



# LNDB

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## LoggerNet Database Software

# Campbell Scientific, Inc.

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# 1. Introduction

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LNDB is an application used to move data from one LoggerNet server into a single database. There are two main components in LNDB: LNDB Manager and LNDB Engine. LNDB Manager is used to set up a database and select the datalogger data tables that will be stored in the database. It also provides tools to monitor the LNDB Engine and to review the database data. LNDB Engine runs as a service and sends the selected data from the LoggerNet data cache to the database. LNDB also includes a report generator and utilities for importing and exporting data.

**NOTE:**

LNDB works with only one LoggerNet server and a single database. Only one copy of LNDB can be running on a computer. If you need to work with multiple LoggerNet servers, you will need multiple copies of LNDB running on separate computers. Each will also need its own separate database.

## 1.1 Supported Databases

LNDB has been tested with the following databases:

- Microsoft SQL Server (Express, Standard, and Enterprise) 2016-2022

- Microsoft SQL Server Compact 4.0 SP1 (installed with LNDB. Support ended in July 2021.)

- MySQL 8.0 – 8.4 (with an appropriate 32-bit Unicode ODBC database driver)

- Oracle 19c (19.1.0) and 21c (21.1.0)

- PostgreSQL 12.2 – 17.0

**NOTE:**

LNDB may work with other versions of these databases. This has only been tested against database versions that are either current, or are still being maintained by their respective developers.

SQL Server Compact is at end of life and Microsoft ended their extended support for this database in July 2021. Campbell Scientific provides the option to install SQL Server Compact for compatibility reasons for organizations still using this database.

Relational databases like the ones supported by LNDB enforce an upper limit on the number of columns you can have in a single database table. Depending on the database, this limit is

usually 1000 or 1024. In order for LNDB to store data successfully to the database, we recommend that data tables have fewer than 1000 columns.

A SQL Server Compact database is limited to 4 GB in size. If you anticipate the need for a larger database, a SQL Server or MySQL database should be used.

Using a server-based database such as SQL Server, MySQL, Oracle, or PostgreSQL will be more robust and may give better performance. When using SQL Server, MySQL, Oracle, or PostgreSQL, you will need to create a database instance to be used by LNDB (see [Creating a Database for MySQL, Microsoft SQL Server, Oracle, or PostgreSQL](#) (p. 11)).

Sub-second data in a MySQL database requires MySQL 5.6.4 (or later) and LNDB 1.2 (or later). Note that only newly-created tables will include sub-second data. Existing tables will not be updated to include sub-second data.

If LNDB has been running with a SQL Server 2005 database, the timestamps in the tables will be of type DateTime. If you then upgrade to SQL Server 2008 the DateTime data type for the timestamps is carried over to the 2008 database. However, LNDB expects the timestamps to be of type DateTime2 which has a higher precision than DateTime. This type mismatch causes queries to fail. In order to fix this issue, you will need to use the SQL Server management tools to change the data type for the timestamp columns to DateTime2.

## 1.2 Supported Operating Systems

LNDB runs on Windows 11 or 10 and Windows Server 2012 R2, 2016, or 2019.

### NOTE:

When using Windows Server with security policies other than the default policies, you will need to work with your IT administrator to work out any security issues.

In addition to a supported Windows operating system, LNDB 2.0 requires Microsoft .NET Framework 4.6.2 or newer to run properly. Microsoft .NET Framework 3.5 must also be installed to use the reporting functions of LNDB 2.0.

## 1.3 What's New in 2.0.1?

LNDB 2.0.1 includes the following enhancements from 1.3:

- Support for
  - PostgreSQL
  - Oracle

- Users can optionally include Microsoft SQL Server Compact.
- Miscellaneous other changes and bug fixes.

## 2. Getting Started

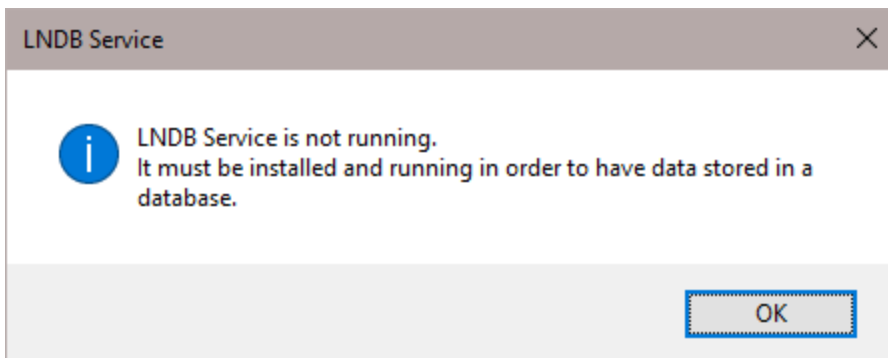
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Setting up LNDB involves the following steps:

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### 2.1 Installing and Starting the LNDB Service

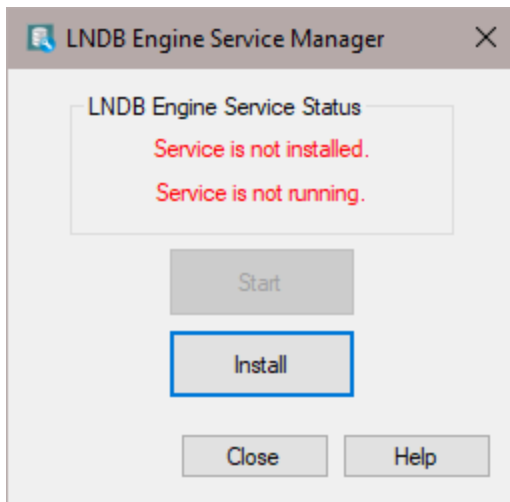
The first time you open LNDB, the following message will occur indicating that the LNDB Engine Service is not running.



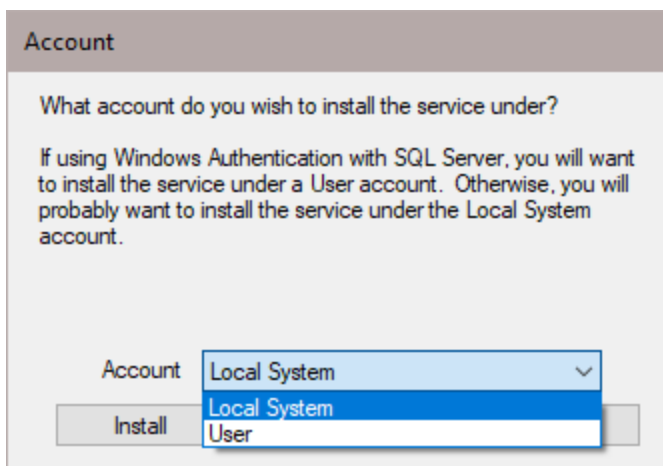
Once you press OK, the LNDB Engine Service Manager will open. This utility is used to install LNDB as a service and to enable/disable that service as required.

#### NOTE:

You must have administrative rights on your computer in order to run the Service Manager. If you do not have administrative rights, an error message will be displayed when the Service Manager tries to open.

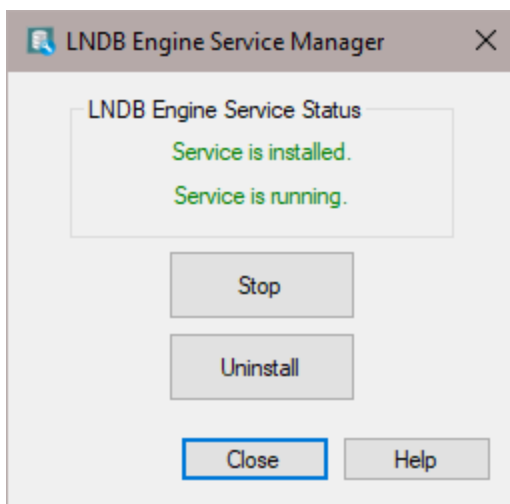
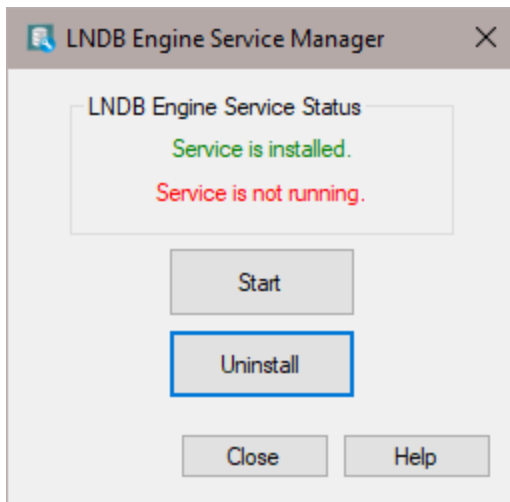


Press the **Install** button to install LNDB as a service. You will then be asked what account to install the service under.



You can choose to install the service under the Local System account or under a User account. Note that a User account is most likely necessary if you are using Windows Authentication in SQL Server. In most other cases, the Local System account can be used. If User account is chosen, you will be asked to provide a username and password.

Once the application is installed as a service, press the **Start** button on the LNDB Engine Service Manager window to start the service.



You can then press the **Close** button to close the LNDB Engine Service Manager.

Once LNDB is installed as a service, you can open the LNDB Engine Service Manager from the File > Configure LNDB Engine Service menu item or by double-clicking on the LNDB Engine Status Label on the [Status Bar](#) (p. 23). The LNDB Engine Service Manager can also be opened directly from the LoggerNet toolbar under the Database category.

## 2.2 Selecting a LoggerNet Server

The **Log into LoggerNet Server** dialog box comes up automatically the first time LNDB is run, once the LNDB Service is installed and started. It can be opened at any time from the File > Select LoggerNet Server menu item or by double-clicking on the LN Connection Status Label on the [Status Bar](#) (p. 23).

This dialog box allows you to specify the computer running the LoggerNet server to which LNDB should connect. The dialog box has the following fields:

**Server Address** - This is the TCP/IP address of the computer running the LoggerNet server to which you are trying to connect. This must be the valid name of an existing computer or a TCP/IP address (in the form ###.###.###.### for an IPv4 address or [#####:#####:#####:#####:#####:#####] for an IPv6 address). If the software server resides on the same computer as the client, you can simply type in LocalHost for the server name.

**NOTE:**

Note that if you have used a command line argument to change LoggerNet's default port number, you must specify this alternate port number when entering the Server Address (e.g., LocalHost:**6700** or 192.168.7.123:**6700**).

**Username** - Your username on the LoggerNet server.

**Password** - Your password for the LoggerNet server.

The **User Name** and **Password** fields are required only if your server administrator has set up security on your LoggerNet server.

Each time you start the client, you will be prompted to enter this information. However, you can save the login information by selecting the **Remember username and password** check box, or you can select the **Automatically login to this server** check box to skip this window and use the information from the last session.

**NOTE:**

All information must be saved for the LNDB Engine. The **Remember username and password** check box and the **Automatically login to this server** check box apply only to the LNDB Manager.

If you are connecting to a remote LoggerNet server, the LoggerNet server must have Remote Connections enabled (Tools > Options > Allow Remote Connections) in order for LNDB to be able to connect to the server.

## 2.3 Selecting a Database

The **Select Database** dialog box comes up automatically the first time LNDB is opened once the service is installed and started and the server is selected. At other times, it can be opened from the File > Select Database menu item or by double-clicking on the DB Connection Status Label on the [Status Bar](#) (p. 23). LNDB supports SQL Server Compact, SQL Server, MySQL, Oracle, and PostgreSQL databases. Once you select a database, fill in the necessary information, and click OK, a connection attempt will be made. If the connection succeeds, the database dialog will be closed and the connection will be used for the application. If the connection fails, a message will be shown and the Select Database dialog will continue to be shown.



#### NOTE:

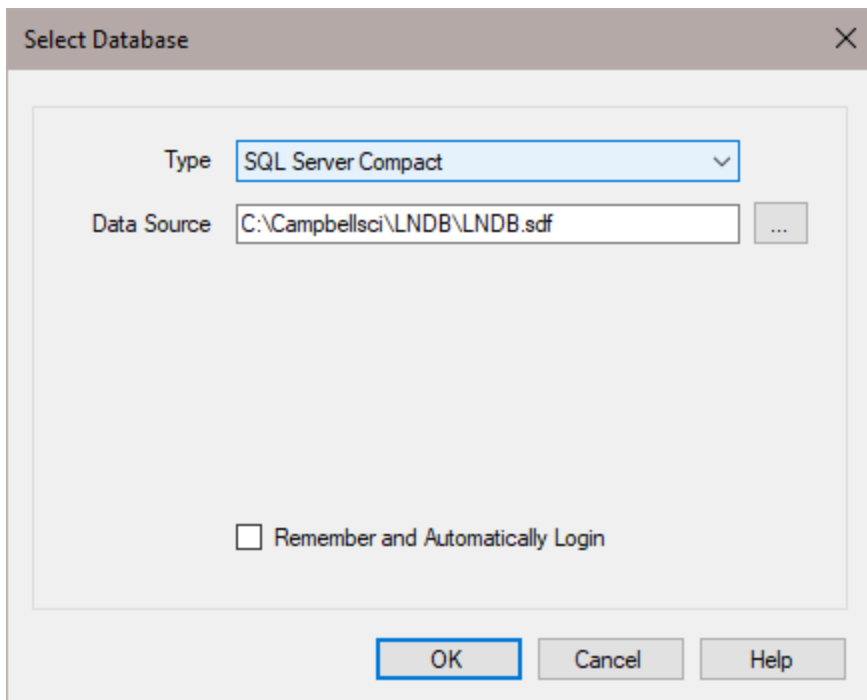
When using SQL Server, MYSQL, Oracle, or PostgreSQL, you will need to first create a database instance to be used by LNDB. See [Creating a Database for MySQL, Microsoft SQL Server, Oracle, or PostgreSQL](#) (p. 11).

For LNDB versions 2.0 and older, SQL Server Compact is included with the LNDB install. If you are running LNDB 2.0 or older, this database should not be uninstalled. It is required for LNDB to function correctly.

When installing LNDB versions newer than 2.0, you are given the option of whether or not to install SQL Server Compact. (SQL Server Compact is at end of life and Microsoft ended their extended support for this database in July 2021. Campbell Scientific provides the option to install SQL Server Compact for compatibility reasons for organizations still using this database.)

If you have upgraded an older version of LNDB to a version newer than 2.0 and you are not using the SQL Server Compact database, you can uninstall the database without affecting the functionality of LNDB.

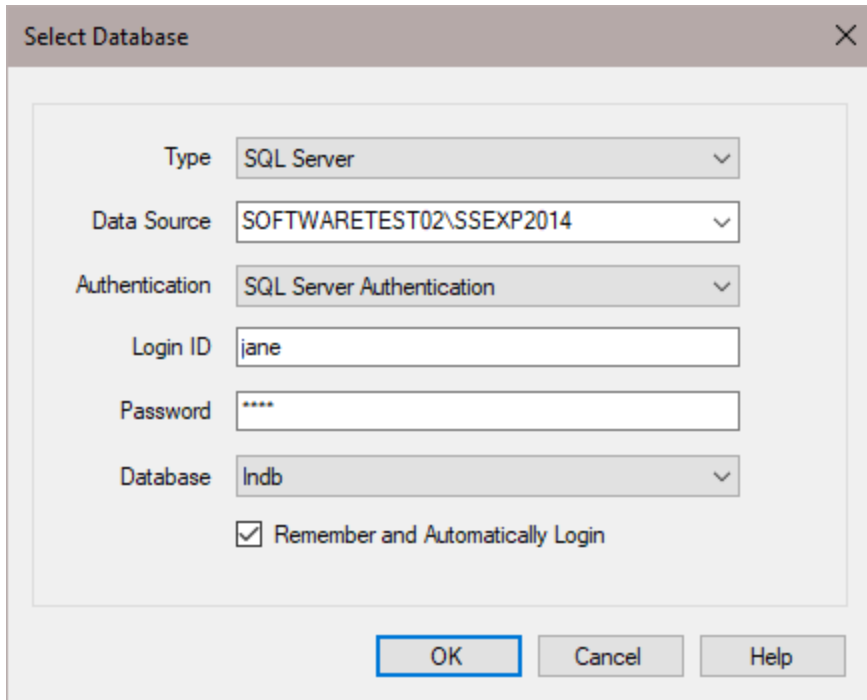
## 2.3.1 SQL Server Compact



SQL Server Compact is a single-file database that is optionally installed when LNDB is installed. It only requires the selection of a filename. The default location of the database will be *<working directory>\LNDB.sdf*. LNDB does not support any encryption or security options on the SQL

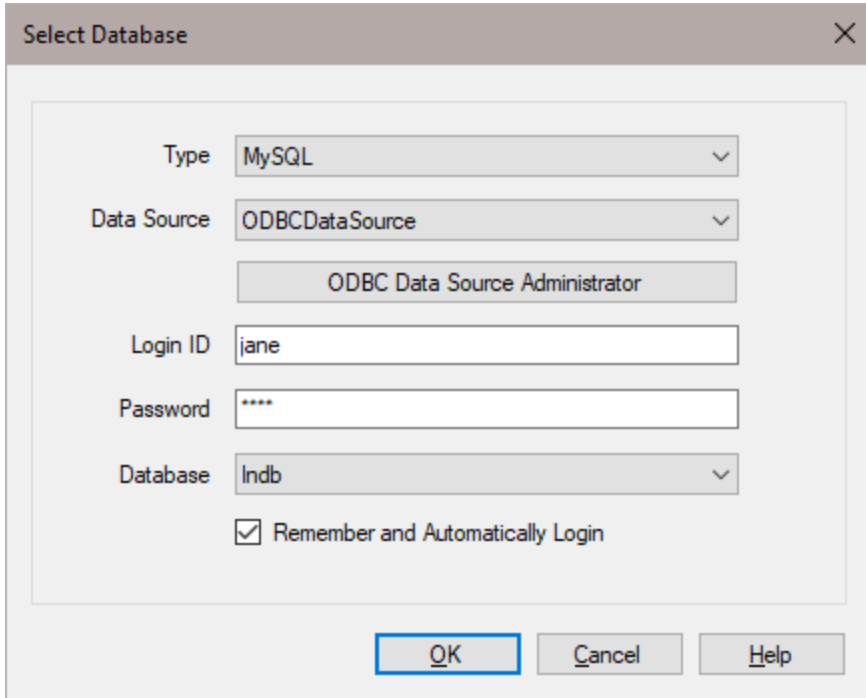
Server Compact database. When selecting the database within the LNDB Manager, the database will be created when the **OK** button is pressed.

## 2.3.2 SQL Server

A screenshot of a 'Select Database' dialog box. The dialog has a title bar with a close button (X). Inside, there are several fields: 'Type' is a dropdown menu set to 'SQL Server'; 'Data Source' is a dropdown menu set to 'SOFTWARETEST02\SSEX2014'; 'Authentication' is a dropdown menu set to 'SQL Server Authentication'; 'Login ID' is a text box containing 'jane'; 'Password' is a text box containing four asterisks; 'Database' is a dropdown menu set to 'Indb'. Below these fields is a checkbox labeled 'Remember and Automatically Login' which is checked. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'. The 'OK' button is highlighted with a blue border.

To configure a connection to SQL Server you must select a SQL Server instance. The list of published SQL Server instances is shown in the Data Source combo box. You can also type into the Data Source combo box, because the desired server might not be published. Windows Authentication or SQL Server Authentication can be selected. Windows Authentication does not require a username and password, but rather uses Windows user accounts to authenticate valid users. SQL Server Authentication requires a login ID and Password and is independent of Windows user accounts. You can select the <default> database or select a specific database from the Database combo box.

## 2.3.3 MySQL



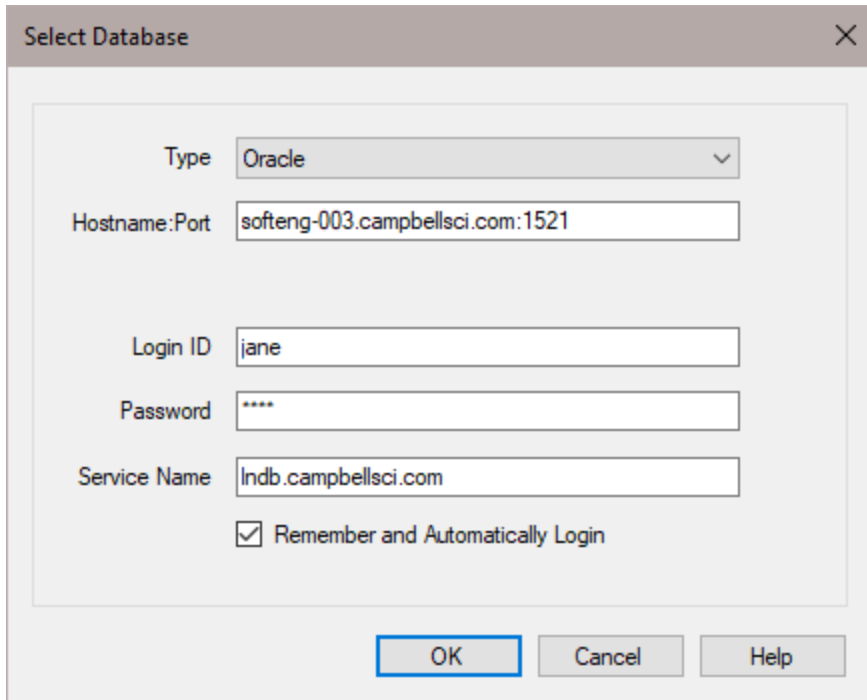
The MySQL connection is an ODBC connection. You must use the Windows ODBC Data Source Administrator to configure the database connection. A 32-bit ODBC driver must be used. 64-bit ODBC drivers are not supported. Press the **ODBC Data Source Administrator** button in the **Select Database** screen of LNDB Manager to open the 32-bit version of the Administrator. If you choose to open the Administrator outside of LNDB, the 32-bit version can be accessed from *c:\windows\syswow64\odbcad32.exe* (on 64-bit Windows) or *c:\windows\system32\odbcad32.exe* (on 32-bit Windows).

Currently only system data sources are supported and show in the **Data Source** combo box.

A **Login ID** and **Password** are needed in most cases for LNDB to authenticate and activate its connection to the mySQL database. The **Login ID** and **Password** may be left blank, if their values have been specified in the configuration of the ODBC driver (performed in a separate screen). If the ODBC driver configuration does not specify these values, they should be provided using this screen. Both the **Login ID** and **Password** should be specified together, otherwise the values from the ODBC driver configuration will be used. If values for **Login ID** and **Password** are provided in both this screen and the ODBC driver configuration, the values specified in this screen will be used during authentication, and those in the ODBC driver configuration will be ignored.

You can select the <default> database (default as configured in the data source) or select a different database.

## 2.3.4 Oracle



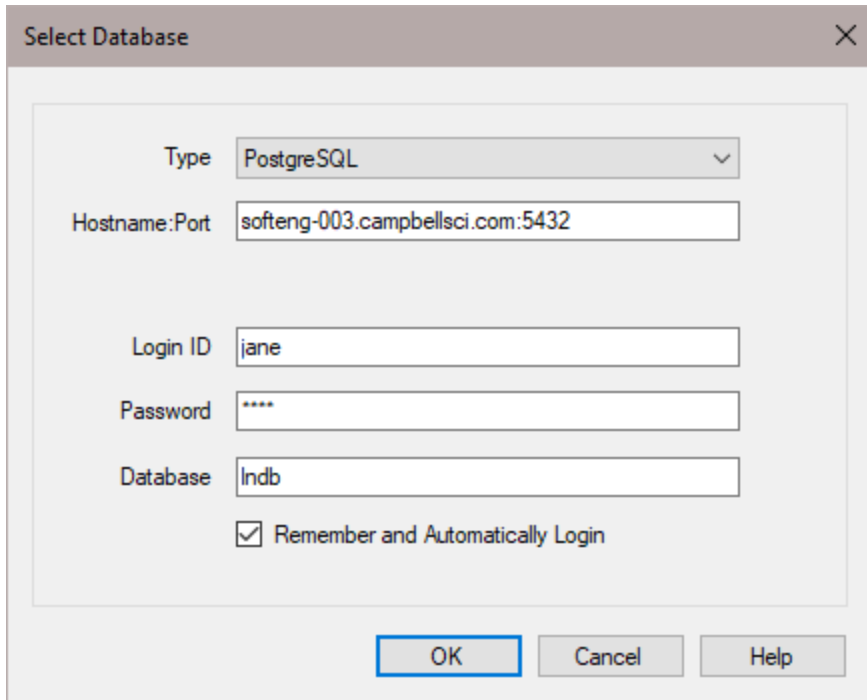
The image shows a 'Select Database' dialog box with a close button (X) in the top right corner. The dialog contains the following fields and options:

- Type:** A dropdown menu set to 'Oracle'.
- Hostname:Port:** A text field containing 'softeng-003.campbellsci.com:1521'.
- Login ID:** A text field containing 'jane'.
- Password:** A text field containing four asterisks '\*\*\*\*'.
- Service Name:** A text field containing 'lndb.campbellsci.com'.
- Remember and Automatically Login:** A checked checkbox.

At the bottom of the dialog are three buttons: 'OK' (highlighted with a blue border), 'Cancel', and 'Help'.

To configure a connection to an Oracle database you must enter a Hostname:Port, Login ID, Password, and Service Name. The default port for Oracle is 1521.

## 2.3.5 PostgreSQL



The screenshot shows a 'Select Database' dialog box with a close button (X) in the top right corner. Inside the dialog, there are several input fields and a checkbox. The 'Type' field is a dropdown menu set to 'PostgreSQL'. The 'Hostname:Port' field contains the text 'softeng-003.campbellsci.com:5432'. The 'Login ID' field contains 'jane'. The 'Password' field is masked with four asterisks '\*\*\*\*'. The 'Database' field contains 'Indb'. Below these fields is a checked checkbox labeled 'Remember and Automatically Login'. At the bottom of the dialog are three buttons: 'OK' (highlighted with a blue border), 'Cancel', and 'Help'.

To configure a connection to a PostgreSQL database you must enter a Hostname:Port, Login ID, Password, and Database. The default port for PostgreSQL is 5432.

## 2.3.6 Remember and Automatically Login

If you select the **Remember and Automatically Login** check box, the Login ID and Password will be remembered and the next time the application starts an attempt will be made to login without showing the dialog again. Regardless of whether this check box is selected, all other information (Database Type, Data Source, etc.) will be remembered for all databases.

If you do not check the **Remember and Automatically Login** check box, the username and password are still saved so the LNDB Engine can connect to the database. However, in this case, the username and password are not automatically filled in on the login dialog box.

## 2.3.7 Creating a Database for MySQL, Microsoft SQL Server, Oracle, or PostgreSQL

When you select mySQL, Microsoft SQLServer, Oracle, or PostgreSQL as your database engine used with LNDB, you will usually want to work with the Information Technology (IT) personnel at your organization or with external database hosting partners. Unless you have sufficient

experience and expertise for administering these database servers, running them yourself is often very time consuming and distracting.

LNDB requires a "database" instance to be created on a mySQL, Microsoft SQLServer, Oracle, or PostgreSQL database server. This will (in most circumstances) only be used by LNDB. This database instance can also be referred to as a "catalog" or "service". You should work with your IT personnel or hosting partner to get this database/catalog/service created on the database server before you begin using LNDB.

When configuring LNDB to interact with mySQL, Microsoft SQLServer, Oracle, or PostgreSQL you will refer to the database/catalog/service by its name. This enables LNDB to know where to create its tables and populate (insert) the data into the database server. This database/catalog/service can be named anything you choose, but you may wish to choose a name like "LNDBDatabase" or "LoggerNetData" so that its purpose will be clear to all parties involved.

The database/catalog/service name is specified in the **Select Database** screen of the LNDB Manager. Selecting the wrong database name from the server (such as system databases or other databases that exist by default) can have highly unfavorable results. Please work carefully with the appropriate personnel to ensure this is configured properly.

## 3. Selecting Datalogger Tables

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The first tab on the main screen is Setup. From this screen, you select the datalogger tables for which you would like to move data into the database. The right side of the screen changes depending upon whether a station or a table is highlighted in the left tree as described below.

If you check a station in the left tree, all final storage tables for the station are selected. This includes all tables except Public, Status, DataTableInfo, ports\_and\_flags, and \_\_inlocs\_\_. If a table has a conflict and is enabled for storage, its icon and its parent station's icon are overlaid with an error icon.

The toolbar at the top of the Setup tab can be used to **Select All Final Storage Tables** for all stations or to **Deselect All Tables** for all stations. It can also be used to select whether to view the entire network or a **Subnet**. (Note to use subnets, they must first be configured in the LoggerNet Admin Setup Screen.)

If a change is made to the setup, the **Apply** and **Cancel** buttons are enabled. Press **Apply** to save the pending edits and restart the engine. Press **Cancel** to undo the pending edits.

## NOTE:

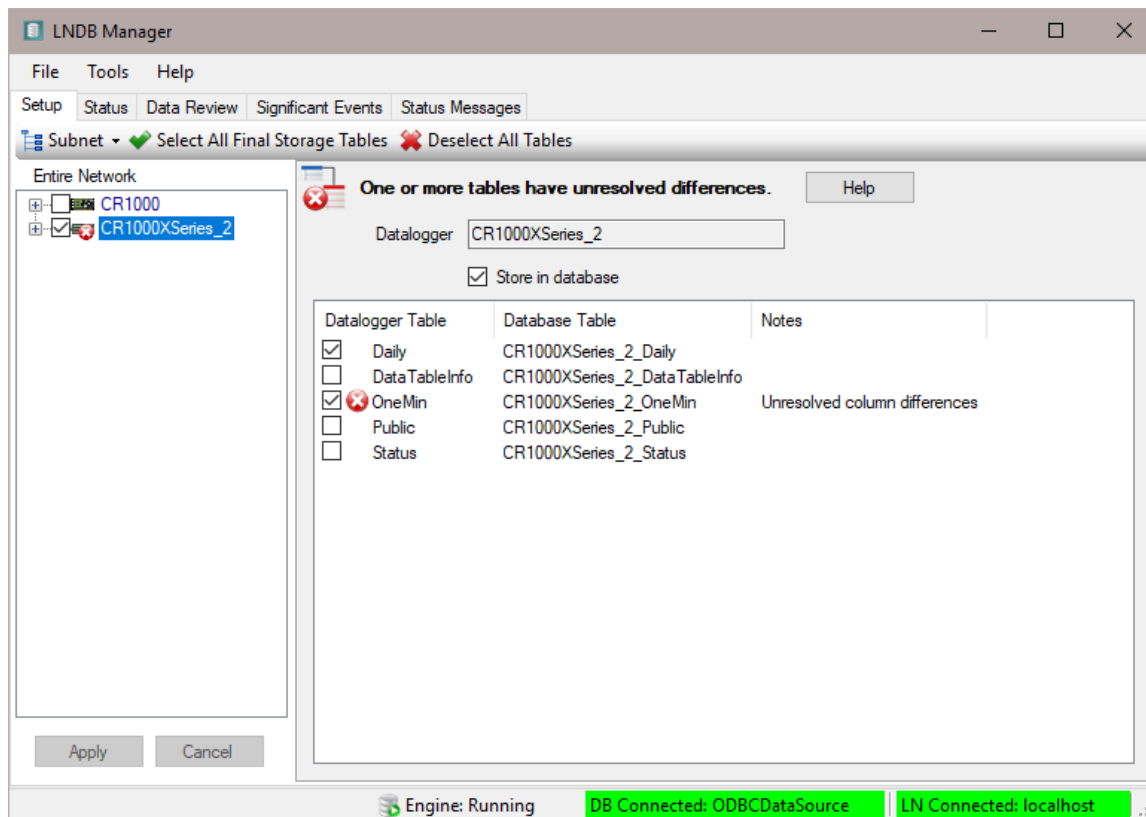
If a station, table or column that is enabled for storage has an invalid name (i.e., contains ', ", or `), an icon and text indicating such is placed at the top of the screen. The issue can be resolved by changing the station name in LoggerNet's Setup Screen or by changing the table or column name in the CRBasic program.

## 3.1 Station Setup

When a station is highlighted in the left tree, the Station Setup screen is shown. On the Station Setup screen, tables can be enabled/disabled for storage by selecting/deselecting the check boxes next to the table names.

A conflict exists for a table when datalogger columns do not match database columns.

If in "Stop Storing Data" mode (see [Options](#) (p. 15)) and conflicts exist, an icon is placed next to the table with the conflict. Also a larger icon with bold text stating there are conflicts is placed at the top of the station setup screen. To resolve a conflict, right-click on the table name on the right side of the screen and select **Resolve**. This brings up the Resolve Table dialog box which allows you to resolve the conflict. See [Resolving a Conflict](#) (p. 15).

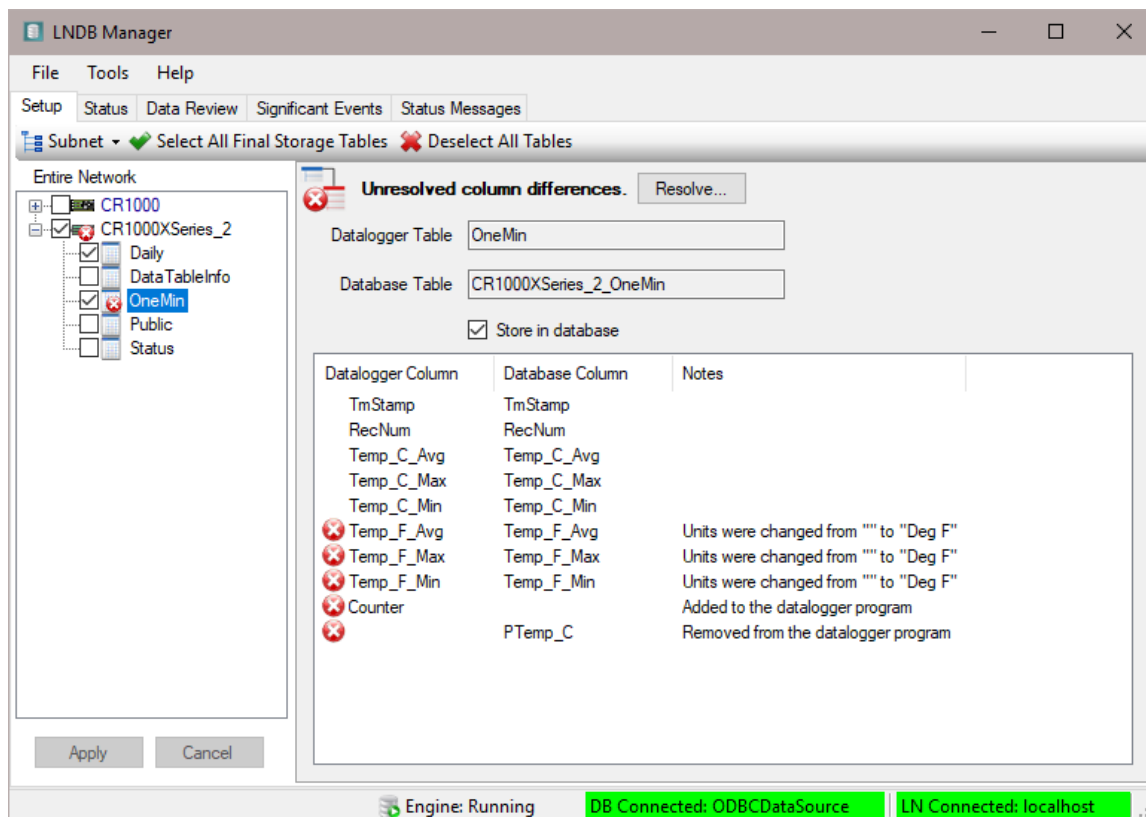


## 3.2 Table Setup

When a table is highlighted in the left tree, the right side contains the Table Setup screen. Clicking the **Store in Database** check box will enable storage for the table.

The datalogger columns and database columns are listed side by side. If the database table does not currently exist, the name of the column that will be created is listed next to the datalogger column. If the database table does exist and you have chosen "Stop Storing Data" or "Modify/Archive Database Table" when table definitions change, the datalogger columns are matched up with the database columns. Blank spaces exist where there is not a corresponding datalogger or database column.

If in "Stop Storing Data" mode, the table is enabled for storage, and a conflict exists, an icon is placed next to those columns with conflicts. An icon and bold text stating there is a conflict is also placed at the top of the screen. A **Resolve...** button is made visible and can be used to resolve the conflict. See [Resolving a Conflict](#) (p. 15).





# 4. Options

---

The Options Dialog can be opened from the Tools > Options menu item. The following options are available:

## When Tables Change

This tab allows you to determine what will happen when a datalogger's table definitions change. Choose from the following options:

### Stop Storing Data

Storing data to the database for the individual table stops if table definitions change. You must manually resolve the change.

### Archive Database Table (continue storing)

The table is automatically archived when table definitions change. Following the archive, the database table is automatically recreated and LNDB begins to store data into the newly created table.

An archive consists of renaming the existing table. The new name is chosen by attaching "\_arch#" to the original name. # is chosen by starting with 1 and increasing until a table name is found that does not already exist.

### Modify/Archive Database Table (continue storing)

When table definitions change:

- New columns are added to the database table. (previous rows are filled with NULL.)

- Old columns are orphaned. (Columns are left, new records contain NULL.)

- If any column's process, units, or data type change the table is archived.

## Data Review Options

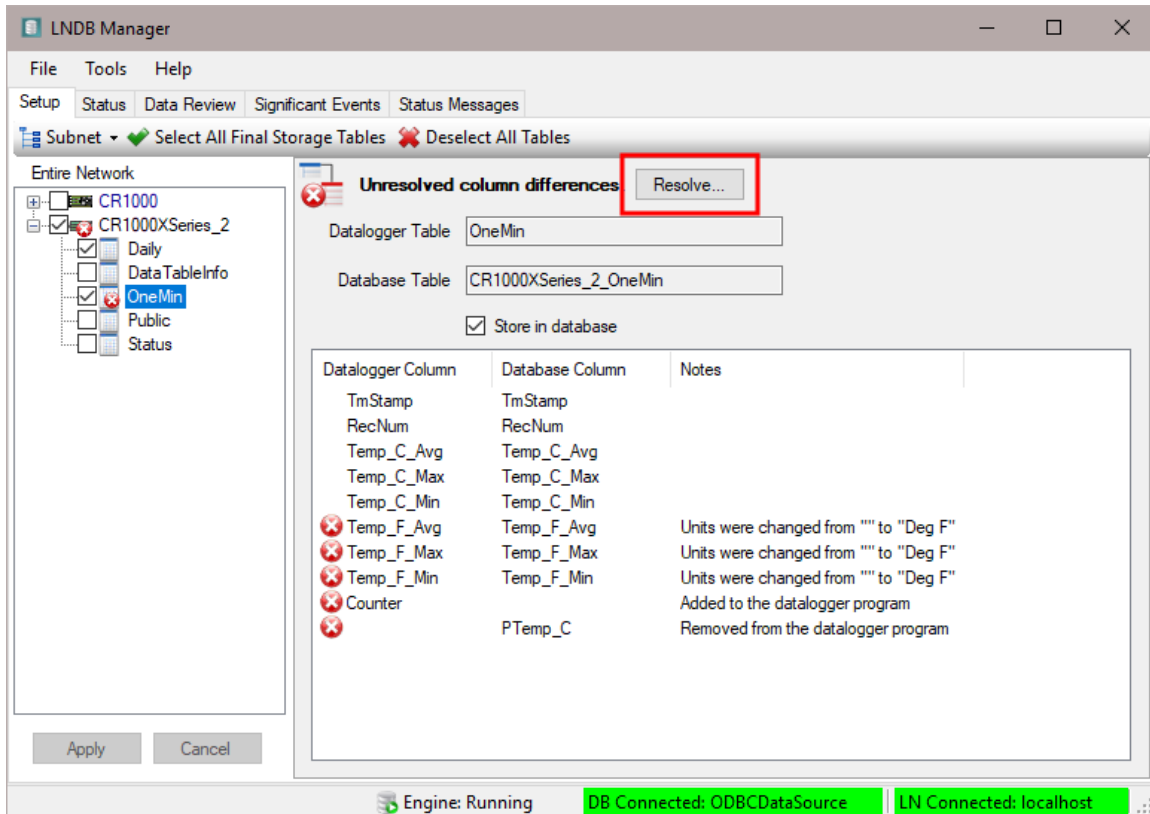
This tab allows you to select the number of records to be shown in the Data Review tab. The maximum number of records to show is 100,000.

# 5. Resolving a Conflict

---

A conflict exists for a table when datalogger columns do not match database columns. If in "Stop Storing Data" mode (see [Options](#) (p. 15)), the conflict must be manually resolved by selecting the

table in the left tree of the Setup tab and then pressing the **Resolve...** button on the Table Setup screen. (Alternately, you can select the datalogger in the left tree of the Setup tab, right click on the table name on the right side of the screen, and select **Resolve**.)



Clicking the **Resolve...** button brings up the Resolve Table dialog. You have two options:

1. Archive Database Table.
2. Modify Database Table. (This option is disabled if a column's data type has changed. The only way to resolve this conflict is to archive the database table.)

Once a conflict has been resolved, the conflict icons and bold text are removed. Storage begins (or continues) for the table once the action(s) have completed.

## 5.1 Archive Database Table

Resolve Table

Database Action

☒ Archive Database Table

☐ Modify Database Table

(New Columns will be added. Old columns will be orphaned. Units and Process will be updated in metatable)

Database Table	Action
CR1000XSeries_2_OneMin	rename to CR1000XSeries_2_OneMin_arch1

Archive Table Cancel Help

If **Archive Database Table** is selected, the database table name is shown with the action stating that the table will be renamed to a specific new name. Press the **Archive Table** button to archive the table.

## 5.2 Modify Database Table

**Resolve Table**

Database Action

☐ Archive Database Table

☒ **Modify Database Table**  
(New Columns will be added. Old columns will be orphaned. Units and Process will be updated in metatable)

Database Column	Action
Counter	Add column to database
PTemp_C	Orphan database column
Temp_F_Avg	Units changed from "" to "Deg F". Modify units in LNDBColumnMeta table.
Temp_F_Max	Units changed from "" to "Deg F". Modify units in LNDBColumnMeta table.
Temp_F_Min	Units changed from "" to "Deg F". Modify units in LNDBColumnMeta table.

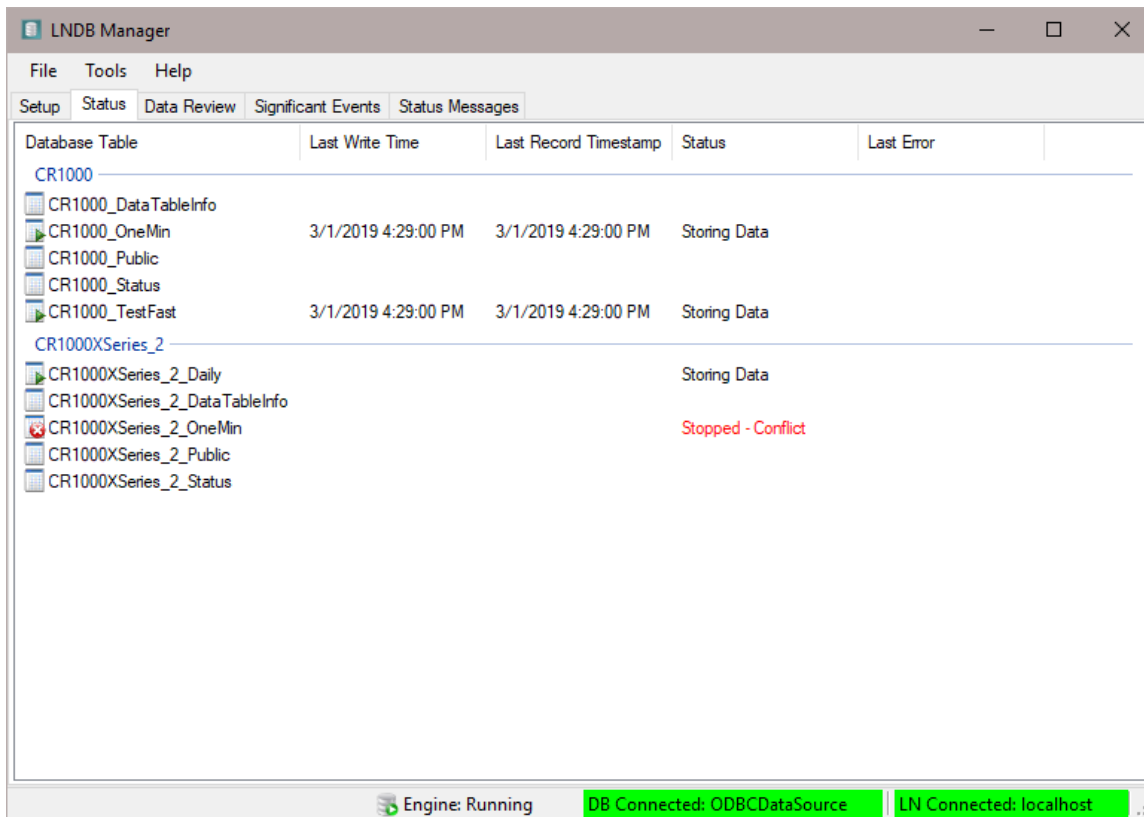
Execute Actions Cancel Help

If **Modify Database Table** is selected, each column that has a conflict is shown with the proper action displayed. Each action is done when you click the **Execute Actions** button.

## 6. Checking Status and Reviewing Data

The function of the Setup Tab of LNDB's main screen is described in [Selecting Datalogger Tables](#) (p. 12). The other tabs on the main screen can be used to check the status of LNDB and to review LNDB data. The Status Bar at the bottom of the LNDB main screen can also be used to quickly check the status of the LNDB engine, database, and LoggerNet server. All of these functions are described below.

## 6.1 Status Tab



The screenshot shows the LNDB Manager application window with the 'Status' tab selected. The table displays the following data:

Database Table	Last Write Time	Last Record Timestamp	Status	Last Error
<b>CR1000</b>				
CR1000_DataTableInfo				
CR1000_OneMin	3/1/2019 4:29:00 PM	3/1/2019 4:29:00 PM	Storing Data	
CR1000_Public				
CR1000_Status				
CR1000_TestFast	3/1/2019 4:29:00 PM	3/1/2019 4:29:00 PM	Storing Data	
<b>CR1000XSeries_2</b>				
CR1000XSeries_2_Daily			Storing Data	
CR1000XSeries_2_DataTableInfo				
CR1000XSeries_2_OneMin			Stopped - Conflict	
CR1000XSeries_2_Public				
CR1000XSeries_2_Status				

At the bottom of the window, the status bar shows: Engine: Running, DB Connected: ODBCDataSource, and LN Connected: localhost.

The Status tab shows the storage status for each datalogger table. The following columns are shown:

**Database Table** - The database table name for each station's table. They are grouped by station.

**Last Write Time** - The last time that data was written to the database table.

**Last Record Timestamp** - The timestamp of the last record in the database table.

**Status** - There are 3 valid values:

**Storing Data:** Data for the table is being stored

**Stopped – Conflict:** The table has a conflict and storage has stopped.

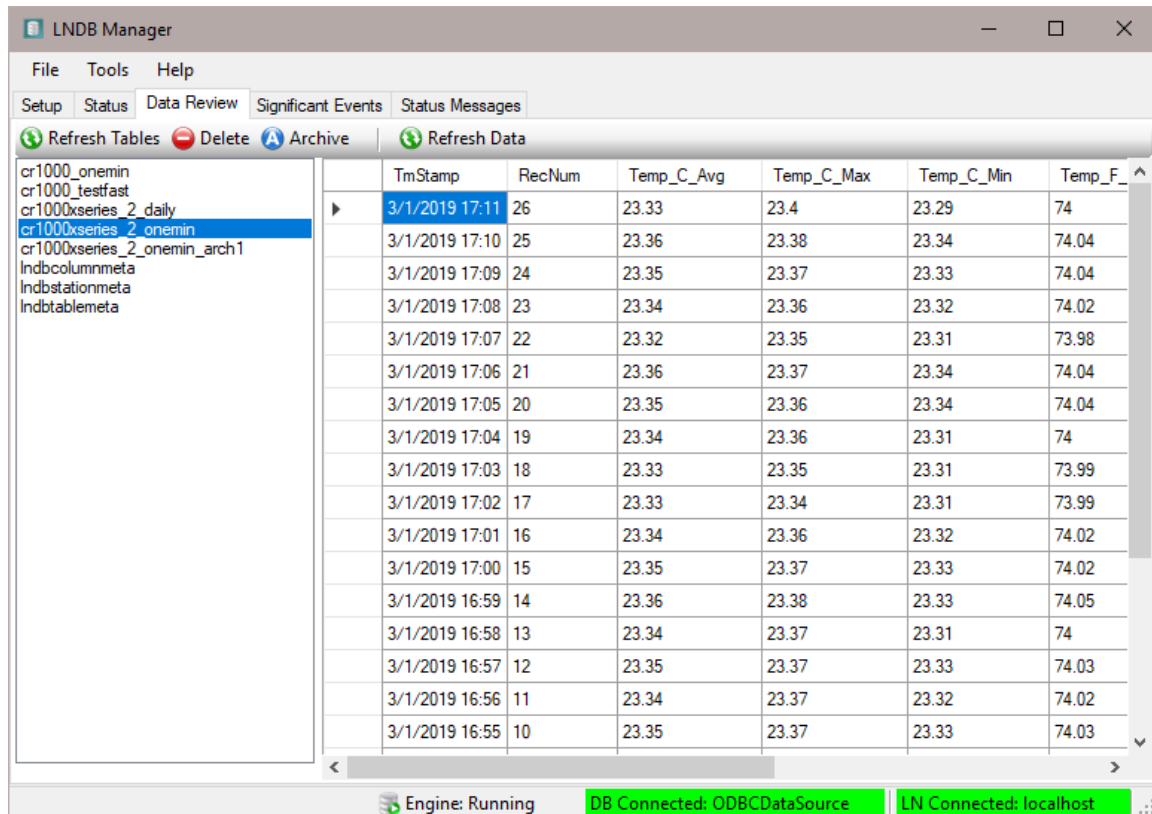
**Blank:** Not storing data for this table

**Last Error** - The last database error (insert error, error creating a database table, or error retrieving the start conditions) for the given table. This value is only reset when you restart the engine.

The Status columns can be sorted. When you click a column other than the Database Table column, the grouping of tables by station is removed and the records are sorted. Click the Database Table column to again group the tables by station.

When the engine is stopped all engine statistics are cleared.

## 6.2 Data Review Tab



The screenshot shows the LNCB Manager application window. The 'Data Review' tab is active. On the left, a list of tables is shown, with 'cr1000xseries\_2\_onemin' selected. On the right, a data table is displayed with the following columns: TmStamp, RecNum, Temp\_C\_Avg, Temp\_C\_Max, Temp\_C\_Min, and Temp\_F\_.

TmStamp	RecNum	Temp_C_Avg	Temp_C_Max	Temp_C_Min	Temp_F_
3/1/2019 17:11	26	23.33	23.4	23.29	74
3/1/2019 17:10	25	23.36	23.38	23.34	74.04
3/1/2019 17:09	24	23.35	23.37	23.33	74.04
3/1/2019 17:08	23	23.34	23.36	23.32	74.02
3/1/2019 17:07	22	23.32	23.35	23.31	73.98
3/1/2019 17:06	21	23.36	23.37	23.34	74.04
3/1/2019 17:05	20	23.35	23.36	23.34	74.04
3/1/2019 17:04	19	23.34	23.36	23.31	74
3/1/2019 17:03	18	23.33	23.35	23.31	73.99
3/1/2019 17:02	17	23.33	23.34	23.31	73.99
3/1/2019 17:01	16	23.34	23.36	23.32	74.02
3/1/2019 17:00	15	23.35	23.37	23.33	74.02
3/1/2019 16:59	14	23.36	23.38	23.33	74.05
3/1/2019 16:58	13	23.34	23.37	23.31	74
3/1/2019 16:57	12	23.35	23.37	23.33	74.03
3/1/2019 16:56	11	23.34	23.37	23.32	74.02
3/1/2019 16:55	10	23.35	23.37	23.33	74.03

The Data Review tab shows tables and data from the database. When a table on the left side is selected, the data for the table is shown on the right side. You can refresh tables or data by clicking the corresponding refresh button.

### 6.2.1 Deleting or Archiving Tables

All database tables except the [Metatables](#) (p. 50) (LNDBStationMeta, LNDBTableMeta, and LNDBColumnMeta) can be removed by clicking the **Delete** button or archived by clicking the **Archive** button. If a metatable is selected, the **Delete** and **Archive** buttons are grayed out.

#### NOTE:

The metatables should not be modified by the user.

When you archive a table, you are asked for an archive name. The default name is `<basename>_arch<number>`. *Basename* is the first part of the name before the first "\_arch". *Number* is the smallest number that makes the table name unique. The maximum number of characters allowed for the table name is 64 for MySQL and 128 for SQL Server and SQL Server Compact.

Upon completion of a Delete or Archive, any conflicts for the table are removed and storage is restarted for the table (if enabled for storage).

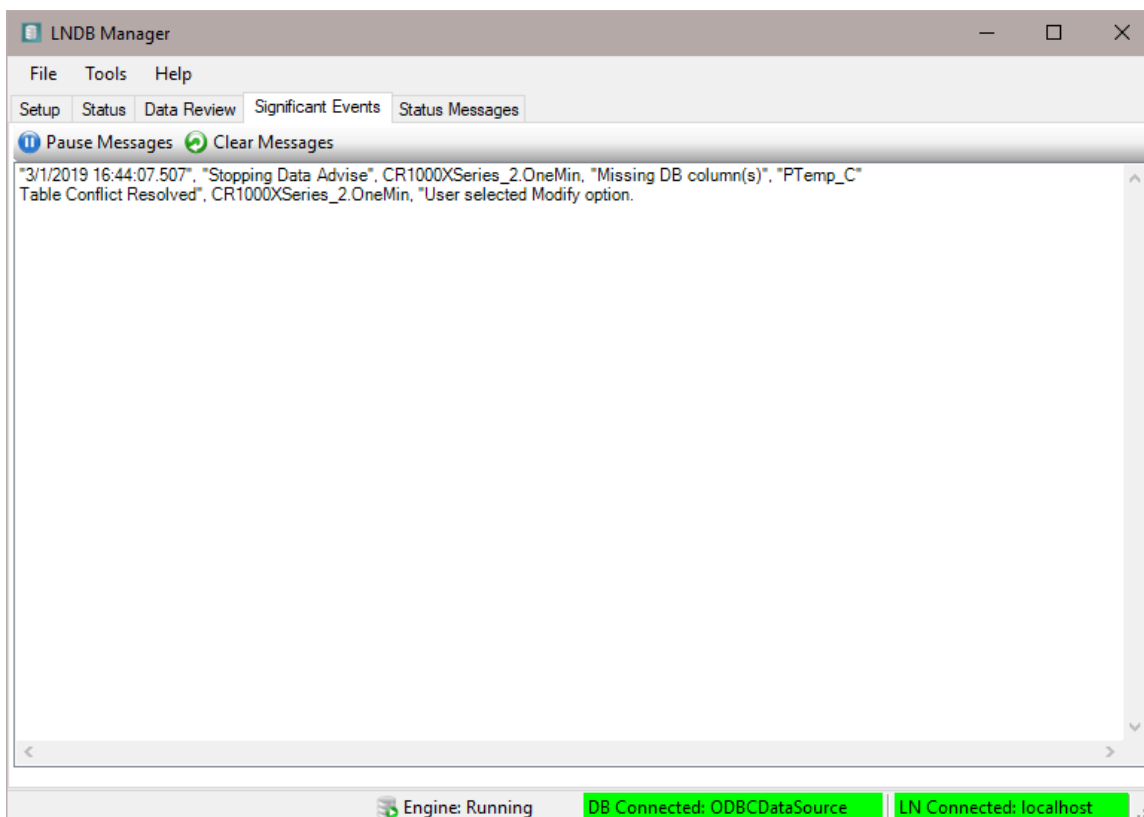
**NOTE:**

When storage begins for a newly created table, data always backfills and starts at the oldest available record. It does not start at the last record from the deleted or archived table.

Therefore, a table may be recreated so quickly after deletion, that it may appear as if the table was not actually deleted.

The format of timestamp columns is based on the precision of the first two records shown. If the time has second data, it will be shown. If the time has sub-second data, it will show 3 or 7 decimal places based on the precision.

## 6.3 Significant Events Tab

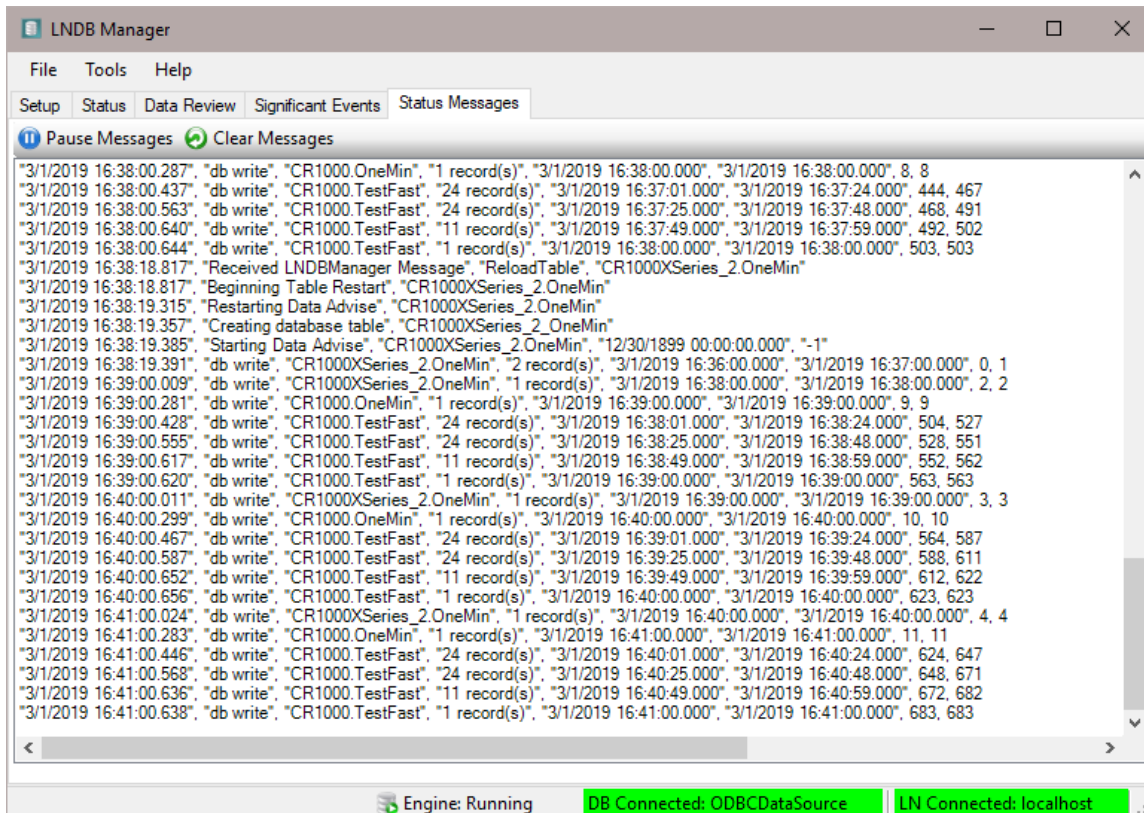


The Significant Events tab shows significant messages. The messages can be paused by clicking the **Pause Messages** button. Up to 400 messages are displayed, after which the oldest is removed when new messages are added. If you close down LNDB Manager and reopen it, the messages are not lost. Clicking the **Clear Messages** button permanently removes the messages. They are not shown again the next time LNDB Manager is started.

The Significant Events include:

- Database Table Created
- Database Table Modified
- Database Table Archived
- Database Table Storage Stopping due to a conflict
- Table Conflict Resolved
- Insert Record Failure

## 6.4 Status Messages Tab



The Status Messages tab shows events and the state of the LNDB Engine. These include the Significant Event messages, data events, LoggerNet events, database events, etc. The **Pause**



**Messages** button pauses the displaying of new messages. These messages are not persistent and ring at 100 messages. When LNDB Manager closes and reopens, or if you click the **Clear Messages** button, the messages clear and are not shown again.

## 6.5 Log Files

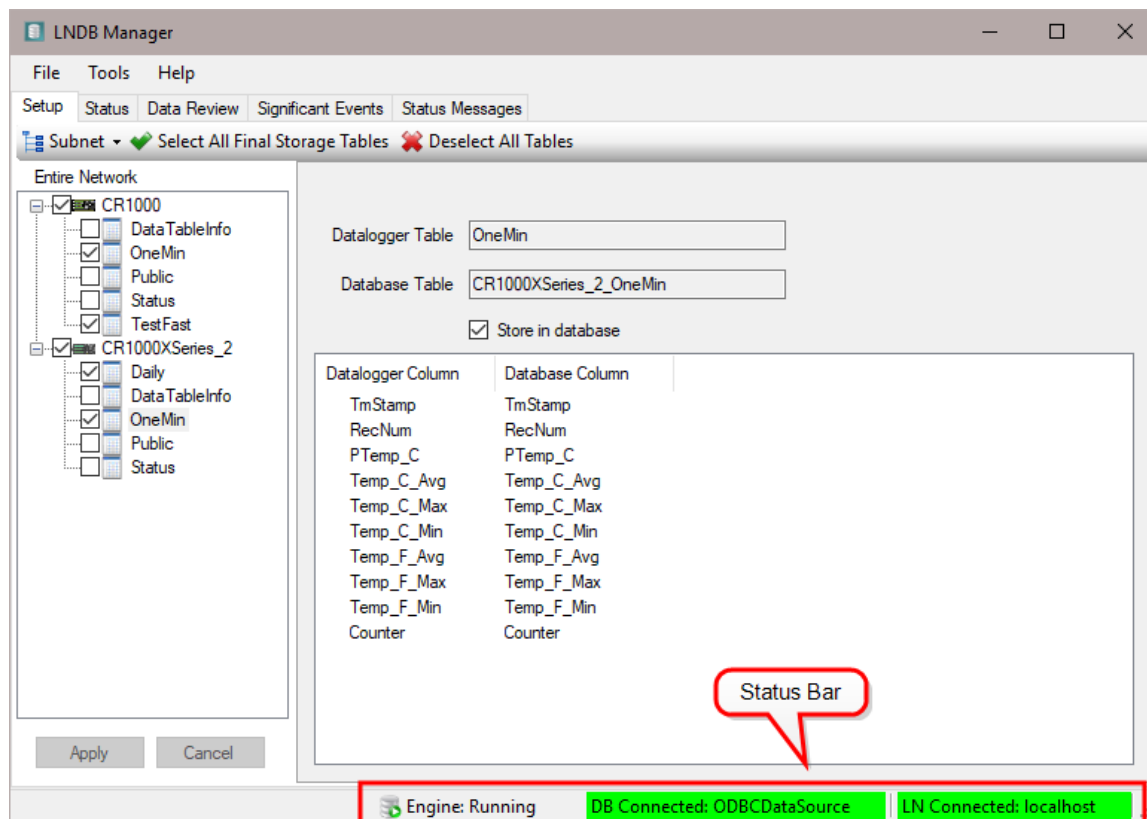
Three log file types are created and stored at *<working directory>\logs*. For each log file type, there can be up to ten 1MB files. Once the tenth log file reaches 1 MB, the oldest file will be overwritten with new messages. The three log file types are:

**Significant.log** - Contains the [Significant Events Tab](#) (p. 21) messages.

**State.log** - Contains all of the [Status Messages Tab](#) (p. 22) messages.

**<database name>\_Failed Inserts.log** - Contains SQL insert statements for all records that failed to be inserted. This log will contain no error information.

## 6.6 Status Bar



The Status Bar at the bottom of the main screen has three status labels:

**LNDB Engine Status Label** - Shows the state of the LNDB Engine.

**DB Connection Status Label** - Shows the selected data source and whether the connection is not connected, connecting, or connected.

**LN Connection Status Label** - Shows the LoggerNet host and port (if not the default port 6789) and whether the connection is not connected, connecting, or connected.

You can use the Status Bar as an alternative to LNDB's File menu. Double-click on any of the Status Bar labels to bring up the corresponding dialog box (i.e., the LNDB Engine Status Label to bring up the **LNDB Engine Service Manager** (see [Installing and Starting the LNDB Service](#) (p. 3)), the DB Connection Status Label to bring up **Select Database** (see [Selecting a Database](#) (p. 6)), or the LN Connection Status Label to bring up **Login to LoggerNet Server** (see [Selecting a LoggerNet Server](#) (p. 5)).

## 7. Importing Data

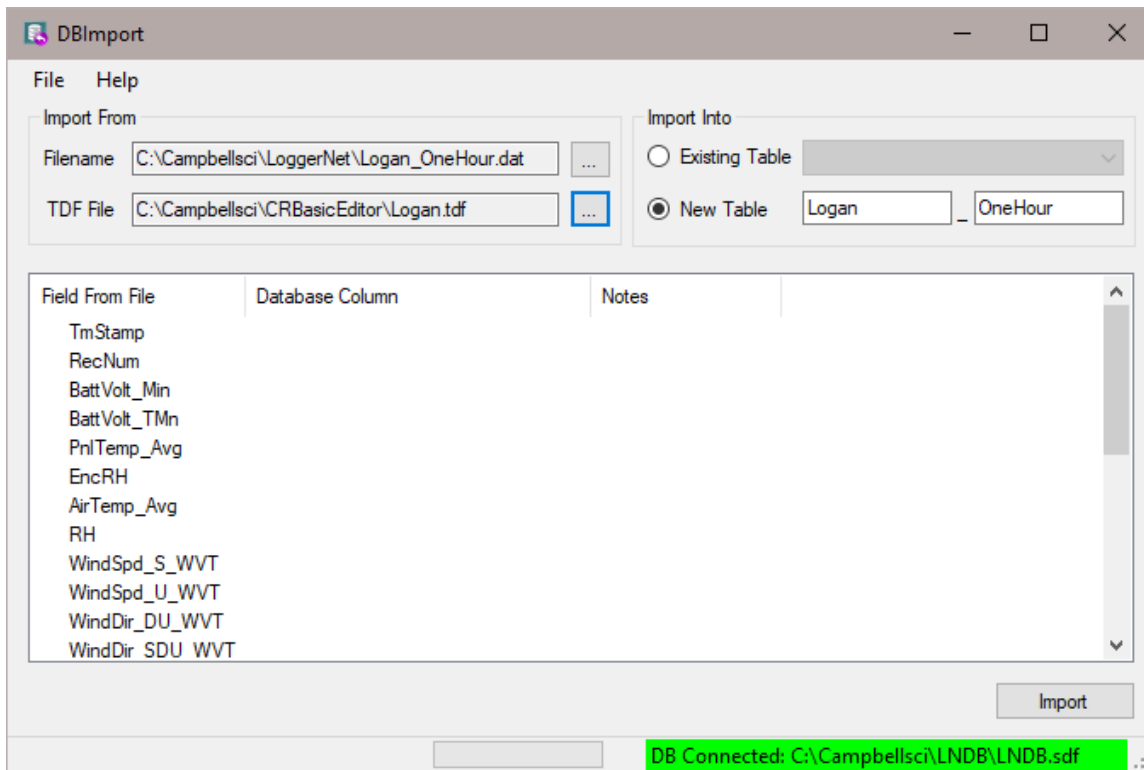
---

The DBImport utility, launched from LNDB's Tools > Import Data menu item or from the LoggerNet toolbar under the Database category, is used to import data from a data file into a database table.

**NOTE:**

Files from mixed array dataloggers are not supported.

In order to be imported, a file must contain timestamps and record numbers.



## 7.1 Database Selection

When launched for the first time, DBImport uses the database selected for LNDB. You can change this selection using DBImport's File > Select Database menu item. The DBImport database selection will then be independent of LNDB's database selection. The database selection dialog (see [Selecting a Database](#) (p. 6)) is identical to the one used in LNDB. If you select **Remember** and **Automatically Login**, the login information is only remembered for DBImport.

## 7.2 Import From

The **Filename** field is used to indicate the file from which data is to be imported. Press the browse button (...) to browse to the desired file.

### NOTE:

Files from mixed array dataloggers are not supported.

In order to be imported, a file must contain timestamps and record numbers.

## 7.3 TDF File

This field is only enabled when you are importing a TOA5 or TOACI1 file into a **New Table**. These file formats do not store data type information in their headers. Therefore, it is recommended that you specify a TDF file associated with the data file. This provides DBImport with the information necessary to more accurately and efficiently map data in the data file into data types supported by the database.

TDF stands for Table Definitions File. When a program is precompiled for a CR1000, CR3000, CR800/850, or CR6 Series datalogger, a *program\_name*.TDF file is created along with the original program file. Both Short Cut and the CRBasic Editor have the option to produce a .TDF file when a program is created or compiled. This file contains the table definitions (table size, variable names, data types, etc.) for that program.

### NOTE:

When importing a TOA5 or TOACI1 data file into a new database table, a TDF file is particularly important if you anticipate the need to add data to the table later on via an LNDB/LoggerNet connection.

## 7.4 Import Into

Select **Existing Table** to import the data into an existing table. The **Existing Table** combo box is filled with all tables from the selected database. Select the table into which the data should be imported.

Select **New Table** to import the data into a newly created table. By default, the new table will be named *stationname\_datatablename*. Type in a different name if desired.

### NOTE:

It is important to follow the LNDB database table naming convention of *stationname\_datatablename*, if you anticipate the need to add data to the table later on via an LNDB/LoggerNet connection.

## 7.5 Data File Columns vs Database Table Columns

After a file is selected, the list of data fields from the file is placed in the list view under the heading **Field From File**.

If an existing database table is selected, the list of column names from the database table is placed in the list view under the heading **Database Column**. The data file fields and database columns are matched up. Data file fields that do not have a corresponding database column have an attached note indicating that the *"Database column is missing"*. Columns in the database table that do not have a corresponding data file field have a note indicating that the *"Column does not exist in file"*.

## 7.6 Import Requirements (into existing table)

A file can be imported if all the data file fields have a corresponding database table column. This means that there can be extra database columns that do not have a corresponding data file field. If there are data file fields that do not have corresponding database columns, a bold note next to the import button indicates *"Fields from the file are not compatible with database table columns"*. In this case, the data file cannot be imported into the database table.

No check is made to validate the columns units, process, or data type. If the data type is not compatible, the insert will likely fail and you will be notified of the failure.

## 7.7 Import

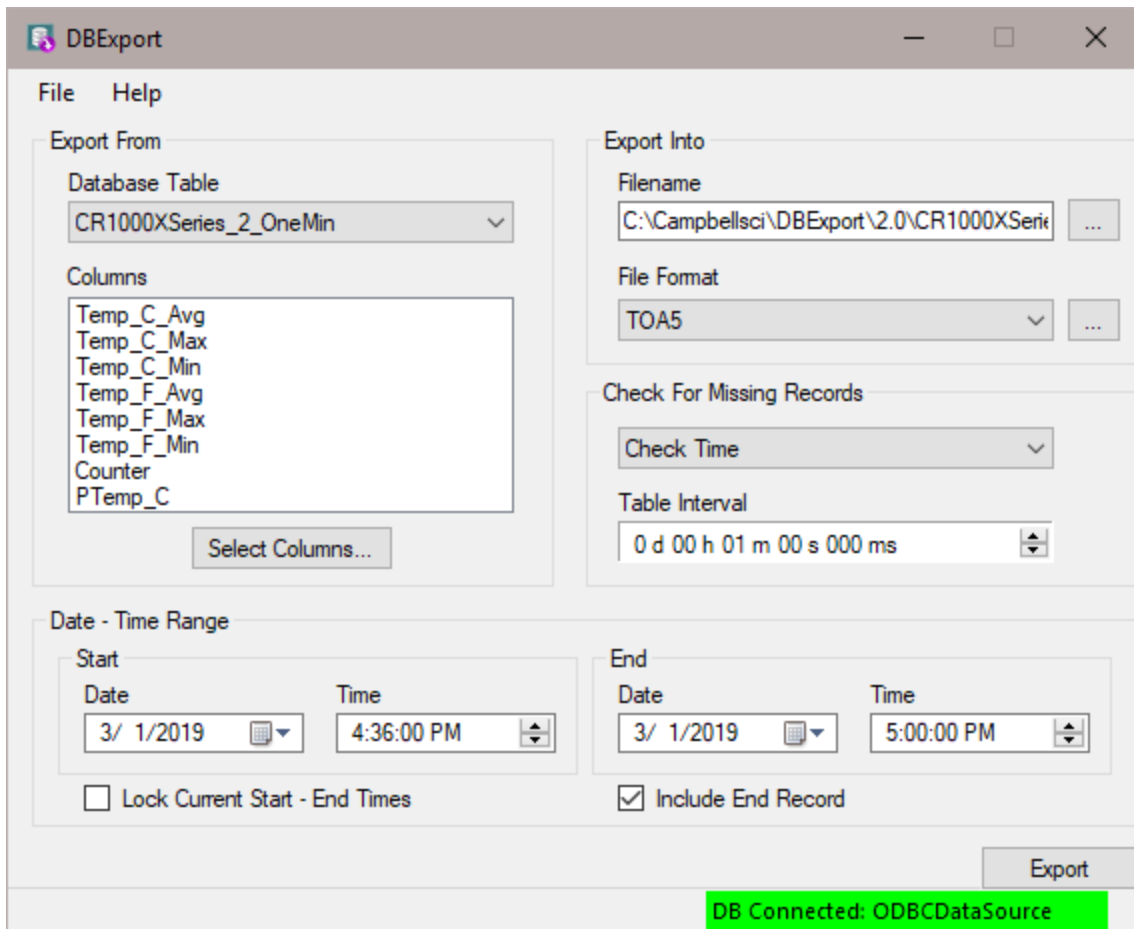
Once the data file and database table are selected, press the **Import** button to begin importing data. Data import will begin if the file is compatible with the selected database table as described above.

### NOTE:

The import process will slow down significantly when duplicates are encountered (between records in the data file and records that already exist in the database) during the import process. This is expected behavior. Just allow the import process to complete.

# 8. Exporting Data

The DBExport utility, launched from LNDB's Tools > Export Data menu item or from the LoggerNet toolbar under the Database category, is used to export data from a database table into a data file.



## 8.1 Database Selection

When launched for the first time, DBExport launches the [Selecting a Database](#) (p. 6) dialog which allows you to select the database from which to export data. The database selection dialog is identical to the one used in LNDB. If you select **Remember and Automatically Login**, the login information is only remembered for DBExport.

You can change the database selection at any time using DBExport's File > Select Database menu item or by double-clicking on the database connection status panel at the bottom of the DBExport window.

## 8.2 Export From

### Database Table

The **Database Table** combo box is filled with all tables from the selected database. Select the table from which the data should be exported.

## Columns

This list box contains a list of all data columns that will be exported. By default, the list contains all columns in the selected database table. Press the [Select Columns](#) (p. 31) button to select a custom set of columns.

## Date – Time Range

### Start Date/Time and End Date/ Time

These fields are used to determine what data will be exported to the file. The Start and End controls can be set by the user. When a new database table is selected the Start time is set to the timestamp of the oldest record for the table in the database. The End time is set to the newest. The **Lock Current Start - End Times** checkbox can be used to prevent this.

### Lock Current Start – End Times

When this check box is selected, the Start and End date/time controls will not be updated when a new table is selected. They will keep their current settings.

### Include End Record

When this check box is selected, a record that matches the date and time specified in the **End** control will be included in the data file. If the check box is not selected, that record will not be included. To export the entire set of data this control should be checked.

## 8.3 Export Into

### Filename

The **Filename** field is used to indicate the file to which data should be exported. Press the browse button (...) to browse to the desired file.

### File Format

The **File Format** is used to select the format in which the data file should be saved. Select the desired option from the list box:

**TOACI1** - Data is stored in a comma separated format. Header information for each of the columns is included.

**TOA5 (ASCII Table Data)** - Data is stored in an ASCII comma separated format. Header information for each of the data values is included, along with field names and units of measure if they are available. When this option is selected, the browse

button to the right of the field is available. Pressing this button opens a window from which you can specify whether timestamps and record numbers are included with each record. You can also specify that **Midnight is 2400**. When this option is selected, the timestamp will reflect midnight as the current date with 2400 for the Hour/Minutes. Otherwise, the timestamp will reflect midnight as the next day's date, with the Hours/Minutes as 0000.

**TOB1 (Binary Table Data)**- Data is stored in a binary format. Though this format saves disk storage space, it must be converted before it is usable in other programs. When this option is selected, the browse button to the right of the field is available. Pressing this button opens a window from which you can specify whether timestamps and record numbers are included with each record.

**CSIXML** - Data is stored in XML format with Campbell Scientific defined elements and attributes. When this option is selected, the browse button to the right of the field is available. Pressing this button opens a window from which you can specify whether timestamps and record numbers are included with each record. You can also specify that **Midnight is 2400**. When this option is selected, the timestamp will reflect midnight as the current date with 2400 for the Hour/Minutes. Otherwise, the timestamp will reflect midnight as the next day's date, with the Hours/Minutes as 0000.

**Custom\_CSV** - Data is stored in a user-defined comma separated format. This option can be used to produce output files from table data dataloggers that are similar to those created by mixed array dataloggers. When this option is chosen, the [Array Compatible CSV Options](#) (p. 32) button becomes available, so that you can customize the data string for the CSV file.

## **8.4 Check for Missing Records**

Select an option from this list box to determine whether DBExport checks for missing records.

**No Checking**– DBExport does not check for missing records.

**Check Time** – DBExport checks for missing records based on the data timestamps and the interval entered in the **Table Interval** field.

**Check Record Number** – DBExport checks for missing records based on the record number sequence.

**Check Time and Record Number** – DBExport checks for missing records based on both data timestamps and record numbers.



**NOTE:**

DBExport will not check for missing records before the first record or beyond the last record in the database table. Therefore, if the **Start Date/Time** is before the first record in the database table, records before the **Start Date/Time** will not be reported as missing. Likewise, if the **End Date/Time** is beyond the last record in the database table, records after the **End Date/Time** will not be reported as missing. DBExport will not report this as an error.

**Table Interval**

Specify the interval of the database table. This interval is used to check for missing records when checking based on time.

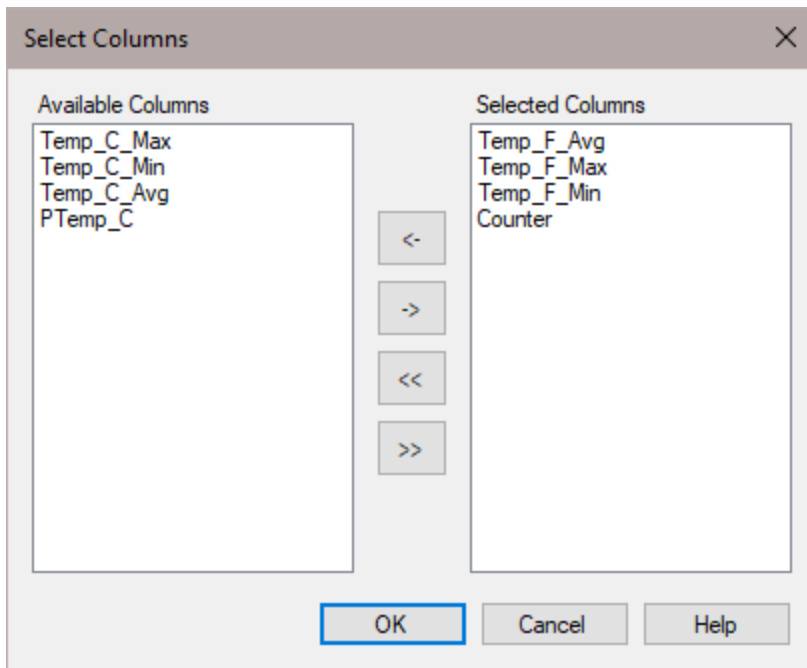
## 8.5 Export

Once the database table, data file, and other options are set, press the **Export** button to begin the export. While exporting is in process, you can press the **Cancel** button to abort the export.

While export is in process, a progress percentage will be displayed. Note that the displayed percentage is based on the Start and End date/times selected and the timestamp of the record currently being processed. If the Start and End date/times are in the table and there is a fairly complete set of interval data between these times, the progress will be fairly accurate. If there are gaps in the data, or if the Start and/or End date/times are not in the data, or if the data is event driven (not interval based), the progress percentage may not accurately represent progress.

## 8.6 Select Columns

When the **Select Columns** button is pressed, the Select Columns dialog box appears.



The **Available Columns** field will list all of the available data columns in the selected database table that are not currently included for export. To choose a column to be exported, highlight it and press the right arrow button or, alternately, double-click the column name. This moves the column heading into the **Selected Columns** field. To specify that all columns are to be exported, press the double right arrow button. When the dialog box is closed, the columns will be added to the Columns list and will be included in the export.

Columns can be reordered in the Selected Columns field by dragging and dropping them to the desired location.

Columns can be removed from the export by moving them back into the **Available Columns** field using the left arrow button.

## 8.7 Array Compatible CSV Options

When File Format is set to **Custom\_CSV**, the browse button next to the field can be pressed to open the Array Compatible CSV Options dialog box. This dialog box is used to customize the output file produced by DBExport. It is most often used to produce output files from table data data loggers that are similar to those created by mixed array data loggers.

The screenshot shows a dialog box titled "Array Compatible CSV Options". It has a close button (X) in the top right corner. The dialog is divided into three main sections. The first section, "Timestamp Options", contains five checkboxes: "Year" (checked), "Day" (checked), "Hour/Minutes" (checked), "Seconds" (checked), and "Midnight is 2400" (unchecked). The second section, "Include Array ID", has a checked checkbox and a text field labeled "Array ID:" containing the value "101". The third section, "Max and Min Timestamp Options", contains two radio buttons: "TOA5 Format" (unchecked) and "Array Datalogger Format" (checked). Below these is a dropdown menu currently set to "Hour/Minutes and Seconds". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

If an array ID is desired, select the **Include Array ID** check box and enter a value into the field. The value can range from 1 to 1023. The array ID will be the first value in the array of data.

Select the appropriate timestamp options for the type of timestamp to write to the file. Each time element will be output as a separate data value in the array and the data values will be separated by a comma. Selecting **Year** will output the year represented by four digits, YYYY (e.g., 2006). The **Day** will be represented as a Julian Day. The Hour/Minutes will be represented by four digits (hhmm). When **Midnight is 2400** is selected, the timestamp will reflect midnight as the current date with 2400 for the Hour/Minutes. Otherwise, the timestamp will reflect midnight as the next day's date, with the Hours/Minutes as 0000.

The **Max and Min Timestamp Options** is used to determine the type of timestamp that will be used for Maximum and Minimum outputs that include a timestamp along with the value. You can choose a TOA5 format timestamp (e.g., 2008-10-27 17:17:33.7), a timestamp that includes Hours/Minutes and Seconds (produces two values, hhmm and seconds), a timestamp that includes Hours/Minutes only (hhmm), or a timestamp that includes Seconds only.

## 8.8 Representation of NULL Values

When the database table being exported contains NULL values, they will be represented as described in the table below:

NAN representation of NULL values from a database							
Datalogger Data Type	NAN Value	Example	MySQL Type	SQL Server Type	SQL Server Compact Type	Oracle	PostgreSQL
IEEE8	Positive Max	0xFFFFFFFFFFFFFFF (9223372036854775807)	DOUBLE	FLOAT(53)	FLOAT	BINARY_ DOUBLE	DOUBLE PRECISION
IEEE4	Quiet NAN	0x7FFFFFFF (2147483647)	FLOAT	REAL	REAL	BINARY_ FLOAT	REAL
LONG	Negative Max (LONG)	-2147483648	INT	INT	INT	Number(10,0)	integer
SecNano	Jan 1 1990	0	DATETIME	DATETIME	DATETIME	TIMESTAMP	timestamp
BOOL	False	0	BIT(1)	BIT	BIT	Number(1,0)	boolean
USHORT	Zero	0	SMALLINT UNSIGNED	INT	INT	Number(5,0)	integer
string-spec	Empty String		TEXT	NVARCHAR (MAX)	NVARCHAR (2048)	NVARCHAR2 (2000)	text

## 9. QuickReports

QuickReports, launched from the LNDB Tools > QuickReports menu item, is used to design simple reports from an LNDB database. It is very simple and quick and enables you to generate a new report with just a few mouse clicks. The report can then be printed or exported to an Acrobat file.

The [QuickReports Setup](#) (p. 40) dialog is displayed every time a new report is created and presents you with a few basic options such as title, time range, database table, and up to 4 data columns. When you accept the settings in the QuickReports dialog, the report is then bound to the selected table. You can customize the report further using each component's property sheet. The report can then be saved and run as a report in the Report Preview window. The Report Preview window paginates the report and gives options to print or export to an Acrobat file.

The saved report can be loaded in RTMC Pro where it can be modified with advanced features and components. When the report is saved in RTMC Pro, it will be saved as a \*.rtmc2 project file.

This file cannot be loaded in QuickReports. However, the QuickReports \*.rtmq file will not be overwritten. This file can still be loaded in QuickReports, but it will contain none of the changes made in RTMC Pro.

## 9.1 Database Selection

The Database Data Source Properties dialog box comes up automatically the first time QuickReports is opened. At other times, it can be opened from the File | Select Database menu item or by double-clicking on the database portion of the status bar at the bottom of the QuickReports window. This dialog box is used to set up the database source for your report.

### Source Name

Designates the name that will be used for the database in QuickReports.

### Type

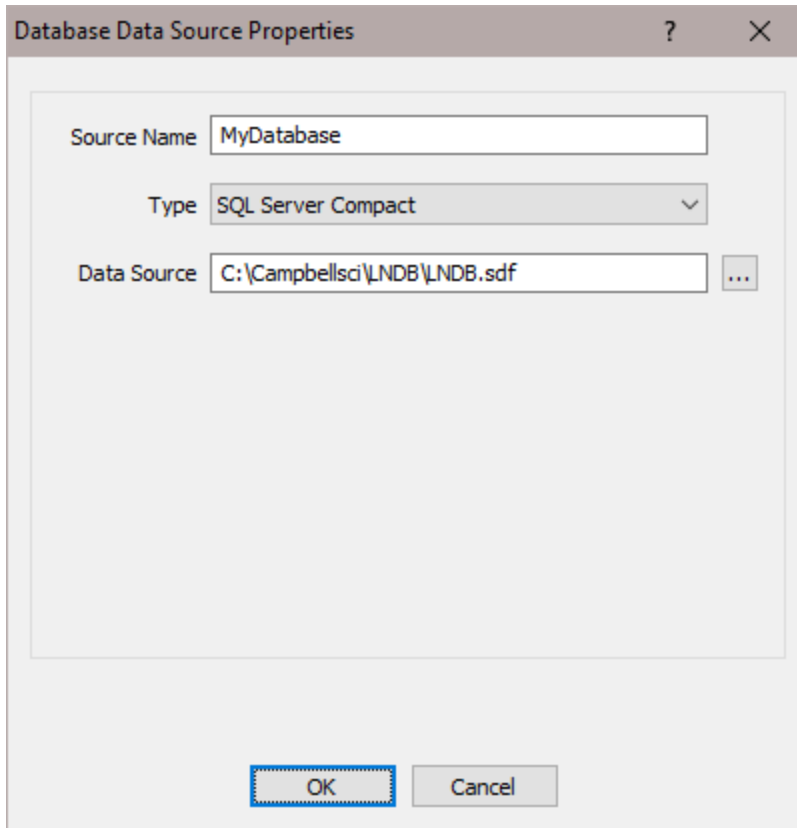
The type of database. Choose a type from the drop-down list.

The following database types are supported in QuickReports:

- SQL Server Compact
- SQL Server
- MySQL
- Oracle
- PostgreSQL

The remaining information changes depending on the database type as described below:

## SQL Server Compact



Database Data Source Properties

Source Name: MyDatabase

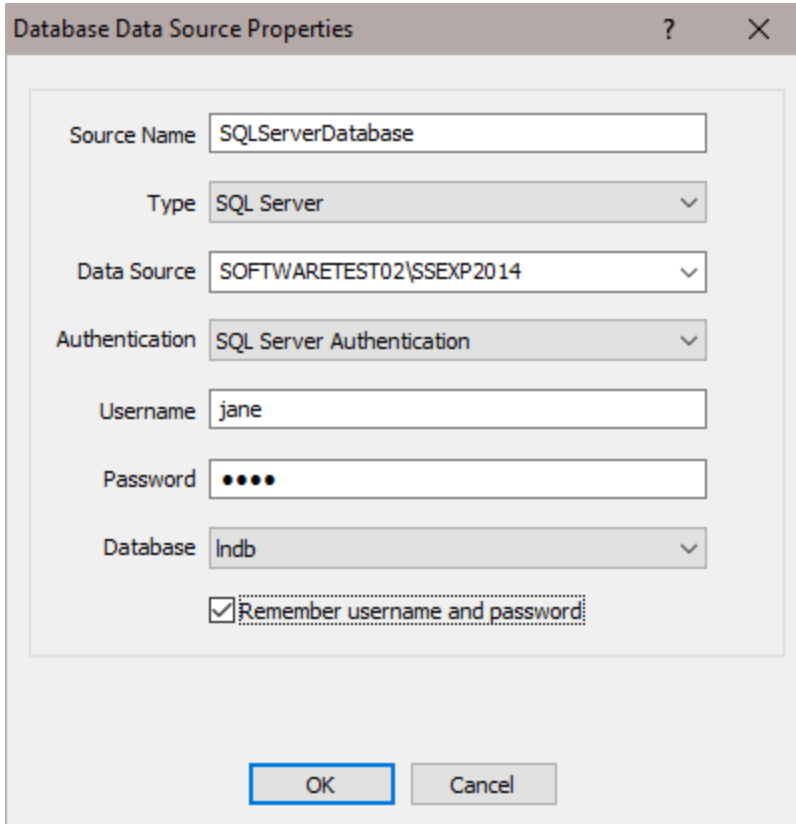
Type: SQL Server Compact

Data Source: C:\Campbellsci\LNDB\LNDB.sdf

OK Cancel

The only additional information needed for a SQL Server Compact database source is the database file to be used. Type in the name directly or press the button to the right of the field to browse to the database file.

## SQL Server



Database Data Source Properties

Source Name: SQLServerDatabase

Type: SQL Server

Data Source: SOFTWARETEST02\SSEX2014

Authentication: SQL Server Authentication

Username: jane

Password: ••••

Database: Indb

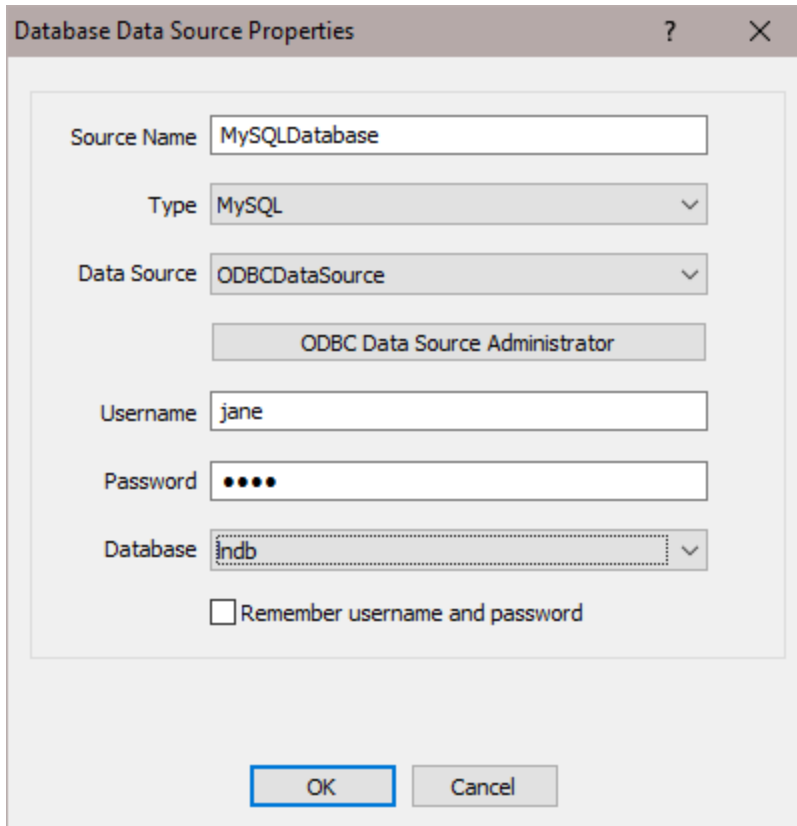
☒ Remember username and password

OK Cancel

To select a SQL Server database source you must select a SQL Server instance. The list of published SQL Server instances is shown in the Data Source combo box. You can also type into the Data Source combo box, because the desired server might not be published. Windows Authentication or SQL Server Authentication can be selected. Windows Authentication does not require a username and password, but rather uses Windows user accounts to authenticate valid users. SQL Server Authentication requires a login ID and Password and is independent of Windows user accounts. You can select the <default> database or select a specific database from the Database combo box.

The **Remember username and password** checkbox can be selected to save the username and password. If this check box is not selected and you are using SQL Server Authentication, you will be required to enter the username and password each time a report is opened that uses this database source.

## MySQL



Database Data Source Properties

Source Name: MySQLDatabase

Type: MySQL

Data Source: ODBCDataSource

ODBC Data Source Administrator

Username: jane

Password: ••••

Database: indb

☐ Remember username and password

OK Cancel

The MySQL connection is an ODBC connection. You must use the Windows ODBC Data Source Administrator to configure the database connection. Currently only system data sources are supported and show in the Data Source combo box. The Username and Password may be optional. They will be set to blank in the connection string. It has been found that when set to blank, the login id and password configured in the ODBC Data Source Administrator are used. You can select the <default> database (default as configured in the data source) or select a different database.

The **Remember username and password** checkbox can be selected to save the username and password. If this check box is not selected and the username and password were not configured in the ODBC Data Source Administrator, you will be required to enter the username and password each time a report is opened that uses this database source.



## Oracle

The screenshot shows a dialog box titled "Database Data Source Properties" with a question mark icon and a close button (X). The dialog contains several input fields and a checkbox:

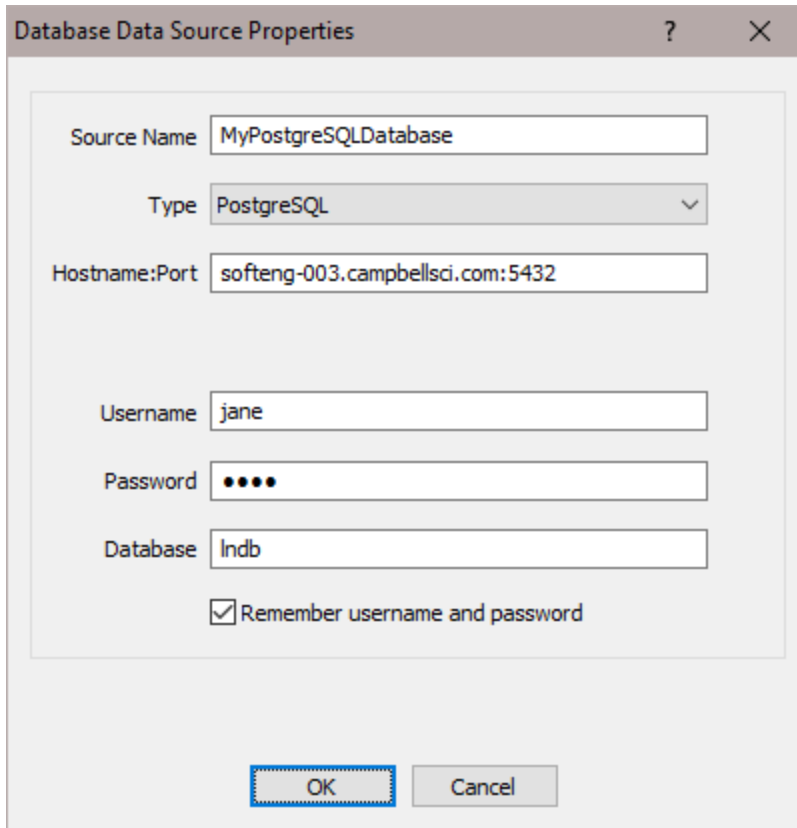
- Source Name:** A text field containing "MyOracleDatabase".
- Type:** A dropdown menu showing "Oracle".
- Hostname:Port:** A text field containing "softeng-003.campbellsci.com:1521".
- Username:** A text field containing "jane".
- Password:** A text field containing four dots (••••).
- Service Name:** A text field containing "lnodb.campbellsci.com".
- Remember username and password:** A checked checkbox.

At the bottom of the dialog are two buttons: "OK" and "Cancel". The "OK" button is highlighted with a blue dashed border.

To select an Oracle database source you must enter a Hostname:Port, Username, Password, and Service Name. The default Oracle port is 1521.

The **Remember username and password** checkbox can be selected to save the username and password. If this check box is not selected, you will be required to enter the username and password each time a report is opened that uses this database source.

## PostgreSQL



The screenshot shows a dialog box titled "Database Data Source Properties" with a question mark icon and a close button (X). The dialog contains several input fields and a checkbox:

- Source Name:** A text box containing "MyPostgreSQLDatabase".
- Type:** A dropdown menu showing "PostgreSQL".
- Hostname:Port:** A text box containing "softeng-003.campbellsci.com:5432".
- Username:** A text box containing "jane".
- Password:** A text box containing four dots (••••).
- Database:** A text box containing "Indb".
- Remember username and password:** A checked checkbox.

At the bottom of the dialog are two buttons: "OK" and "Cancel".

To select a PostgreSQL database source you must enter a Hostname:Port, Username, Password, and Database. The default PostgreSQL port is 5432.

The **Remember username and password** checkbox can be selected to save the username and password. If this check box is not selected, you will be required to enter the username and password each time a report is opened that uses this database source.

## 9.2 QuickReports Setup

The QuickReports Setup window comes up automatically after a new data source has been selected. At other times, it can be opened to edit an existing report by selecting Edit > QuickReports Setup from the menu or by right-clicking on the chart and selecting QuickReports Setup. It can be opened to create a new report by selecting File > New Report from the menu.

This window allows you to designate a title for your report, select the data table that will be used for the report, select the columns of data that will be displayed, and select the date range that will be displayed.

QuickReports Setup

Title: Logan Weather

Data Table: MyPostgreSQLDatabase:Logan\_OneDay [Browse...]

Data Column 1: AirTemp\_Max | Data Column 2: AirTemp\_Min | Data Column 3: Rain\_Tot | Data Column 4: [ ]

Begin Date: 2/ 1/2019 12:00:00 AM | Oldest Available Date: 1/4/2017 12:00:00 AM

End Date: 3/ 1/2019 12:00:00 AM | Newest Available Date: 3/12/2019 12:00:00 AM

[OK] [Cancel]

## Title

Specify the title to be displayed at the top of the report.

## Data Table

Indicates the data table from which to display data values. Use the **Browse** button to open the Data Source Browser and select a table.

## Data Column 1 – Data Column 4

Use the drop-down lists to select up to 4 data values to be displayed. (Note that you can add more data values later. See [Customizing Your Report](#) (p. 42).)

## Begin Date/End Date

Enter the Begin Date/Time and End Date/Time to specify the time period for which data will be displayed. The **Oldest Available Date** and **Newest Available Date** fields indicate the date range that is in the table and able to be displayed.

### NOTE:

By default, the Data Grid can display a maximum of 5000 records. If your selected date range exceeds 5000 records, you will only see 5000 records in the Data Grid with a note at the bottom indicating "Max Records Exceeded". In order to view all of the records in your date range, you will need to use the Data Grid's property sheet to increase Max Records. (See [Customizing Your Report](#) (p. 42) for more information on using property sheets to customize

your report.)

When using the QuickReports Setup window to edit the date range for a report, you will lose any customization you have done to chart traces. If you wish to maintain the customization, you should edit the date range using the Report Range property sheet.

## 9.3 Customizing Your Report

Once you have set up a report using the QuickReports Setup dialog box, you can customize the report using each component's property sheets. The components on a report include the Report Range, Report Title, Report Subtitle, Logo, Chart and Data Grid. A component's property sheet can be opened by double-clicking on the component, by right-clicking on the component and selecting *<Component Name> Properties* or by choosing the component from the Edit menu. For example, to edit the properties of the chart, double-click on the chart, right-click on the chart and select Chart Properties, or select Edit > Chart Properties from the QuickReports menu.

Press the '?' button at the top right of a component's property box for additional information on that component's properties.

### NOTE:

You can add traces to the chart using the **Add** button on the Series tab of the Chart property sheet. Columns can be added to the Data Grid using the **Select Columns** button on the Data Grid property sheet.

A component can be deleted from the report by right-clicking on the component and selecting Delete *<Component Name>*. For example, to delete the chart, right-click on the chart and select Delete Chart. Once a component has been deleted, it can be restored to the report by selecting Edit > Undo from the QuickReports menu.

### NOTE:

Once a report has been closed, you will not be able to restore the component.

The Undo and Redo functions in QuickReports apply only to deleting components.

## 9.4 Generating Your Report

Once you have set up your report and customized the components, you save and generate the report by selecting File > Save and Generate Report from the QuickReports menu. The report is saved as a \*.rtmq file.

When a report is generated you will see a preview of the report. From the toolbar on the Report Preview window you can print the report or export it to an Acrobat (PDF) file.

# 10. Troubleshooting

---

## Database already opened by a different user

The "Database already opened by a different user" error can occur if Windows UAC (User Account Control) is on, an application with standard rights connects to the database first, and then a second application run as an administrator attempts to connect. With UAC on, the SQL Server CE database determines that the second application is being run by a different user. This error can be seen with the LNDB Engine, because it always runs with certain administrative rights.

To fix this problem, all connections to the database should be closed and then the connection can be attempted again. If the first application that connects is run with administrative rights, all other applications with or without administrative rights can connect.

# Appendix A. Data Type Mapping

---

Datalogger data types are mapped into database data types differently depending on the type of database as described below.

## SQL Server Compact

Datalogger Data Type	SQL Server Compact Data Type	Notes
IEEE8	FLOAT	
IEEE4	REAL	
FP2	REAL	
Long	INT	
UINT2	INT	
String	NVARCHAR(2048)	
Boolean	BIT	
Bool8	BIT	
Nsec	DATETIME	Resolution is 3ms

## SQL Server

Datalogger Data Type	SQL Server Data Type	Notes
IEEE8	FLOAT(53)	
IEEE4	REAL	
FP2	REAL	
Long	INT	
UINT2	INT	
String	NVARCHAR (MAX)	

Boolean	BIT	
Bool8	BIT	
Nsec	DATETIME or DATETIME2	Record Timestamp is DateTime2 (resolution is 100ns). All others are DateTime (resolution is 3ms).

## MySQL

Datalogger Data Type	MySQL Data Type	Notes
IEEE8	DOUBLE	
IEEE4	FLOAT	MySQL FLOAT data type only stores 6 digits of precision. The datalogger stores 7.
FP2	FLOAT	
Long	INT	
UINT2	SMALLINT UNSIGNED	
String	TEXT	
Boolean	BIT(1)	
Bool8	BIT(1)	
Nsec	DATETIME	MySQL DATETIME does not support subsecond information.

## Oracle

Datalogger Data Type	Oracle Data Type	Notes
IEEE8	BINARY_DOUBLE	
IEEE4	BINARY_FLOAT	
FP2	BINARY_FLOAT	
Long	Number(10,0)	
UINT2	Number(5,0)	

String	NVARCHAR2(2000)	
Boolean	Number(1,0)	
Bool8	Number(1,0)	
Nsec	TIMESTAMP	Resolution is 1 microsecond

## PostgreSQL

Datalogger Data Type	PostgreSQL Data Type	Notes
IEEE8	double precision	
IEEE4	real	
FP2	real	
Long	integer	
UINT2	integer	
String	text	
Boolean	boolean	
Bool8	boolean	
Nsec	timestamp	Resolution is 1 microsecond



# Appendix B. SQL Rights

---

LNDB requires you to have rights to the following commands based on the database type:

## SQL Server Compact

No security available.

## SQL Server

Command	Usage
Alter	Used to add columns to existing data tables
Create Table	Creates meta and data tables
Drop	Delete tables (only initiated by user in LNDB Manager). Also used when creating a temporary meta table during an archive.
Delete	Deletes meta table records. (Never deletes data table records.)
Insert	Meta table and data table inserts.
sp_rename	Stored procedure used to rename a table during an archive.
Select	Meta table and data table data requests.
Update	Used to update meta table records during an archive.
References	Used when creating meta tables.
View Database State	Used by DBExport and RTMC Pro to get the number of records in a table.

## MySQL

Command	Usage
Alter	Used to add Columns to existing data tables. Also used to rename data tables.
Create Table	Creates meta and data tables

Drop	Delete tables (only initiated by user in LNDB Manager). Also used when creating a temporary meta table during an archive.
Delete	Deletes meta table records. (Never deletes data table records.)
Insert	Meta Table and data table inserts.
Select	Meta Table and data table data requests.
Update	Used to update meta table records during an archive.
References	Used when creating meta tables.

## Oracle

Command	Usage
Alter Any Table	Used to add columns to existing data tables. Also used to rename data tables.
Create Sequence	Used to create unique identifiers used as primary keys within the Meta tables.
Connect	To establish a connection (Granted Role)
Create Table	Create mete and data tables
Delete Any Table	Deletes meta table records. (Never deletes data table records.)
Drop Any Table	Delete tables (only initiated by user in LNDB Manager). Also used when creating a temporary meta table during an archive.
Insert Any Table	Meta table and data table inserts.
Select Any Table	Meta table and data table data requests.
Update a Table	Used to update meta table records during an archive.
Unlimited Tablespace	Lets the LNDB engine service create tables as needed without running into allocation of space issues.

## PostgreSQL

Command	Usage
Can Login	To allow the SQL user to log in to the SQL server
Connect	To establish a connection
Create	Creates meta and data tables
Delete	Deletes meta table records. (Never deletes data table records.)
Insert	Meta table and data table inserts.
Select	Meta table and data table data requests.
Temporary	Allows temporary files to be created to manipulate meta table records.
Update	Used to update meta table records during an archive.
References	Used when creating meta tables.

# Appendix C. Metatables

---

There are three metatables which contain the relationships between LoggerNet and the database: `Indbstationmeta`, `Indbtablemeta`, and `Indbcolumnmeta`.

**NOTE:**

The metatables should not be modified by the user.

## **Indbstationmeta**

Information for every station for which data has been or will be stored.

`stationID` - primary key

`InStationName` - LoggerNet station name

## **Indbtablemeta**

Information for every database data table that has been or will be written to.

`tableID` - primary key

`LNDBStationMeta_stationID` - foreign key referencing `Indbstationmeta.stationID`

`InTableName` - LoggerNet tablename

`dbTableName` - database tablename

## **Indbcolumnmeta**

Information for every database "data" column that has been or will be written to.

`LNDBStationMeta_stationID` - foreign key referencing `Indbstationmeta.stationID`.

`LNDBTableMeta_tableID` - foreign key referencing `Indbtablemeta`

`InColumnName` - datalogger column name (from LoggerNet)

`dbColumnName` - Database column name

`process` - process as defined in datalogger program

`units` - units as defined in datalogger program

`dataType` - datalogger column's data type

`columnOrder` - actual order in datalogger table definitions

`active` - true if data for the column should be stored

# Appendix D. Unicode Support and Upgrade Process

---

With LNDB versions 1.2 and later, support is provided for storing Unicode (UTF-8) strings into the LNDB database. DBExport, DBImport, and QuickReports have also been Unicode-enabled. LoggerNet version 4.2 or later is required to enable the Unicode features of LNDB.

UTF-8 Unicode encoding includes characters from languages such as Russian, Chinese, Japanese, Greek, Korean, and many other languages of the world. For brevity, the UTF-8 character sets are not shown here. For non-English UTF-8 character data to be created and stored within an LNDB database, the CRBasic program running on a datalogger must be modified to explicitly provide source data in the desired language using UTF-8/Unicode format.

LNDB deployments using Microsoft SQLServer databases require the Unicode-enabled versions of LoggerNet and LNDB to be installed, and then these will store Unicode strings automatically as soon as datalogger program modifications that use UTF-8 are implemented.

MySQL databases that are created new in LNDB v1.2 (and later) are automatically encoded using UTF-8, and therefore will also store any UTF-8 characters that arrive from a datalogger source (as long as a Unicode-enabled ODBC driver is used - see step 6. of the migration process below). However, existing MySQL tables that were created using LNDB v1.0 or v1.1 are not encoded with UTF-8, and are not automatically converted to UTF-8 when LNDB v1.2 (or later) is installed and executed. These legacy database tables should be considered for migration to UTF-8 format, although migration is often not necessary.

## D.1 Deciding Whether to Migrate MySQL Tables to UTF-8

If the string data to be stored in the existing MySQL tables will continue to be English, or a language that uses predominantly English/Latin characters with only a few non-English extended characters required, you do not need to migrate your database tables to UTF-8. This usually applies to the use of western European languages (such as German, French, Spanish, Italian, Dutch, etc.). You can continue to use these tables in their original format with LNDB v1.2. MySQL has usually encoded these tables in the Latin1 character set, which is sufficient for storing the kind of string data used in these cases.

**NOTE:**

To determine exactly which characters are supported in legacy LNDB tables (i.e., without migrating them to UTF-8), refer to the section below entitled **Windows Code Page 1252**.

However, if you will begin requiring the storage of non-English (non-Latin-based) characters from languages such as Russian, Chinese, Japanese, Greek, Korean, and many other languages of the world into these legacy LNDB tables, they will require migration to the UTF-8 format.

When migrating your tables to UTF-8, you should carefully follow the migration process shown in the section below entitled **Migrating Existing MySQL Tables to UTF-8**. The migration process includes these main actions:

- Performing a backup of the MySQL database.
- Upgrading LoggerNet to a Unicode-enabled version (4.2 or later).
- Upgrading LNDB to version 1.2 or later.
- Installing a 32-bit, Unicode-enabled MySQL ODBC driver and configuring LNDB to use that driver.
- Converting the LNDB tables in the MySQL database to UTF-8 (from Latin1, etc.). (Note that this step is performed within the LNDB Manager software.)
- Modifying the datalogger programs to use UTF-8 characters, loading the programs into the dataloggers, and starting the programs.

## **D.2 Migrating Existing MySQL Tables to UTF-8**

To avoid loss of data, perform the UTF-8 table migration by following these steps in order:

1. Close the LNDB Manager, QuickReports, DBImport, and DBExport.
2. Pause the scheduled collection process in LoggerNet to avoid any writing of data into the MySQL database. To do this, select the Status Monitor from the Main section of the LoggerNet toolbar, and check the **Pause Schedule** checkbox.
3. Perform a backup of the tables stored in the MySQL database to secure against data loss. This backup process is done using standard MySQL database administration techniques and is not executed from within LNDB.
4. Shut down the LoggerNet Toolbar. Upgrade LoggerNet to version 4.2 or later. The latest shipping version of LoggerNet is recommended for installation. The latest 4.x patches are available on the Campbell Scientific website.

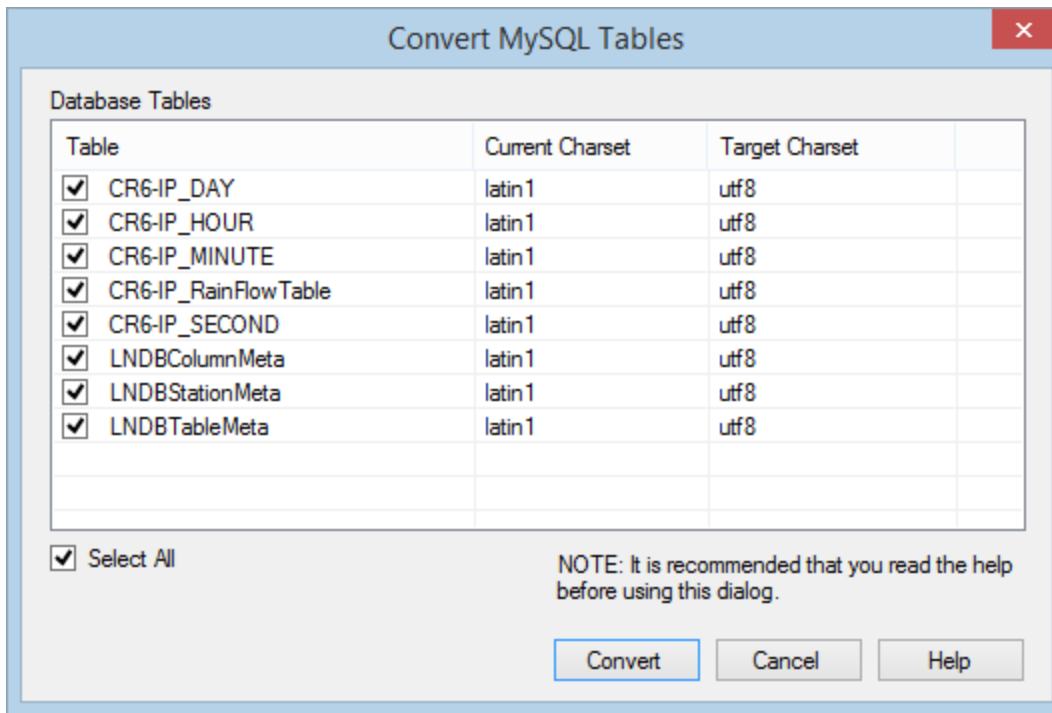
5. Upgrade LNDB to version 1.2 or later. Check the Campbell Scientific website for the latest version.
6. Install a 32-bit, Unicode version of the MySQL ODBC driver (v5.2.6 or later). The driver installation software is obtained from a MySQL software provider and not from Campbell Scientific.
7. Start the LoggerNet Toolbar. Start the LNDB Manager from the Toolbar.
  - a. Start the LNDB Engine service (if needed) when prompted.
  - b. Connect to LoggerNet as prompted.
  - c. In the **Select Database** screen, make sure the ODBC data source used by LNDB is configured to use the newly installed 32-bit, Unicode-enabled driver. Use the **ODBC Data Source Administrator** button as needed, along with the **Select Database** screen itself.
8. Open the **Convert MySQL tables** dialog box from the **Tools** menu of the LNDB Manager. Using this screen, convert the LNDB database and metadata tables to use the UTF-8 character set/encoding (instead of Latin1, for example). Refer to [Convert MySQL Tables](#) (p. 54) for further details.
9. Modify the CRBasic program running in the affected dataloggers to use the desired Unicode (UTF-8) characters. The CRBasic Editor provided with LoggerNet 4.2 and later will allow the native processing of UTF-8 characters on-screen. Start the Unicode-enabled programs on the dataloggers.
10. Uncheck the **Pause Schedule** checkbox in the Status Monitor of LoggerNet to allow data to be collected and sent to LNDB. Use the Connect Screen and LNDB Manager to confirm that data is flowing from the dataloggers into LoggerNet, and from LoggerNet into LNDB. Confirm that Unicode characters are written properly into the data tables of LNDB.

**NOTE:**

Make sure you do not start a datalogger program that uses Unicode characters until LoggerNet and LNDB have been updated, the LNDB tables have been converted to UTF-8, and the proper MySQL Unicode driver has been installed, as described above. Most Unicode characters cannot be stored in the LNDB database until all of these actions have been executed properly. MySQL tables that use the Latin1 character set instead of UTF-8 cannot store Unicode characters. String data written into LNDB databases when any of the above conditions are not satisfied may result in unrecoverable or corrupt string storage.

## D.3 Convert MySQL Tables

The Convert MySQL Tables dialog box, launched from LNDB's Tools > Convert MySQL Tables menu item, is used to convert database tables and metatables in a MySQL database that have been storing Windows code page 1252 characters (extended ASCII/Latin1/ISO 8859-1) to Unicode (UTF-8) strings in the LNDB database.



After upgrading to LNDB 1.2, any tables that need to be converted in order to start storing Unicode characters will be shown in the dialog box along with their current character set and their target character set. Simple select the tables you wish to convert (or **Select All** to select all of the tables) and press the **Convert** button. The selected tables will be converted to Unicode.

## D.4 Windows Code Page 1252

MySQL tables used in LNDB 1.1 and LNDB 1.0 did not use Unicode/UTF-8 for displaying extended (non-English) characters. They used Windows Code Page 1252 (CP1252), which is nearly identical to ISO 8859-1, and which is sometimes called ANSI or Extended ASCII. CP1252 is shown here for reference:



```

.....
.....
!"#$%&'()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~.
€.,f„...†‡^%Š<£.Ž.
.‘’“”•—~™Š>œ.žŸ
ıçŁıŸı$`©ª«¬®¯
°±²³´µ¶·¸¹º»¼½¾¿
ÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏ
ÐÑÒÓÔÕÖ×ØÙÚÛÜÝÞß
àáâãäåæçèéêëìíîï
ðñòóôõö÷øùúûüýþÿ

```

To store characters that are not shown above (not a part of CP1252) with Campbell Scientific products, it is necessary to use UTF-8 Unicode encoding.

LNDB 1.1 and 1.0 systems that used MySQL usually encoded database tables as Latin1. Latin1 is 100% compatible with the CP1252 characters shown above. If your ongoing use of LNDB 1.2 and later does not require any more characters than those shown above, you may continue using the Latin1 table encoding that was created by LNDB 1.0 and/or 1.1. In that case, no migration of the table encoding and data is necessary. LoggerNet 4.2 or later and LNDB 1.2 or later can be installed and will work properly with existing Latin1 tables (CP1252) just as they did with earlier versions of LNDB and LoggerNet. This will not require any migration steps other than standard upgrade installations.

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