



CANARY Quick Start Guide

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1. Introduction

This document presents a step-by-step guide to downloading, installing, and running CANARY on a PC with a Microsoft® WindowsTM operating system. The steps described in this document are the prerequisites for deploying CANARY as a water quality event detection tool.

Detailed information on CANARY can be found in the CANARY User's Manual (Hart and McKenna 2011). Additional background on the motivation and theory behind CANARY can be found in the EPA report, Water Quality Event Detection Systems for Drinking Water Contamination Warning Systems: Development, Testing, and Application of CANARY(Murray et al. 2010).

1.1 Purpose

This document provides step-by-step instructions on where to download the CANARY software, how to install CANARY on a computer, how to obtain and install the latest update to the software, how to run the software, and how to analyze output files. This document also describes the folders and files that are installed on a PC when CANARY is installed.

More detailed information on CANARY, such as algorithm definitions and configuration file format, can be found in the CANARY User's Manual (Hart and McKenna 2011).

Please note that the screen shots contained in this Quick Start Guide may appear slightly different depending on the operating system of the computer on which CANARY is installed.

2. CANARY Installation

An automated CANARY installer is available that contains a set of executable files. Email Terra Haxton at <u>Haxton.Terra@epa.gov</u> to receive a link and a password to an FTP site containing the files. From this FTP site, download and save the files "setup.exe" and "update.exe" on the computer that will be running CANARY.

When installing CANARY for the first time, both files are executed as described in Section 2.1.

If an older version of CANARY is already installed on the computer, only the "update.exe" file needs to be executed to update the software to the latest available version. Updates are available on the website: <u>http://software.sandia.gov/trac/canary</u>. In this case, skip ahead to Section 2.2.

2.1 Installing the CANARY Software

1. Double-click the "setup.exe" file to start the installation. Click "Next" on the CANARY Setup Wizard dialog box (Figure 1).



Figure 1: Installation Startup Dialog Box

2. After reading the license agreement, select "I accept the agreement" and click "Next" to continue the installation (Figure 2). The license agreement must be accepted in order to install and run CANARY. The full license agreement is included in Section 3.1 of this document.



Figure 2: License Agreement Dialog Box

3. Click "Browse" to choose the folder location where CANARY should be installed (Figure 3) or use the default location and click "Next." Typically, software is installed in a new folder under the Program Files folder. This new folder, in this case called CANARY, will be created during the installation process.

| 🐇 Setup - CANARY | – – X |
|--|--------------|
| Select Destination Location Where should CANARY be installed? | |
| Setup will install CANARY into the following folder. | |
| To continue, click Next. If you would like to select a different folder, click | Browse. |
| C:\Program Files (x86)\CANARY | Browse |
| At least 278.3 MB of free disk space is required. | |
| < Back Next > | Cancel |

Figure 3: File Location Dialog Box

4. Select "Example configuration and data files" (Figure 4), and click "Next." These files contain example input data and CANARY configuration files which will be installed in a folder called "My CANARY." With these files, users can practice running CANARY and modifying configuration files.

| 🐇 Setup - CANARY | _ - x | | | |
|---|--------------|--|--|--|
| Select Components Which components should be installed? | | | | |
| Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue. | | | | |
| Full installation | - | | | |
| Example configuration and data files | 39.2 MB | | | |
| Current selection requires at least 317.4 MB of disk space. | | | | |
| < Back Next > | Cancel | | | |

Figure 4: Select Components Dialog Box

Click "Browse" to choose the location in the Start Menu for a shortcut to CANARY (Figure 5) or use the default location and click "Next." This shortcut allows the user to access CANARY from All Programs under the Start Menu.

| 🐇 Setup - CANARY | _ _ X |
|--|--------------|
| Select Start Menu Folder Where should Setup place the program's shortcuts? | |
| Setup will create the program's shortcuts in the following Start M | enu folder. |
| To continue, click Next. If you would like to select a different folder, click | Browse. |
| CANARY | Browse |
| | |
| | |
| | |
| | |
| | |
| | |
| < Back Next > | Cancel |

Figure 5: Select Start Menu Folder Dialog Box

6. Select "Run Tests" to have CANARY run a short example calculation as part of the installation process (Figure 6) and click "Next." This will ensure CANARY has been installed correctly.



Figure 6: Select Additional Tasks Dialog Box

7. Click "Install" if the information listed on the "Ready To Install" dialog box is accurate (Figure 7). If this is the first time CANARY has been installed on the computer, the progress bar will be shown (Figure 8).

| 🐇 Setup - CANARY | _ _ x | | | | |
|---|--------------|--|--|--|--|
| Ready to Install Setup is now ready to begin installing CANARY on your computer. | | | | | |
| Click Install to continue with the installation, or click Back if you want to review or change any settings. | | | | | |
| Destination location: C:\Program Files (x86)\CANARY | Â | | | | |
| Setup type: Full installation | | | | | |
| Selected components: Example configuration and data files | = | | | | |
| Start Menu folder: CANARY | | | | | |
| Additional tasks: | - | | | | |
| | ۲. | | | | |
| < Back Install | Cancel | | | | |

Figure 7: Installation Verification Dialog Box



Figure 8: Installation Progress Dialog Box

The setup application will automatically begin installing the MATLAB Compiler Runtime. This library contains a number of functions that CANARY accesses when running.

8. Choose setup language or use the default option and click "OK" (Figure 9). Next, a progress bar will be shown (Figure 10).

| Choose Se | etup Language | | | | | |
|---|-------------------------|--|--|--|--|--|
| Select the language for this installation from the choices below. | | | | | | |
| | English (United States) | | | | | |
| | OK Cancel | | | | | |

Figure 9: MATLAB Language Selection Screen



Figure 10: MATLAB Install Screen

9. Click "Next" (Figure 11) to begin installing the MATLAB Compiler Runtime.



Figure 11: MATLAB Compiler Runtime InstallShield Wizard

10. Type in the user's information (Figure 12) or use the default name and organization and click "Next." This window is part of the MATLAB installer.

| B MATLAB(R) Compiler Runtime 7.9 - InstallShield Wizard | | x |
|---|-------------|-----|
| Customer Information | | |
| Please enter your information. | | |
| User Name: | - | |
| 1 | | |
| Organization: | - | |
| 1 | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| InstallShield | | |
| < Back N | lext > Cano | cel |

Figure 12: Customer Information Window

11. Click "Change" to select another location other than the default to install the MATLAB Compiler Runtime (Figure 13) and click "Next." Typically, the default location is selected.



Figure 13: MATLAB Compiler Runtime Destination Folder Window

12. Click "Install" (Figure 14) to begin installation of the MATLAB Compiler Runtime. As the installation progresses, the status will be shown (Figure 15).



Figure 14: Begin Installation Window

| | (R) Compiler Runtime 7.9 - InstallShield Wizard | | | | | | |
|---|---|--|--|--|--|--|--|
| Installing MATLAB(R) Compiler Runtime 7.9 The program features you selected are being installed. | | | | | | | |
| B | Please wait while the InstallShield Wizard installs MATLAB(R) Compiler Runtime 7.9. This may take several minutes. | | | | | | |
| | Status: Validating install | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| InstallShield – | | | | | | | |
| | < Back Next > Cancel | | | | | | |

Figure 15: MATLAB Installation Status Window

13. Click "Finish" (Figure 16) and the MATLAB Compiler Runtime is now installed.



Figure 16: MATLAB InstallShield Wizard Complete

14. If an error message appears (Figure 17), click "OK" and then click "Finish." To fix this problem, the installation needs to be repeated starting with step 1. During the process, another error might occur stating that the UM is read only – click "Ignore." A dialog box will show with the options to modify, repair, or remove the MATLAB Compiler Runtime (Figure 18), choose "Repair" and click "Next."



Figure 17: CANARY.exe System Error

| MATLAB(R) Compiler Runtime 7.9 - InstallShield Wizard | | | | | |
|---|--|--|--|--|--|
| Program Maintenance | | | | | |
| Modify, repair, | Modify, repair, or remove the program. | | | | |
| Modify | | | | | |
| Change which program features are installed. This option displays the Custom Selection dialog in which you can change the way features are installed. | | | | | |
| Repair Repair installation errors in the program. This option fixes missing or corrupt files, shortcuts, and registry entries. | | | | | |
| Remove Remove MATLAB(R) Compiler Runtime 7.9 from your computer. | | | | | |
| InstallShield ——— | < Back Next > Cancel | | | | |

Figure 18: MATLAB Compiler Modify, Repair, and Remove

15. If there were no errors, and if the "Run Tests" option was selected, a DOS window will show and a test will be completed for a simple example (Figure 19). If the installation was successful, this window will disappear once the run is complete.

```
X
C:\Program Files (x86)\CANARY\bin\canary.exe
CANARY 4.3.1 (b435:r3634, 2012-01-04, 13:56:02) [MATLAB Compiler version: 4.9 (R
2008b)] on win32
CANARY — Copyright 2007—2009 Sandia Corporation.
Under the terms of Contract DE-AC04-94AL85000 with Sandia Corporation,
the U.S. Government retains certain rights in this software.
MATLAB – Copyright The Mathworks, Inc. 1984–2009.
Redistribution of MATLAB compiler runtime (MCR) libraries by end user
is NOT allowed per the deployment addendum of MCR license (see deploy.txt)
and the CANARY-binary license
[CANARY_Log]
Version: CANARY 4.3.1 (b435:r3634, 2012-01-04, 13:56:02) [MATLAB Compiler versio
n: 4.9 (R2008b)] on win32
 [Startup]
Timestamp: 20120131T165932
IntializeLocation: St
                                          StationD
Intra

IBatchProcessing]

Timestamp: 20120131T165935

BatchStartDateTime: 2008-01-15 00:00:00

BatchStartDateTime: 2008-01-30 13:48:00

Commute data test
Timestamp: 2012
BatchStartDateTime:
BatchStopDateTime:
UpdateFromSource:
UpdateDuration:
                                         2008-01-30 13:48:00
...sample_data\test_station_d.csv
20120131T165935 --> 20120131T165937
output_CSV_File_Input.
20120131T165937 --> 20120131T165937
UpdateFromSource:
UpdateDuration:
Message:
    timestamp:20120131T165951
                    EDS
Time to process day: 19.4 sec; est. remain: 4.7 min
2008-01-15 23:58:00
    from:
    subject:
    content:
Message:
    timestamp:20120131T170006
from: EDS
                    Time to process day: 15.1 sec; est. remain: 3.9 min 2008-01-16 23:58:00
    subject:
    content:
  - -
Message:
   timestamp:20120131T170022
from: EDS
                    EDS
EDS
Time to process day: 15.3 sec; est. remain: 3.5 min
2008-01-17 23:58:00
    subject:
    content:
  - -
Message:
   timestamp:20120131T170037
from: EDS
                    EDS

Time to process day: 15.2 sec; est. remain: 3.1 min

2008-01-18 23:58:00
    subject:
    content:
   timestamp:20120131T170052
from: EDS
Message:
                    Time to process day: 15.1 sec; est. remain: 2.8 min 2008-01-19 23:58:00
    subject:
    content:
Message:
    timestamp:20120131T170107
                    EDS
EDS
Time to process day: 15.0 sec; est. remain: 2.5 min
2008-01-20 23:58:00
    from:
    subject:
content:
```



16. Click "Finish" (Figure 20). The installation is complete!



Figure 20: CANARY Setup Complete

2.2 Updating the CANARY Software

Double-click the "update.exe" file to start the installation. Follow steps 1-7 above. During the process, an error might occur that says the UM is read only – click "Ignore." Then follow steps 15-16 above. The update is complete!

2.3 Files and Associations

A list of the main directories and files associated with the CANARY installation are described below. The options under the CANARY shortcut are also described.

The "CANARY" folder under "Program Files" has four subfolders and three files (Figure 21). The folders are listed below and should not be modified. Typically, a user might never access these subfolders directly. Screen shots of each folder's contents are provided in Section 3.2.

- bin contains the executables for running CANARY
- doc contains documentation, including the CANARY User's Manual
- etc contains icons and configuration files associated with databases
- lib contains information the code needs to run



Figure 21: CANARY Directory

A "MY CANARY" folder is installed under "My Documents," which contains one subfolder and four files (Figure 22). The four files are:

- CANARY-UM.pdf the CANARY User's Manual
- DummyAlgorithm.java an example custom algorithm written in java
- EDDIES-Setup.txt a help file for using the EDDIES SCADA interface
- readme.txt a help file for the MATLAB Runtime Compiler

| C C C C C C C C C C C C C C C C C C C | | | | | |
|---|--------------------------------|--------------------|-----------------|----------------|--|
| Organize ▼ Share with ▼ Burn New folder 🔠 ▼ 🗍 🔞 | | | | | |
| ☆ Favorites ■ Desktop | Documents library My CANARY | | Arrange | e by: Folder 🔻 | |
| \rm Downloads | Name | Date modified | Туре | Size | |
| 🔠 Recent Places 🗏 | 📔 examples | 10/19/2011 3:31 PM | File folder | | |
| 🚍 Libraries | CANARY-UM.pdf | 3/31/2011 10:35 AM | Adobe Acrobat D | 2,066 KB | |
| Documents | DummyAlgorithm.java | 3/31/2011 10:35 AM | JAVA File | 2 KB | |
| My Documents | EDDIES-Setup.txt | 3/31/2011 10:35 AM | Text Document | 3 KB | |
| Public Docume | 📄 readme.txt | 3/31/2011 10:35 AM | Text Document | 10 KB | |
| J Music | | | | | |
| Pictures | | | | | |
| Videos 🔻 | | | | | |
| 5 items | | | | | |

Figure 22: My CANARY Directory

If the example configuration and data files option was selected during installation, then a subfolder called "examples" is located within the MY CANARY folder. The examples folder contains four additional folders, in which two of the folders (algorithm_opts and signal_opts) are place holders for future CANARY releases (Figure 23). Screen shots of the contents for the two folders listed below are provided in Section 3.3.

- datasource_opts contains example configuration files
- sample_data contains example monitoring station data files

| Ce Co v 🎍 🕨 Libraries | Documents My CANARY example: | s) | | ▼ [€] ŷ | Search examples |
|----------------------------------|--------------------------------------|--|----------------------------|-------------------------|----------------------|
| Organize 👻 Share with | a ▼ Burn New folder | | | | := - 🔟 🔞 |
| 🔆 Favorites 📃 Desktop | Documents library examples | | | | Arrange by: Folder 🔻 |
| \rm Downloads 📃 Recent Places | Name A | Date modified | Type | Size | |
| 🥽 Libraries | datasource_opts | 1/31/2012 5:03 PM | File folder | | |
| Documents | 🕌 sample_data 퉬 signal_opts | 1/31/2012 4:21 PM 1/31/2012 4:20 PM | File folder File folder | | |
| Public Documents Music | | | | | |

Figure 23: My CANARY/examples Directory

Under the Start Menu, click on "All Programs" and then "CANARY." Several options are available:

- CANARY option to run CANARY
- Uninstall CANARY option to uninstall CANARY
- Cluster Pattern Editor option to edit cluster patterns
- Graph Data Files option to graph CANARY output

Four file types are associated with CANARY after running the software and are stored in the MY CANARY folder. These files have the following endings:

- .EDSY This is a CANARY configuration and settings file in the YML format. Double click this type of file to run CANARY, or right-click and choose "Edit" to open the configuration editor in a text editor (see Configuration Details section in the CANARY User's Manual). Older configuration files were written in XML format and ended in EDSX. These older files can still be read by CANARY.
- .EDSD This is a CANARY output data file, which is graphed when double-clicked.
- .EDSC This is a CANARY clustering-pattern library file.
- .log This is a CANARY log file. It will open in a text editor if double-clicked.

2.4 Running CANARY

The process of running CANARY is demonstrated through an example. Readers can follow along using their own installation of CANARY.

In order to run CANARY, a data source is needed (a data file or database) as well as a configuration file. Typically, the data source is made up of data from water quality sensors collected over a period of time. Configuration files contain information about how to run CANARY on a specific data set. These files typically end in *.yml or *.edsy; see the Configuration Details section in the CANARY User's Manual for more details.

In Figure 24, "test_station_B.yml," located in the datasource_opts folder, is the configuration file that is used in this example. The data file used in this example, "test_station_b.csv," is located in the sample_data folder and shown in Figure 25.

| 🕞 🕞 🗢 📕 « Documen | ts My CANARY examples datasource_opts | • • • • • • • • • • • • • • • • • • • | rch datasource_ | opts 🔎 |
|----------------------------|--|---------------------------------------|-----------------|----------------|
| Organize 🔻 🎒 Open | ✓ Share with ▼ Burn | | | = • 🗍 🔞 |
| ★ Favorites ■ Desktop | Documents library datasource_opts | | Arra | nge by: Name 🔻 |
| Downloads | Name | Date modified | Туре | Size |
| 🚆 Recent Places | 🔳 example | 2/3/2012 3:34 PM | YML File | 7 KB |
| 🚍 Libraries | 🐇 example_CSV_File_Input | 7/1/2011 11:17 AM | EDSX File | 8 KB |
| Documents | ፋ example_CSV_File_Input | 2/3/2012 3:33 PM | EDSY File | 7 KB |
| My Documents | 🐁 example_MS_SQL_Server_2008 | 12/20/2010 4:25 PM | EDSX File | 8 KB |
| Public Docume | 💊 example_MS_SQL_Server_2008 | 8/1/2011 12:11 PM | EDSY File | 8 KB |
| J Music | 🐁 example_MySQL_Server_5 | 12/20/2010 4:25 PM | EDSX File | 8 KB |
| Pictures | 💊 example_MySQL_Server_5 | 8/1/2011 3:12 PM | EDSY File | 8 KB |
| Videos | 💊 example_Oracle_Database_10g_XE | 12/20/2010 4:25 PM | EDSX File | 8 KB |
| | 💊 example_Oracle_Database_10g_XE | 8/1/2011 3:12 PM | EDSY File | 8 KB |
| Computer | 💊 example_SQLServer_2008_by_cols | 8/1/2011 12:11 PM | EDSY File | 8 KB |
| 💑 OS (C:) | 💊 example_SQLServer_2008_by_rows | 8/1/2011 12:11 PM | EDSY File | 8 KB |
| DATAPART1 (D;) | est_station_B | 2/3/2012 3:42 PM | YML File | 5 KB |
| test_station_B YML File | Date modified: 2/3/2012 3:42 PM Date created: 2 Size: 4.33 KB | 2/3/2012 3:33 PM | | |

Figure 24: Location of YML Configuration File

| | | | | - 0 × |
|------------------------------------|--|----------------------------------|--|----------|
| Solo Cumen | ts 🕨 My CANARY 🕨 exa | imples F sample_data | Search sample_aata | ٩ |
| Organize 🔻 💽 Open | ✓ Share with ▼ | Print Burn N | New folder | • 🔳 🔞 |
| ★ Favorites ■ Desktop | Documents lib sample_data | rary | Arrange by: | Folder 🔻 |
| Downloads | Name | Date modified | Туре | Size |
| Recent Places | 🚳 test_station_a | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 3,008 KB |
| 🚍 Libraries 🗧 | 🖲 test_station_b | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 547 KB |
| | 🖲 test_station_c | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 4,499 KB |
| My Documents | 🚳 test_station_d | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 7,559 KB |
| Public Docume | 🚳 test_station_e | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 3,584 KB |
| Music | <table-of-contents> test_station_f</table-of-contents> | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 4,386 KB |
| Pictures | 🝓 test_station_g | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 4,776 KB |
| Videos | 🐴 TST1_Jan_Aug_08 | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 5,764 KB |
| | 👬 TST2 | 12/20/2010 4:25 PM | CANARY Cluster Pattern Library | 125 KB |
| 🖳 Computer | 🐴 TST2_Jan_Aug_08 | 12/20/2010 4:25 PM | Microsoft Office Excel Comma Separated Values File | 5,716 KB |
| 🚮 OS (C:) 🗸 | | | | |
| test_station_b Microsoft Office | Excel Comma Separated V | Date modified: 1. /al Size: 5 | 2/20/2010 4:25 PM Date created: 1/31/2012 4:21 PM 46 KB | Л |

Figure 25: Location of CSV Data Source File

If the default installation Start Menu shortcut was selected, CANARY can be accessed by going to "All Programs," "CANARY," "CANARY." This will bring up a browser window in which a CANARY configuration file should be selected (Figure 26). The user should browse to the directory in which the correct YML file is located and select it. In this example, browse to the directory shown in Figure 24 and select the "test_station_B.yml" configuration file.

| Select Configuration File | | | | Ŀ | x |
|---------------------------|--|--------------------|--|------------------|---|
| 🕞 🕞 🗢 📕 « My Docur | nents 🕨 My CANARY 🕨 examples 🕨 datasou | rce_opts 🔹 | ♣ Search datasou | irce_opts | ٩ |
| Organize 🔻 New folde | r | | - | ≡ ▾ 🔳 | 0 |
| ☆ Favorites | Name | Date modified | Туре | Size | |
| 📃 Desktop | example | 2/3/2012 3:34 PM | YML File | 7 KB | |
| 〕 Downloads | 💊 example_CSV_File_Input | 7/1/2011 11:17 AM | CANARY Configur | 8 KB | |
| 🖳 Recent Places | 💊 example_CSV_File_Input | 2/3/2012 3:33 PM | CANARY Configur | 7 KB | |
| | 💊 example_MS_SQL_Server_2008 | 12/20/2010 4:25 PM | CANARY Configur | 8 KB | |
| 🥽 Libraries | 💊 example_MS_SQL_Server_2008 | 8/1/2011 12:11 PM | CANARY Configur | 8 KB | |
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Figure 26: Selection of Configuration File

After the execution of the "test_station_B.yml" configuration file, the following files (Figure 27) are created:

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| Documents | CONTROL.msg | 2/3/2012 3:45 PM | Text Document | 2 KB | |
| My Documents | test_station_b.StationB.summary | 2/3/2012 3:45 PM | Text Document | 5 KB | |
| Public Docume | test_station_b.StationB | 2/3/2012 3:45 PM | EDSD File | 135 KB | |
| J Music | test_station_b | 2/3/2012 3:45 PM | EDSD File | 134 KB | |
| Pictures | heartbeat.dat | 2/3/2012 3:45 PM | DAT File | 1 KB | |
| Videos | test_station_b_out | 2/3/2012 3:44 PM | YML File | 5 KB | |
| · · · · · · · · · · · · · · · · · · · | <pre>1 test_station_B</pre> | 2/3/2012 3:42 PM | YML File | 5 KB | - |
| 20 items | | | | | |

Figure 27: Initial CANARY Run File Creation

- test_station_B.log Log file for every day that CANARY runs. This log is generated from the information that prints out onto the DOS window.
- status.log Status log that tracks when CANARY is running.
- CONTROL.msg File which contains the messages passed between CANARY and Control.
- test_station_B.StationB.summary.text Summary of the current CANARY run, which explains the inputs and outputs of the YML (or EDSY) file and provides log information of every event detected.
- test_station_b.edsd Comprehensive output file.
- test_station_b.StationB.edsd Output file just for the Station B sensor station. Note this file will be created for every individual sensor station included in the configuration file.
- heartbeat.dat File which states the specific date and time CANARY was run.
- test_station_b_out.yml A copy of the YML file which was run.

2.5 Analysis of CANARY Output

To visualize and utilize the output data contained in the EDSD files, four different automated methods are available. The different methods are Graph Data, Convert to CSV, Create Cluster Library, and Combine EDSD Files. All of these methods can be accessed by right-clicking on the EDSD file. The following sections provide examples of each method.

2.5.1 Graph Data

To visualize the results of the CANARY analysis, the Graph Data option can be utilized. The process is demonstrated using the test_station_B example files.

1. Open the datasource_opts folder under the My CANARY examples folder to locate the test station b EDSD files (Figure 28).

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| Pictures | heartbeat.dat | 2/3/2012 3:45 PM | DAT File | 1 KB | |
| Videos | test_station_b_out | 2/3/2012 3:44 PM | YML File | 5 KB | |
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Figure 28: Directory Window Where EDSD File is Located

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| Videos | <pre>test_station_b_out</pre> | Create Cluster Lib | orary | PM | YML File | 5 KB | |
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2. Right click on "test_station_b.StationB.edsd" and select "Graph Data" (Figure 29).

Figure 29: Selecting the Graph Data Option

3. Select "Probability" (Figure 30) to graph the probability of an event.



Figure 30: Graph Result Type Window

4. Select "StationB" (Figure 31) and Click "OK." Note that an EDSD file can contain results from more than one sensor station.

| 🛃 Graph data 💷 💷 | x |
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| Please select one or more | |
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Figure 31: Station Selection Window

5. Select "Weekly" to graph the data on a weekly basis (Figure 32) and click "OK."

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| OK Cancel | |

Figure 32: Graph Scale Window

Once this process is completed, the graphs are created and added to the folder in which the EDSD was located (Figure 33).

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| My Documents | test_station_b.StationB.2006-04-04.thru.2006-04-10 | 2/3/2012 4:02 PM | PNG image | 44 KB | |
| Public Documents | test_station_b.StationB.2006-03-28.thru.2006-04-03 | 2/3/2012 4:02 PM | PNG image | 35 KB | |
| J Music | test_station_b.StationB.2006-03-21.thru.2006-03-27 | 2/3/2012 4:02 PM | PNG image | 37 KB | = |
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Figure 33: Output files from Graph Data

After the graphs are created, they can be opened and viewed. Each graph contains the water quality signals analyzed, any operational signals, and a probability of event plot for each algorithm utilized. Water quality signal labels are in black, operational signal labels are green, and operational signals that are ignored are labeled in purple. The probability of event plots are at the bottom of the graph. A blue dot on the probability of event plot indicates an event. In addition, a dot will be located on each water quality signal that contributed to the detection of the event.

6. Double-click the "test_station_b.StationB.2006-02-21.thru.2006-02-27.png" file to examine the results.

Figure 34 shows the content of this file: the water quality signals are chlorine (CL2), pH (PH), conductivity (COND), turbidity (TURB), and total organic carbon (TOC). The operational signals in this example are the temperature (TEMP), plant pressure (PLNT OP PRES), and flow

(PLNT OP FLOW). The probability of an event plot shows the probability that an event is occurring at each time step as computed by CANARY using the LPCF algorithm. The first event detected was caused by an unexpected change in the chlorine signal (CL2).





2.5.2 Converting to CSV Files

To view the contents of the EDSD file, it is recommended that the "Convert to CSV" option be utilized. This converts the contents of the file to a comma separated values (CSV) file that can be opened in Microsoft Excel. Two types of CSV are created, a summary file and a details file. The summary file provides the probability of an event and the CANARY status at every time step. The details file provides extensive details on CANARY results for every time step, including the CANARY status, the probability of an event, and the residuals for each active

water quality signal. A details CSV file is written for each active algorithm in the configuration file. The process is demonstrated below using the previous example files.

- 1. Open the datasource_opts folder under the My CANARY examples folder to locate the "test station b.StationB.edsd" (Figure 28).
- 2. Right click on "test_station_b.StationB.edsd" file and select "Convert to CSV" to convert the format of the results data (Figure 35).

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| Music | test_station_b | (| Graph Data | | 5 PM | EDSD File | 134 KB | |
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Figure 35: Selecting the Convert to CSV Option

The converted CSV files are added to the folder (Figure 36). The new files are "test_station_b.StationB-summary.csv" and "test_station_b.StationB-details-alg_1.csv."

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| Public Documents | test_station_b.StationB.2006-04-11.thru.2006-04-17 | 2/3/2012 4:17 PM | PNG image | 40 KB | |
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| | test_station_b | 2/3/2012 4:15 PM | EDSD File | 125 KB | |
| | heartbeat.dat | 2/3/2012 4:15 PM | DAT File | 1 KB | |
| | test_station_b_out | 2/3/2012 4:14 PM | YML File | 5 KB | |
| | test_station_B | 2/3/2012 4:14 PM | YML File | 5 KB | Ψ. |
| ² items selecte | d Date modified: 2/3/2012 4:53 PM Date created: Size: 939 KB | 2/3/2012 4:53 PM | | | |

Figure 36: Converting to CSV File Output

2.5.3 Create Cluster Library

Another option available by right-clicking on the EDSD file is "Create Cluster Library." This is an advanced option for CANARY users; for details, please refer to the CANARY User's Manual section on Water Quality Pattern Matching (Hart and McKenna 2011).

2.5.4 Combine EDSD Files

This option is most often needed for long-term CANARY runs in online mode (i.e., connected to a database) when a separate EDSD file is created every day. This option allows multiple EDSD files to be combined into a single EDSD file. Note that CANARY expects the EDSD file names being joined to have a particular naming convention, see Figure 37. This is the same naming convention used for the daily EDSD files created during an online run. This convention is also followed for intermediate files created in offline mode (i.e., running from a CSV file). At the

end of an offline run, CANARY automatically deletes the intermediate files and combines them into the final EDSD file. The process is demonstrated below through an example.

1. Open the folder where the EDSD files are located (Figure 37).

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| Recent Places | heartbeat.dat | 2/3/2012 4:07 PM | DAT File | 1 KB | |
| 🚍 Libraries | | 2/3/2012 4:07 PM | CANARY Data | 86 KB | |
| | 🚟 test_station_b.2006-04-02.thru.2006-04-03 | 2/3/2012 4:07 PM | CANARY Data | 86 KB | E |
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Figure 37: Example EDSD Naming Convention

2. Right click on any of these intermediate EDSD files and select "Combine EDSD Files" (Figure 38)

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| | test_station_b.2006-03-03.thru.2006-03-04 | 2/3/2012 6:41 PM | EDSD File | 82 KB |
| | test_station_b.2006-03-02.thru.2006-03-03 | 2/3/2012 6:41 PM | EDSD File | 82 KB |
| | test_station_b.2006-03-01.thru.2006-03-02 | 2/3/2012 6:41 PM | EDSD File | 81 KB |
| | test_station_b.2006-02-28.thru.2006-03-01 | 2/3/2012 6:41 PM | EDSD File | 81 KB |
| | test_station_b.2006-02-27.thru.2006-02-28 | 2/3/2012 6:41 PM | EDSD File | 81 KB |
| | test_station_b.2006-02-26.thru.2006-02-27 | Graph Data | file | 81 KB |
| | test_station_b.2006-02-25.thru.2006-02-26 | Convert To CSV | file | 81 KB |
| | test_station_b.2006-02-24.thru.2006-02-25 | Create Cluster Library | file | 80 KB |
| | test_station_b.2006-02-23.thru.2006-02-24 | Combine EDSD Files | file | 80 KB |
| | test_station_b.2006-02-22.thru.2006-02-23 | Open with | file | 79 KB |
| | test_station_b.2006-02-21.thru.2006-02-22 | Share with |) ile | 77 KB 👻 |
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Figure 38: Selecting Combine EDSD Files Option

3. Select the "test_station_b.2006-02-21.thru.2006-02-22.edsd" file as the first EDSD file to be included in the combined file (Figure 39).

| Select the FIRST raw data file to combine | | | | | | | | | |
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| 〕 Downloads | 🔚 test_station_b.2006-02-22.thru.2006-02-23 | 2/3/2012 4:14 PM | CANARY Data File | 79 KB | | | | | |
| 🔚 Recent Places | 🚟 test_station_b.2006-02-23.thru.2006-02-24 | 2/3/2012 4:14 PM | CANARY Data File | 80 KB | | | | | |
| | 😸 test_station_b.2006-02-24.thru.2006-02-25 | 2/3/2012 4:14 PM | CANARY Data File | 80 KB | = | | | | |
| 🥃 Libraries | 😸 test_station_b.2006-02-25.thru.2006-02-26 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | | | |
| Documents | 😸 test_station_b.2006-02-26.thru.2006-02-27 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | | | |
| 👌 Music | 😸 test_station_b.2006-02-27.thru.2006-02-28 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | | | |
| Pictures | 😸 test_station_b.2006-02-28.thru.2006-03-01 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | | | |
| 😸 Videos | 😸 test_station_b.2006-03-01.thru.2006-03-02 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | | | |
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| 👰 Computer | 😸 test_station_b.2006-03-03.thru.2006-03-04 | 2/3/2012 4:14 PM | CANARY Data File | 82 KB | | | | | |
| 🐔 OS (C:) | 😸 test_station_b.2006-03-04.thru.2006-03-05 | 2/3/2012 4:15 PM | CANARY Data File | 83 KB | | | | | |
| 👝 DATAPART1 (D:) | 🚟 test_station_b.2006-03-05.thru.2006-03-06 | 2/3/2012 4:15 PM | CANARY Data File | 83 KB | | | | | |
| 👝 Removable Disk (H:) | 🚟 test_station_b.2006-03-06.thru.2006-03-07 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | | | |
| | 🚟 test_station_b.2006-03-07.thru.2006-03-08 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | | | |
| 📬 Network | 🚟 test_station_b.2006-03-08.thru.2006-03-09 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | | | |
| | 🚟 test_station_b.2006-03-09.thru.2006-03-10 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | | | |
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| | | | Open 🚽 | Cancel | | | | | |
| | | | | | t | | | | |

Figure 39: First EDSD File to Combine

4. Select the "test_station_b.2006-03-09.thru.2006-03-10.edsd" file as the last EDSD file to be included in the combined file (Figure 40).

| Select the LAST raw data file to combine | | | | | | | |
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| 🥃 Libraries | 😸 test_station_b.2006-02-25.thru.2006-02-26 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | |
| Documents | 🚼 test_station_b.2006-02-26.thru.2006-02-27 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | |
| 👌 Music | 🚼 test_station_b.2006-02-27.thru.2006-02-28 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | |
| Pictures | 🚼 test_station_b.2006-02-28.thru.2006-03-01 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | |
| 😸 Videos | 🚼 test_station_b.2006-03-01.thru.2006-03-02 | 2/3/2012 4:14 PM | CANARY Data File | 81 KB | | | |
| | 🚼 test_station_b.2006-03-02.thru.2006-03-03 | 2/3/2012 4:14 PM | CANARY Data File | 82 KB | | | |
| 👰 Computer | 🚼 test_station_b.2006-03-03.thru.2006-03-04 | 2/3/2012 4:14 PM | CANARY Data File | 82 KB | | | |
| 🚮 OS (C:) | 🚟 test_station_b.2006-03-04.thru.2006-03-05 | 2/3/2012 4:15 PM | CANARY Data File | 83 KB | | | |
| 👝 DATAPART1 (D:) | 🚼 test_station_b.2006-03-05.thru.2006-03-06 | 2/3/2012 4:15 PM | CANARY Data File | 83 KB | | | |
| 👝 Removable Disk (H:) | 🚼 test_station_b.2006-03-06.thru.2006-03-07 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | |
| | 🚼 test_station_b.2006-03-07.thru.2006-03-08 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | |
| 📬 Network | 🚼 test_station_b.2006-03-08.thru.2006-03-09 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | |
| | test_station_b.2006-03-09.thru.2006-03-10 | 2/3/2012 4:15 PM | CANARY Data File | 82 KB | | | |
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| | | | Open | Cancel | | | |

Figure 40: Last EDSD File to Combine

Once the last EDSD file is selected, CANARY creates a combined EDSD file, "test_station_b.2006-02-21.combined.2006-03-10.edsd," containing the first, the last, and all the intermediate files (Figure 41).

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Figure 41: Combined EDSD File Created

3. Additional Resources

In this section, the CANARY license text, an example YAML configuration file, and screen captures of CANARY related directories are provided.

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Copyright and license statement for the original Mersenne twister C routines translated in MersenneTwister class in package org.apache.commons.math.random:

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3.2 CANARY Directory Structure

This section provides screen captures of the subfolders and files contained in the CANARY directory under Program Files once the software is installed on a computer.

Figure 42 shows the files contained within the "bin" folder of the "CANARY" directory found under Program Files.



Figure 42: CANARY\bin Folder

Figure 43 shows the files contained within the "doc" folder of the "CANARY" directory found under Program Files.

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Figure 43: CANARY\doc Folder

Figure 44 shows the files contained within the "etc" folder of the "CANARY" directory found under Program Files.

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| Figure 44: | CANARY\etc Folder |
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Figure 45 shows the files contained within the "lib" folder of the "CANARY" directory found under Program Files.

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Figure 45: CANARY\lib Folder

3.3 MY CANARY Directory Structure

This section provides screen captures of the subfolders and files contained in the examples folder under the My CANARY directory after the software is installed on a computer.

Figure 46 shows the files contained within the "datasource_opt" folder of the "examples" directory.

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Figure 46: My CANARY\examples\datasource_opts Folder

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Figure 47 shows the files contained within the "sample_data" folder of the "examples" directory.

Figure 47: My CANARY\examples\sample_data Folder

4. References

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