Drive PC tools

# User manual
# Application worksheet for DriveSize

## 1) Hoist function

| | | |
|---|---|---|
| Weight of rope and hook | 1000 | kg |
| Weight of the load | 10000 | kg |
| Mechanical efficiency | 0,9 | |
| Hoisting speed | 5 | m/min |
| Other inertia on motor shaft | 1 | $kgm^2$ |
| Acceleration 0...max.sp (s) | 5 | s |
| ED % | 50 | % |
| Hoisting height | 20 | m |

## 2) Motor specification

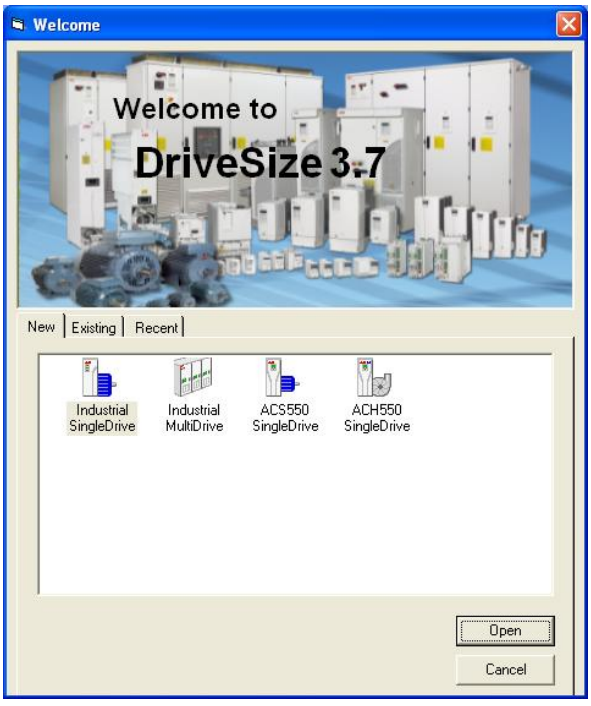
| | | |
|---|---|---|
| Motor speed at hoist speed | 1470 | RPM |
| Estimated motor inertia | 0,16 | $kgm^2$ |

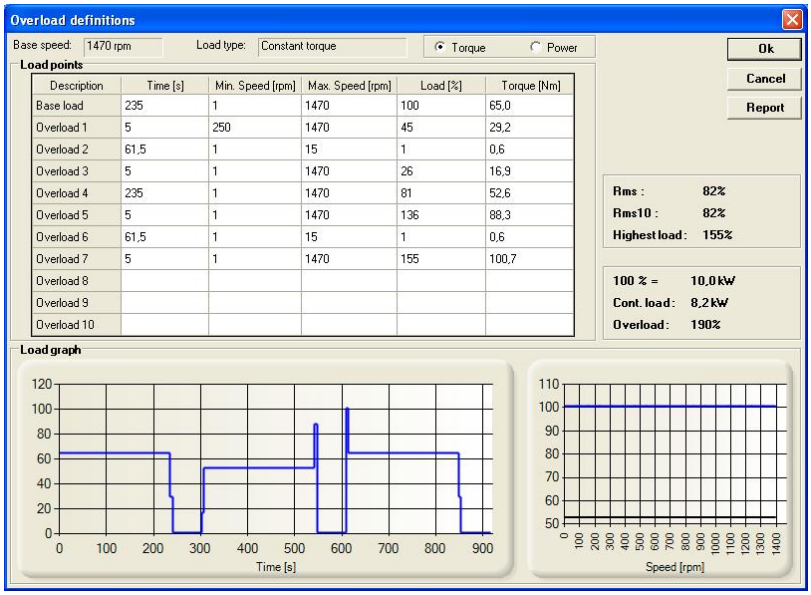
## 3) Call DriveSize calculator

Calculate

## Calculated values

| | |
|---|---|
| Constant speed time | 235 s |
| Acceleration | 0,017 m/s2 |



# User manual

## Application worksheet for DriveSize

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# Table of contents

***Introduction to the manual*** ***5***
What this chapter contains....5
Applicability....5
Purpose of the manual....5
Target audience....5
Terms and abbreviations....6

***Overview of Application worksheet for DriveSize*** ***7***
What this chapter contains....7

***Application worksheets for DriveSize*** ***11***
What this chapter contains....11
Working with Excel sheets....11
First Step is to give input data....12
Second Step....13
Third Step....13
Continue with DriveSize....13
Selecting ambient conditions....14
The main dimensioning window....14
Toolbar....15

***Creating application worksheets*** ***17***
What this chapter contains....17
Basics....17
Making Excel parts....18
The testing part....19
Understanding VB Macros on worksheet....21

1

# Introduction to the manual

## What this chapter contains

This chapter gives basic information on the manual.

## Applicability

This manual applies to Application worksheets for DriveSize which are really Microsoft Excel sheets and DriveSize 3.7 or later.

## Purpose of the manual

This manual instructs you to use Application worksheets and the idea of using those together with DriveSize for selecting ABB AC motors and AC drives. Also hints to create Application worksheets are given.

## Target audience

To use this manual you must have basic knowledge of:

- Terminology of AC drives
- ABB product names
- Load torque, power and speed requirements.
- DriveSize purpose and normal usage
- Knowledge of Microsoft Excel, actual used version is Excel 2010.

# Terms and abbreviations

The table below lists the terms and abbreviations which have a special meaning in the DriveSize software and this manual.

| Term/Abbreviation | Description |
|---|---|
| Base speed | Maximum speed of the driven machinery at nominal load torque. Also maximum speed of constant torque range (and minimum speed of constant power range). |
| Base power | Motor shaft power, typically, nominal load of the machinery on the motor shaft. Also used as the reference value for loads of the duty cycle. |
| Drive | Frequency converter for controlling AC motors |
| DSU | Diode supply unit |
| Generating | The operating mode of the IGBT supply unit when converting power from the drive back to the AC supply. |
| IC | International Cooling |
| IP | International Protection |
| ISU | IGBT supply unit |
| LC | Liquid cooling |
| Line-up | Consists of the supply unit and inverters which have a common DC bus. |
| Motoring | The operating mode of the IGBT supply unit when converting power from the AC supply into the drive DC link. |
| Overload | Defines the maximum required power for short durations. The power is overload in percent x base power. The overload in percent is normally positive, but a negative value means the overload has a different sign than the base power. |
| One-time at start overload | This overload type is allowed once, for instance, at start. Before the next start, it is assumed that the drive has cooled down to the ambient temperature. |
| TempRiseClass | Temperature rise class of the motor. |

2

# Overview of Application worksheet for DriveSize

## What this chapter contains

This chapter provides general information about using Application worksheets with DriveSize.

DriveSize have been used more than since 2003 years. A long ago Pulp&Paper organization made NYSA-tool where list of loads is in Excel, which then call so called PlantSize interface of DriveSize. The motor and drive dimensioning happens with DriveSize computing engine and even the results are returned back to NYSA.

Then starting from 2011 it was possible to import motor loads from Excel into DriveSize projects. This is possible for all Single drives family types and also for MultiDrives. This feature is known with its template name: MotorLoadData.xlsx. The purpose of this functionality is to increase productivity of those engineers who work with massive lists of motors. Other condition is that it is possible to describe the motor load with the simple overload style of DriveSize. This means the complicated overloads and one time overloads will be done through DriveSize graphical user interface.

Application worksheets have an idea that a complicated overloads are moved from Excel to DriveSize per application or machine type. One Excel workbook can contain naturally many sheets but each sheet load data for just one motor and drive.

The applicability of DriveSize is best described as multifunctional and following abbreviations are used to at this content. This is to finally make a list all possible Excel combinations on Table 1.

**Abbreviations**:

| Project Type | |
|---|---|
| **Term** | **Definition** |
| SD | Industrial Single Drive |
| MD | Industrial Multi Drive |
| Standard | ACS550 Single Drive |
| HVAC | ACH550 Single Drive |

| Load Type | |
|---|---|
| **Term** | **Definition** |
| CP | Constant Power |
| CT | Constant Torque |
| CTP | Constant Torque and Power |
| PF | Pump/Fan Load |

| Overload Type | |
|---|---|
| **Term** | **Definition** |
| Single | Simple Cyclic |
| One-Time | One-Time at start |
| Multiform | Multiform Cyclic |

Basically all possible Excel combinations are listed here. The ones having “Yes” is really implemented.

Table 1. All possible and available Excel combinations.

| Project | Load | Overload Type | Available |
|---|---|---|---|
| SD | CP | Single | |
| SD | CP | One-Time | |
| SD | CP | Multiform | **Yes** |
| SD | CT | Single | **Yes** |
| SD | CT | One-Time | **Yes** |
| SD | CT | Multiform | **Yes** |
| SD | CTP | Single | |
| SD | CTP | One-Time | |
| SD | CTP | Multiform | **Yes** |
| SD | PF | Single | |
| SD | PF | One-Time | |

| | | | |
|---|---|---|---|
| SD | PF | Multiform | **Yes** |
| | | | |
| MD | CP | Single | |
| MD | CP | One-Time | |
| MD | CP | Multiform | |
| MD | CT | Single | |
| MD | CT | One-Time | |
| MD | CT | Multiform | **Yes** |
| MD | CTP | Single | |
| MD | CTP | One-Time | |
| MD | CTP | Multiform | |
| MD | PF | Single | |
| MD | PF | One-Time | |
| MD | PF | Multiform | |
| | | | |
| Standard | CP | Single | |
| Standard | CP | One-Time | |
| Standard | CP | Multiform | |
| Standard | CT | Single | |
| Standard | CT | One-Time | |
| Standard | CT | Multiform | **Yes** |
| Standard | CTP | Single | |
| Standard | CTP | One-Time | |
| Standard | CTP | Multiform | |
| Standard | PF | Single | |
| Standard | PF | One-Time | |
| Standard | PF | Multiform | |
| | | | |
| HVAC | PF | Single | |
| HVAC | PF | One-Time | |
| HVAC | PF | Multiform | **Yes** |

3

# Application worksheets for DriveSize

## What this chapter contains

This chapter describes how to make dimensioning by DriveSize but starting with application worksheets, which transform the application data into the format required by DriveSize.

## Working with Excel sheets

You start by opening the application worksheet with Microsoft Excel.

Then you fill in data fields which are normally indicated special color (green).

The power of Excel is used to convert, arrange and compute speed range and base power for DriveSize. By hitting Compute button you call a macro which will open DriveSize with proper product series and overload type.

From now on the Crane application is used as an example (See *Figure 1: Layout of two application worksheets*

A properly made application Excel will guide user by having numbered steps like 1,2 and 3.

In this case first thing is entering hoist data. A properly made Excel sheet contains some default values when fetched from ABB. Also Excel files can be used as good templates.

In this case the Excel is providing good explanation of data and data units.

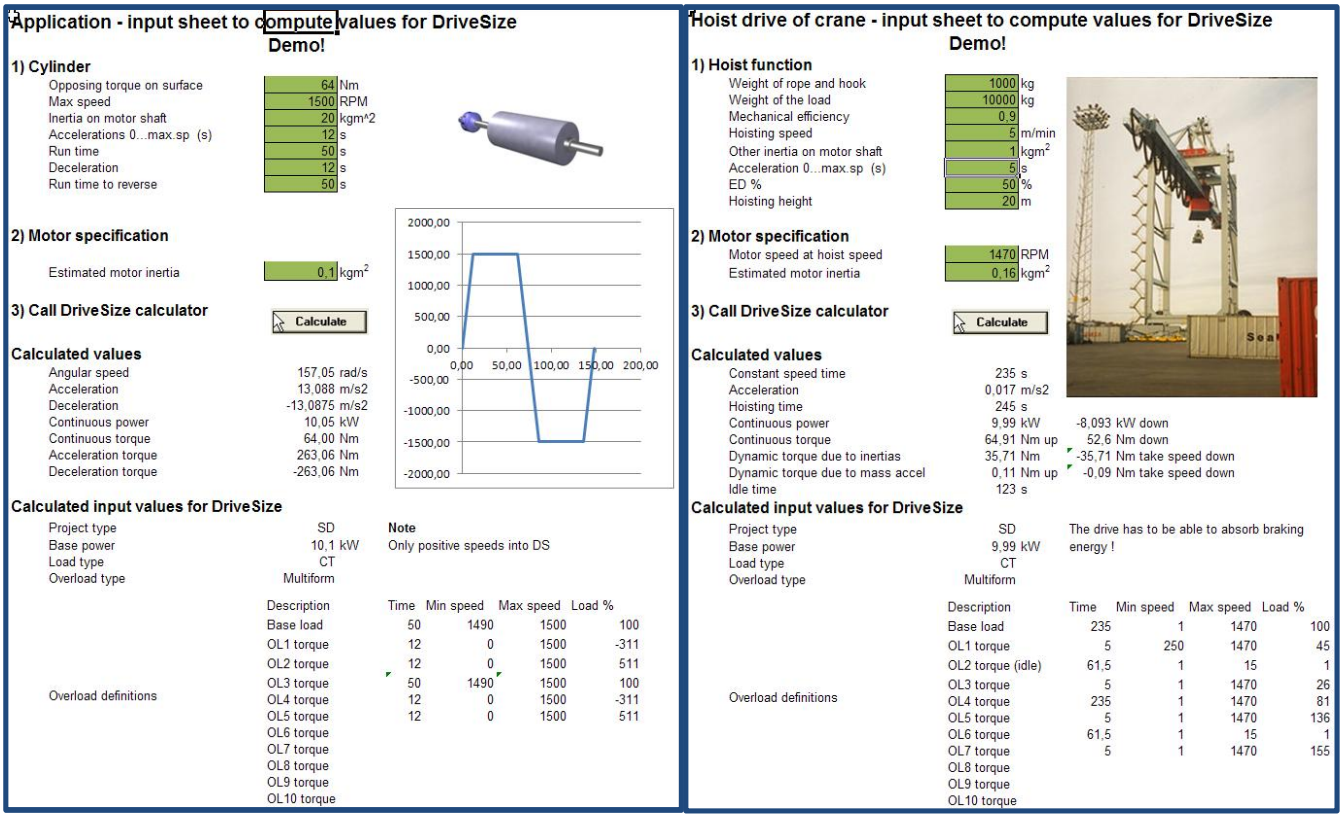
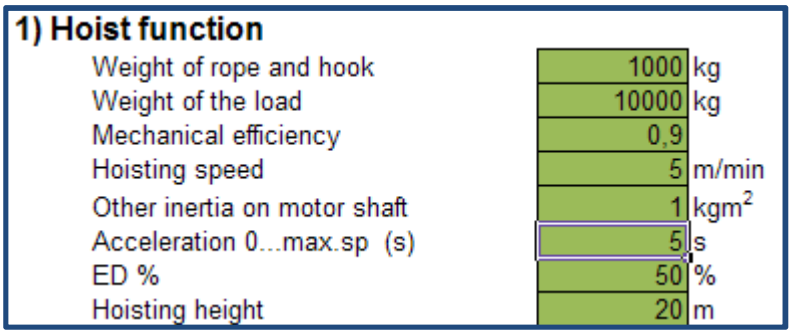



*Figure 1: Layout of two application worksheets*

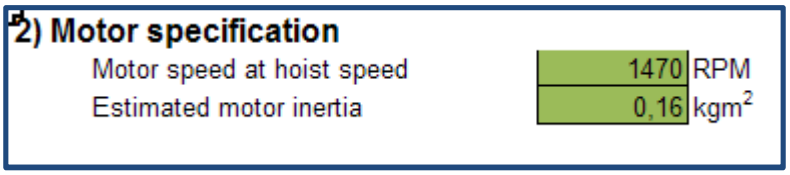
## First Step is to give input data

Here example hoist data

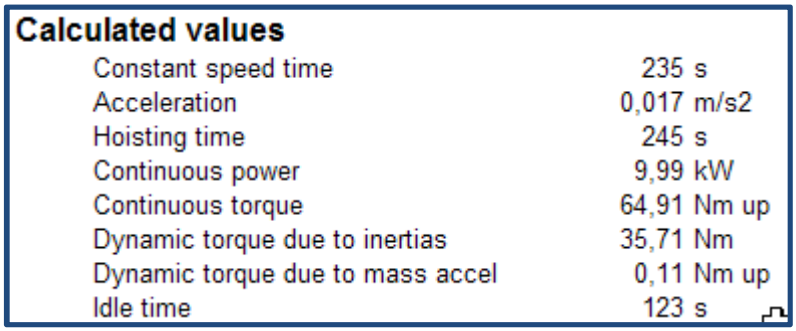


## Second Step

In this case some desired motor data is given to compute gearing from hoist to motor shaft. In this case it also determines directly the base speed of load. The creator of Excel have made this choice. The estimated motor inertia is a strange data. At the end it is known only when motor is selected. So the estimated motor inertia has to be bigger than real one.




At this point you may want to monitor the calculated values of Excel. You are able to effect these by inputs but not change them directly. Then there is some fixed settings like project type, load type and overload type. These are fixed by by creator of Crane Excel.




## Third Step

Hit the Calculate button. This will call DriveSize and fill in DriveSize UI with application data.

# Continue with DriveSize

Next step is to change focus to opened DriveSize and review all its settings. There is no need to close Excel.

DriveSize has opened as everything has been selected already. But remember it is only with DriveSize defaults. Naturally you will consider even the Supply voltage, Drive product series (type) and Motor type. At this point it is also very important to notice what kind of braking is required: resistor type or network braking. Application worksheet for Crane is good example of this.

Set the ambient conditions if they deviate from normal (See *Figure 2: Ambient conditions*).

Reenter the network data (voltage and frequency) if they are deviate from your previous setting by highlighting the transformer. (See *Figure 3: The main dimensioning window* and *Figure 4: Network data)*.

In **System configuration**, highlight the drive and reselect the product series type and other settings (air/liquid). Then highlight the motor and enter motor specification part carefully. After changes Let DriveSize select the motor and drive again. If you wish to change the motor manually, use the User selection functions.

## Selecting ambient conditions

*Figure 2: Ambient conditions* shows the **Ambient** conditions window. Type new data to the ~~appropriate text box to change~~ the ambient conditions. The practical range for altitude is between 1000 m and 4000 m.

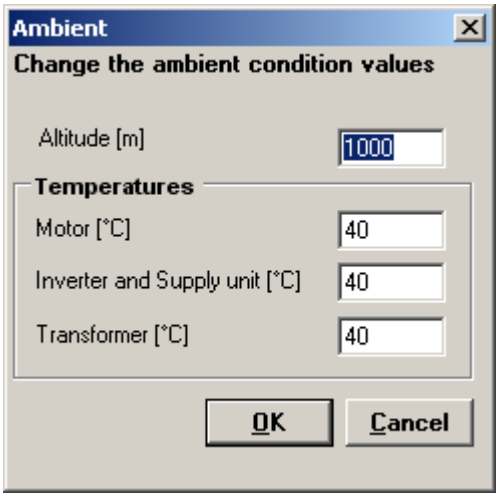



*Figure 2: Ambient conditions*

# The main dimensioning window

After opening or creating a project the main window opens. *Figure 3: The main dimensioning window* shows its main parts.

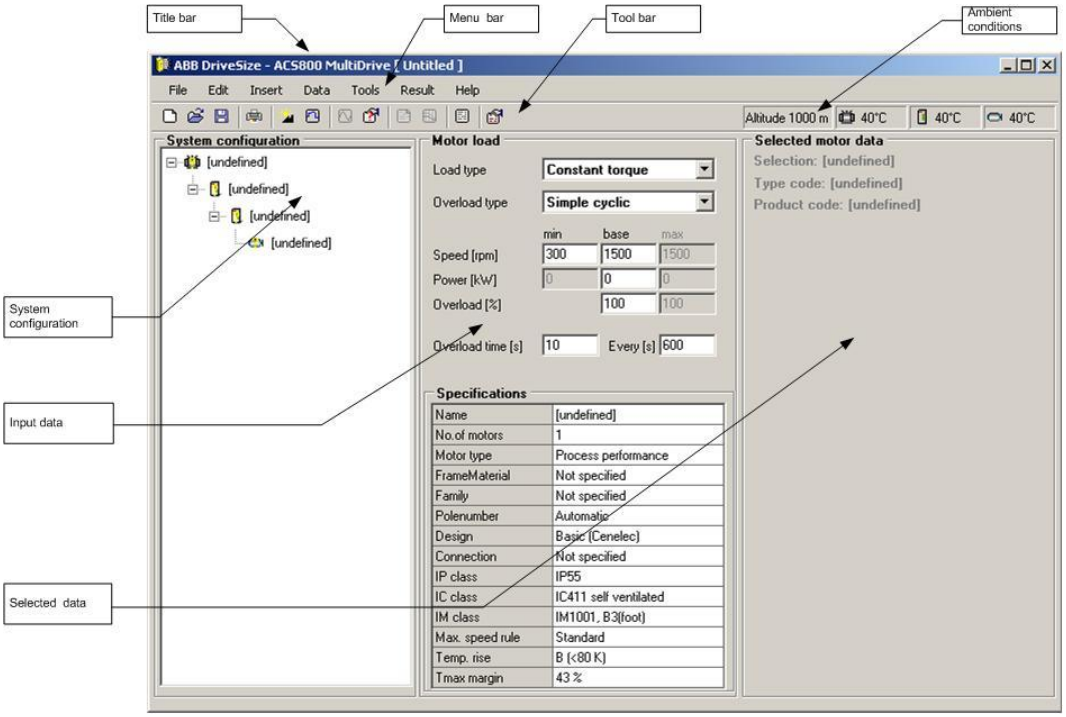



*Figure 3: The main dimensioning window*

The main window contains a title bar, a menu bar, a toolbar, the **System configuration** field, the input data field and a field which displays the data that you selected. Each field has a specific usage and functions.

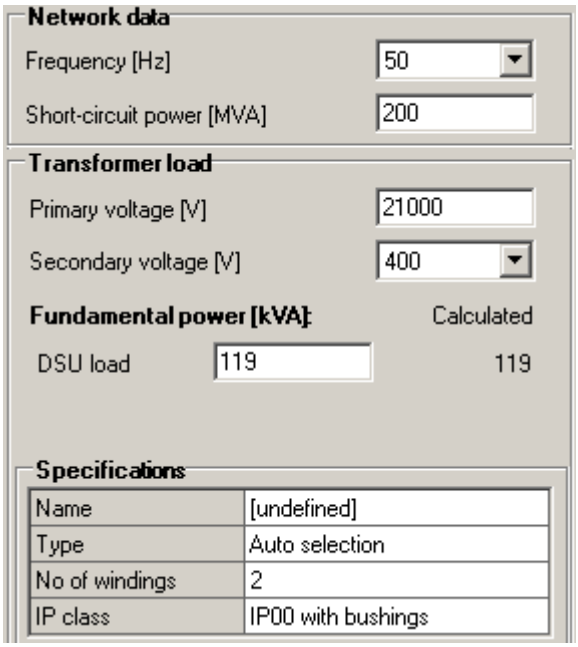



*Figure 4: Network data*

## Toolbar

The toolbar provides quick access to common commands in DriveSize. Toolbar buttons perform a function just like a menu selection. To perform the function of a certain button, click the button on the toolbar.

Table 1: Toolbar icons

| Icon | Action | Menu equivalent |
|---|---|---|
| | Opens a new project. | **New**... command under the **File** menu. |
| | Opens a project. | **Open**... command under the **File** menu. |
| | Saves the project. | **Save**... command under the **File** menu. |
| | Shows the **Print** dialog. | **Print**... command under the **File** menu. |
| | Shows the **Ambient Conditions** view. | **Ambient Conditions**… command under the **Data** menu. |
| | Shows the **Overload Definitions** view. | **Overload Definitions**… command under the **Data** menu. |
| | Shows the **Network Check** view. | **Network Check**... command under the **Tools** menu. |
| | Dimensions the selected item. | **Make Dimensioning**… command under the **Tools** menu. |
| | Shows the dimensioning **Results** view. | **Dimensioning Result**... command under the **Result** menu. |

| | | |
|---|---|---|
| | Shows the **Graph** view. | **Graphs...** command under the **Result** menu. |
| | Shows the **Selected Unit** view. | **List of Selected**... command under the **Result** menu. |
| | Shows the **User Selection** view. | **User Selection**… command under the **Tools** menu. |

The **Motor load**, **Inverter load**, **Line supply unit load**, **Network data** and **Transformer load** view appears in the input data field depending on which drive component you select in the **System configuration** field.

More instructions how to use DriveSize is written into DriveSize User manual. A copy of it should be on your PC at DriveSize directory.

4

# Creating application worksheets

## What this chapter contains

This chapter instructs how to make new application worksheet valid for DriveSize.

## Basics

Application under development can include many electric motor drives and each motor drive need its own Excel sheet but they can be within same Excel workbook and then you may use Excel nice features that some application data flows from one sheet to other. This help to make data consistent and avoid retyping errors.

One critical issue is to think about and decide which of the basic Application specific basic templates is best for the targeted application. Refer the Table 1 on chapter 2. In many cases the dimensioning is done based on part of the full cycle or according to some exceptional load condition for example according to emergency stop.

To compute the base power from inputs is essential. Remember that this is just base for all overloads. Normally also the motor has to be able to provide this power even continuously but this is not the rule.

Equally important might be the minimum and maximum speeds related to base power. There are two problems with these. DriveSize will accept only positive speeds and if motor drive systems is really a 4Q, four quadrant drive then intelligence has to be used to convert the system to equivalent 2Q system. The other point is that motor drive will normally start from zero speed but minimum speed should be such speed which is really needed by application for long times. The “long time” here refers to thermal time constants of motor and drive.

# Making Excel parts

In the Crane Excel the **Calculated values** part is to give feedback to user but technically it is unnecessary. Anyway we encourage this part to convert the user input to basic SI units and also to promote step by step (modular) computing.

The **Calculated input values for DriveSize** should remain as it is in templates. This is to say that no new columns should be added or removed to column range A-J. Also the application specific computing should fit into area row above 28.

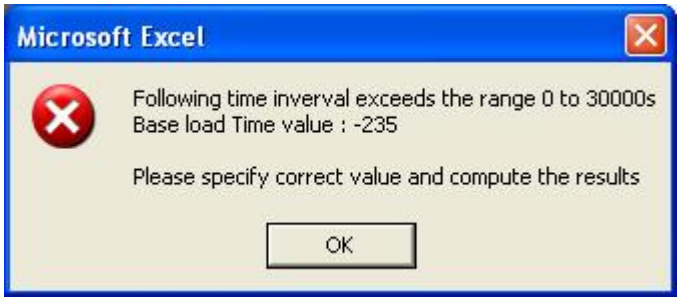
This has been programmed into subroutine :Sub cmdCalculate_Click() this way

```
    DriveSize_RegKey = DS_STARTER_REGKEY


  Dim tInPut As tdef_InPut
  ' DriveSize input values start from row number 29th onwards
  tInPut.iRow_Base = 28


  If IsDriveSizeInstalled() = True Then
     Read_InputValues tInPut
     If ValidateInputs(tInPut) = True Then
        Execute tInPut
     End If
  End If
```

The Excel and DriveSize interface will work nicely provided the application Excel is properly made and tested.

But during development you may get many kinds of error messages. Some of them are trapped by error handling and some of them come from system. show typical trapped error messages.

*Figure 5: Error messages, one system message.*



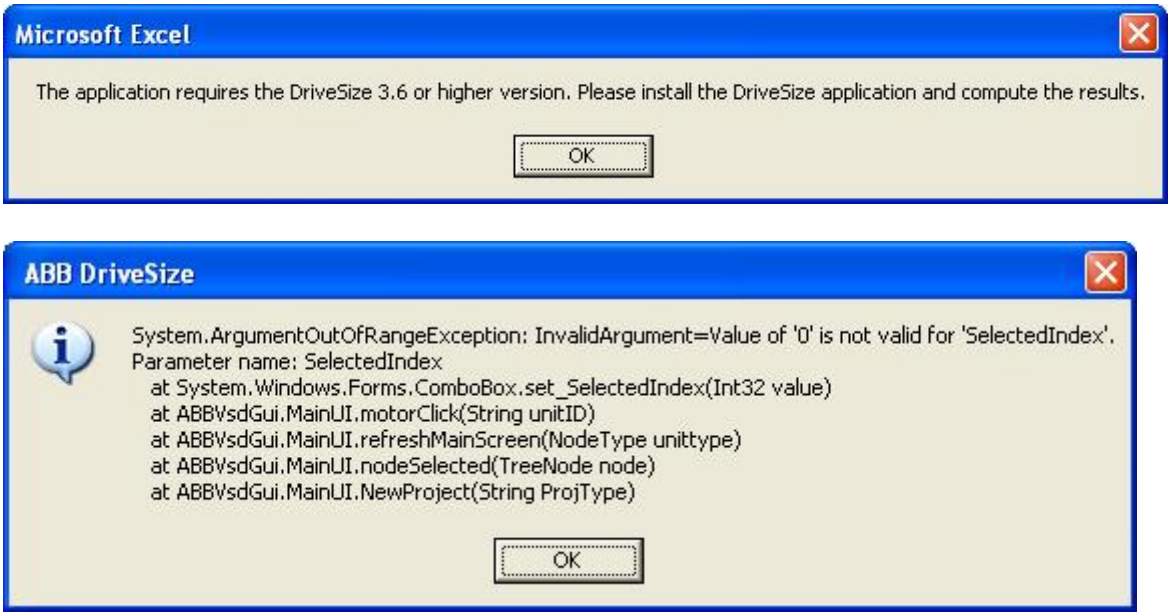


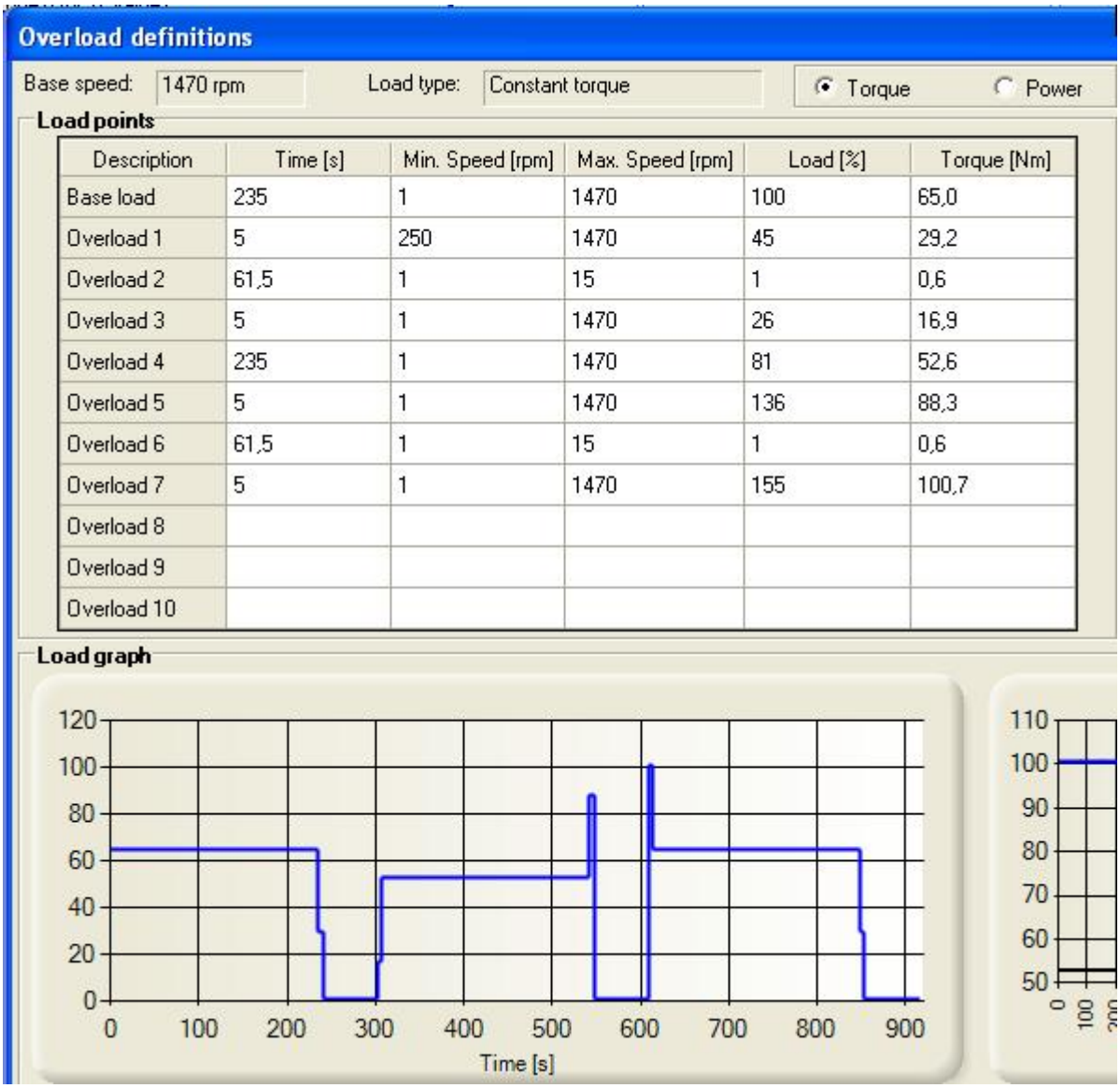

*Figure 5: Error messages, one system message.*

## The testing part

The minimum testing requirement is that intended data for DriveSize really is transferred into proper places at DriveSize. With Crane Excel it would mean that data from this:

| | | | | | | |
|---|---|---|---|---|---|---|
| Project type | SD | The drive has to be able to absorb braking energy ! | | | | |
| Base power | 9,99 kW | | | | | |
| Load type | CT | | | | | |
| Overload type | Multiform | | | | | |
| | Description | Time | Min speed | Max speed | Load % | |
| | Base load | 235 | 1 | 1470 | 100 | |
| | OL1 torque | 5 | 250 | 1470 | 45 | |
| | OL2 torque (idle) | 61,5 | 1 | 15 | 1 | |
| | OL3 torque | 5 | 1 | 1470 | 26 | |
| Overload definitions | OL4 torque | 235 | 1 | 1470 | 81 | |
| | OL5 torque | 5 | 1 | 1470 | 136 | |
| | OL6 torque | 61,5 | 1 | 15 | 1 | |
| | OL7 torque | 5 | 1 | 1470 | 155 | |
| | OL8 torque | | | | | |
| | OL9 torque | | | | | |
| | OL10 torque | | | | | |

is transferred without errors into Multiform load points in SingleDrive project type and with load type constant torque. The graphics is helpful to detect logical errors. See *Figure 6: Comparing DriveSize inputs.*




| Description | Time [s] | Min. Speed [rpm] | Max. Speed [rpm] | Load [%] | Torque [Nm] |
|---|---|---|---|---|---|
| Base load | 235 | 1 | 1470 | 100 | 65,0 |
| Overload 1 | 5 | 250 | 1470 | 45 | 29,2 |
| Overload 2 | 61,5 | 1 | 15 | 1 | 0,6 |
| Overload 3 | 5 | 1 | 1470 | 26 | 16,9 |
| Overload 4 | 235 | 1 | 1470 | 81 | 52,6 |
| Overload 5 | 5 | 1 | 1470 | 136 | 88,3 |
| Overload 6 | 61,5 | 1 | 15 | 1 | 0,6 |
| Overload 7 | 5 | 1 | 1470 | 155 | 100,7 |
| Overload 8 | | | | | |
| Overload 9 | | | | | |
| Overload 10 | | | | | |

*Figure 6: Comparing DriveSize inputs.*

# Understanding VB Macros on worksheet

The application specific worksheets contains following macro and subroutines.

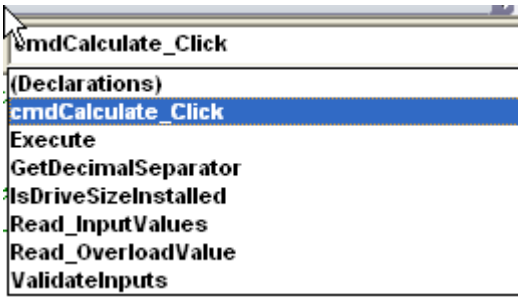



*Figure 7: List of DriveSize macros to implement data transfer*..

**cmdCalculate_Click** is to start execution.

**IsDriveSizeInstalled** as the name indicates is to find out if proper DriveSize has been installed into PC.

**GetDecimalSeparator** is to get decimal separator information of user PC

**Read_InputValues** is to read input values for DriveSize into a VB table.
A subroutine of this is **Read_OverloadValue.**

**ValidateInputs** will check the inputs after reading data into table.

**Execute** will call DriveSize with input string.