AVW Technical Guide

Risk Assessment for Stage Automation Systems

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1. Introduction

Stage automation systems can involve large moving structures, heavy loads, and complex control systems operating close to performers and technicians. These systems must therefore be carefully designed to minimise the risk of injury or equipment damage.

A **risk assessment** is a structured process used to identify hazards, evaluate the risks associated with those hazards, and determine appropriate safety measures.

Risk assessment forms the foundation of automation safety and is referenced in many safety standards including **BS EN 17206, ISO 13849**, and **EN IEC 61508**.

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2. What is a Hazard?

A **hazard** is any situation that has the potential to cause harm.

In stage automation systems, hazards often arise from the movement of machinery or equipment.

Examples include:

- moving scenery or stage wagons
- lifting systems and stage lifts
- automated flying systems
- rotating stages or turntables
- moving platforms

Hazards may also result from **control system failures**, such as unexpected movement or loss of position control.

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3. Risk and Risk Reduction

Risk is typically defined as a combination of:

- the **severity** of potential harm
- the **likelihood** that harm will occur

Risk reduction measures aim to lower either the likelihood or the severity of a hazardous event.

In stage automation systems, risk reduction may involve:

- safety-related control systems
- mechanical safeguards
- operational procedures
- operator training

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4. Risk Assessment Process

A typical risk assessment process includes several key stages.

1. Identify Hazards

List all potential hazards associated with the machinery or automation system.

2. Evaluate Risk

Consider:

- how serious the potential injury could be
- how frequently people are exposed to the hazard
- how easily the hazard can be avoided

3. Determine Safety Measures

Identify measures that can reduce risk to an acceptable level.

These may include:

- protective guards
- safety interlocks
- emergency stop systems
- safety control systems

4. Verify Risk Reduction

Ensure that the chosen safety measures are sufficient to control the identified hazards.

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5. Hierarchy of Risk Reduction

Risk reduction typically follows a hierarchy.

1. **Eliminate the hazard**
2. **Substitute with a safer design**
3. **Engineering controls**
4. **Administrative controls**

5. **Warnings and training**

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6. Safety Functions

When hazards cannot be eliminated entirely, **safety functions** are used to reduce risk.

A safety function is a system response that prevents a hazardous condition.

Examples include:

- stopping machinery when an emergency stop button is pressed
- preventing motion beyond defined limits
- detecting overspeed conditions
- monitoring load limits

These functions are often implemented using safety control systems designed according to standards such as **ISO 13849** or **EN IEC 61508**.

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7. Documentation

Risk assessments should always be documented.

Typical documentation includes:

- hazard identification
- risk evaluation
- chosen safety measures
- verification of safety functions

Proper documentation helps demonstrate compliance with relevant safety standards and supports ongoing maintenance and system modifications.

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8. Review and Maintenance

Risk assessments are not a one-time activity.

They should be reviewed whenever:

- equipment is modified
- new automation systems are installed
- operating procedures change
- incidents occur

Regular review ensures that safety measures remain effective throughout the life of the system.

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9. Practical Takeaways

- Risk assessment is the **foundation of automation safety**.
- Hazards must be identified before safety measures can be designed.
- Safety functions reduce risk when hazards cannot be eliminated.
- Documentation and periodic review are essential.
- Risk assessment supports compliance with relevant safety standards.

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10. Further Reading

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

About the Author

Anton Woodward works in theatre engineering and stage automation systems.

More technical resources and safety guides are available at:

www.avw.co.uk