AVW Technical Guide

SIL vs Performance Level (PL) in Automation Safety

Author: Anton Woodward OBE CEng MInstMC FRSA
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1. Introduction

Modern automation systems rely on safety-related control systems to reduce the risk of hazardous machinery operation. Two commonly referenced safety measures are **Safety Integrity Levels (SIL)** and **Performance Levels (PL)**.

Although both concepts aim to quantify the reliability of safety functions, they originate from different standards and use different methods of assessment. This often causes confusion for engineers and technicians working with safety systems.

Understanding the difference between SIL and PL is important when designing, evaluating, or integrating safety-related control systems in stage automation.

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2. Safety Integrity Level (SIL)

Safety Integrity Level is defined in the functional safety standard **IEC 61508** and is used to specify the reliability required of a safety function.

SIL defines the probability that a safety function will fail when required.

There are four SIL levels:

SIL	Relative Risk Reduction
SIL 1	Basic safety integrity
SIL 2	Moderate risk reduction
SIL 3	High safety integrity
SIL 4	Extremely high reliability

SIL is widely used in industries such as:

- process control
- chemical plants
- oil and gas
- rail systems
- industrial automation

In stage automation applications, safety functions typically fall within **SIL 2 or SIL 3**, depending on the risk assessment.

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3. Performance Level (PL)

Performance Level is defined in the machinery safety standard **EN ISO 13849**.

PL measures the reliability of safety-related control systems based on:

- component reliability
- system architecture
- diagnostic coverage
- fault detection capability

Performance Levels range from **PL a to PL e**.

PL	Risk Reduction
PL a	Lowest reliability
PL b	Low
PL c	Medium
PL d	High
PL e	Very high

PL is commonly used in **machinery safety**, including many stage machinery systems.

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4. Why Two Systems Exist

SIL and PL originate from different engineering traditions.

SIL

- Developed for **functional safety systems**
- Focuses on **probability of failure**
- Common in **process industries**

PL

- Developed for **machine control systems**
- Focuses on **control system architecture**
- Widely used in **machinery design**

Both approaches ultimately aim to achieve the same goal: **reducing risk to an acceptable level**.

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5. Approximate Comparison

Although SIL and PL are calculated differently, approximate equivalences are often used for comparison.

SIL	Approximate PL Equivalent
SIL 1	PL c
SIL 2	PL d
SIL 3	PL e

These comparisons are only approximate and should not be used as a direct conversion.

Safety functions should always be evaluated according to the requirements of the relevant standard.

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6. Application in Stage Automation

Stage machinery and automation systems may reference multiple safety standards.

Common examples include:

- BS EN 17206 – stage machinery safety
- EN ISO 13849 – machinery safety control systems
- IEC 61508 – functional safety framework

In practice:

- **Machinery safety systems** are often designed using **PL (EN ISO 13849)**
- **Functional safety frameworks** may reference **SIL concepts**

Understanding both approaches helps engineers interpret manufacturer specifications and safety documentation.

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7. Key Differences

Feature	SIL	Performance Level
Standard	IEC 61508	EN ISO 13849
Scale	SIL 1–4	PL a–e
Approach	Probability of failure	System architecture & diagnostics
Common use	Functional safety systems	Machinery safety

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8. Practical Takeaways

- SIL and PL both measure **safety function reliability**
- They originate from **different safety standards**
- Direct conversion between SIL and PL is **not exact**
- Many automation systems reference EN **ISO 13849 performance levels**

Understanding both systems helps engineers correctly interpret safety ratings and design safer automation systems.

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9. Further Reading

- IEC 61508 – Functional Safety of Electrical/Electronic/Programmable Systems
- EN ISO 13849 – Safety of Machinery: Control Systems
- BS EN 17206 – Machinery for Stages and Production Areas

About the Author

Anton Woodward works in theatre engineering and stage automation systems.

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