



The bar code


As already explained in the general section, bar codes in a wide variety of forms have been used in commerce and industry for 30 years and are still in use today alongside the 2D codes and other identification technologies. This is because the bar code has many advantages, e.g. a high "read-first-time" rate, short training time for employees, high reading rate and not least the low equipment and operating costs. For these reasons, bar codes are used in the packaging industry, handling and warehousing systems, the pharmaceutical industry and many other branches.



Example: Code 39 with 16 digits (module size 0.3mm)

Overview of bar code types

The table below gives a brief overview of the most common types of 1-D code which are used today.



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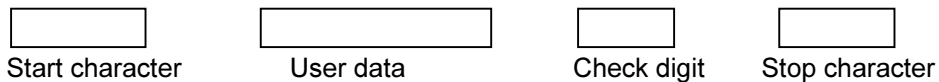
Bar codetypes			
	Numeric characters	Alphanumeric characters	Binary characters
COM-MERCE	EAN 8/13 UPC A/E EAN 128C	EAN 128A,B	
INDUSTRY	Family 2/5 -2/5 I -2/5 IATA -2/5 Industry Code 128 C Plessey Code	Code 39 Code 128 A,B Codabar Monarch Code 93	OMR Code
PHARMA-INDUSTRY	Pharma Code	Code 32 / 39	

Overview of bar code types



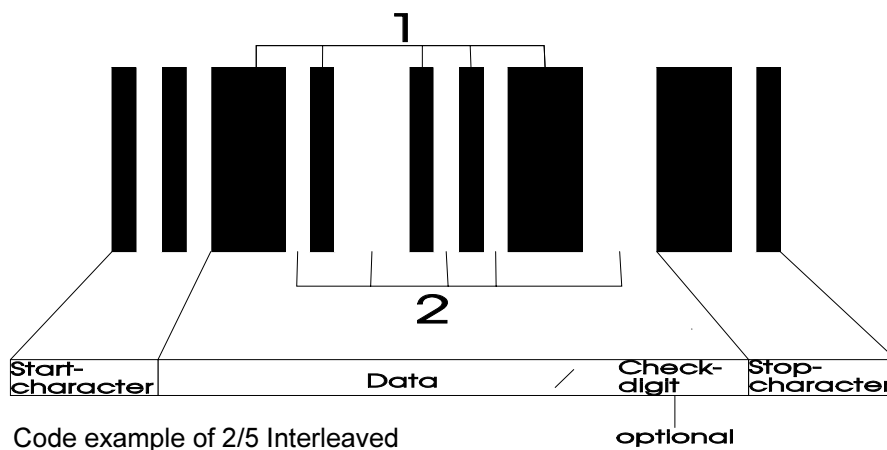
Basic structure of a bar code

The structure of a bar code, the number of black bars and white gaps for a character to be encoded is fixed for each bar code type. The information is contained in the bars and partly in the gaps of a bar code. The following structure is, however, generally applicable to all bar codes.



This translates as follows when applied to the 2/5 Interleaved code:

Code example



There is, however, an exception to every rule. The Pharma Code, for example, has no start/stop character.

Typically, up to 50 characters (depending on the type of code) can be encoded and described using these bar codes. Used in conjunction with an optical reading system, bar codes can be detected and read very reliably. The advantage of the bar code is the low cost of manufacture by means of various printing methods, e.g. thermo, thermo-transfer, ink-jet or laser technology, and the very low price of bar code scanners. The print quality of the bar code on a label is always a decisive factor influencing the reading result.

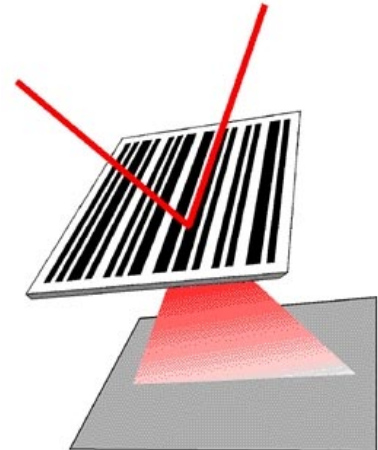


Optical properties

The reflectance of a base material depends on its surface and the wavelength of the emitted light.

White base material is best.
Base material with a high level of transparency (e.g. parchment etc.) is unsuitable and should therefore be avoided.

The level of nontransparency should be at least 85%.

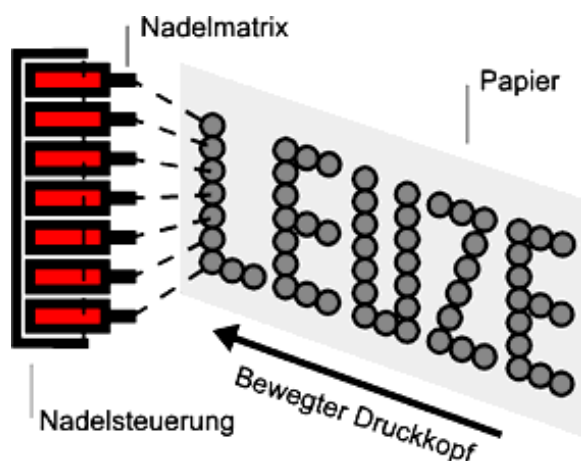


Brief overview of printing techniques

There are "on-site" and "off-site" printing techniques. Off-site means that the labels are not printed "on-site" but rather beforehand using more expensive, professional (and complex) methods, e.g. offset printing and photosetting. This is not usually done at the same location where the labels are read. This will not be dealt with in any greater detail here. Only the "on-site" printing techniques which are suitable for printing labels at the location where they will be read are described here.

Dot matrix printers

Matrix printers produce a character by pressing individual pins against a ribbon. Alternatively, some printers allow one line to be printed twice. This is referred to as "two-phase printing".



Advantages:

- Low purchase and operating costs
- Flexible use, for text and code printing
- Possible to print on different materials

Disadvantages:

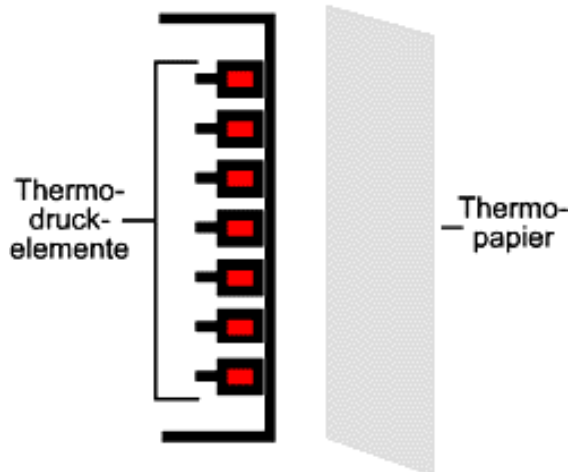
- Low speed when printing graphics and bar codes
- Loud
- Low contour definition
- Low resolution
- Ribbon fades relatively quickly when printing graphics

Nadelmatrix=pin matrix
Papier=paper
Bewegter Druckkopf=moving print head
Nadelsteuerung=pin control



Thermoprinters

Thermoprinters basically function using the same dot matrix principle as dot matrix printers. A character is produced on the printing medium by applying heat. Instead of moving pins, the printing heads on thermoprinters have point electrodes. Heat-sensitive paper must be used as the printing material.



Thermodruckelemente = thermal print elements
Thermopapier = heat-sensitive paper

Advantages:

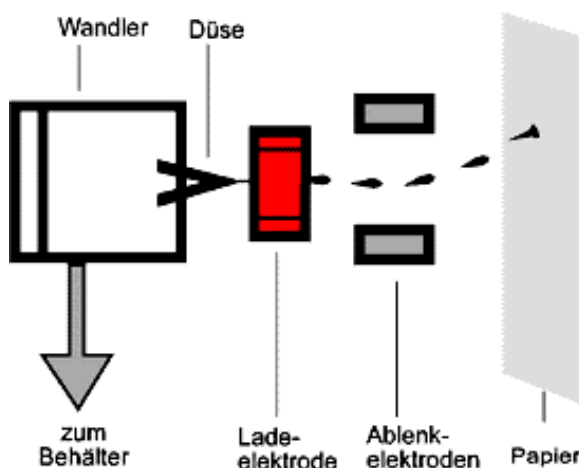
- Good print quality
- Low purchase costs
- Low maintenance (few moving parts)

Disadvantages:

- Heat-sensitive paper is required
- Heat-sensitive paper fades with time, especially when exposed to strong sunlight or other light sources
- High operating costs owing to special paper
- Expensive ribbon and short service life of printing head
- Slow printing speed

Ink-jet printers

With ink-jet printers, tiny drops of ink are fired at the printing material. Once again, the character is produced in a predefined dot matrix. The precharged particles are deflected by means of deflection electrodes which influence the trajectory of the particles.



Wandler = Converter
Düse = nozzle
Zum Behälter = to container
Ladeelektrode = charging electrode
Ablenkelektroden = deflection electrodes
Papier = paper

Advantages:

- Printing speed
- Low noise
- Low operating costs
- Printing possible on uneven surfaces

Disadvantages:

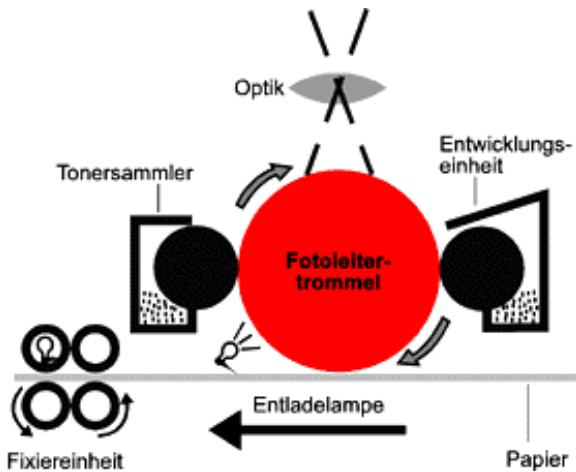
- Low resolution
- Low contour definition
- Paper surface can influence printing results



Laser printers

Nowadays, laser printers are virtually unrivalled with respect to printing speed and quality. The printing process is similar to that of a photocopier. However, with photocopiers a paper original is used instead of an electronic memory. The entire printing procedure is very complicated:

An electrostatic charge (positive) is applied to the light-sensitive photoconductor drum. A latent image is then generated on the drum. To do this, a laser beam exposes the image in mirror symmetry on the photoconductor drum. This is followed by the development process. Since the drum has a negative charge in the exposed areas, it attracts the positively charged toner to these areas. The print image on the drum must now be transferred to the paper. The paper, which has a higher charge than the drum, is guided closely over the drum. The toner is transferred to the paper and held there electrostatically. The toner is then fixed on the paper before the paper is finally output by the printer.



Advantages:

- Highest printing quality
- High printing speed
- High resolution and contour definition
- Low noise

Disadvantages:

- Relatively expensive (however, profitability depends on number of printed codes)

Optik = optics

Tonersammler = toner collector

Entwicklungseinheit = development unit

Fixiereinheit = fixing unit

Entladelampe = discharging lamp

Fotoleitertrommel = photoconductor drum

Papier = paper

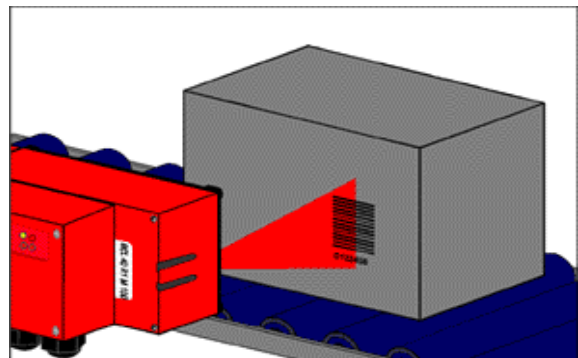
The bar code principle

The information is encoded
by means of software.

The bar code is printed
e.g. using one of the above-mentioned methods.

The bar code is read
using a bar code reader. Leuze electronic offers a wide selection of devices, including zero-range devices, large distance devices up to devices with integrated Profibus.

The bar code information is decoded.
The information is output on the computer or controller in a fraction of a second.



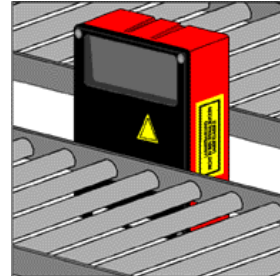


The information is processed.

Automatic product identification and simultaneous data transfer optimise operating cycles.

The advantages at a glance:

- High productivity owing to high "read-first-time" rate
- High data transfer rate
- Further processing of bar code information using PC or PLC
- Low cost
- Short training time for users



Bar code scanners

Leuze electronic offers the user a very large range of Leuze bar code scanners (the "BCL Family") which have been tried and tested all over the world.

Semiconductor laser scanners use a red-light laser diode and a rotating mirror wheel to produce an apparently static line which is visible to the human eye.

The different contrast between the bar and gap produces a reflection pattern which is proportional to the code.

A photodetector converts the reflected signals into electric pulses. These are amplified in analogue form before being digitalised in an A/D converter.

A decoder decodes the digitalised string of pulses before the result is made available at an electrical interface for further processing.

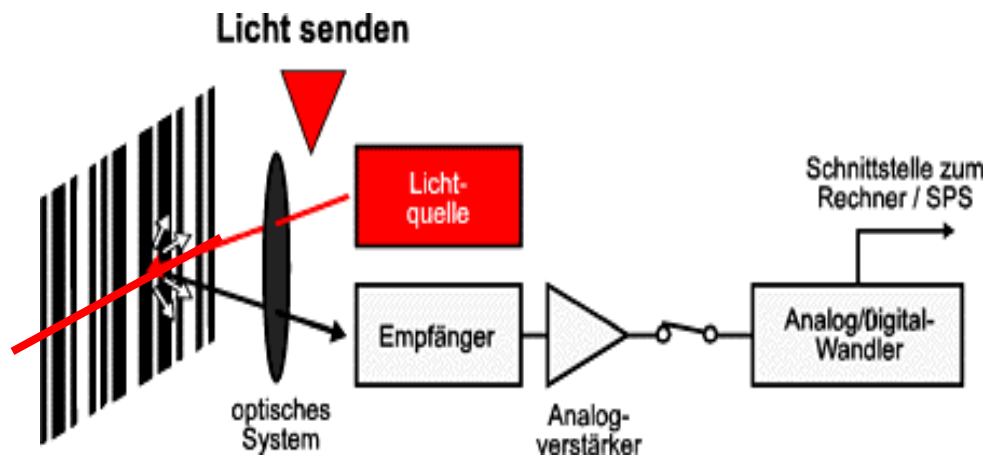


Diagram explaining the operating principle

Licht senden = light emission

Optisches System = optical system

Lichtquelle = light source

Empfänger = receiver

Analogverstärker = analog amplifier

Schnittstelle zum Rechner / SPS = interface to PC / PLC

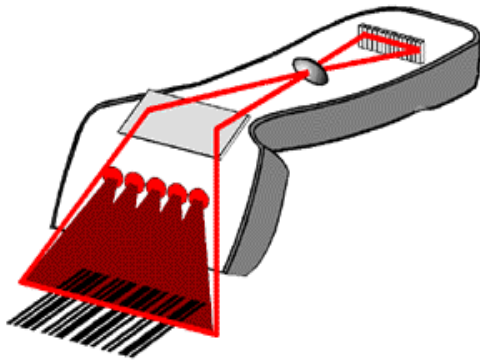
Analog / Digital Wandler = A/D converter



Reading techniques

Touchreader / CCD hand-held scanner

The touchreader / CCD hand-held scanner also reads bar codes on curved and uneven surfaces. The bar code is illuminated by a block of LEDs. The reflected light is converted into electric pulses. The string of pulses, which is proportional to the code, is conditioned and amplified before it is made available to the decoder for further processing.



Advantages:

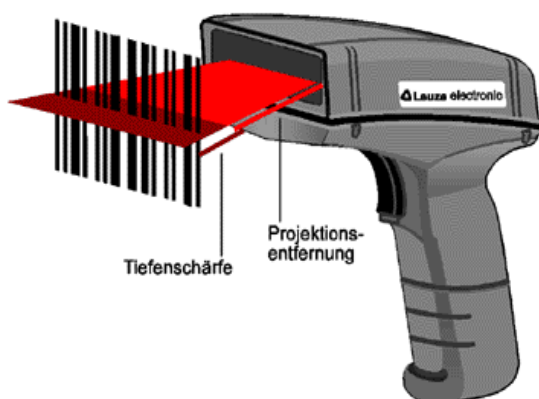
- No manual reading movement necessary
- Low weight
- Simple operation

Disadvantages:

- Reading distance max. 300mm

Hand-held laser scanners

Hand-held laser scanners read bar codes on different surfaces. The laser beam is deflected automatically by a deflecting mirror. The light beam is reflected and converted into a digital signal in the optoelectronic receiver unit. Here too, the string of pulses, which is proportional to the code, is amplified and made available to the decoder for further processing.



Advantages:

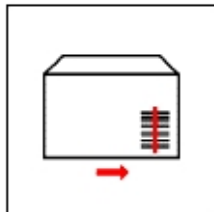
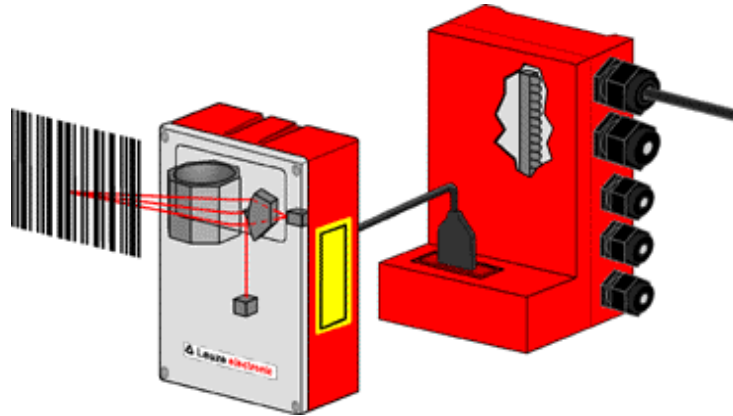
- Reading distances up to a few metres
- Low weight
- Compact
- Suitable for use in hostile industrial environments (depending on series)

Tiefenschärfe = depth of field
Projektionsentfernung = projection distance



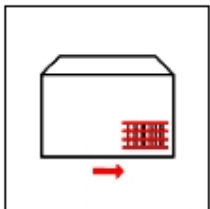
Stationary bar code readers

With the stationary bar code readers, a distinction is made between 4 reading techniques: line scanners (single beam), raster scanners, oscillating mirror scanners and omnidirectional reading.



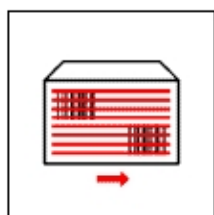
Line scanners

The bars of the code are parallel (horizontal) to the direction of travel. The direction of travel means that the code automatically passes through the scanning beam and can be read throughout the entire pass



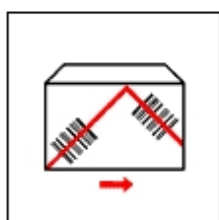
Raster scanner

This scanner type is used when the lines of the bar code can only be positioned vertically with respect to the direction of travel, or when the code is to be read while stationary.



Oscillating mirror scanners

An oscillating mirror combines the vertical deflection of the line scanner with an additional horizontal deflection so that a large area can be scanned. In this way it is possible to read various labels at various positions.



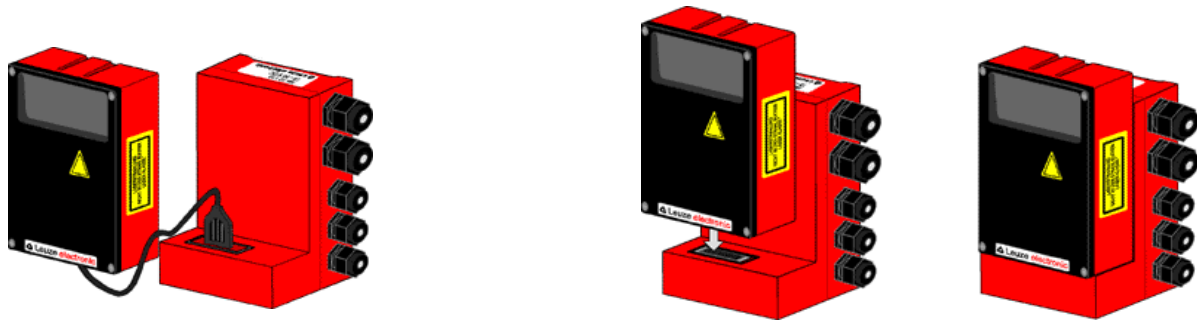
Omnidirectional reading

Required if the article or bar code cannot be aligned. With oversquare codes, two line scanners in a "V" arrangement can read bar codes in any position. If, however, oversquare printing is not possible, products with code fragment technology can be used.



Product philosophy

Leuze electronic always separates the reading unit from the connector unit. The reason for this is that the reading unit often has to be fitted at positions where very little space is available, e.g. between two conveyor sections. In addition, the scanner must provide maximum performance while occupying as little space as possible.



Connection by cable

or

plugged directly into connector unit

The connector unit itself enables convenient cable connection and indicates the device and network status. It can be fitted separated from the scanner at an easily accessible location. Leuze electronic has been active on the German and international market for 40 years and has gathered comprehensive know-how in identification technology and optoelectronics. This has also led to the many product innovations which over the years have resulted in the company's impressive range of products.



Selection of bar code readers from Leuze electronic