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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 d'identification automatique et de capture de données — Spécifications de conformité des vérificateurs de codes à barres —

Partie 2: Symboles bidimensionnels

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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 15426-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

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 part of ISO/IEC 15426 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 part of ISO/IEC 15426 is intended to be similar in technical content (mutatis mutandis) to the linear bar code verifier conformance standard, ISO/IEC 15426-1, on which it has been based. It should 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.

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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 ten 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
Modulation	Matrix	± 0,08 of the value measured for the reduced dark widow on a calibrated test symbol card
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 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 2859-1:1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 9001:2000, *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 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 19762 (all parts), *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

ISO/IEC 18004, *Information technology — Automatic identification and data capture techniques — Bar code symbology — QR Code*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15415, ISO/IEC 19762 (all parts) 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 assure 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

Scanning and other equipment use parameters during the tests 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 to be tested, test symbols should be used which conform with the relevant symbology specification and which have been measured on a calibrated verifier conforming with this part of ISO/IEC 15426. The parameters which require testing for these symbologies are 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. Other parameters are fully covered by the reference test symbols defined in Annex A, provided that the verifier is designed to measure these.

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