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

Part 1: Linear symbols

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

Partie 1: Symboles linéaires

Reference number
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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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 15426-1 was prepared by Joint Technical Committee 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 15426-1:2000), Clause 2 of which has been technically revised.

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*

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Introduction

The technology of bar coding is based on the recognition of patterns encoded in dark and light elements of defined dimensions according to rules defining the translation of characters into such patterns, known as the symbology specification.

The bar code 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 this methodology, to ensure the accuracy and consistency of performance of this equipment.

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

Part 1: Linear symbols

1 Scope

This part of ISO/IEC 15426 defines test methods and minimum accuracy criteria for verifiers using the methodology of ISO/IEC 15416 for linear bar code symbols, 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 15426-2 applies to verifiers for two dimensional 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 of individual reported parameters are within the tolerances shown in Table 1 below.

Table 1 — Tolerances for measured parameter values

Parameter	Tolerance
R_{max}	± 5% reflectance
R_{min}	± 3% reflectance
Decodability	± 0,08
Defects	± 0,08

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 9001, *Quality management systems — Requirements*

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

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

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4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762 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 of the verifier to be tested, by methods traceable to national standards

5 Symbols and abbreviations

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

PCS Print Contrast Signal, as defined in ISO/IEC 19762

6 Functional requirements

6.1 General requirements

The general requirement of a bar code 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. ISO/IEC 15416 provides for the use of two calibration points, one as near the high reflectance end of the range and the other as near the low reflectance end of the range as possible.

6.3 Mandatory functions

A bar code verifier, in accordance with ISO/IEC 15416, shall be capable of:

— collecting reflectance measurements from points along one or more scan paths across a bar code symbol;

— establishing a scan reflectance profile from these measurements;

— analysing the scan reflectance profile;

— reporting individual scan reflectance profile parameter grades;

— determining and reporting an overall symbol grade (including aperture diameter and peak wavelength of light used);

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— reporting the decoded data;

— reporting all encoded symbol characters.

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 on which the overall symbol grade is based;

— reporting of average and maximum and minimum bar width deviations;

— reporting of symbology verified;

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

— calculation and reporting of Print Contrast Signal (PCS) as $(R_{max} - R_{min}) / R_{max}$.

NOTE The calculation of Print Contrast Signal is included to assist users following application specifications which define contrast by that method. This parameter correlates less closely than does Symbol Contrast with scanning performance.

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.

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7.3.2 Storage temperature range

The manufacturer shall state the range of temperatures in degrees Celsius which the equipment (including removable batteries) shall be 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 shall be in accordance with the requirements of ISO 9001.

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.

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 speeds during the tests (i.e. the speed at which the aperture traverses the test symbol) and other equipment use parameters shall fall within the range specified by the manufacturer of the equipment. The scanning speed should be constant, or variations should be capable of being compensated for in the equipment.

8.1.3 Test measurements

A series of ten consecutive scans shall be carried out across each test symbol in the set to be used. The overall symbol grade, and the values for the individually measured parameters of these scans where 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 in this case are Decode and Decodability (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.

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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 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 in detail the verification requirements for primary reference test symbols.

If multiple peak wavelengths of light or measuring apertures are commonly used within the scanning environment for the symbol in question, a primary reference test symbol with multiple wavelength/aperture 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 recognised industry specification, for the symbology in question) and shall be supplied with a statement of:

— the symbology used;

— the data encoded;

— measurement aperture(s) and peak wavelength(s) of light used for calibration;

— overall symbol grade in accordance with ISO/IEC 15416 or an individual parameter grade and value in accordance with ISO/IEC 15416 (if the primary reference test symbol variation is designed to emphasise a particular parameter within the scan reflectance profile.

Primary reference test symbols shall be used for the purposes of type testing of verification equipment by conformance testing laboratories, and by manufacturers of verification equipment for the purpose of self-certification of conformity with this part of ISO/IEC 15426. A subset of the primary reference test symbols may be compiled for verifier users. This subset of primary reference test symbols would provide the users with the means for periodic calibration checks of their verifier and for training in the proper use of their instrument.

Primary reference test symbols shall be produced on materials which show negligible dimensional variation with changes in temperature and humidity under ambient conditions of 10°C to 30°C and 30% to 70% R.H. Consideration should be given to the use of materials that will retain or return to their original dimensions after being transported under conditions that may be outside these ranges.

Verification device manufacturers and users may choose to use, as part of their routine production quality assurance procedures, secondary test symbols. The parameter values for secondary test symbols shall have been determined through the use of a verifier the calibration of which has been checked against primary reference test symbols. While secondary test symbols may be used for routine production quality assurance procedures, they do not provide for a statement of conformance with this part of ISO/IEC 15426.

8.4 Test report

The test environment, equipment configuration, scanning parameters, and primary reference test symbols used shall be recorded together with the following:

— symbology(ies) tested;

— overall symbol grade as measured and reported by the instrument and as defined for the primary reference test symbol in question;

— confirmation that values measured are within the tolerances defined in Clause 2.

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Copies of the reports output by the verifier under test, if available, shall be attached to the test report. These may, for example, be printed reports or prints of the screen display of a computer to which the verifier is connected.

9 Certification and labelling

The manufacturer shall include with the verifier documentation a declaration that the equipment has been tested in accordance with this part of ISO/IEC 15426.

The manufacturer may affix labels to the equipment indicating that the verifier conforms with this part of ISO/IEC 15426. No requirements are defined for this labelling.

10 Equipment specification

The manufacturer shall specify the following in documentation available to users of the equipment:

— which symbologies the verifier is capable of verifying, including the specification of optional features of the symbologies which are supported;

— the measuring apertures available;

— the specification of the illumination source, including the peak light wavelength;

— the means of reflectance calibration;

— the means of reporting and, if available, of recording verification results;

— the verification parameters which can be reported;

— ability to average results from repeated scans;

— interfacing capabilities with other equipment e.g. personal computer or printer;

— programming and configuration specifications.

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Annex A
(normative)

Primary reference test symbols

Primary reference test symbols shall include sets of symbols with varying grades for the individual parameters analysed in the ISO/IEC 15416 scan reflectance profile. In each case the parameter value shall be sufficiently far from a grade transition to avoid introducing uncertainty, as illustrated for the various parameters in Table A.1. A recommended selection comprises the following:

a) EAN or UPC symbols in accordance with ISO/IEC 15420, with varying parameter grades (X dimension 0,330 mm)

   — Symbol Contrast grades 4 and 1

   — Modulation grades 4 and 1

   — Defects (both spots and voids) grades 4 and 1

   — Decodability (edge to similar edge) grades 4 and 1

   — Decodability (bar) grades 4 and 1

b) Code 39 symbols in accordance with ISO/IEC 16388, with varying parameter grades (two sets, one with X dimension 0,191 mm, the other with X dimension 0,600 mm)

   — Modulation grades 4 and 1

   — Decodability grades 4 and 1

   — Defects (void) grades 4 and 1

c) Code 128 symbols in accordance with ISO/IEC 15417, with varying parameter grades (two sets, one with X dimension 0,191 mm, the other with X dimension 0,600 mm)

   — Decodability grades 4 and 1

   — Defects (spot) grades 4 and 1

The above selection provides a representative set of test symbols which will enable all essential parameters to be compared as measured with the actual values certified by the supplier of the symbols and confirm conformity with this part of ISO/IEC 15426.

Table A.1 below illustrates the range of values of the individual parameters which will meet the requirement stated above.

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Table A.1 — Parameter values for primary reference test symbols

Parameter	Grade 4	Grade 1
Symbol contrast	≥ 73.75%	25% - 35%
Modulation	≥ 0,725	0,425 - 0,475
Defects	≤ 0,1375	0,2625 - 0,2875
Decodability	≥ 0,65	0,28 - 0,34

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Annex B
(normative)

Verification requirements for primary reference test symbols

Primary verification refers to measurement by a device that mimics the measurement methodology of typical commercial verification devices and has national standard traceable performance on the reflectance and on the linear distance axes at a magnitude of ten times better than such devices. Furthermore, a primary verification device must have demonstrable repeatability ten times better than typical commercial verification devices. The instrument generally used for primary verification is a high resolution scanning microdensitometer.

Measurement of linear distance should be based on a chrome on glass linear encoder, laser interferometer or equivalent and be traceable to a measured chrome on quartz national measurement standard.

Measurement of reflectance should be based on a high-resolution (≥10 bit) analogue-to-digital converted voltage detector of reflected light and the result be traceable to a measured national standard reflectance tablet.

The repeatability over the same scan path of measured linear distance must be within ± 0.5 micron worst case element width spread over 39 elements for five scans. Measured reflectance must be repeatable within ± 0.5% worst case spread over 19 spaces and two quiet zones for five scans over the same scan path.

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

[4] ISO/IEC 15420, *Information technology — Automatic identification and data capture techniques — Bar code symbology specification — EAN/UPC*

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