



SMART
SENSOR
BUSINESS

BAR CODE DETECTION

White Paper



Chapter 2

READING FIELDS

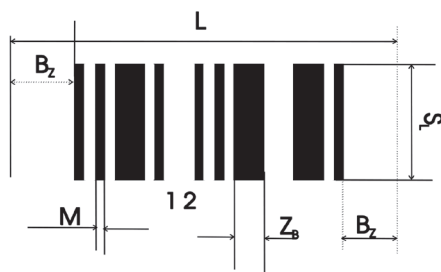
Welcome to **Leuze electronic** bar code detection 101. This is a collection of chapters to provide you more information about technologies and products to make your life easier and less complicated.

Reading Fields – what are they and how would a Lab Automation professional use these?

A review of the fundamentals needed to effectively read a 1D, Linear, Bar Code

Bar codes need to include at least the following:

- **Quiet zone (B_z)** = the light area before the start character and after the stop character of a bar code. The quiet zone (min. 10 x Module) is needed in order to indicate the start of the bar code to the scanner.
- **Module Size (M)** = the narrowest bar or gap in a bar code
- **Broad bar or gap (Z_b)** = Broad bars or gaps are always a multiple of the module. Module x Ratio = Z_b (Normal Ratio 1:2.5)
- **Length of the bar code (L)** = the length of the bar code including start/stop character (in mm). Depending on definition, the quiet zone must be added or not.
- **Length of a bar (in mm) (S_l)** =



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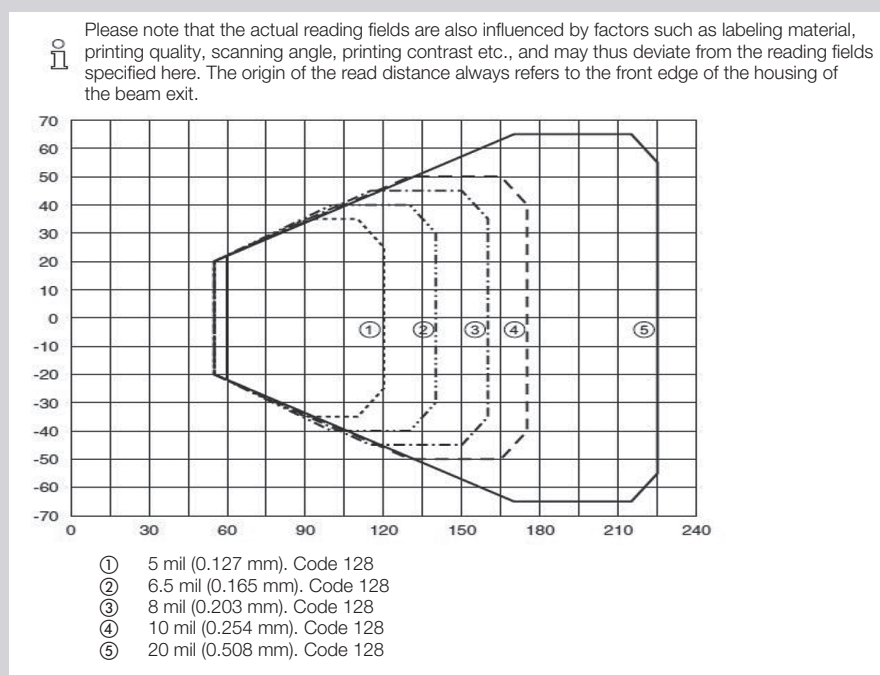
An often misunderstood aspect of selecting the best bar code reader is how to effectively view the bar code. To determine this you will need to identify the following:

- The minimum distances from the bar code reader to the bar codes being inspected
- The maximum distances from the bar code reader to the bar codes being inspected
- The module size being used
- The code being used

Understanding the ability to use the reading fields will ensure you are using a reader that will perform within the distances you require. The reading field data is taken from the individual Bar Code Reader Technical Manual. These reading fields requirements will vary depending on the laser/imager and the optics selected.

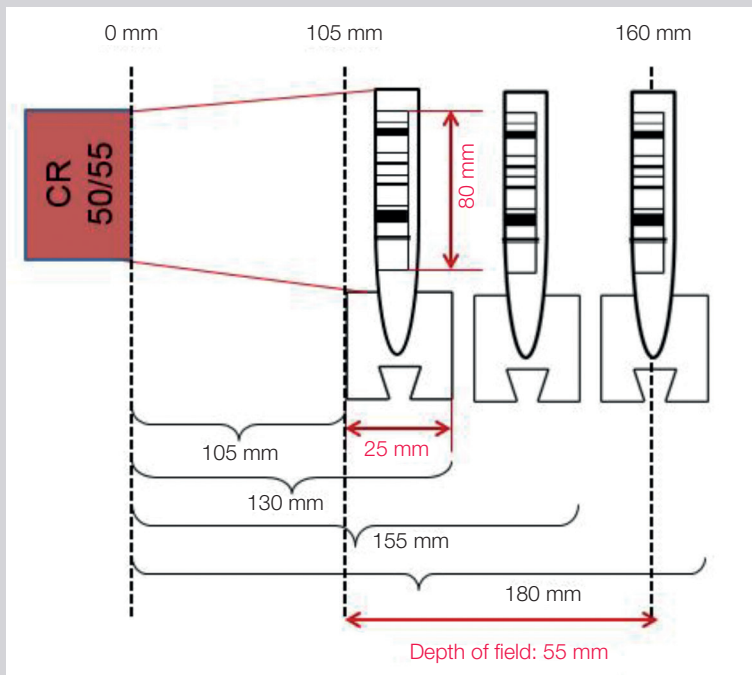
Below are several examples using readers manufactured by Leuze electronic.

From the **CR55** Technical Manual the following reading field chart is available with 5 examples of module sizes provided.



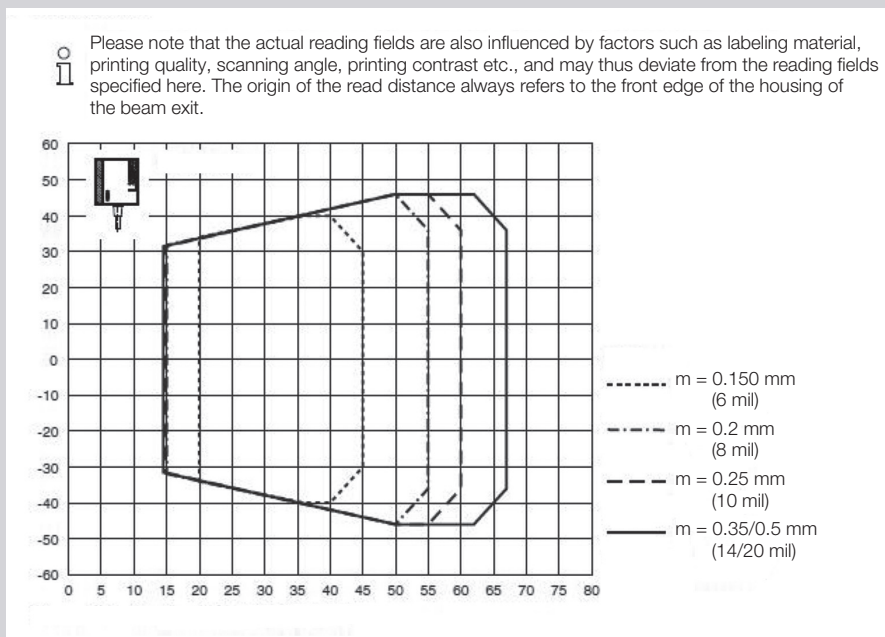
In a real life Laboratory Automation application reading multiple rows of vials using a **CR50/CR55** (CR standard for Code Reader) with a **module code size of 0,2 mm/8mil** provides us the following reading field using standard optics. Note: custom optics may be available.





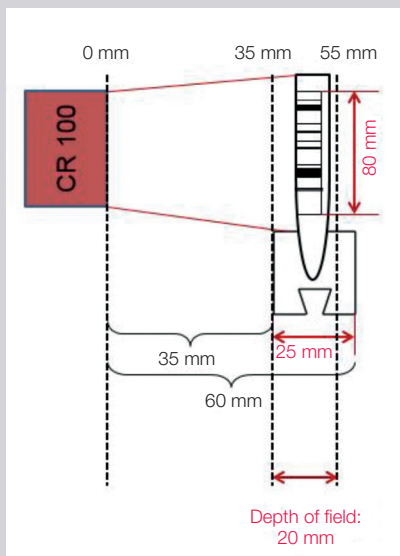
A very important aspect which needs to be taken into account is the length of the bar code (in this case 80 mm height) and how to mount the bar code reader to ensure the correct reading over the whole depth of field. To illustrate this further we will use a second example.

From the **CR100** Technical Manual the following reading field chart is available with 4 examples of module sizes provided. The CR100 is ideal for close in scanner mounting and where a **small Quiet Zone** is required. Note: custom optics may be available.

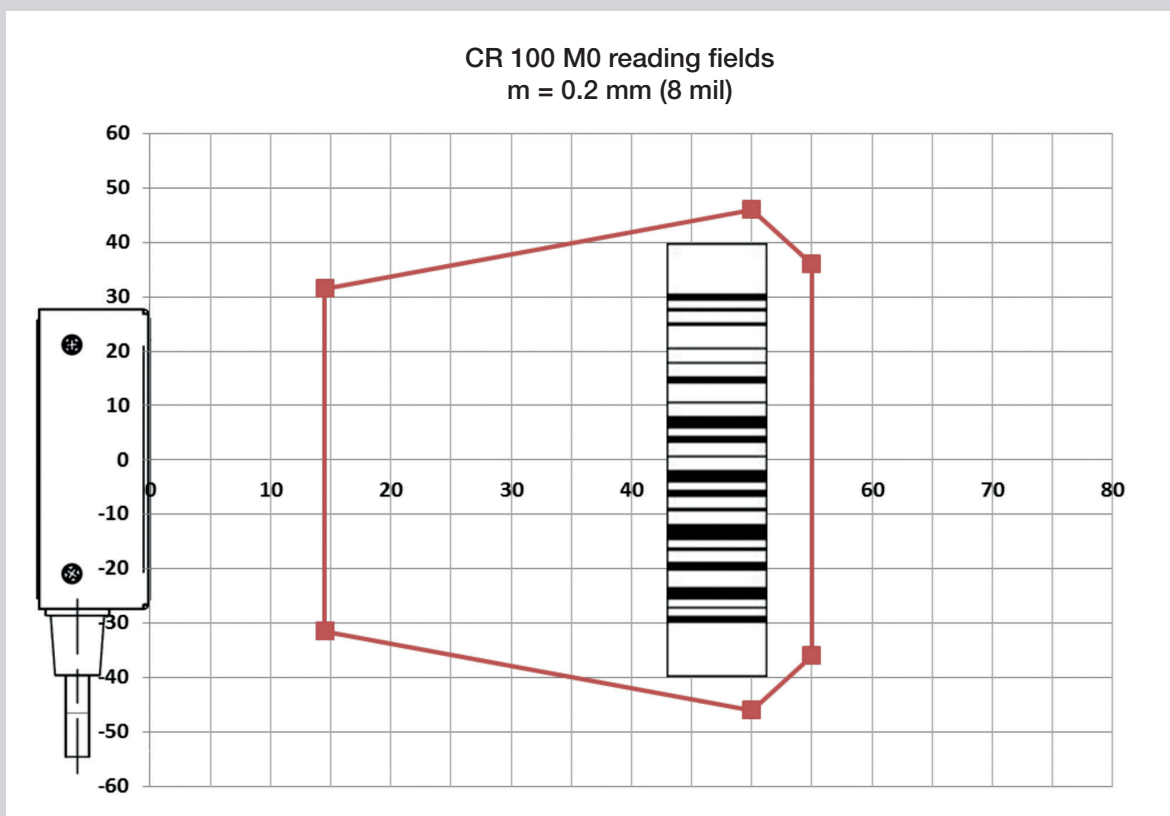


In Laboratory Automation there are limitations where a bar code reader can be installed mechanically and where the vials under inspection are transported. Using a **CR100** with a **module code size of 0,2 mm/8mil** provides us the following reading field using standard optics. Note: custom optics may be available.





So combining this inside the reading field chart will give us the following chart

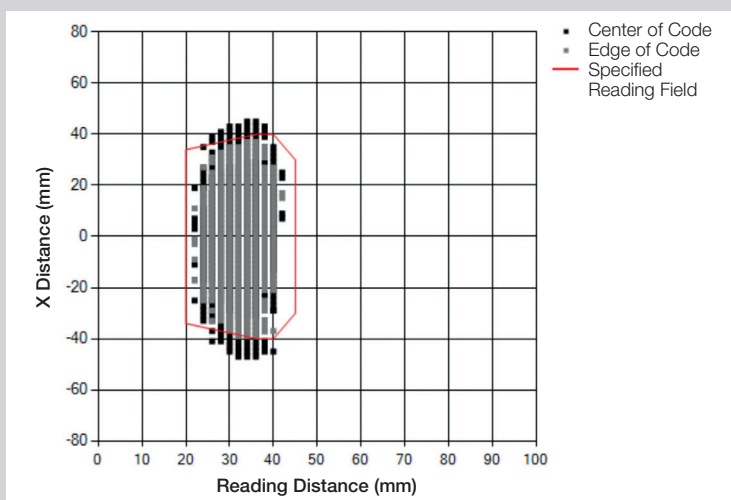
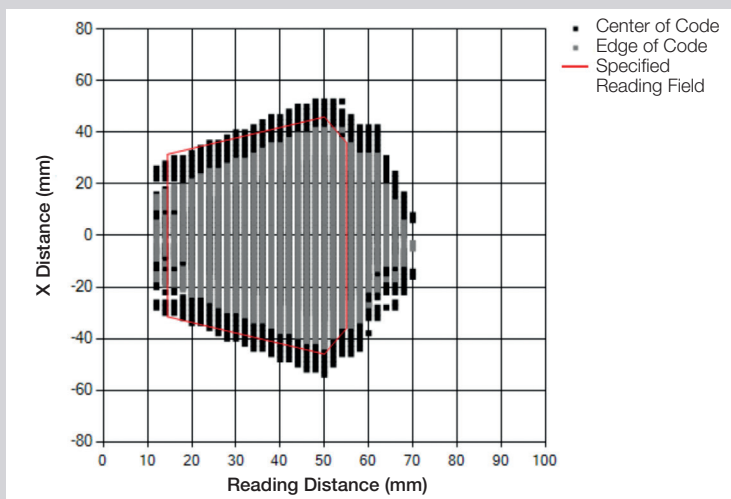


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After aligning the bar code reader towards the label inside the reading field another aspect needs to be highlighted. When looking at datasheets of bar code readers you can find sometimes the term “Typical Reading Field”, whereas Leuze is showing guaranteed reading fields. The difference is best explained in the following graphics.

The first graphic shows again the reading field of the CR100 for a Code 128 with the module size of 8 mil. The reading field shown in red can be found on the CR100 data sheet. The black bars indicate the positions the bar code reader was able to correctly decode the label. This is what Leuze calls **Power Reserve**. Even with the typical manufacturing variations, we can always guarantee the correct decoding inside the given reading field. So even if the application would be at the edge of the reading field you can be sure to have a correct reading with all readers.

Contrary to this “Typical Reading Fields” do not take into account variations between the different readers, as shown in the next graphic. So when looking into your application needs, the correct choice of reading field is essential to secure a correct working of your machine.



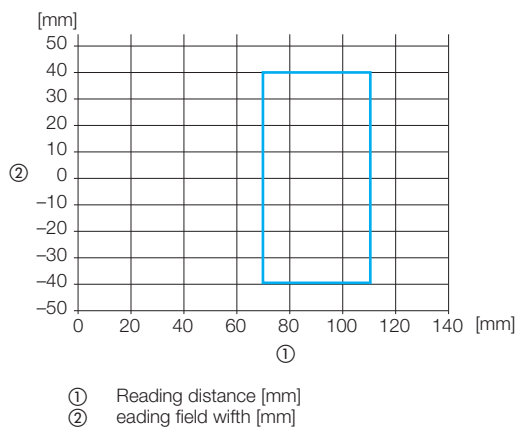
A third example might be of interest for special applications, the need for a higher depth of field for multiple lanes.



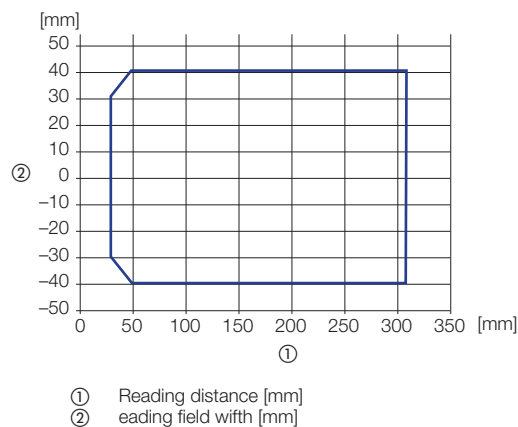
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From the **BCL148** Technical Manual the following reading field charts are available with multiple examples of module sizes provided. The BCL148 is ideal for applications where high depth of field is needed. This requires three different reading fields for three different ranges of module size.

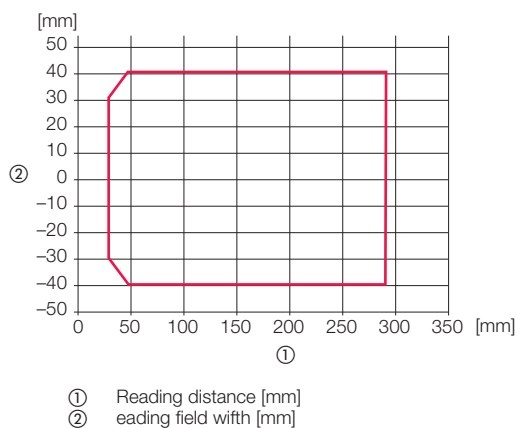
Reading curve for module $m = 127 \mu\text{m}$



Reading curve for module $m = 200 \dots 300 \mu\text{m}$

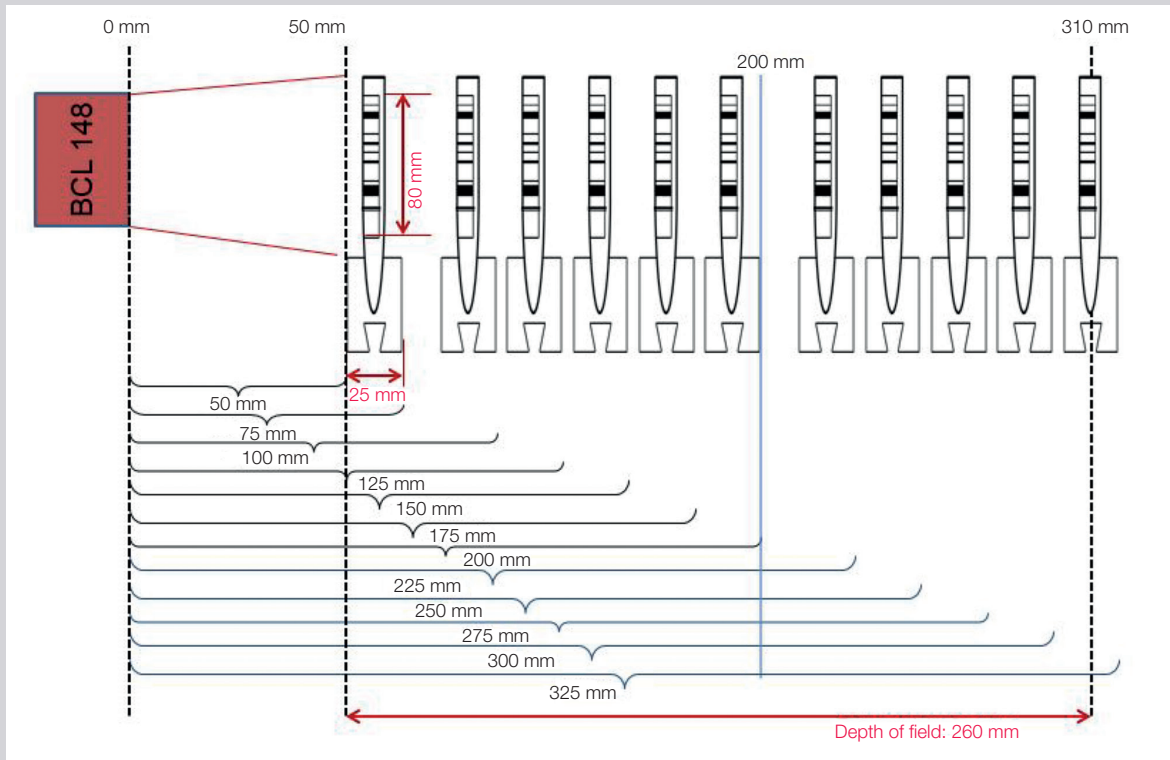


Reading curve for module $m = 167 \dots 200 \mu\text{m}$



In Laboratory Automation there are applications where there are several lanes of vials which need to be inspected. These require a high depth of field to ensure the nearest, the farthest and all vials in between can be read. Using a **BCL148** (BCL standard for Bar Code Laser) with a **module code size of 0,2 mm/8mil** provides us the following reading field using standard optics. Note: custom optics may be available.





Leuze electronic

WE ARE THE SENSOR PEOPLE

For more than 50 years, Leuze electronic has stood for innovative and efficient sensor solutions in the area of factory automation worldwide. Our range of products extends from switching and measuring sensors, identification and data transmission systems to intelligent image processing systems and solutions for safety at work. Our devices operate optically, inductively, with ultrasonic or via RFID, depending on which technology is appropriate for your application. With 18 of our own subsidiaries and 42 sales partners around the world, our customers can reach us quickly and easily everywhere. To accomplish this, we produce our sensors on four continents and can thereby always guarantee product availability. Regardless of when and where the competence of the sensor people happens to be needed at the moment. We are the right partner for both standard applications as well as for custom, high-end solutions. Through an expanded sales and service network, our competent consultation and our reliable customer service, you can count on us to be at your side around the world.



OUR PROMISE TO YOU

YOU'RE SENSOR BUSINESS - SIMPLER AND MORE EFFICIENT

Many companies say they are “customer orientated” – at Leuze electronic, we go a step further.

We offer specific and measurable added value in the areas of **USABILITY**, **APPLICATION KNOW-HOW** and **SERVICE** – to help make our customers more successful. These areas are our yardstick for new product developments, innovative service offerings and extensive market expertise.

SMARTER PRODUCT USABILITY With regard to our product developments, we systematically place emphasis on the especially good usability of all devices. To this end, simple mounting and alignment are taken into account – just as the uncomplicated integrability of the sensors in existing field bus systems and easy configuration, e.g. via a web browser, are.

SMARTER APPLICATION KNOW-HOW Whoever can do it all, can do nothing right. Which is why we concentrate on selected target sectors and applications. There, we are specialists and know all aspects inside out. For this purpose, we optimize our solutions and offer the absolute best solutions from a single source.

SMARTER CUSTOMER SERVICE The technical and personal proximity to our customers, and a skilled, straightforward handling of queries and problems, are among our strengths – and will remain so.



Switching Sensors

- Optical Sensors
- Ultrasonic Sensors
- Fiber Optic Sensors
- Inductive Switches
- Forked Sensors
- Light Curtains
- Special Sensors

Measuring Sensors

- Distance Sensors
- Sensors for Positioning
- 3D Sensors
- Light Curtains
- Forked Sensors

Products for Safety at Work

- Optoelectronic Safety Sensors
- Safe Locking Devices, Switches and Proximity Sensors
- Safe Control Components
- Machine Safety Services

Identification

- Bar Code Identification
- 2D-Code Identification
- RF Identification

Data Transmission / Control Components

- MA Modular Connection Units
- Data Transmission
- Safe Control Components

Industrial Image Processing

- Light-Section Sensors
- Smart Camera

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