

# DRIVEN BY SPEED

SENSORS - MONITORING - PROTECTION



SpeedSys<sup>®</sup>





# Why Istec is driven by speed

Rotating equipment requires a constant balance between safety and availability. Istec has been active in the speed measurement business since the company was founded, as speed is one of the critical parameters affecting this balance.

Speed monitoring and protection is essential to rotating machines and requires advanced systems. Shifting customer needs, new technologies, and more demanding regulations are increasing both the complexity

and dependency of these systems. Simultaneously, the pressure on in-house engineering teams causes the necessary know-how to work with speed equipment to diminish. The growing gap between system complexity and user know-how requires a different hardware approach.

Decades of experience with speed, functional safety, and ATEX applications allowed Istec to develop our own range of speed equipment. Focused on usability, financial accessibility, and a high data integrity.

## Speed sensors

*Jaquet speed sensors*

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## Speed monitoring

*SpeedSys tachometer series*

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# Speed sensors



A reliable sensor output is key for further processing by monitoring and protection systems. It is therefore essential to select the most suitable sensor for each specific application.

Istec represents some of the biggest brands worldwide and offers advanced speed sensor solutions for each common sensor type; Hall-effect, variable reluctance (electromagnetic), and eddy current.

## Main distributor Jaquet sensors (EMEA)

In Europe, Middle-East and Africa (EMEA) Istec is the main distributor for the Jaquet speed sensor range from TE Connectivity. Their extensive range of speed sensors allows Istec to provide a suitable solution that fits any customer or application requirement. ■



Scan the QR code to learn more about our speed sensors

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# Speed monitoring

Istec offers a range of speed monitoring and switch systems that deliver accurate speed monitoring to any rotating machine. The SpeedSys tachometer series comes in four versions:

- SpeedSys T10: 1-channel speed monitor and switch
- SpeedSys T11: 1-channel speed monitor, switch and display
- SpeedSys T20: 2-channel speed monitor and switch
- SpeedSys T30: 3-channel speed monitor and switch

The SpeedSys tachometer series is designed to provide speed monitoring and switching on rotating equipment. The systems have a small technical footprint and allow for low impact installations. The basic version (T10) converts rotational speed into highly accurate analog signals for further processing and relay functions for alarm and trip.

The T20 and T30 add additional channels and relays, and advanced monitoring functions such as: speed acceleration, zero speed, reverse rotation, dynamic sensor monitoring, and multi-channel integrated trip functions. ■



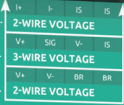
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SENSOR INPUTS



**SpeedSys<sup>®</sup> 300**

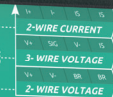
RELAY 1 / RELAY 2 SIL Safety

POWER / ERROR

CONFIGURATION USB PORT

<b>SAFETY ANALOG / FREQ OUT</b> I/A+ mA- Freq+ Freq-	<b>RELAY 3 / RELAY 4</b> NO COM NO COM	<b>PROOF TEST IN / BINARY OUT</b> IN GND OUT GND
<b>POWER PSU 1</b> V+ VD VE+ VE-	<b>SAFETY RELAY 1</b> NO1 COM1 NO2 COM2	<b>MODBUS RS485</b> Data A Data B GND IE+
<b>POWER PSU 2</b> V+ VD VE+ VE-	<b>SAFETY RELAY 2</b> NO1 COM1 NO2 COM2	

SENSOR INPUTS



**SpeedSys 200**

RELAY 1 / RELAY 2 SIL Safety

POWER / ERROR

CONFIGURATION USB PORT

<b>SAFETY ANALOG / FREQ OUT</b> I/A+ mA- Freq+ Freq-	<b>RELAY 3 / RELAY 4</b> NO COM NO COM
<b>POWER PSU 1</b> V+ VD VE+ VE-	<b>SAFETY RELAY 1</b> NO1 COM1 NO2 COM2
<b>POWER PSU 2</b> V+ VD VE+ VE-	<b>SAFETY RELAY 2</b> NO1 COM1 NO2 COM2

# Speed protection

SpeedSys ODS is a SIL-rated overspeed detection system (ODS) for rotating machinery. Its design aligns with our overall product philosophy; stripped of unnecessary complexity and dedicated to its core function. This allows Istec to offer the most advanced SIL-rated overspeed protection system, to reach the desired balance between machine availability and machine safety.

SpeedSys ODS comes in two versions and both globally available through Istec's distribution network:

- SpeedSys 200 (SIL2 rated by design)
- SpeedSys 300 (SIL3 rated by design)

Istec believes that overspeed protection should be both technically and financially accessible to any rotating machine, regardless of size or criticality. By adopting a scalable transmitter-based design, we enable advanced overspeed protection to a wide range of applications.

SpeedSys ODS is adapted to shifting market needs and challenges overly complex rack-based systems. You will find a more extensive overview of how SpeedSys ODS changes the overspeed market on page 10. ■

# How SpeedSys ODS changes the overspeed market

**SpeedSys ODS is a series of SIL-rated overspeed detection systems 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 for a wide range of applications.**

SpeedSys ODS comes in two versions: Istec SpeedSys 200 for machinery that require SIL2 overspeed detection and SpeedSys 300 for more critical machinery that require SIL3 overspeed detection.

SpeedSys ODS is highly adapted to growing market demands and challenges overly complex rack-based systems. We describe 5 ways of how SpeedSys ODS changes the overspeed market.

## Compact architecture

The SpeedSys ODS features a compact architecture while still being able to deliver high integrity overspeed detection. By sticking to the core of overspeed protection, Istec was able to

use a DIN-rail housing as opposed to the traditional 19" rack-based architecture, which mainly occupies the current overspeed market.

As the demand for high integrity (SIL rated) overspeed protection grows and extends to a wider range of machinery, the need for a more compact, yet scalable and modular system emerges. This has become part of the philosophy behind the SpeedSys ODS-series; to protect what was previously left unprotected, both large and small, critical and non-critical rotating machinery. The compact architecture allows for a widely applicable overspeed detection system with a low technical impact.

## SIL and proof-testing

SpeedSys ODS is SIL-certified *by design* as opposed to *proven in use*. The difference between the two certification methods is reflected in the required testing frequency to maintain the SIL rating and the possibility to apply changes or future product updates.

Systems that are certified by proven in use generally require years of usage data and a high testing frequency to maintain their SIL rating. Changes to the system will invalidate this usage data and, subsequently its SIL certification. This could even lead to sudden obsolescence. The certified safety design of SpeedSys ODS features advanced self-monitoring that enables a proof test interval of at least 10 years and acts as a solid basis for future developments in the product line.

## Financially competitive

Complex rack-based systems are often overkill for less critical or smaller machinery and can thus not be financially justified. Depending on the desired voting structure, SpeedSys ODS can be used standalone (1oo1) or scaled up to three modules



(2oo3) in different voting configurations to suit any application. This increases its financial efficiency and machine applicability compared to rack-based systems. One system that fits all rotating equipment, with more efficient spare part management, less maintenance requirements and a lower organisational footprint.

### Extensive support

SpeedSys ODS differs from other overspeed protection systems, not only from a technical and financial point of view, but also due to its outstanding usability and structured support. The system comes with an extensive free online training environment, which includes instruction video's regarding software and product use, valuable e-learning courses and knowledge articles.

### Replacement solution

A growing obsolescence and the general discontinuation of overspeed detection systems by multiple OEM's requires a replacement solution. The SpeedSys ODS-series is designed for low impact retrofitting of any existing overspeed detection system, to minimize the impact on the customer's infrastructure. The small and scalable layout of SpeedSys ODS allows for easy retrofitting and is adaptable to meet the existing measurement set-up. SpeedSys ODS works with the three major sensor types (Hall-effect, VR and eddy current) and features built-in isolators to be integrated with any existing sensor infrastructure. ■



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# SpeedSys<sup>®</sup>



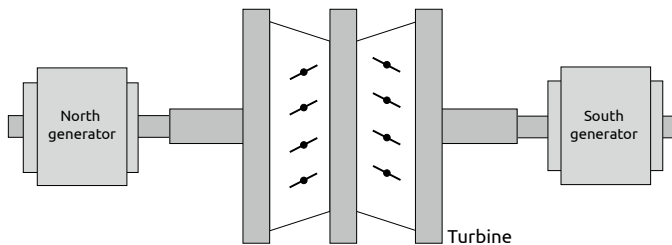
# Replacing the obsolete Jaquet FT3000 to the SpeedSys 200 overspeed detection system

During the blast furnace process at Tata Steel gasses are produced. These excess gasses are used to drive the gas expansion turbine, which subsequently drives two generators.

Tata Steel noticed an issue with one of the speed sensors, which is part of the overspeed protection system. Istec was asked to replace all of the speed sensors in the 2oo3 configuration by Hall-effect speed sensors, followed by testing and verifying the overspeed detection system (ODS) and the new speed sensors. During these tests the ODS showed abnormal behaviour and was not functioning like it should. It wasn't clear where the malfunctioning of the ODS

originated from. This left Tata Steel with two options: to completely check the overspeed system, the internal wiring and its functionalities (1), or to replace the entire system with a new ODS (2).

As the FT3000 ODS is discontinued by its manufacturer (Jaquet) and spare parts are no longer available, Tata Steel decided to replace their current system and purchase and implement a modern ODS: the Istec SpeedSys 200.



**Figure 1** - The gas expansion turbine that drives two generators using excess gasses from the blast furnace process.

## Challenge

As downtime is costly, a fast process was essential; delivery within a week, engineering within a day, and installation within a day. Tata Steel preferred a replacement solution that would keep the necessary infrastructural adjustments to a minimum.

## Solution

To facilitate the required engineering Istec mapped the existing hardware, including every sensor and all inputs and outputs, as well as all the existing (safety) functions of the existing ODS.

## Old system

The obsolete FT3000 system was configured with the following 19" cards:

- Three FTFU3024 overspeed detection cards
- FTW3013 analogue output card to PLC/DCS
- FTK3072 communication module to a PC



**Figure 2**

*The obsolete FT3000 system configuration that needed a replacement solution.*

The 24Vdc power supply was directly connected on the back of the rack. No filters or additional power supplies were used.



### New system

The FT3000 was replaced by a 2oo3 SpeedSys 200 installation. The DIN-rail assembly as shown in the image below was prepared on a 19" aluminium plate, allowing for a quick and easy installation in the existing 19" rack where the FT3000 was installed. This installation covers all the core functions of the obsolete FT3000 that was replaced.



**Figure 3 -** The new ODS installation consisting of a galvanically isolated SELV power supply (1), a double 24V supply distribution for a possibility of redundancy (2), and three SpeedSys 200 units, hardwired to form a 2oo3 voting structure (3).

### Impact

The new SpeedSys 200 installation fits the requirements of Tata Steel, featuring all the core functions of the previous ODS without the need for significant infrastructural adjustments. This low-impact installation is SIL 2 certified by design, as opposed to proven in use, making its required test interval much longer than the previous FT3000 installation. The gas expansion turbine can now safely operate without interference of a malfunctioning safety system. □

# Replacing a malfunctioning Bently Nevada 3500 with a SpeedSys 200 overspeed detection system

AVR is specialized in processing various types of residual waste and converting this waste into energy and raw materials for households and businesses. In their plant in the Botlek (Rotterdam) they operate a steam turbine which drives a generator. AVR used a Bently Nevada BN3500 overspeed detection system (ODS) to detect overspeed situations (BN3500/53) and zero-speed (BN3500/50).

When an overspeed situation occurs the system should trip the steam turbine to prevent potential damage and dangerous situations. Zero-speed was monitored to prevent the turning gear from starting too soon. The turning gear can only be started, when the rotor has come to a complete stop, as this could otherwise damage the turning gear.

## Failing BN3500 overspeed cards

AVR contacted Istec because the

three overspeed protection cards of their Bently Nevada ODS failed simultaneously. This caused downtime of the process as the steam turbine could not be started up, leaving the generator unpowered.

As the Bently Nevada 3500 overspeed protection cards (BN3500/53) have been declared obsolete by its OEM, card replacements are no longer available. AVR decided to replace the Bently Nevada system with a modern overspeed detection system: the Istec SpeedSys 200.

## Challenge

Time was of the essence during this project, as downtime of the machine was costly to AVR. Therefore, the new system was required to be delivered, engineered, implemented, and commissioned within a short period of time. As the SpeedSys is designed for low impact installations,



## OVERSPEED PROTECTION CASE STUDY - AVR

this was done within several days.

AVR wanted to keep using the existing 3-wire eddy current probes that were previously used to send speed signals to the BN3500 system. This raised two issues that required some custom engineering:

1. The SpeedSys 200 is not designed to accept signals from 3-wire eddy current voltage sensors (only 2-wire current sensors).
2. Bently Nevada eddy current probes require a negative supply voltage, whereas the SpeedSys modules expect a positive signal.

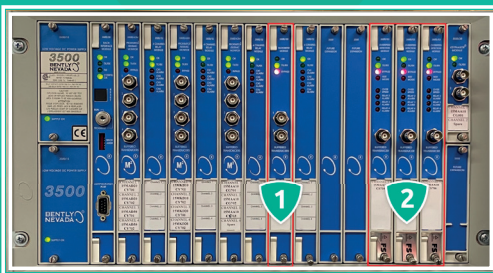
### Solution

Istec has taken over all core functions of the BN3500 system in the SpeedSys 200 configuration.

### Old system

The obsolete Bently Nevada 3500 system was configured with the following 19" cards:

- One 3500/50M tachometer module for zero speed monitoring
- Three 3500/53M electronic overspeed detection cards



**Figure 4**

*The Bently Nevada 3500 system at AVR. The tachometer module (1) for zero speed monitoring and the three overspeed modules (2) were replaced with the SpeedSys 200. The other cards remain in use.*

### New system

By adding three GSI 127 galvanic isolators (one for each SpeedSys module) the existing speed sensors could continue to be used. The GSI 127 can reverse the signal of the

## OVERSPEED PROTECTION CASE STUDY - AVR

eddy current probes to make it usable to the SpeedSys modules, while ensuring sensor monitoring remained available. Moreover, the GSI 127 units power the proximator that is needed to generate output signals for the existing eddy current probes.

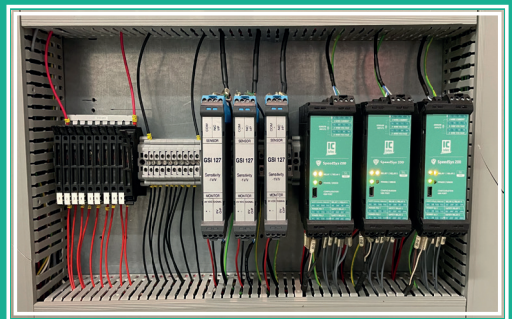
One of the relays of a SpeedSys 200 unit was configured to cover zero-speed monitoring, which was a function that was previously covered by the old BN3500/50 tachometer module.

The BN3500 overspeed protection and zero-speed cards were replaced with a 2oo3 SpeedSys 200 configuration. The DIN-rail assembly was engineered on-site and consists of the following components:

- Two 24V power supplies
- Three GSI 127 galvanic isolators
- Three SpeedSys 200 modules, hardwired to form a 2oo3 voting structure

**Figure 5**

*The new system, delivered, engineered and implemented by Istec. Each of the SpeedSys 200 units in the 2oo3 configuration is wired to a GSI 127 to receive the correct signal from the 3-wire eddy current probes.*



## Impact

The SpeedSys 200 provided a fast solution to replace the BN3500 overspeed and zero-speed cards, without the need for major infrastructural changes. The SpeedSys 200 installation covers all the core functions of the previous system. Any minor issues that occurred could be addressed due to the versatility of the SpeedSys. The low-impact installation is SIL 2 certified by design, which allows for longer proof-test intervals than the previous system. ■



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