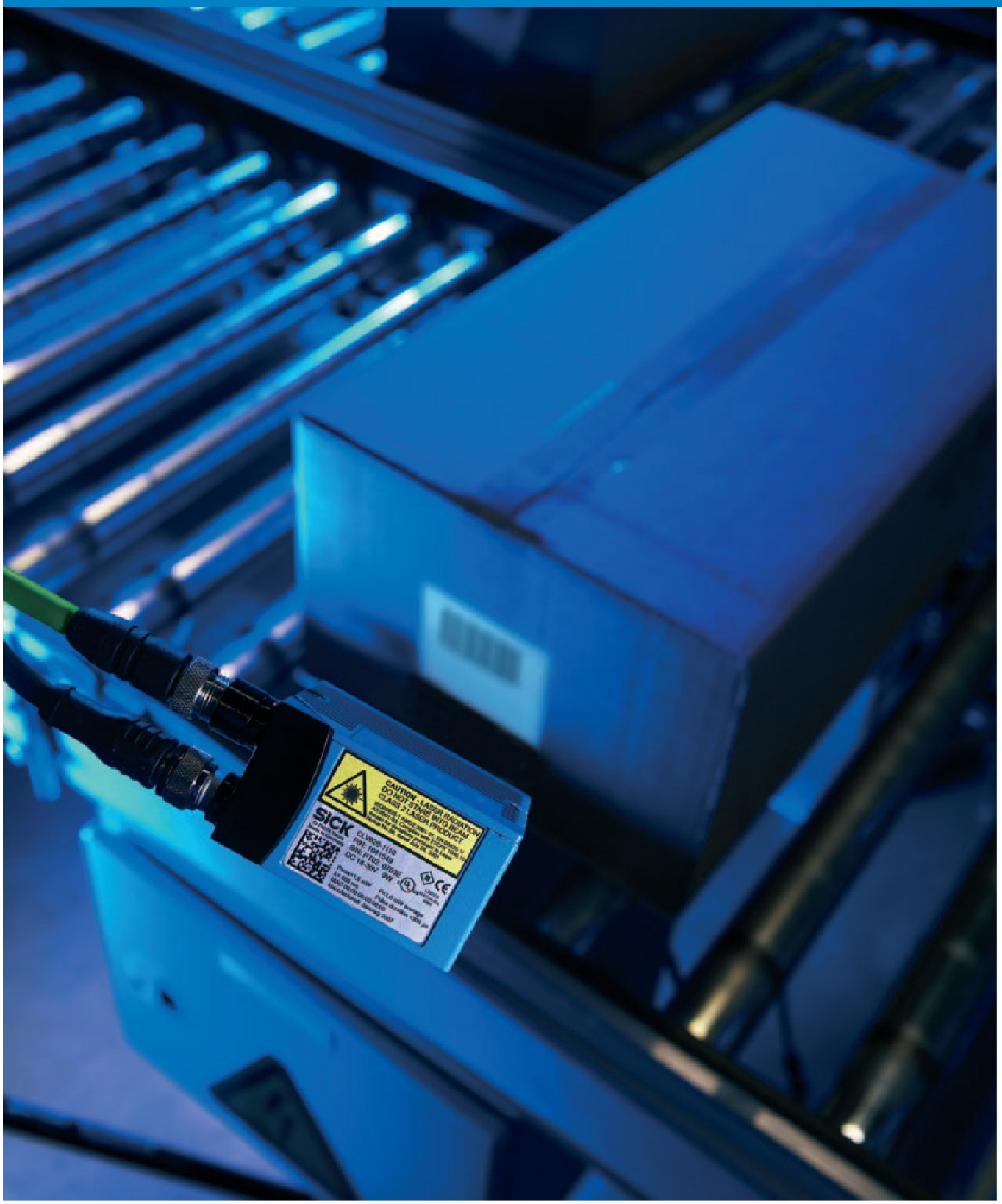
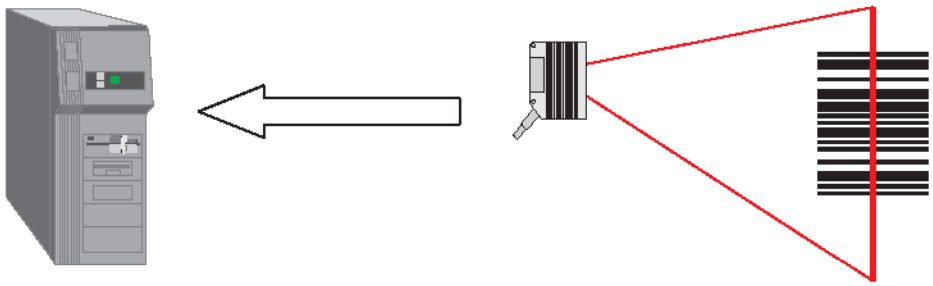
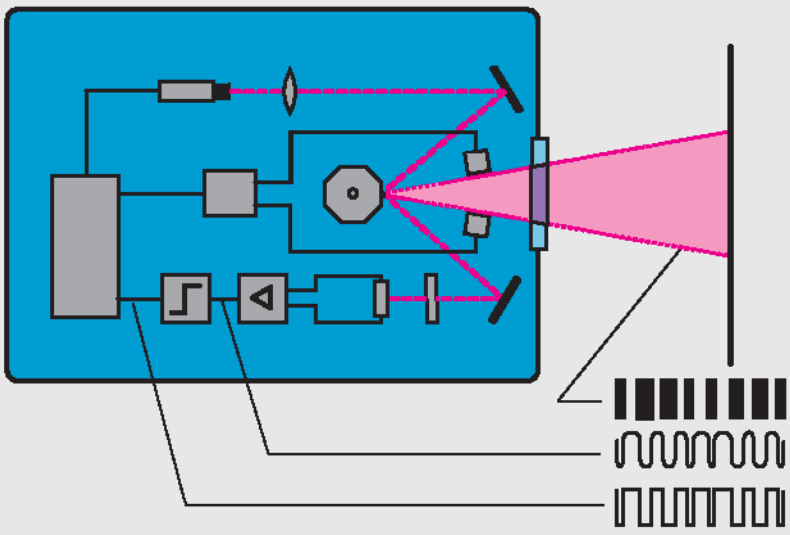
Bar code-reading technology



Functional principle

Bar codes are a data-coding technology that allows identification information to be assigned to a particular object with the help of a suitable reading device. Decoding of the information contained within the bar code is based on the binary principle (0, 1) and uses the information in the gaps (typically a reflective element) and the bars (typically an absorbing element). A reading device is used to illuminate the bar code with red (laser) light and convert the light reflected by the bars and gaps into a binary signal. A processor within the reading device digitalises the analogue signal received, decodes it and transfers its content to the host in a suitable format.





Depending on the appearance of the object upon which the light emitted by the reading device is directed, some of it is absorbed by the material, some is absorbed by the surface, and some is reflected in an altered form.

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Components of a bar code

"Quiet zones", a "start character", the information itself, and a "stop character" are the fundamental parts of a bar code. The information is encoded by means of the appropriate arrangement of bars and spaces. There are two types of codes: discrete, in which only the bars provide information, and continuous, in which the spaces also contain some of the information. Quiet zones are the white zones before and after the code. They are necessary for starting and finishing the read process. They must be at least 10 times larger than the smallest bar or the smallest space in the code.

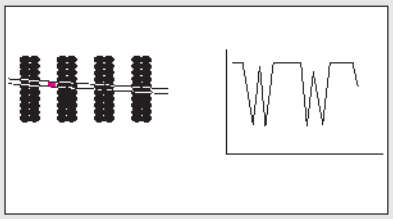
The start and stop character contain information on the type of coding used and allow readability in both directions. The information part contains the data for identifying the product or some of its features. Each symbol is represented by a corresponding sequence of spaces and bars. Some coding types only represent numerical sequences, others alphanumerical. Depending on the type of coding used for the information, each individual element can be represented by a differing number of bars and spaces – thus influencing code density.

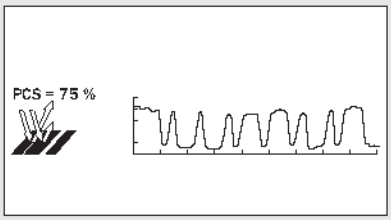
Effect of code print quality on the reception signal

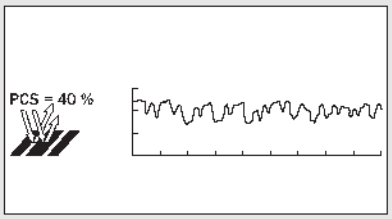
Codes that are printed with insufficient quality generate erroneous signals that only offer spurious interpretation or none whatsoever. The print quality of a code can be described by the so-called Print Contrast Signal. It is calculated as follows:

$$PCS = \frac{\text{background reflection} - \text{bar reflection}}{\text{background reflection}}$$

The PCS should be ≥ 75 % to ensure reliable reading.







Main coding types for bar codes

There are many types of bar codes, whereby the following are used most commonly:

Code 2/5 Interleaved

A continuous code, mainly used in industrial situations, only accepts numerical symbols, one digit of information consists of 5 elements (two wide and five narrow), has a high information density. The most suitable code for numerical codes that must be varied when space is limited.

Code 39

A discrete code, mainly used in industrial situations, accepts alphanumerical symbols, one digit of information consists of 9 elements (three wide bars and six narrow), therefore has a low information density.

Code 128/EAN128

Mainly used in industrial situations (EAN128 for large sales markets), allows complete encoding of the ASCII set of symbols, continuous code, a large advantage through administration of high information density.

Code EAN/UPC

Mainly used for large sales markets (UPC in America), only accepts numerical symbols and has a defined length (8 or 13 symbols), continuous code with the disadvantage of a defined number of symbols.

Bar code-reading technology

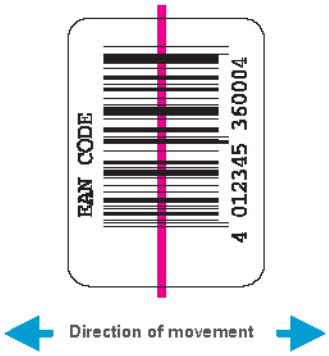
Potential code alignments

There are two possible alignments regarding the direction of movement of the coded object:

LADDER ORIENTATION

In the form of a ladder, whereby the bars are parallel to the direction of movement.

In this case, a line scanner is usually employed, using the movement of the object to be scanned for reading-in the code.

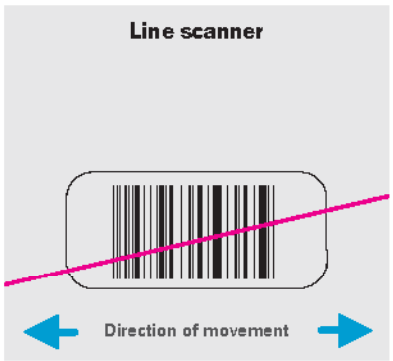


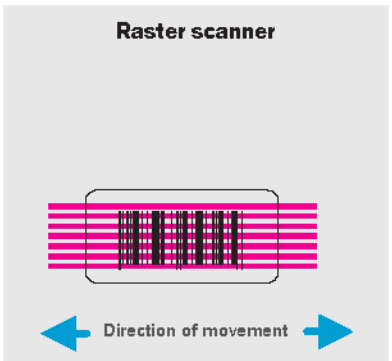
FENCE ORIENTATION

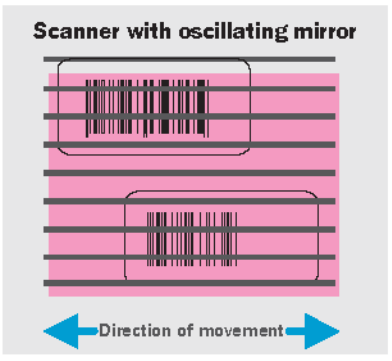
In the form of a fence, whereby the bars are arranged at right angles to the direction of movement.

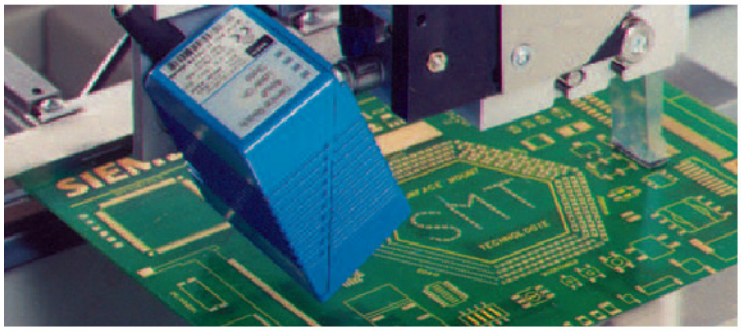
Thus in order to meet the variety of read-in situations, a selection from three different reading device designs can be made depending on the scan process used:

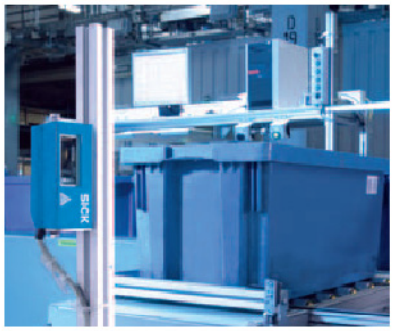
- line scanner
- raster scanner
- scanner with oscillating mirror







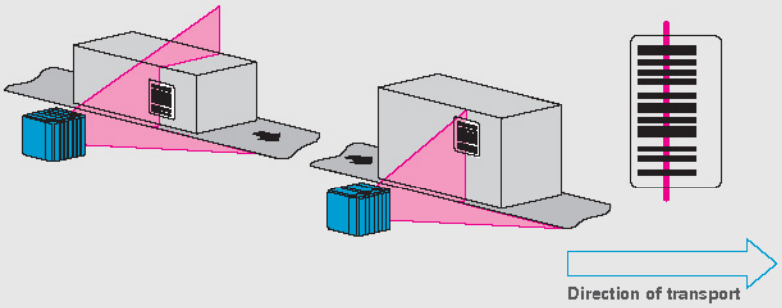




Types of scanners

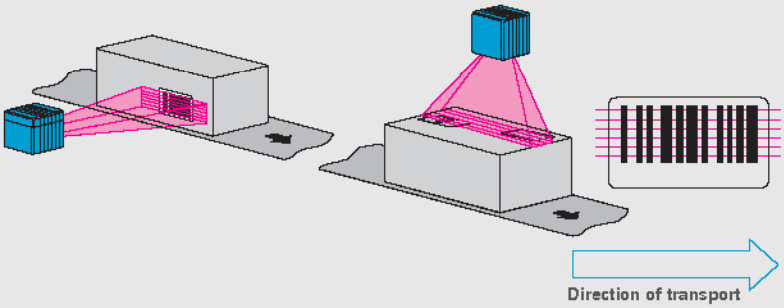
Line scanners

Line scanners are characterised by a single scanning line, and use the code's own movement to read it in. They can be used at right angles to the code or at an angle of a few degrees, depending on the alignment of the code and the decoding type supported by the reading device.



Raster scanners

Raster scanners are characterised by several parallel scanning lines and, when the scanning direction is at right angles to the bars, offer redundancy security if a code is stained or has otherwise defective areas.



Oscillating mirror scanners

Scanners with oscillating mirrors are characterised by an oscillating scanning line. This allows the codes to be read when the code position is not defined, or when several codes have to be read within the detection area.