SpeedSys® 200
SpeedSys® 300

SpeedSys ODS (Overspeed detection 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 in mind. But, as with any safety product, the knowledge 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.

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 SpeedSys 200 & 300. 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 ODS

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

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

Index

1. General

1.1 Introduction

Read this manual carefully and understand the safety instructions before using the product.

This manual provides information on the SpeedSys ODS overspeed detection system (ODS), from Istec's SpeedSys product line. It offers information concerning the installation, configuration and general use of SpeedSys ODS modules for overspeed, underspeed and/or acceleration detection and protection applications.

This manual is applicable to the following models:

- SpeedSys® 200
- SpeedSys® 300

SpeedSys 200 & 300 are part of the SpeedSys product line which also consists of the SpeedSys T10, T20 & T30. In short: SpeedSys 200 & 300 are SIL-rated overspeed detection systems with ATEX certified input circuitry. SpeedSys T10, T20 & T30 are tachometers with a marine type approval.

To simplify the naming and to distinguish between the two product lines the SpeedSys 200 & 300 are referred to as the **SpeedSys ODS** (Overspeed Detection System) and the SpeedSys T10, T20 & T30 are referred to as the **SpeedSys tachometers**. This manual focusses only on SpeedSys ODS.

SpeedSys 200 & 300 are identical except for four differences. SpeedSys 300 features additionally:

- SIL3 in a setup with HFT ≥ 1 (1oo2, 1oo3 or 2oo3)
- Binary input
- Binary output

- Modbus RS 485 (read-only)

All chapters are applicable to both SpeedSys 200 & 300 except where the chapter title is followed by "(SpeedSys 300 only)".

1.2 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.

1.3 Competence

This manual is intended for qualified personnel with a sufficient background in the installation of electronic equipment in an industrial environment. Knowledge of installation of field wiring and protective earth (PE), Instrument Earth (IE) and Intrinsically Safe earth (IS) is required.

1.4 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 and using the equipment, adhere to the environmental specifications (temperature, humidity) quoted in the appropriate data sheet.

1.5 ESD protection

The release of buildup static charge by a user handling the equipment can cause irreparable damage to electronic parts. Although SpeedSys ODS was designed and tested in compliance with the applicable EMC and IEC directives (up to 6 kV electrostatic discharge (ESD)), it is advised while handling the modules to observe the necessary safety precautions to prevent ESD.

Please note that the SpeedSys ODS devices should only be opened by the manufacturer.

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 conducted by the manufacturer.

1.6 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.

1.7 Parts and accessories

SpeedSys 200

- SpeedSys 200 module
- 9 removable connectors
- USB cable [USB A to USB B mini]

SpeedSys 300

- SpeedSys 300 module
- 11 removable connectors
- 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 ODS 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 ODS users can meet these requirements and have an independent and compact, yet reliable solution for overspeed, acceleration and underspeed protection.

SpeedSys ODS is a SIL2/SIL3 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 regular self-checks, SpeedSys ODS manages to have a full proof test interval of 10 years or longer, allowing users to plan full proof tests during outages.

With a compact architecture and small technical footprint SpeedSys ODS 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 application for both low- and high-end rotating equipment will result in a lower economical and organizational footprint.

2.3 Application

SpeedSys ODS 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 galvanically isolated allowing for advanced sensor monitoring and negating the necessity for additional external isolators. For generating trip signals every transmitter has two energized-closed safety relays (SIL2/SIL3). Additionally, for warning or status signals every transmitter has two status/alarm relays (non-safety). These four outputs can all be individually configured. Moreover, SpeedSys ODS is equipped with a SIL2 4-20 mA analog output for either protection or monitoring functions and finally a fast-signalling frequency output to relay the speed signal to tailing equipment.

2.4 Intended use

SpeedSys ODS 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 2 000 m. This device is for use in applications with a pollution degree up to 2 and/or overvoltage category II environment.

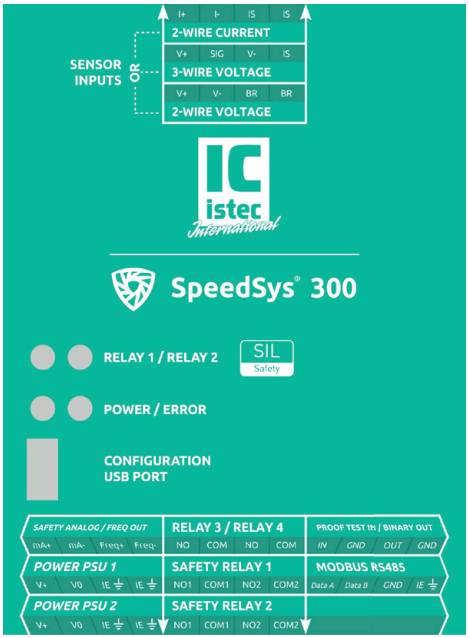
2.5 Environmental conditions

	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 label contains basic information about the connectors, wiring connections and module status.



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

The bottom has four connectors for the output signals: relays, analog and frequency outputs. Two connectors are used for a redundant power supply and earth connection. The SpeedSys 300 has an additionally two connectors for the discrete in- and output and the Modbus RS485.

Four LEDs allow for a status indication of the module. Two LEDs show the status of the two safety relays, open or closed, and the 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 diagnostic error in the device. Details about the different statuses is explained in section **5.10 Status LEDs**.

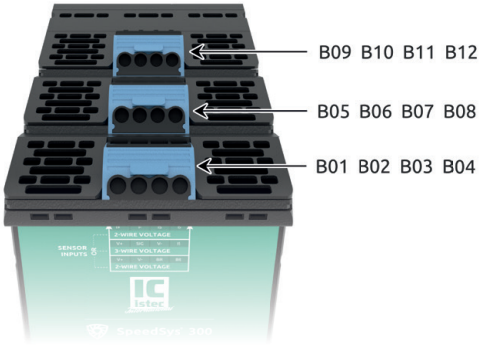
A USB mini-B connector allows for configuration of the unit. The configuration is covered in detail in section **4 and 5**.

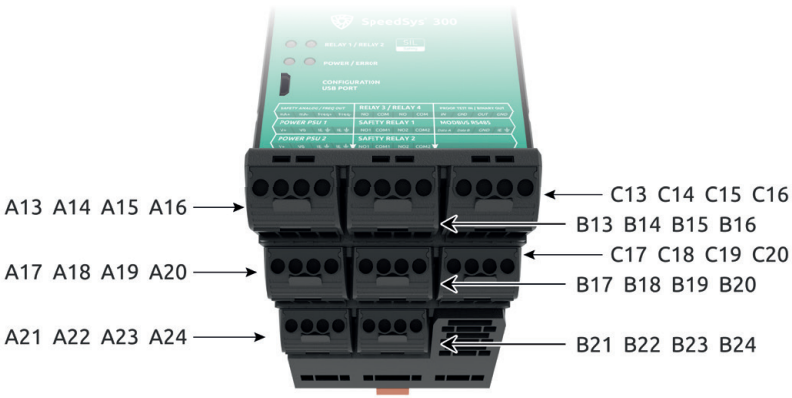
Table 1: The connector arrangement and details are described in the table below.

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
C01			air vent	Digital input: signal	IN	DIGITAL IN/OUT	C13
C02				Digital input: GND	GND		C14
C03				Digital output: signal	OUT		C15
C04				Digital output: GND	GND		C16
C05			air vent	RS485: data A	A	RS485	C17
C06				RS485: data B	B		C18
C07				RS485: GND	GND		C19
C08				Instrument Earth	IE		C20
C09			air vent	air vent			C21
C10							C22
C11							C23
C12							C24

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

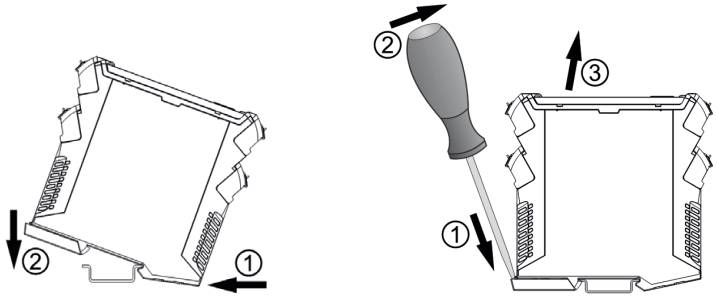
The images below show the pin configuration on the physical unit. The label is designed to be intuitive and lead the user to the right pins and connectors. By virtually sliding the tables in the direction of the white arrow they become imaginary overlays to find the right screw terminal.





3.2 Module dimensions and installation

The product is designed to work with standard DIN rail (top hat rail IEC/EN 60715). 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 spring lock is opened with a slotted screwdriver and the device is removed upwards (see following figures).

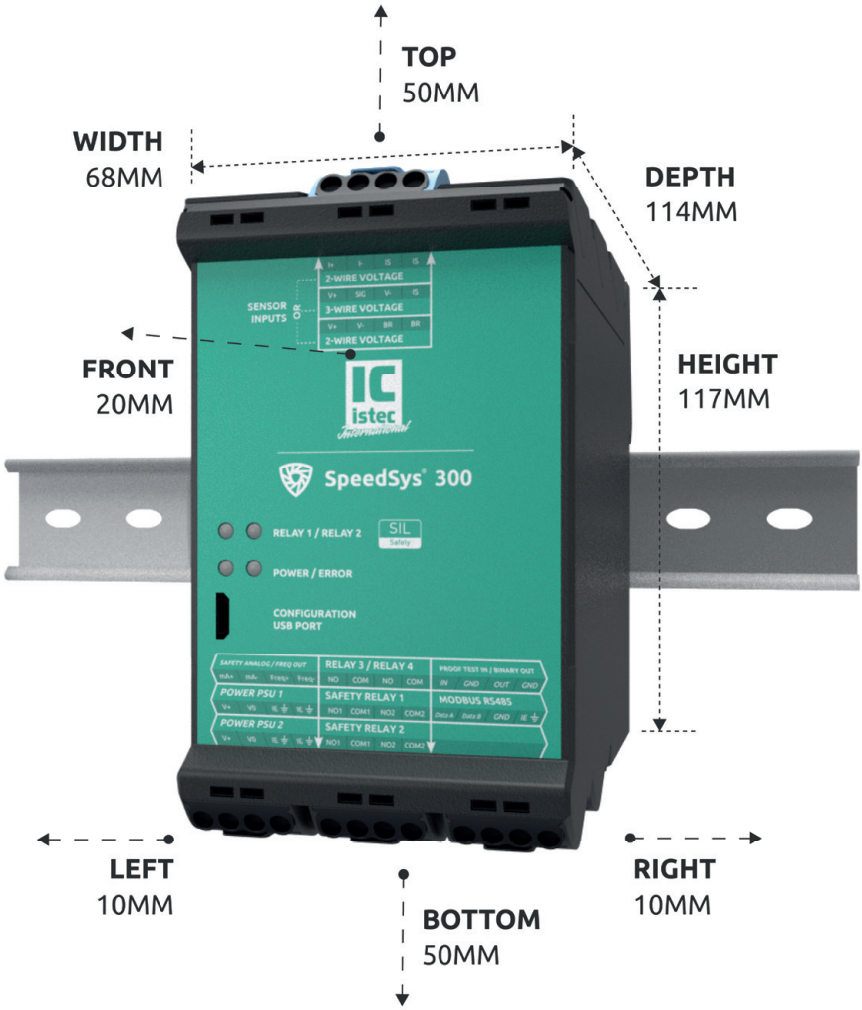


Mounting (left) and demounting (right) of the unit.

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 clearances to allow for sufficient cooling. If the SpeedSys 200 or 300 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.


TOP
50MM
WIDTH
68MM
DEPTH
114MM
FRONT
20MM
HEIGHT
117MM
LEFT
10MM
RIGHT
10MM
BOTTOM
50MM
SENSOR INPUTS
2-WIRE VOLTAGE
3-WIRE VOLTAGE
2-WIRE VOLTAGE
SpeedSys 300
RELAY 1 / RELAY 2
POWER / ERROR
CONFIGURATION USB PORT
RELAY 3 / RELAY 4
POWER PSU 1
SAFETY RELAY 1
MODBUS RS485
POWER PSU 2
SAFETY RELAY 2

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 screw terminals' specifications are:

- Wire clamping range: 0.13 mm² to 3.31 mm²
- Screw tightening torque: 0.4 Nm to 0.6 Nm

The entire pluggable terminal block, the connector, contains 4 contacts and can be removed by flipping the release lever. A factory defined physical coding prevents misplacement of the connectors. The coding is achieved by the orange asymmetrically shaped pins that fit only in their corresponding slot. During assembly of the unit the pins can be oriented in various ways preventing connector mismatch during use.

Pushing a connector into place should not require a lot of force. Applying too much force on a connector can lead to damaged coding pins and incorrect placement.

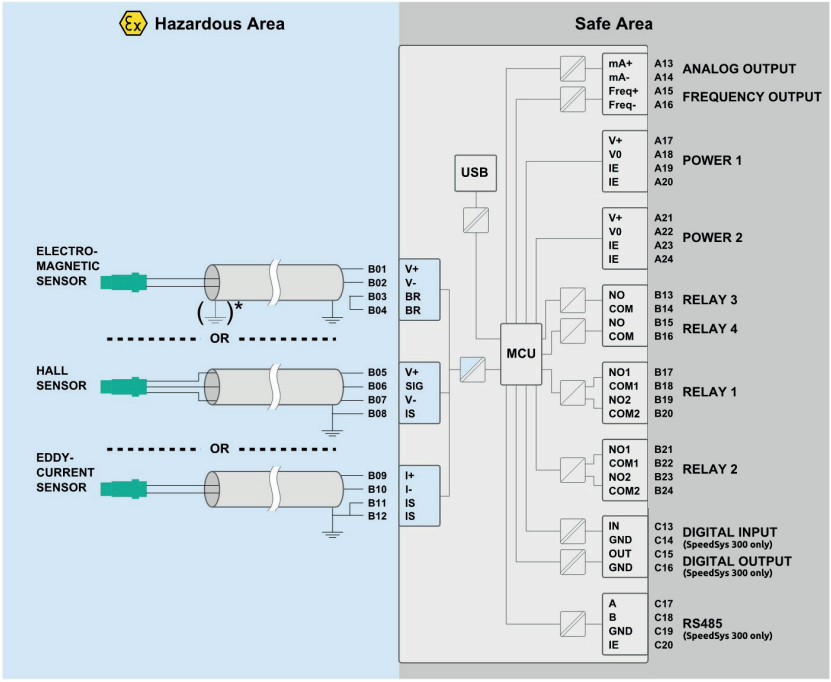
Note that the physical coding is different between connectors, but the same between the units, making the units easily replaceable.

3.3 Connection diagram

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

The ATEX/IECEx certified sensor input circuits are protected against overload and overvoltage. Supplying high voltages to the input circuits can blow the overvoltage fuse leading to an inactive unit.

It is strongly advised, prior to powering the unit, to verify if the applied voltage does not exceed the input limits of SpeedSys (18..36 V_{DC}).



SpeedSys ODS 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 Power supply

SpeedSys ODS is certified as a *Separated Extra Low Voltage* (SELV) system and requires a power supply that complies with this specification.

SELV electrical circuits are electrically separated from other circuits that carry higher voltages, isolated from the earth and from the protective earth conductors of other circuits. The system cannot suffer any electrical surge from other systems, not even through other systems' ground connections.

SpeedSys ODS is designed for 24 V_{DC} (18 to 36 V_{DC}) isolated (SELV) power supplies.

See PSU and Shielding connection diagram for the grounding and shielding option for the connection option of the power supply.

3.5 ATEX/IECEx

SpeedSys ODS has a ATEX/IECEx certification and carries the following identifiers:

- II (1) G [Ex ia Ga] IIC (Gas)
- II (1) D [Ex ia Da] IIIC (Dust)

However, note that only the sensor inputs are ATEX/IECEx certified and the rest of the device is not. This means that sensors can be installed in a hazardous environment, but the SpeedSys ODS body needs to be in a non-harzardous environment or additional protective enclosure.

Part of the ATEX/IECEx protection is that SpeedSys ODS sensor input circuits features

internal galvanic isolators. Because of the integrated design of the isolators, SpeedSys ODS can keep 'sight' of sensors and feature advanced sensor monitoring like open circuit, close circuit, and voltage and/or current range monitoring. Additional barriers or isolators are therefore not required and in some cases would make it impossible to properly monitor the sensor health.

The ATEX/IECEx certified sensor input circuits are protected against overload and overvoltage. Supplying high voltages to the input circuits can blow the overvoltage fuse leading to an inactive unit.

It is strongly advised, prior to powering the unit, to verify if the applied voltage does not exceed the input limits of SpeedSys (refer to the manual for the limit values)

3.6 Functional grounding

SpeedSys ODS requires functional grounding to avoid potential ground noise and EMI effects that can cause unfavourable operating conditions.
Each SpeedSys ODS module always must be grounded as follows:

- One IE* terminal per unit needs to be connected to the IE* ground.
- One IS** terminal needs to be connected to IS** ground in case of an ATEX environment. In case ATEX is not applicable it can be connected to IE* ground.
- Cabinets and casings need to be connected to PE*** ground.

**) IE = Instrument earth*
***) IS = Intrinsically safe earth*
****) PE = Protective earth*

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 ends of the shield 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), SpeedSys ODS requires an installation in a controlled electromagnetic environment and the grounding of the sensor cable shield must be connected at the device side. Otherwise, both ends of the shield must be connected to intrinsically safe earth.

SpeedSys was designed and certified with the following cable and shielding configuration:

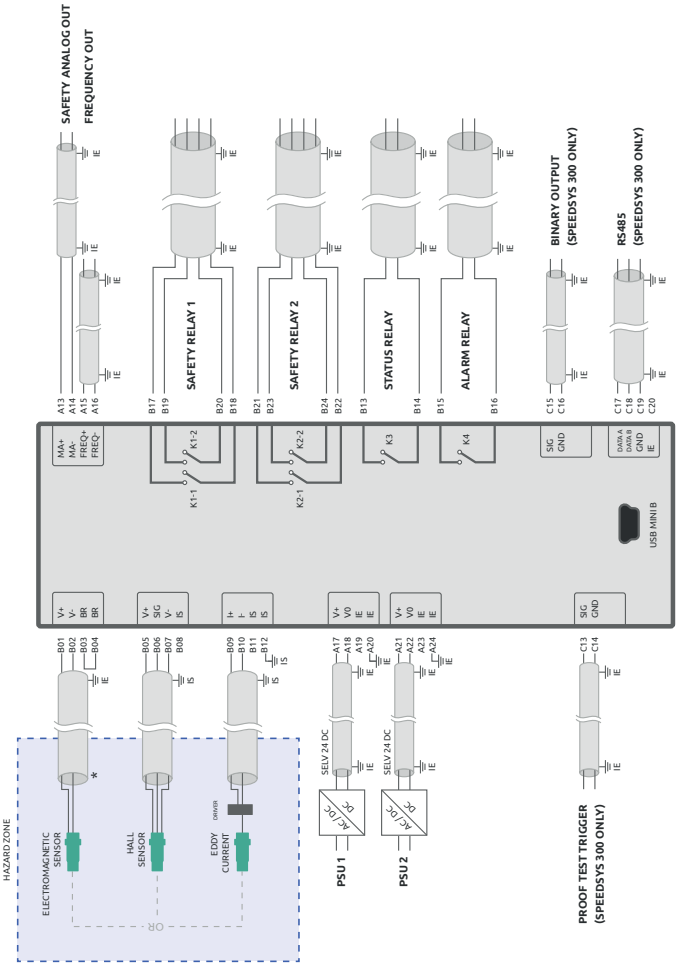
Sensor connection	Description	Max. cable length	Type of cable	Shielding	Shield instrument side	Shield sensor side
B01-B04	Eddy Current	1000 m	Twisted pair	Yes	Yes	No
B05-B08	Hall Sensor	Typically, 300 m	(Li2YCY PiMF 2x ≥ 0.5 mm2)	Yes	Yes	No
B09-B12	Magnetic pickup	300 m - 500 m*	Li2YCY PiMF 2x ≥ 0.5 mm2)	Yes	Yes	Yes**
Other connection	**Description**	**Max. cable length**	**Type of cable**	**Shielding**	**Shield instrument side**	**Shield opposite side**
A01-A04	Safety Analog / Freq out	30 m	2-wire	Yes	Yes	No
A05-A08	PSU 1	10 m	2-wire	Yes	Yes	No
A09-A12	PSU 2	10 m	2-wire	Yes	Yes	No
B01-B04	Safety relay 1	30 m	2-wire	Yes	Yes	Yes***
B05-B08	Safety relay 2	30 m	2-wire	Yes	Yes	Yes***
B09-B12	Status relay 3 & 4	30 m	2-wire	Yes	Yes	Yes***
C01-C04 (SpeedSys 300 only)	PST in / out	30 m	2-wire	Yes	Yes	Yes***
C05-C08 (SpeedSys 300 only)	Modbus interface	30 m	2-wire	Yes	Yes	Yes***

**) The maximum cable length for magnetic pickup sensors is depending on sensor impedance, cable impedance, instrument input impedance, electromagnetic enviroment and cable routing and can therefore range from 30 to 500 m.*

***) In case of an ATEX zone, the area can be regarded as an EMC controlled environment and the shield at the sensor side is not required.*

****) In case of a shielded EMC cabinet the inside of the cabinet can be regarded as a controlled environment. Connections and wiring remaining inside the cabinet do not require any shielding except for the speed signals.*

See PSU and Shielding connection section for the connection cable shielding to ground (IE, IS).



PSU and shielding connection diagram

**) A zoned area can be regarded as an ESD controlled area and the shield can be single ended connected. In case the installation is in an ESD uncontrolled area the magnetic pick-up sensor cable must be connected to IE on both ends.*

3.7 Creating voting structures

To obtain extra safety and/or availability for rotating machinery it is possible to create several hardwired voting structures with SpeedSys ODS. 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. Additionally, adding more logic to the decision change adds to the response time.

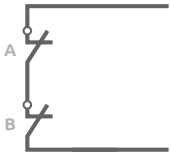
For SIL safety loops using safety relays 1 or 2 is mandatory. Technically it is possible to use relay 3 & 4 for 1oo2 and 2oo2 voting structures, but these won't be SIL rated. Wire configurations involving relay 3 & 4 will not be explored in this manual and are at the user's discretion.

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.

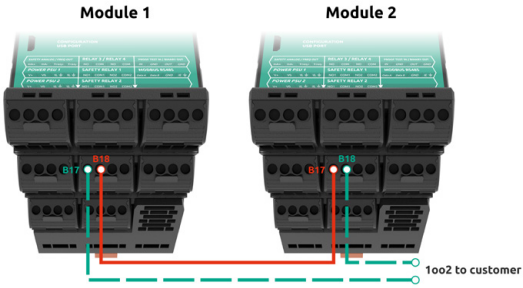
1oo2

To obtain extra safety, two relays can be connected in series to form a 1oo2 voting structure where the loop is interrupted, and the signal drops from high to low, if one of the two relays switches.



1oo2

A graphical representation for a connection with two terminals 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

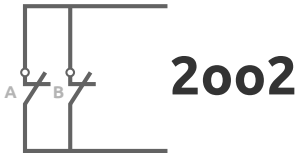
Module 1	Module 2	To customer
B21		Wire out
B22	B21	
	B22	Wire out

1oo2 using safety relays 2

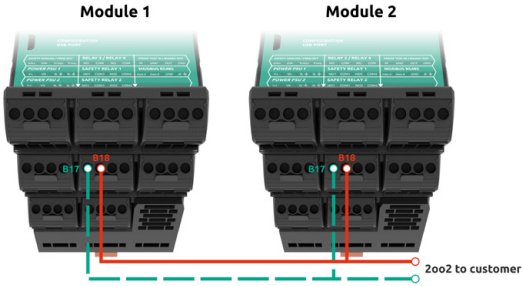
Module 1	Module 2	To customer
B23		Wire out
B24	B23	
	B24	Wire out

2oo2

To obtain extra availability, two relays can be connected in parallel to form a 2oo2 voting structure where the loop is interrupted, and the signal drops from high to low, if both relays switch.



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

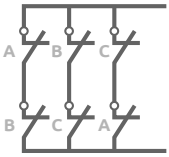
2oo2 using safety relays 2

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

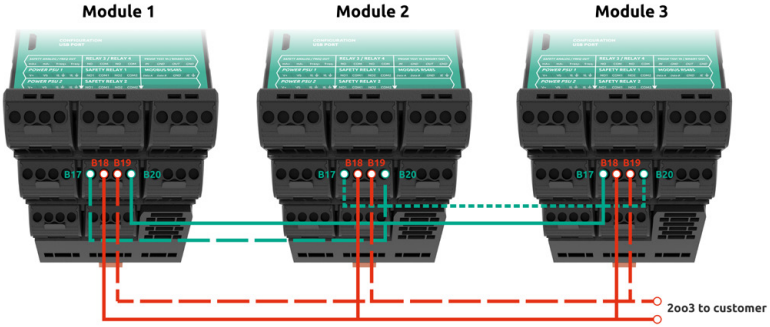
2oo3



2oo3

To obtain extra safety and extra availability, three relays can be connected to form a 2oo3 voting structure where the loop is interrupted, and the signal drops from high to low, if any combination of two relays switch.

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

3.8 Binary input/Proof test IN (SpeedSys 300 only)

The binary input or, as it is shown on the label, the “PROOF TEST IN” is an open collector input exclusive for the SpeedSys 300. The binary input can switch from high to low by providing voltages as described below:

- “Low / inactive” < 5 V_{DC}
- “High / active” > 15 V_{DC}

Despite the suggestion by the name on the label the binary input does not proof test the device. It merely can provide a means to partial proof test the tailing equipment by switching the selected outputs and therefore activating (part of) the tailing equipment. The outputs that should switch upon activation can be selected on the OUTPUT tab by enabling the tick boxes for “Test and reset”

When the binary output is activated it performs the following tasks:

- it switches the selected outputs of the unit.

When deactivated it performs the following tasks:

- resets the switched outputs,
- resets all latched errors,
- clears the error memory, visible on the DEVICE STATUS tab, and
- it clears the minimum and maximum values ‘Process data’ table on the PROCESS DATA tab.

If none of the outputs are selected only the resets will be carried out.

Note that the binary output can be used to announce a test condition to the tailing equipment as the response time of this open collector output is significantly faster than the four relays.

The “Test and reset” function can also be activated by the two buttons on the PROCESS DATA tab. The effect is the same as described above.

3.9 Modbus RTU (SpeedSys 300 only)

The SpeedSys 300 exclusively features a Modbus RS-485 output. This output is read-only and can be used to read out the registers of the device.

Through the software a SpeedSys 300 unit can be configured to communicate with a transmission speed of between 4800 to 115200 bps. It can be can be given a parity check and can be configured as the last device in a multi drop communication chain. In the latter case a 120 Ω resistor on the Modbus terminal is activated.

More information, including an extensive register list, is available in the dedicated SpeedSys 300’s Modbus manual downloadable on Istec’s website.

3.10 Safety Instructions: Functional Safety

SpeedSys ODS 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.

3.11 Safety Instructions: Explosion protection

SpeedSys ODS has the following explosion protection marking referring only to its sensor input circuitry:

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 ODS must be mounted outside the explosive area.

HAZARD: If the SpeedSys ODS 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: Once 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 conducted by the manufacturer.

4. Programming

This programming manual is applicable to the software version 1.0. Note that Speedsys 200 and 300 have different software applications that look very similar, but will reject the other product. For this manual all screen captures are of the SpeedSys 300 software as it also includes all configuration settings for the SpeedSys 200.

4.1 Get started: connect to PC

Connect to PC

- Power up the device by supplying 24V_{DC} (18 - 36 V_{DC}) to the unit.
- Connect the device to a PC using the USB interface. The first time it may take a while for the PC to find and install the necessary drivers for 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 or SpeedSys 300 software

The software is supported by Windows version 7 or higher. On opening, the software detects all the available COM ports.

Place the software on a desired location on the PC. The software doesn't require installation and can be exchanged between computers with impunity. 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 the software or require additional approvals to run third party applications.

Information circles and field types

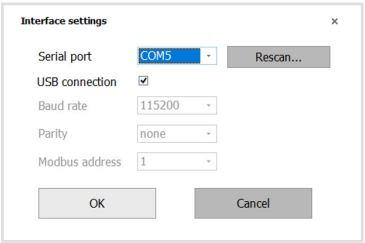
The fields and buttons in the application come with a help text that can be seen by holding the mouse pointer over the information circles at the end of each field or over the button.

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.

Connect the device

Click *Settings* → *Interface* settings to open the Interface settings window. Select the COM port to which the device is connected. The other settings (baud rate, parity and Modbus address) are reserved for manufacturer serial communications.



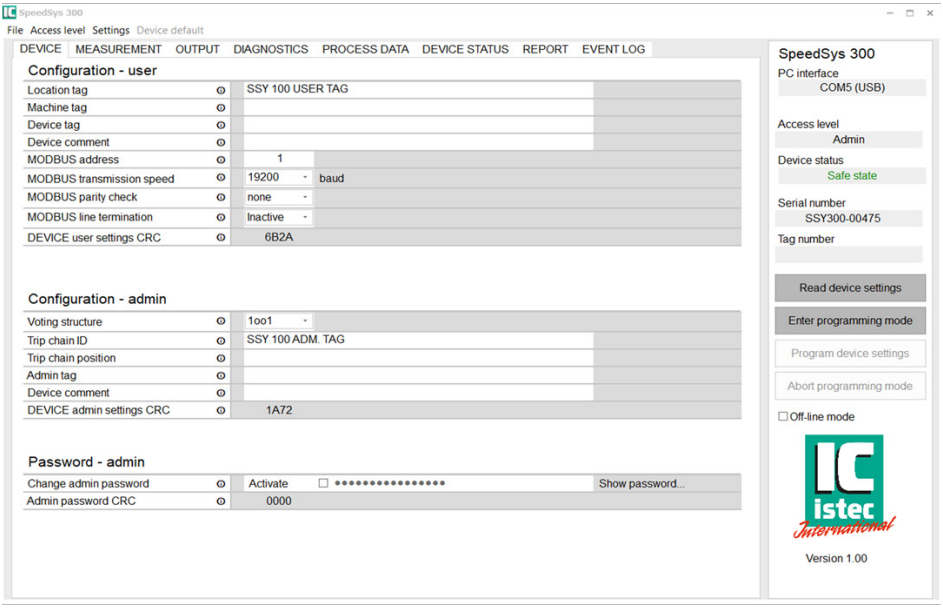
If the device has been connected after starting the software, you may have to click the *Rescan…* button in order to see the corresponding COM port. By connecting and disconnecting the device and clicking the Rescan… button you can identify the COM port that corresponds to the device.

Click *OK*. As the device connects to the software, its status and identification of the connected is shown in the fields 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.

4.2 Module configuration

After the software has connected to the device, 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. Additionaly, the Device status, the serial number and the tag number are displayed. By clicking *Read device settings*, the configuration is read from the device into the software.



The SpeedSys ODS has two layers of permissions. Firstly, the category *user* has basic access permissions. Settings such as location, machine and device tag can be configured. In addition for SpeedSys 300 only, the Modbus fields/parameters are used to configure the Modbus RTU RS-485 connection:

- **Modbus address**
  Any Modbus device in a string gets a unique address ranging from 1 to 254.
- **Modbus transmission speed**
  The transmission speed, called the baud rate, can be set as 4,800, 9,600, 19,200, 38,400, 57,600 or 115,200 bits per second [bps].
- **Modbus parity check**
  This is a preliminary error check on binary level where the master and slave have to agree on the even or odd number of ones per transmitted byte.
- **Modbus line termination**
  When the SpeedSys 300 is the last device in a multi drop communication chain, a 120 Ω resistor on the Modbus terminal must be activated, by setting this field to 'Active'.

For more information on the Modbus connection consult the Modbus manual, which is downloadable from the Istec website.

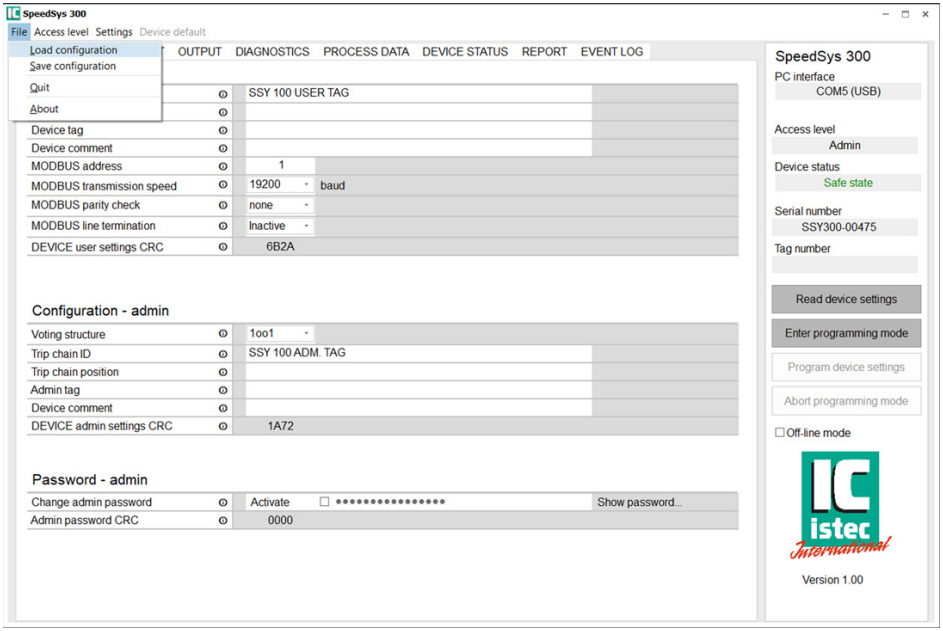
Secondly, the layer *admin* features higher permissions and can configure the voting structure, trip chain and dedicated administrator tags as well as device comments.

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

A configuration file can be saved to a PC. A stored configuration file can be loaded into the software.



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

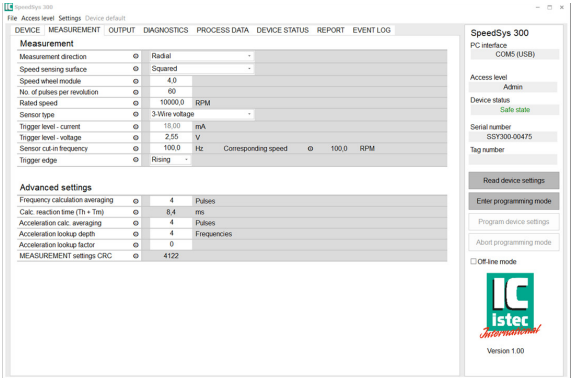
These parameters are [TEXT] only and do not affect the operation of the unit.

This page intentionally left blank

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 [TEXT]**

  Three measurement directions can be selected:

  - *Axial* the sensor measures along the machine's axis.
  - *Radial* the sensor measures perpendicular to the machine's axis.
  - *Tangential* the sensor measures the axis under a certain angle.

- **Speed sensing surface [TEXT]**

  Four options for the speed sensing surface are available:

  - *Involute* Ttypical gear wheel shape
  - *Slotted* Squared teeth
  - *Pole band* Ttoothed band around machine shaft
  - *Holes* Drilled holes which are typically axially located

- **Module [TEXT]**

  The module is a measure of the distance between the teeth on a gear wheel. Wheels with equal module can be connected.

$$M = \frac{D}{n}$$

M = module [mm/tooth]

D = diameter [mm]

n = number of teeth [teeth]

(e.g. a diameter of 200 mm and 100 teeth result in a module of 2 mm/tooth).

- **No. of pulses per revolution [INPUT]**

  The number of pulses that corresponds to one revolution of the rotary setup. Required for correct rotational speed calculation and thus also reaction time under advanced settings.

- **Rated speed [INPUT]**

  The nominal speed of the machine. This value is used for the reaction time calculation under advanced settings. It also affects the scaling of the y-axis of the graph on the *Process Data* tab.

- **Sensor type [INPUT]**

  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).

  Depending on the selection irrelevant parts of the application will grey out. Mostly notable with the trigger level.

- **Trigger level – current / voltage [INPUT]**

  The threshold for current or voltage signals. Above the threshold, a signal is assumed to be a pulse.

  Default settings:

  - 2- wire current: 18 mA per default
  - 3-wire voltage: 3 V per default
  - 2-wire voltage: best engineering practice

Note: for the MPU/VR sensor there is 2,5 V_{DC} offset on the signal to detect cable break.

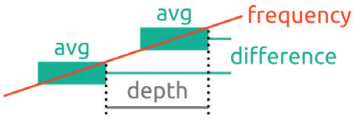
- **Sensor cut-in frequency [INPUT]**
  The lower frequency limit of a reliable sensor signal. Below this limit the evaluated speed and acceleration are assumed and outputted as 0 and no bad pulse evaluation is performed. This is predominantly observed.
- **Trigger edge [INPUT]**
  The device counts signals as pulses when they cross the trigger level either on the rising or falling flank.

Advanced settings

- **Frequency calculation averaging [INPUT]**
  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_h+ T_m) [OUTPUT]**
  This value estimates the SpeedSys reaction time. It is the sum of the hardware and measurement reaction time (T_h + T_m). The estimated hardware reaction time (T_h) is a fixed value of 8 ms. The measurement reaction time (T_m) is the time it maximally takes to detect an event and is evaluated as the time between two pulses multiplied by the averaging.
  Note: delays specified on the OUTPUT tab are not included in this calculation.
- **Acceleration calc. averaging [INPUT]**
  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 [INPUT]**
  The acceleration 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 [INPUT]**

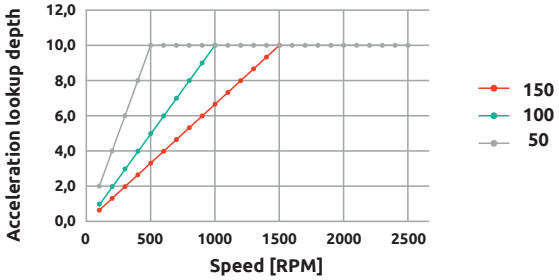
  The lookup factor can be used to create a dynamic lookup depth for the lower frequencies. If the lookup factor is other than 0, the lookup depth is calculated by the ratio of the measured frequency and the specified lookup factor, as described in the following formula:

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

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

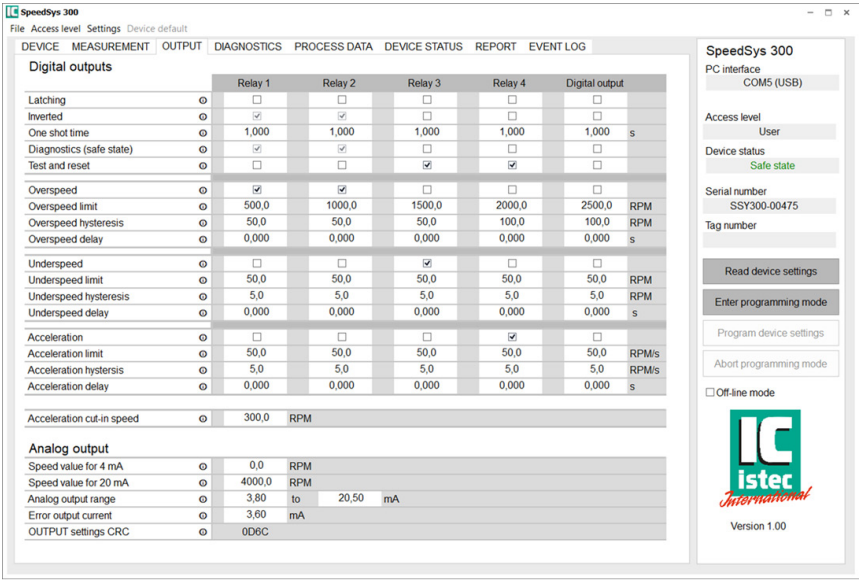
f_n Frequency evaluated for pulse n

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



The acceleration lookup depth for the acceleration lookup factors 50, 100 and 150.

5.2 Output configuration



The output tab enables the user to define the behaviour of the relays and the binary output (SpeedSys 300 only) as well as the analogue output.

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

Note: the binary output is a SpeedSys-300-only feature. It can be configured the same way as the relays. However, as it is an open collector output, it boasts a notably faster response time compared to the relays. This characteristic allows it to optionally signal a test situation to the tailing equipment.

Digital outputs

- **Latching [INPUT]**

  Enabling this setting will hold a relay in the NOT OK state after the activation of an alarm. It will remain in the activated state even when the alarm condition has been removed or resolved. The relay will return to its normal state after a reset. To reset the relay, use the "Test and Reset" function in the PROCESS DATA tab.

- **Inverted [INPUT]**

  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 the event of a power interruption to the unit they will naturally switch to the open position.

  - Enabled: normally open
  - Disabled: normally closed

- **One shot time [INPUT]**

  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. Inoperable when Latching is activated

- **Diagnostics (safe state) [INPUT]**

  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 [INPUT]**

  This will switch the selected relays with the 'Test and reset' buttons on the PROCESS DATA tab.

- **Overspeed [INPUT]**

  This category parametrizes the overspeed alarm condition. Enable the checkbox to activate overspeed alarm for the respective output. The upper limit value of the rotational speed, as well as the hysteresis and delay can be individually configured.

- **Underspeed [INPUT]**

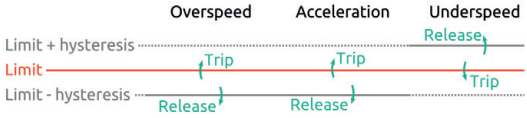
  This category parametrizes the underspeed alarm condition. Enable the checkbox to activate overspeed alarm for the respective output. The lower limit value of the rotational speed, as well as the hysteresis and delay can be individually configured

- **Acceleration [INPUT]**

  This category parametrizes the acceleration alarm condition. Enable the checkbox to activate acceleration alarm for the respective output. The upper limit for the rotational acceleration, as well as the hysteresis and delay can be individually configured.

- **Overspeed / Underspeed / Acceleration Hysteresis and Delay [INPUT]**

  When the respective limit for overspeed or acceleration has been violated, the alarm signal automatically latches until it falls below the limit minus the *hysteresis*. When an underspeed limit has been violated, the alarm signal latches until it rises above the limit plus the *hysteresis*. See the figure below. The *delay* adds to the total reaction time and an alarm is initiated if the alarm conditions are continuously met during this time frame.



- **Acceleration cut-in speed [INPUT]**

  Define this parameter to set the minimal speed for which acceleration alarms are indicated. Below this speed, no acceleration alarms are evaluated. This is particularly interesting for VR/ MPU probes as these are passive probes that can give an unreliable signal at low speeds. Leading to possible false alarms, preventing the machine to get through the startup phase.

Analog output

- **Speed value for 4 mA / 20 mA [INPUT]**

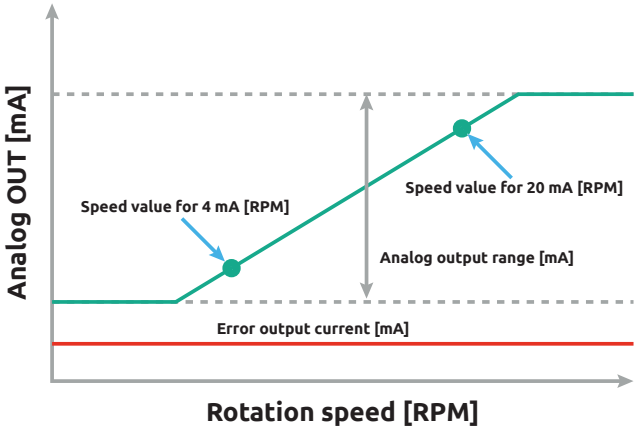
  Calibrates the 4 – 20 mA output linearly.

  Values can also be inputted as a split range (e.g. 1500 RPM and 2000 RPM) to maximally utilize the analog output resolution in the top speed range of the machine. Additionally, the values can also be reversed, e.g. 4 mA = 2000 RPM and 20 mA = 0 RPM. Note that the current gradient will be negative and thus current will decrease with increasing speed.

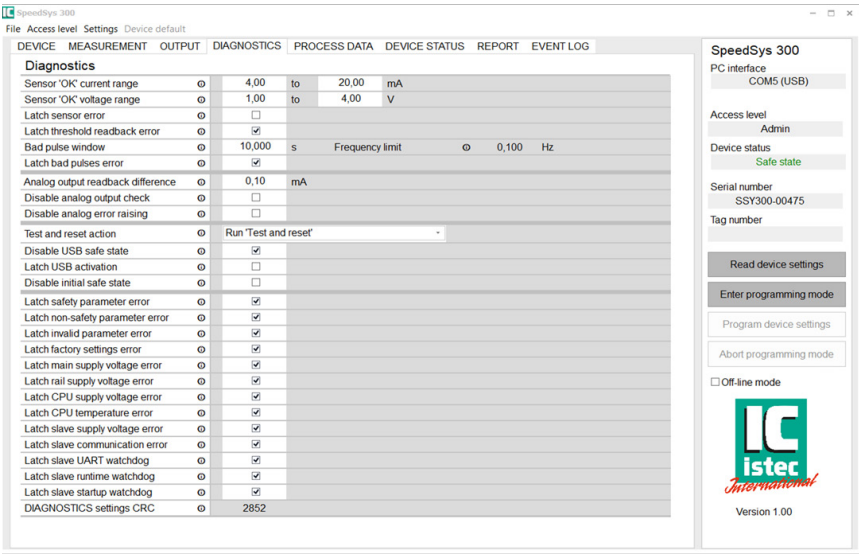
- **Analog output range [INPUT]**

  When the speed of the machine goes outside the value range set for the calibration the full range of the current output can be limited with this setting.
- **Error output current [INPUT]**

  Defines the output current when a diagnostic error occurs.



5.3 Diagnostics



- **Sensor 'OK' current/voltage range [INPUT]**

  Define 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 [INPUT]**

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

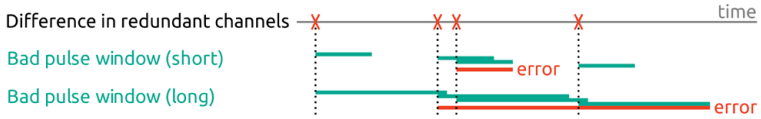
- **Latch threshold readback error [INPUT]**

  This will do a diagnosis on the user defined trigger level value and the actual internally used value. It will keep the unit in 'safe state' after a threshold readback error and will require a reset to make it operational again.

- **Bad pulse window [INPUT]**

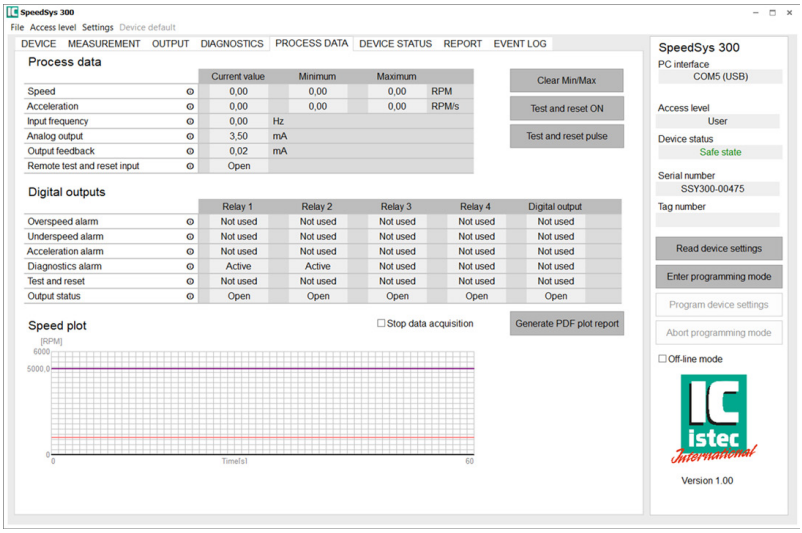
  Determines the time frame in which 2 or more bad pulses will result in an error. SpeedSys 200 & 300 exhibits a double, identical pulse detection circuitry, to allow for self-diagnosis. Any relevant difference between the two pulses will lead to a

'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 [INPUT]**
  This will keep the unit in 'safe state' after a bad pulse error and will require a reset to make it operational again.
- **Analog output difference [INPUT]**
  The allowed difference between expected and outputted current.
- **Disable analog output check [INPUT]**
  This prevents the 'Analog output difference' to cause a diagnostic error.
- **Disable analog error raising [INPUT]**
  This will prevent the analog OUT to output the error current when a diagnostic error occurs.
- **Test and reset action [INPUT]**
  Determines the behaviour when initiating a test with the 'Test & reset' buttons on the PROCESS DATA tab.
- **Disable USB safe state [INPUT]**
  This will disable the diagnostic error upon connecting a USB cable.
- **Latch USB activation [INPUT]**
  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 [INPUT]**
  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) [INPUT]**
  This will keep the unit in 'safe state' after the *** error and will require a reset to make it operational again.

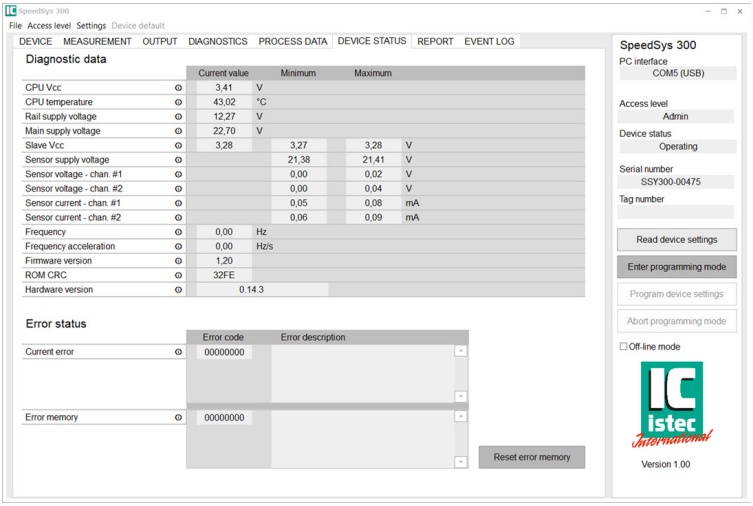
5.4 Process data



The *Process Data* tab displays relevant information about the current state of the process parameters as well as the status of the outputs. 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 rated speed specified on the MEASUREMENT tab. By clicking *Output plot* to PDF, the plot can be exported.

- **Test and reset ON/OFF button [INPUT]**
  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 [INPUT]**
  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



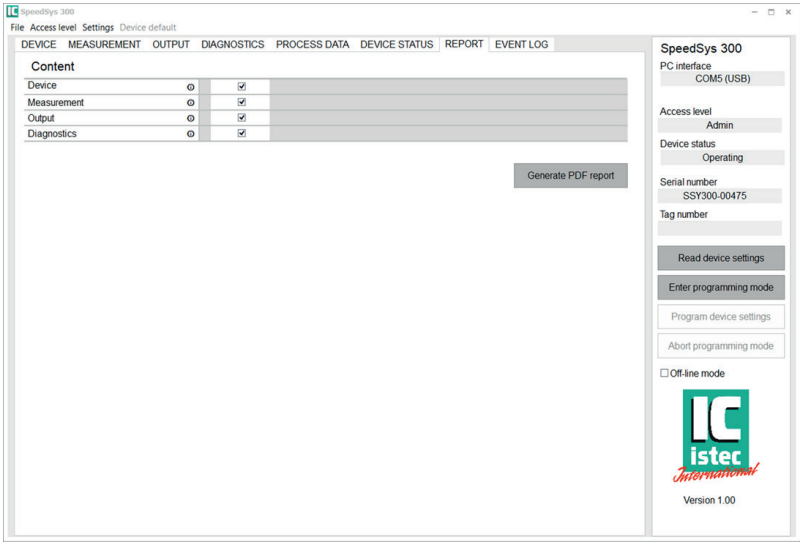
The *Device Status* window displays real-time information on different parameters. The user can observe the different supply voltages, the temperature and the sensor currents for each of the 'Duotec' channels. The minimum and maximum values of the latest sampling period are stored. These numbers are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

Keep in mind that for the MPU/VR probes there is an 2.5 V_{DC} offset on the line. Additionally, the device's firmware and hardware version and information on the cyclic redundancy check (CRC) are given.

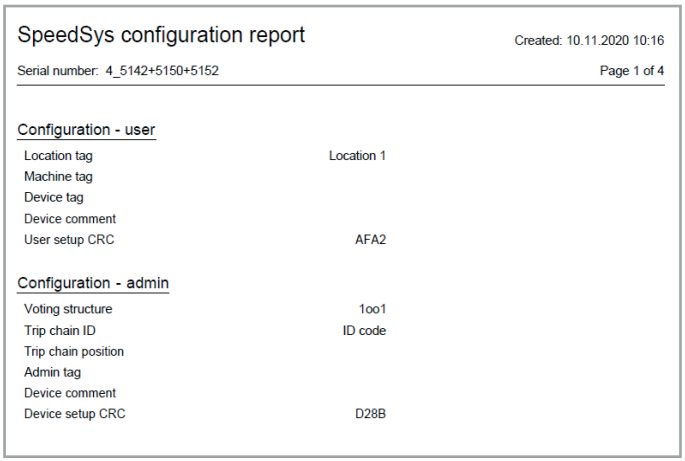
On the bottom of the window, the error status is displayed. All current and latched errors are displayed including the respective error code. Past errors are stored in the error memory to give the user the ability to identify potential risks that are caused by short-term malfunctions or that remain undetected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

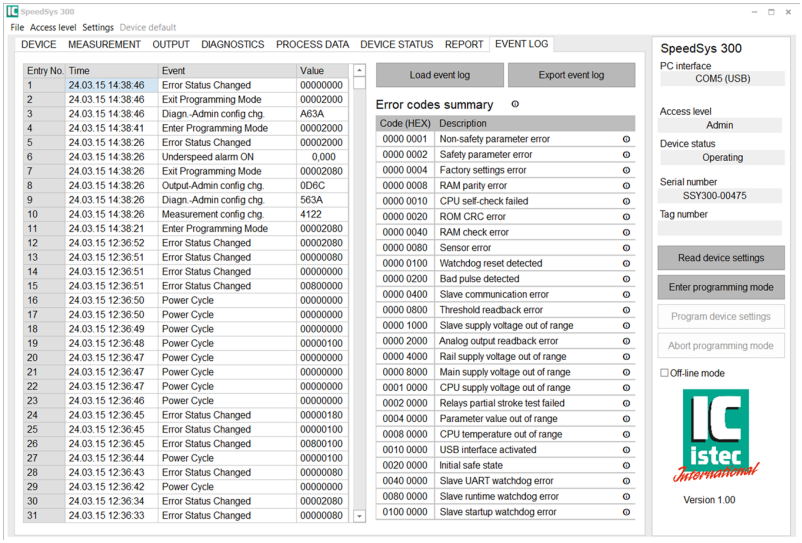
Configuration - user

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 ODS 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 pointer over the error in the event log highlights the combination of errors on the right as is shown in the figure above.

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.
Safety parameter error	Bad CRC in one or more of the following parameter groups: ▪ DEVICE tab: configuration - admin ▪ MEASUREMENT tab ▪ OUTPUT tab ▪ DIAGNOSTICS tab
Factory settings error	Bad CRC in one or more of following parameter groups: ▪ DEVICE configuration-factory ▪ DIAGNOSTICS-factory ▪ OUTPUT-factory ▪ Default DEVICE configuration-user ▪ Default DEVICE configuration-admin ▪ Default MEASUREMENT ▪ Default DIAGNOSTICS-admin ▪ Default OUTPUT-admin
RAM parity error	Basic RAM error check on binary level.
Self-check failed	One or more of internal diagnostic tests failed. i.e. program sequence monitoring, assertion, stack overrun, interrupt execution, main-loop execution timing, ALU and register check, calculation surveillance, clock surveillance.
ROM CRC error	Checksum error of internal ROM.
RAM check error	Checksum error of internal RAM.
Sensor error	Sensor error detected. The 'Sensor OK' ranges entered on the DIAGNOSTICS tab were exceeded.

Table continues on next page →

Diagnostic error	Description
Watchdog reset detected	Master MCU was reset by watchdog.
Bad pulse detected	The measured pulses are led through two comparison channels. At least two non-synchronism through the comparison channels were detected, see section 5.3 Diagnostics.
Slave communication error	Communication between master and slave MCU failed.
Threshold readback error	The diagnosis on the user defined trigger level value on the MEASUREMENT tab and the actual internally used value failed.
Slave supply out of range	Slave MCU supply voltage or sensor supply voltage out of range
Analog output readback error	Analog output readback difference, as defined on the DIAGNOSTICS tab, was exceeded, 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.
CPU temperature out of range	MCU temperature out of range
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.

Table continues on next page →

Diagnostic error	Description
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 ODS, 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 status

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.

Device status	Description
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 & 300 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	Active error
	blinks	Error occurred in the past and is stored in the error memory
	off	No errors 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_{DC}, 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 SSYx00-000-00n (x = 2 or 3, n = model version)

SER SSYx00-nnnnn (x = 2 or 3, nnnnn = numerical identifier)

PNR ISTSSYx00n (x = 2 or 3, n = numerical identifier)

7.2 Electrical rating

Electrical 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

Electrical 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 (U_m)	250 V
Current loop output	**Connectors A13, A14**
Voltage	20 V_{DC}
Current rating	63 mA
Maximum voltage (U_m)	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 (U_m)	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 (U_m)	220 V
USB interface	**Front USB-B mini**
Voltage	5 V_{DC}
Current rating	63 mA
Maximum voltage (U_m)	125 V
Digital frequency output	**Connectors A15, A16**
Voltage	24 V_{DC}
Current rating	100 mA
Maximum voltage (U_m)	125 V

“Game changing innovation for SIL rated overspeed protection“

Istec International

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