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1. SIKOSTART solid-state motor controllers and SIRIUS 3R soft starters

Solid-state motor controllers protect drives in every way without the restrictions that normally apply as a result of limiting the motor torque and the starting current. They protect the power supply against dangerous peaks by reducing the current input. Load transfers and abrupt changes in the torque characteristic of the kind commonly encountered with star-delta starters, for instance, are avoided. Once the drive has been run up to rated speed, the motors are operated with the line voltage.

1.1. Basic physical principles

Three-phase asynchronous motors are increasingly gaining a foothold in industry, commerce and the manual trades on account of their rugged, yet simple, design and their ability to run practically without maintenance. Their starting characteristics, however, their unfavorable torque characteristic and their high starting current often prevent motors of this type from being connected to the line directly.

1.1.1. Starting current

Three-phase asynchronous motors have a very high inrush current $I_{starting}$. Depending on the motor type, this current can be 3 to 15 times as high as the rated operational current I_e. A value of around 7 to 8 times the motor rated current is probably typical.

Fehler! Keine gültige Verknüpfung.

Fig. 1 Typical current characteristic of a 3-phase asynchronous motor

Note:
This starting current needs to be adequately taken into account when the supply system is designed, for example by adapting the supply cable (to reduce the generation of heat) and the fuse protection (accidental tripping of fuses).

1.1.2. Starting torque

The characteristic points on the torque-speed curve are the starting torque $M_{starting}$, the pull-up torque $M_{pull-up}$, the stalling torque $M_{stalling}$ and the rated torque M_{rated}. In order for a motor to be able to start at all, the motor torque M_{motor} must remain higher than the load torque M_{load} throughout the complete acceleration phase, as otherwise a stable operating point will be reached before the rated speed (in other words, the motor will 'cog').

A very high impulse torque $M_{starting}$ occurs if the motor is switched on directly. This jerk places a load not only on the driven motor but also on the power transmission elements (for instance V-belts, gears etc.) and on the load machine.

Fehler! Keine gültige Verknüpfung.

Fig. 2 Typical torque characteristic of a three-phase asynchronous motor with a square-law load torque

1.2. Alternatives for motor starting

Three-phase asynchronous motors can be started in numerous different ways:

- by means of a direct on-line starter,
- by means of a star-delta starter,
- by means of a soft starter,
- and by means of a frequency converter

The starting characteristics can only be influenced if a soft starter or a frequency converter is used!

A soft starter reduces the motor voltage by means of generalized phase control and then increases it from a settable starting voltage to the line voltage within a defined time.

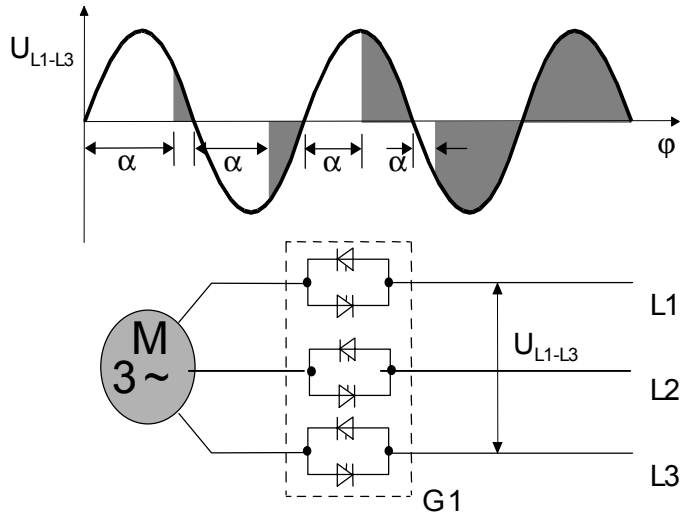


Fig. 3 **Principle of generalized phase control of the line voltage by means of semiconductor elements for soft starters**

Since the motor current is approximately proportional to the motor voltage, the starting current is reduced by a factor equivalent to the set starting voltage.

A soft starter also reduces the motor torque. This explains why there is no longer a starting jerk with soft-started motors. The relationship is as follows: the motor torque is proportional to the square of the motor voltage.

Fehler! Keine gültige Verknüpfung.

Fig. 4 Typical current and torque characteristics when a soft starter is used

Is the starting voltage for instance equal to 50% of the rated voltage U_e, you will have following connections for starting current and starting torque:

- Starting current approx. 50% of motor starting current $I_{starting}$ with direct online starting.
- Starting torque approx. 25% starting torque $M_{starting}$ with direct online starting.

Example:

Motor = 55 kW, rated current = 100 A, starting current = 7 x rated current,
motor torque = 355 Nm, starting torque = 2,4 x rated torque.

Soft starter settings: starting voltage approx. 50% motor rated voltage.
This results in the following reduction:

- The starting current is reduced to approximately half compared with direct on-line starting:
  50% of (7 x 100 A) = 350 A
- The starting torque is reduced to approximately 0.5 x 0.5 = one quarter compared with direct on-line starting:
  25% of (2,4 x 355 Nm) = 213 Nm

Note:

The starting voltage must hence not be set too low, owing to the square-law relationship between it and the torque. In order for a motor to be able to reach its rated speed at all, the motor torque must be higher than the torque required by the load at all times during the acceleration phase, as otherwise a stable operating point will be reached before the motor rated speed (in other words, the motor will 'cog').
The difference between the motor torque and the load torque is the accelerating torque, which is responsible for increasing the speed of the drive. The lower the accelerating torque, the longer the motor will take to run up to rated speed.

Fehler! Keine gültige Verknüpfung.

Fig. 5 Load / motor torques and typical motor terminal voltage when the motor is started with a soft starter

1.3. Siemens soft starters

1.3.1. Overview

Siemens soft starters are available for a wide range of applications.
The table below provides an overview of the soft starter family manufactured by Siemens and of their basic functions:

Soft starter family	**Motor**	Max. **ratings** P_e	Max. **rated operational voltage** U_e	Max. **ramp time** t_r	**Basic function**
3RW22 [1])	Three-phase	1200 kW (at 690 V AC)	1000 V AC	1000 s	Soft starting Soft stopping
3RW34	Three-phase	1200 kW [2]) (at 500 V AC)	600 V AC	60 s	Soft starting Soft stopping
3RW30	Three-phase	70 kW (at 500 V AC)	575 V AC	20 s	Soft starting Soft stopping
	Single-phase	11 kW (at 230 V AC)	240 V AC	20 s	Soft starting Soft stopping
3RW31 [3])	Three-phase	15 kW (at 500 V AC)	575 V AC	20 s	Soft starting 1 Soft starting 2

[1]) Additional functions look at following section
[2]) with inside delta curcuit
[3]) for motor controlling with two different rotational speeds

1.3.2. Additional 3RW22 functions

- Breakaway torque
- Current and voltage limiting
- Acceleration detection
- Various stopping modes
- DC braking
- Pump functionalities (e.g. pump stopping)
- Memory for three different parameter records
- Energy saving mode
- Operation with bypass contactor
- Temperature monitoring
- Solid-state overload protection
- Option of operation with a PC via an RS232 port

- Suitable for worldwide use thanks to a very wide voltage range from 200 V to 1000 V
- Frequency range from 45 Hz to 66 Hz
- UL and CAS approvals

For more detailed information, please refer to the "SIKOSTART 3RW22 Application Manual"
(Order No. E20001-P285-A484-V4).

1.3.3. Curcuit types

On principle there are two different curcuit types: inline curcuit and inside delta curcuit.

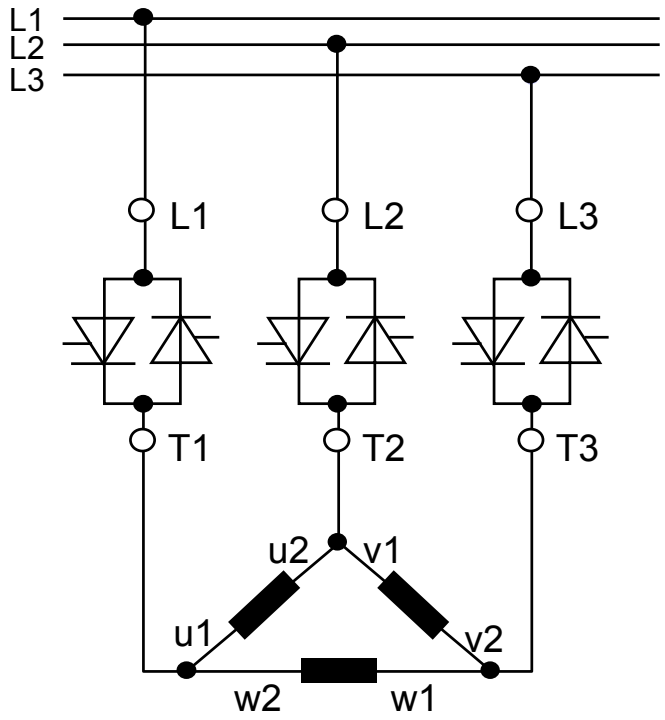


Fig. 6 Inline circuit (all soft starters: 3RW22, 3RW30, 3RW31, 3RW34)

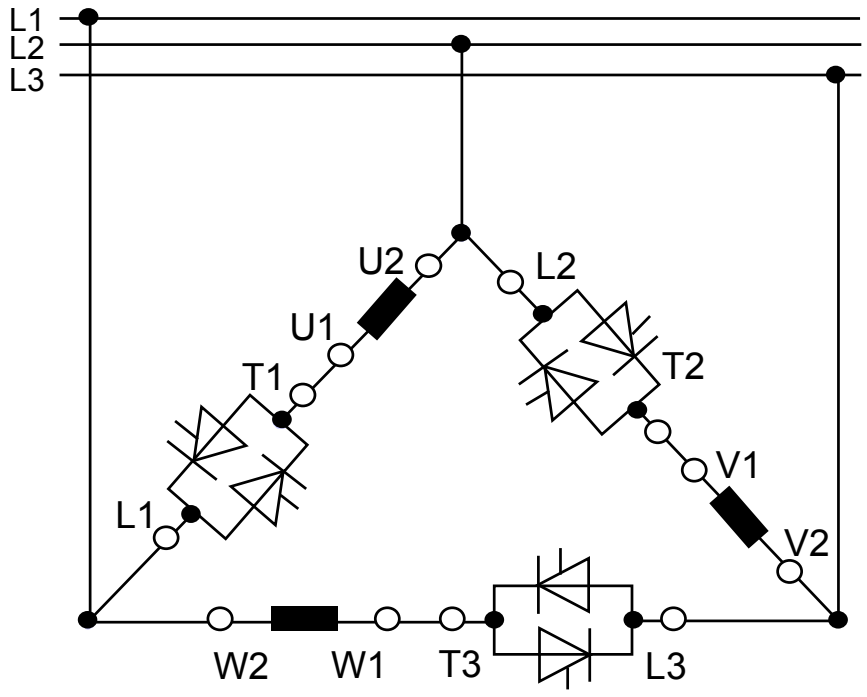


Fig. 7 Inside delta curcuit (optional setting with 3RW34)

1.3.4. Operating modes

Each operating mode describes the transition between operating phases with and without a current load. This is important when semiconductor elements are used, to prevent overloading. There are two alternative options to define the operating mode:

1. **Number of switching (per time period) and ON time (in %)**
   Number of switching = 1 / (operating time + rest time)
   ON time = operating time / (operating time + rest time)

2. **Operating time (conducting time) and rest time (dead time)**
   Operating time = ON time [in %] / Number of switching
   Rest time = (1 – ON time [in %]) / Number of switching

1.3.5. Typical applications

The possible applications include:

Conveyor belts, transport systems:
- Jerk-free starting
- Jerk-free braking
- Use of a cheaper belt material

Centrifugal pumps, reciprocating pumps:
- Avoidance of pressure surges
- Extension of the service life of the piping system

Agitators, mixers:
- Reduction in the starting current

Fans:
- Protection of the gears and V-belts

1.4 Selection and simulation of soft starters with Win-SIKOSTART

A detailed description of the application is necessary in order to be able to select the soft starter correctly.

Win-SIKOSTART allows all the essential application data relating to the line, motor and load to be selected and entered. The requirements that must be satisfied by the soft starter, such as current limiting and pump stopping, can then be specified.

On the basis of this specified application data, Win-SIKOSTART selects the most suitable starter families and simulates the starting and stopping phases with the preset default parameters. Starting with the Win-SIKOSTART version 1.1 it is possible to manually change the default parameters data on the mask before the first simulation.

The soft starters which achieve the best starting characteristics with the parameter settings are subsequently offered for the user to select. Only the rated control supply voltage is not yet known.

Finally, the starting and stopping phases can be further optimized by fine-tuning the parameter settings for the selected soft starter until the required characteristics are obtained.

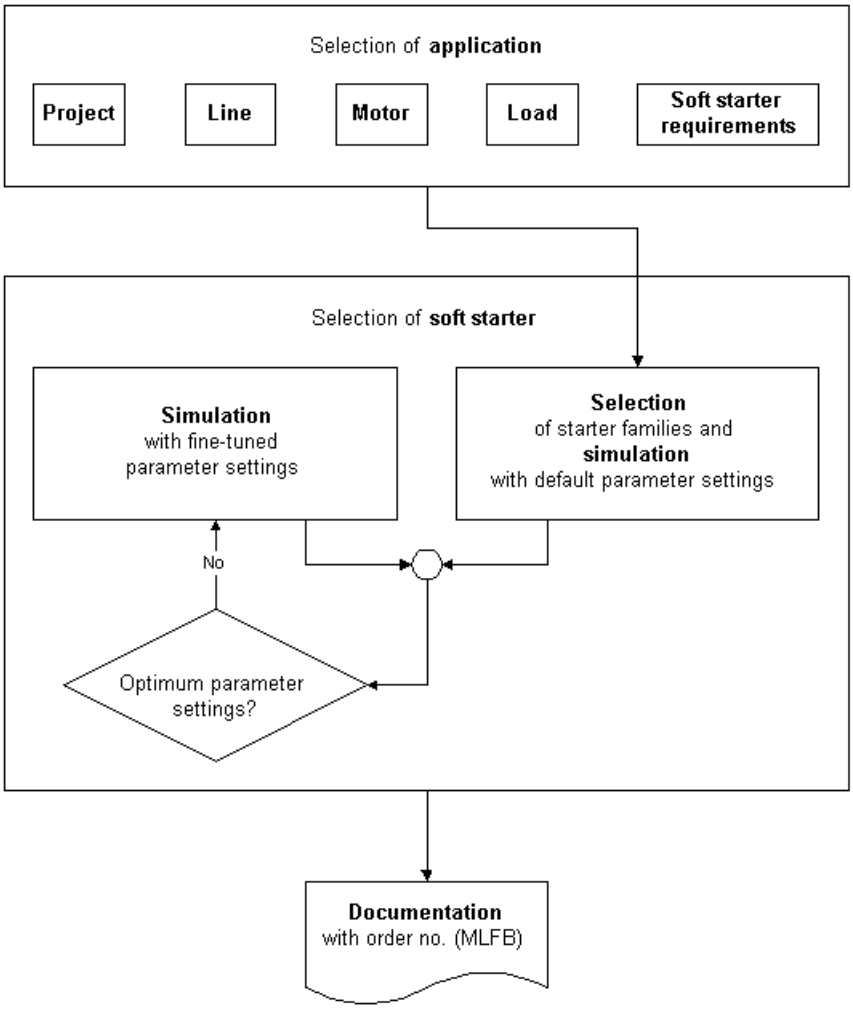


Fig. 8 Program structur Win-SIKOSTART

2. Operating instructions of Win-SIKOSTART

One of the main operational areas of electronic switching is the line and load sparing starting of squirrel cage induction motors. For this application Siemens offers the ultimate solution with soft starters.

For selecting their own soft starters Siemens develops a selection and simulation program as well as for simulation of difficult starting and stopping performances. With Win-SIKOSTART the selection of the most suitable soft starter - out of one of the three soft starter families - is not only to achieve with a minimum amount of steps, but with the integrated Windows user interface it is reachable with many comfort.

2.1. Summary of the steps necessary

To select the optimum soft starter for your motor, we recommend that you follow the procedure described below:

Project

Start by creating a project. The purpose of a project is to allow you to export all the data you have entered, for instance if you want Siemens AG to resimulate a starter. Please refer to *Selecting a project* for details of how to create a project.

Line

The next step is to specify your line data. There are three different ways of doing so:

The first alternative is to click on the *Line* entry in the directory tree in the left part of the program screen. This tree is based on the familiar Windows Explorer principle.

The second way is to select the appropriate command in the *Go to* menu.

The third, and probably the most convenient, method is to navigate through the program using the *Previous* and *Back* buttons, in other words to work your way through the recommended procedure step by step.

This approach is easy to apply to all other points.

Motor

After you have specified the voltage and frequency of the line, you can either select an existing motor or enter new motor data. Please refer to *Selecting the motor data* for details of how to do so and the meanings of the possible inputs.

Load

The next step is to select the load. Please refer to Selecting the load data for further details of what to do here.

You can monitor the progress of your inputs at any time in the directory tree. Each step is ticked off there as soon as it is complete.

Note: All the steps must be ticked off before you can run a simulation.

Requirements

Finally, you must specify certain requirements that need to be satisfied by the soft starters which are calculated by the program. ". Please refer to *Selecting the soft starter requirements* for details of how to do so.

At the bottom of each window you can see a small *traffic light*. Please pay attention to the color of this *traffic light* whenever you change any of the requirements. Red means that the values you have attempted to set for the soft starter are too high. In this case you must either reduce the values for some of the data or unselect a few options. Green means that you are allowed to specify more restrictions. Amber means that you have already specified enough restrictions.

Parameter Default (starting with version 1.1)

Here default parameters can be changed. Further explanations concerning this you find under *Select your default parameters*

Simulation

You now have all the data you need to run a simulation and are ready to start. The simulation may take a few minutes, so please be patient. The results can take several different forms. They are described in detail in the section called *Running a simulation*.

Optimize the operating parameters

When the simulation has finished, you are given a chance to fine-tune the soft starter operating parameters individually in an optimization phase and subsequently resimulate the starters.

Documentation

Please refer to the final section called *Printing a report* for details of how to print out your specifications and results. You will be shown a preview of the report first before it is printed out.

2.2. Brief description

This CD-ROM offers you a program for selecting and simulating Siemens soft starters.

The software integrates the following features:

- Soft starter database with all current Siemens soft starter types
- Catalog quick selection based on line voltage and motor rating (starting with version V1.1)
- Replacement of a star-delta starter by a soft starter (starting with version V1.1)
- Motor database containing a wide range of motor types currently available from Siemens
- Conversion of units of measurement from SI to American units system and vice versa (starting with version V1.1)
- Support for the calculation of a load if the direct starting time, the star-delta running-up time or the type of load are known (starting with version V1.1)
- Automatic calculation of the most suitable soft starter on the basis of the specified

parameters by the user
- Output of a documentation containing the completed simulation and the proposed soft starter in pdf. format
- User-friendly Windows interface
- Interface to the interactive CA 01 catalogue
- Automatic update via internet
- Option of entering and maintaining your own data (motors, loads)

This CD provides you with a valuable tool that is designed to make complex and time-consuming manual calculations for selecting the suitable soft starters superfluous.

2.3. System requirements

- IBM-compatible PC, Pentium processor or similar
- Operating system: Windows 98/ME/NT/2000/XP
- Main memory 64 MB RAM or more
- Screen 1024x768 pixels, 65536 colors or higher
- CD-ROM drive
- MS-compatible mouse

2.4. Starting the program

To start the software, insert the CD-ROM in your CD-ROM drive. If the program does not start automatically, please select the start.exe file in the CD-ROM's main folder.

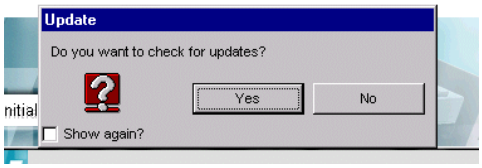
The first time you start the program, you will be prompted to confirm your acceptance of the terms of the license agreement. You are only allowed to use the software if you consent to the conditions of this agreement. You will then be requested to specify the folder in which you want to save the program and all user-defined data.

Is already an older version of Win-SIKOSTART installed on your computer, it is possible to overwrite it in the shown directory by pressing the *Existing version* button. The projects of the old version can be used direct in the new installation.
If you press *New installation* you can install Win-SIKOSTART in a new directory.

If there are more then one Win-SIKOSTART installed, you will be asked at every program start which version you will start. To deactivate this feature, tick of the button in the menu *Tools/Settings/Versions*.

Each time you start the program you will be asked whether you want to browse the internet for new updates. Your computer must be online in order to do so, of course. All the other steps are completely automatic. Your local version numbers are compared first of all with those on the net and the latest files downloaded if necessary. All the data you have already entered remains stored.

Information about the new program components is displayed on your screen while the update files are downloading. You are thus kept absolutely up to date about all new features. When the update has finished, Win-SIKOSTART is started automatically.



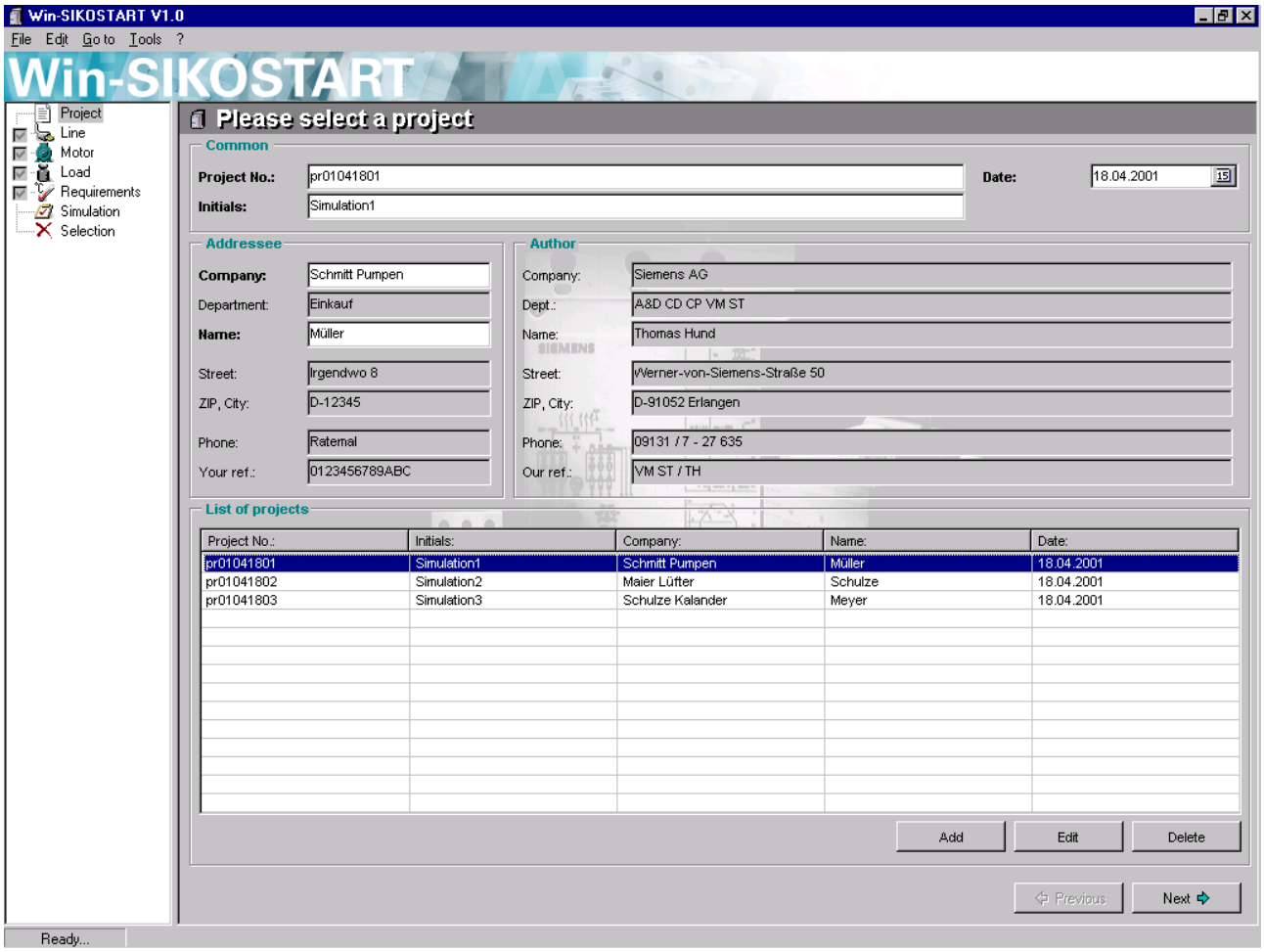
The dialog box which asks you whether you want to browse for updates also contains an option that prevents this box from being displayed again in future. This will be done by a click on the bottom of left corner.

Click *Yes* to browse automatically each time you start the program or *No* to skip this step. You can also reset this option again in Win-SIKOSTART if you want to see the dialog box every time. Therefore you can use the menu *Extras.*

2.5. Selecting a project

General

You can enter general information about your project in this module. In particular, you can specify who created the project and who it is to be sent to. This information is also saved in the database and printed out together with the report (see below).



To search for a project

All the boxes in bold type are search boxes. Please enter suitable criteria in these boxes. The purpose of search criteria is to act as a filter for the list that appears in the bottom part of the mask. You can use the *Tab* key to jump from one box to the next or press *Enter* to apply the filter. The list box will then only show those projects that match the specified criteria.

To select a project

You can select a project either by clicking on one of the entries in the list or by pressing *Enter*. This project then appears in the display boxes. If you overwrite the entry in a search box, the previous selection is canceled.

To enter a new project

Click the *New* button to change to input mode and enable all the boxes. *Apply* causes the project to be copied to the database, while *Cancel* can be pressed to discard your inputs again.

To change a project

You can also change to input mode by clicking the *Edit* button. The data for the currently selected project is then displayed and you can click *Apply* to incorporate your changes in the database. *Cancel* can be pressed to discard your inputs again.

To delete a project

Click the *Delete* button to delete the currently selected project.

To save a project

At the beginning of each simulation a selected project will be saved. Thereby all selected data will be saved and they will be at your disposal for a further simulation.

To import and export a project

Saved projects could be read from the selected data medium by using *File Import a project*. *File Export a project* saves your project on the selected data medium.

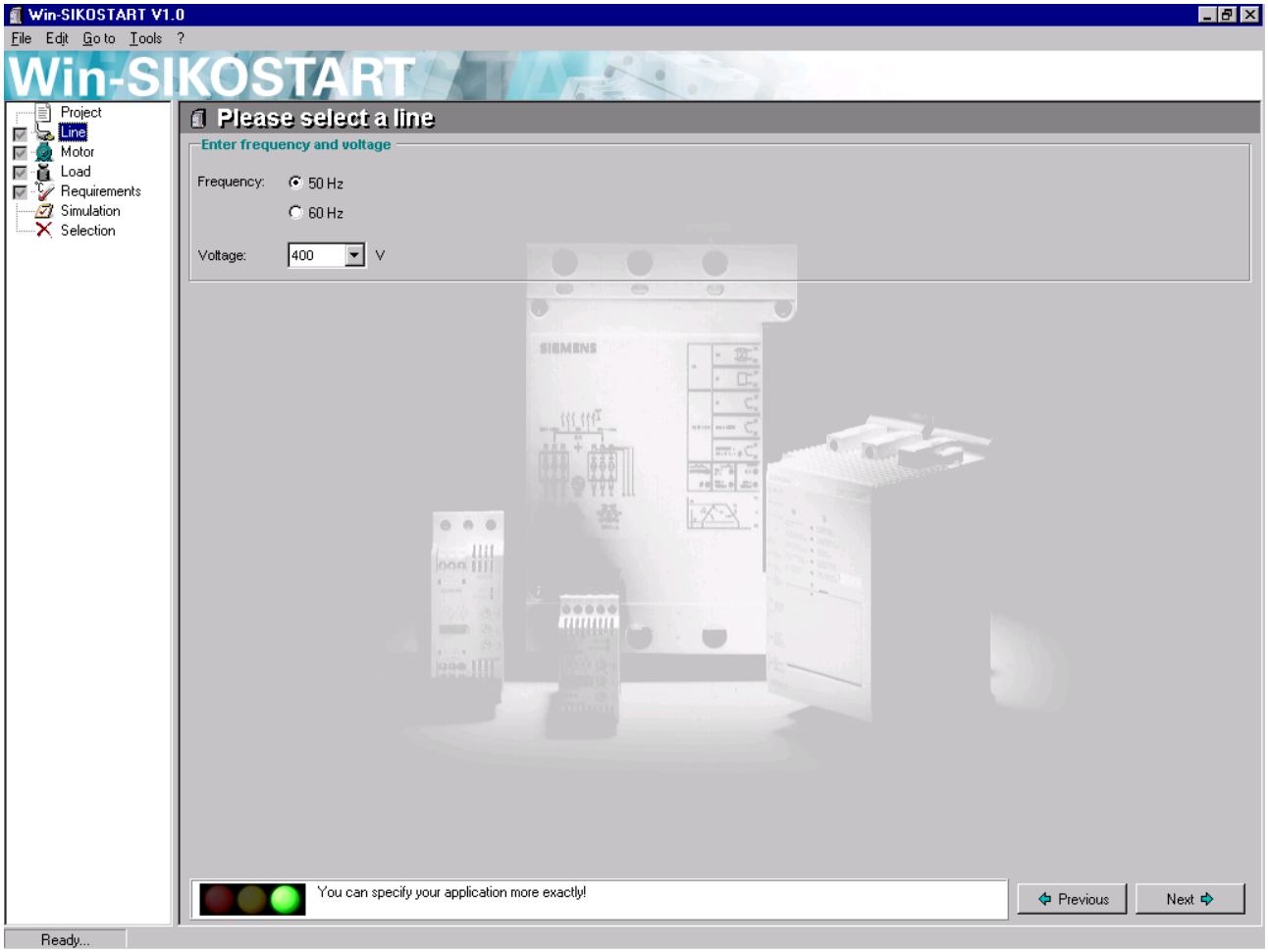
Buttons

- *New*: Adds a new entry
- *Edit*: Edits the selected entry
- *Delete*: Deletes the selected entry
- *Apply*: Saves the data in your working directory
- *Cancel*: Cancels your inputs again
- *Previous*: Opens the *Line* mask

2.6. Selecting the line data

General

You can specify your line data in this mask, in other words you can enter the required line frequency and select the line voltage from a list.



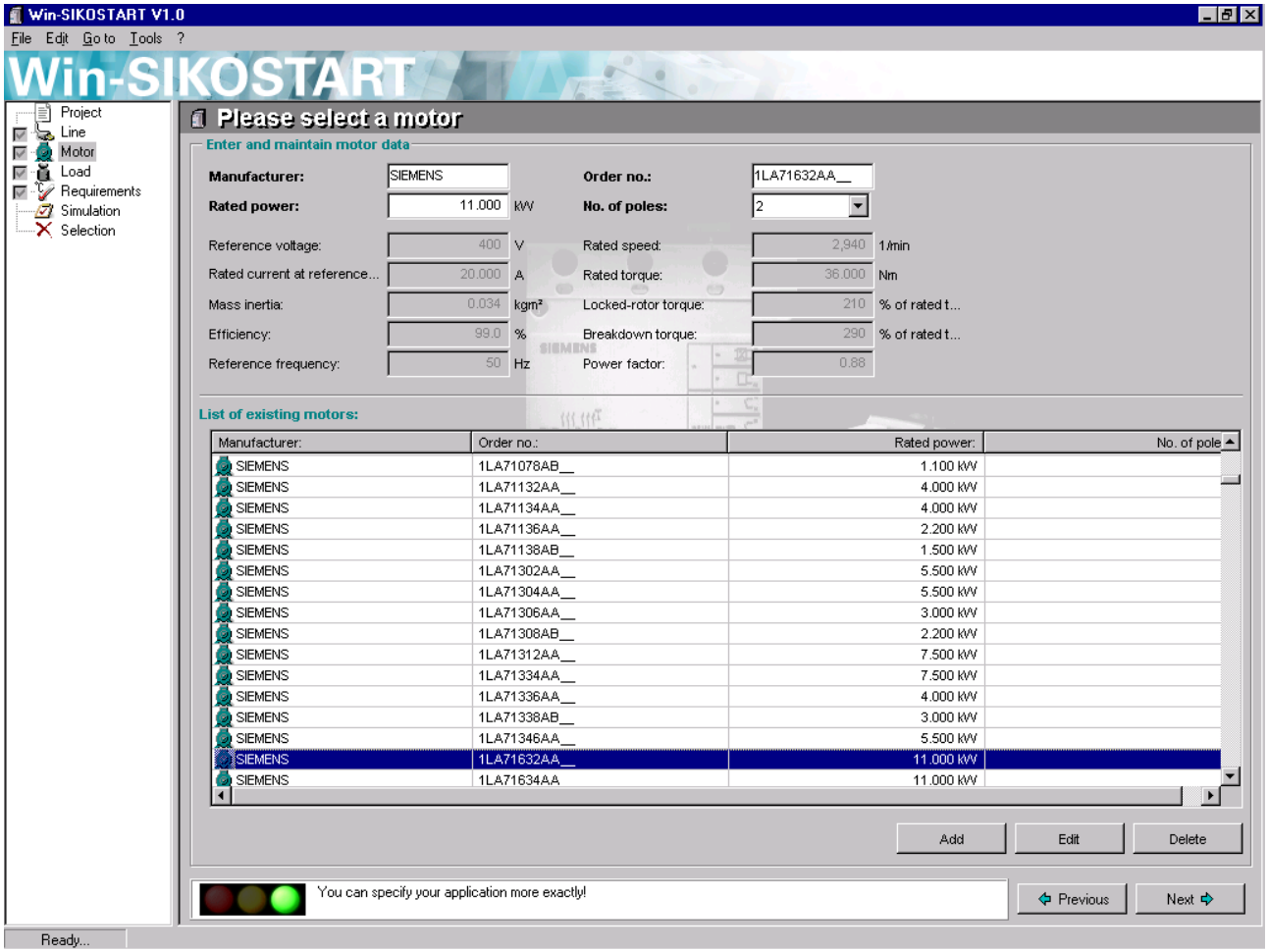
Buttons

- *Back*: Returns you to the *Project* mask
- *Previous*: Opens the *Motor* mask

2.7. Selecting the motor data

General

You can specify the motor for which you want to rate the soft starter in this mask. You can either select one of the predefined motors for this purpose or enter a motor of your own.



To search for a motor

All the boxes in bold type are search boxes. Please enter suitable criteria in these boxes. The purpose of search criteria is to act as a filter for the list that appears in the bottom part of the mask. You can use the *Tab* key to jump from one box to the next or press *Enter* to apply the filter. The list box will then only show those motors that match the specified criteria.

To select a motor

You can select a motor either by clicking on one of the entries in the list or by pressing *Enter*. This motor then appears in the display boxes. If you overwrite the entry in a search box, the previous selection is canceled.

To enter a new motor

Click the *New* button to change to input mode and enable all the boxes. *Apply* causes the motor to be copied to the database, while *Cancel* can be pressed to discard your inputs again.

To change a motor

You can also change to input mode by clicking the *Edit* button. The data for the currently selected motor is then displayed and you can click *Apply* to incorporate your changes in the database. *Cancel* can be pressed to discard your inputs again. Only motor data, which have been generated in this project, can be changed.

To delete a motor

Click the *Delete* button to delete the currently selected project. Only motor data, which have been generated in this project, can be deleted.

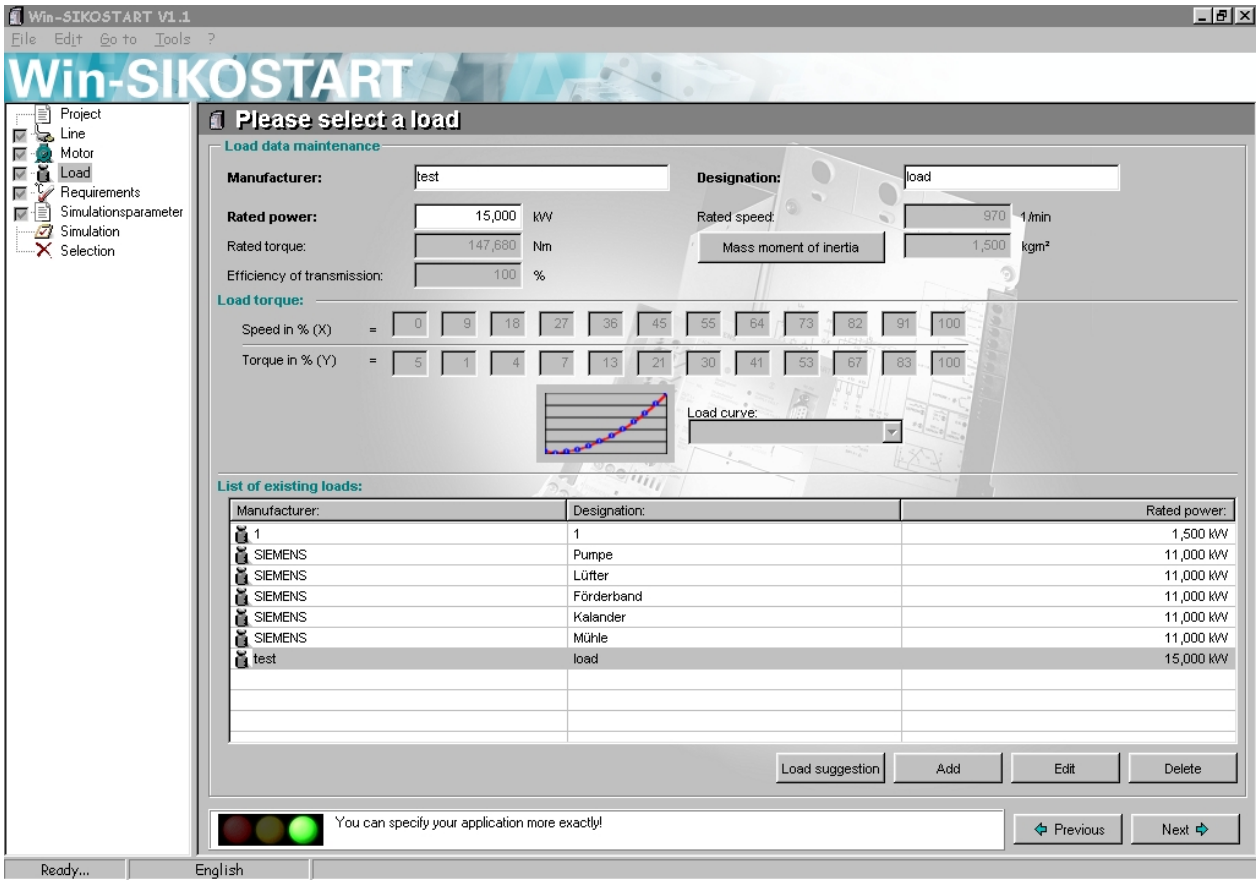
Buttons

- *New*: Adds a new entry
- *Edit*: Edits the selected entry
- *Delete*: Deletes the selected entry
- *Apply*: Saves the data in your working directory
- *Cancle*: Cancles your inputs again
- *Back*: Returns you to the *Line* mask
- *Previous*: Opens the *Load* mask

2.8. Selecting the load data

General

You can specify the load for which you want to rate the soft starter in this mask. You can either select one of the predefined loads for this purpose or have Win SIKOSTART propose a load based on the selected motor or enter a load of your own. This module also integrates a graphic editor that allows you to define the load as a characteristic curve by dragging it with the mouse. You can open this editor by double-clicking on the graph in input mode.



To search for a load

All the boxes in bold type are search boxes. Please enter suitable criteria in these boxes. The purpose of search criteria is to act as a filter for the list that appears in the bottom part of the mask. You can use the *Tab* key to jump from one box to the next or press *Enter* to apply the filter. The list box will then only show those loads that match the specified criteria.

To select a load

You can select a load either by clicking on one of the entries in the list or by pressing *Enter*. This load then appears in the display boxes. If you overwrite the entry in a search box, the previous selection is canceled.

To propose a load

Click on the button *Load suggestion* and right away load data applied to the ratings of a

selected motor are generated. These data can be changed and adjusted. The rated values are taken direct from the selected Motor. The Mass Moment of Inertia of the load (J_L) is given as 10 times of Mass Moment of Inertia of the Motor (J_M). Click *Apply* to store the load in a data file, click *Delete* to erase the input data.

To enter a new load

Click the *NEW* button to change to input mode and enable all the boxes. *Apply* causes the load to be copied to the database, while *Cancel* can be pressed to discard your inputs again.

To change a load

You can also change to input mode by clicking the *Edit* button. The data for the currently selected load is then displayed and you can click *Apply* to incorporate your changes in the database. *Cancel* can be pressed to discard your inputs again. Only motor data, which have been generated in this project, can be changed.

To calculate the mass inertia

By clicking the *mass inertia* button you have the option to calculate a **rough** mass inertia based on the known type of load or the star-delta or direct starting time, respectively. You need to set the motor rating, motor speed and the load speed. After the input of the running up time or the type of load and the calculation of a value the calculated, motor-related mass inertia can be transferred to the load mask by clicking the *Apply* button. The speeds and motor ratings used for the calculation must correspond with the actually set values.

To delete a load

Click the *Delete* button to delete the currently selected project. Only motor data, which have been generated in this project, can be deleted.

Buttons

- *New*: Adds a new entry
- *Mass inertia*: If start-delta running up time, direct starting time or type of load is known, a rough mass inertia can be calculated.
- *Load suggestion* : a load based on the motor ratings is generated.
- *Edit*: Edits the selected entry
- *Delete*: Deletes the selected entry
- *Apply*: Saves the data in your working directory
- *Cancel*: Cancels your inputs again
- *Back*: Returns you to the *Motor* mask
- *Previous*: Opens the *Requirements* mask

Support for calculation of a load

Load-specific characteristics:

Depending on the physical characteristics of a load every load has a different starting performance.

- Rated power : The power rating of a load defines the power which should be supplied during rated operation. It should not be higher than the motor power rating, which may cause an impermissible heating of the motor.

- Rated speed : It defines the speed at which the rated power of a load is supplied.

- Efficiency factor: The efficiency factor of a load machine defines the losses originated at the machine, e.g. losses due to bearing friction and gear. Typical values of gears see **table 3**

- Rated-load torque: It defines the value which the load demands from the motor after a successful running up during rated operation.

- Load characteristic: It describes the performance of the counter-torque of the load over the speed range, which the motor must exceed when running up. Typical load characterisitcs see **table 2** .

- Mass inertia: The mass inertia (or rotating mass) of the load is the determinant criterion for the duration of the running up time of the load. A high mass inertia of the load means a longer running-up procedure and consequently a higher starter and feeder loading when the motor is running up. The value of the mass inertia can either be read on the rating plate or in the data sheet or be inquired from the manufacturer. Possible values in relation to a certain application see **table 2**. **Attention**: **The calculated values are only approximate values ! The real values of applications can differ from these approximate values.**

- When replacing an existing direct or star-delta starter the real running-up time measured at the machine can be used for the calculation of the approximate mass inertia. See **table 1**. **Attention**: **The calculated values are only approximate values ! The real values of applications can differ from these approximate values.**

-

Example of a calculation of a load

For the most part the load and motor data are unknown.

The installed star-delta starter of a fan in a mill is replaced by a Siemens soft starter.

Known data :

Motor (read off on motor rating plate)

P_{motor} : 55kW

I_N : 95A

n_{motor}: 1489min^{-1}

Load:

$n_{Last:}$ 990min^{-1} (driven by V-belt)

measured, complete running-up time, star-delta starter : 30s

Procedure:

Input of values on the mask “Select your motor“

On the mask “Select your motor“ a 4pole 55kW Siemens motor 1LA62534AA is selected from the data base. By clicking the button *NEW* and *Copy* the default data can be synchronized with the given details on the rating plate and then be saved under a new name in the database. If values are unavailable data of the 1LA62534AA motor are accepted. The more data of the actually used motor are available the more precise the result of the simulation is !

Input of values on the mask “Select your load“

Rated power of the load is assumed : motor power = load power: 55kW

Rated speed of the load: 990min^{-1}

Rated-load torque (is calculated after input on mask “load“: 531 Nm

Efficiency factor of the load (see table 3) 95%

Mass inertia of the load (see table 1) 104 kgm²

Load characteristic (see table 3) quadratic

The simulation was done with a current limit of 3,5 times of the rated current of the Motor. The selected Softstarter by Win-SIKOSTART is a 3RW22350DB15.

Table 1

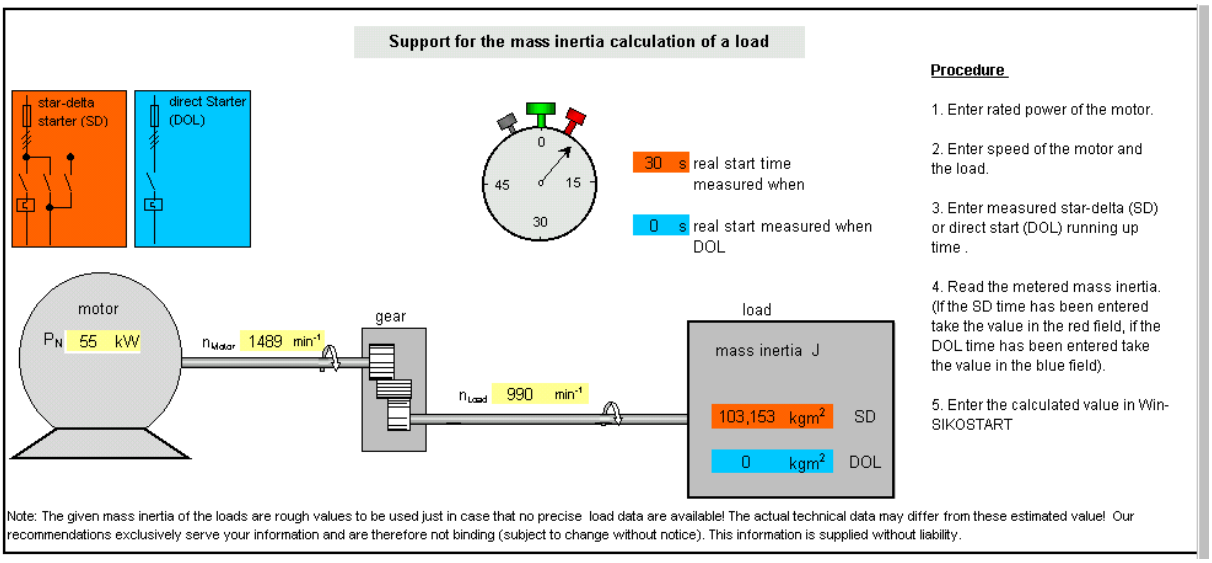


Table 2

Applikation	Factor for multiplying Mass-moment of inerta of the motor, to get the Massmoment of the applikation	
pump	5	quadratic
hydraulic pump	5	quadratic
small fan	10	quadratic
big ventilator	100	quadratic
grinder	50	inverse- proportional
crusher	100	inverse- proportional
compressor	10	constant
lathe	10	quadratic
milling machine	100	quadratic
conveyor belt	5	constant
escalator	10	constant
extruder	10	constant
circular saw	10	quadratic
band saw	30	quadratic
roller-type conveyor	5	constant
chain conveyor	5	constant
press	5	quadratic
tube extruder	10	quadratic
drilling machine	10	quadratic
calander	20	linear

Table 3

Gear type	Gear ratio n_M/n_L	Gear efficiency factor %
Spur-gear unit	Up to 8 (single-step) 6 to 45 (two-step) 30 to 250 (three-step)	96-99 91-97 85-85
Worm gear	Up to 8 (single-step)	50-70 (one gear) 70-80 (two gear)
Belt gear	Up to 8	94-97
Chain gear	Up to 6	97-98
Friction wheel gear	Up to 6	95-98

2.9. Specifying special soft starter requirements

General

You can specify special requirements that must be satisfied by the soft starter in this mask. These requirements are subdivided into four groups:

- Ambient conditions
- Installation conditions
- Special functions
- Operating mode

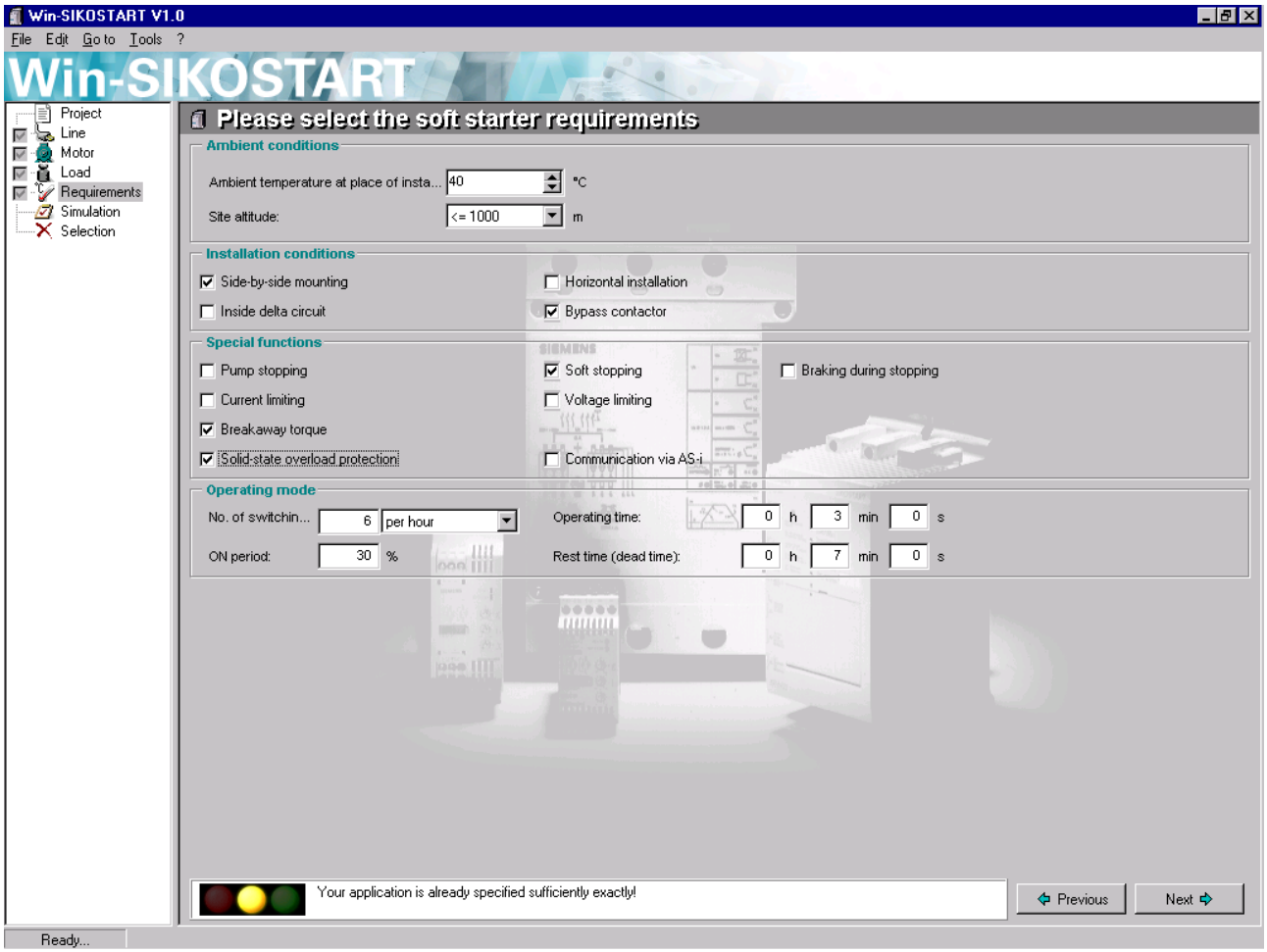
Please note that certain fields are mutually exclusive, in other words if you select one option, all the others are automatically unselected.

As mentioned above, the progress of your inputs at any given time is indicated by a traffic light.

This traffic light can have the following colors:

- Red: You must reduce your requirements. Using the set requirements no soft starter can be found!
- Amber: Max. one more certain soft starter type can be simulated unless you reduce your requirements!
- Green: You can still define more requirements concerning the soft starter

You must now fine-tune your data according to the color of the traffic light, in order to be able to start the simulation.



Ambient conditions

The ambient temperature of the soft starter at the place of installation will be defined here (for instance in a switchgear cubicle). If you selected in Menu Tools-Settings-Maesurement System the Funktion SI (Standard International) is the default setting 40°C. If you selected ASMS (American Standard Measurement System) is 122°F (50°C) pre setted.
An indication of the site altitude above mean sea level is possible too.

Installations conditions

For determined soft starter families it is important to specify if the soft starter is mounted side-by-side or in a horizontal way.

Moreover it has to be defined, if the soft starter runs in inside delta circuit (6 cables to the motor) or if a bypass contactor will be used for saving energy loss. Final result of selecting inside delta circuit or bypass contactor is to get a better dimensioning of the soft starter.

Special functions

You can choose between three different kinds of stopping: pump stopping, soft stopping or braking during stopping.

Either the voltage (for a specified time frame) or the current can be limited during the start. The current limiting can be used for instance for loads with a high mass inertia.

You can define a breakaway impuls for loads with a high starting torque. The high of the voltage can be specified as well as the time frame of the breakaway impuls.

Moreover solid-state overload protection and communication via AS-interface could be defined as a requirement to the soft starter.

Operating mode

You define the operating mode either by specifying number of switching operations and ON time or by specifying operating time and rest time.

Each variable is defined as follows and need to be activated by a click:

- Number of switching (per time period) and ON time (in %)
  number of switching = 1 / (operating time + rest time)
  Range of values: 1 ... 1800 1/h resp. 1 ... 43200 1/d
  Default value: 6 1/h
  ON time = operating time / (operating time + rest time)
  Range of values: 1 ... 100 %
  Default value: 30 %
- Operating time (conducting time) and rest time (dead time)
  operating time = ON time [in %] / number of switching
  Range of values: at least 1 s
  Default value: 3 min (reckons out)
  rest time = (1 – ON time [in %]) / number of switching
  Range of values: at least 1 s
  Default value: 7 min (reckons out)

Buttons

- *Back*: Returns you to the *Load* mask
- *Previous*: Opens the *Simulation* mask

- *Continue:* next menu item “Parameter Default“

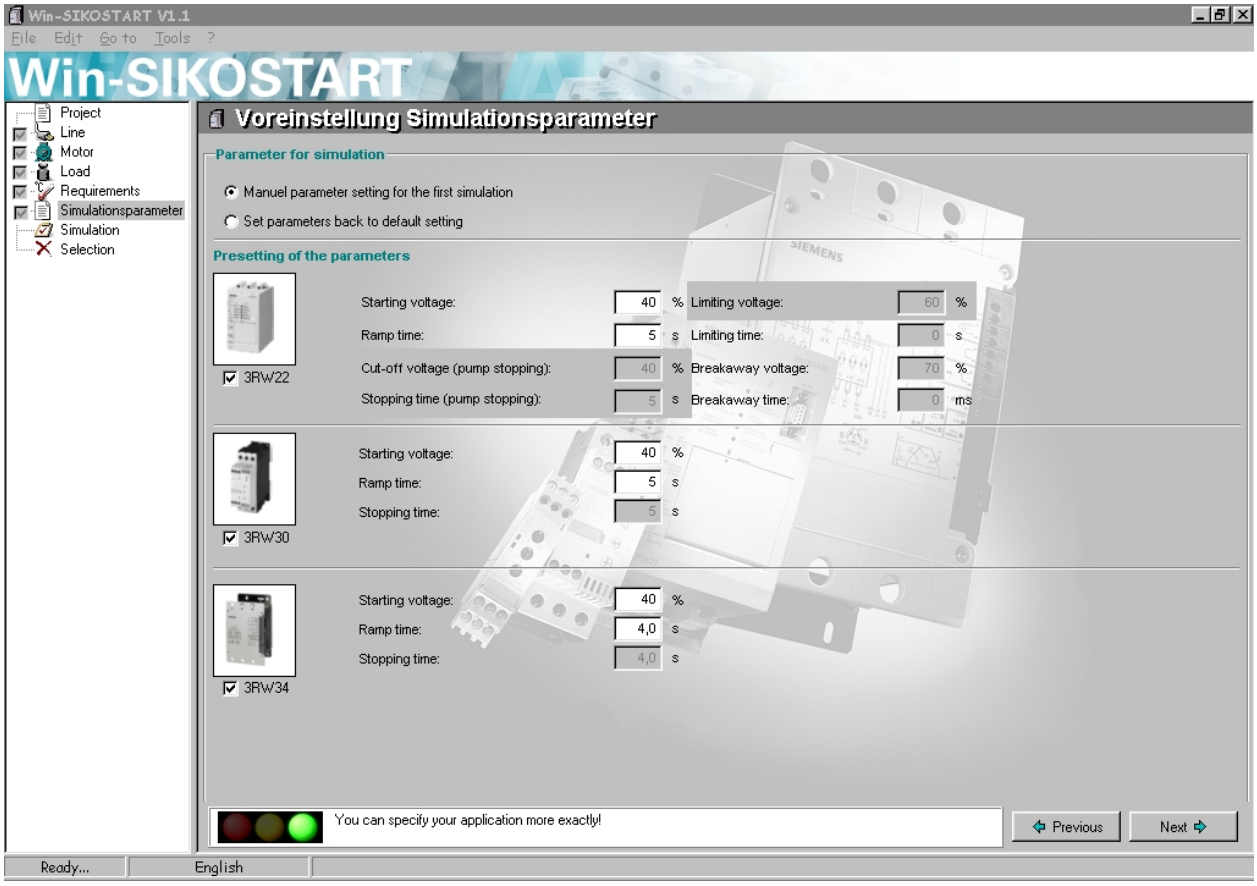
2.10 Default Simulation Parameter

General

On this mask you can manually alter the default simulation parameter in the program or narrow down the choice if you do not want to simulate all types of soft starters.

Default Parameter

Preselection of Soft Starters for simulation



Default Parameter

The functions adjusted on the mask *requirements* are now released and can manually be altered before the first simulation.

You can choose if these settings shall be maintained for the duration of the whole session or if the next simulation shall start with the programmed default parameter again.

The parameters can also be reset to the manufacturer’s settings

Preselection of Soft Starters for Simulation

The manufacturer's default comprises all soft starters for simulation unless certain soft starters are excluded based on the selected requirements.(also see chapter 2.9 *Select your soft starter requirements*)

Buttons

- *Back*: Returns you to the *requirements* mask
- *Continue*: Opens the *Simulation* mask

2.11 Running a simulation

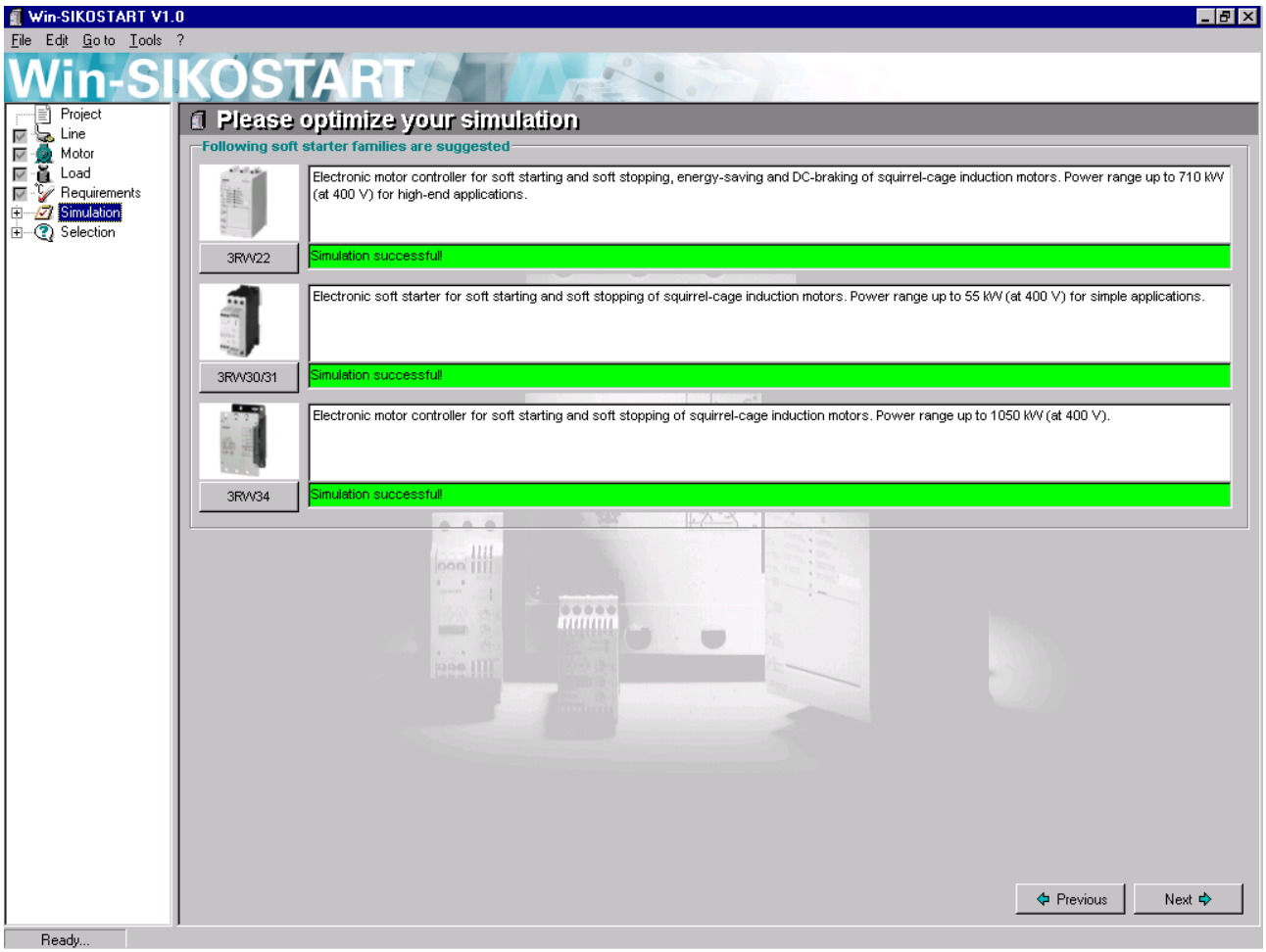
General

When you have entered the required data and parameters correctly and in full, all the steps in the tree will be ticked off and you can start the simulation. This may take a few minutes. A progress bar indicates how near the calculation is to completion.

When the simulation has finished, the results are displayed on the screen. You will be offered suitable soft starters from up to three different families. It is of course also possible that no soft starters which match the specified data will be found.

If the program succeeds in finding suitable soft starters, it will also provide additional information about the results of the simulation. You can display details of the results either in the tree or by clicking on the buttons in this mask.

You can optimize the soft starter settings in the detailed view. Please refer to the descriptions of the individual masks for further information about these settings.



Buttons

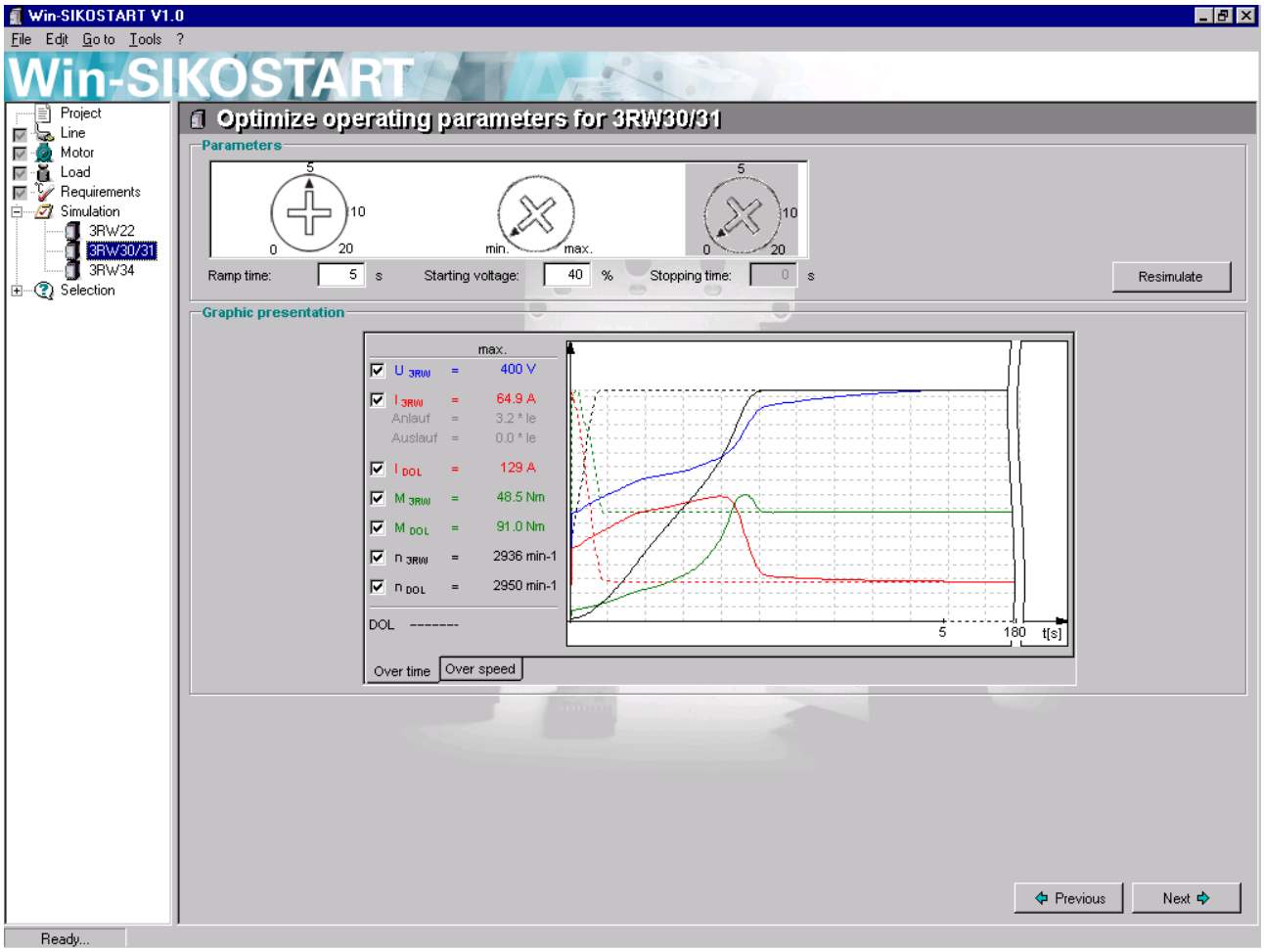
- *Back*: Returns you to the *Default Simulation Parameter* mask
- *Previous*: Opens the next mask

2.12 Optimizing the operating parameters for 3RW30/31

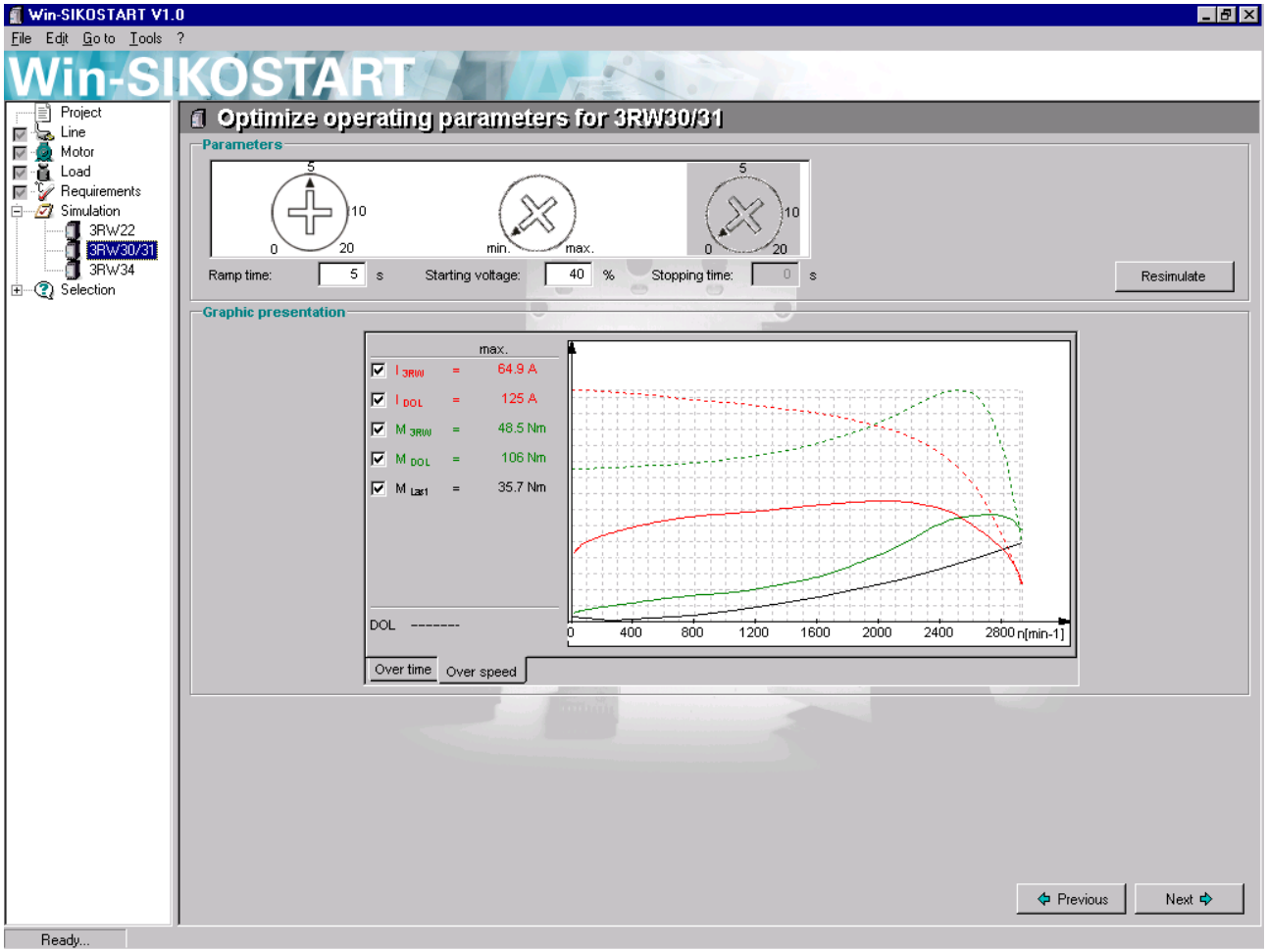
General

This mask contains the default values that were used by the program for the original simulation. You can change these values here if you wish and then run a new simulation to see if you can improve your results.

Underneath the default values is a graph showing the torque, the rotational speed, the current and the voltage characteristics. This graph is plotted as a function of time. Depending on your selection there will be indicated different graphs.



You can also switch to an alternative graph which displays the characteristics as a function of rotational speed. This graph indicates the torque and the current characteristics with and without a soft starter (DOL), as well as the torque characteristic for the load.



You can optimize the values for each of the suggested soft starter families in this mask.

After you have filled in all the boxes, you can get the program to run a new simulation.

Operating parameters

Ramp time:

- Range of values: 0 ... 20 s
- Default value: 5 s

Starting voltage:

- Range of values: 40 ... 100 %
- Default value: 40 %

Stopping time:

- Range of values: 0 ... 20 s
- Default value: 5 s

Buttons

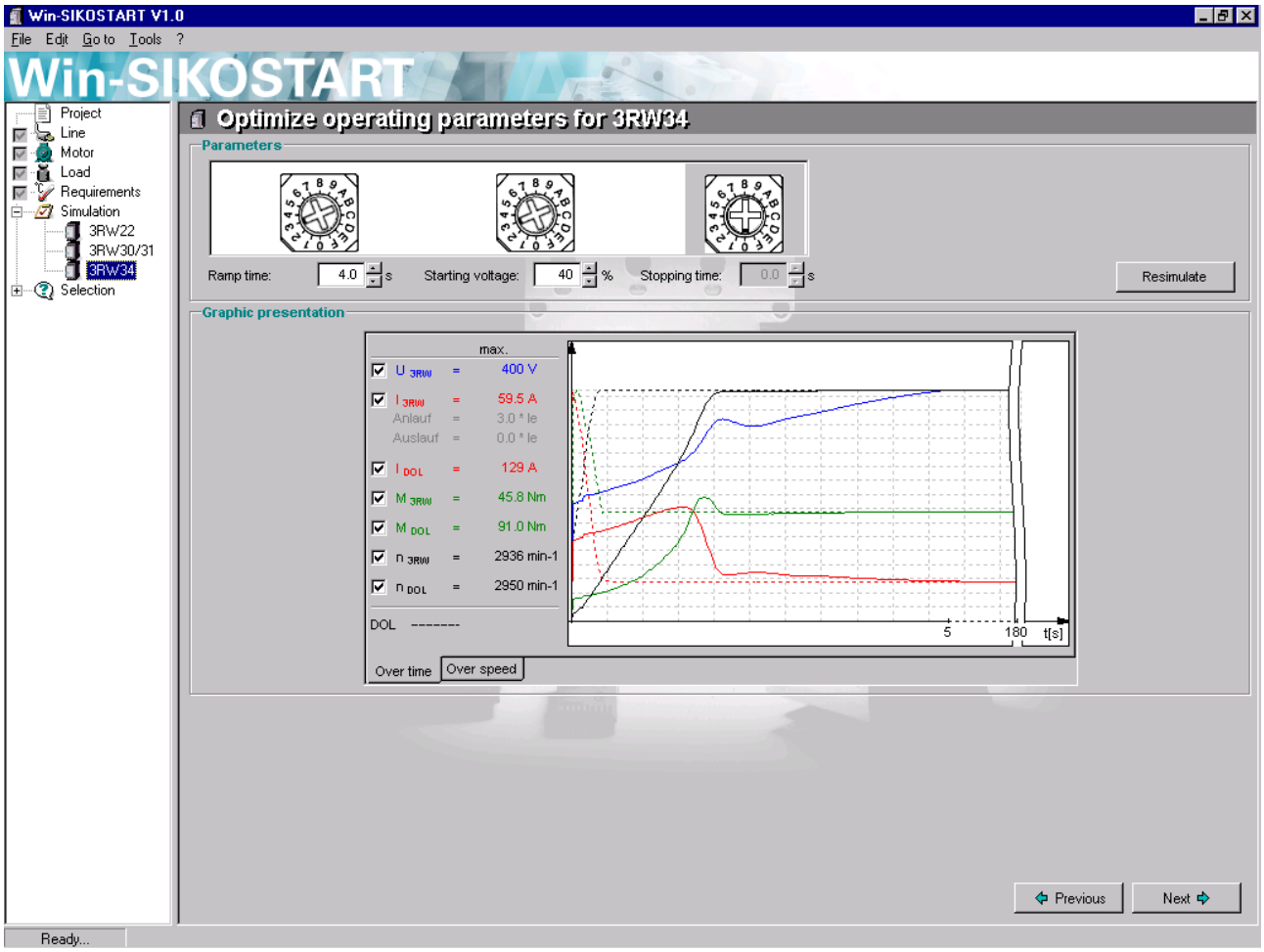
- *Resimulate*: Runs another simulation with the new values
- *Back*: Returns you to the previous mask
- *Previous*: Opens the next mask

2.13 Optimizing the operating parameters for 3RW34

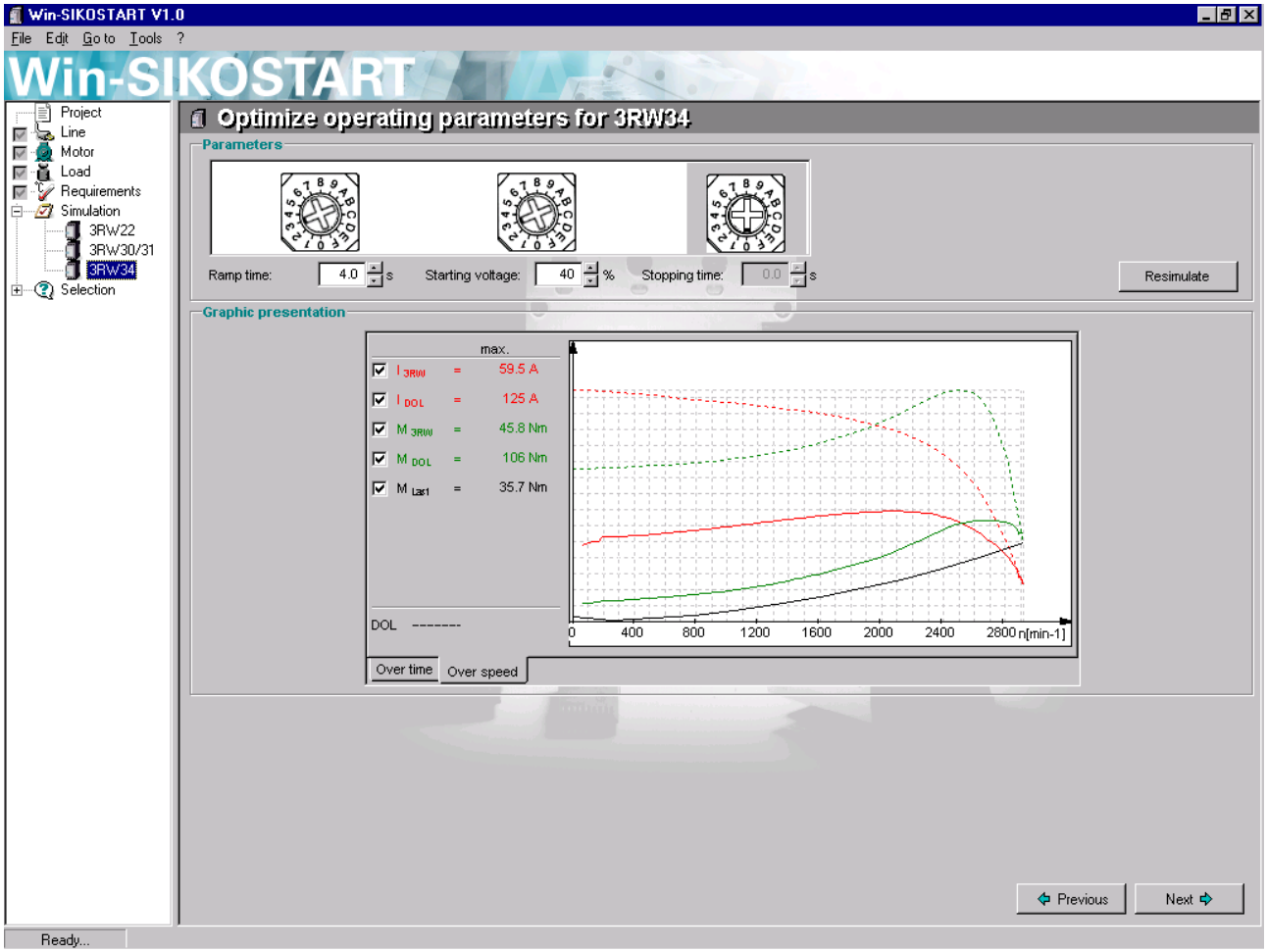
General

This mask contains the default values that were used by the program for the original simulation. You can change these values here if you wish and then run a new simulation to see if you can improve your results.

Underneath the default values is a graph showing the torque, the rotational speed, the current and the voltage characteristics. This graph is plotted as a function of time. Depending on your selection there will be indicated different graphs.



You can also switch to an alternative graph which displays the characteristics as a function of rotational speed. This graph indicates the torque and the current characteristics with and without a soft starter (DOL), as well as the torque characteristic for the load.



You can optimize the values for each of the suggested soft starter families in this mask.

After you have filled in all the boxes, you can get the program to run a new simulation.

Operating parameters

Ramp time:

- Range of values: 0,5 ... 60 s
- Default value: 4 s

Starting voltage:

- Range of values: 30 ... 80 %
- Default value: 40 %

Stopping time:

- Range of values: 0,5 ... 60 s
- Default value: 4 s

Buttons

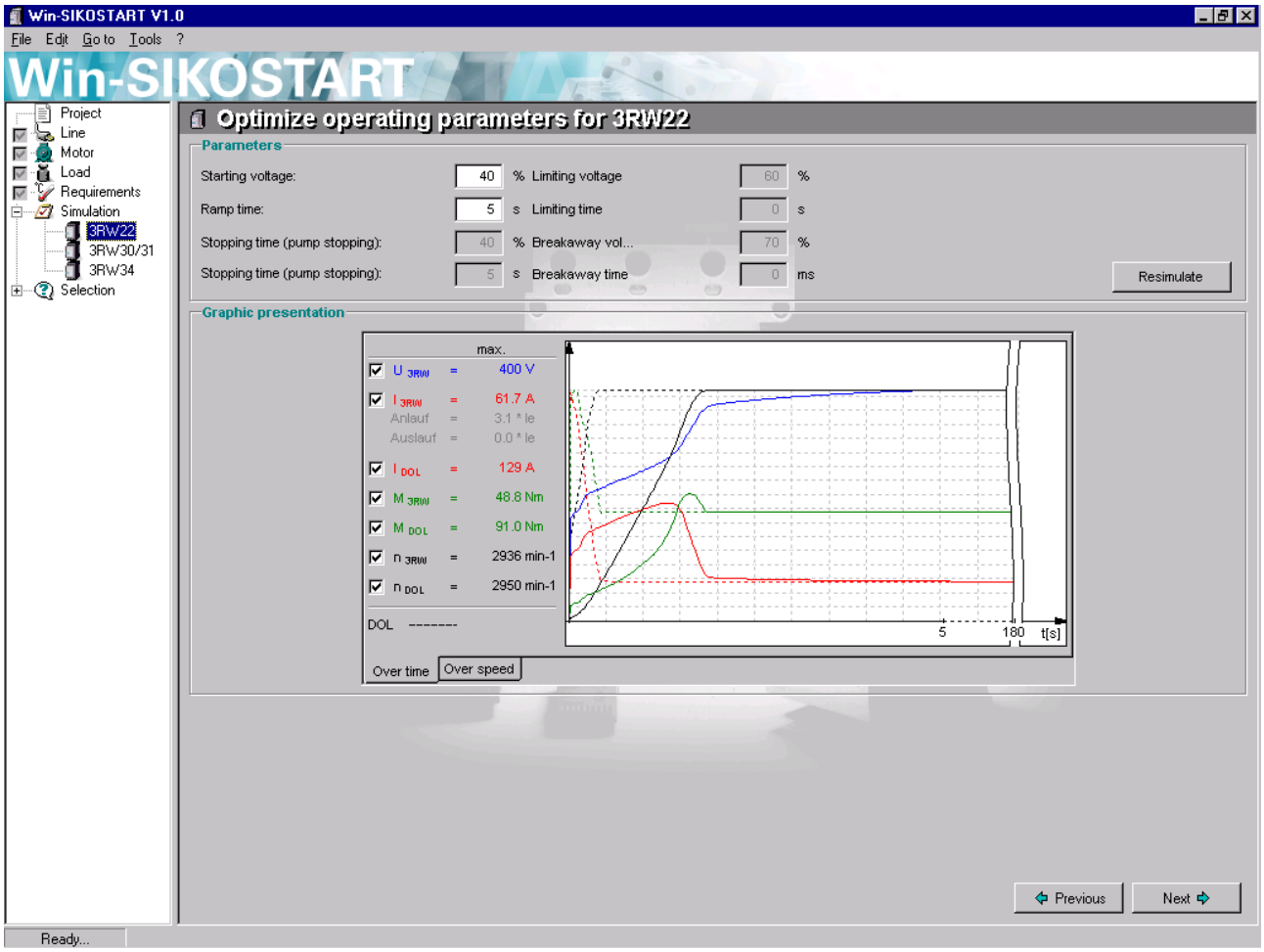
- *Resimulate*: Runs another simulation with the new values
- *Back*: Returns you to the previous mask
- *Previous*: Opens the next mask

2.14 Optimizing the operating parameters for 3RW22

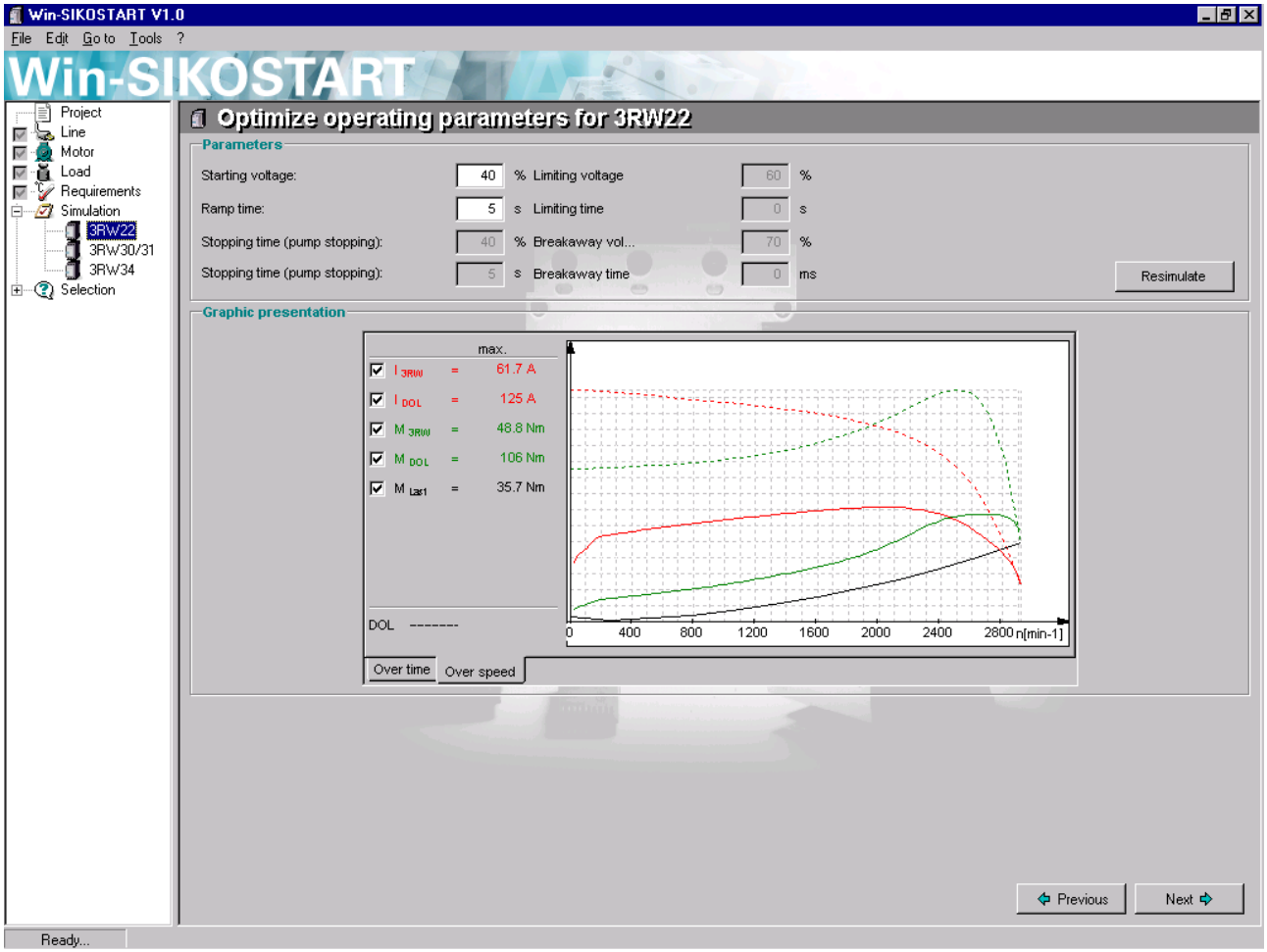
General

This mask contains the default values that were used by the program for the original simulation. You can change these values here if you wish and then run a new simulation to see if you can improve your results.

Underneath the default values is a graph showing the torque, the rotational speed, the current and the voltage characteristics. This graph is plotted as a function of time. Depending on your selection there will be indicated different graphs.



You can also switch to an alternative graph which displays the characteristics as a function of rotational speed. This graph indicates the torque and the current characteristics with and without a soft starter (DOL), as well as the torque characteristic for the load.



You can optimize the values for each of the suggested soft starter families in this mask.

After you have filled in all the boxes, you can get the program to run a new simulation.

Operating parameters

Ramp time:

- Range of values: 0 ... 1000 s
- Default value: 5 s

Starting voltage:

- Range of values: 20 ... 100 %
- Default value: 40 %

Cut-off voltage (for pump stopping):

- Range of values: 20 ... 90 %
- Default value: 40 %

Stopping time (for pump stopping):

- Range of values: 5 ... 200 s
- Default value: 5 s

Cut-off voltage (for soft stopping):

- Range of values: 20 ... 100 %
- Default value: 40 %

Stopping time (for soft stopping):
- Range of values: 0 ... 1000 s
- Default value: 5 s

Braking torque:
- Range of values: 20 ... 100 %
- Default value: 40 %

Braking time:
- Range of values: 1 ... 18 s
- Default value: 5 s

Limiting current:
- Range of values: 1 ... 6535 A
- Default value: 2,5 x Bemessungsbetriebsstrom bei Netzspannung

Limiting voltage:
- Range of values: 20 ... 100 %
- Default value: 60 %

Limiting time:
- Range of values: 0 ... 1000 s
- Default value: 5 s

Breakaway voltage:
- Range of values: 20 ... 100 %
- Default value: 80 %

Breakaway time:
- Range of values: 50 ... 1000 ms
- Default value: 300 ms

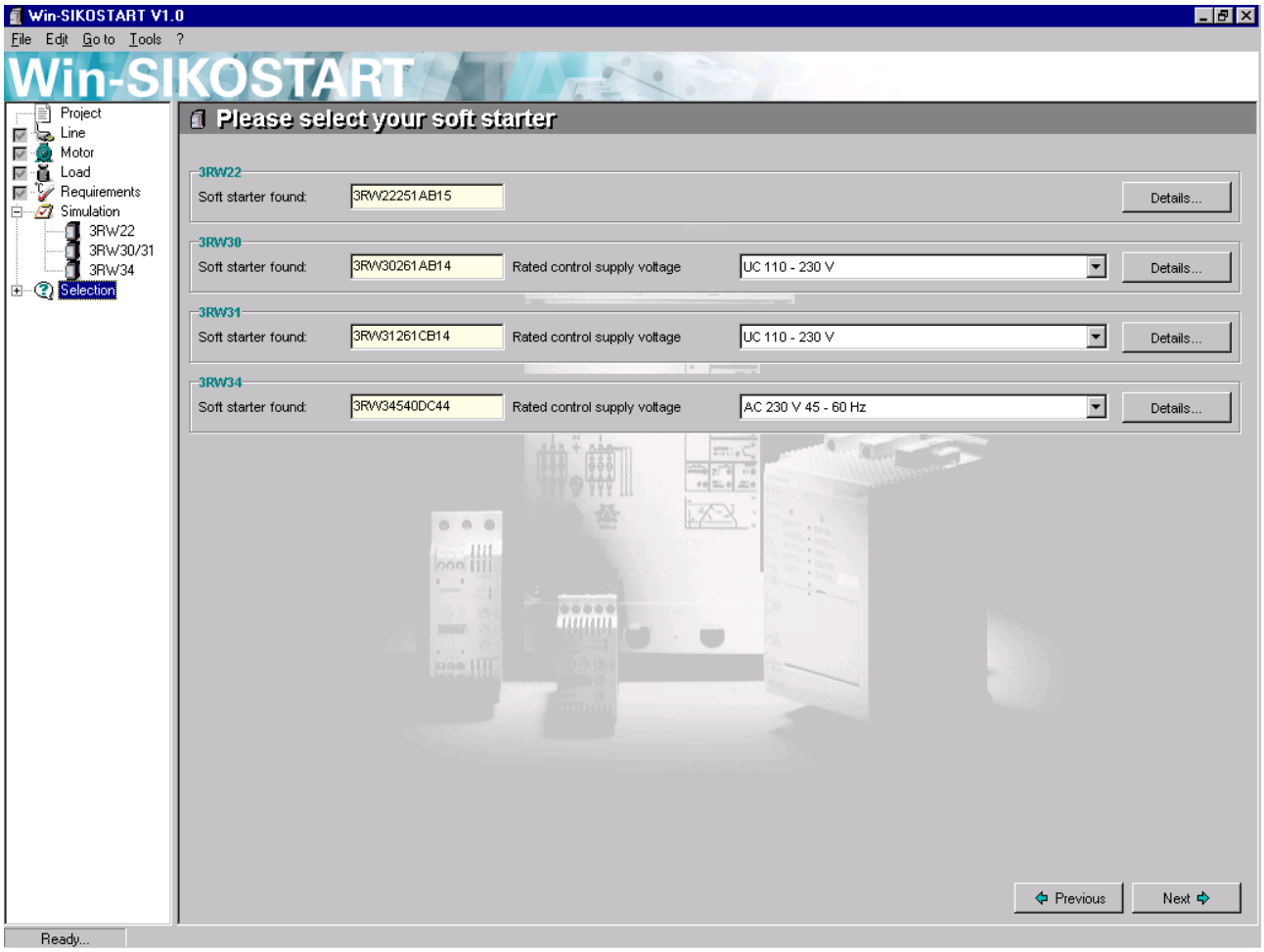
Buttons

- *Resimulate*: Runs another simulation with the new values
- *Back*: Returns you to the previous mask
- *Previous*: Opens the next mask

2.15 Selecting the soft starter

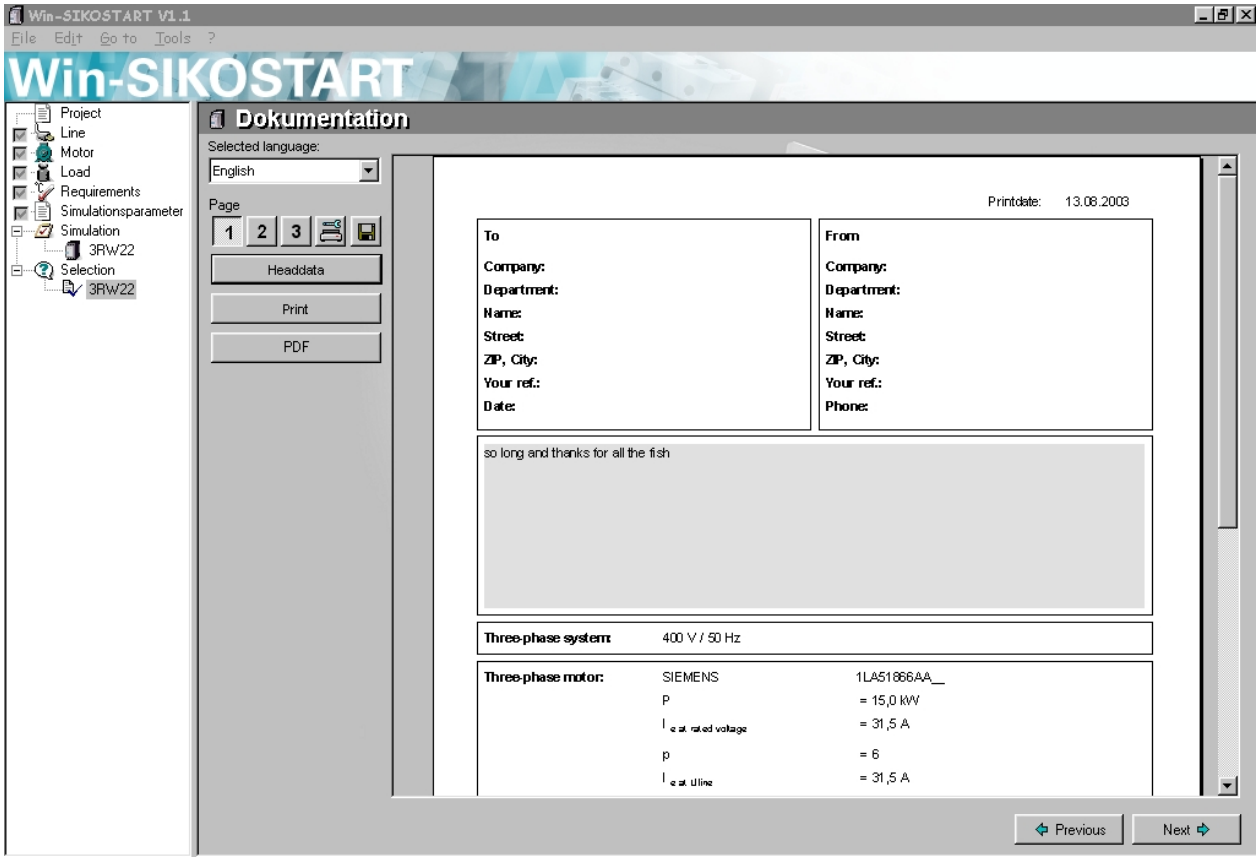
General

When you are satisfied with the overall result, you can proceed to the *Selection* mask. This contains a summary of the suitable soft starter types from the point of view both of the specified requirements and of the thermal design.

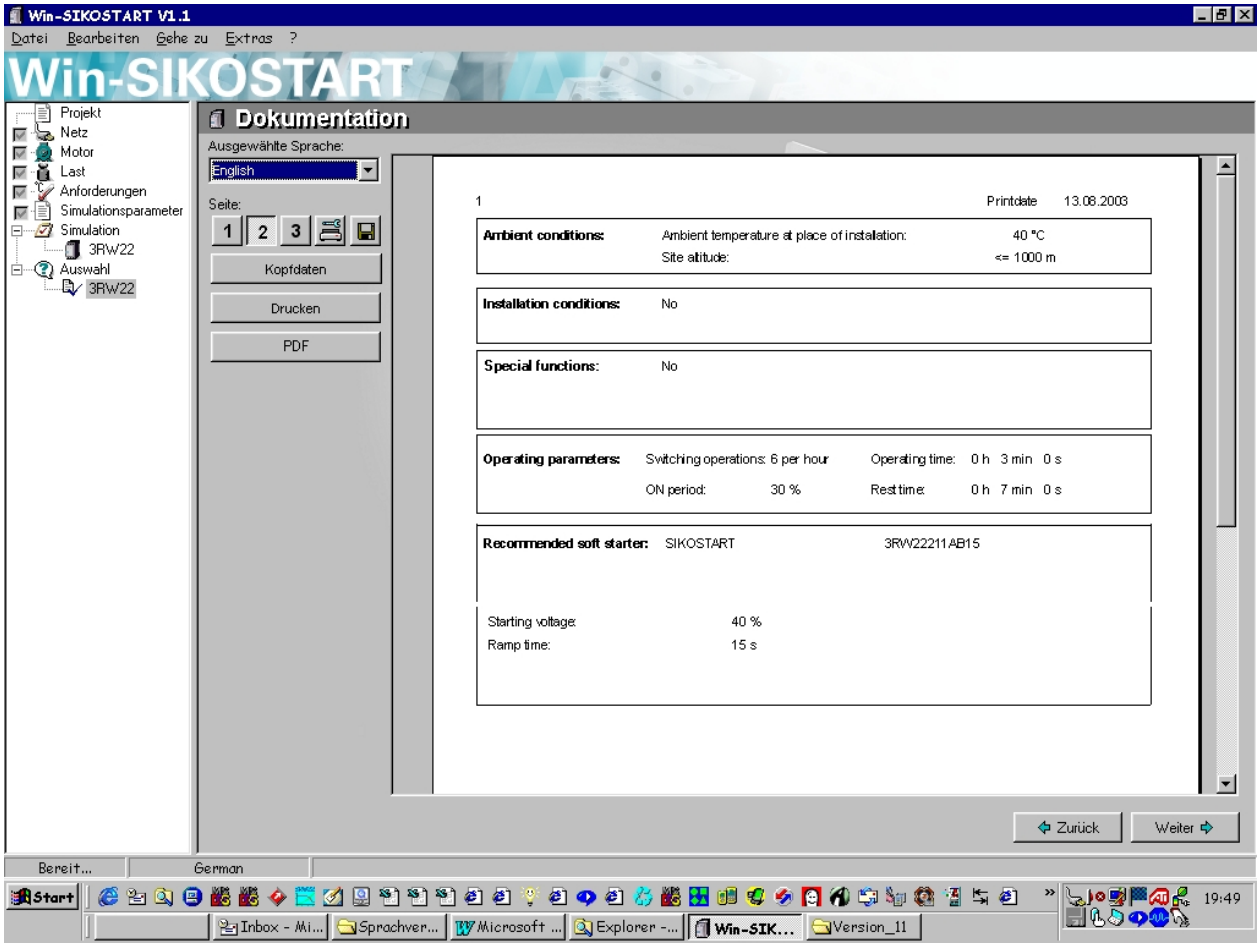


You can then display or print out a report of the results for each of the soft starters that has been found. First of all, however, you must select the rated control supply voltage, to enable the order-number MLFB (machine-readable product designation) to be completed.

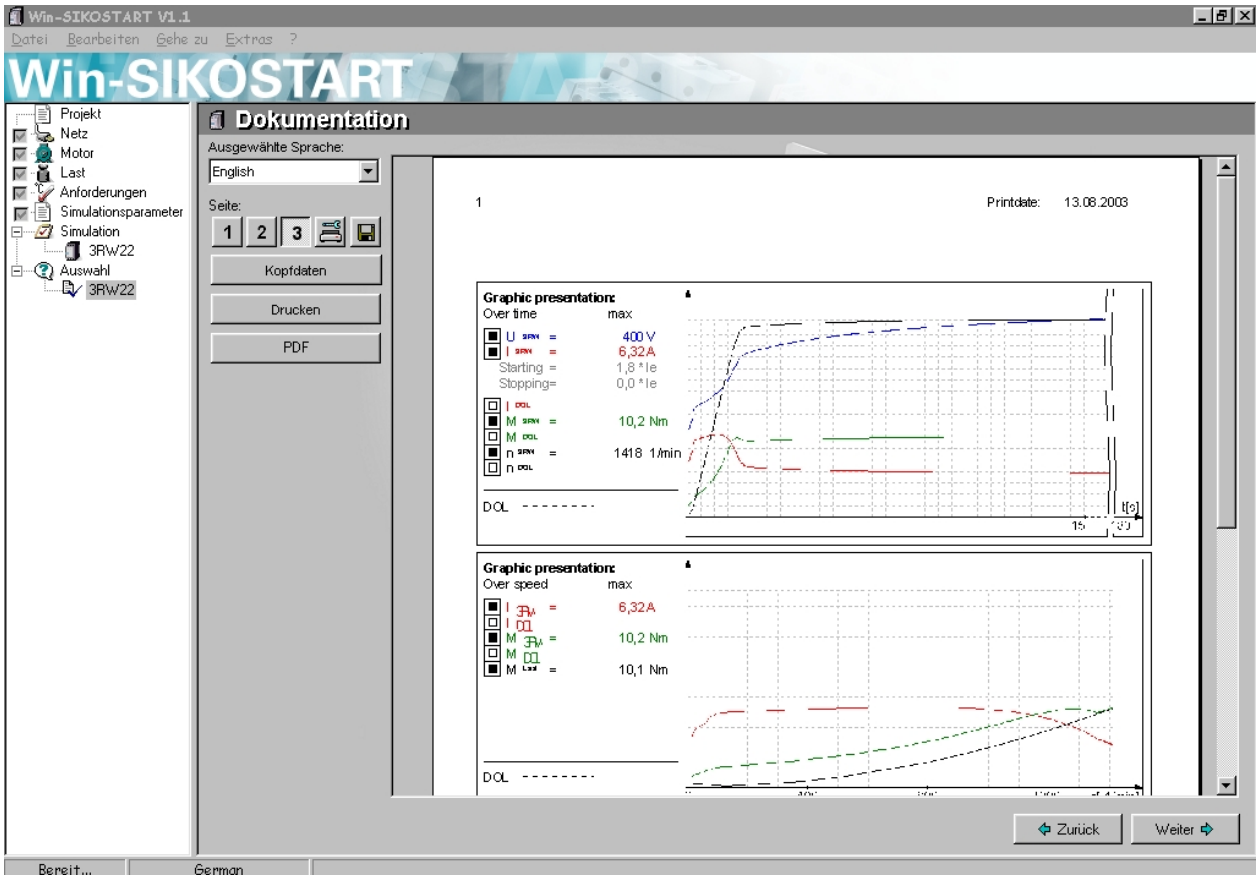
Page 1:


Win-SIKOSTART V1.1
File Edit Go to Tools ?
Win-SIKOSTART
Project
Line
Motor
Load
Requirements
Simulationsparameter
Simulation
3RW22
Selection
3RW22
Dokumentation
Selected language:
English
Page
1 2 3
Headdata
Print
PDF
Printdate: 13.08.2003
To
Company:
Department:
Name:
Street:
ZIP, City:
Your ref.:
Date:
From
Company:
Department:
Name:
Street:
ZIP, City:
Your ref.:
Phone:
so long and thanks for all the fish
Three-phase system: 400 V / 50 Hz
Three-phase motor: SIEMENS 1LA51866AA__
P = 15,0 kW
I e at rated voltage = 31,5 A
p = 6
I e at Uline = 31,5 A
Previous
Next

Page 2:


Win-SIKOSTART V1.1
Datei Bearbeiten Gehe zu Extras ?
Win-SIKOSTART
Projekt
Netz
Motor
Last
Anforderungen
Simulationsparameter
Simulation
3RW22
Auswahl
3RW22
Dokumentation
Ausgewählte Sprache:
English
Seite:
1 2 3
Kopfdaten
Drucken
PDF
1
Printdate 13.08.2003
Ambient conditions:
Ambient temperature at place of installation: 40 °C
Site altitude: <= 1000 m
Installation conditions: No
Special functions: No
Operating parameters: Switching operations: 6 per hour Operating time: 0 h 3 min 0 s
ON period: 30 % Rest time: 0 h 7 min 0 s
Recommended soft starter: SIKOSTART 3RW22211AB15
Starting voltage: 40 %
Ramp time: 15 s
Zurück
Weiter
Bereit...
German
Start
Inbox - Mi...
Sprachver...
Microsoft ...
Explorer -...
Win-SIK...
Version_11
19:49

Page 3:



Buttons

- *Details*: Displays a summary report for the selected soft starter
- *Back*: Returns you to the previous mask
- *Previous*: Opens the next mask

You can also select the following options for each report:

- *Selected language*: language in which you want to print out the report
- *Print*: printout of the report or simply a preview
- *Page 1* / *Page 2/ Page 3*: page of the report
- *Headers: You can insert notes in a labelling field*
- *PDF: You can generate a pdf.-file based on the documentation*

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