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Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification —

Part 2: Two-dimensional symbols

Technologies de l'information — Techniques automatiques d'identification et de capture des données — Spécifications de conformité des vérificateurs de codes à barres —
Partie 2: Symboles bidimensionnels

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Contents

Page

Foreword

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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 ISO documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 15426-2:2005), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC 15426-2:2005/Cor1:2008.

ISO/IEC 15426 consists of the following parts, under the general title *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification*:

— *Part 1: Linear symbols*

— *Part 2: Two-dimensional symbols*

Introduction

The technology of bar coding is based on the recognition of patterns encoded, in bars and spaces or in a matrix of modules of defined dimensions, according to rules defining the translation of characters into such patterns, known as the symbology specification. Symbology specifications may be categorised into linear symbols, on the one hand, and two-dimensional symbols on the other; the latter may in turn be sub-divided into «multi-row bar codes» sometimes referred to as “stacked bar codes”, and “two-dimensional matrix codes”.

Multi-row bar codes are constructed graphically as a series of rows of symbol characters, representing data and overhead components, placed in a defined vertical arrangement to form a (normally) rectangular symbol, which contains a single data message. Each row of the symbol has the characteristics of a linear bar code symbol and may be read by linear symbol scanning techniques.

Two-dimensional matrix symbols are usually rectangular arrangements of modules placed at the intersections of a grid of two (sometimes more) axes; the coordinates of each module need to be known in order to determine its significance, and the symbol must therefore be analysed two-dimensionally before it can be decoded.

Unless the context requires otherwise, the term “symbol” in this International Standard may refer to either type of symbology.

The symbol, as a machine-readable data carrier, must be produced in such a way as to be reliably decoded at the point of use, if it is to fulfil its basic objective. Standard methodologies have been developed for measuring and assessing the quality of symbols for process control and quality assurance purposes during symbol production as well as afterwards.

Manufacturers of bar code equipment, the producers of bar code symbols and the users of bar code technology require publicly available standard conformance specifications for measuring equipment applying these methodologies, to ensure the accuracy and consistency of performance of this equipment.

This International Standard is intended to be similar in technical content (mutatis mutandis) to ISO/IEC 15426-1 (the linear bar code verifier conformance standard), on which it has been based. It is intended to be read in conjunction with the symbology specification applicable to the bar code symbol being tested, which provides symbology-specific detail necessary for its application.

Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification —

Part 2: Two-dimensional symbols

1 Scope

This part of ISO/IEC 15426 defines test methods and minimum accuracy criteria applicable to verifiers using the methodologies of ISO/IEC 15415 for multi-row bar code symbols and two-dimensional matrix symbologies, and specifies reference calibration standards against which these should be tested. This part of ISO/IEC 15426 provides for testing of representative samples of the equipment.

NOTE ISO/IEC 15426-1 applies to verifiers for linear bar code symbols.

2 Conformance

The instrument shall be considered to conform with this part of ISO/IEC 15426 if it performs the functions defined in 6.3 and if the results of measurements of primary reference test symbols carried out in accordance with Clause 8 demonstrate that the arithmetic means of the 10 measurements (for multi-row bar code symbols) or five measurements (for two-dimensional matrix symbols) of individual reported parameters are within the tolerances shown in Table 1 below.

Table 1 — Tolerances for measured parameter values

Parameter	Symbology type	Tolerance
R_{max} and/or R_s	Both	±5 % reflectance
R_{min} and/or R_b	Both	±3 % reflectance
UEC	Both	±0,0
Decodability	Multi-row	±0,08
Defects	Multi-row	±0,08
Codeword Yield	Multi-row	±0,08
Grid Nonuniformity	Matrix	±0,06
Axial Nonuniformity	Matrix	±0,02
Contrast Uniformity (Modulation)	Matrix	±0,08 of the MOD value described in A.3.2
Fixed Pattern Damage	Matrix	Within calibrated grade boundaries

NOTE The tolerances in Table 1 are additional to any tolerances stated by the supplier of the primary reference test symbols.

3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 15416, *Information technology — Automatic identification and data capture techniques — Bar code symbol quality test specifications — Linear symbols*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-2, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 2: Optically readable media (ORM)*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15415, ISO/IEC 19762-1, ISO/IEC 19762-2 and the following apply.

4.1
primary reference test symbol
bar code symbol intended for the testing of the accuracy of bar code verifiers and manufactured to close tolerances, of at least ten times the precision listed in Table 1, by methods traceable to national standards

5 Symbols

R_b	Bar Reflectance, as defined in ISO/IEC 15416
R_{max}	Maximum reflectance, as defined in ISO/IEC 15416
R_{min}	Minimum reflectance, as defined in ISO/IEC 15416
R_s	Space Reflectance, as defined in ISO/IEC 15416

6 Functional requirements

6.1 General requirements

The general requirement of a two-dimensional symbol verifier is that it shall provide assessments of the quality of a bar code symbol which are accurate and consistent, both in relation to measurements of a specific symbol made with the same instrument over a period of time and in relation to measurements of a specific symbol made by different instruments. Such consistency is essential to enable valid comparisons to be made of assessments of a symbol verified at two different times or on two different instruments.

6.2 Reflectance calibration

Verifiers shall have means of calibration and adjustment where necessary of reflectance values against reference reflectance calibration samples. Two calibration points should be used, one as near the high reflectance end of the range and the other as near the low reflectance end of the range as possible.

ISO/IEC 15415 defines the reference reflectance material against which these samples shall be calibrated.

6.3 Mandatory functions

6.3.1 Verifiers for multi-row bar code symbols

A verifier for multi-row bar code symbols applying the methodology defined in ISO/IEC 15415 shall be capable of:

— collecting reflectance measurements from points along multiple scan paths across a bar code symbol;

— establishing scan reflectance profiles from these measurements;

— analysing the scan reflectance profiles;

— reporting individual scan reflectance profile parameter grades and profile grades;

— reporting the Codeword Yield value and grade;

— reporting the Unused Error Correction value and grade;

— determining and reporting an overall symbol grade;

— reporting the decoded data.

6.3.2 Verifiers for two-dimensional matrix symbols

A verifier for two-dimensional matrix symbols applying the methodology defined in ISO/IEC 15415 shall be capable of:

— collecting reflectance measurements from a sample area framing the test symbol and its quiet zones, extending for certain symbol sizes 20X beyond the quiet zones (see Clause 10);

— establishing a reference grey-scale image and a binarised image as described in ISO/IEC 15415;

— decoding these images in accordance with the applicable reference decode algorithm;

— reporting individual values and grades for each of the parameters listed in ISO/IEC 15415;

— determining and reporting an overall symbol grade;

— appending an asterisk to the reported overall symbol grade, for certain symbol sizes, under the additional reflectance check provisions of ISO/IEC 15415;

— reporting the decoded data.

The method of reporting is not specified but may be by means of, for example, a display screen in the instrument, a printed report, or electronic communication with another device such as a computer.

6.4 Optional functions

Users of verifiers have differing requirements for the amount of detail reported by the instrument, and a verifier may therefore perform additional functions, for example:

— reporting of number of scan reflectance profiles or images on which the overall symbol grade is based;

— reporting of print growth in one or both axes;

— reporting of symbology verified;

— reporting all decoded symbol characters or codewords;

— print-out or display of all or, at the user's option, selected scan reflectance profiles or images.

7 General constructional and operational requirements

7.1 Installation, operation and maintenance

The manufacturer shall specify in documentation provided for or available to the installer, user and maintainer of the equipment the conditions for installation, operation and maintenance of the equipment. These documents shall indicate the recommended extent and frequency of maintenance, if any. When equipment which is the subject of this part of ISO/IEC 15426 is installed, operated and maintained in accordance with the above conditions, it shall be capable of operating as specified.

7.2 Power supply

The manufacturer shall indicate the minimum and maximum parameters of the power supply at which the device is able to operate according to its specifications. The accuracy of the bar code verifier shall not be adversely affected by fluctuations in supply voltage and frequency within the range specified by the manufacturer.

In the case of battery-powered equipment, the instrument shall either give a warning signal to the operator or shall cease to operate when approaching the battery power limit at which the reliable performance of the instrument can no longer be guaranteed. For equipment powered by rechargeable batteries, the manufacturer shall indicate the requirements for recharging the batteries.

7.3 Temperature

7.3.1 Operating temperature range

The manufacturer shall state the range of temperatures in degrees Celsius within which the equipment will operate.

7.3.2 Storage temperature range

The manufacturer shall state the range of temperatures in degrees Celsius which the equipment (including removable batteries) is capable of withstanding during storage and transportation, without loss of performance.

7.4 Humidity

The manufacturer shall state the range of values of relative humidity (RH) of the air within which the equipment will operate and whether the environment is condensing or non-condensing.

7.5 Ambient light immunity

The characteristics of ambient light vary very widely and should be taken into consideration. Some examples of typical light sources which may be the cause of problems are high-efficiency fluorescent lighting, sodium vapour lamps, mercury vapour lamps, red neon lights and direct sunlight.

The manufacturer shall state the recommended ambient light conditions under which the equipment is intended to be used.

8 Test requirements

8.1 Test methods

Manufacturers' test procedures should be in accordance with the requirements of ISO 9001. The methodology defined in ISO/IEC 15415 shall be followed.

8.1.1 Selection of equipment for testing

Tests shall be carried out on at least one verifier which has been selected from a production batch in accordance with the manufacturer's own quality control sampling scheme. The manufacturer should implement a quality programme to ensure that all similar devices will satisfy the requirements of this part of ISO/IEC 15426.

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

8.1.2 Scanning parameters

During the tests, the scanning and other equipment operating parameters shall fall within the range specified by the manufacturer of the equipment.

8.1.3 Test measurements

The overall symbol grade, and the values for the individually measured parameters reported by the instrument, shall be compared with the actual measurements supplied with the test symbols.

Should performance for symbologies other than those listed in Annex A require testing, test symbols should be used which conform with the relevant symbology specification which should include descriptions of or sample pictures of symbols that test these symbologies for Decode (for all symbols), Decodability (for multi-row bar code symbols), Unused Error Correction and Fixed Pattern Damage (for two-dimensional matrix symbols), to ensure that the verifier applies the reference decode algorithm defined in the symbology specification. In addition, a symbology specification may specify other conformance tests as necessary for parameters applicable to the symbology.

8.2 Test environment

Tests on bar code verifiers shall be conducted under manufacturer-specified environmental conditions. These should, as a minimum, include the power supply, temperature, relative humidity and ambient light conditions.

8.3 Primary reference test symbols

All tests for conformance with this part of ISO/IEC 15426 shall be carried out using a selection of primary reference test symbols. Primary reference test symbols are used because their scan reflectance profiles or images present known values of specific parameters to the manufacturer or user of a verifier. The values are determined by a measurement device that mimics the commercial verification device methodology and has national standard traceable performance on the reflectance and on the linear distance axes at a magnitude of ten times better than the commercial verification device. Annex A lists an appropriate range of primary reference test symbols. Annex B describes the verification requirements for primary reference test symbols.

If multiple light sources with different spectral characteristics or measuring apertures/effective resolutions are commonly used within the scanning environment for the symbol in question, a primary reference test symbol with multiple spectral and aperture/effective resolution calibration points may be required. In all cases, the primary reference test symbols shall conform with the relevant symbology specification (national, regional or International Standard if one exists, or a recognized industry specification, for the symbology in question) and shall be supplied with a statement of:

— the symbology used;

— the data encoded;

— measurement aperture(s) or effective resolution and spectral characteristics [e.g. peak wavelength(s) or colour temperature(s)] of light used for calibration;

— overall symbol grade in accordance with ISO/IEC 15416 or ISO/IEC 15415;