WHEN YOU NEED TO BE SURE

CyFlex® Duty Cycle Analysis User Guide

Version 5

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Version History

Version	Date	Revision Description
1	1/25/2016	Initial publication
2	8/23/2018	Format to SGS brand
3	3/31/2020	Retrofit to new template
4	8/31/2021	Added hyperlinked cross-reference to cyflex.com usage help for `duty_cycle` in *Section 2* on page 2.
5	5/24/2022	Updated hyperlinked cross-reference to cyflex.com usage help for `duty_cycle` in *Section 2* on page 2

Document Conventions

This document uses the following typographic and syntax conventions.

- Commands, command options, file names or any user-entered input appear in Courier type. Variables appear in Courier italic type.

  Example: Select the `cmdapp-`*`relVersion-buildVersion`*`.zip` file….

- User interface elements, such as field names, button names, menus, menu commands, and items in clickable dropdown lists, appear in Arial bold type.

  Example: **Type**: Click **Select Type** to display drop-down menu options.

- Cross-references are designated in Arial italics.

  Example: Refer to *Figure 1*…

- Click intra-document cross-references and page references to display the stated destination.

  Example: Refer to *Section 1* Overview on page 1.

  The clickable cross-references in the preceding example are *1*, *Overview*, and on page 1.

CyFlex Documentation

CyFlex documentation is available at https://cyflex.com/. View **Help & Docs** topics or use the **Search** facility to find topics of interest.

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1 Overview

A duty cycle matrix in its most basic form is an analysis of time accumulation while a device (typically, an engine) is within a specified range of operating conditions. The example output file below illustrates this.

	<0	0	50	>=100
<0	0	0	0	0
0	0	2.3	3.1	0
10	0	1.3	1	0
>=20	0	1	5	0

In the preceding example the device spent 2.3 hours with the X channel in the range of 0-50 and the Y channel in the range of 0-10 while the device ran for 3.1 hours with the X channel in the range of 50-100 and the Y channel in the range of 0-10.

Up to 8 other variables can be defined as the Z label. The duty cycle analysis for these other variables is stored in similar matrix of another file. The results of those files are a sum of the samples of the Z variable while the device is the range of those same operating conditions.

2 Running Duty Cycle Analysis

Use the following syntax:

`duty_cycle <spec_filename> [-r]`

where:

spec_filename is the specification file. Refer to *Section 3 Example Specification File* on page 3.

Refer to `duty_cycle` on cyflex,com for full usage help.

3 Example Specification File

The following is an example specification file:

```
# Output File Process_Interval (ms) Scans_Per_Save
/data/PC_format/duty 1000 1000
#
# X_Label X_Min X_Max X_Grid_Width
Engine_Speed 0 80 20
#
# Y_Label Y_Min Y_Max Y_Grid_Width
Gross_Torque 0 500 100
#
# Z_Labels
Intake_Manifold_Temp
Intake_Manifold_Press
```

3.1 Specification File Configuration Outputs

The output of duty cycle analysis is one file for each specified Z variable, with an extra file for time accumulation. The files are named with the specified file name with an extension of the Z variable name (ex. /`usr/local/duty.Intake_Manifold_Temp`).

A scan and update of the duty cycle matrix occurs at a rate defined by the `Process_Interval`, in this case, every 1 second. The `Scans_Per_Save` parameter defines how many scans will occur before the matrix is save to the disk.

The next line of the specification is the definition of the X variable. The first parameter is the variable's label.

The minimum and maximum are then defined followed by the grid width. In this example, the X values ranges are:

`x<0, 0 <= x < 20, 20 <= x < 40, 40 <= x < 60, 60 <= x < 80, x>=80`.

The headings are:

`<0, 0, 20, 40, 60, >=80`, respectively. There are 2 extra columns to catch values outside the minimum and maximum values.

The `X_Label` specification defines the columns of the duty cycle matrix. The `Y_Label` specification works the same way and defines the rows of the matrix.