SpeedSys 200

Overspeed protection system

Manual

Doc.-No.: MSSY00038

Dutch innovation, German manufacturing.

Congratulations on taking this step in solidifying the safety of your critical assets with SpeedSys; SIL-rated overspeed protection characterized by Dutch innovation and German quality and reliability.

Before you continue...

We made every effort to design this product with great usability. But, as with any safety product, the understanding of its user is key. Therefore, we have created an online learning environment: The Istec Academy.

Istec Academy

Our free online learning environment is intended to provide valuable (video) content to become familiar with our products and related parameters.

By registering your product we are able to provide application-specific courses and support from our (over)speed specialists.

Register at https://members.istec.com

For more information about this product and other ISTEC products, please visit www.istec.com.

This document is subject to change without notice. The latest version of this document can be downloaded from the ISTEC website.

Important notice

This product has been tested according to the listed standards. If the product is used in a manner not specified by manufacturer the degree of protection may be impaired. Therefore, this user manual must be read completely, carefully and all safety instructions must be followed.

ISTEC has made every effort to include all specific safety-related instructions and warnings in this manual, but the completeness and accuracy of this data cannot be guaranteed. Not all possibilities or situations are described in this manual. Before using this product, the user must evaluate it and determine its suitability to the intended application.

This manual is written for operators and integrators of the SpeedSys 200 product. All operating personnel is expected to follow the specific safety related procedures and all applicable other (general) safety procedures. Operating personnel is assumed to have the necessary technical training and proven competence to enable them to install the product correctly and safely.

In case of unsafe, inexpert or irregular use, ISTEC will decline any liability or warranty claims.

About SpeedSys 200

SpeedSys 200 is a SIL-rated overspeed detection system for rotating machinery. It delivers the core layer of protection with a compact architecture.

Its small technical footprint and low impact installation enables advanced protection to a wide range of applications.

Index

1. General

Read this manual carefully and understand the safety instructions before use.

This manual is applicable to the following models:

- SpeedSys 200

1.1 Symbols used in this manual

This symbol indicates information, directives, procedures or precautionary measures concerning safety and the correct use of the device. Failure to obey this information could lead to injury or damage.

This symbol indicates that a product is compliant to ATEX production guideline 2014/34.EU (also known as ATEX 114). ATEX certified electrical equipment for explosive atmospheres must be marked with the 'Epsilon x' logo.

Electrostatic discharge: The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and EN 61340-5-2.

1.2 General handling precautions

- Do not drop the product or subject it to physical shocks.
- Protect the product using suitable protective materials when handling, storing or transporting the product. Remove all protective materials before installation and use of the product.

When storing the product, respect the environmental conditions as specified for the product.

1.3 Maintenance and cleaning

This product is an electronic device. There are no serviceable parts inside the product. The product should not be opened, modified, transformed or changed in any way. Return the product to the supplier for service and calibration. This product contains electrostatic sensitive components that can be damaged by electrostatic discharges.

All maintenance and repair should be carried out by the manufacturer of the product. If required, clean gently with a soft, dry cloth. Do not soak. Do not use steamer, ultrasonic, soap or brush. Avoid exposure to acids or chemicals. Damaged devices, mechanical or otherwise, must be labelled as 'unusable' and must be returned for service.

1.4 Parts and accessories

System components

- SpeedSys 200 module
- 9 removable connectors

Accessories

- USB cable [USB A to USB B mini]

Only use with the original components and accessories. Defective components and accessories may only be replaced by identical parts.

2. System overview

2.1 System description

SpeedSys 200 is a compact, yet versatile overspeed protection system. It forms the last line of defence as an isolated layer of protection against dangerous overspeed situations for heavy and/or (semi-)critical machinery with high speed, mass and/or accumulated energy.

2.2 Concept

Since the fourth edition of the API Standard 670, it states that overspeed protection shall be separate and distinct from the speed control system, and have its own speed probes. With SpeedSys 200 users can meet these requirements and have an independent and compact, yet reliable solution for overspeed, acceleration and underspeed protection.

SpeedSys 200 is a SIL 2 rated product that is 'safe by design'. Meaning that the reliability data of all components is known and the self-diagnosis does not temporarily suspend the monitoring and detection function. By performing a regular self-check, SpeedSys 200 manages to have a full proof test interval of typically 10 years, allowing users to plan a full proof test during outages.

With a compact architecture and small technical footprint SpeedSys 200 can easily be integrated into new designs, but is also ideally suited for retrofit projects.
The modularity and scalability of the product allows users to install a variety of voting structures all with the same product that can even be modified after initial installation. Having a single system, procedure and software for both low- and high-end rotating equipment will result in a lower economical and organizational footprint.

2.3 Application

SpeedSys 200 is a one-channel transmitter and is designed to be compatible with the most commonly used rotational speed probes; Hall-effect, electromagnetic (VR/

MPU) and 2-wire dynamic current eddy current (proximity). The input circuitry is internally galvanically isolated allowing for advanced sensor monitoring and negating the necessity for additional interposing relays. For generating trip signals every transmitter has two fast-signalling energized-closed safety relays (SIL2). Additionally, for warning or status signals every transmitter has two status/alarm relays (non-safety). These four outputs can all be individually configured. Moreover, the SpeedSys 200 is equipped with a SIL2 4-20 mA output for either protection or monitoring functions and a frequency output to relay the speed signal to tailing equipment.

2.4 Intended use

SpeedSys 200 is an industrial and professional overspeed protection system intended for heavy duty and/or (semi-)critical machinery in the oil, gas and process industry, but can also be used on wind or hydro turbines or any similar application. This device was designed for indoor use only. Do not use in wet locations. It must only be operated in an altitude up to 2000 m. This device is for use in applications within a pollution degree up to 2, overvoltage category II environment.

2.5 Environmental conditions

	Operating	Storage
Temperature	-20 to +60°C	-40 to +85°C
Humidity	5 to 80% non-condensing	5 to 85% non-condensing
Protection rating	IP20 according to IEC 60529	

3. Mounting and installation

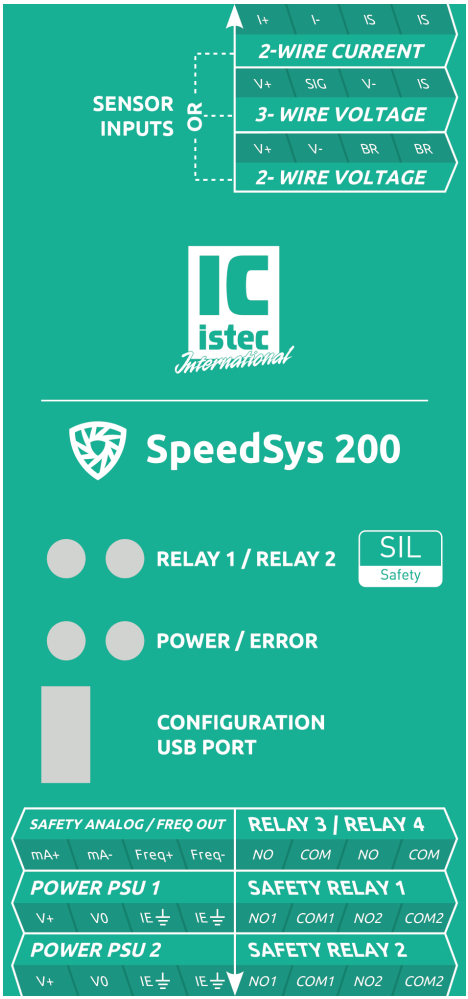
3.1 Module details

The front panel sticker contains basic information about the connectors, wiring connections and module status.

On the top side of the module there are three connectors for the signals coming from the respective sensor type.

The bottom side has four connectors for the output signals: relays, analog and frequency outputs. Two power connectors are used for a redundant power supply and earth connection.

Four LEDs allow for a status indication of the module. Two LEDs show the status of the two safety relays, open or closed, and two other LEDs are used to display the operational status of the module. The POWER LED shows if the device has booted properly. The ERROR LED indicates if there is a safety relevant problem with the input signals or the device itself. Details about the different status is explained in: **5.10 Status LEDs.**



A USB mini-B connector allows for configuration of the unit. The configuration is covered in detail in section 4 and 5.

The connector arrangement and details are described in the table below.

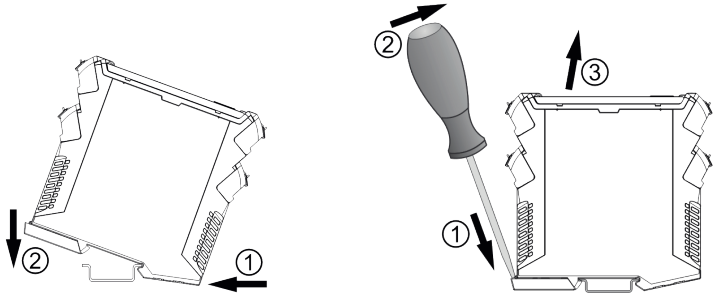
Top				Bottom			
Pin	Name	Sign	Function	Function	Sign	Name	Pin
A01	Air vent			Safety Analog output +	mA+	OUTPUT	A13
A02				Safety Analog output -	mA-		A14
A03				Frequency output: signal	Freq+		A15
A04				Frequency output: GND	Freq-		A16
A05	Air vent			Power supply 1 +	V+	POWER 1	A17
A06				Power supply 1 -	V0		A18
A07				Instrument Earth	IE		A19
A08				Instrument Earth	IE		A20
A09	Air vent			Power supply 2 +	V+	POWER 2	A21
A10				Power supply 2 -	V0		A22
A11				Instrument Earth	IE		A23
A12				Instrument Earth	IE		A24
B01	Sensor EM	V+	Electromagnetic Sensor: Signal	Relay 3 : NO3	NO	RELAY 3/4	B13
B02		V-	Electromagnetic Sensor: GND	Relay 3: COM3	COM		B14
B03		BR	Bridge to B04	Relay 4 : NO4	NO		B15
B04		BR	Bridge to B03	Relay 4: COM4	COM		B16
B05	Sensor HALL	V+	Hall Sensor: Power Supply	Safety relay 1: NO1	NO1	RELAY 1	B17
B06		SIG	Hall Sensor: Signal	Safety relay 1: COM1	COM1		B18
B07		V-	Hall Sensor: GND	Safety relay 1: NO2	NO2		B19
B08		IS	Intrinsically Safe Earth	Safety relay 1: COM2	COM2		B20
B09	Sensor EC*	I+	Eddy-current Sensor (current loop): Power Supply	Safety relay 2: NO1	NO1	RELAY 2	B21
B10		I-	Eddy-current Sensor (current loop): GND	Safety relay 2: COM1	COM1		B22
B11		IS	Intrinsically Safe Earth	Safety relay 2: NO2	NO2		B23
B12		IS	Intrinsically Safe Earth	Safety relay 2: COM2	COM2		B24

**) 2-Wire dynamic current eddy current probes ONLY! Other eddy current sensors require an isolator, which will disable some of the advanced sensor monitoring.*

The images below show the pin configuration on the physical unit. The label is designed to be intuitive and lead the user to the right pins and connectors.

3.2 Module dimensions and installation

The product is designed to work with standard DIN rail. For installation, the device is clipped onto the upper part of the DIN rail and pressed down until the lock snaps in. For deinstallation, the lock is loosened with a slotted screwdriver and the device is removed upwards (see following figures).

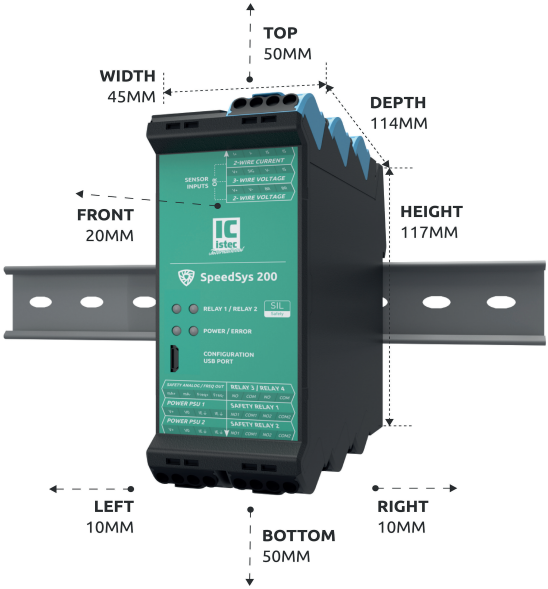


Mounting (left) and demounting (right) of the unit.

Install the device in a suitable housing with a suitable degree of protection in accordance with IEC 60529 in order to protect it from mechanical and electrical damage.

Electrostatic discharge: The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and EN 61340-5-2.

Observe the minimum mounting distances to allow for sufficient cooling. If the SpeedSys 200 is connected to circuits entering explosive areas, the general installation regulations for explosion protection EN 60079-14 and the applicable safety directives must be observed.

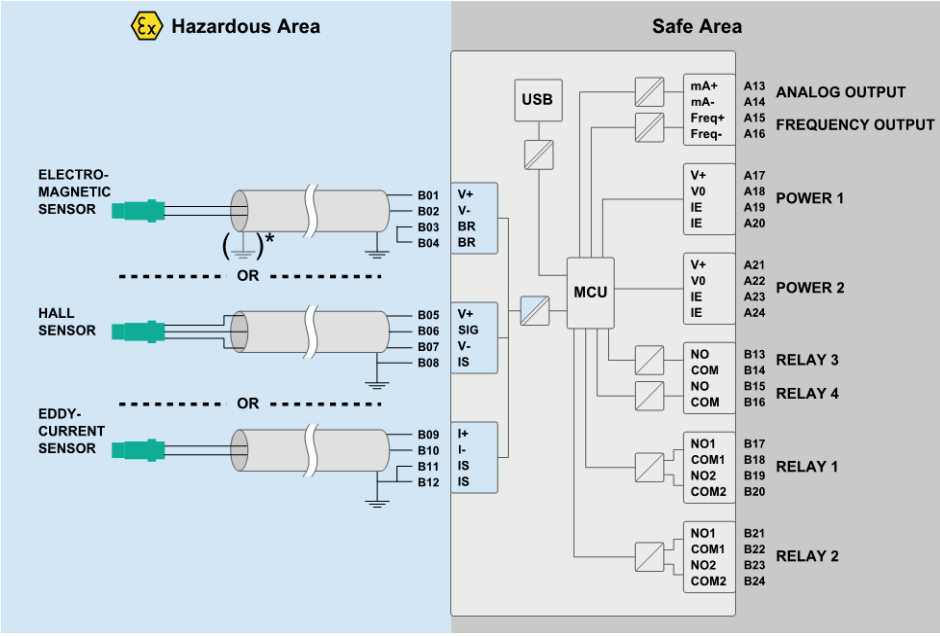


The electrical connections are established via screw terminals. Use a matching screwdriver to loosen and tighten the screws before and after inserting the wire into the clamp. The entire pluggable terminal block, containing 4 contacts can be removed by flipping the lever. A factory defined coding prevents the permutation of the terminal blocks.

3.3 Connection diagram

The figure shows the electrical interfaces for the product. The sensor inputs are short circuit proof.

> Observe the information in the datasheet before connecting electrical interfaces.



SpeedSys 200 connection diagram

**) install in controlled electromagnetic environment or connect both sides of cable shield to intrinsically safe earth*

Note: Only one sensor is allowed to be connected at a time.

WARNING: The use of an electromagnetic sensor (2-wire voltage sensor) requires a bridge to be set between the clamp-contacts B03 and B04 (see connection diagram). In case the 2-wire voltage sensor is not used, the bridge must be removed, to ensure full functionality of the device.

3.4 Functional grounding

This product requires functional grounding to avoid potential ground noise and EMI effects that can cause unfavorable operating conditions.

Each SpeedSys 200 module must be grounded through the instrument earth connections on the power supply connectors, as well as the intrinsically safe earth connectors at the sensor connection.

All connections must be installed with shielded cables. Connect all cable shields in the non-explosive area to instrument earth at both sides of the cable.

In case of the **3-wire voltage sensor** (hall sensor) or the **2-wire current sensor** (dynamic current eddy current sensor), the cable shield has to be connected to intrinsically safe earth at the device side. If disturbances occur and inductive interferences need to be reduced, both sides of the screen might be connected to intrinsically safe earth (observe the general installation regulations for explosion protection EN 60079-14, if installed in explosive areas).

In case of the **2-wire voltage sensor** (electromagnetic sensor), the SpeedSys 200 requires an installation in a controlled electromagnetic environment and the grounding of the sensor cable shield at the device side. Otherwise, both sides of the screen must be connected to intrinsically safe earth.

3.5 Creating voting structures

To obtain extra safety and/or availability for rotating machinery it is possible to create several hardwired voting structures with SpeedSys 200. Hardwiring the voting structures avoids the introduction of interposing relays or tailing PLCs, which would inevitably add failure modes to the whole chain, negatively affecting the calculations for the SIL level and therefore the overall reliability.

For SIL safety loops using safety relays 1 or 2 is mandatory. Technically it is possible to use relay 3 & 4 for 1oo2 and 2oo2 voting structures, but these won't be SIL rated. Wire configurations involving relay 3 & 4 will not be explored in this manual and are at the user's discretion.

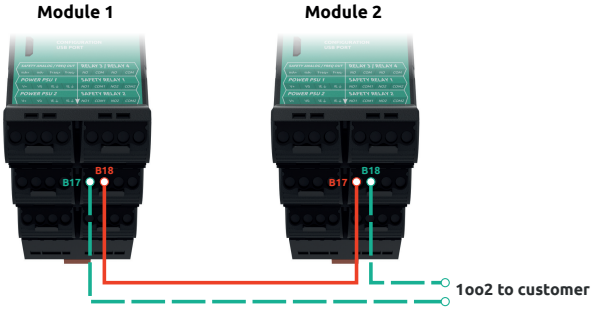
It is not recommended to mix differently numbered relays in one voting structure.

The following voting structure designations are regarded from a safety point of view.

1oo2

With two devices in series we can make a 1oo2 voting structure where a signal is given if one of the two devices switches its relay.

A graphical representation for a connection with two pins of safety relay 1 is shown below.



Since the safety relays are Double Pole Single Throw (DPST) relays, there are several ways the relays between the units can be wired. See tables for several suggestions including safety relay 2.

1oo2 using safety relays 1

Module 1	Module 2	To customer
B17		Wire out
B18	B17	
	B18	Wire out

1oo2 using safety relays 1

Module 1	Module 2	To customer
B19		Wire out
B20	B19	
	B20	Wire out

1oo2 using safety relays 2

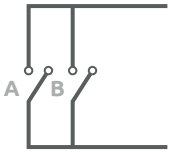
Module 1	Module 2	To customer
B21		Wire out
B22	B21	
	B22	Wire out

1oo2 using safety relays 2

Module 1	Module 2	To customer
B23		Wire out
B24	B23	
	B24	Wire out

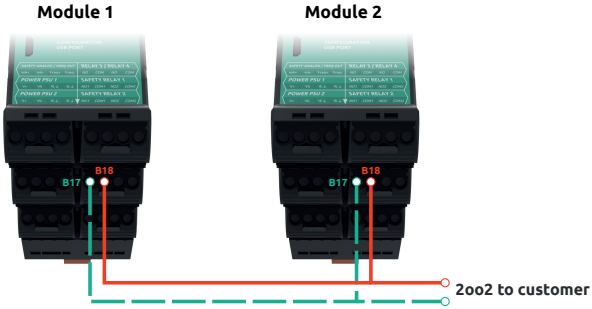
2oo2

With two devices in parallel we can make a 2oo2 voting structure where a signal is given if both devices switch their relays.



2oo2

A graphical representation for a connection with two pins of safety relay 1 is shown below.



Since the safety relays are Double Pole Single Throw (DPST) relays, there are several ways the relays between the units can be wired. See tables for several suggestions including safety relay 2.

2oo2 using safety relays 1

Module 1	Module 2	To customer
B17	B17	Wire out
B18	B18	Wire out

2oo2 using safety relays 1

Module 1	Module 2	To customer
B19	B19	Wire out
B20	B20	Wire out

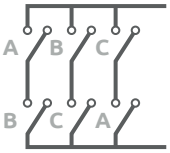
2oo2 using safety relays 2

Module 1	Module 2	To customer
B21	B21	Wire out
B22	B22	Wire out

2oo2 using safety relays 2

Module 1	Module 2	To customer
B23	B23	Wire out
B24	B24	Wire out

2oo3



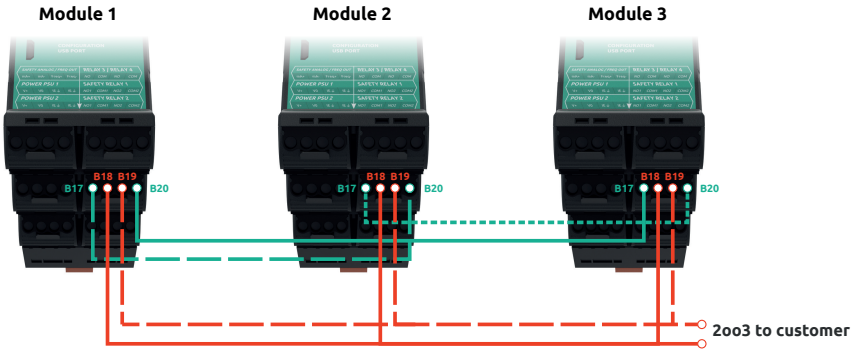
2oo3

Three SpeedSys 200 units can be connected to form a 2oo3 voting structure. The connection is achieved by hardwiring the Double Pole Single Throw (DPST) relays (relay 1 or 2) between the units.

The DPST relays allow for a hardwired voting structure as shown in the figure below where a signal is given when two out of three devices switch the relays.

Every SpeedSys module has two DPST safety relays, so two 2oo3 voting structures can be made.

A graphical representation for the connections of safety relay 1 is shown below. For using safety relay 2 consult the tables below for the right pin numbers.



2oo3 using safety relays 1

Module 1		Module 2		Module 3		To customer
B17	← →	B20				
		B17	⇠⇢	B20		
B20	⟷			B17		
B18	⟷	B18	⟷	B18	⟷	Wire out
B19	← →	B19	← →	B19	← →	Wire out

2oo3 using safety relays 2

Module 1	Module 2	Module 3	To customer
B21 ← – →	B24		
	B21 ←·····→	B24	
B24 ←——→		B21	
B22 ←——→	B22 ←——→	B22 ←——→	Wire out
B23 ← – →	B23 ← – →	B23 ← – →	Wire out

3.6 Safety Instructions: Functional Safety

The SpeedSys 200 is equipped with two microcontrollers that mutually monitor each other, the 'Duotec' system.

For all information and installation instructions concerning functional safety, see the functional safety manual.

3.7 Safety Instructions: Explosion protection

The SpeedSys 200 has the following explosion protection marking:

Ex II (1) G [Ex ia Ga] IIC

Ex II (1) D [Ex ia Da] IIIC

Category (1) G equipment:

As a certified category (1) G equipment, the device may only be mounted in the ex-safe (non-hazardous) area. The protected sensor circuits (B01-B02, B05-B06-B07, or B09-B10) may reach into areas, requiring 1G, 2G or 3G equipment.

Category (1) D equipment:

As a certified category (1) D equipment, the device may only be mounted in the ex-safe (non-hazardous) area. The protected sensor circuits (B01-B02, B05-B06-B07, or B09-B10) may reach into areas, requiring 1D, 2D or 3D equipment.

HAZARD: As an associated apparatus, the SpeedSys 200 must be mounted outside the explosive area.

HAZARD: If the SpeedSys 200 is connected to circuits entering explosive areas, the general installation regulations for explosion protection EN 60079-14, the applicable safety directives, and the instructions of the operation manual must be observed. Specifically, attention must be paid to strict compliance with the ambient conditions and connection parameters (see section 7.2) as well as the hints on mounting and grounding (see section 3). Only one sensor is allowed to be connected to the system at a time. The installation of explosive systems must always be carried out by qualified personnel.

HAZARD: When carrying out measurements on the intrinsically safe side, be sure to observe the relevant regulations regarding the connection of intrinsically safe equipment. Only use devices approved for use in intrinsically safe circuits.

HAZARD: If the device has been used in non-intrinsically safe circuits, it must not be used again in intrinsically safe circuits. Clearly label the module as being non-intrinsically safe.

HAZARD: The circuits inside the device must not be accessed. Do not repair the device yourself, but replace it with an equivalent device. Repairs may only be carried out by the manufacturer.

4. Programming

This programming manual is applicable to the software version 1.0.

4.1 Get started: connect to PC

Connect to PC

- Turn the device on by supplying 24V_{DC} (18 - 36 V_{DC}) to the unit.
- Connect the product to a PC using the USB interface. The first time it may take a while for the computer to find and install the USB COM port.

Note: The software is supported by Windows version 7 or higher. Connect the USB cable BEFORE opening the software. On opening, the software detects all the available COM ports.

Open the SpeedSys 200 software

Drag the software to a desired location on the PC. The software doesn't require installation. Run the software by double clicking the icon. The latest version of the software can be downloaded from the manufacturer's website www.istec.com.

When the application is started it loads a language pack from the same folder. If the language pack is missing the application reverts to its default language embedded in the application, which is English. Make sure that the folder contains only ONE language file.

Note: Some anti-virus suites may block or require additional approvals to run third party applications.

Information circles and field types

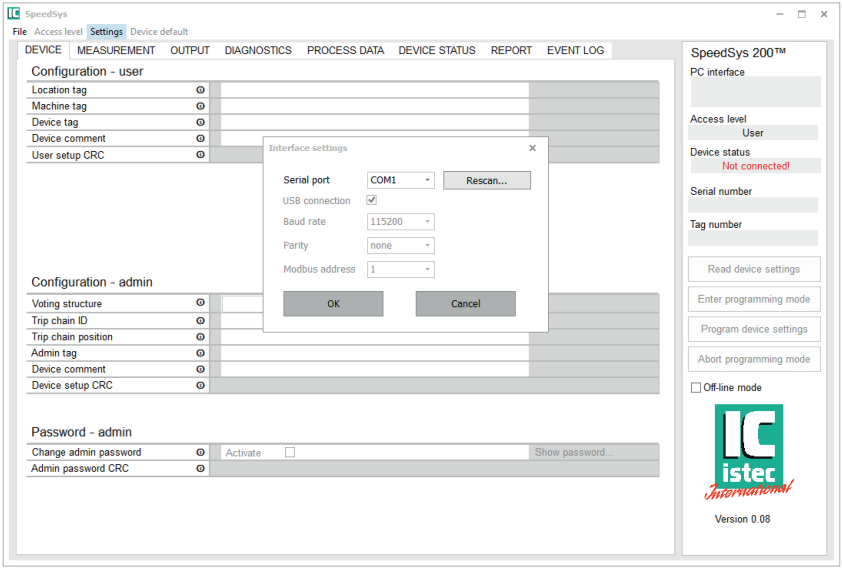
The fields and buttons in the application come with a help text that can be seen by holding the mouse over the information circles at the end of each field or over the button.

The fields come in three types [TEXT], [INPUT] and [OUTPUT].

Field type	Meaning
[TEXT]	The content of this field does not affect the operation of the unit. It is however sometimes important information that needs to be included in a commissioning report.
[INPUT]	This field does indeed affect the operation of the unit and changing it will change the behaviour and functioning of the unit.
[OUTPUT]	Values in this field are output from the unit and cannot be edited.

Select the COM port

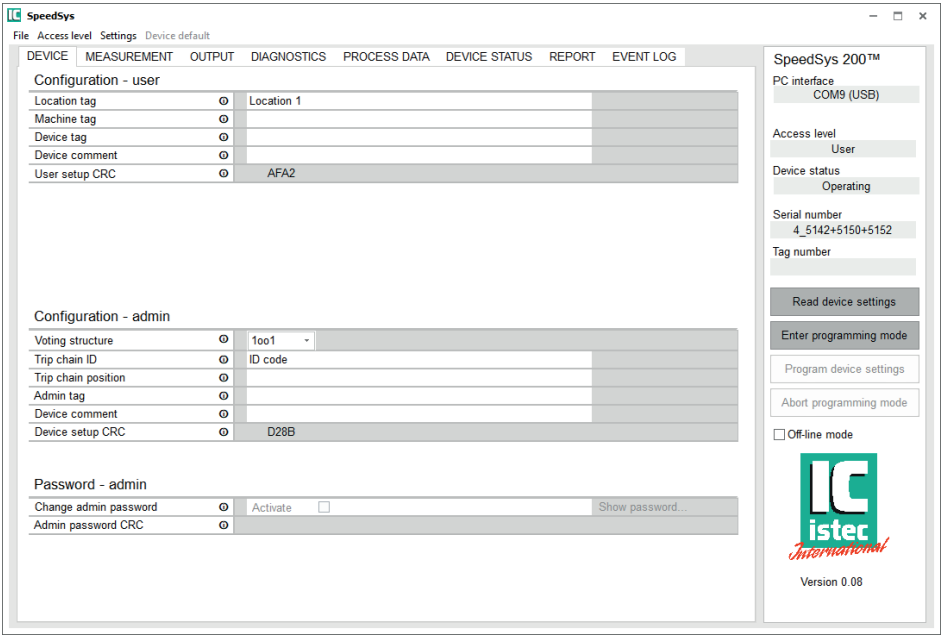
In the software, select the COM port the product is connected to by clicking *Settings - Interface Setup*. If the device is connected via USB, make sure the checkbox USB connection is enabled. If the device has been connected after startup, you may have to click the *Rescan…* button in order to see the device. By connecting and disconnecting the device and clicking the *Rescan…* button you can identify the COM port that corresponds to the device.



The device is now connected to the software. Continue the software configuration.

4.2 Module configuration

After the software has detected the connected module, the software is ready to read the configuration. The status and identification of the connected device is displayed on the right side of the window. *PC interface* displays the port number, *Access level* shows the access permissions. Also, the Device status, the serial number and the tag number are displayed. By clicking *Read device settings*, the current settings are downloaded from the device into the PC software.



The SpeedSys 200 has two layers of permissions. Firstly, the category *user* has basic access permissions. Settings such as location, machine and device tag can be configured.

Secondly, the layer *admin* features higher permissions and can parametrize the voting structure, trip chain and dedicated administrator tags as well as device comments.

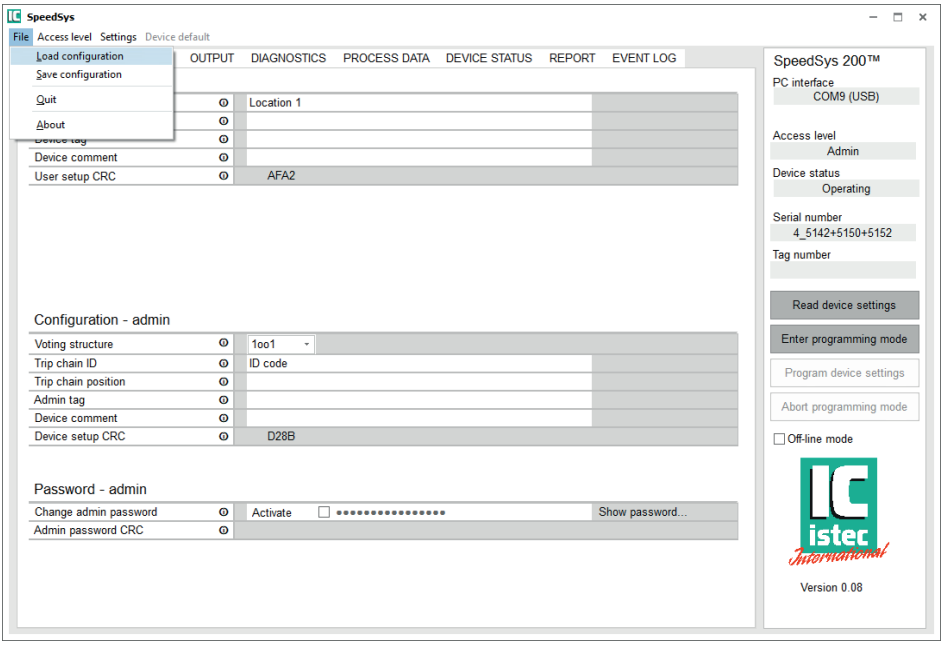
The *admin* access can be entered, by clicking *Access level, Admin* and by entering the

password. The initial password to access the *admin* layer is "*speedsys*". Changing the password after the first login is highly recommended. The *admin* password can be set only with admin layer permissions. If the *admin* password is lost, the device must be returned to the manufacturer.

4.3 Loading and saving configuration files

The configuration file can be saved to a PC.

A stored configuration file can be loaded in the software.



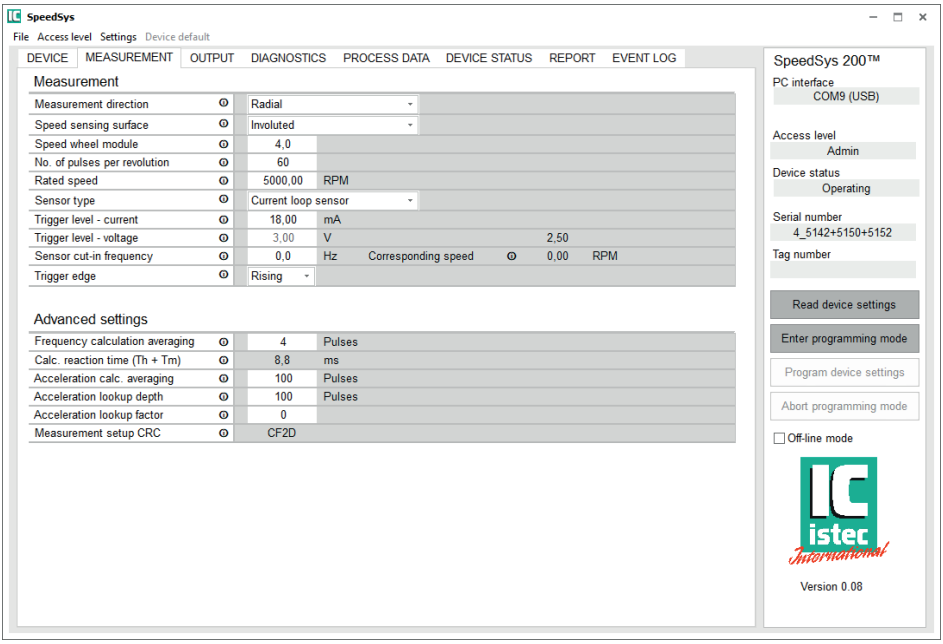
The entry fields under 'Configuration - admin' are required to create an IEC 61511 compliant report. Make sure to enter correct data.

These parameters are text only and do not affect the operation of the unit.

5. Commissioning

5.1 Measurement parameters and settings

To create a fully functioning configuration, all of the necessary fields and boxes need to be filled and selected.



Measurement

- **Measurement direction**

  Three measurement directions can be selected: *Axial, Radial* and *Tangential*. If *Axial* is selected, the sensor measures along the machine's axis. Selecting *Radial* switches to measuring perpendicular to the machine's axis. *Tangential* means measuring the axis under a certain angle.

- **Speed sensing surface**

  Four options for the speed sensing surface are available: *Involute* (typical gear wheel shape), *Slotted* (squared teeth on speed wheel), *Pole band* (toothed band around machine shaft), and *Holes* (drilled holes which are typically located axially)

- **Module**

  Enter factor of speed wheel diameter divided by the number of teeth (e.g. a diameter of 200mm and 100 teeth result in a module of 2)
- **No. of pulses per revolution**

  Defines how many pulses refer to one revolution of the rotary setup. Required for correct rotational speed calculation.
- **Rated speed**

  Defines the operational speed of the machine. This value affects the scaling of the graphical display on the *Process Data* tab.
- **Sensor type**

  The device features three different sensor types that activate the corresponding functionality in the software upon activation: the *2-wire current* is meant for 2-wire dynamic current eddy current sensors. The *3-wire voltage* uses the 3 wire voltage input for powered Hall effect sensors. *2-wire voltage* is used for self-generating types of probes like variable reluctance (VR) or electromagnetic probes (MPU). The input voltage ranges from 20 mV_{RMS} to 80 V_{RMS}.
- **Trigger level – current / voltage**

  Configures the threshold for current or voltage signals. Above the threshold, a signal is assumed to be a pulse. *For current*: applicable for 2-wire dynamic current input (2-wire: 18mA per default) *For voltage*: applicable for 2-wire and 3-wire input. (3-wire: 3V per default; 2-wire: best engineering practice)
- **Sensor cut-in frequency**

  Defines a lower frequency limit of a reliable sensor signal. Below this limit the evaluated speed and acceleration are assumed and outputted as 0 and no bad pulse evaluation is performed.
- **Trigger edge**

  Defines the trigger type as either a rising or falling flank.

Advanced settings

- **Frequency calculation averaging**

  Number of pulses for the calculation of the moving average of the frequency. Be aware that a higher setting negatively affects the system reaction time to speed events.

- **Calc. reaction time (T_m+rel)**

  This value is an estimation of the SpeedSys response time. It is the sum of the hardware and measurement reaction time. Hardware reaction time T_h is a fixed value (8ms). Measurement reaction time is the time it maximally takes to detect an event and is evaluated as the time between two pulses multiplied by the averaging. If on the OUTPUT tab delays are other than 0, they add to the total reaction time.

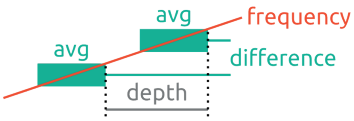
- **Acceleration calc. averaging**

  Number of pulses for the calculation of the moving average of the frequency, which is exclusively used for acceleration calculation. Be aware that a higher setting negatively affects the system reaction time to acceleration events.

- **Acceleration lookup depth**

  The acceleration value is evaluated from two frequency values and their time-stamps. For evaluation, the most recent frequency and one of the previous is considered. Which of the previous values is to be considered is determined by the user in the measurement configuration parameters as the “acceleration lookup depth”. This parameter can be set between 1 and 5000.

  The acceleration is calculated by dividing a frequency difference by the time that has passed. The difference is calculated from averaged frequencies (see following figure). The time between the two frequency averaging periods is defined by the depth-parameter (as it is given as a number of pulses, the actual time is frequency dependent).



- **Acceleration lookup factor**

  The lookup factor can be used for a dynamic lookup depth for the lower frequencies. If the lookup factor is used, the lookup depth is calculated by the ratio of the measured frequency and the specified lookup factor, as described in the following formula:

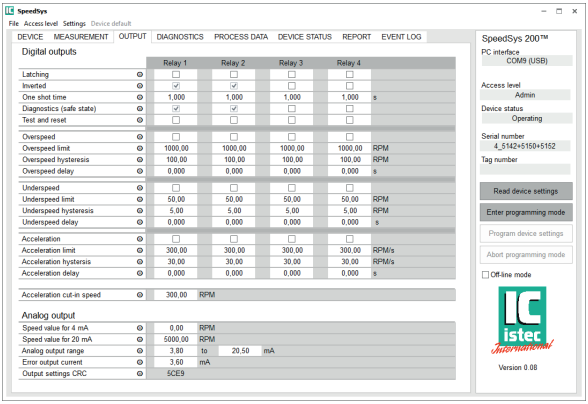
$$D_f = \frac{f_n}{X_{lookup}}$$

D_f Lookup depth calculated from depth factor. Lower limit is 1, upper limit is the fixed acceleration lookup depth parameter.

f_n Frequency evaluated for pulse n

X_{lookup} *Acceleration lookup factor*. If the parameter is set to 0, the fixed *acceleration lookup depth* parameter is applied.

5.2 Output configuration



The output configuration enables the user to define the behaviour of the digital outputs as well as the analogue output.

Each relay can be configured individually. Note that relay 1 and 2 are safety relays. Their output mode can't be configured; they are fixed normally open / energized closed. Additionally, the relays can't be disconnected from the device diagnostics; internal errors will always switch the safety relay.

Digital outputs

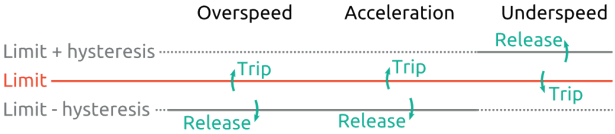
- **Latching**
  The latching function is a set/reset of the relay. Once the alarm has been activated, the relay switches to the NOT OK state. This state is set and remembered, even when the alarm is gone. The relay will go back to the normal state after a reset. To reset the relays, go to "Test and Reset" in the PROCESS DATA Tab.
- **Inverted**
  Determines the energized/de-energized state of the relay. For the safety relays 1 & 2 this option is fixed so that they are normally open. In case of a power interruption to the unit they will naturally switch open.
- **One shot time**
  Inoperable when Latching is activated. It determines how long the relay is held after tripping and it is released back to operational, given that a new trip event does not occur as that will reset the timer. This could be seen as a timed latch.
- **Diagnostics (safe state)**
  This will switch the selected relays in case of a diagnostic error. For the safety relays 1 & 2 this option is fixed to trip the machine. Diagnostic errors are listed on the DIAGNOSTICS tab.
- **Test and reset**
  This will switch the selected relays with the 'Test and reset' buttons on the PROCESS DATA tab.
- **Overspeed**
  This category parametrizes the overspeed indication. Activate the checkbox to enable overspeed indication for the respective output. The upper limit value of the rotation frequency, as well as the hysteresis and delay can be individually configured.

- **Underspeed**

  This category parametrizes the underspeed indication. Activate the checkbox to enable overspeed indication for the respective output. The lower limit value of the rotation frequency, as well as the hysteresis and delay can be individually configured.
- **Acceleration**

  This category parametrizes the indication of acceleration violations. Activate the checkbox to enable overspeed indication for the respective output. The upper limit for the acceleration can be configured, as well as the hysteresis and delay.
- **Overspeed / Underspeed / Acceleration Hysteresis and Delay**

  When the respective limit for overspeed or acceleration has been violated, the trip signal automatically latches until it falls below the limit minus the *hysteresis*. When an underspeed limit has been violated, the trip signal latches until it rises above the limit plus the *hysteresis*. See the figure below. The *delay* adds to the total reaction time. A trip is initiated if the duration of a trip event is at least as long as this time frame.



- **Acceleration cut-in speed**

  Define this parameter to set the minimal speed for which acceleration alarms are indicated. Below this speed, no acceleration alarms are evaluated

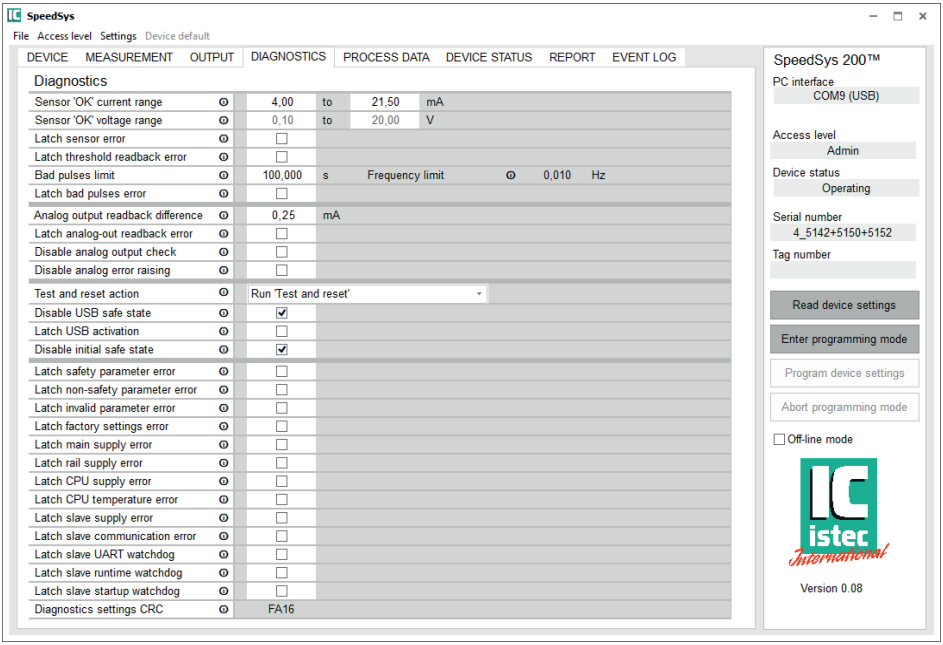
Analog output

- **Speed value for 4 mA / 20 mA**

  Calibrates the 4 – 20 mA output linearly.
- **Error output current**

  Defines the output current in case of diagnostic errors.

5.3 Diagnostics



- **Sensor 'OK' current/voltage range**

  Determine the ranges for a healthy sensor. A sensor exceeding these ranges will result in a 'sensor error'. These fields might grey out depending on the sensor type chosen on the MEASUREMENT tab.

- **Latch sensor error**

  This will keep the unit in 'safe state' after a sensor error and will require a reset to make it operational again.

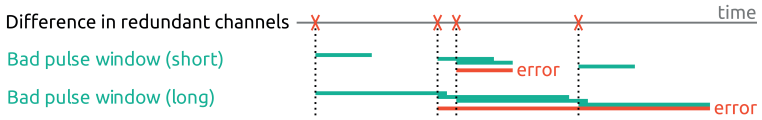
- **Latch threshold readback error**

  This will do a diagnosis on the user defined trigger level value and the actual internally used value.

- **Bad pulse window**

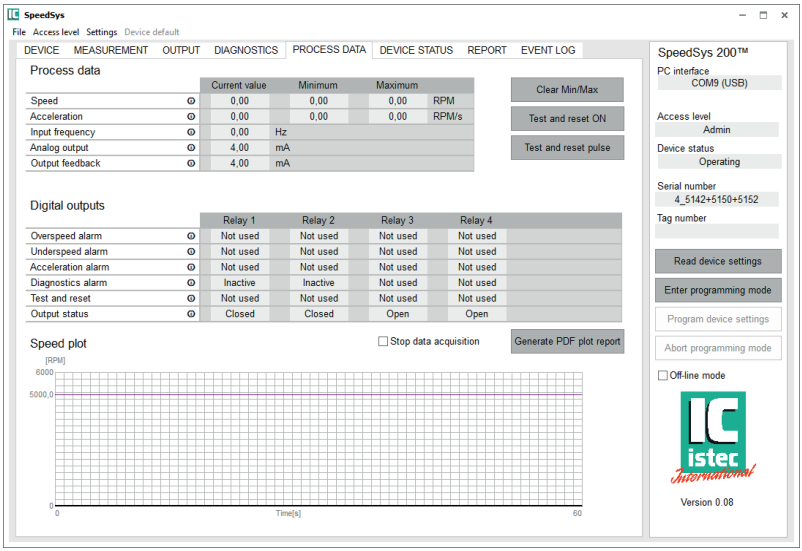
  Determines the time frame in which 2 or more bad pulses will result in an error. SpeedSys 200 exhibits a double, identical pulse detection circuitry, to allow for self-diagnosis. Any relevant difference between the two pulses will lead to a 'bad

pulse' for the duration of the bad pulse window (see figure). This typically happens around the trigger level as one circuit evaluates it as 'no pulse' and the other lets the pulse through.



- **Latch bad pulse error**
  This will keep the unit in 'safe state' after an bad pulse error and will require a reset to make it operational again.
- **Analog output difference**
  The allowed difference between expected and outputted current.
- **Disable analog output check**
  This prevents the 'Analog output difference' to cause a diagnostic error.
- **Disable analog error raising**
  This will prevent the analog out to output the error current when a diagnostic error occurs.
- **Test and reset action**
  Determines the behaviour when initiating a test with the 'Test & reset' buttons on the PROCESS DATA tab.
- **Disable USB safe state**
  This will disable the diagnostic error upon connecting a USB cable.
- **Latch USB activation**
  This will keep the unit in 'safe state' after a bad pulse error and will require a reset to make it operational again.
- **Disable initial safe state**
  This will disable the initial 'safe state' upon power up and the unit will become operational right away.
- **Latch *** error (remaining errors at the bottom of DIAGNOSTICS tab)**
  This will keep the unit in 'safe state' after the *** error and will require a reset to make it operational again.

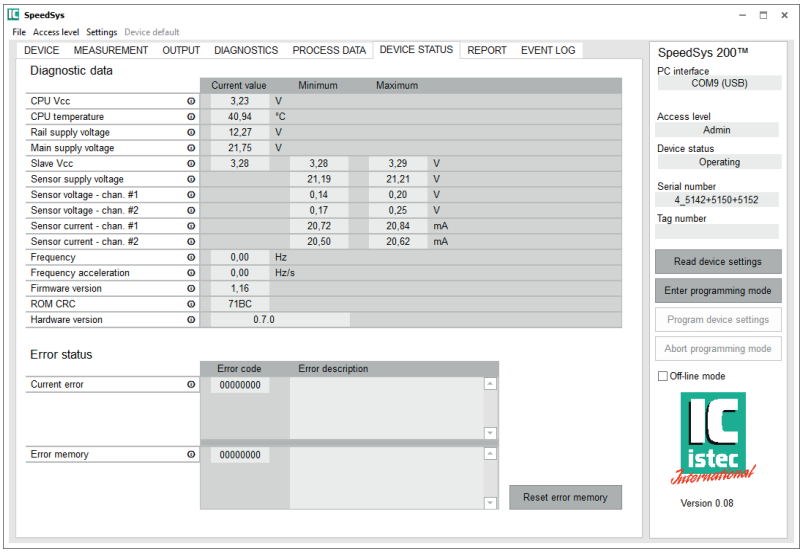
5.4 Process data



The *Process Data* window displays relevant information about the current state of the process parameters as well as the status of the alarm relays. Furthermore, the minimum and maximum measurement values are stored for speed and acceleration. The two bottom rows of the *Process data* block show the 'Analog output' and 'Output feedback'. The 'Analog output' is the expected output and the 'Output feedback' is the generated output. The speed measurement history is shown in a speed plot at the bottom of the window. The horizontal axis is scaled to 60 seconds, the vertical axis is scaled depending on the previously rated speed specified on the MEASUREMENT tab. By clicking *Output plot* to PDF, the plot can be exported.

- **Test and reset ON/OFF button**
  Activate/deactivate the 'Test and reset' function. This will switch the relays based on the settings on the OUTPUT and DIAGNOSTICS tab.
- **Test and reset pulse**
  Activate 'Test and reset' function for 100 ms. This will switch the relays based on the settings on the OUTPUT and DIAGNOSTICS tab.

5.5 Device Status



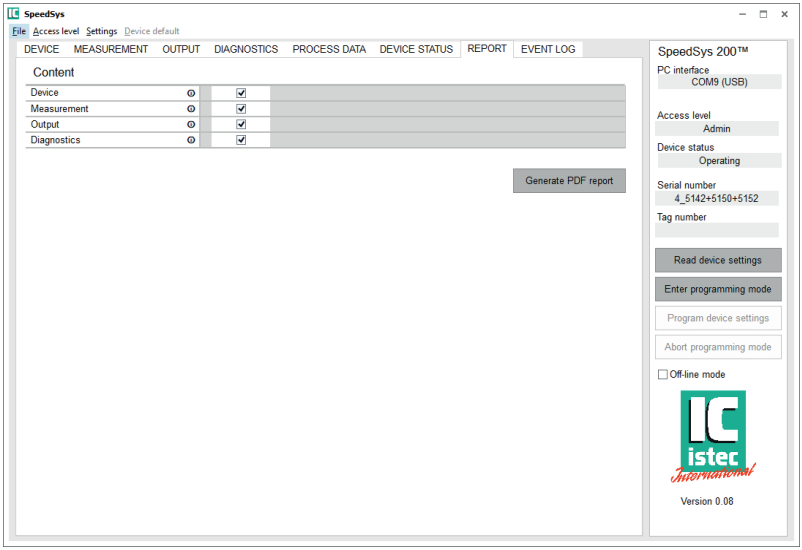
The *Device Status* window displays real-time information on different parameters. The user can observe the different supply voltages, the temperature and the sensor currents for each channel. The minimum and maximum values of the latest sampling period are stored. These numbers are updated every sampling period. Also, the current measurement values for frequency and acceleration are displayed.

Additionally, the device's firmware and hardware version and information on the cyclic redundancy check (CRC) are given.

On the bottom of the window, the error status is displayed. All current and latched errors are displayed including the respective error code. Past errors are stored in the error memory to give the user the ability to identify potential risks that are caused by short-term malfunctions or that remain undetected due to the short duration.

The error 'USB active' is an exception and will reset once the USB cable is disconnected.

5.6 Report



By clicking on *Generate PDF report*, the *Report* window allows the user to obtain a PDF file that contains information on the configuration of the SpeedSys 200. The content can be individually selected.

SpeedSys configuration report

Created: 10.11.2020 10:16

Serial number: 4_5142+5150+5152

Page 1 of 4

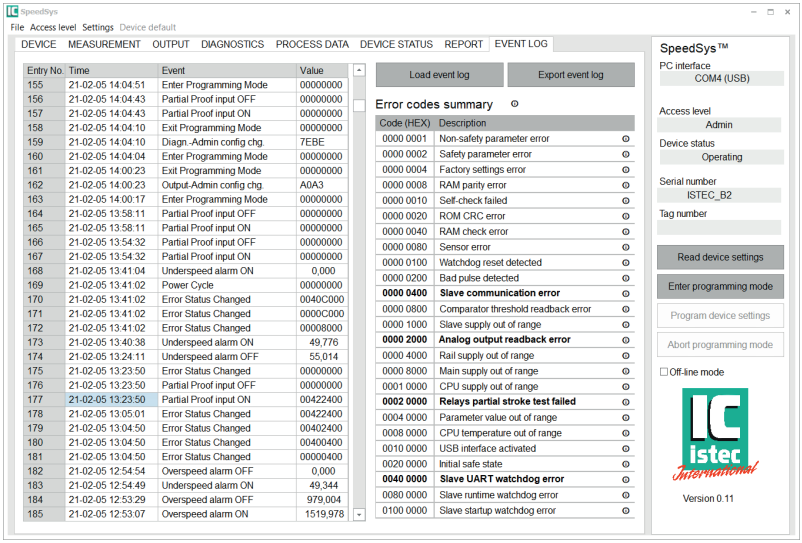
Configuration - user

Location tag	Location 1
Machine tag	
Device tag	
Device comment	
User setup CRC	AFA2

Configuration - admin

Voting structure	1oo1
Trip chain ID	ID code
Trip chain position	
Admin tag	
Device comment	
Device setup CRC	D28B

5.7 Event log



The EVENT LOG tab allows the user to review and download all events. With a SpeedSys unit connected click the ‘Load event log’ button to download the event log from the Speedsys unit.

SpeedSys 200 does not contain an internal clock, it counts the time when it is powered up. The displayed time stamps are calculated by using the current time of the connected computer. Periods in which the SpeedSys unit was powered down cannot be recognized.

All errors have a hexadecimal code. If multiple errors occur at the same time, the codes are combined. Holding the mouse over the error in the event log highlights the combination of errors on the right.

By clicking the ‘Export event log’ the event log can be downloaded as a .csv file.

Diagnostic error	Description
Non-safety parameter error	Bad CRC of parameter group 'configuration - user' (DEVICE tab) or bad CRC of non-volatile status. If error reoccurs, please return device to manufacturer.
Safety parameter error	Bad CRC in one or more of the following parameter groups: ▪ DEVICE tab: configuration - admin ▪ MEASUREMENT tab ▪ OUTPUT tab ▪ DIAGNOSTICS tab If error reoccurs, please return device to manufacturer.
Factory settings error	Bad CRC in one or more of following parameter groups: ▪ DEVICE config-factory ▪ DIAGNOSTICS-factory ▪ OUTPUT-factory ▪ Default DEVICE config-user ▪ Default DEVICE config-admin ▪ Default MEASUREMENT ▪ Default DIAGNOSTICS-admin ▪ Default OUTPUT-admin If error reoccurs, please return device to manufacturer.
RAM parity error	Parity error interrupt triggered. If error reoccurs, please return device to manufacturer.
Self-check failed	One or more of internal diagnostic tests failed. If error reoccurs, please return device to manufacturer.

Table continues on next page →

Diagnostic error	Description
ROM CRC error	Checksum error of internal ROM. If error reoccurs, please return device to manufacturer.
RAM check error	Checksum error of internal RAM. If error reoccurs, please return device to manufacturer.
Sensor error	Sensor error detected. The limit values entered in DIAGNOSTICS tab were exceeded.
Watchdog reset detected	Master MCU was reset by watchdog.
Bad pulse detected	Non-synchronism of redundant channels detected, see section 5.3 Diagnostics.
Slave communication error	Communication between master and slave MCU failed.
Comparator threshold readback error	The setting of the comparator threshold level has failed, due to a deviation of the readback value.
Slave supply out of range	Slave MCU supply voltage or sensor supply voltage out of range
Analog output readback error	Deviation of the analog output readback value from the nominal value detected, see section 5.3 Diagnostics.
Rail supply out of range	Internal rail supply out of range
Main supply out of range	External main supply voltage out of range
CPU supply out of range	Master MCU supply voltage out of range
Relays partial stroke test failed	Cyclic operability check of the relays failed. One or more of the relays cannot be controlled as intended.
Parameter value out of range	Parameter values stored in internal memory are out of permissible range. If error reoccurs, please return device to manufacturer.
CPU temperature out of range	MCU temperature out of range

Table continues on next page →

Diagnostic error	Description
USB interface activated	Safe state activated upon connecting a USB device. For configuration see section 5.3 Diagnostics.
Initial safe state	Safe state activated upon connecting a USB device. For configuration see section 5.3 Diagnostics.
Slave UART watchdog error	The slave MCU has stopped communication, which causes the device to enter the safe state.
Slave runtime watchdog error	Slave MCU was reset by watchdog during normal operation
Slave start-up watchdog error	Slave MCU was reset by watchdog during initial self-check (ROM, RAM, CPU)

5.8 Programming parameters

After configuring all parameters, the configuration has to be written to the device. This is only possible when the device is set to programming mode. In order to write the parameters to the SpeedSys 200, click *Enter programming mode*. This makes the device switch to the safe state. Proceed by confirming the safe state prompt. Now the *Device status* displays 'Programming – safe state'.

By clicking *Program device settings*, the parameters on the device can be overwritten with the new configuration.

5.9 Device statuses

The device can be in several operation statuses. This is shown on the right side under 'Device status' in the previous figures.

Device status	Description
Operating	Device is operational and actively monitoring. Switching relays will not affect the device status.
Safe state	The device has switched to safe state due to: ▪ detected diagnostic error. ▪ simulated diagnostic error with 'Test and reset' buttons on PROCESS DATA tab. ▪ initial safe state at power up (disable on DIAGNOSTICS tab) In the safe state relays selected after 'Diagnostics (safe state)' on the OUTPUT tab will switch.
Programming – safe state	Device is accepting new configurations and has switched to safe state. In the safe state relays selected after 'Diagnostics (safe state) on the OUTPUT tab will switch.

5.10 Status LEDs

The front panel of the SpeedSys 200 has four LEDs for status indication. See the table below for a detailed description of their status.

LED	Status	Description
Power LED (green)	on	Device is powered and booted up properly
Error LED (red)	on	Error (still present)
	blinks	Error (occurred in the past and is stored in the error memory)
	off	No errors were detected
Relay 1 LED (yellow)	on	Relay 1 is energized
	off	Relay 1 is de-energized
Relay 2 LED (yellow)	on	Relay 2 is energized
	off	Relay 2 is de-energized

6. Service

HAZARD: The circuits inside the device must not be accessed. Do not repair the device yourself, but replace it with an equivalent device. Repairs may only be carried out by the manufacturer.

6.1 Spare parts

- non listed-

6.2 Contact information

Istec International

Meer en Duin 8

2163 HA, Lisse Netherlands

+31 (0)252 433 400

www.istec.com

Questions and support?

We are ready to help you!

Visit www.istec.com/support

7. Technical information

7.1 Labels and certifications

Power supply (DC): 18..36 V, 315 mA

Instrument earth connection (functional earth, not safety earth)

The manufacturer declares that the product conforms to the applicable ATEX production directive 2014/34.EU.

The manufacturer declares that the product conforms to the applicable standards.

The manufacturer declares that the product conforms to the applicable standards.

The manufacturer declares that the product conforms to the applicable standards.

The manufacturer declares that the product conforms to the applicable standards.

The manufacturer declares that the product conforms to the applicable RoHS 2 directive 2011/65/EU.

The manufacturer declares that the product conforms to the applicable standard IEC 61508.

Product identifiers

MFR	H7368
Model	SSY200-000-001
SER	XX-xxxxx
PNR	ISTSSY2001

7.2 Specification

Input	
Sensor	
Explosion safety (sensor input only)	Ex II (1) G [Ex ia Ga] IIC (Gas) Ex II (1) D [Ex ia Da] IIIC (Dust)
Applicable standards (ATEX)	EN IEC 60079-0:2018, EN 60079-11:2012
Applicable standards (IECEx)	IEC 60079-0:2017, IEC 60079-11:2011
Eddy-current sensor *(Proximity)*	2-wire current input. Advanced sensor monitoring **2-Wire dynamic current eddy current probes ONLY! Other eddy current sensors require an isolator, which will disable some of the advanced sensor monitoring.**
Electronic sensor *(Hall-effect)*	3-wire voltage input. Advanced sensor monitoring
Electromagnetic sensor *(Magnetic pick-up MPU)*	2-wire voltage input. Open circuit detection
General sensor input	
Frequency range	0.025 Hz to 35 kHz
Input impedance	100 kΩ
Input voltage range	20 mV_{RMS} to 80 V_{RMS}
Permissible input current	Max. 200 mA

Table continues on next page →

Input	
Trigger level	0 V to 5 V (software selectable) 0.0 to 20.5 mA (software selectable)
Sensor supply	current loop supply: 21.0 V (@ 0 mA) to 20.0 V (@ 21 mA) 3-wire supply: 21.0 V (@ 0 mA) to 15.5 V (@ 15 mA)
Measurement accuracy	
Frequency measurement accuracy	0.05% Accuracy depends on frequency calculation averaging value.

Rating for Ex-Circuits	
2-wire current input	**Connectors B09, B10**
Maximum output voltage (U_o)	22.69 V
Maximum output current (I_o)	57.9 mA
Maximum output power (P_o)	689 mW
Maximum external inductance (L_o)	0.23 mH
Maximum external capacitance (C_o)	47 nF
3-wire voltage input	**Connectors B05, B06, B07**
Maximum output voltage (U_o)	22.69 V
Maximum output current (I_o)	66.0 mA
Maximum output power (P_o)	374 mW
Maximum external inductance (L_o)	0.50 mH
Maximum external capacitance (C_o)	110 nF
2-wire voltage input	**Connectors B01, B02 (B03, B04: bridge)**
Maximum output voltage (U_o)	22.69 V
Maximum output current (I_o)	0.7 mA
Maximum output power (P_o)	3 mW
Maximum external inductance (L_o)	100 mH
Maximum external capacitance (C_o)	110 nF

Rating for non-Ex-Circuits	
Supply input	**Connectors A17, A18 and A21, A22**
Voltage	18 V_{DC} to 36 V_{DC}
Current consumption	<315 mA
Maximum voltage (Um)	250 $V_{AC/DC}$
Current loop output	**Connectors A13, A14**
Voltage	20 VDC
Current rating	63 mA
Maximum voltage (Um)	125 V
Safety relays	**Connectors B17, B18 / B19, B20 and B21, B22 / B23, B24**
Switching voltage	30 V_{DC}
Switching current (resistive load)	2 A_{DC}
Switching current (inductive load)	0.1 A_{DC}
Switching power	60 W
Maximum voltage (Um)	220 V
Non-safety relays	**Connectors B13, B14 and B15, B16**
Switching voltage	30 V_{DC}
Switching current (resistive load)	2 A_{DC}
Switching current (inductive load)	0.1 A_{DC}
Switching power	60 W
Maximum voltage (Um)	220 V
USB interface	**Front USB-B mini**
Voltage	5 V_{DC}
Current rating	63 mA
Maximum voltage (Um)	125 V
Digital frequency output	**Connectors A15, A16**
Voltage	24 V_{DC}
Current rating	100 mA
Maximum voltage (Um)	125 V

Output	
All relays (4x)	Programmable overspeed, acceleration and underspeed Programmable hysteresis Maximum switching capacity: ▪ 30 V_{DC} / 2 A (resistive load) ▪ 30 V_{DC} / 100 mA (inductive load)
Safety relay (2x)	Double Pole Single Throw (DPST) safety relay Certified for SIL safety loops
Status/alarm relay (2x)	Single Pole Single Throw (SPST) non-safety relay NOT certified for SIL safety loops
Safety analog output (1x)	16 bit 4 mA to 20 mA Certified for SIL safety loops
Digital frequency output (1x)	Open collector Max. 24 V_{DC} / 100 mA NOT certified for SIL safety loops

System	
Reaction time	
Measurement time (T_m)	Dependent on signal frequency and averaging, typically ≤ 2 ms
Hardware reaction time (T_h)	≤ 8 ms (relays) ≤ 100 ms (analog out)
Total reaction time ($T_h + T_m$)	≤ 10 ms (relays) ≤ 100 ms (analog out)
PC interface	USB-B mini for programming and status reading (Windows® 10 proprietary software application)
Power supply (2x)	24 V_{DC} (18 V_{DC} to 36 V_{DC} at device) / 210 mA Redundant supply connection Reverse voltage protection

Table continues on next page →

System	
Status LED indicators (4x)	
Relay indicators (2x)	Indicates safety relay status
Power / error indicators (2x)	Indicates power and module status
Heat dissipation	Maximum 5.0 W (@ 24 VDC)
Connectors	Plug-in connectors with screw terminals
Operating temperature	-20 to 60 °C (-4 to 140 °F)
Storage temperature	-40 to 85 °C (-40 to 185 °F)
Operating humidity	5% to 80% RH (non-condensing)
Storage humidity	5% to 85% RH (non-condensing)
Mounting Location	Not suitable for wet locations. For indoor use only.
Altitude of Operation	max. 2000 m
Pollution Degree	2
Overvoltage Category	I
Housing	Weidmüller CH20M45
Ingress protection	IP20
Mounting assembly	DIN rail
Dimensions (W x H x D)	45 x 117 x 114 mm (1.77 x 4.61 x 4.49”)
Weight	Approx. 350 g

“Game changing innovation for SIL rated overspeed protection“

Istec International

Meer en Duin 8
2163 HA, Netherlands
www.istec.com