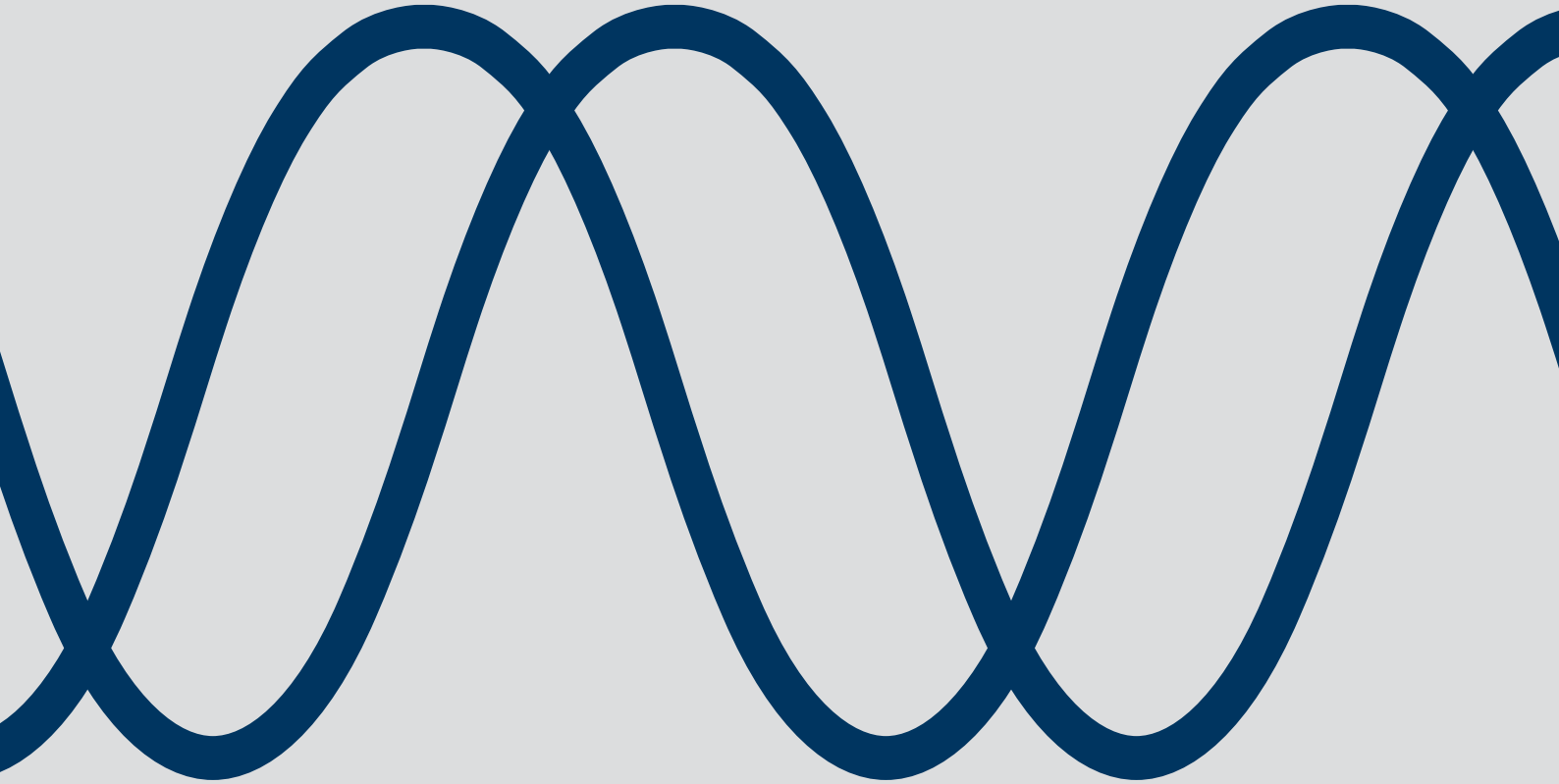
LEINE LINDE



FSI Monitor

MANUAL / USER'S GUIDE

FSI MONITOR

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LEINE LINDE

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1 General information

This manual explains the use of the FSI Monitor software and digital I/O:s for configuration of the following encoders:

FSI 984
FSI 985
FSI 986
FSI 987

To cover all applicable variants, the name FSI 9XX will be used throughout the text in this manual.
The X denotes any number 0-9.

All safety-related data is provided in the mounting instructions for the FSI 984, 985, 986 and 987.

Status LED can be found in mounting instruction for models FSI 984, 985, 986, 987 in chapter 3. parts of the product.

2 Installation of FSI Monitor

The software is available for download at www.leinelinde.com/support/downloads.

When you download the software, the installation file will be transferred to your computer: FSIMonitor.ConfigSW.msi, the actual software for configuration of the FSI encoder.

A 1.8-m USB cable (art. no. 687661-01) for connection between the computer and FSI 9XX can be ordered from Leine Linde. It has a standard USB 2.0 connector for connection to a PC and a mini-USB connector for connection to the rear cover of the FSI 9XX.

System requirements
Operating systems: Windows 7, 8 or 10
.NET framework is required. Separate installation with download from the Internet may be necessary.
Drivers are included in the installation package for FSI Monitor.

Note that administrative rights are required by Windows 7 for installation of software.

2.1 Installation procedure

Note: Any older version of FSI Monitor must be uninstalled before a newer version can be installed. The software will not work otherwise.

Open the “Leine Linde” folder and double-click FSIMonitor.ConfigSW.msi to begin installation.

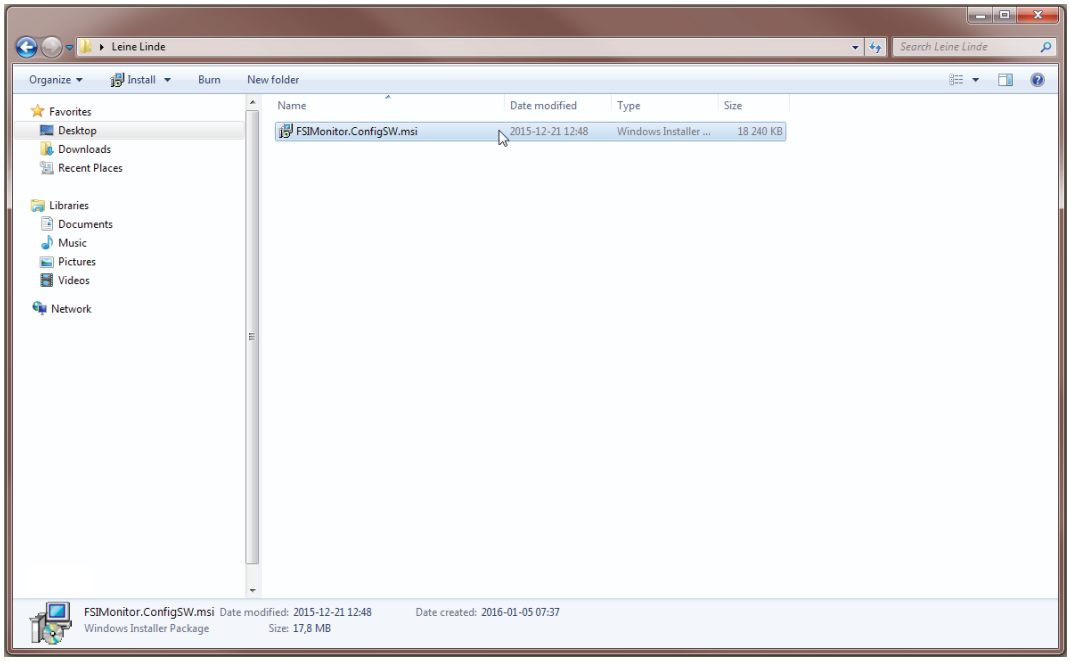


Figure 1 Downloaded folder with software

A security warning may be displayed when clicking the file. Ignore the warning by clicking “Run”.

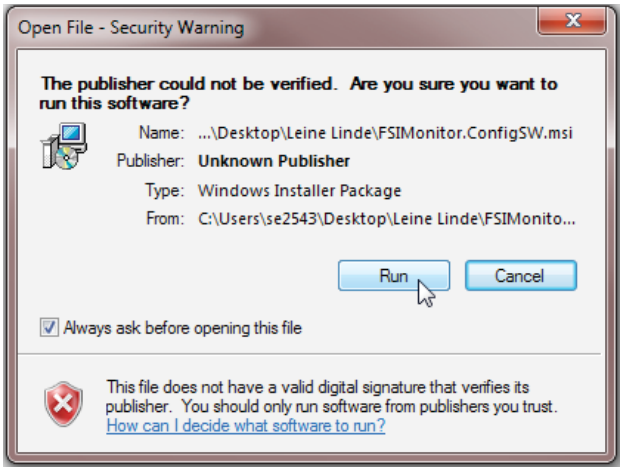


Figure 2 Ignore the warning

Now follow the installation instructions in the dialogue box.

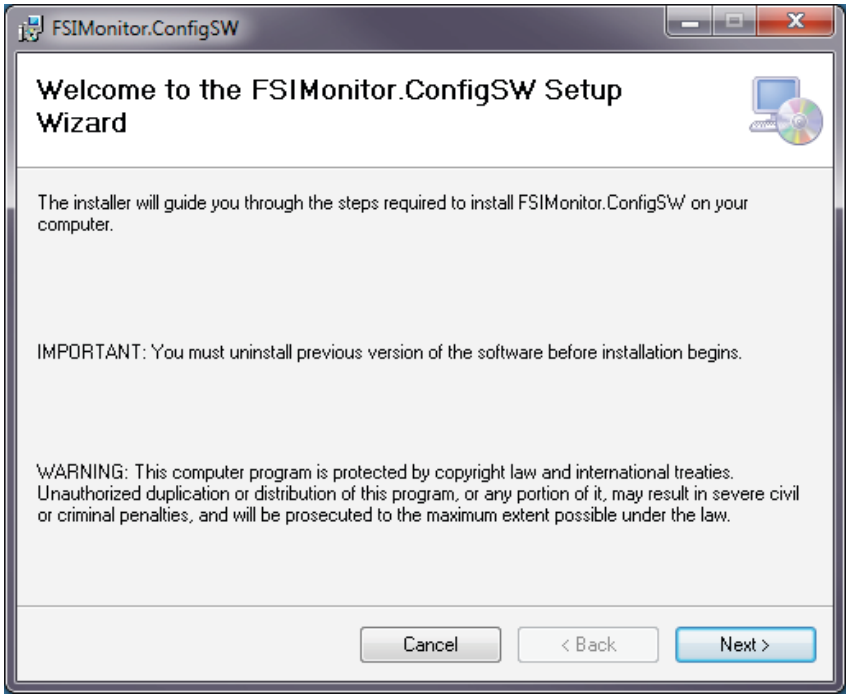


Figure 3 Installation procedure

Choose where the software will be installed on the computer.

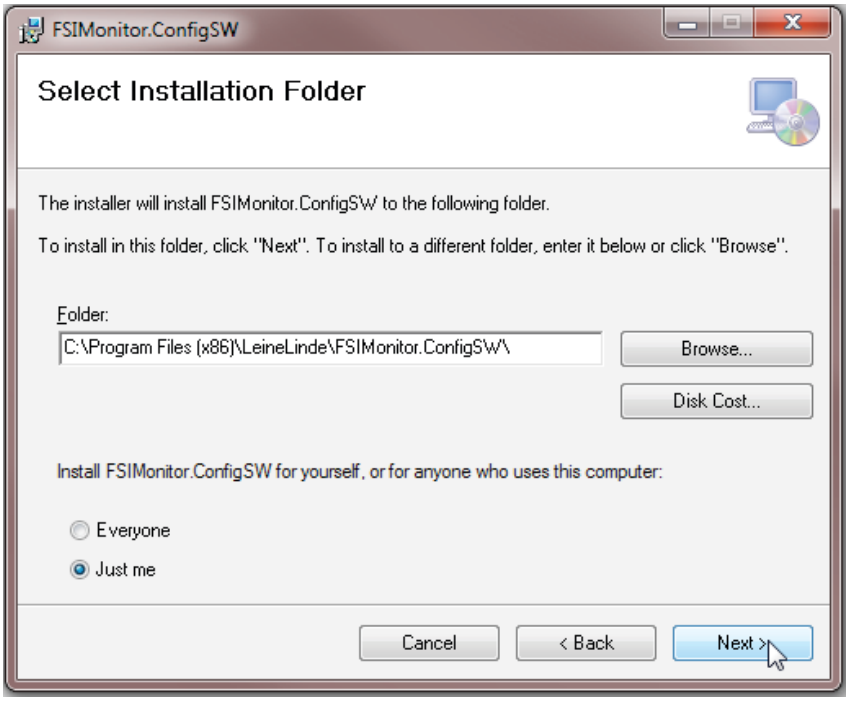


Figure 4 Installation procedure, step 2

Click “Next” to install the software. The process will take no longer than a few minutes.

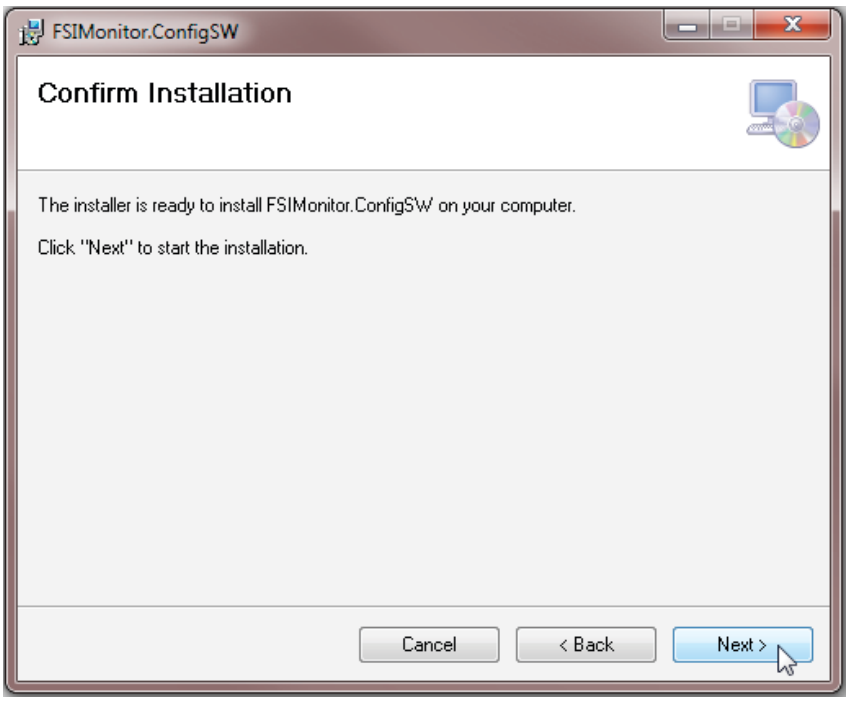


Figure 5 Installation procedure, step 3

Exit by clicking “Close”. A shortcut to FSI Monitor will now be available on the desktop.

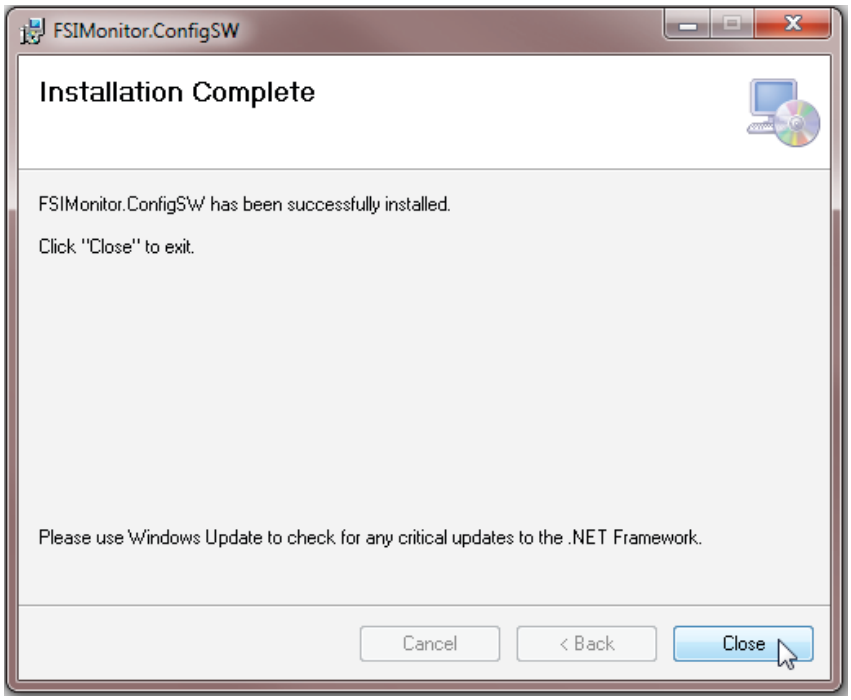


Figure 6 Final step in the installation procedure

3 First use

Use the USB interface on the FSI 900 to connect it to a PC with the installed FSI Monitor software. Note that the encoder needs a separate 24 V power supply. See separate mounting instruction for encoder connector information. Start the FSI monitor software by double-clicking the icon. It may take a few seconds before it opens.

Figure 7 Icon for FSI Monitor

Login with a user name is required to use the software, preferably with both a first and last name. The user name is the name saved during configuration. See Chapter 4.2, Configuration setup page, for more on this.

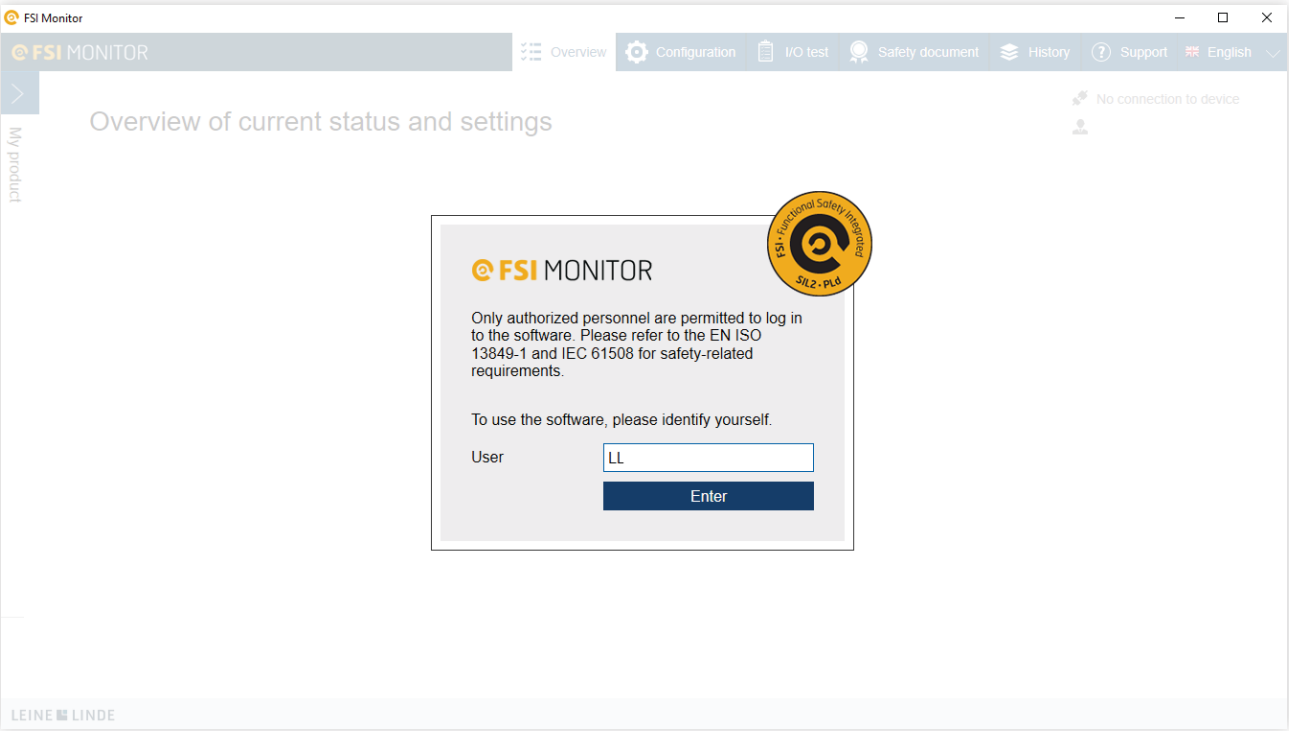


Figure 8 Dialogue box for login

After clicking “Enter”, an overview is displayed in the software. This is the actual start page for the software and an active configuration will be displayed when it is run. See Chapter 4.3, Examples of function configuration, for further details. When the software starts for the first time, or if it is not connected to an FSI 9XX, the overview page will be empty and an information box will describe what must be done to continue. Information if the device is connected or not will be shown in the upper-right corner shown, see next page.
If standard USB drivers are not installed, the FSI Monitor software will inform of this and provide the possibility to install such drivers.

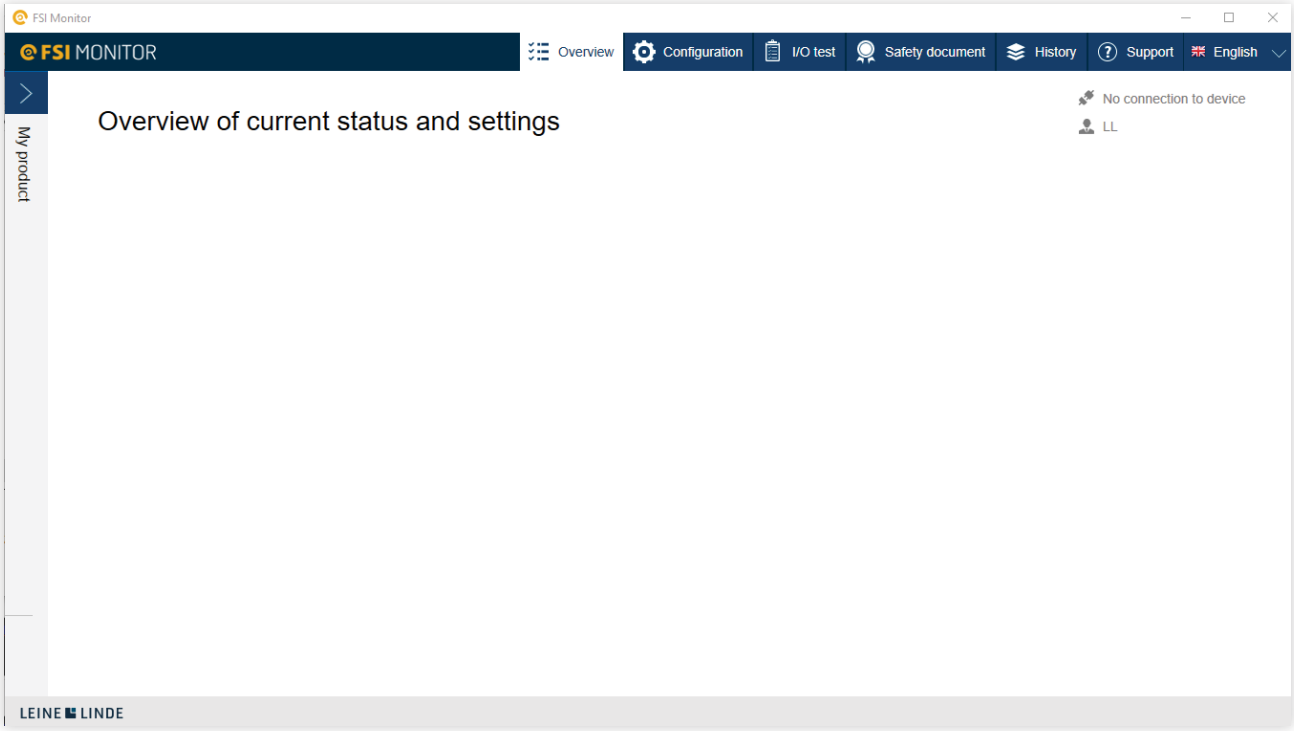


Figure 9 No encoder connected

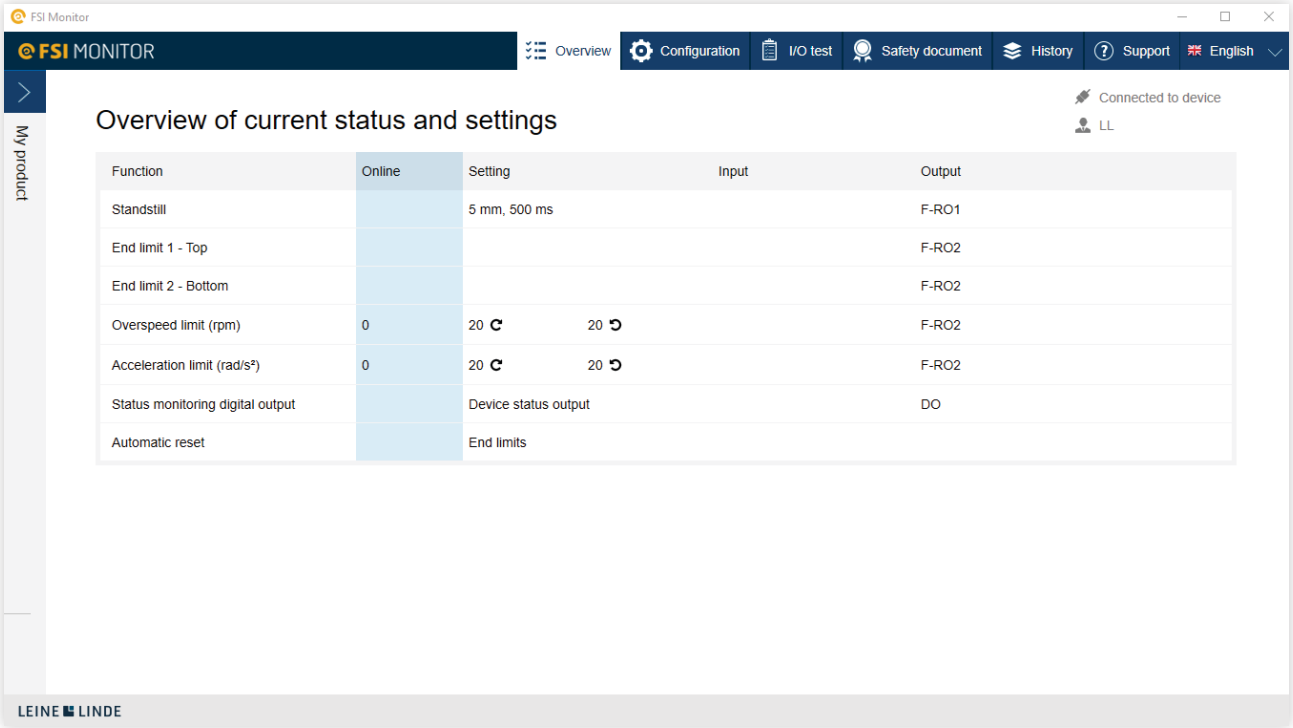


Figure 10 Example of a connected encoder with active configuration

3.1 Information boxes

To clarify what is happening in the software, the information is divided into the following four sections:

Error (red colour)	– If a specified limit has been exceeded, such as the speed monitor being activated due to excessive speed, the red information box is displayed. Can also inform of an internal FSI 9XX error. Requires action by user.
Warning (orange colour)	– Upon incorrect input in the configuration; informs the user of what has to be corrected before continuing. Requires action by user.
Success (green colour)	– A confirmation of successful transfer of the configuration, which closes after 5 seconds.
Information (blue colour)	– Provides necessary information. Closes after the page reloads.

3.2 Content in FSI Monitor

The software is divided into different sections to provide a quick overview of where all data is located.

Menu
There are tabs for various purposes at the top-right corner.

Overview	– Start page for FSI Monitor.
Configuration	– This is where the actual configuration of the FSI 9XX is performed. See the section with the example configuration.
I/O test	– All inputs and outputs can be activated here to test functionality together with the application.
Safety document	– This is where safety-related data is generated in a PDF for the active configuration.
History	– Information about the 20 most recent configurations is saved here and generated in a PDF.
Support	– Leine & Linde AB contact information for when support is needed.
Language (English)	– The currently selected language is indicated with the language name and flag. You can choose another language here.

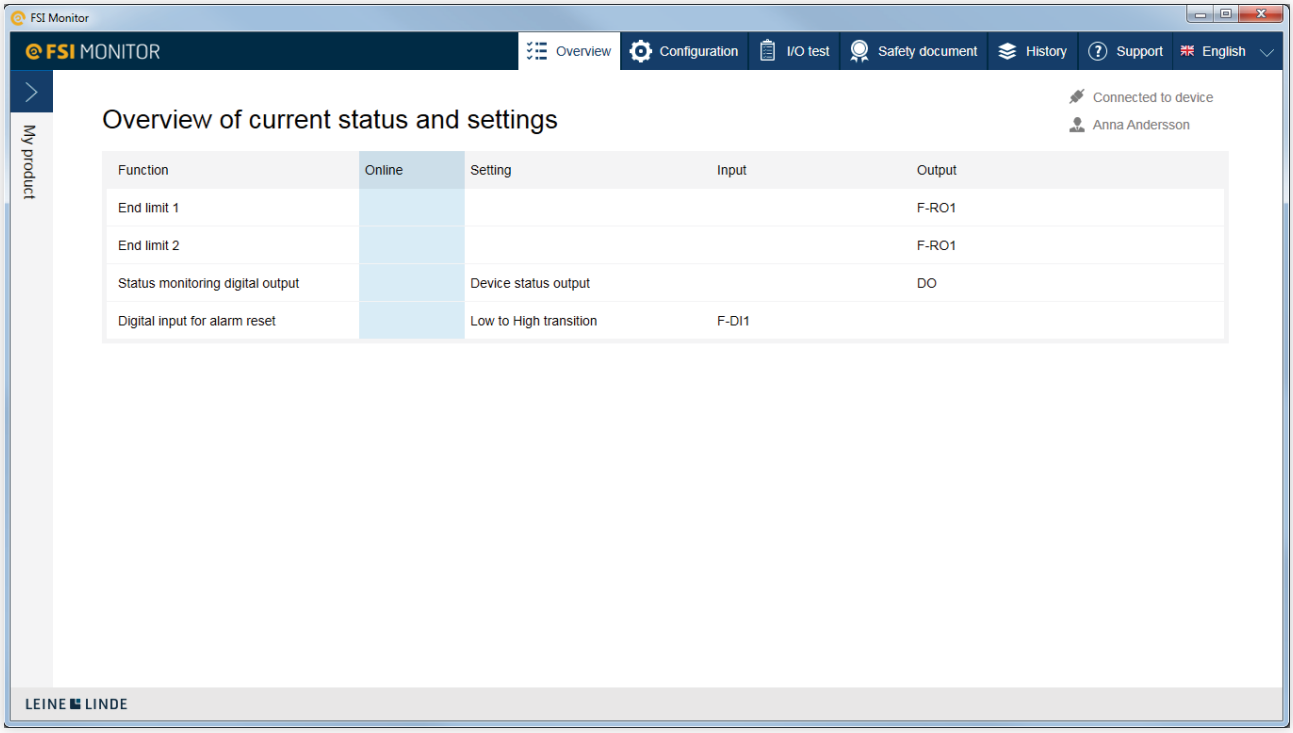


Figure 11 Content sections tabs

My product

At the far left on the overview page there is a tab that can be opened and closed by clicking the arrow. It shows general information about the actual FSI 9XX encoder and the most recently performed configuration; see Figure 12.

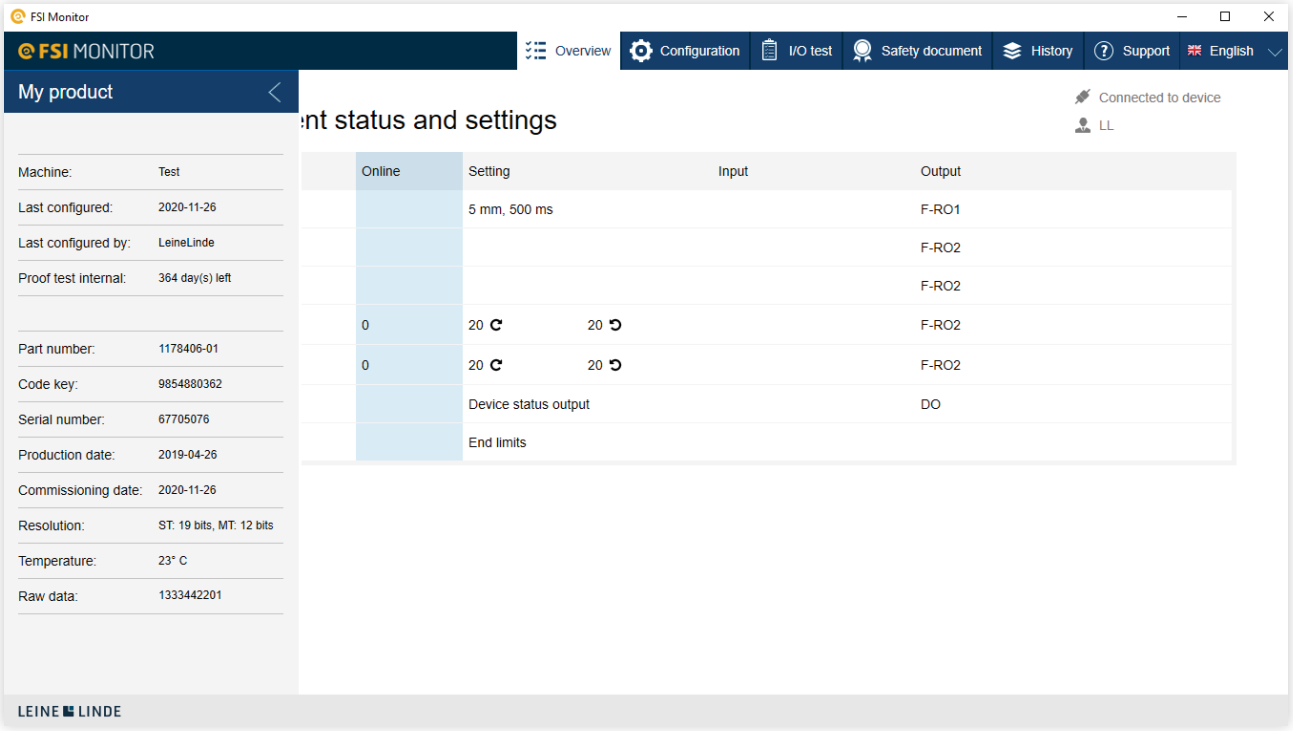


Figure 12 My product, expanded

My product

The top-left corner menu tab shows the following information:

Machine:	Name of the machine, chosen in the active configuration. Relates to where the FSI 9XX is installed.
Last configured:	Shows when the latest configuration was made.
Last configured by:	Shows who made the latest configuration.
Proof test internal:	Countdown from the day the latest proof test was done. Relates to powering off and restarting the FSI 9XX for internal check of everything being in order.
Part number:	The Leine Linde part number for the FSI 9XX, which is used for orders.
Code key:	Code key defining which parts and functions are included in the FSI 9XX.
Serial number:	The unique serial number for FSI 9XX, used for full production traceability, in case of product return.
Commissioning date:	When the latest configuration was done of the device.
Resolution:	The FSI 9XX scanning resolution for process data.
Temperature:	Temperature inside the FSI 9XX.
Raw data:	Position value only used for support

Overview of real-time data and settings

The active configuration for the FSI 9XX is displayed here. If the machine is run where the FSI 9XX is installed, the values are displayed in the “Online” column.

User information

Whether or not the FSI 9XX is connected is indicated in the upper-right corner. There are two alternatives:
No connection to device
Connected to device
It is only when the software is connected to the FSI 9XX that a configuration can be performed.

The person indicated is the user who logged in to the software. The user’s name will appear in the completed configuration.

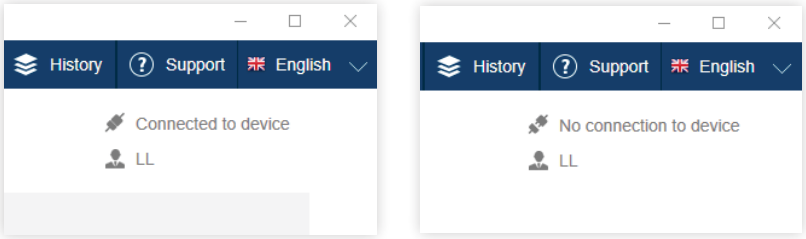


Figure 13 Connected or non-connected device

Exit by clicking the X at the upper-right corner. A pop-up window requests confirmation for exiting the software.

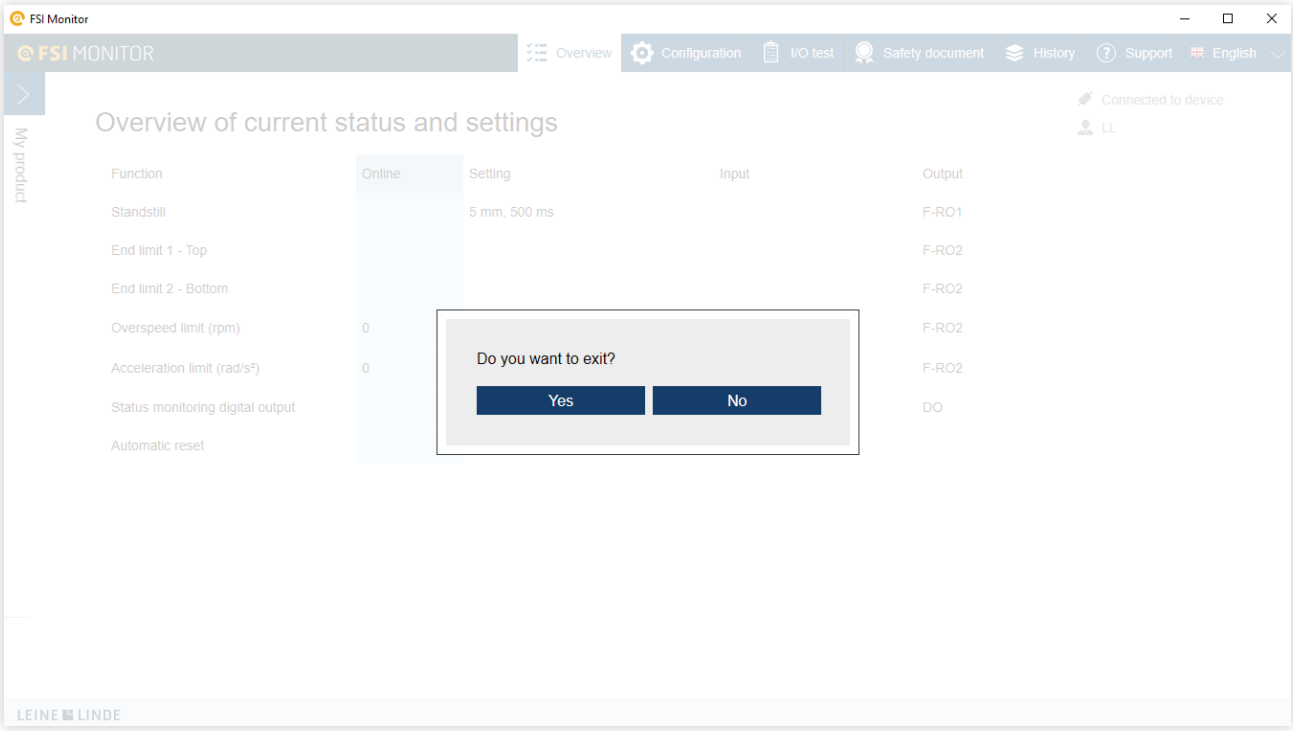


Figure 14 Exit FSI Monitor

I/O Test tab

The purpose of the I/O test tab is for the user to test and evaluate the activated configuration in the system, without running Overspeed for real. By turning on/off the failsafe relays connected to the configuration, such as Overspeed, the function is simulated and the users can make sure their own connections work as intended. For example, it may be verifying the activation of brakes when the Overspeed limit is reached, or it may be switching off power to the driving motor.

As the content under the I/O test tab is made for actively testing the relays which may be connected to other components or machinery, it is important that the user takes into account that the unit has to be in operating mode when using the I/O tab. This is to avoid occurrence of accidents.

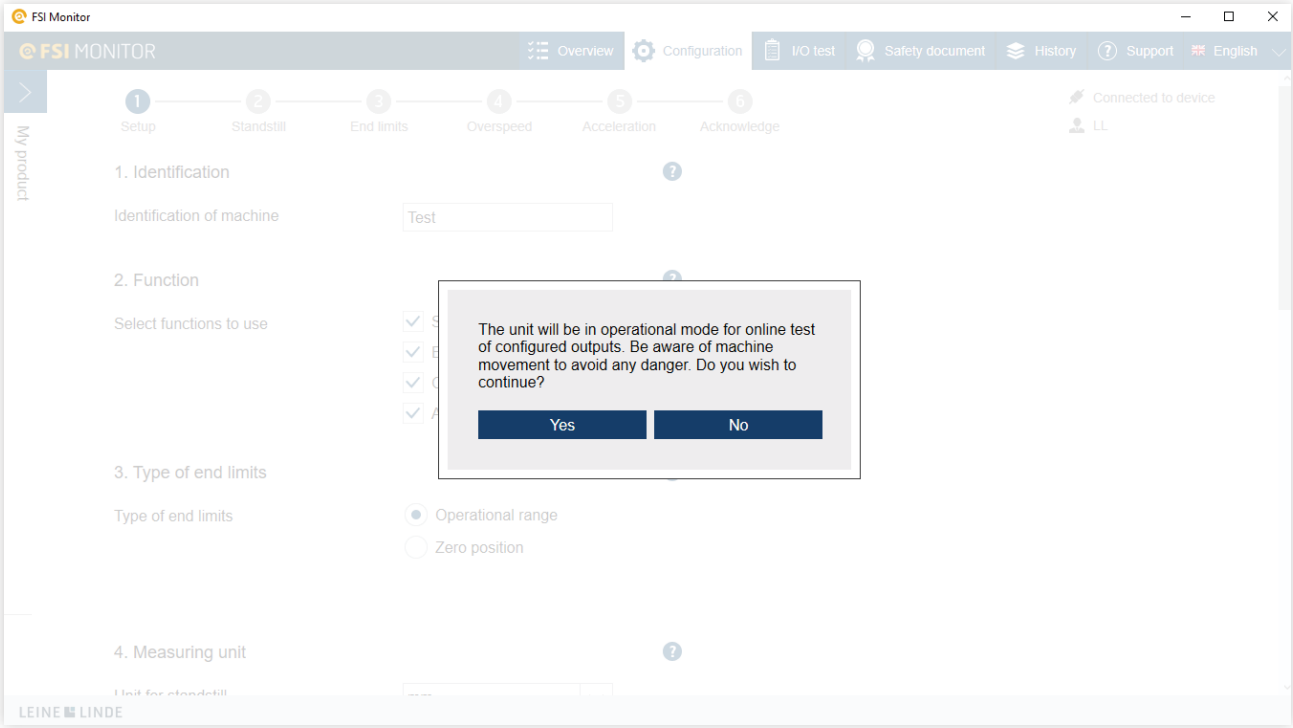


Figure 15 In order to test the relays, the unit has to be operational.

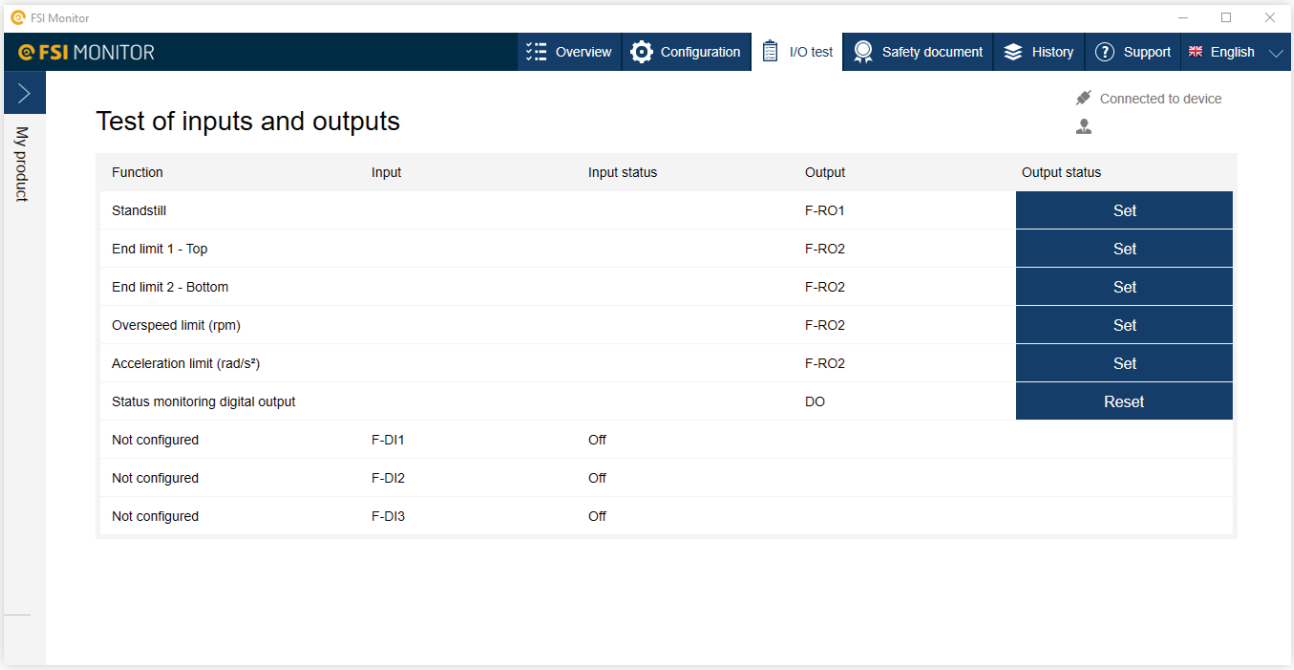


Figure 16 Overview of the I/O test tab

Safety document
All safety-related documents can be generated here in PDF format.

Safety report – Includes the configuration's parameters and the validated limit values if the checkbox is selected. Limits tested and approved check box should only be checked if the limits are tested.
Certificate – Safety certificate issued by the assessor (TÜV SÜD).
Declaration of conformity – Issued by Leine & Linde AB.

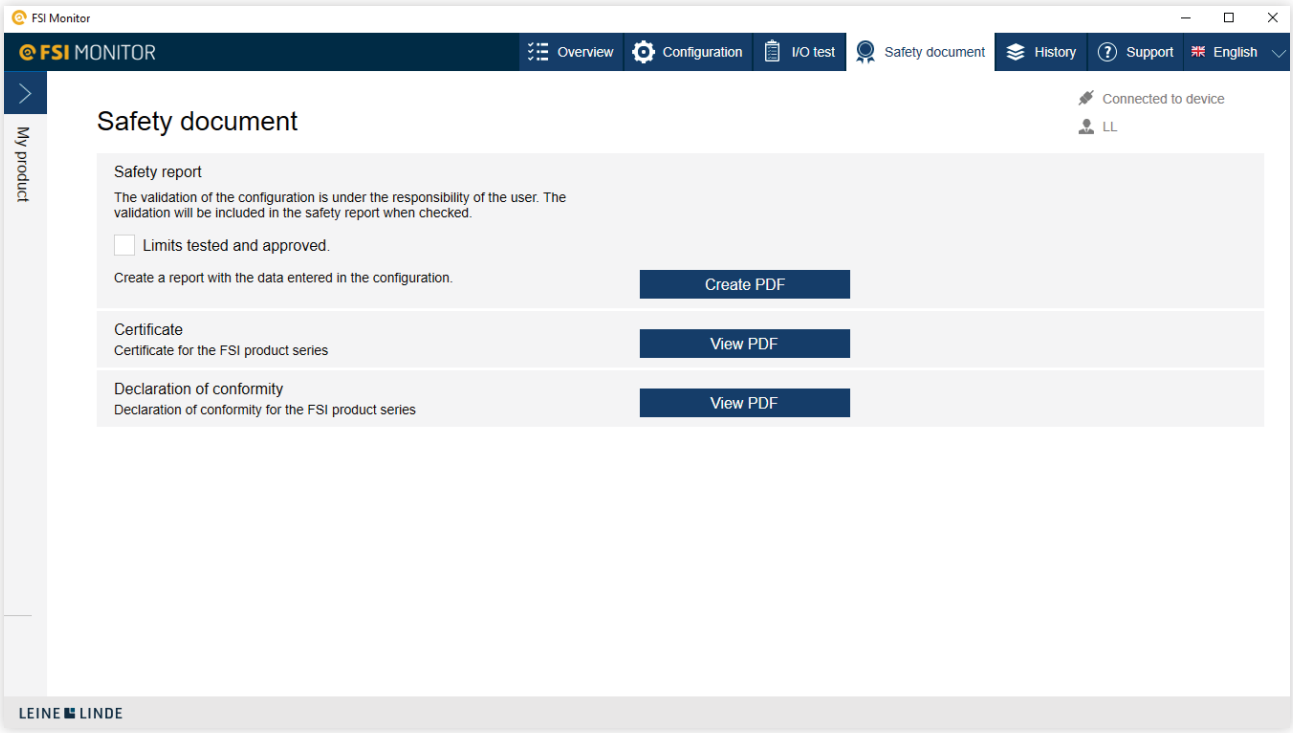


Figure 17 Section with all product and safety-related documents

History
A PDF can be generated containing the 20 most recent configurations with the following information:

- Name of the machine the configuration applies to and the current date
- Date when the configuration was activated
- User name
- ID
- Department

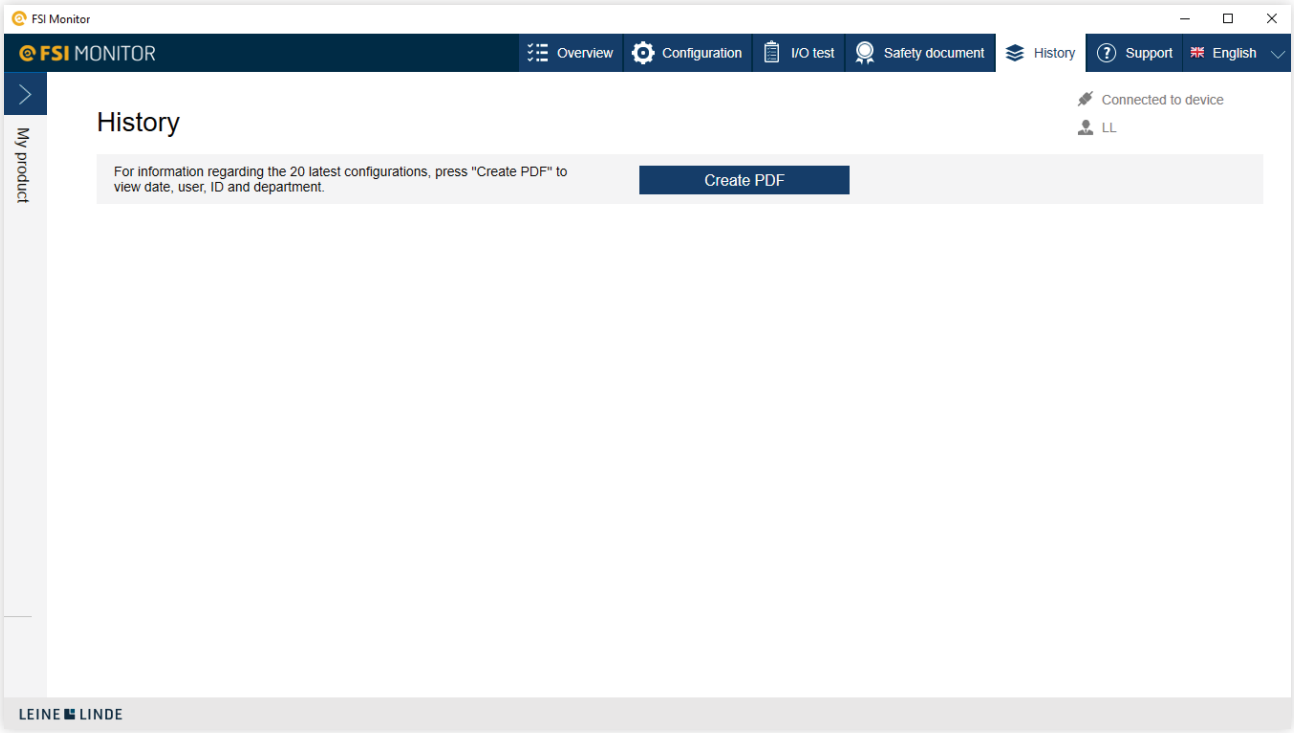


Figure 18 Section for retrieving historical data from the encoder

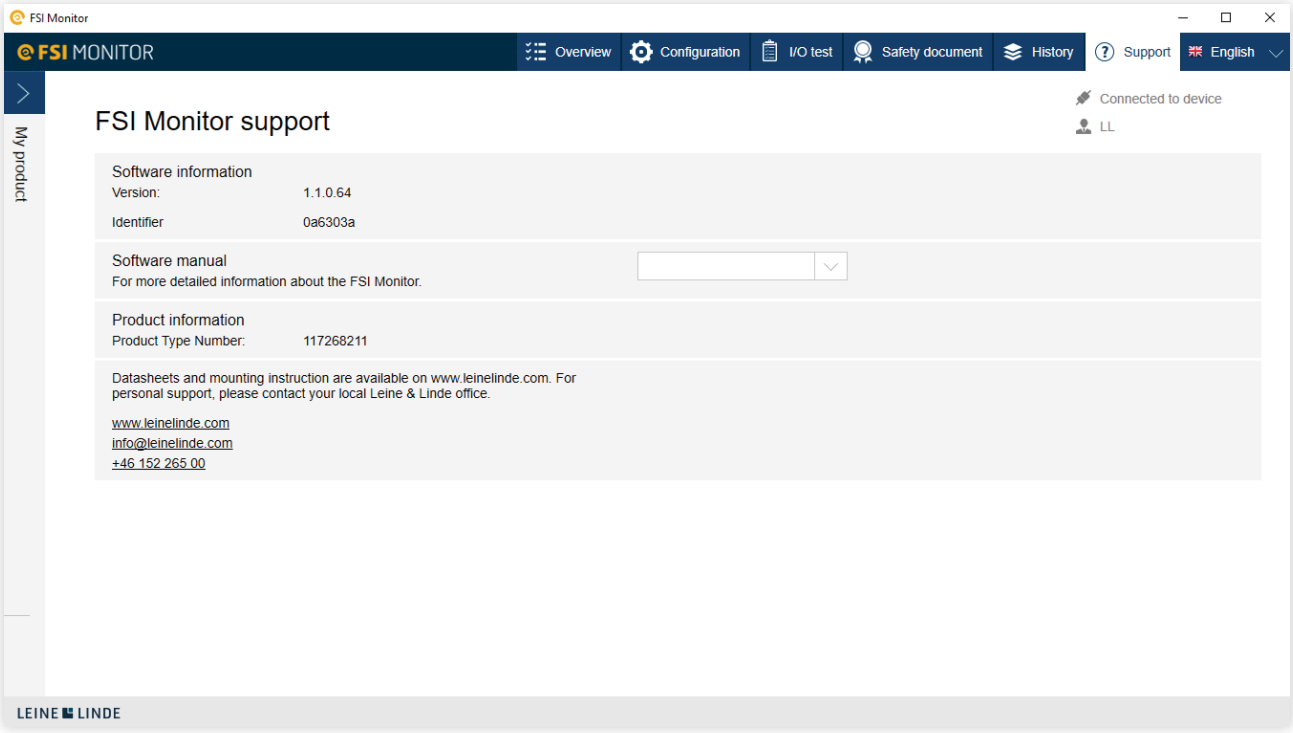


Figure 19 Software and product information, software manual download and contact information.

4 Configuration

Functions and parameter settings in the configuration section

Note: Connect only one FSI 9XX to the PC at a time. This ensures that the configuration will be correct for the connected device. The software automatically finds the USB port the device is connected to.

The configuration cannot be started unless a device is connected.

Note: The encoder needs a separate 24 V power supply when connected to the PC. See separate mounting instruction for encoder connector information.

4.1 Starting a configuration

There are five alternatives for starting/continuing a configuration:

Continue configuration – If a configuration has been terminated in an uncontrolled manner, such as because of a computer power failure, the user can continue with the current configuration.

Open active – Only displayed when an active configuration is available from the connected FSI 9XX.

Create new – Creates a new configuration.

Import – If a configuration has been previously performed and saved to the computer, it can be imported.

Export – The active configuration in the FSI 9XX can be exported and saved for later use.

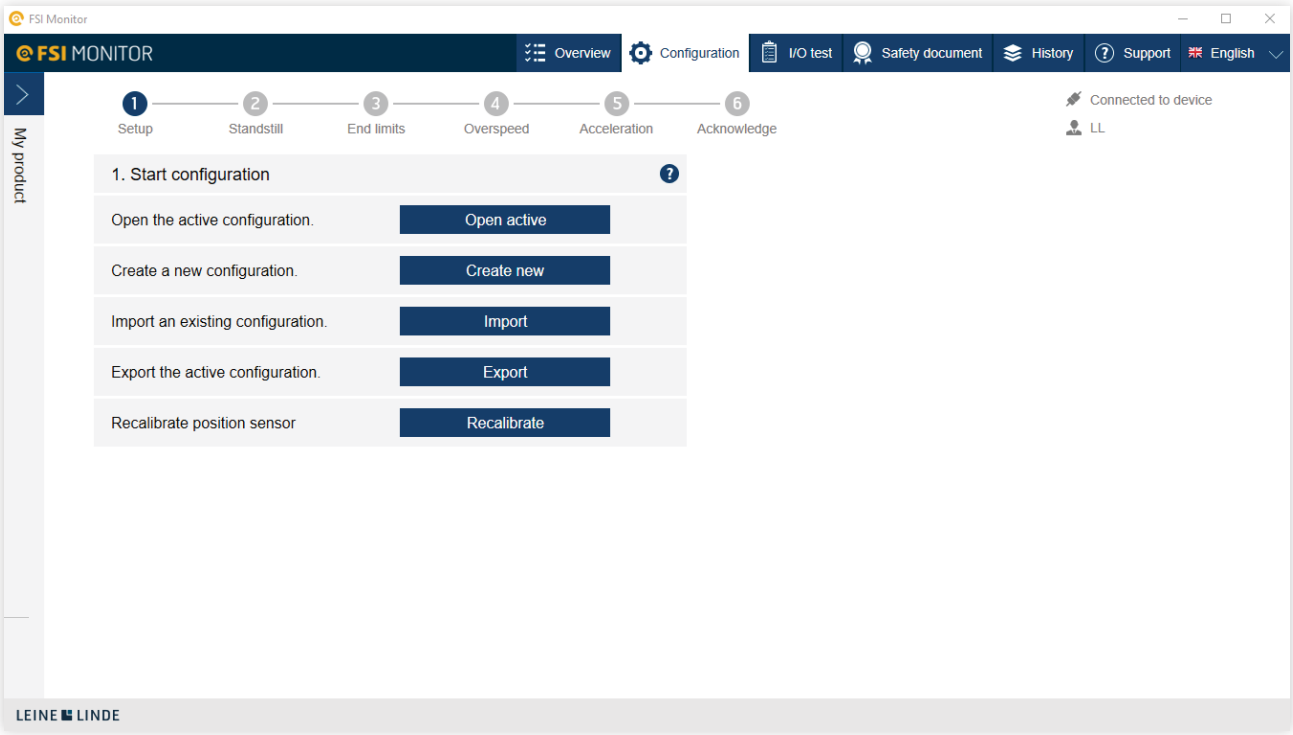
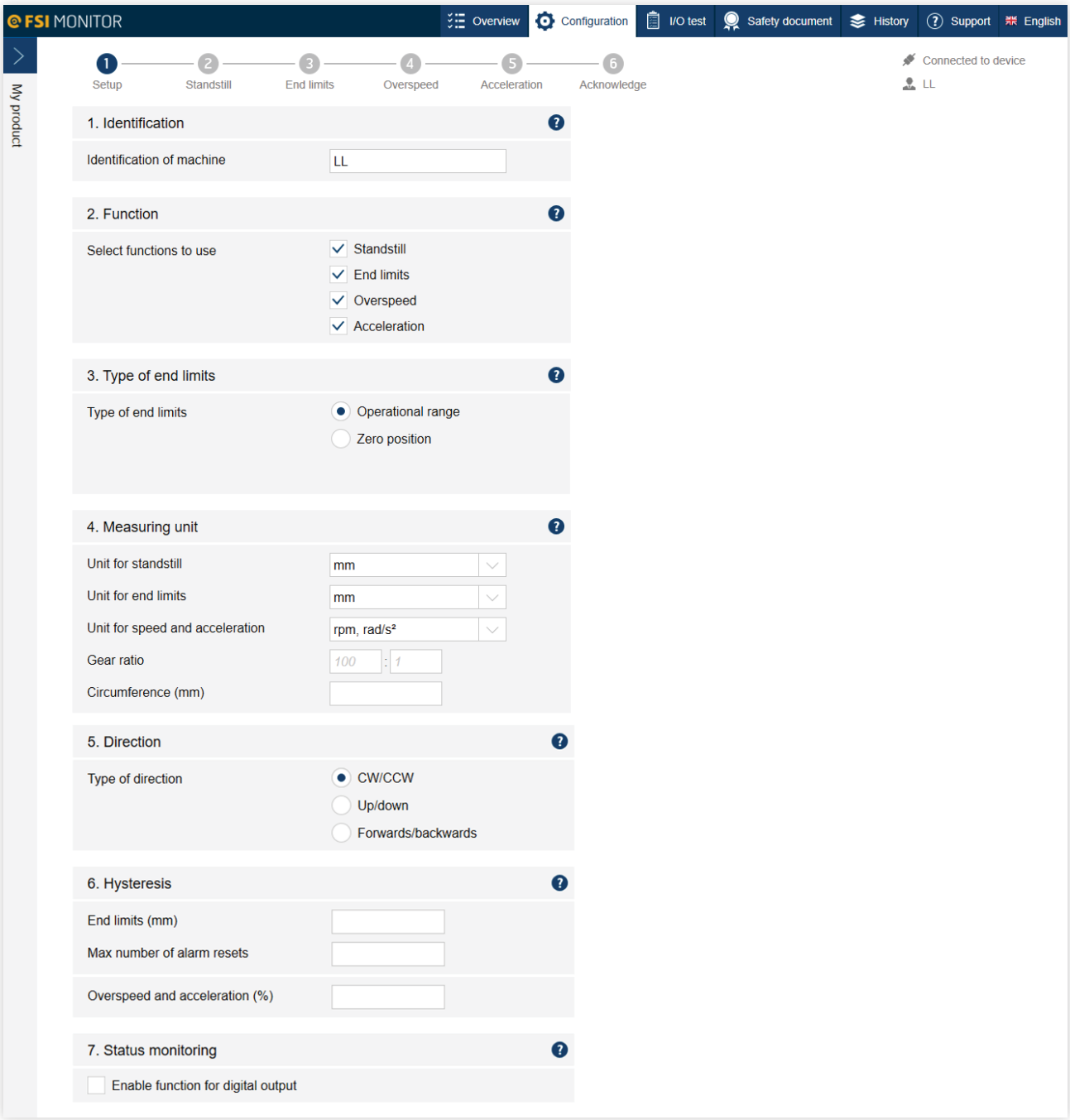


Figure 20 Start page for configuration

4.2 Configuration setup page

Follow the setup procedure and go through the configuration setup page, step by step. At a later stage, you will move on to a more detailed setup for the functions you have chosen. This manual will show you examples of configuration for all these functions in chapter 4.3, Examples of function configuration.



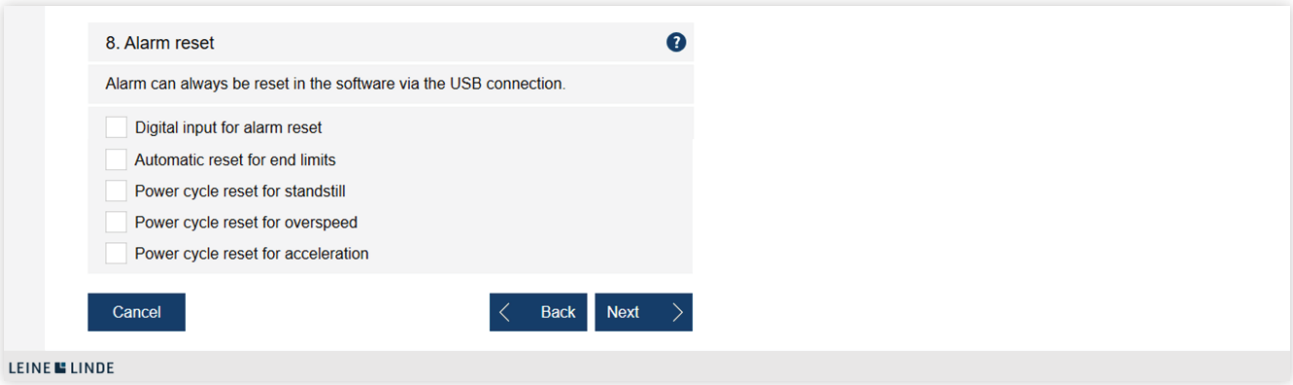


Figure 21 Configuration setup list page

1. Identification – Give the configuration the same name as the machine. The designation accompanies the safety document that is generated in the software and can thus more easily be kept together with the machine.

2. Function
The functions that can be configured to activate safe relay outputs are described here with examples of what can be configured with the FSI 9XX. How the safety functions are connected in the machine is the responsibility of the user.

Standstill – To prevent the machine from moving. By setting maximum allowed movement of the machine during standstill the functionality also can be used in applications where the environment might create acceptable movements of the machine during standstill.

End limits – The machine's permitted operating range is defined by specifying one or two end limits. If the machine is operated beyond the specified end limits, it comes to a stop.

Overspeed – Prevents the machine from moving faster than permitted. Using a failsafe digital input, there can be two different speed limits, one lower and the other higher. The limit values are also direction based.

Acceleration – Prevents the machine from accelerating faster than permitted. Using a failsafe digital input, there can be two different acceleration limits, one lower and the other higher. The limit values are also direction based.

3. Type of end limits
By selecting the End limits function, the user can choose the type of configuration for the end limits.

End limits with operating range – One or two end limits are specified here by the machine first being run to one selected position and then to the other. Next, the machine is run to an arbitrary position within what is now the approved operating range.

End limits with zero position – A zero position is specified as the machine's starting point. The operating range is thereafter specified in application movement in which movement may occur in each direction before an end limit is reached. Specified by millimetres or degrees.

4. Measuring unit
There is a choice of which measurement units to use for designation of the safety functions.

Unit for standstill	– Specified in mm or degrees.
Unit for speed and acceleration	– Specified in RPM and rad/s^2 or mm/s and mm/s^2.
Unit for end limits	– Specified in mm or degrees.
Gear ratio	– Depending on where the FSI 9XX is mounted on the machine, there can be gearing to take into consideration. Only gearing down may be specified. Minimum: 1, maximum: 1000. If no other scaling is specified, 1:1.
Circumference	– The FSI 9XX is not necessarily mounted exactly where the safety function is applied and there can then be a circumference to take into consideration. An example of such an application is when the speed of a winch drum is important and the FSI encoder is mounted on a motor shaft. Minimum: 50 mm, maximum: 10 000 mm.

5. Direction
For the safety functions to be in agreement with the application's movement, the designation to be used is chosen here.

Clockwise/counter-clockwise
Up/down
Forwards/backwards

6. Hysteresis
Hysteresis permits movement within a specific range around the specified limit value without activating the safety functions. The specified range also includes the area that is within the approved operating range. The reason for this is to minimize the risk of movement activating an additional alarm. Hysteresis is only being considered after alarm occurs.

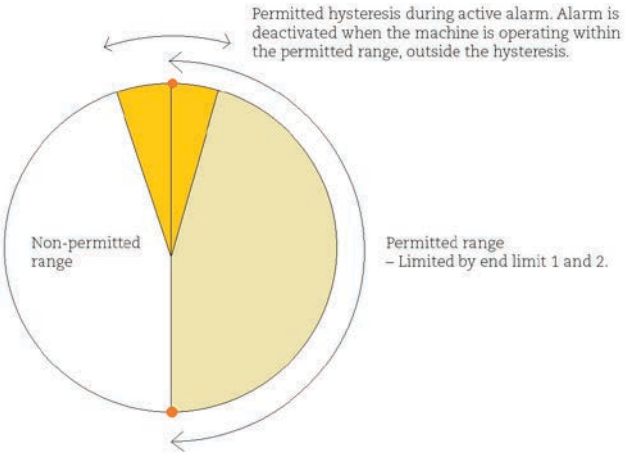


Figure 22 Permitted movement within the hysteresis range

Speed and acceleration	– Minimum 1%, maximum 95%
Position	– Millimetre: Minimum 1 mm, maximum 10 000 mm. – Degrees: Minimum 1˚, maximum 72 000˚

In choosing the end limits, a maximum number of resets must also be specified. The reason for this is to avoid the possible increased risk for a hazardous state if too many alarm resets are conducted.

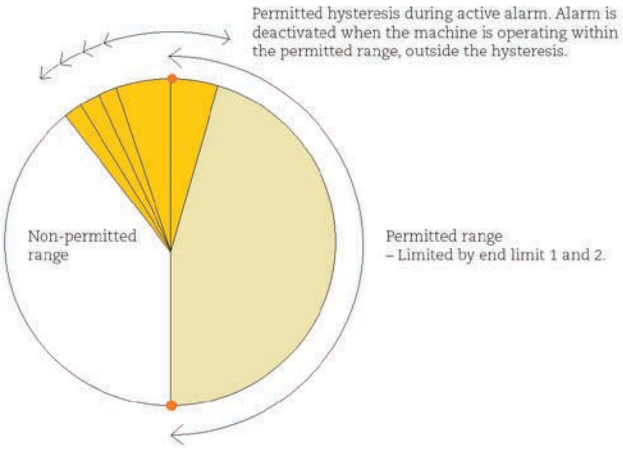
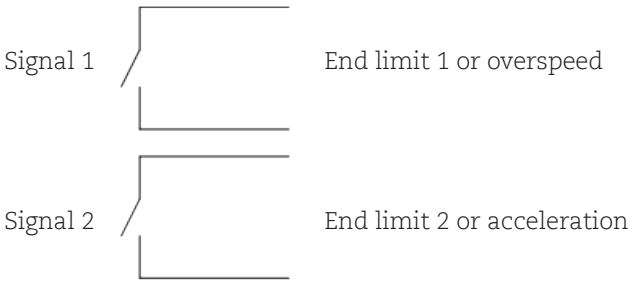


Figure 23 Too much movement within the hysteresis range, thereof the limitation.

7. Signal output
If several safety functions are used on the same failsafe relay output, it can be necessary to determine which has been activated in the event of, for example, an emergency stop. The signal output is a standard relay output that is not safety classified, but is used solely for information. Signalling options are as follows:



This signal output is only for FSI 986 and FSI 987

8. Status monitoring
A signal regarding the status of the FSI 9XX is transmitted to notify of any alarms or internal faults. This is accomplished with a digital output that does not need safety certification.

Status Output can be used to generate a pulsed signal suitable to achieve category 3 with one F-DI

9. Resetting alarms
Alarms can always be reset in the software if the FSI 9XX is connected. If additional reset options are needed, the following choices are available:

Resetting via failsafe digital input	– The signal type and failsafe digital input to be used are chosen here.
Signal type	
Low to high transition	– Requires two failsafe digital inputs for Category 3
Single pulse	– Duration of 500, 1000 or 1500 ms
Pulse train	– 100 Hz, 20 pulses

Note: In selection of the signal type Low to high transition, two failsafe digital inputs must be used to achieve Category 3. It decreases to just one failsafe digital input for the safety functions overspeed and acceleration, which entails that the signal will automatically be pulsed. (Category 3 is subsequently achieved.) For more information on this, please refer to the mounting instructions of the product.

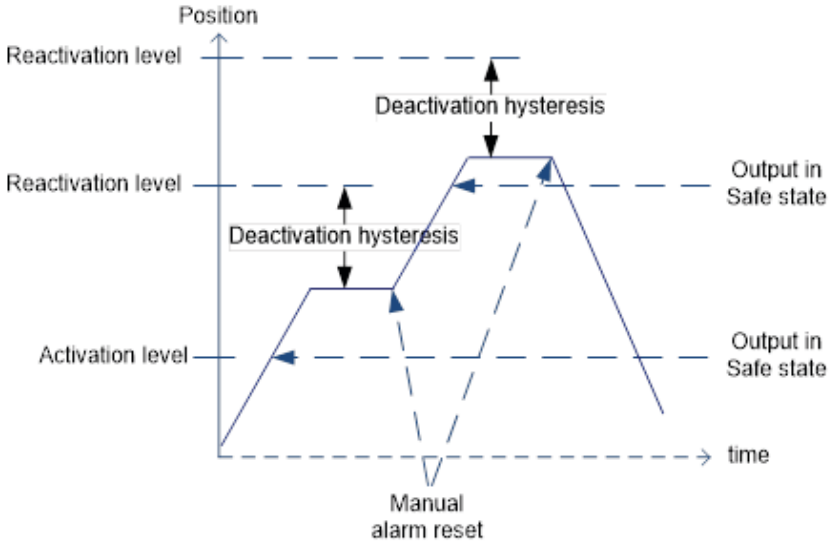


Figure 24 Manual reset of end limits

Automatic reset for end limits – This option can only be used for the end limits. This means that the alarm is automatically reset when the machine is moved in the opposite direction from when the alarm was activated, and out of the hysteresis area.

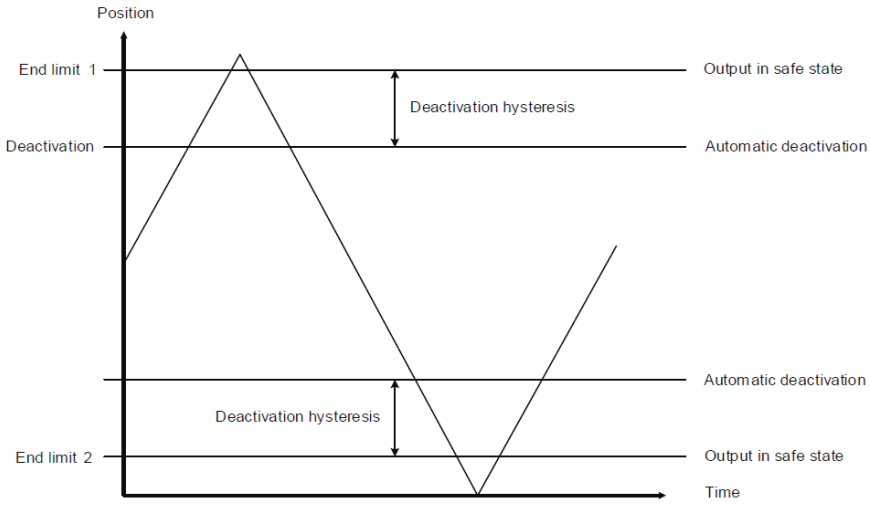


Figure 25 Automatic reset of end limits

Power cycle reset – Selectable for standstill, overspeed and acceleration.

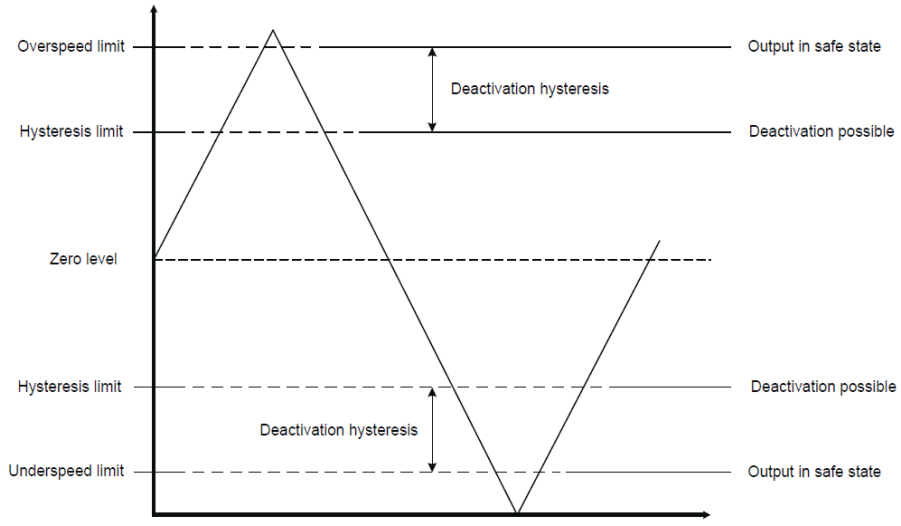


Figure 26 Power cycle reset of speed-based functions

Note: If input data is lacking or if data has been incorrectly entered, a warning will be displayed. The fault must be corrected before configuration can continue.

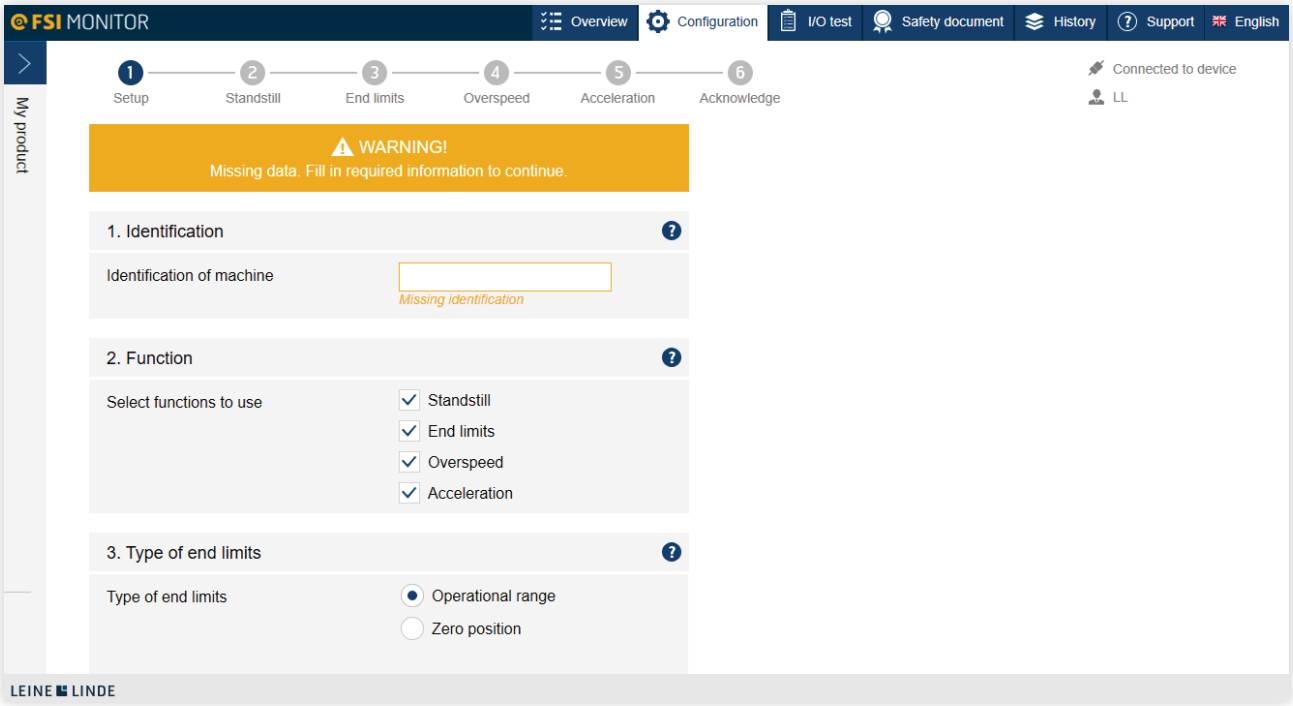


Figure 27 If data is lacking in the fields, configuration cannot continue.

4.3 Examples of function configuration

Depending on which functions you chose to activate, you will continue with the setup of standstill, end limit with operating range, end limit with zero position, overspeed, or acceleration.

4.3.1 Standstill

Specified here are the amount of movement and length of time that movement is permitted without activating an alarm. This is illustrated in the diagram below.

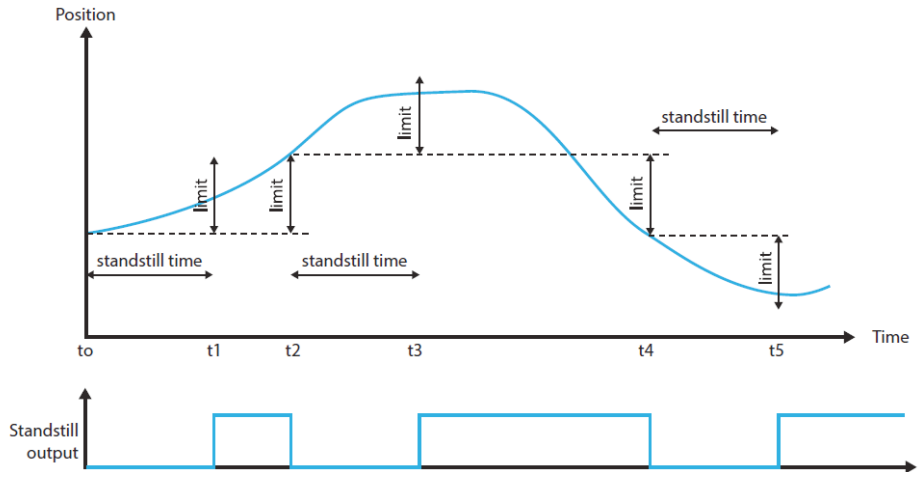


Figure 28 Activation/deactivation of standstill

Maximum movement allowed
– The amount of permitted movement is specified here, in mm or revolutions. Minimum: 1 mm, maximum 10 000 mm. This value is the maximum based on circumference and ratio.

Time movement is allowed
– Specify the permitted time to be considered as standstill. Minimum: 500 ms, maximum 10 000 ms.

Standstill output
– Choose the F-RO relay output that will be activated in the event of an alarm. No other safety functions can be used on the same output as standstill. Note that a pulsed signal must be used to comply with the requirement for Category 3 per EN ISO 13849-1.

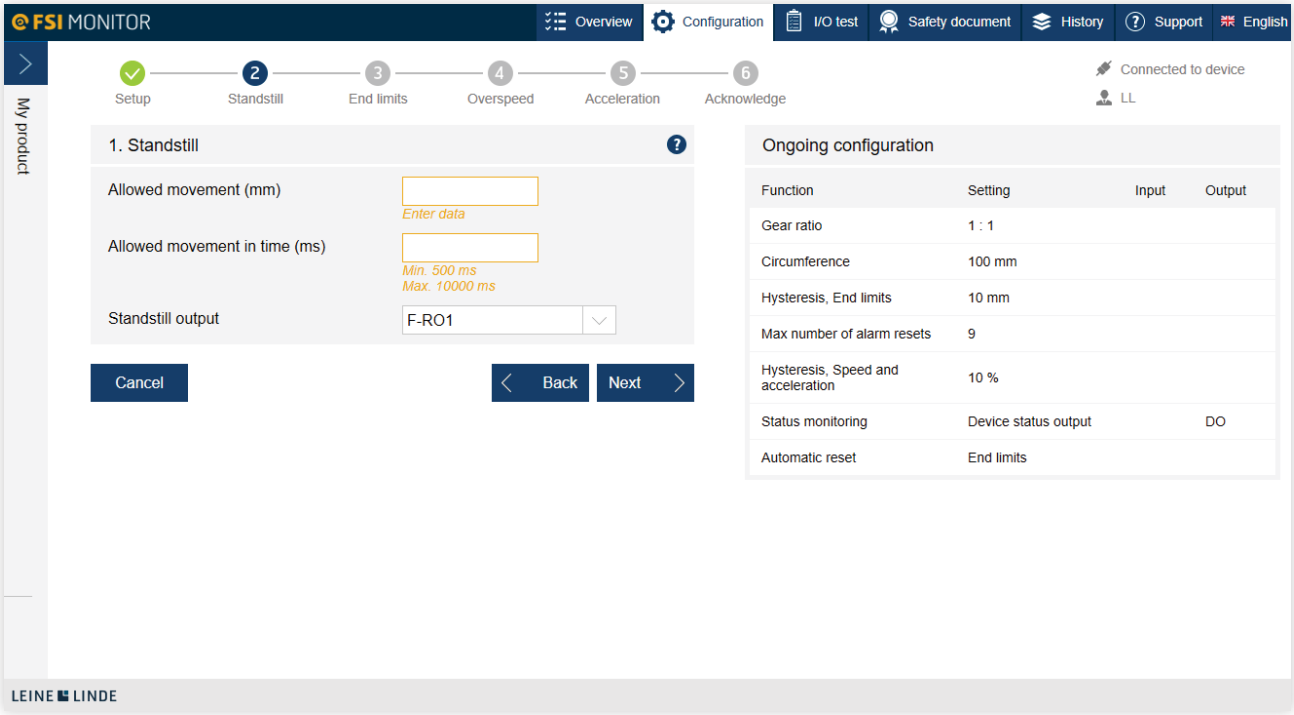


Figure 29 Standstill function

Example:
A crane located in an outdoor environment is often affected by the weather. A strong wind can cause the winch to sway and create minor movement in the crane drum. To prevent the unnecessary activation of safety functions, time and distance specifications for standstill are used to permit movement in the crane but without activating an alarm.

4.3.2 End limit settings with operating range configured in FSI Monitor

The end limits are specified to define the permitted range of movement by configuring the machine's selected positions. Movements beyond the positions entail activation of the failsafe relay output.

Note that configuration of the end limits cannot be exported. They must always be specified anew.

Total end limits – 1 or 2. You can always go back to the configuration and change this setting. To confirm the new end limit selection, recommissioning is required.

Start commissioning – To begin end limit configuration, approval is required by clicking "OK" in a dialogue box. The sole purpose of this dialogue box is to inform the user that the machine is now operable and that consequently, hazardous situations may arise. The operator is alone responsible so no dangerous situations occurs.

Designation of end limits – If the end limits need to be named, enter a name in this field.

Set end limits – Run the machine to the position that will correspond to the end limit, stop and then click the "Set end limit" button. The button is always active during commissioning in case the position of the end limit needs to be adjusted.

Set operating range – Run the machine to an arbitrary position between the end limits, stop and then click the button "Set operating range". This defines the permitted operating range for the configuration.

End limit output – Choose the relay output that will be activated by the end limits. Note that a pulsed signal must be used to comply with the requirement for Category 3 per EN ISO 13849-1. For more information on this, please refer to the mounting instructions of the product.

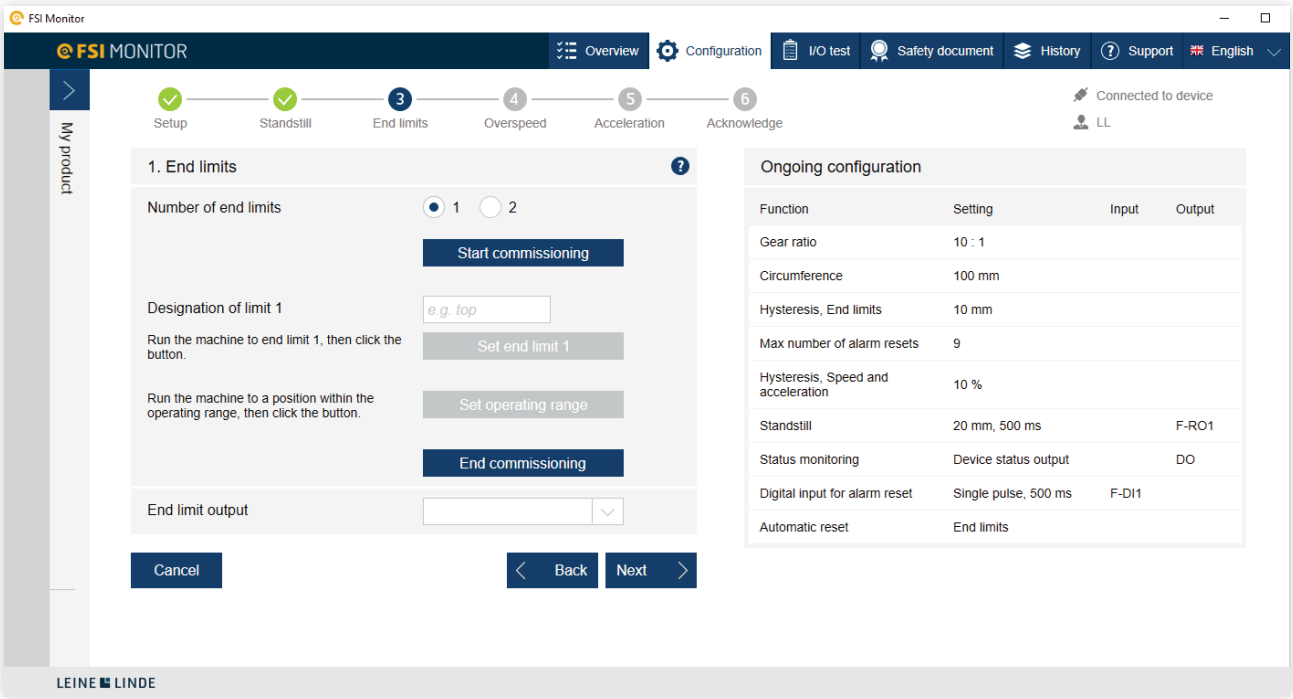


Figure 30 First step in configuring an end limit

Clicking "Start commissioning" is only possible after having verified that the machine is now operable.

4.3.3 End limits setting of operating range with one digital input F-DI

When the machine is totally still it is possible to use one F-DI to set the end limits. A logic High level on the selected F-DI for 5000 ±200 ms enables the Position End limit-set enable for 10 minutes. The Enable time is set to 10 minutes for each time new End limit-set enable. A logic Low level of minimum 500 ms on the F-DI is required prior to each new activation.

After the end limits is set with the F-DI, it is the users responsibility to validate that they are correct.

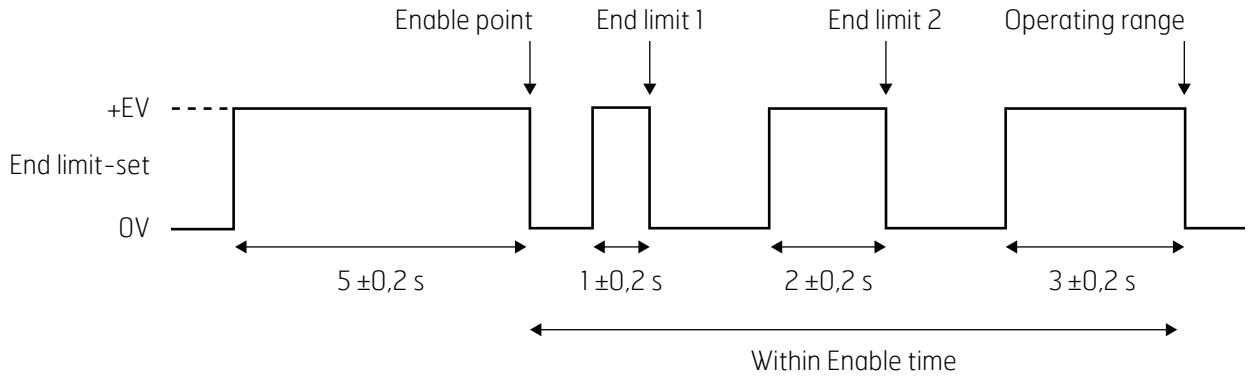


Figure 31 If the software is not connected to an encoder, the overview page will be empty and described in the upper-right corner.

4.3.4 End limit settings with zero position configured in FSI Monitor

By specifying a zero position for the machine, a range is defined based on how far the machine is permitted to operate in both directions from this central point.

Start commissioning – To begin end limit configuration, approval is required by clicking “OK” in a dialogue box. The sole purpose of this dialogue box is to inform the user that the machine is now operable and that consequently, hazardous situations may arise. The operator is alone responsible so no dangerous situations occurs.

Set zero position – Run the machine to the position that the operating range will be based on, stop and then click the “Set zero position” button. Commissioning is thereafter concluded by clicking “End commissioning”.

Operating range (mm) +/- – The maximum permitted operating range for the machine is set here. Input value applies to both directions based on the zero position. The operating range’s end limits in each direction are then defined as end limits 1 and 2. The operating range can be adjusted in the software at any time without needing to run the machine.

End limit output – Choose the relay output that will be activated by the end limits. Note that a pulsed signal must be used to comply with the requirement for Category 3 per EN ISO 13849-1. For more information on this, please refer to the mounting instructions of the product.

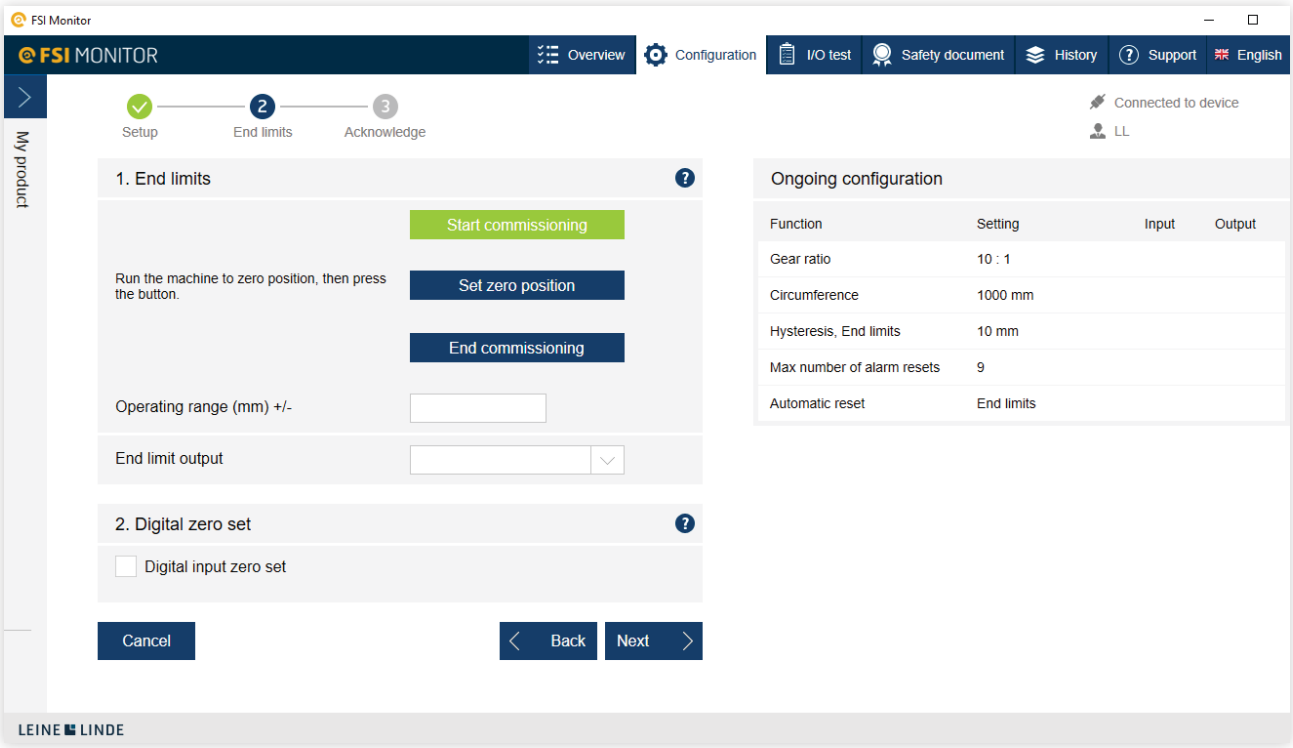


Figure 32 The end limits with zero position only require one specified position

The operating range is defined based on the set zero position for the specified machine.

4.3.5 End limit settings with zero set and one digital input F-DI

A logic High level on the selected F-DI for 4000 ±200 ms enables the Position Zero-set enable for 30 seconds.
The Enable time is set to 30 seconds for each time new Zero-set enable.
A logic Low level of minimum 500 ms on the F-DI is required prior to each new activation.

After the end limits is set with the F-DI, it is the users responsibility to validate that they are correct.

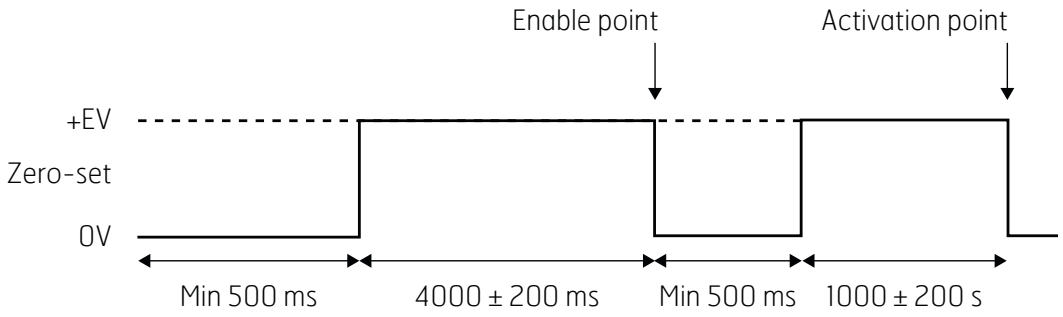


Figure 33 Pulse signal sequence needed for setting end limits from zero set.

4.3.6 Overspeed

To specify the overspeed limit values, the direction of travel must first be specified:

Start commissioning	– Activate after the user has verified that the machine is now operable. The operator is alone responsible so no dangerous situations occurs.
Direction (based on setting in Setup)	– Run the machine in the selected direction and then click the set direction button. Both selected directions must be set.
End commissioning	– Conclude specification of directions.
Limit value for overspeed	– Specify the maximum permitted speed when the speed monitor is to be activated. The limit value in both directions must be specified in the configuration. The speed value is limited by data specified in the "Setup" settings. The maximum speed value is limited in the configuration by the gear ratio.

The limit values for the overspeed are specified in step 2.

Speed limit CW	– The limit value for movement in clockwise direction.
Speed limit CCW	– The limit value for movement in counter-clockwise direction.
Overspeed output	– Selection of relay output for the speed monitor.

An additional speed monitor can be added in step 3. The speed monitor is connected to the selected input and when the input is active, the first speed limit is exceeded.

Speed limit CW	– The limit value for movement in clockwise direction.
Speed limit CCW	– The limit value for movement in counter-clockwise direction.
Overspeed input	– The input that activates the speed monitor. Note that to activate additional over speed limit a pulsed signal with a frequency of 100Hz is needed when using one digital input or a low to high transition on both DI-1 and DI-3 to comply with the requirement for Category 3 per EN ISO 13849-1.
Overspeed output	– Selection of relay output for the speed monitor.

Note: Even if the speed monitor is only needed in one direction, a value still must be specified for the opposite direction. It is then advisable to specify a high value so as to avoid the risk of this monitor affecting other functions in the machine.

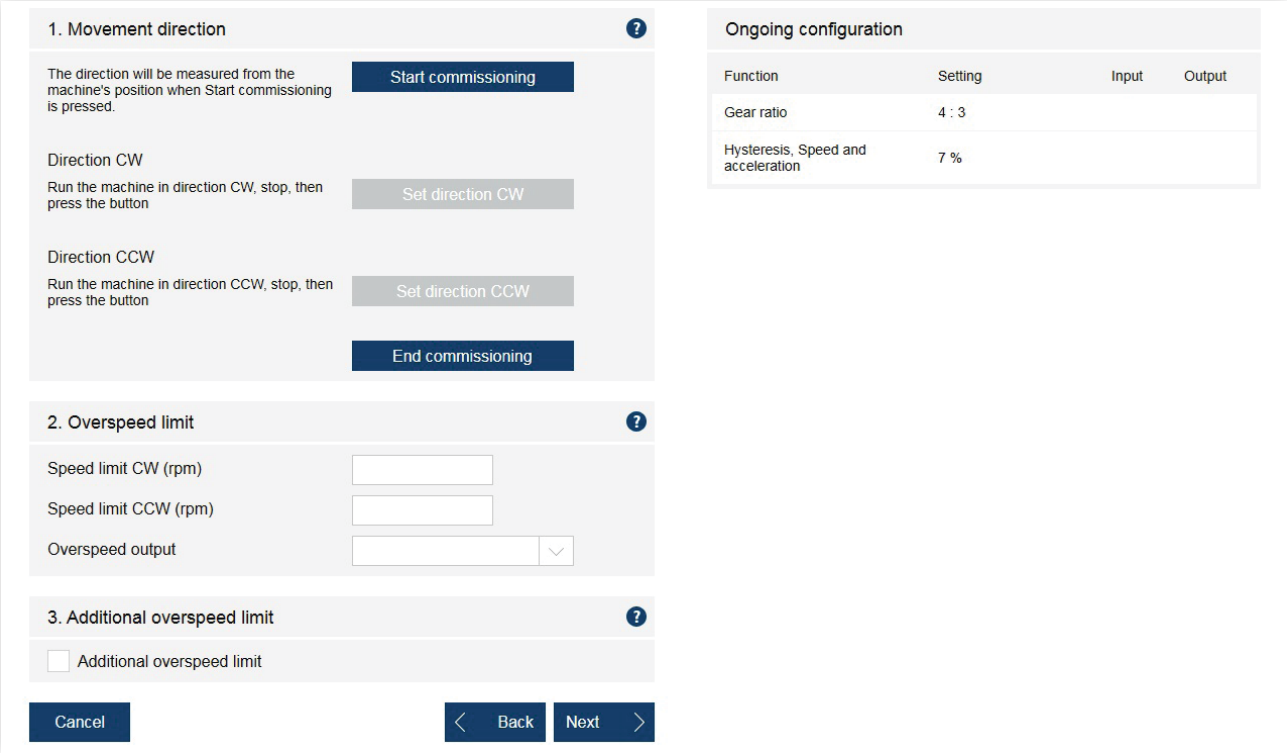


Figure 34 Overspeed configuration; one or two speed value limits may be selected

Example:
The speed monitor is used on a crane drum to control the speed and to guarantee that it is not exceeded. With a full load, the speed values are specified to control up and down crane movement. A higher speed is specified for up and a lower for down since there is always a lorry under the crane that is to be either loaded or unloaded.

The extra speed monitor is used for empty loads and is controlled by an input that is activated by the operator. Because the load is lighter and strain on the crane lower, the speed can be higher than with a full load, but any risks are still avoided.

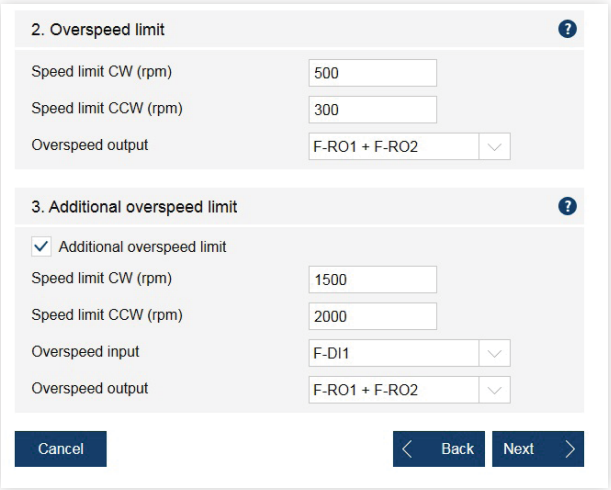


Figure 35 The additional overspeed is activated by one of the failsafe digital inputs.

4.3.7 Acceleration

Direction setting are the same for overspeed and acceleration.

Note that if no overspeed is used, the direction setting must be specified in the acceleration configuration.

Acceleration limit CW – The limit value for acceleration in clockwise direction.
Acceleration limit CCW – The limit value for acceleration in counter-clockwise direction.
Acceleration limit output – Selection of relay output for Acceleration.

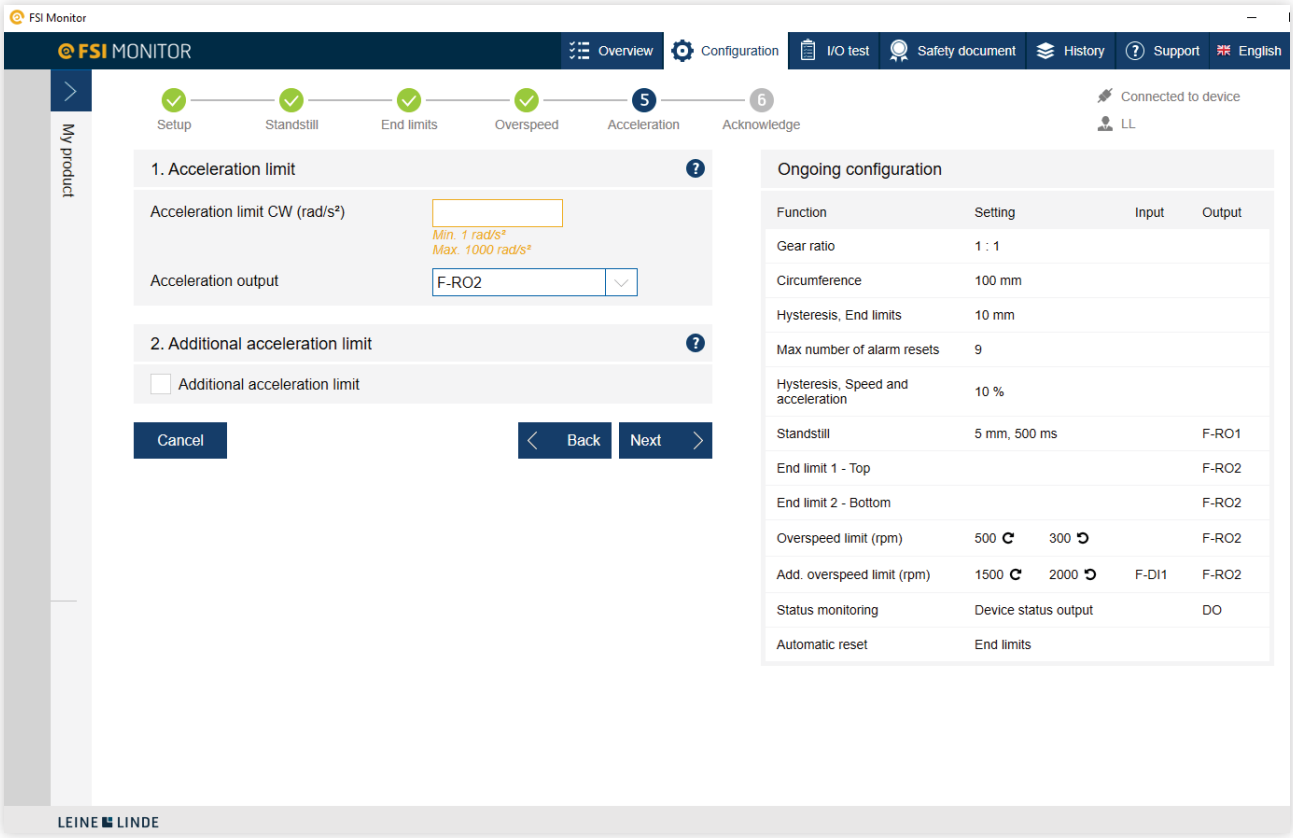


Figure 36 Page for configuration of the limit value for acceleration

An additional acceleration limit can be added in step 2. It is connected to the selected input and when it is active, the additional acceleration limit is active.

Acceleration limit CW – The limit value for acceleration in clockwise direction.
Acceleration limit CCW – The limit value for acceleration in counter-clockwise direction.
Acceleration limit input – The input that activates the acceleration limit. Note that to activate additional overspeed limit a pulsed signal with a frequency of 100Hz is needed when using one digital input or dual input on DI-1+DI-3 with a low to high transition on both signals. Must be used to comply with the requirement for Category 3 per EN ISO 13849-1.
Acceleration limit output – Selection of relay output for the acceleration limit. For more information on this, please refer to the mounting instructions of the product.

Note: Even if an acceleration limit is only needed in one direction, a value still must be specified for the opposite direction. It is advisable to specify a high value so as to avoid the risk of this monitor affecting other functions in the machine.

Example:
An acceleration limit is needed for a crane drum. This is necessary because the load can accelerate faster than permitted, leading to a dangerous situation despite the limit value for the specified speed monitor not being exceeded. Acceleration is thus an important addition and must be specified.

4.4 Confirm configuration

Once the entire configuration has been completed, it must be checked, confirmed and thereafter activated in the FSI encoder. All this is done in “Acknowledge”.

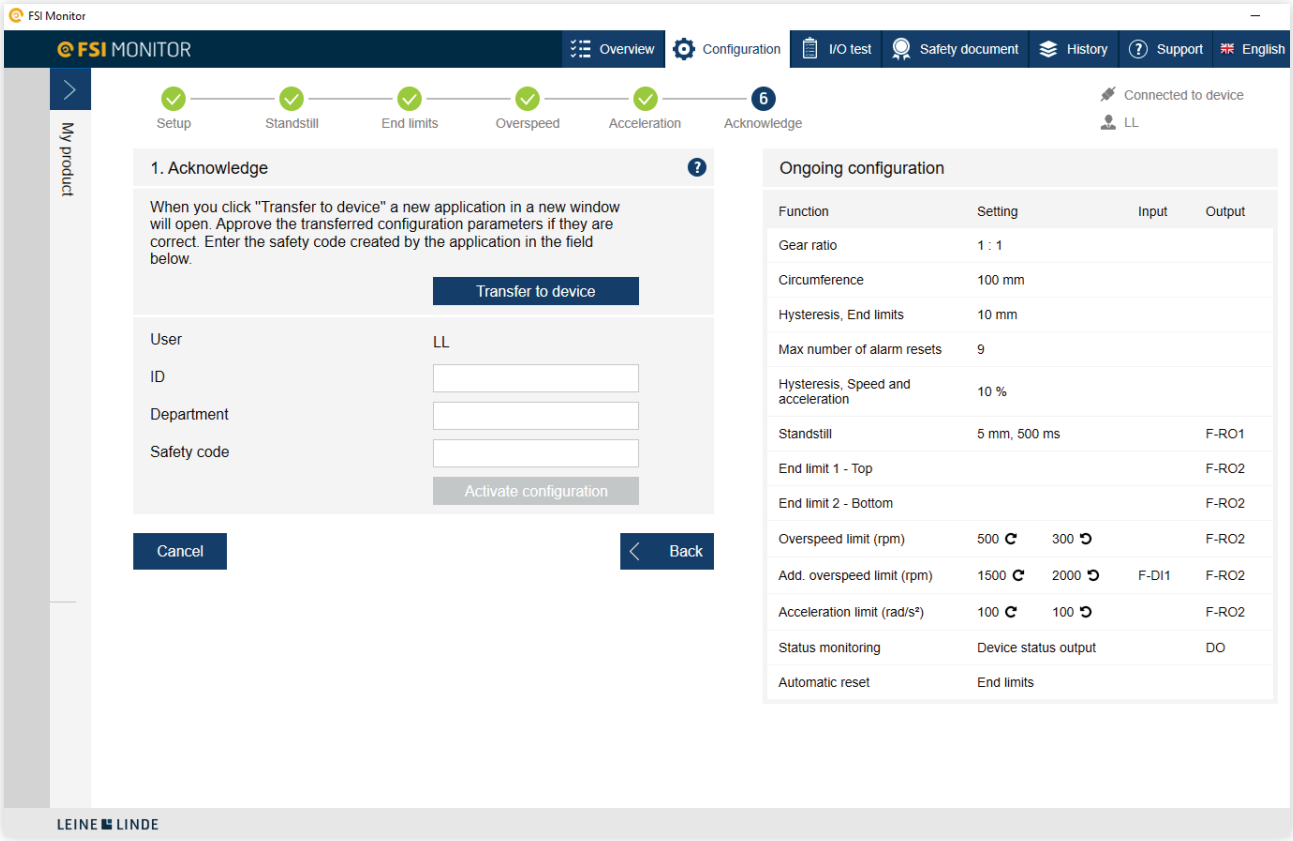


Figure 37 Sending the configuration to the encoder overwrites the previous configuration

By clicking “Transfer to device”, the configuration is sent to the device, after which the user must confirm that the sent configuration is correct. This is done by comparing the information presented in the overlying window with “Ongoing configuration”. If everything is correct and is according to safety requirements in the application, click the checkbox for generating a security code.

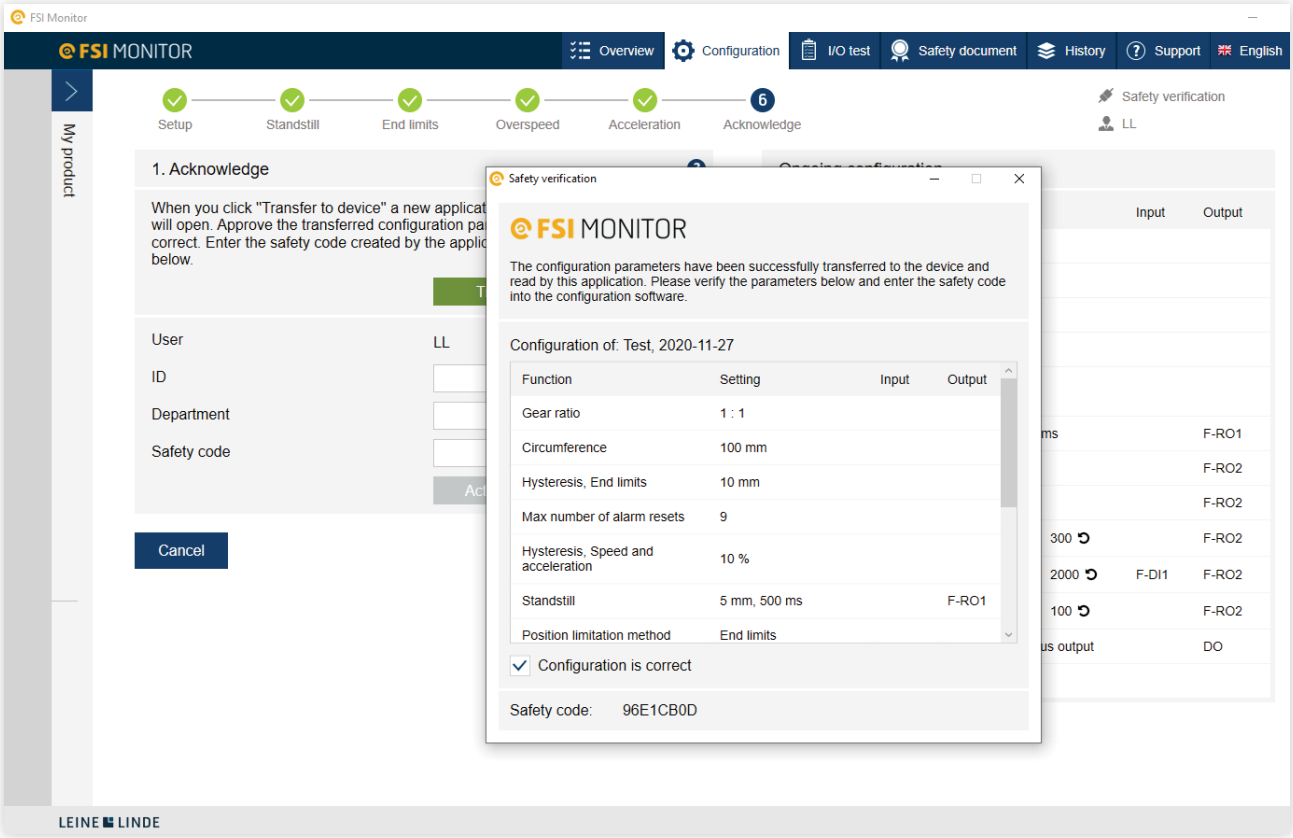


Figure 38 By having the active configuration to the right, it is easy to verify the new configuration

The user is responsible for testing his or her safety functions to guarantee full functionality. The software can even help to print this information in the safety document.

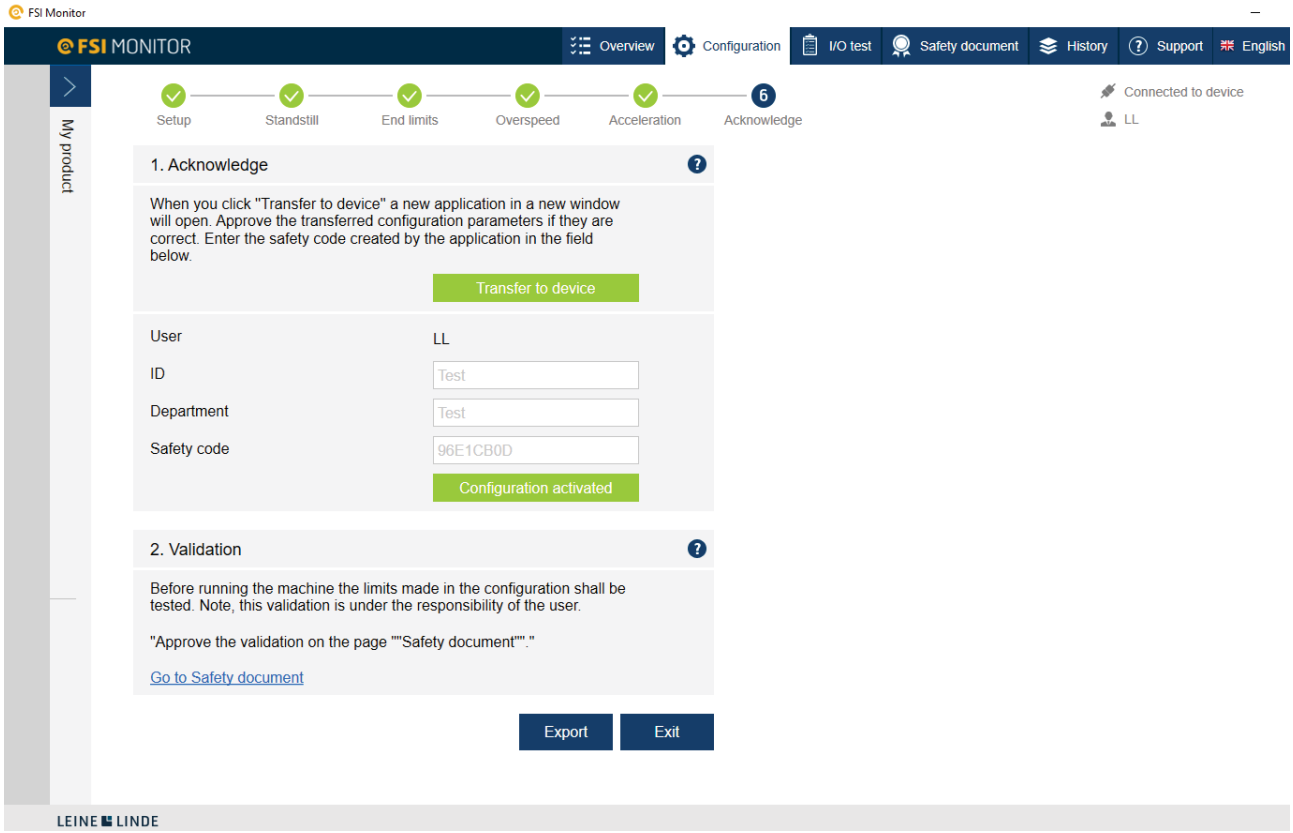


Figure 39 An easy way to validate the functions, which can be done afterwards.

By clicking “Exit”, configuration is terminated and the software returns to overview mode.

6 Error messages

In the event of an internal error in the device, the following information is communicated to the user in the FSI monitor interface.. The FSI device enters safe mode if any errors occur. If problems remain after action is taken, contact the nearest Leine Linde office.

Bit	Signal	Description	Action
1	Position error	Error when reading position from PSM has occurred (last valid position value has become too old)	Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced.
2	PSM supply	Supply voltage error	Restart the encoder. Check voltage supply to encoder. If voltage to encoder is OK it has to be replaced.
3	Temperature alarm	Temperature alarm has been triggered	Internal temperature is too high. Try to reduce ambient temperature or lower rotational speed.
4	F-DI verification	F-DI mismatch between FPGA1 and FPGA2	Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced.
5	Pos1/Pos2 diff	Difference found in Pos1/Pos2 com	Make an alarm reset. If problem remains an internal error is permanent and the encoder has to be replaced.
6	F-RO/DO error	Error in output readback value	Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced. Investigate output load and make sure it is within the specification.
7	PSM type verification	Wrong type or no support for safety functions	The internal position sensor module is of wrong type. The encoder has to be replaced.
8	PSM memory	PSM memory verification error	The memory of the internal position sensor module have been corrupted. The encoder has to be replaced.
9	PSM transmission	Error in PSM transmission has occurred	Data transmission from the internal position sensor module have taken too long. Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced.
10	Internal clock verification	Clock frequency error detected	A fault on the internal clocks have been found. Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced.
11	Internal interface verification	Error in communication between FPGA1 and FPGA2	A data mismatch has occurred. Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced.

Bit	Signal	Description	Action
12	Internal supply	Supply voltage error	An internal supply voltage error has occurred. Restart the encoder. If problem remains an internal error is permanent and the encoder has to be replaced.
13	Configuration parameter	Invalid parameter value or error in parameter CRC	A faulty configuration has been entered. Please make a new commissioning.
16	Commissioning error	Invalid commissioning parameters	Set end limits and/or set rotation direction and/or set reference position.

Table 1 Error messages

Revision history

Revision	Date	Changes
1.0	2017-06-29	First release
2.0	2019-03-21	Updeted information regarding DI for add. overspeed and add. acceleration. Added error code 16.
3.0	2021-05-24	Updated pictures and text for added functionality, zero set and end-limit setting with one F-DI and better info via acyclic parameters.

Table 2 Revision history

The best encoders and sensors are those you never have to think about. Those that simply do their job – year after year. Leine Linde develops and manufactures customized encoder and sensor solutions for demanding environments, advanced measuring systems for accurate feedback of speed, position or strain.

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