

# Relationship between the type of an ESPE and the SIL/PL

## Distinction between type, SIL and PL

The type, Safety Integrity Level (SIL) and Performance Level (PL) are classifications of safety-related components. The IEC 61496 standard series for example sets out criteria for the design and testing of electro-sensitive protective equipment (ESPE). Modern ESPE generally takes the form of optical sensors such as light barriers or laser scanners for the detection of human beings. The individual standards are developed in the IEC/TC 44 committee, Safety of machinery – Electrotechnical aspects. They define Types 1, 2, 3 and 4. Type 1 is however not relevant. In the past, users have tended to associate the numbers 2, 3 and 4 with Categories 2, 3 and 4 as specified in the previous EN 954-1 standard for safety-related parts of control systems. The Categories have been replaced in the more up-to-date EN 13849-1 and in the IEC 61508 series of control standards by the Performance Level, PL (a, b, c, d, e) and the Safety Integrity Level, SIL (1, 2, 3) respectively.

Some manufacturers have however applied the SILs only to hardware reliability aspects, and not to systematic aspects as required by the standard. The latter also take account of failures such as those arising during development, design or programming, or as a result of environmental influences during operation. It is therefore quite conceivable for a manufacturer to classify an ESPE as Type 2, SIL 3. A user specifying the necessary risk reduction in the form of a PL, SIL or type does not know exactly how he can use such an item of ESPE, particularly when a high risk reduction is required. However, in SIL terms, SIL 3 already refers to the highest risk reduction in the machinery sector, whereas Type 2 describes a somewhat lower risk reduction. This inconsistency must be corrected urgently.

## Revision of the standard

As is usual, individual parts of the standard have undergone revision in the course of maintenance. The results are now available in the form of IEC/EN standards. In Part 1 of the standard, which describes the general requirements, the most important changes – besides some adjustments – are Tables 1 and 2, which cross-reference the type defined in the standard to the SIL/PL.

The reader might reasonably wonder why the developers of the standards did not adopt the more elegant solution, and thus one simpler for the user, of formulating the requirements/classification directly in the form of SILs or PLs rather than as a table of equivalents. In this context, the standard states: *"In addition to the different levels of safety performance of the electrical parts of an ESPE control system, the potential risk reduction that can be provided by an ESPE is limited also by the systematic capabilities (for example, environmental influences, EMC, optical performance and detection principle)."* A type therefore encompasses more properties than those defined in the generic control standards, and the decision of the standard's developers thus appears logical, whilst at the same time providing clear guidance for the user.

In addition, the previous requirements concerning the use of complex integrated circuits and software were replaced by reference to IEC 61508/ISO 13849.

## Relationship according to EN 62061 and EN ISO 13849-1

The standard IEC 61496-1, Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests, which was published in April 2012, contains two tables in which the type of an ESPE is unambiguously cross-referenced to an SIL/PL to EN 62061/EN ISO 13849-1.

The two new tables describe types and necessary safety performance on the one hand, and the PL or SIL and the suitable type of ESPE on the other. The ensuing relationships are as follows (see table, condensed form).

Table: Relationship between the type of the ESPE and the SIL and PL (condensed)

| Type of ESPE   |                   |                   |                   |
|----------------|-------------------|-------------------|-------------------|
| 1              | 2                 | 3                 | 4                 |
| Not applicable | SIL 1 and/or PL c | SIL 2 and/or PL d | SIL 3 and/or PL e |

If the risk assessment of a machine yields a safety function with a PL<sub>r</sub> of d, a Type 3 item of ESPE would be required. Part 2 of the IEC 61496 series of standards governing light barriers, light curtains and light grids defines only Types 2 and 4, however. Recourse would therefore be made in this particular case to Type 4.

The product-specific reliability parameters (PFH values) claimed by the manufacturer, for example for the control electronics, are not constrained by the tables: a manufacturer can for example state a PFH superior to 10<sup>-6</sup>, the limit of SIL 1/PL c, for a Type 2 ESPE.

Owing to its publication in the Official Journal of the European Union, EN 61496-1 has been a harmonized European standard since 11 April 2014. The existing standard that is replaced by the new standard will cease to give rise to a presumption of conformity on 10 May 2015. The further parts of the EN 61496 standard series for light barriers, light curtains and light grids (AOPD, Part 2), laser scanners (AOPDDR, Part 3), vision-based protective devices employing reference pattern techniques (VBPDP, Part 4-2) and vision-based protective devices employing stereo techniques (VBPDDST, Part 4-3) are not subject to harmonization at the moment.

### Further information

- IEC 61496-1: Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests (2012-04). IEC Central office, Geneva 2012

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