Driver (d BX)**

# Contents

<b>1.</b>	<b>c-treeACE SQL dbExpress .....</b>	<b>1</b>
1.1	Install c-treeDBX.....	1
<b>2.</b>	<b>Quick Tour.....</b>	<b>2</b>
2.1	Introductory Tutorial .....	3
	Init 4	
	Define .....	5
	Manage .....	6
	Done.....	8
	Additional Resources .....	9
2.2	Relationships .....	10
	Init 12	
	Define .....	13
	Manage .....	15
	Done.....	18
	Additional Resources .....	19
2.3	Record/Row Locking.....	20
	Init 21	
	Define .....	22
	Manage .....	23
	Done.....	25
	Additional Resources .....	26
2.4	Transaction Processing.....	27
	Init 28	
	Define .....	29
	Manage .....	32
	Done.....	35
	Additional Resources .....	36
<b>3.</b>	<b>Index .....</b>	<b>40</b>



# 1. c-treeACE SQL dbExpress

Embarcadero's dbExpress provides developers superb database connectivity from their applications. dbExpress is a set of lightweight database drivers providing fast access to SQL database servers. When you deploy a c-treeACE SQL database application utilizing dbExpress, you need only include the c-treeACE SQL dbExpress Driver dll with the application files you build.

The c-treeACE SQL DBX Interface technology provides the driver necessary to connect to the c-treeACE SQL database engine. Quickly build client applications using the advanced RAD Studio development environment and efficiently access your c-treeACE SQL data through either Delphi or C++Builder.

By no means does this introduction cover the full scope, detail, or flexibility that the dbExpress technology, and c-treeDBX in particular, offers. It does, however, provide a quick glimpse into the advantages of using powerful c-treeACE SQL database technology in combination with a RAD tool. This is one of the easiest and quickest ways for your client application to access c-treeACE SQL. To learn more about dbExpress technology, visit [embarcadero's web site](http://www.embarcadero.com) [www.embarcadero.com](http://www.embarcadero.com) [http://www.embarcadero.com/](http://www.embarcadero.com) or consult the help files of your RAD Studio tools.

## 1.1 Install c-treeDBX

### RAD Studio Component Installation

You will need to be sure you properly register the dbExpress components in your RAD Studio environment. The c-treeACE dbExpress components will be copied to your specified directory location by the installer. However, the components will not be registered into the compiler(s) version(s) you have selected.

Install them through the **Component > Install Packages...** option in your Embarcadero RAD Studio XE package.

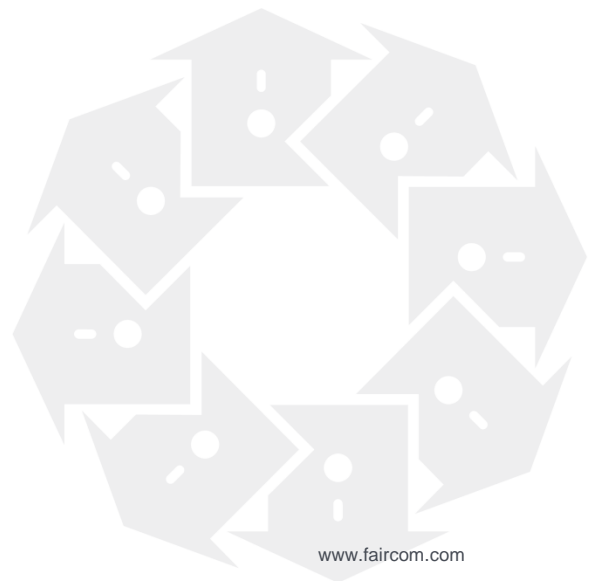
The packages are located in the following directories of your c-treeACE installation:

- **VCL for Delphi** - `C:\FairCom\V*\win32\sdk\ctree.vcl.delphi\src\<studio version>\ct<driver version>s<studio version>dt.bpl`
- **VCL for C++Builder** - `C:\FairCom\V*\win32\sdk\ctree.vcl.cbuilder\src\<studio version>\ct<driver version>s<studio version>dt.bpl`
- **dbExpress 4.0** - `C:\FairCom\V*\win32\sdk\sql.dbx\4.0\<studio version>\DBXCtreeDriver40<studio version>.bpl`

(Where `C:\FairCom\V*` is the default installation directory.)

## 2. Quick Tour

This section introduces c-treeACE SQL dbExpress using a hands-on approach. The tutorial includes a sample project for developing a simple database application in RAD Studio. The full source is included with explanations of each part. The RAD Studio project files are included.





## 2.1 Introductory Tutorial

*..lsdk\sql.dbx\Tutorial1\Unit1.pas*

This tutorial will take you through the basic use of the c-treeACE SQL DBX Component - Delphi.

Like all other examples in the c-tree tutorial series, this tutorial simplifies the creation and use of a database into four simple steps: Initialize(), Define(), Manage(), and You're Done() !

### **Tutorial #1: Introductory - Simple Single Table**

We wanted to keep this program as simple as possible. This program does the following:

- Initialize() - Connects to the c-treeACE Database Engine.
- Define() - Defines and creates a "customer master" (custmast) table/file.
- Manage() - Adds a few rows/records; Reads the rows/records back from the database; displays the column/field content; and then deletes the rows/records.
- Done() - Disconnects from c-treeACE Database Engine.

Note our simple mainline:

```
procedure TForm1.btnStartClick(Sender: TObject);
begin
    Init;
    Define;
    Manage;
end;

procedure TForm1.btnDoneClick(Sender: TObject);
begin
    Done;
    Close;
end;
```

We suggest opening the source code with your own editor.

Continue now to review these four steps.



## Init



First we need to open a connection to a database by providing the c-treeACE Database Engine with a user name, password and the database name.

Below is the code for **Initialize()**:

```
procedure TForm1.Init;
var
  ininame : string;
  reg : TRegistry;
  ini : TIniFile;
begin
  // retrieve the driver ini file
  reg := TRegistry.Create;
  try
    Reg.RootKey := HKEY_CURRENT_USER;
    if Reg.OpenKey('\Software\Borland\DBExpress', True) then
      begin
        ininame := Reg.ReadString('Driver Registry File');
        Reg.CloseKey;
      end;
  finally
    reg.free;
  end;

  // retrieve the LibraryName and VendorLib from ini file
  ini := TIniFile.Create(ininame);
  try
    SQLConnection1.LibraryName := ini.ReadString('ctreeDBX', 'LibraryName',
'ctreedbx.dll');
    SQLConnection1.VendorLib := ini.ReadString('ctreeDBX', 'VendorLib', 'ctesql.dll');
  finally
    ini.free;
  end;

  // connect to server
  SimpleDataSet1.Active := false;
  SQLConnection1.Connected := true;
end;
```



## Define



The define step is where specific data definitions are established by your application and/or process. This involves defining columns/fields and creating the tables/files with optional indices.

Below is the code for **Define()**:

```
procedure TForm1.Define;
begin
    try
        // start transaction
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE custmast (' +
            'cm_custnumb CHAR(4),' +
            'cm_custzipc CHAR(9),' +
            'cm_custstat CHAR(2),' +
            'cm_custrtng CHAR(1),' +
            'cm_custname VARCHAR(47),' +
            'cm_custaddr VARCHAR(47),' +
            'cm_custcity VARCHAR(47))');
        // commit transaction
        SQLConnection1.Commit(td);

    except on E: Exception do Handle_Exception(E);
    end;
end;
```



## Manage



The manage step provides data management functionality for your application and/or process.

Below is the code for **Manage()**:

```
procedure TForm1.Manage;
begin
    // delete any existing records
    Delete_Records;
    // populate the table with data
    Add_Records;
    // display contents of table
    Display_Records;
end;

procedure TForm1.Delete_Records;
begin
    try
        SQLConnection1.StartTransaction(td);
        SQLConnection1.ExecuteDirect('DELETE FROM custmast');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Add_Records;
const
    data : array [1..4] of string = (
        ('1000', '92867', 'CA', '1', 'Bryan Williams', '2999 Regency', 'Orange'),
        ('1001', '61434', 'CT', '1', 'Michael Jordan', '13 Main', 'Harford'),
        ('1002', '73677', 'GA', '1', 'Joshua Brown', '4356 Cambridge',
        'Atlanta'),
        ('1003', '10034', 'MO', '1', 'Keyon Dooling', '19771 Park Avenue',
        'Columbia')
    );
    nRecords : integer = 4;
var
    i : integer;
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        for i := 1 to nRecords do
            begin
                // add one record at time to table
                str := 'INSERT INTO custmast VALUES ' + data[i];
                SQLConnection1.ExecuteDirect(str);
            end;
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;
```





## Quick Tour

```
        end;  
    end;  
  
    procedure TForm1.Display_Records;  
    begin  
        try  
            SimpleDataSet1.DataSet.CommandType := ctQuery;  
            SimpleDataSet1.DataSet.CommandText := 'SELECT * FROM custmast';  
            SimpleDataSet1.Active := true;  
        except on E: Exception do Handle_Exception(E);  
        end;  
    end;  
end;
```



## Done



When an application and/or process has completed operations with the database, it must release resources by disconnecting from the database engine.

Below is the code for **Done()**:

```
procedure TForm1.Done;  
begin  
    SimpleDataSet1.Active := false;  
    SQLConnection1.Connected := false;  
end;
```



## Additional Resources

We encourage you to explore the additional resources listed here:

- Complete source code for this tutorial can be found in Unit1.pas in your installation directory, within the 'sdk\sql.dbx\Tutorial1' directory for your platform.  
Example for the Windows platform: C:\FairCom\V\*\win32\sdk\sql.dbx\Tutorial1\Unit1.pas.
- Additional documentation may be found on the FairCom Web site at: [www.faircom.com](http://www.faircom.com)



## 2.2 Relationships

..*sdksql.dbx\Tutorial2\Unit1.pas*

Now we will build some table/file relationships using the c-treeACE SQL DBX Component - Delphi.

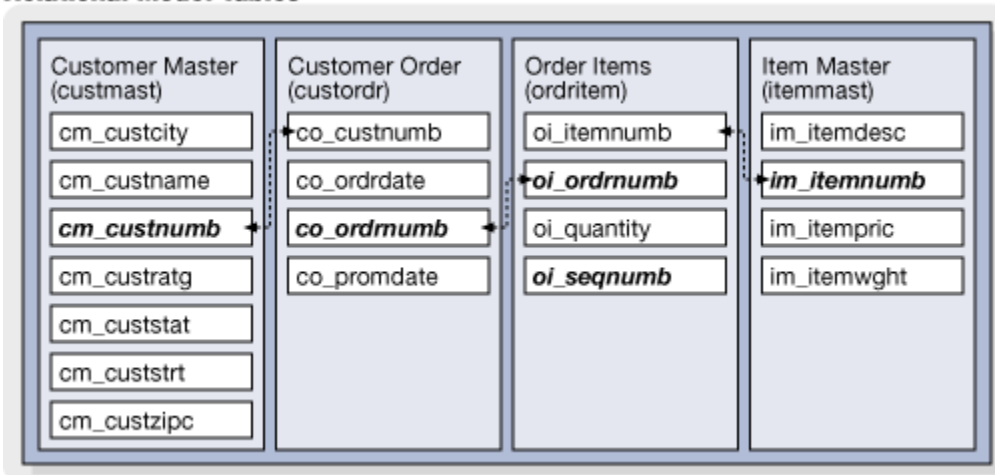
This tutorial will advance the concepts introduced in the first tutorial by expanding the number of tables. We will define key columns/fields and create specific indices for each table to form a relational model database.

Like all other examples in the c-tree tutorial series, this tutorial simplifies the creation and use of a database into four simple steps: Initialize(), Define(), Manage(), and You're Done() !

### Tutorial #2: Relational Model and Indexing

Here we add a bit more complexity, introducing multiple tables, with related indices in order to form a simple "relational" database simulating an Order Entry system. Here is an overview of what will be created:

#### Relational Model Tables



- Initialize() - Connects to the c-treeACE Database Engine.
- Define() - Defines and creates the "custmast", "custodr", "ordritem" and the "itemmast" tables/files with related indices.
- Manage() - Adds some related rows/records to all tables/files. Then queries the database.
- Done() - Disconnects from c-treeACE Database Engine.

Note our simple mainline:

```
procedure TForm1.FormShow(Sender: TObject);
begin
    Initialize;
    Define;
    Manage;
end;

procedure TForm1.btnCloseClick(Sender: TObject);
```



## Quick Tour

```
begin
  Done;
  Close;
end;
```

We suggest opening the source code with your own editor.

Continue now to review these four steps.



## Init



First we need to open a connection to a database by providing the c-treeACE Database Engine with a user name, password and the database name.

Below is the code for **Initialize()**:

```
procedure TForm1.Initialize;
var
  ininame : string;
  reg : TRegistry;
  ini : TIniFile;
begin
  // retrieve the driver ini file
  reg := TRegistry.Create;
  try
    Reg.RootKey := HKEY_CURRENT_USER;
    if Reg.OpenKey('\Software\Borland\DBExpress', True) then
      begin
        ininame := Reg.ReadString('Driver Registry File');
        Reg.CloseKey;
      end;
  finally
    reg.free;
  end;
  // retrieve the LibraryName and VendorLib from ini file
  ini := TIniFile.Create(ininame);
  try
    SQLConnection1.LibraryName := ini.ReadString('ctreeDBX', 'LibraryName',
'ctreedbx.dll');
    SQLConnection1.VendorLib := ini.ReadString('ctreeDBX', 'VendorLib', 'ctesql.dll');
  finally
    ini.free;
  end;
  // establish the connection
  SQLConnection1.Connected := true;
end;
```



## Define



The define step is where specific data definitions are established by your application and/or process. This involves defining columns/fields and creating the tables/files with optional indices.

Below is the code for **Define()**:

```
procedure TForm1.Define();
begin
    // open or create the tables
    Create_CustomerMaster_Table;
    Create_CustomerOrders_Table;
    Create_OrderItems_Table;
    Create_ItemMaster_Table;
end;

procedure TForm1.Create_CustomerMaster_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE custmast (' +
            'cm_custnumb CHAR(4),' +
            'cm_custzipc CHAR(9),' +
            'cm_custstat CHAR(2),' +
            'cm_custrtng CHAR(1),' +
            'cm_custname VARCHAR(47),' +
            'cm_custaddr VARCHAR(47),' +
            'cm_custcity VARCHAR(47))');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;

    try
        SQLConnection1.StartTransaction(td);
        SQLConnection1.Executedirect('CREATE UNIQUE INDEX cm_custnumb_idx ON custmast
(cm_custnumb)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_CustomerOrders_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE custordr (' +
            'co_ordrdate DATE,' +
            'co_promdate DATE,' +
            'co_ordrnumb CHAR(6),' +
            'co_custnumb CHAR(4))');
```



## Quick Tour

```
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;

    try
        SQLConnection1.StartTransaction(td);
        SQLConnection1.ExecuteDirect('CREATE UNIQUE INDEX co_ordrnumb_idx ON custordr
(co_ordrnumb)');
        SQLConnection1.ExecuteDirect('CREATE INDEX co_custnumb_idx ON custordr (co_custnumb)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_OrderItems_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE ordritem (' +
            'oi_sequnumb SMALLINT,' +
            'oi_quantity SMALLINT,' +
            'oi_ordrnumb CHAR(6),' +
            'oi_itemnumb CHAR(5))');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;

    try
        SQLConnection1.StartTransaction(td);
        SQLConnection1.ExecuteDirect('CREATE UNIQUE INDEX oi_ordrnumb_idx ON ordritem
(oi_ordrnumb, oi_sequnumb)');
        SQLConnection1.ExecuteDirect('CREATE INDEX oi_itemnumb_idx ON ordritem (oi_itemnumb)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_ItemMaster_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE itemmast (' +
            'im_itemwght INTEGER,' +
            'im_itempric MONEY,' +
            'im_itemnumb CHAR(5),' +
            'im_itemdesc VARCHAR(47))');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;

    try
        SQLConnection1.StartTransaction(td);
        SQLConnection1.ExecuteDirect('CREATE INDEX im_itemnumb_idx ON itemmast (im_itemnumb)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;
```





## Manage



The manage step provides data management functionality for your application and/or process.

Below is the code for **Manage()**:

```
procedure TForm1.Manage();
var
    str : string;
begin
    // populate the tables with data
    Add_CustomerMaster_Records;
    Add_CustomerOrders_Records;
    Add_OrderItems_Records;
    Add_ItemMaster_Records;

    // perform a query:
    // list customer name and total amount per order

    // name                total
    // @@@@@@@@@@@@@@@@    $xx.xx

    // for each order in the CustomerOrders table
    //   fetch order number
    //   fetch customer number
    //   fetch name from CustomerMaster table based on customer number
    //   for each order item in OrderItems table
    //     fetch item quantity
    //     fetch item number
    //     fetch item price from ItemMaster table based on item number
    //   next
    // next

    try
        SQLQuery1.SQL.Clear;
        str := 'SELECT cm_custname, SUM(im_itempric * oi_quantity) ' +
            'FROM custmast, custordr, ordritem, itemmast ' +
            'WHERE co_custnumb = cm_custnumb AND co_ordrnumb = oi_ordrnumb AND oi_itemnumb =
im_itemnumb ' +
            'GROUP BY cm_custnumb, cm_custname';

        SQLQuery1.SQL.Add(str);
        SQLQuery1.Prepared := true;
        SQLQuery1.Open;
        ClientDataSet1.Active := true;
    except on E: Exception do Handle_Exception(E);
    end;

end;

procedure TForm1.Add_CustomerMaster_Records;
const
    data : array [1..4] of string = (
```



## Quick Tour

```
        ('1000', '92867', 'CA', '1', 'Bryan Williams', '2999 Regency', 'Orange'),
        ('1001', '61434', 'CT', '1', 'Michael Jordan', '13 Main', 'Harford'),
        ('1002', '73677', 'GA', '1', 'Joshua Brown', '4356 Cambridge',
'Atlanta'),
        ('1003', '10034', 'MO', '1', 'Keyon Dooling', '19771 Park Avenue',
'Columbia')
    );
    nRecords : integer = 4;
var
    i : integer;
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        Delete_Records('custmast');
        for i := 1 to nRecords do
            begin
                // add one record at time to table
                str := 'INSERT INTO custmast VALUES ' + data[i];
                SQLConnection1.ExecuteDirect(str);
            end;
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Add_CustomerOrders_Records;
const
    data : array [1..2] of string = (
        ('09/01/2002', '09/05/2002', '1', '1001'),
        ('09/02/2002', '09/06/2002', '2', '1002')
    );
    nRecords : integer = 2;
var
    i : integer;
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        Delete_Records('custordr');
        for i := 1 to nRecords do
            begin
                // add one record at time to table
                str := 'INSERT INTO custordr VALUES ' + data[i];
                SQLConnection1.ExecuteDirect(str);
            end;
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Add_OrderItems_Records;
const
    data : array [1..4] of string = (
        ('1', '2', '1', '1'),
        ('2', '1', '1', '2'),
        ('3', '1', '1', '3'),
        ('1', '3', '2', '3')
    );
```



## Quick Tour

```
nRecords : integer = 4;
var
  i : integer;
  str : string;
begin
  try
    SqlConnection1.StartTransaction(td);
    Delete_Records('ordritem');
    for i := 1 to nRecords do
      begin
        // add one record at time to table
        str := 'INSERT INTO ordritem VALUES ' + data[i];
        SqlConnection1.ExecuteDirect(str);
      end;
    SqlConnection1.Commit(td);
  except on E: Exception do Handle_Exception(E);
  end;
end;

procedure TForm1.Add_ItemMaster_Records;
const
  data : array [1..4] of string = (
    (''10'', ''19.95'', ''1'', ''Hammer''),
    (''3'', ''9.99'', ''2'', ''Wrench''),
    (''4'', ''16.59'', ''3'', ''Saw''),
    (''1'', ''3.98'', ''4'', ''Pliers'')
  );
  nRecords : integer = 4;
var
  i : integer;
  str : string;
begin
  try
    SqlConnection1.StartTransaction(td);
    Delete_Records('itemmast');
    for i := 1 to nRecords do
      begin
        // add one record at time to table
        str := 'INSERT INTO itemmast VALUES ' + data[i];
        SqlConnection1.ExecuteDirect(str);
      end;
    SqlConnection1.Commit(td);
  except on E: Exception do Handle_Exception(E);
  end;
end;

procedure TForm1.Delete_Records(Table : string);
var
  str : string;
begin
  try
    str := 'DELETE FROM ' + Table;
    SqlConnection1.ExecuteDirect(str);
  except on E: Exception do Handle_Exception(E);
  end;
end;
```



## Done



When an application and/or process has completed operations with the database, it must release resources by disconnecting from the database engine.

Below is the code for **Done()**:

```
procedure TForm1.Done();  
begin  
    SQLConnection1.Connected := false;  
end;
```



## Additional Resources

We encourage you to explore the additional resources listed here:

- Complete source code for this tutorial can be found in Unit1.pas in your installation directory, within the 'sdk\sql.dbx\Tutorial2' directory for your platform.  
Example for the Windows platform: C:\FairCom\V\*\win32\sdk\sql.dbx\Tutorial2\Unit1.pas.
- Additional documentation may be found on the FairCom Web site at: [www.faircom.com](http://www.faircom.com)



## 2.3 Record/Row Locking

*..lsdk\sql.dbx\Tutorial3\Unit1.pas*

Now we will explore row/record locks using the c-treeACE SQL DBX Component - Delphi.

The functionality for this tutorial focuses on inserting/adding rows/records, then updating a single row/record in the customer master table under locking control. The application will pause after a LOCK is placed on a row/record. Another instance of this application should then be launched, which will block, waiting on the lock held by the first instance. Pressing the <Enter> key will enable the first instance to proceed. This will result in removing the lock thereby allowing the second instance to continue execution. Launching two processes provides a visual demonstration of the effects of locking and a basis for experimentation on your own.

Like all other examples in the c-tree tutorial series, this tutorial simplifies the creation and use of a database into four simple steps: Initialize(), Define(), Manage(), and you're Done() !

### Tutorial #3: Locking

Here we demonstrate the enforcement of data integrity by introducing record/row "locking".

- Initialize() - Connects to the c-treeACE Database Engine.
- Define() - Defines and creates a "customer master" (custmast) table/file.
- Manage() - Adds a few rows/records; Reads the rows/records back from the database; displays the column/field content. Then demonstrates an update operation under locking control, and a scenario that shows a locking conflict.
- Done() - Disconnects from c-treeACE Database Engine.

Note our simple mainline:

```
procedure TForm1.FormShow(Sender: TObject);
begin
    Initialize;
    Define;
    Manage;
end;

procedure TForm1.BtnCloseClick(Sender: TObject);
begin
    Done;
    Close;
end;
```

We suggest opening the source code with your own editor.

Continue now to review these four steps.



## Init



First we need to open a connection to a database by providing the c-treeACE Database Engine with a user name, password and the database name.

Below is the code for **Initialize()**:

```
procedure TForm1.Initialize();
var
    ininame : string;
    reg : TRegistry;
    ini : TIniFile;
begin
    // retrieve the driver ini file
    reg := TRegistry.Create;
    try
        Reg.RootKey := HKEY_CURRENT_USER;
        if Reg.OpenKey('\Software\Borland\DBExpress', True) then
            begin
                ininame := Reg.ReadString('Driver Registry File');
                Reg.CloseKey;
            end;
    finally
        reg.free;
    end;

    // retrieve the LibraryName and VendorLib from ini file
    ini := TIniFile.Create(ininame);
    try
        SQLConnection1.LibraryName := ini.ReadString('ctreeDBX', 'LibraryName',
'ctreedbx.dll');
        SQLConnection1.VendorLib := ini.ReadString('ctreeDBX', 'VendorLib', 'ctesql.dll');
    finally
        ini.free;
    end;

    // connect to server
    SQLConnection1.Connected := true;
end;
```



## Define



The define step is where specific data definitions are established by your application and/or process. This involves defining columns/fields and creating the tables/files with optional indices.

Below is the code for **Define()**:

```
procedure TForm1.Define();
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE custmast (' +
            'cm_custnumb CHAR(4),' +
            'cm_custzipc CHAR(9),' +
            'cm_custstat CHAR(2),' +
            'cm_custrtng CHAR(1),' +
            'cm_custname VARCHAR(47),' +
            'cm_custaddr VARCHAR(47),' +
            'cm_custcity VARCHAR(47))');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;

    try
        SQLConnection1.StartTransaction(td);
        SQLConnection1.ExecuteDirect('CREATE UNIQUE INDEX cm_custnumb_idx ON custmast
(cm_custnumb)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;
```





## Manage



The manage step provides data management functionality for your application and/or process.

Below is the code for **Manage()**:

```
procedure TForm1.Manage();
begin
    // delete any existing records
    Delete_Records();
    // populate the table with data
    Add_CustomerMaster_Records();
    // display contents of table
    Display_Records();
end;

procedure TForm1.btmUpdateClick(Sender: TObject);
begin
    // update a record under locking control
    Update_CustomerMaster_Record();
    // display again after update and effects of lock
    Display_Records();
end;

procedure TForm1.Add_CustomerMaster_Records;
const
    data : array [1..4] of string = (
        ('1000', '92867', 'CA', '1', 'Bryan Williams', '2999 Regency', 'Orange'),
        ('1001', '61434', 'CT', '1', 'Michael Jordan', '13 Main', 'Harford'),
        ('1002', '73677', 'GA', '1', 'Joshua Brown', '4356 Cambridge',
        'Atlanta'),
        ('1003', '10034', 'MO', '1', 'Keyon Dooling', '19771 Park Avenue',
        'Columbia')
    );
    nRecords : integer = 4;
var
    i : integer;
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        for i := 1 to nRecords do
            begin
                // add one record at time to table
                str := 'INSERT INTO custmast VALUES ' + data[i];
                SQLConnection1.ExecuteDirect(str);
            end;
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;
```



## Quick Tour

```
procedure TForm1.Delete_Records;
begin
    try
        SQLConnection1.ExecuteDirect('DELETE FROM custmast');
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Display_Records;
begin
    try
        SimpleDataSet1.Active := false;
        SimpleDataSet1.DataSet.CommandType := ctQuery;
        SimpleDataSet1.DataSet.CommandText := 'SELECT * FROM custmast';
        SimpleDataSet1.Active := true;
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Update_CustomerMaster_Record;
var
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        str := 'UPDATE custmast SET cm_custname = ''KEYON DOOLING'' where cm_custnumb = ''1003''';
        SQLConnection1.ExecuteDirect(str);

        Application.MessageBox('Click OK to unlock', '', 0);

        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;
```



## Done



When an application and/or process has completed operations with the database, it must release resources by disconnecting from the database engine.

Below is the code for **Done()**:

```
procedure TForm1.Done();  
begin  
    SQLConnection1.Connected := false;  
end;
```



## Additional Resources

We encourage you to explore the additional resources listed here:

- Complete source code for this tutorial can be found in Unit1.pas in your installation directory, within the 'sdk\sql.dbx\Tutorial3' directory for your platform.  
Example for the Windows platform: C:\FairCom\V\*\win32\sdk\sql.dbx\Tutorial3\Unit1.pas.
- Additional documentation may be found on the FairCom Web site at: [www.faircom.com](http://www.faircom.com)



## 2.4 Transaction Processing

*..lsdk\sql.dbx\Tutorial4\Unit1.pas*

Now we will discuss transaction processing as it relates to the c-treeACE SQL DBX Component - Delphi.

Transaction processing provides a safe method by which multiple database operations spread across separate tables/files are guaranteed to be atomic. By atomic, we mean that, within a transaction, either all of the operations succeed or none of the operations succeed. This "either all or none" atomicity ensures that the integrity of the data in related tables/files is secure.

Like all other examples in the c-tree tutorial series, this tutorial simplifies the creation and use of a database into four simple steps: Initialize(), Define(), Manage(), and You're Done()!

### Tutorial #4: Transaction Processing

Here we demonstrate transaction control.

- Initialize() - Connects to the c-treeACE Database Engine.
- Define() - Defines and creates our four tables/files.
- Manage() - Adds rows/records to multiple tables/files under transaction control.
- Done() - Disconnects from c-treeACE Database Engine.

Note our simple mainline:

```
procedure TForm1.FormShow(Sender: TObject);
begin
    Initialize;
    Define;
    Manage;
end;

procedure TForm1.BtnCloseClick(Sender: TObject);
begin
    Done;
    Close;
end;
```

We suggest opening the source code with your own editor.

Continue now to review these four steps.



## Init



First we need to open a connection to a database by providing the c-treeACE Database Engine with a user name, password and the database name.

Below is the code for **Initialize()**:

```
procedure TForm1.Initialize();
var
  ininame : string;
  reg : TRegistry;
  ini : TIniFile;
begin
  // retrieve the driver ini file
  reg := TRegistry.Create;
  try
    Reg.RootKey := HKEY_CURRENT_USER;
    if Reg.OpenKey('\Software\Borland\DBExpress', True) then
      begin
        ininame := Reg.ReadString('Driver Registry File');
        Reg.CloseKey;
      end;
  finally
    reg.free;
  end;

  // retrieve the LibraryName and VendorLib from ini file
  ini := TIniFile.Create(ininame);
  try
    SQLConnection1.LibraryName := ini.ReadString('ctreeDBX', 'LibraryName',
'ctreedbx.dll');
    SQLConnection1.VendorLib := ini.ReadString('ctreeDBX', 'VendorLib', 'ctesql.dll');
  finally
    ini.free;
  end;

  // connect to server
  SQLConnection1.Connected := true;
end;
```



## Define



The define step is where specific data definitions are established by your application and/or process. This involves defining columns/fields and creating the tables/files with optional indices.

Below is the code for **Define()**:

```
procedure TForm1.Define();
begin
    // delete tables ...
    Delete_Tables();
    // ...and re-create them with constraints
    Create_CustomerMaster_Table;
    Create_CustomerOrders_Table;
    Create_OrderItems_Table;
    Create_ItemMaster_Table;
end;

procedure TForm1.Delete_Tables;
begin
    try
        SQLConnection1.StartTransaction(td);
    except on E: Exception do Handle_Exception(E);
    end;
    try
        SQLConnection1.ExecuteDirect('DROP TABLE ordritem');
    except on E: Exception do Handle_Exception(E);
    end;
    try
        SQLConnection1.ExecuteDirect('DROP TABLE custordr');
    except on E: Exception do Handle_Exception(E);
    end;
    try
        SQLConnection1.ExecuteDirect('DROP TABLE custmast');
    except on E: Exception do Handle_Exception(E);
    end;
    try
        SQLConnection1.ExecuteDirect('DROP TABLE itemmast');
    except on E: Exception do Handle_Exception(E);
    end;
    try
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_CustomerMaster_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
```



## Quick Tour

```
        SQLConnection1.ExecuteDirect('CREATE TABLE custmast (' +
            'cm_custnumb CHAR(4) PRIMARY KEY,' +
            'cm_custzipc CHAR(9),' +
            'cm_custstat CHAR(2),' +
            'cm_custrtng CHAR(1),' +
            'cm_custname VARCHAR(47),' +
            'cm_custaddr VARCHAR(47),' +
            'cm_custcity VARCHAR(47))');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_CustomerOrders_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE custodr (' +
            'co_ordrdate DATE,' +
            'co_promdate DATE,' +
            'co_ordrnumb CHAR(6) PRIMARY KEY,' +
            'co_custnumb CHAR(4),' +
            'FOREIGN KEY (co_custnumb) REFERENCES custmast)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_OrderItems_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE ordritem (' +
            'oi_sequnumb SMALLINT,' +
            'oi_quantity SMALLINT,' +
            'oi_ordrnumb CHAR(6),' +
            'oi_itemnumb CHAR(5),' +
            'FOREIGN KEY (oi_itemnumb) REFERENCES itemmast,' +
            'FOREIGN KEY (oi_ordrnumb) REFERENCES custodr)');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Create_ItemMaster_Table;
begin
    try
        SQLConnection1.StartTransaction(td);
        // create table
        SQLConnection1.ExecuteDirect('CREATE TABLE itemmast (' +
            'im_itemwght INTEGER,' +
            'im_itempric MONEY,' +
            'im_itemnumb CHAR(5) PRIMARY KEY,' +
            'im_itemdesc VARCHAR(47))');
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;
```





Quick Tour



## Manage



The manage step provides data management functionality for your application and/or process.

Below is the code for **Manage()**:

```
procedure TForm1.Manage();
begin
    // populate the tables with data
    Add_CustomerMaster_Records;
    Add_ItemMaster_Records;

    Add_Transactions();

    // display the orders and their items
    Display_CustomerOrders();
    Display_OrderItems();
end;

procedure TForm1.Add_CustomerMaster_Records;
const
    data : array [1..4] of string = (
        ('1000', '92867', 'CA', '1', 'Bryan Williams', '2999 Regency', 'Orange'),
        ('1001', '61434', 'CT', '1', 'Michael Jordan', '13 Main', 'Harford'),
        ('1002', '73677', 'GA', '1', 'Joshua Brown', '4356 Cambridge',
        'Atlanta'),
        ('1003', '10034', 'MO', '1', 'Keyon Dooling', '19771 Park Avenue',
        'Columbia')
    );
    nRecords : integer = 4;
var
    i : integer;
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        for i := 1 to nRecords do
            begin
                // add one record at time to table
                str := 'INSERT INTO custmast VALUES ' + data[i];
                SQLConnection1.ExecuteDirect(str);
            end;
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Add_ItemMaster_Records;
const
    data : array [1..4] of string = (
        ('10', '19.95', '1', 'Hammer'),
        ('13', '9.99', '2', 'Wrench')
    );
```



## Quick Tour

```
        (''4'', '16.59'', '3'', 'Saw'),
        (''1'', '3.98'', '4'', 'Pliers')
    );
    nRecords : integer = 4;
var
    i : integer;
    str : string;
begin
    try
        SQLConnection1.StartTransaction(td);
        for i := 1 to nRecords do
            begin
                // add one record at time to table
                str := 'INSERT INTO itemmast VALUES ' + data[i];
                SQLConnection1.ExecuteDirect(str);
            end;
        SQLConnection1.Commit(td);
    except on E: Exception do Handle_Exception(E);
    end;
end;

procedure TForm1.Add_Transactions;
const
    orders : array [1..3, 1..4] of string = (
        ('09/01/2002', '09/05/2002', '1', '1001'),
        ('09/02/2002', '09/06/2002', '2', '9999'), // bad customer number
        ('09/22/2002', '09/26/2002', '3', '1003')
    );
    items : array [1..6, 1..4] of string = (
        ('1', '1', '2', '1'),
        ('1', '2', '1', '2'),
        ('2', '1', '1', '3'),
        ('2', '2', '3', '4'),
        ('3', '1', '2', '3'),
        ('3', '2', '2', '99') // bad item number
    );
    nOrders : integer = 3;
    nItems : integer = 6;
var
    i : integer;
    j : integer;
    str : string;
begin
    j := 1;
    // process orders
    for i := 1 to nOrders do
        begin
            try
                // start a transaction
                SQLConnection1.StartTransaction(td);
                str := 'INSERT INTO custodr VALUES (' +
                    '''' + orders[i,1] + ''', ' +
                    '''' + orders[i,2] + ''', ' +
                    '''' + orders[i,3] + ''', ' +
                    '''' + orders[i,4] + ''')';
                // add order record
                SQLConnection1.ExecuteDirect(str);
            except on E: Exception do Handle_Exception(E);
            end;
        end;
    end;
```



## Quick Tour

```
// process order items
while (CompareStr(items[j,1], orders[i,3]) = 0) do
begin
    try
        str := 'INSERT INTO ordritem VALUES (' +
            items[j,2] + ', ' +
            items[j,3] + ', ' +
            ''' + items[j,1] + ''', ' +
            ''' + items[j,4] + ''')';
        // add order item record
        SQLConnection1.ExecuteDirect(str);
    except on E: Exception do Handle_Exception(E);
    end;

    // bump to next item
    j := j + 1;

    // exit the while loop on last item
    if (j >= nItems) then
        break;
end;

try
    // commit the transaction
    SQLConnection1.Commit(td);
except on E: Exception do
    Handle_Exception(E);
end;
end;

procedure TForm1.Display_CustomerOrders();
begin
    ClientDataSet1.Active := false;
    SQLQuery1.SQL.Clear;
    SQLQuery1.SQL.Add('SELECT * FROM custordr');
    SQLQuery1.Prepared := true;
    SQLQuery1.Open;
    ClientDataSet1.Active := true;
end;

procedure TForm1.Display_OrderItems();
begin
    ClientDataSet2.Active := false;
    SQLQuery2.SQL.Clear;
    SQLQuery2.SQL.Add('SELECT * FROM ordritem');
    SQLQuery2.Prepared := true;
    SQLQuery2.Open;
    ClientDataSet2.Active := true;
end;
```



## Done



When an application and/or process has completed operations with the database, it must release resources by disconnecting from the database engine.

Below is the code for **Done()**:

```
procedure TForm1.Done();  
begin  
    Delete_Tables();  
    SQLConnection1.Connected := false;  
end;
```



## Additional Resources

We encourage you to explore the additional resources listed here:

- Complete source code for this tutorial can be found in Unit1.pas in your installation directory, within the 'sdk\sql.dbx\Tutorial4' directory for your platform.  
Example for the Windows platform: C:\FairCom\V\*\win32\sdk\sql.dbx\Tutorial4\Unit1.pas.
- Additional documentation may be found on the FairCom Web site at: [www.faircom.com](http://www.faircom.com)

# FairCom Typographical Conventions

Before you begin using this guide, be sure to review the relevant terms and typographical conventions used in the documentation.

The following formatted items identify special information.

Formatting convention	Type of Information
<b>Bold</b>	Used to emphasize a point or for variable expressions such as parameters
CAPITALS	Names of keys on the keyboard. For example, SHIFT, CTRL, or ALT+F4
<i>FairCom Terminology</i>	FairCom technology term
<b>FunctionName()</b>	c-treeACE Function name
<i>Parameter</i>	c-treeACE Function Parameter
Code Example	Code example or Command line usage
<b>utility</b>	c-treeACE executable or utility
<i>filename</i>	c-treeACE file or path name
CONFIGURATION KEYWORD	c-treeACE Configuration Keyword
<b>CTREE_ERR</b>	c-treeACE Error Code





# Copyright Notice

Copyright © 1992-2019 FairCom USA. All rights reserved.

No part of this publication may be stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of FairCom USA. Printed in the United States of America.

Information in this document is subject to change without notice.

## Trademarks

c-treeACE, c-treeRTG, c-treeAMS, c-tree Plus, c-tree, r-tree, FairCom and FairCom's circular disc logo are trademarks of FairCom USA, registered in the United States and other countries.

The following are third-party trademarks: AMD and AMD Opteron are trademarks of Advanced Micro Devices, Inc. Macintosh, Mac, Mac OS, and Xcode are trademarks of Apple Inc., registered in the U.S. and other countries. Embarcadero, the Embarcadero Technologies logos and all other Embarcadero Technologies product or service names are trademarks, service marks, and/or registered trademarks of Embarcadero Technologies, Inc. and are protected by the laws of the United States and other countries. Business Objects and the Business Objects logo, BusinessObjects, Crystal Reports, Crystal Decisions, Web Intelligence, Xcelsius, and other Business Objects products and services mentioned herein as well as their respective logos are trademarks or registered trademarks of Business Objects Software Ltd. Business Objects is an SAP company. HP and HP-UX are registered trademarks of the Hewlett-Packard Company. AIX, IBM, POWER6, POWER7, and pSeries are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. Intel, Intel Core, Itanium, Pentium and Xeon are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. Microsoft, the .NET logo, the Windows logo, Access, Excel, SQL Server, Visual Basic, Visual C++, Visual C#, Visual Studio, Windows, Windows Server, and Windows Vista are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. Novell and SUSE are registered trademarks of Novell, Inc. in the United States and other countries. Oracle and Java are registered trademarks of Oracle and/or its affiliates. QNX and Neutrino are registered trademarks of QNX Software Systems Ltd. in certain jurisdictions. CentOS, Red Hat, and the Shadow Man logo are registered trademarks of Red Hat, Inc. in the United States and other countries, used with permission. UNIX and UnixWare are registered trademarks of The Open Group in the United States and other countries. Linux is a trademark of Linus Torvalds in the United States, other countries, or both. Python and PyCon are trademarks or registered trademarks of the Python Software Foundation. OpenServer is a trademark or registered trademark of Xinuos, Inc. in the U.S.A. and other countries. Unicode and the Unicode Logo are registered trademarks of Unicode, Inc. in the United States and other countries.

Btrieve is a registered trademark of Actian Corporation.

ACUCOBOL-GT, MICRO FOCUS, RM/COBOL, and Visual COBOL are trademarks or registered trademarks of Micro Focus (IP) Limited or its subsidiaries in the United Kingdom, United States and other countries.

isCOBOL and Veryant are trademarks or registered trademarks of Veryant in the United States and other countries.

All other trademarks, trade names, company names, product names, and registered trademarks are the property of their respective holders.

Portions Copyright © 1991-2016 Unicode, Inc. All rights reserved.

Portions Copyright © 1998-2016 The OpenSSL Project. All rights reserved. This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>).

Portions Copyright © 1995-1998 Eric Young (eay@cryptsoft.com). All rights reserved. This product includes cryptographic software written by Eric Young (eay@cryptsoft.com). This product includes software written by Tim Hudson (tjh@cryptsoft.com).

Portions © 1987-2019 Dharma Systems, Inc. All rights reserved. This software or web site utilizes or contains material that is © 1994-2007 DUNDAS DATA VISUALIZATION, INC. and its licensors, all rights reserved.

Portions Copyright © 1995-2013 Jean-loup Gailly and Mark Adler.

2/28/2019

# 3. Index

**A**  
Additional Resources .....9, 19, 26, 36

**C**  
Copyright Notice .....xxxix  
c-treeACE SQL dbExpress ..... 1

**D**  
Define .....5, 13, 22, 29  
Done .....8, 18, 25, 35

**F**  
FairCom Typographical Conventions .....xxxvii

**I**  
Init .....4, 12, 21, 28  
Install c-treeDBX..... 1  
Introductory Tutorial.....3

**M**  
Manage .....6, 15, 23, 32

**Q**  
Quick Tour .....2

**R**  
Record/Row Locking.....20  
Relationships ..... 10

**T**  
Transaction Processing .....27

