



**International
Standard**

ISO/IEC 29158

**Automatic identification and data
capture techniques — Bar code
symbol quality test specification —
Direct part mark (DPM)**

**Second edition
2025-03**

This document is a preview generated by EMS



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	2
4.1 Symbols.....	2
4.2 Abbreviated terms.....	3
5 Overview of methodology	3
5.1 Process differences from ISO/IEC 15415.....	3
5.2 Lighting.....	3
5.3 Tilted coaxial lighting and camera position.....	4
6 Obtaining the image	5
6.1 Camera position and symbol orientation.....	5
6.1.1 Symbol placement.....	5
6.1.2 Camera position in a 90° camera angle set up.....	5
6.1.3 TCL setup.....	5
6.2 Lighting environments.....	5
6.2.1 General.....	5
6.2.2 Perpendicular coaxial (“90”).....	5
6.2.3 Diffuse off-axis (“D”).....	5
6.2.4 Four direction (“Q”).....	6
6.2.5 Two direction (“T”).....	6
6.2.6 One direction (“S”).....	6
6.2.7 TCL setup.....	6
6.3 Image focus.....	7
6.4 Depth of field.....	7
6.5 System response adjustment and reflectance calibration.....	7
7 Verifying a symbol	7
7.1 Initial image reflectance.....	7
7.1.1 General.....	7
7.1.2 Initializing the aperture size.....	7
7.1.3 Creating an initial histogram.....	7
7.1.4 Computing the mean.....	7
7.1.5 Optimizing an image.....	8
7.2 Obtaining the test image.....	8
7.2.1 Matrix symbologies.....	8
7.2.2 Binarizing the image.....	8
7.3 Applying a reference decode algorithm.....	8
7.3.1 General.....	8
7.3.2 Repeating if necessary.....	8
7.3.3 Continuing until the end.....	8
7.4 Final image adjustment.....	8
7.4.1 General.....	8
7.4.2 Determining the grid-centre point reflectance with two apertures.....	9
7.4.3 Creating a grid-centre point histogram.....	9
7.4.4 Measuring the mean light.....	9
7.4.5 Recording parameters.....	9
7.4.6 Creating binarized images for the symbology reference decode.....	9
7.4.7 Decoding.....	9
8 Determining the contrast parameters	9
8.1 Initializing the aperture size.....	9

ISO/IEC 29158:2025(en)

8.2	Calculating cell contrast.....	9
8.3	Calculating the cell module modulation	10
8.4	Calculating the minimum reflectance.....	10
9	Grading.....	10
9.1	Cell contrast.....	10
9.2	Minimum reflectance.....	11
9.3	Cell modulation.....	11
9.4	Fixed pattern damage.....	12
9.5	Final grade.....	12
10	Communicating grade requirements and results.....	12
10.1	General.....	12
10.2	Communication of application requirements.....	12
10.3	Communicating from verifier to application.....	13
10.4	Communicating the use of a proprietary decode.....	13
Annex A	(normative) Threshold determination method.....	14
Annex B	(informative) Evaluation of image at virtual 90° camera position from real tilted camera position.....	18
Annex C	(normative) Dot connecting algorithm.....	21
Annex D	(informative) Communicating the grade.....	23
Annex E	(informative) Cross-reference comparison to ISO/IEC 15415.....	26
Bibliography	27

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and <https://patents.iec.ch>. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/JTC 1, *Information Technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 29158:2020), which has been technically revised.

The main changes are as follows:

- the definition of continuous grading has been deleted (it is now defined in ISO/IEC 15415);
- the rounding method has been revised to always round down.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

Direct part marking (DPM) is a technology whereby, generally, an item is physically altered to produce two different surface conditions. This alteration can be accomplished by various means including, but not limited to, dot peen, laser mark, ink jetting and electro-chemical etch. The area of the alteration is called "the mark." The area that includes the mark and background as a whole, when containing a pattern defined by a bar code symbology specification, is called "a symbol."

When light illuminates a symbol, it reflects differently depending on whether it impinges on the background of the part or on the physical alteration. In most non-DPM bar code scanning environments, light is reflected off a smooth surface that has been coloured to produce two different diffuse reflected states. The DPM environment generally does not fit this model because the two different reflected states depend on at least one of the states having material oriented to the lighting such that the angle of incidence is equal to the angle of reflection. Sometimes, the material so oriented produces a specular (mirror like) reflectance that results in a signal that is orders of magnitude greater than the signal from diffuse reflectance.

In addition, from the scanner point-of-view, some marking and printing methods generate dots and are not capable of producing smooth lines. This is important for symbologies such as Data Matrix, which is specified to contain smooth continuous lines, but can be marked with disconnected dots in DPM applications.

Current specifications for matrix symbologies and two-dimensional print quality are not exactly suited to reading situations that have either specular reflection or unconnected dots or both. Additionally, symbologies specified to consist of smooth continuous lines may appear with unconnected dots. This is intended to act as a bridge between the existing specifications and the DPM environment in order to provide a standardized image-based measurement method for DPM that is predictive of scanner performance.

As with all symbology and quality standards, it is the responsibility of the application to define the appropriate parameters of this document for use in conjunction with a particular application.

This document was developed to assess the symbol quality of direct marked parts, where the mark is applied directly to the surface of the item and the reading device is a two-dimensional imager.

When application specifications allow, this method is also potentially applicable to symbols produced by other methods. This is appropriate when DPM symbols and non-DPM symbols are being scanned in the same scanning environment. The symbol grade is reported as a DPM grade rather than as an ISO/IEC 15415 grade.

Automatic identification and data capture techniques — Bar code symbol quality test specification — Direct part mark (DPM)

1 Scope

This document describes the modifications to the symbol quality methodology defined in ISO/IEC 15415 and provides a symbology specification.

This document establishes alternative illumination conditions, some new terms and parameters, modifications to the measurement and subsequent grading of certain parameters, and the reporting of the grading results.

This document is intended for verifier manufacturers and application specification developers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15415, *Information technology, Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols*

ISO/IEC 19762, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15415, ISO/IEC 19762 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 reference symbol

high-contrast printed calibration card for which results are traceable back to national or international standards and for which the supplier supplies a calibration certificate

3.2 stick

line segment comprised of image pixels that is used to connect areas of the same colour that are near to each other