INTERNATIONAL STANDARD

ISO/IEC 15423

First edition
2004-06-15

Information technology — Automatic identification and data capture techniques — Bar code scanner and decoder performance testing

Technologies de l'information — Techniques d'identification automatique et de capture des données — Contrôle de scanner de code à barres et de performance du décodeur

Reference number
ISO/IEC 15423:2004(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15423 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This first edition cancels and replaces ISO/IEC 15423-1:2001, which has been technically revised.

Introduction

The technology of bar coding is based on the recognition of patterns encoded in bars and spaces of defined dimensions or arrangements of marks in matrix patterns both of which are constructed according to rules defining the translation of characters into such patterns, known as the symbology specification.

Bar code symbols can be produced with a wide variety of printing and other techniques, and the overall symbol dimensions can be uniformly scaled to suit particular requirements.

There is a wide range of bar code reading equipment using various scanning techniques, which enable bar code symbols to be read under many different conditions.

Bar code symbols may be a) “linear” i.e. read in a single dimension, where the height of the bars provides redundancy of information, or b) “two dimensional”, either in stacked rows to be read unidimensionally with multiple scans, or as a matrix of elements requiring two dimensional reading.

Bar code reading equipment must be capable of reliably converting the information represented as a bar code symbol into a form meaningful to the host computer system or otherwise to the user.

Manufacturers of bar code equipment, the producers of bar code symbols and the users of bar code technology require publicly available standard test specifications for bar code reading equipment to ensure the accuracy and consistency of performance of this equipment.

Information technology — Automatic identification and data capture techniques — Bar code scanner and decoder performance testing

1 Scope

This International Standard defines the test equipment and procedures to be used to determine the performance of bar code scanning and decoding equipment. It deals with bar code scanning and decoding equipment both as integrated reading systems and as discrete units. It defines performance of the equipment in a particular configuration (e.g. a specific model) irrespective of the individual components used. It also defines in a normative annex operational parameters for the test equipment, and describes, in an informative annex, a means of classifying scanners.

2 Normative references

The following referenced documents are indispensable for the application 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 9001, *Quality management systems – Requirements*

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

ISO/IEC 15416, *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols*

ISO/IEC 15417, *Information technology — Automatic identification and data capture techniques — Bar code symbology specification — Code 128*

ISO/IEC 15424, *Information technology — Automatic identification and data capture techniques — Data Carrier Identifiers (including Symbology Identifiers)*

ISO/IEC 15426-1, *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specifications — Part 1: Linear symbols*

ISO/IEC 15426-2, *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specifications — Part 2: Two-dimensional verifiers*

ISO/IEC 15438, *Information technology — Automatic identification and data capture techniques — Bar code symbology specifications — PDF417*

ISO/IEC 16022, *Information technology — International symbology specification — Data matrix*

ISO/IEC 16388, *Information technology — Automatic identification and data capture techniques — Bar code symbology specification — Code 39*

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

ITS/99-001, *International Symbology Specification — Reduced Space Symbology (RSS)* (AIM Inc.)

ITS/99-002, *International Symbology Specification — EAN.UCC Composite Symbology* (AIM Inc.)

NOTE The specification referenced ITS/99-001 will be superseded by ISO/IEC 24724, which is under development, and that referenced ITS/99-002 will be superseded by ISO/IEC 24723, which is also under development, on publication of the International Standards in question.

3 Terms and definitions

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

3.1
contact scanner
particular type of scanner in which the scanning action takes place with the scanner in actual or near contact with the symbol, e.g. wand or light pen

3.2
composite symbology
bar code symbol composed of both a linear bar code symbol and a two-dimensional bar code symbol

3.3
decode redundancy
acquisition of a predetermined number of identical decodes before acceptance by a decoder of a valid decode

EXAMPLE Decode redundancy of 2 requires two identical decodes.

3.4
exit window
datum point from which the reading diagram is measured, positioned on the beam midpoint and closest to the reading end of the scanner

3.5
maximum reading distance
distance from the exit window to the end of the depth of field

NOTE See R in Figure 2.

3.6
minimum reading distance
distance from the exit window to the beginning of the depth of field

NOTE See A in Figure 2.

3.7
raster
projection of a laser beam to create multiple, nearly parallel scan lines instead of a single line

3.8
raster distance
distance between the two most widely spaced adjacent scan lines projected on a plane at a defined distance from the scanner exit window

NOTE See E in Figure B.3.

3.9
raster width
distance between the two outermost scan lines projected on a plane at a defined distance from the scanner exit window

NOTE This covers a reading field which depends on the construction of the scanner and on the reading distance. See D in Figure B.3.

3.10
reading angle
angular rotation of a symbol in an axis relative to a scan line

NOTE Three different reading angles, tilt, skew and pitch are illustrated in Figure 1. Tilt refers to rotation around the z axis, skew to rotation around the x axis and pitch to rotation around the y axis.

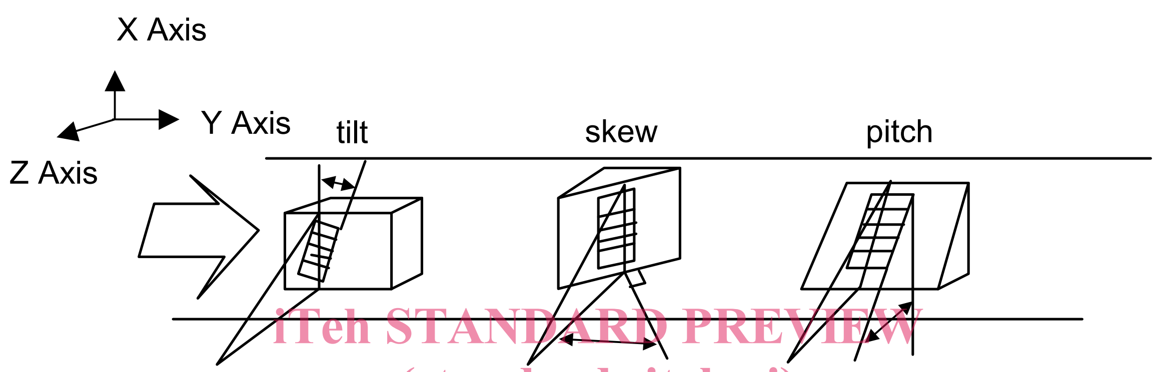

Figure 1 — Reading angles

3.11
reading diagram
graphical representation of the reading zone for a specific X dimension (or other parameters) of the bar code symbol

NOTE The parameters of the reading diagram are:

— measurements made from the exit window of the reader;

— reading distance, measured on the z axis;

— X dimension (in mm);

— skew, tilt and pitch angles;

— symbol contrast value;

— ambient light level; and

— symbology.

See Annex B.

3.12
reading zone
whole region (line, area or volume) in front of the exit window of a non-contact scanner in which defined symbols can be read

NOTE See zone MNOP in Figure 2.

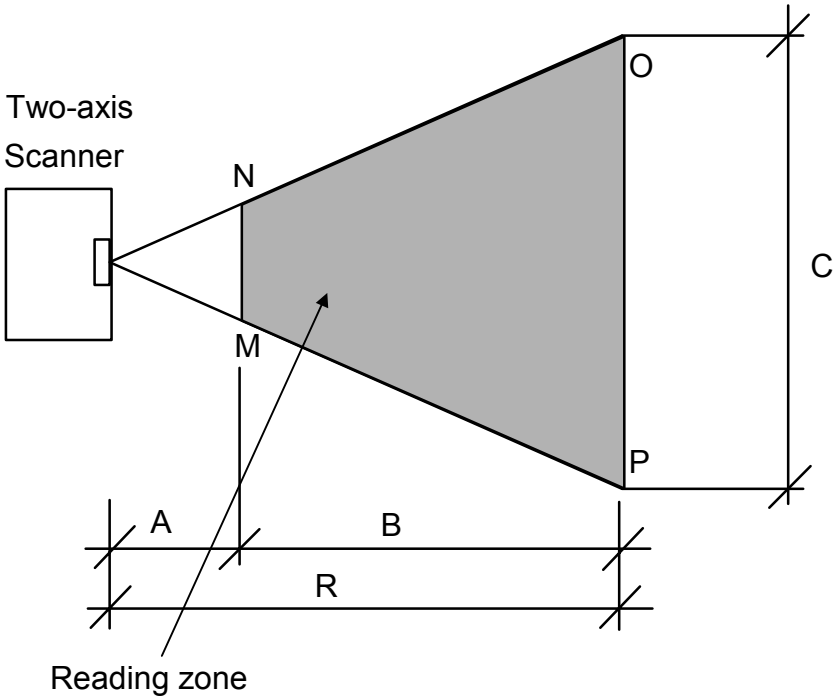

Figure 2 — Example of reading zone (MNOP)

NOTE Certain application requirements, for example in automated conveyor scanning systems, may restrict the effective reading zone to that shown in Figure 3 (MNO'P').

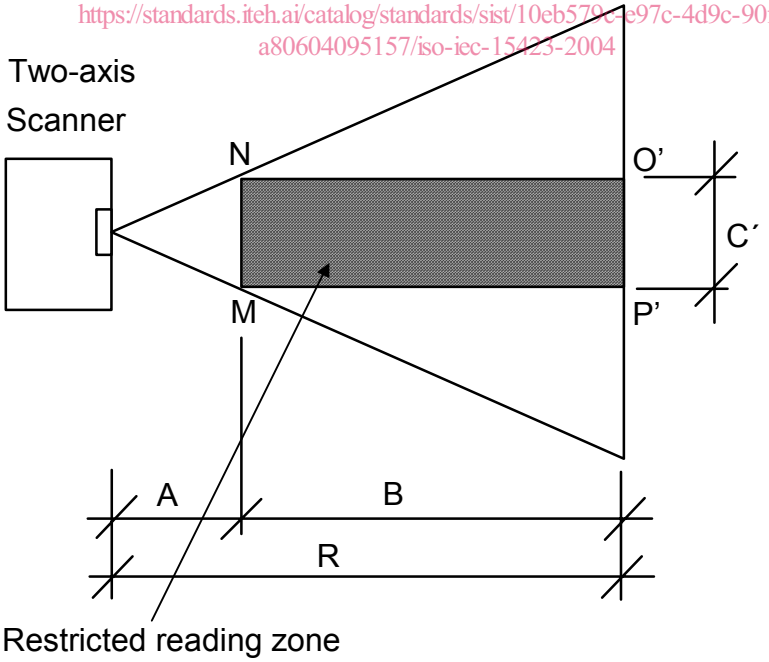

Figure 3 — Example of restricted reading zone (MNO'P')

3.13
read rate
percentage representing the number of good reads per 100 attempts to read a particular symbol

3.14
resolution
width of the narrowest element capable of being read by the equipment under test

3.15
scan, noun
single pass of the scanning beam over the symbol or a portion of the symbol, or a single image capture with an image capture device

scan, verb
to pass the scanning beam over the symbol or a portion of the symbol, or to capture a single image with an image capture device

3.16
scan attempt
single pass of the scanner relative to the symbol (or vice versa), or a single activation of the scanner, e.g. triggering, for a period not exceeding two seconds or a time period specified by the manufacturer

3.17
scanning rate
number of times the bar code symbol is scanned per second, expressed in scans per second, or scan lines per second

3.18
scanning speed
speed at which the scanning spot of a scanner with a single axis reading diagram is passed across a bar code symbol

3.19
X axis
direction parallel to the motion of the scan beam, nominally perpendicular to the bars of a linear symbol

3.20
Y axis
direction perpendicular to the motion of the scan beam, nominally parallel to the bars of a linear symbol

3.21
Z axis
direction from the exit window to the symbol, nominally normal to the plane of the symbol

4 Abbreviations

Abbreviations:

CCD Charge Coupled Device.

CMOS Complementary Metal Oxide Semiconductor.

LED Light Emitting Diode.

5 Categories of scanning equipment

In order to enable the most appropriate set of tests for a given scanning device or unit to be selected, scanners are grouped for the purposes of this International Standard into three categories. The basis for this categorisation is the nature of the reading diagram applicable. Examples of various types of scanners are given in Annex B. Each category may be further subdivided into ‘continuously operating’ scanners, in which the scanning operation is already in progress when the symbol enters the reading zone, and ‘triggered’ scanners, where the symbol is already in the reading zone when the scanning operation is initiated.

5.1 Scanners with single-axis reading diagram

These are defined as scanners with a reading diagram which extends as a single line from the exit window of the scanner to the maximum reading distance along the z axis. The scanning action therefore has to be created by moving either the scanner or the symbol relative to the other in a direction nominally perpendicular to the height of the bars.

The reading diagram for such scanners can be represented as a single line extending outwards from the exit window of the scanner. See Figure B.1.

5.2 Scanners with two-axis reading diagram

These are defined as scanners with a reading diagram which extends in a single plane from the exit window of the scanner to the maximum reading distance along the z axis and perpendicularly in both directions along the x axis. The scanning action is created either by sweeping the scanner beam across the symbol in a direction nominally perpendicular to the height of the bars, or by electronically sampling in turn individual elements of a photosensitive array on which an image of the bar code symbol is focussed.

The reading diagram for such scanners can be represented in a two-dimensional form. See Figure B.2.

5.3 Scanners with three-axis reading diagram

These are defined as scanners with a reading diagram which extends from the exit window of the scanner to the maximum reading distance along the z axis, and perpendicularly to this in both directions along the x and y axes which are also perpendicular to each other.

The reading diagram for such scanners is the representation of a three-dimensional solid.

5.3.1 Multi-line Scanners

The scanning action is created either by sweeping the scanner beam across the symbol in a series of nominally parallel scans in a direction nominally perpendicular to the height of the bars, see Figure B.3 or in a pattern of scan lines at various angles, or multi-window scanners, see Figure B.5.

5.3.2 Image Scanners

The scanning action is created by electronically sampling in turn individual photosensitive elements of an area array on which an image of the bar code symbol is focussed; see Figure B.4.

6 Test requirements

6.1 Test methods

Manufacturers' test procedures should be in accordance with the requirements of ISO 9001.

Tests should wherever possible be carried out on a complete reading system comprising both scanner and decoder.

Where it is required to report the performance of a scanner or a decoder independently, the unit shall be tested in conjunction with one or more representative decoder or scanner unit(s) respectively, but only the parameters relative to scanning or decoding performance, as applicable, shall be reported. The decoder or scanner units used shall be reported with the test results.

Manufacturers may optionally test scanner or decoder performance independently using the equipment defined in 6.5.4.1 or 6.5.4.2 but it should be noted that the results may not correspond exactly to those obtained when tested as a complete system.

6.2 Selection of equipment for testing

Tests shall be carried out on at least one unit which has been selected from a production batch in accordance with the manufacturer's quality control sampling scheme.

NOTE It is in the manufacturer's interest to ensure that the unit selected is representative of its type. Guidance on sampling is given in ISO 2859-1.

6.3 Test conditions

6.3.1 Environment

Tests shall be conducted under manufacturer-specified environmental conditions (power supply, temperature, relative humidity and ambient light conditions) and the test conditions shall be recorded as part of the test report.

Test charts to be used shall have been stored under the temperature and humidity conditions specified for a sufficient time to ensure their dimensional stability during the test period.

6.3.2 Equipment configuration

The following information on the installation of the equipment under test shall be recorded:

— description of configuration, including type/model of scanner and decoder, and other Physical conditions, e.g. type of interface, etc.;

— logical conditions such as the type of output by the scanner, or sent to the decoder e.g. analogue waveform, digital output (where a scanner or decoder is being tested rather than a complete reader).

6.4 Test Charts

Test charts should be produced on dimensionally stable materials with image characteristics which are consistent within the image or symbol area used for the test. As an example, Kodak Kodagraph Continuous Tone White Film (CTW7) is one material that has been found to be suitable when backed with a black opaque material to minimize the effects of show-through.

When equipment which is unable to process any of the symbologies in the test charts is to be tested, an equivalent set of test symbols in another appropriate symbology should be used. When other symbologies are being used, certain parameters may require to be modified to comply with the parameters of the symbology specification, e.g. row height or wide-to-narrow ratio.

When selecting materials for this use it is important to consider:

— high dimensional stability

— high substrate opacity (minimized show-through)

— high consistency of substrate surface reflectance

— bars (regions of low reflectivity) should appear black and have a low reflectivity over the entire visible portion of the spectrum

— space (regions of high reflectivity) should appear white and have a high reflectivity over the entire visible portion of the spectrum

— high consistency of image reflectance

— high image sharpness (edge definition or acuity)